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 mandatory wage increases and hours restrictions. Deflation ended but output stagnated. We present time-series and cross-sectional evidence that these 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 medium scale, multi-sector model calibrated to match our cross-sectional estimates. We conclude that the new Keynesian model is a poor guide to the effects of supply-side shocks in depressed economies.

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1 Introduction

The output effects of supply-side policies in depressed economies are controversial. Much of the debate has focused on the U.S. New Deal's supply-side elements, in particular the National Industrial Recovery Act (NIRA).[1] 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). More recently, this debate has resurfaced in the context of whether structural reforms would be helpful or harmful for the Eurozone periphery (e.g., Bundick, 2014; Eggertsson, Ferrero, and Raffo, 2014; Fernández-Villaverde, Guerrón-Quintana, and Rubio-Ramírez, 2014; Lo and Rogoff, 2015).

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 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 depressed economies. The large increase in inflation that followed the Popular Front's election also makes this episode a useful test of the new Keynesian model's prediction that higher expected inflation and lower *ex ante* real interest rates raise output (Dupor and Li, 2013; Wieland, 2015).

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

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[1]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).

the Great Depression. First, we show that price increases and output declines coincided with the implementation of supply-side restrictions. Second, by exploiting variation in the implementation date of the 40-hour law across industries, we show that it lowered output and raised prices. Third, we consider the possibility that the 40-hour law was contractionary in the cross-section but expansionary in the aggregate, as implied by standard new Keynesian models. We analyze the effect of the 40-hour law in a medium-scale new Keynesian model calibrated to match our cross-sectional output estimates. Due to the large increase in expected inflation and decline in *ex ante* real interest rates caused by the 40-hour law, the model predicts an implausible doubling of output. The model's inability to match the aggregate French data is evidence that the new Keynesian model is a poor guide to the effects of supply-side policies in depressed economies.

In the next section we show 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 they 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 fell again.

In section 3, we obtain further evidence on the effects of the 40-hour law from the industry cross-section. Our identification strategy uses cross-industry variation in when the 40-hour law took effect. The implementation across industries was staggered in part for technical reasons, such as the need to conduct working-place surveys. This implies that the timing variation was at least in part exogenous to contemporaneous industry-specific conditions. We combine this information with monthly industry-level production data from Sauvy (1937), Sauvy and Magnin (1939) and Statistique Générale (1941), and we find that the 40-hour law 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%.

While our cross-sectional estimates provide direct evidence that the 40-hour law was contractionary at the industry-level, they do not directly rule out expansionary general equi-

librium effects. General equilibrium effects are the basis for the new Keynesian model's prediction that an hours restriction is expansionary with fixed nominal interest rates. To assess whether such general-equilibrium effects are plausible, we follow Nakamura and Steinsson (2014) and calibrate a medium-scale, multi-sector new Keynesian model to match the cross-sectional evidence. The model draws on existing medium-scale models such as Smets and Wouters (2007) with two new features to match the French data: first, firms optimally employ workers for 48 hours a week, but are restricted to a 40-hour work-week when the 40-hour law is implemented. As in the data, the implementation of the 40-hour law is staggered across industries. Second, the central bank follows a fixed nominal interest rate policy. We show that to replicate our cross-sectional regression results in the model requires fairly flexible prices (an average duration of four months) and fully-flexible wages. Thus as in Nakamura and Steinsson (2014), our empirical work is informative about general-equilibrium effects because it narrows the plausible parameter-space.

With this parameterization of price and wage stickiness in the model, the 40-hour law more than doubles the level of output. The increase in the marginal cost of production from the hours restriction causes firms to gradually raise their prices, ultimately more than doubling the price level. Consumers and firms thus anticipate substantial inflation, which given fixed nominal interest rates means low *ex ante* real interest rates. The resulting stimulus to consumption and investment leads to the large predicted increase in output. Put differently, because the 40-hour law is so successful at generating expected inflation and lowering *ex ante* real interest rates, the model predicts it should have lifted the French economy out of depression and generated an unprecedented boom.

The model's prediction of output doubling is implausibly large given the French data. Therefore, in section 5 we consider possible sources of the disconnect between the new Keynesian prediction and the data, such as political uncertainty, capital flight, and ongoing strikes. While an evaluation of these factors is necessarily uncertain, we argue that none can resolve the disconnect between the model's predictions and the data. Thus we conclude that the standard new Keynesian model exaggerates the benefits of restrictive supply-side policies.

We wish to emphasize that our paper's concern is with the *output* effects of France's

3

supply-side policies, not with their welfare effects. A full cost-benefit analysis of the Popular Front's policies would need to assess their 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 several 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.[2] We add to this prior literature by providing econometric evidence on the effects of the 40-hour law and by showing that the French experience does not fit with the standard new Keynesian model.

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. Their models, however, 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. We show that a conventional new Keynesian model can replicate the large reduction in real interest rates, but then also generates an implausibly large expansion. Thus, the sluggish performance of the French economy is puzzling from the perspective of this standard macroeconomic model.

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 rapid U.S. growth after 1933 may have occurred despite, and not because,

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[2]This is also the view of Marjolin (1938), Sauvy (1984), and Villa (1991), among others.

of the NIRA, a conclusion 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).

Fourth, our results relate to a current debate (in 2016) about the usefulness of structural reforms in the depressed countries of the Eurozone periphery. Our results accord with those in Fernández-Villaverde et al. (2014) and Bundick (2014), who suggest that structural reforms raise output and that restricting aggregate supply is counter-productive. As in Eggertsson et al. (2014) (their figure 8), in our medium-scale new Keynesian model, efficiency-increasing structural reforms substantially *reduce* output when nominal interest rates are fixed.[3] However, because the new Keynesian model predicts an implausibly large expansion from the 40-hour law, we conclude that it exaggerates both the expansionary benefits of supply-side restrictions and the contractionary effects of supply-side reforms.

Fifth, 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 the model implies that raising inflation expectations when nominal interest rates are fixed is expansionary. In this paper, however, we add to the empirical evidence in Wieland (2015) that the new Keynesian model's depiction of the benefits of higher expected inflation may be simplistic; demand-side policies that raise inflation expectations may be expansionary, but it need not follow that supply-side policies that raise inflation expectations are as well. Relative to Wieland (2015) 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.[4]

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[3]Indeed, our parameterization implies an even larger negative effect of structural reforms than that in Eggertsson et al. (2014), because we require very flexible prices and wages to match our cross-sectional estimates. This amplifies the contractionary effect of supply-side reforms in depressed economies as stressed in Eggertsson and Krugman (2011) and Werning (2011).

[4]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.

2 The Great Depression and the Popular Front

The Great Depression in France lasted 7 years.[5] Figure 1a 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 1b 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).

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.[6] 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 this background, the Popular Front decisively won the May 1936 parliamentary elections. Inspired workers responded with an unprecedented wave of strikes.[7] In June 1936,

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[5]For further discussion of the Great Depression in France, see Eichengreen (1992), Mouré (1991), and Beaudry and Portier (2002).

[6]Unless otherwise noted, the facts that follow are drawn from Jackson (1988).

[7]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.
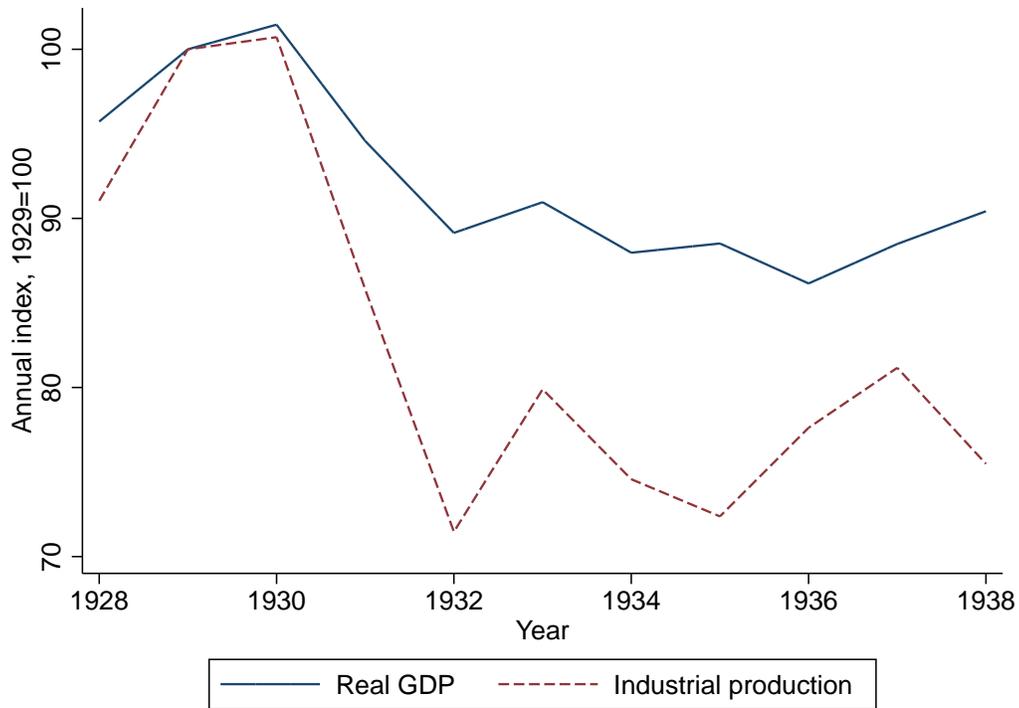
(a) Real GDP and IP 1928-1938
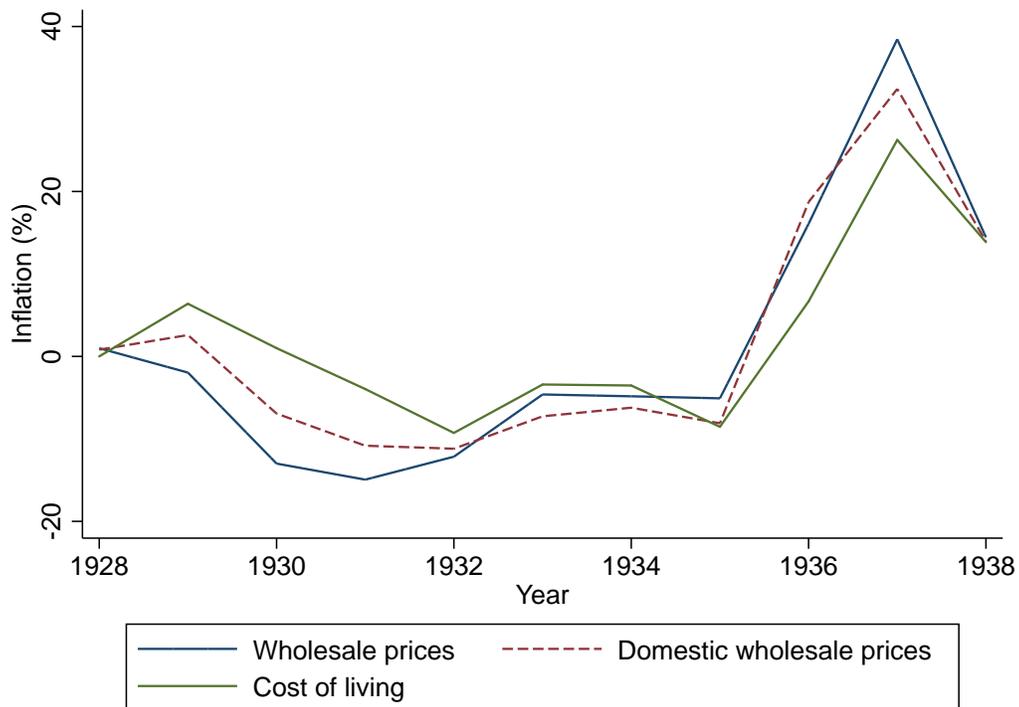
(b) Inflation 1928-1938

Figure 1 – 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.

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).

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 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.

Events did not unfold as the Popular Front hoped. Figure 2a 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.[8] As desired, the Popular Front's policies then led both nominal and

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[8]The extreme flatness in 1935 and the first half of 1936 is due to interpolation (Sauvy and Depoid, 1940).

(a) Index, n.s.a, 1/1935=100

Popular front elected

Devaluation

180
160
140
120
100
80

1935m1 1936m1 1937m1 1938m1 1939m1
Year

| Nominal | Real, domestic wpi deflator |
| Real, cpi deflator | |
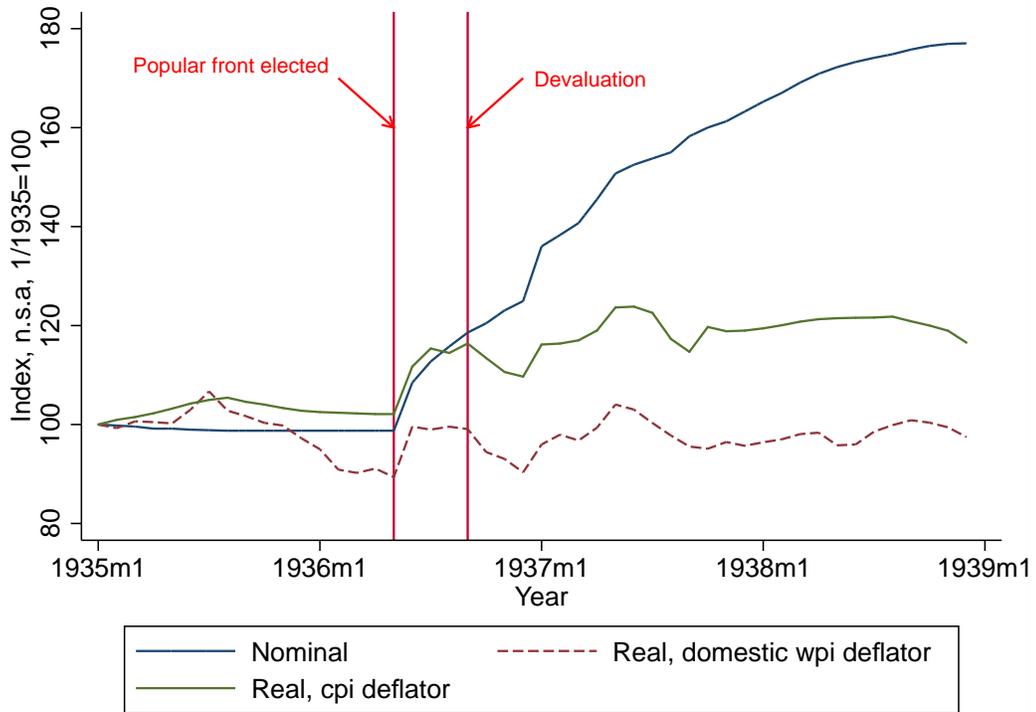
(a) Nominal and real hourly wages 1935-38

(b) Index, n.s.a, 1/1935=100

Popular front elected

Devaluation

200
180
160
140
120
100

1935m1 1936m1 1937m1 1938m1 1939m1
Year

| Wholesale prices | Domestic wholesale prices |
| Consumer prices | |
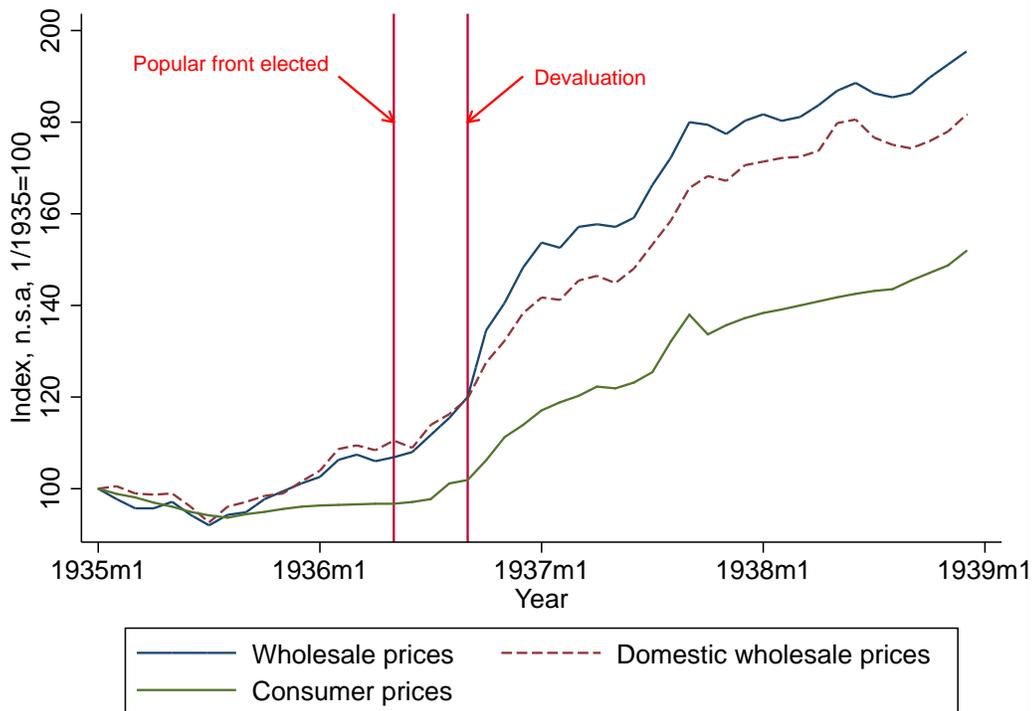
(b) Wholesale and consumer prices 1935-38

Figure 2 – 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.

9

real wages to rise. Unlike Roosevelt's NIRA, the Popular Front's high wage policies were not accompanied by parallel efforts to raise prices.[9] 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: 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%.[10] Kalecki (1938) ascribes this real wage increase to the stickiness of housing rents and food prices.

2.1 Devaluation Devaluation was an unpopular prospect, and the Popular Front hoped to ignite recovery without it.[11] 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), table 160, p. 547). 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 3a). The departure from monetary orthodoxy was accompanied by and in part caused by a departure from fiscal orthodoxy. From 1935 to 1937, the budget deficit as a share of GDP rose from

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[9]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).

[10]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).

[11]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).
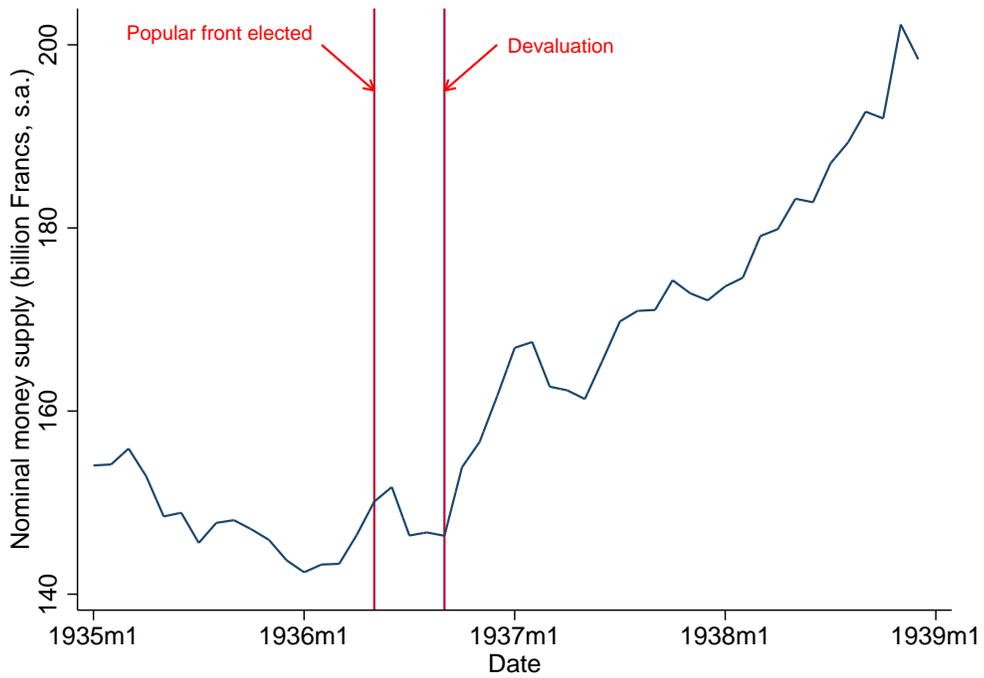
(a) The money supply (M2) 1935-38
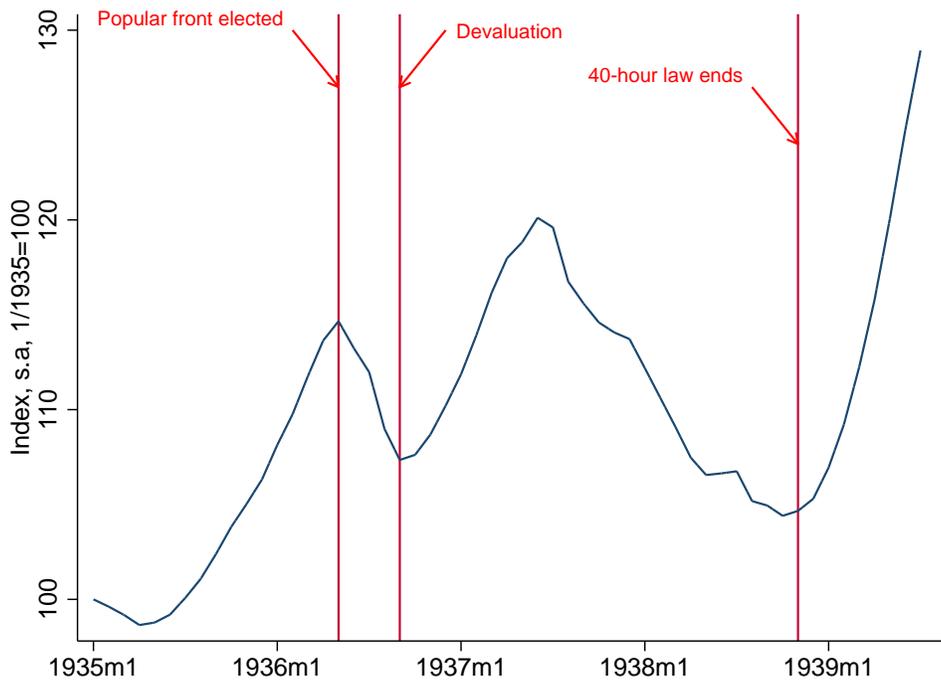
(b) Industrial production 1935-1939

Figure 3 – 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.

11

4.0% to 6.3%.[12] 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 3b shows the behavior of monthly, seasonally adjusted industrial production from 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.[13] And four-quarter 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).

2.2 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 3b). Unemployment also rose, though it remained below its early 1936 level. 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 1b). This increase in inflation was not accompanied by a significant change in nominal interest rates. Figure 4 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

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[12]Revenue and expenditure data are from Sauvy (1984), v. 3, p. 380. Nominal GDP data are from Villa data, series PIBVAL.

[13]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).
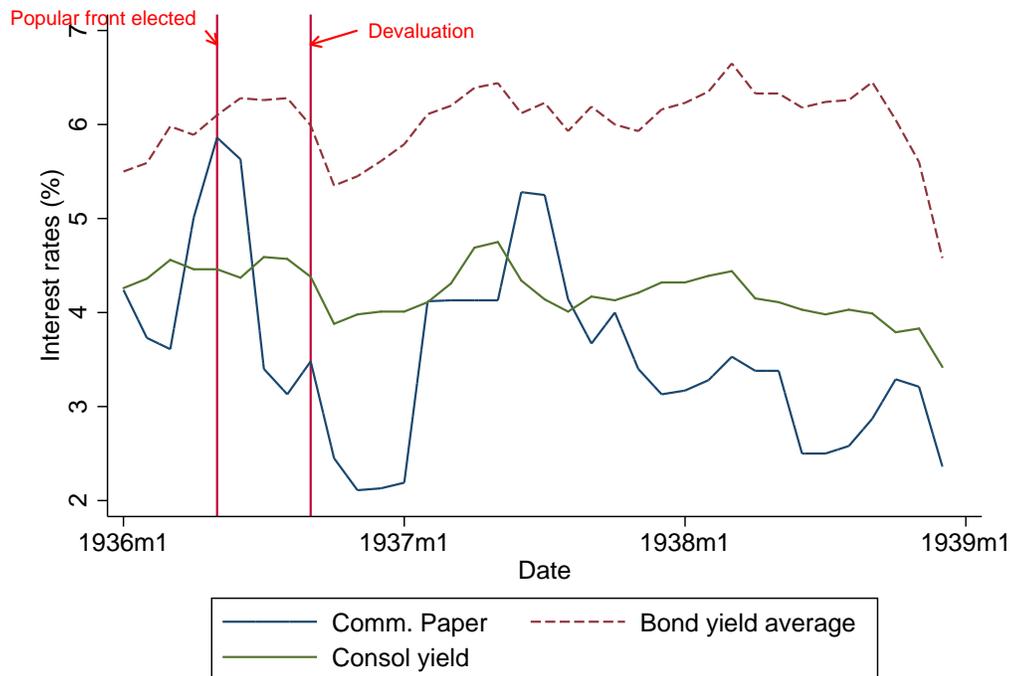
Figure 4 – Nominal interest rates 1936-1938. *Notes:* The first vertical line indicates May 1936, when the Popular Front government was elected. The second vertical line indicates September 1936, when France left the Gold Standard. The bond yield average includes 3 government, 2 mortgage, 12 railway, 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.

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 the degree of pass-through from higher costs to higher prices.[14] 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 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

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[14]Appendix A provides references as well as full quotes in French and English and further narrative evidence.
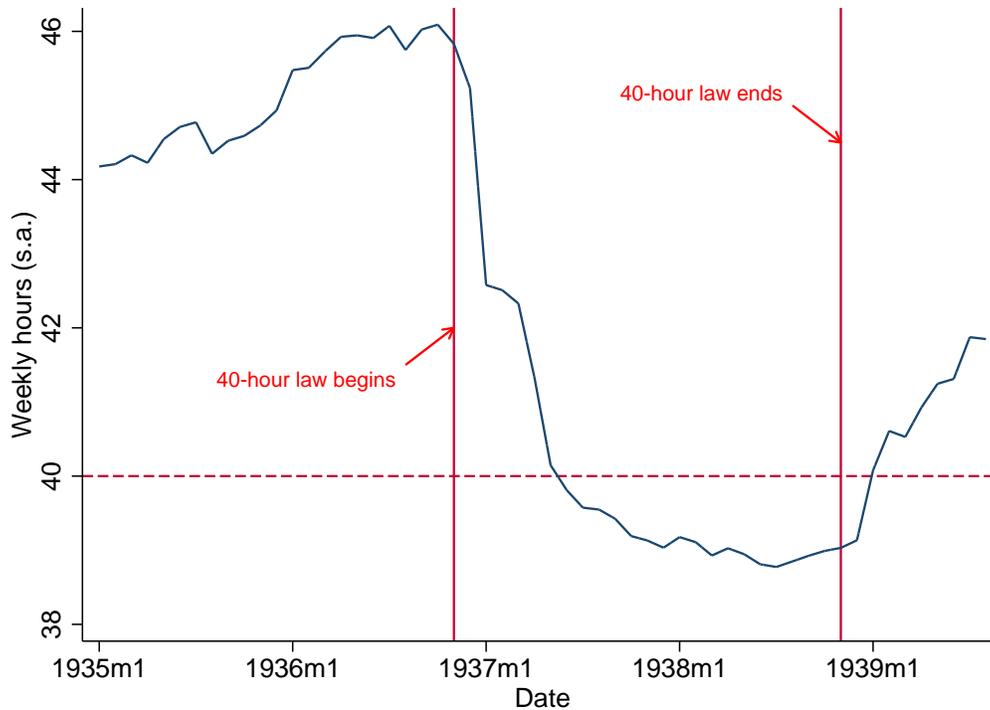
Figure 5 – Weekly hours 1935-1939. *Notes:* The first vertical line indicates November 1936, when the 40-hour law began to bind. The second vertical line indicates November 1938, when the 40-hour law was relaxed. Source: Statistique Générale (1941), p. 158.

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.[15]

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 5 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.[16] Still, the series conveys a striking message.

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[15]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 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).

[16]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,

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.

Putting aside its cause, the relatively poor performance of the French economy under the Popular Front had political consequences.[17] 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 gradually shifted economic policy to the right, culminating in the relaxation of the 40-hour law in November 1938.[18]

3 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.

3.1 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.

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after an establishment fell under the 40-hour law, the first three categories were collapsed to one.

[17]This paragraph draws on Jackson (1988).

[18]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.

3.1.1 Application dates of the 40-hour restriction We obtain data on when the 40-hour law began to bind from the original source, so-called "application decrees" as published in the *Journal Officiel.*[19] 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.*[20] For most industries, the law came 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.

3.1.2 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.[21] 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

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[19]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.

[20]Except in two cases (navigation and public transportation in the Paris region) in which the decree was published after the law came into effect, there was generally a lag between when the decree was published in the *Journal Officiel* and when the law came into effect. This lag is, however, not 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.

[21]See http://www.insee.fr/fr/ppp/sommaire/imet104d.pdf, p. 52.

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 B.

Statistique Générale (1941) contains further description of the industrial production index and some data unavailable in Sauvy and Magnin (1939).[22] 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 in all cases identical. 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. Appendix table 6 provides further details on the individual series.

3.1.3 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 2b). 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

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[22]In particular, Statistique Générale (1941) extends several series through July 1939, and it provides data on rayon production that were not reported in Sauvy and Magnin (1939).

reported prices move infrequently. For instance, the price of coal is unchanged between July 1935 and June 1936.

3.2 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.[23]

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 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.

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[23]For some industries, a second announcement date is listed when the announcement occurred in different months in sub-sectors.

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.

Table 1 – Timing of the 40-hour law

Industry	Announcement	Decree publication	Entry into effect
Mining			
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
Chemical products	August 36	March 37	March 37
Paper	August 36	April 37	April 37
Textiles			
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
Leather	August 36	March 37	March 37
Metallurgy			
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
Metal working			
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
Construction	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.

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."[24] 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."[25] In January 1937, *X-conjoncture* concludes that "the current problem [with the French economy] boils down to its supply elasticity as demand has been regenerated."[26]

3.3 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. Unfortunately, these data 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 6 shows the path of hours in these

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[24]*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."*

[25]*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'accentuer avec l'application de la loi de quarante heures, par suite de la pénurie de main d'oeuvre qualifiée."*

[26]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."*
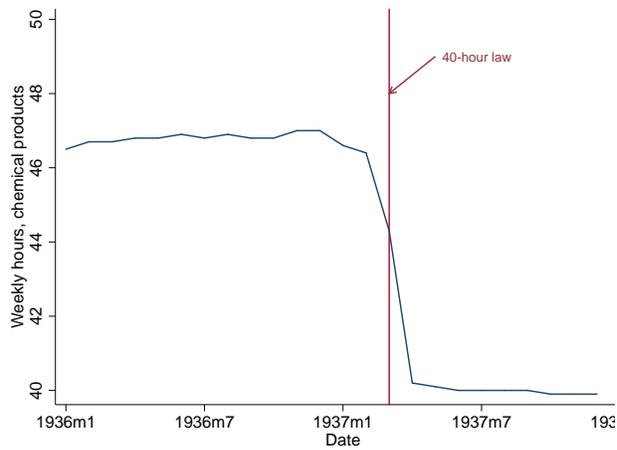
(a) Chemical products
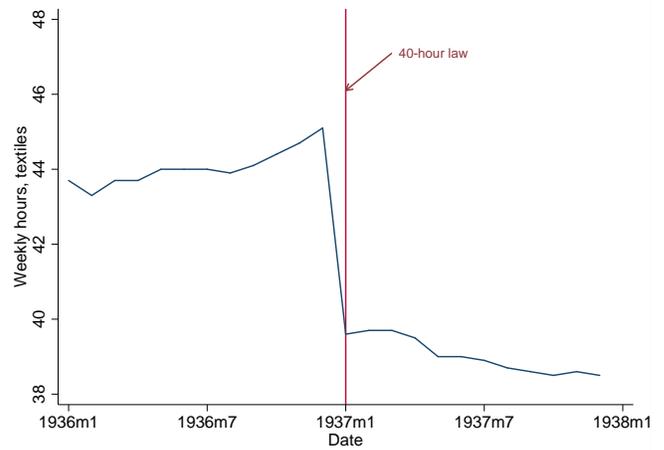
(b) Textiles
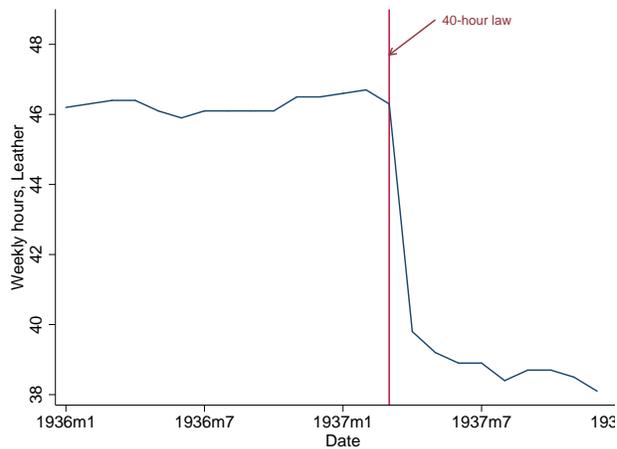
(c) Leather
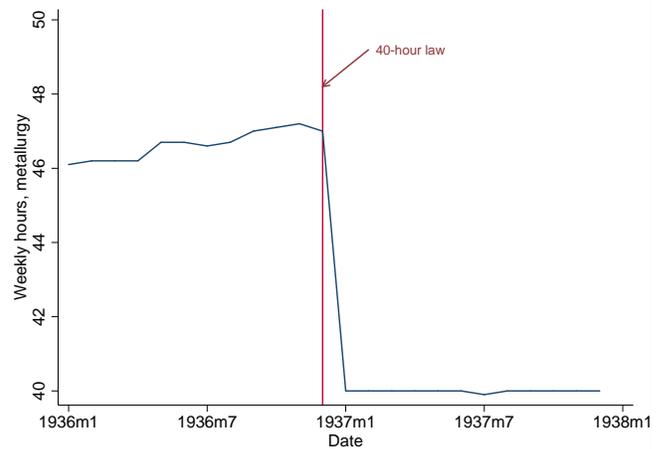
(d) Metallurgy
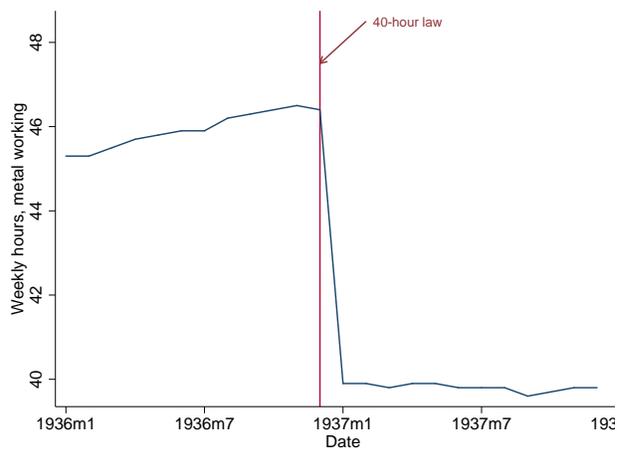
(e) Metal working
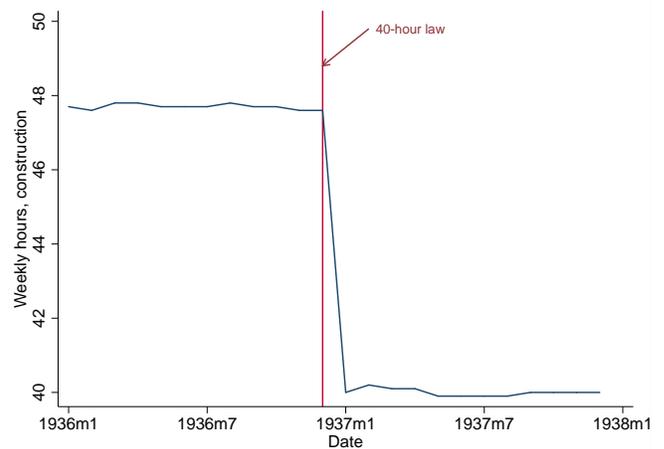
(f) Construction

Figure 6 – Weekly hours. *Notes:* These graphs show weekly hours worked as measured on the 1st of the month. The red vertical line indicates the month the 40-hour law took effect. If the law took effect after the 22nd day of the month, the vertical line indicates the following month. Sources: See text.
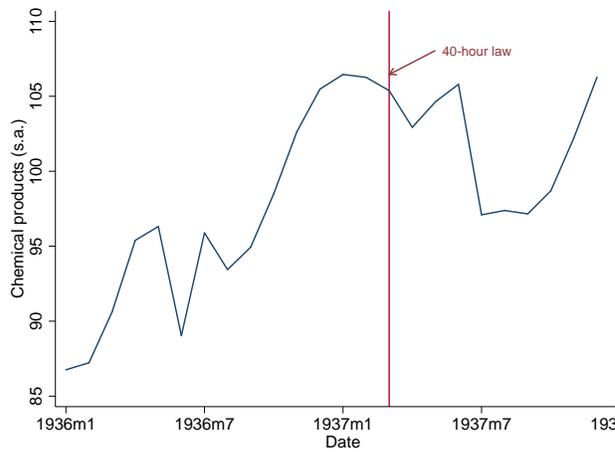
(a) Chemical products
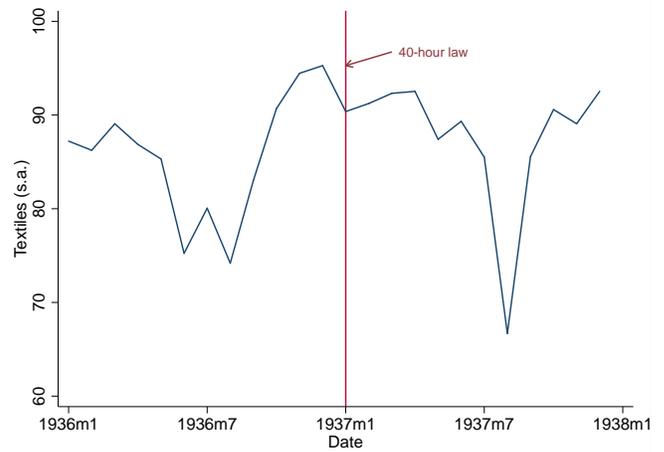
(b) Textiles
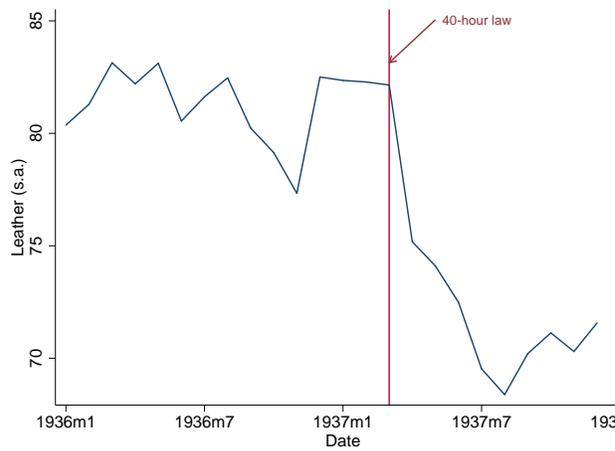
(c) Leather
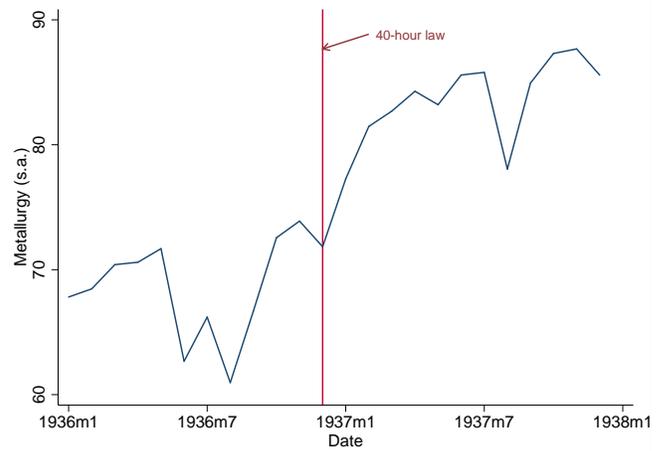
(d) Metallurgy
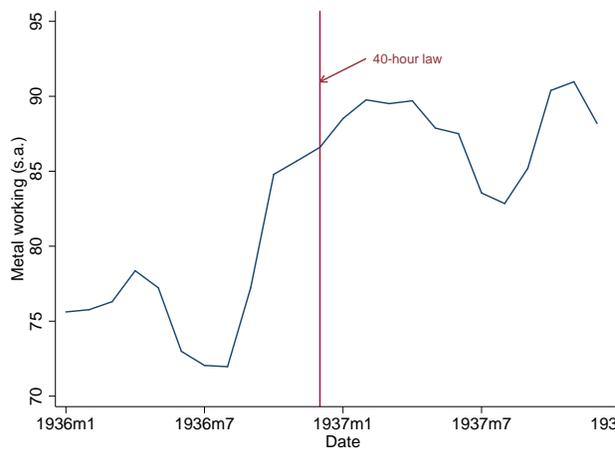
(e) Metal working
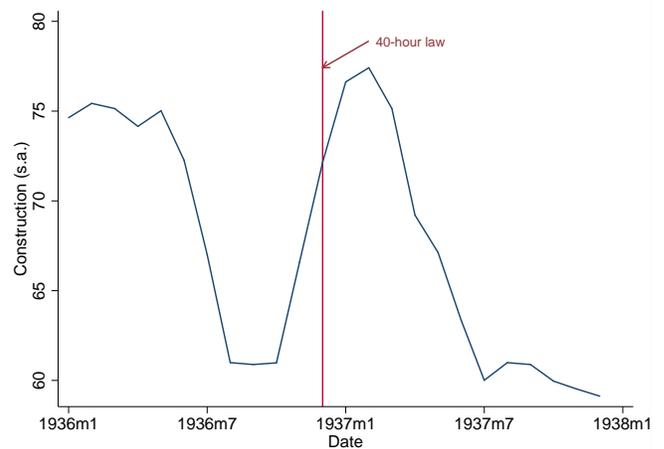
(f) Construction

Figure 7 – 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 22nd day of the month, the vertical line indicates the following month. Sources: See text.

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.[27]

3.4 Industrial production: graphical evidence To understand the effect of the 40-hour law on production, we start with graphical evidence. Figure 7 shows the path of seasonally adjusted industrial production in 6 industries.[28] In each graph, the vertical line indicates the month that the 40-hour 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 law.

3.5 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

$$\Delta \log IP_{i,t} = \beta_1 \Delta \text{40-hr}_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t}, \tag{1}$$

where $IP_{i,t}$ is seasonally adjusted industrial production in industry i in month t, $\text{40-hr}_{i,t}$ is a dummy variable equal to 1 when the 40-hour week restriction took effect in industry i,[29] and $X_{i,t}$ are control variables. $\text{40-hr}_{i,t}$ 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. We deliberately use the *change* in the 40-hour law as a regressor. The equation can then be understood as the differenced version of a regression of the log-level of industrial production on the 40-hour dummy. We choose to estimate the equation in differences because log industrial production is likely non-stationary.

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[27]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).

[28]Due to space constraints, we do not show all 22 industries in our sample. Instead, we show the major industry groups (except mining).

[29]If the 40-hour restriction took effect after the 22nd day of the month, we code it as occurring the following month.

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

Panel A: All industries

Specification	Ind-FE + time-FE		Ind-FE + time-FE + lags		Ind-FE		Ind-FE + lags	
	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative
Δ 40-hour restriction	−0.057**	−0.055**	−0.057**	−0.056**	−0.049**	−0.052**	−0.050**	−0.053**
	(0.021)	(0.019)	(0.018)	(0.017)	(0.011)	(0.011)	(0.010)	(0.010)
Δ Devaluation					0.084**	0.085**	0.101**	0.101**
					(0.012)	(0.012)	(0.017)	(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

Panel B: Results at industry group level

Specification	Ind-FE + time-FE		Ind-FE + time-FE + lags		Ind-FE		Ind-FE + lags	
	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative
Δ 40-hour restriction	−0.039+	−0.039+	−0.035+	−0.036+	−0.048**	−0.051**	−0.047**	−0.052**
	(0.023)	(0.023)	(0.021)	(0.020)	(0.013)	(0.013)	(0.012)	(0.012)
Δ devaluation					0.068**	0.068**	0.082**	0.082**
					(0.014)	(0.014)	(0.024)	(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.

(a) Column 2

(b) Column 4
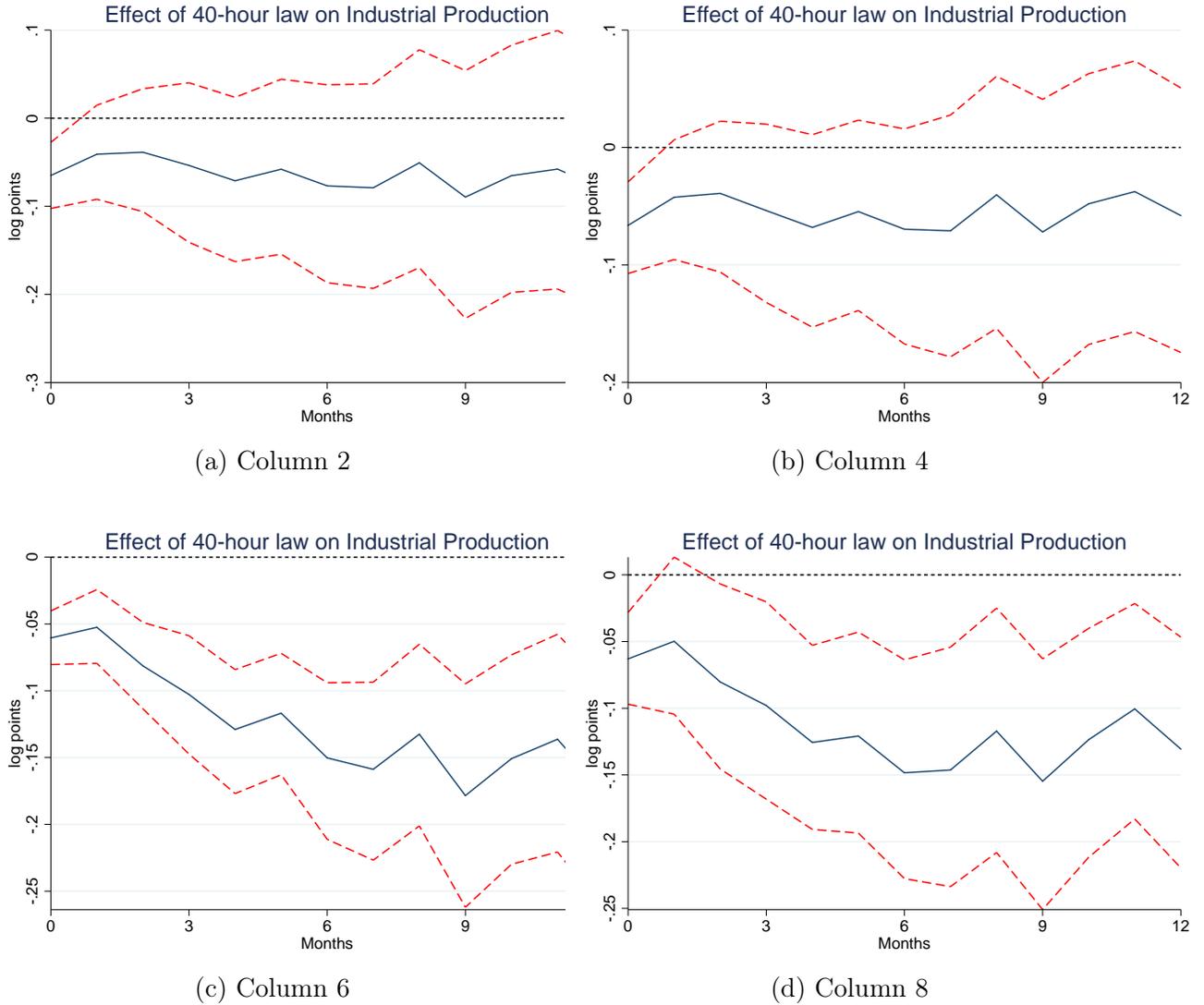
(c) Column 6

(d) Column 8

Figure 8 – Impulse response functions of log industrial production 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.

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 8 we also report the impulse response functions for the *level* of industrial production implied by the regressions with 12 decree lags (column 2). The results for the 40-hour law's immediate effect on output are similar across specifications, but there are differences in the implied dynamic effects. When we control for time fixed effects (figures 8a and 8b), the impulse response function is flat, implying a level drop in output from the 40-hour law. Without time fixed effects (figures 8c and 8d), there appears to be a further decline in industrial production after the 40-hour law takes effect.

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.[30] 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.

In figure 9 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 were news effects of the law or if the law was selectively applied to weaker industries, we would also expect to see significant coefficients 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 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. Therefore, the observed negative effect of the law on production is unlikely to

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[30]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.
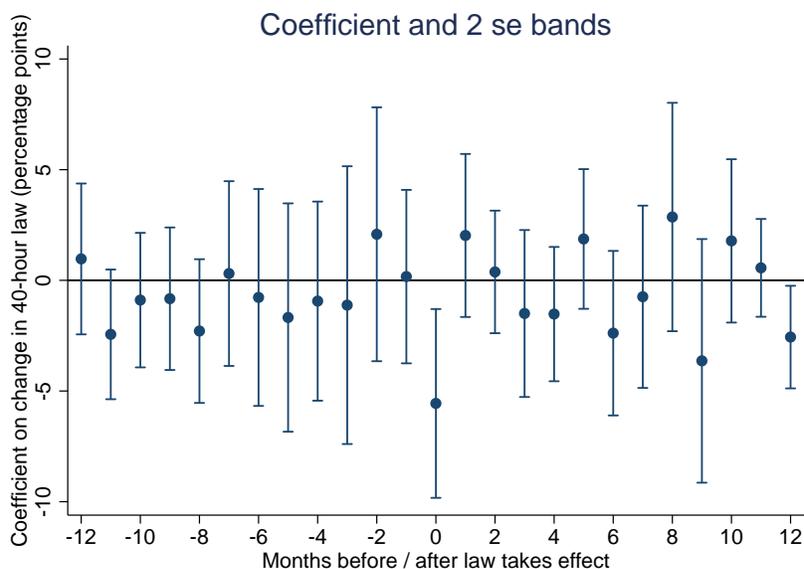
Figure 9 – Coefficients and standard errors on leads and lags of the change in the 40-hour law. The dependent variable is the change in the log of seasonally adjusted industrial production. The specification controls for date and time fixed effects. See text for sources and further description.

be due to pre-trends in affected industries.

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 was 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). 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 B 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.

3.6 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 1), 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.

3.7 General Equilibrium This empirical evidence above 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.

4 The French experience and the new Keynesian model

Our approach is similar to that used in Nakamura and Steinsson (2014) to map cross-sectional fiscal multiplier estimates to aggregate, economy-wide multipliers. Like their cross-sectional estimates of fiscal multipliers, our cross-sectional estimates of the 40-hour law are not directly informative about the aggregate effect. However, like Nakamura and Steinsson we can use the cross-sectional estimates to discipline a new Keynesian model. We then assess whether the general-equilibrium effects are consistent with the French data.

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
Δ 40-hour restriction	0.059**	0.062**	0.056**	0.057**	0.019	0.017	0.019	0.018
	(0.019)	(0.018)	(0.019)	(0.020)	(0.013)	(0.012)	(0.012)	(0.012)
Δ Devaluation					0.086**	0.087**	0.081*	0.082*
					(0.032)	(0.032)	(0.033)	(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.

4.1 A simple new Keynesian model Before considering a multi-sector model that can be directly matched to the data, we illustrate the implications of an hours restriction in a simple new Keynesian model following Woodford (2003); the model is described in more detail in appendix C. Because this model is now standard in macroeconomics, we directly study the log-linearized equations:

$$y_t = E_t y_{t+1} - \sigma^{-1} E_t(i_t - \pi_{t+1}). \tag{2}$$

$$\pi_t = \beta E_t \pi_{t+1} + \kappa[(\sigma + \eta)y_t - (1 + \eta)a_t - \psi_t]. \tag{3}$$

y_t is log output; i_t is the nominal interest rate; π_t is inflation; a_t is aggregate productivity; ψ_t captures the effect of hours restrictions.

The first equation is the Euler equation of the model. Solving this equation forward shows that expected future real interest rates are a key determinant of output today,[31]

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

Thus, 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.[32] The strength of this effect is determined by the intertemporal elasticity of substitution σ^{-1}.

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

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

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

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[31]In solving forward, we assume that output reverts to trend, $\lim_{T \to \infty} y_T = 0$, which will occur if shocks are temporary.

[32]This result depends a on a firm meeting all demand for its product even if its preset price is unchanged. This assumption is present in all new Keynesian DSGE models that we are aware of, and it reflects the difficulty of dynamically solving models with both price and quantity constraints occasionally binding. As such, it is possible that relaxing this assumption would bring the model closer to the data, but resolving the computational issues involved is beyond the scope of this paper. (We are indebted to Miles Kimball for emphasizing this point to us.)

inflation π_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 (σ^{-1}) and the elasticity of labor supply (η^{-1}).

Hours restrictions are captured by a decline in ψ_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, where $\Psi_t = \exp(\psi_t)$. To capture the French hours restriction we first assume that workers typically supply 48 hours out of a total of 120 waking hours each week, $\bar{H} = \frac{48}{120}$. In June 1936 $(t = 0)$ the government announces that the 40-hour law will bind starting in November 1936 $(t = 5)$, so $\Psi_t = \frac{5}{6}$ and total hours worked are $H_t = \frac{40}{120}$. In November 1938 $(t = 29)$ the 40-hour law is abolished, and $\Psi_t = 1$. In short, the restrictions imposed by the 40-hour law are:

$$
\begin{aligned}
\Psi_t &= 1 & t < 5; \\
\Psi_t &= \frac{5}{6} & 5 \le t \le 28; \\
\Psi_t &= 1 & t \ge 29.
\end{aligned}
\tag{6}
$$

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.

To close the model we need to specify how the nominal interest rate is set. Because the nominal interest rate in France barely moved despite a large increase in inflation, we assume it is fixed, $i_t = \bar{i}$, for the duration of the 40-hour law. To ensure the existence of a unique bounded equilibrium, we assume that after some arbitrarily long time $T > 29$ the interest rule follows the taylor principle, $i_t = r_t + \phi_\pi \pi_t$ where $\phi_\pi > 1$.

We can then prove that the hours restriction raise output in the standard new Keynesian model.

Proposition 1 *Let Δy_t be the change in output due to the hours restriction* (6) *in the standard new Keynesian model with fixed nominal interest rates. Then output is unambiguously*

higher while the hours restriction is in place,

$$\Delta y_t > 0, \qquad t < 29;$$

$$\Delta y_t = 0, \qquad t \geq 29.$$

Proof See appendix D.1. ∎

Intuitively, the hours restriction generates expectations of higher future prices by raising production costs. With fixed nominal interest rates, the impact on output is determined by the change in the future price level when the policy terminates,

$$\Delta y_t = \sigma^{-1} \sum_{s=0}^{29} \Delta \pi_{t+1+s} = \sigma^{-1} \Delta p_{29},$$

where Δp_{29} is the change in the price level at $t = 29$ due to the 40-hour law. Higher prices in the future raise output today because they imply higher expected inflation and lower expected real interest rates, which stimulates consumption demand and raises output.

While this model highlights the key mechanism through which an hours restriction raises output in the new Keynesian model, it does not give us an estimate of the quantitative magnitude of the output expansion, making it difficult to compare the model with the data. We therefore turn to a non-linear, medium-scale new Keynesian model in the spirit of Smets and Wouters (2007) that is better suited to providing such an answer.

4.2 Medium-scale model   The medium-scale, multi-industry model is populated by households, goods-producing firms in each industry, and capital producing firms. We describe each of them in turn. Appendix E lists the set of equilibrium conditions of the model.

4.2.1 Households: A representative household maximizes expected discounted utility,

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

where β_t is the time-varying discount factor with steady-state value β, C_t is consumption, N_{it} is the number of employed workers in industry i, each of whom supplies up to $\bar{H}$ hours, σ^{-1} is the intertemporal elasticity of substitution, η^{-1} is the Frisch elasticity of labor supply, Ξ captures the disutility of supplying labor, and τ_i is the relative size of industry i.

The household's per-period budget constraint is

$$P_t C_t + B_t = B_{t-1}(1 + i_t) + \sum_{i}^{I} W_{it} N_{it} + \Pi_t,$$

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, and Π_t are profits rebated by firms. The household's first order conditions are:

$$C_t^{-\sigma} = \lambda_t;$$

$$\Xi \tau_i^{\eta} N_{it}^{\eta} = \lambda_t \frac{W_{it}}{P_t};$$

$$\lambda_t = E_t \beta_{t+1} \lambda_{t+1}(1 + i_{t+1} - \pi_{t+1}).$$

λ_t is the Lagrange multiplier on the (real) budget constraint, and π_t is inflation.

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

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

where θ is the elasticity of substitution across industry goods, and τ_{it} is the weight of good i in the consumption basket. The consumer's relative demand for each industry good is

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

Given the industry weights τ_i, we define the aggregate price index as

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

4.2.2 Consumption-goods firms: Firms producing consumption goods are indexed by $j \in [0, 1]$ within each industry $i = 1, ..., I$. They produce output using the technology

$$Y_{ijt} = A_t (N_{ijt} H_{ijt})^{1-\alpha} K_{ijt}^{\alpha}.$$

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

Industry output is a CES-aggregate over firm output,

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

where ζ is the elasticity of substitution across firm output. Thus, each firm j faces a downward-sloping demand curve,

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

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

$$\min_{H_{ijt} \leq \bar{H}_{it}, N_{ijt}, K_{ijt}} \frac{W_{it}}{P_t} N_{ijt} + R_t^k K_{ijt}$$

$$s.t. \quad A_t (N_{ijt} H_{ijt})^{1-\alpha} K_{ijt}^\alpha = Y_{ijt}.$$

$\bar{H}_{it}$ is a limit on the hours that each worker can be employed at, and R_t^k is the real rental rate of capital. Firms take all factor prices as given. The first-order conditions are

$$H_{ijt} = \bar{H}_{it};$$

$$\frac{N_{ijt}}{K_{ijt}} = \frac{(1-\alpha)}{\alpha} \left(\frac{W_{it}/P_t}{R_t^k} \right)^{-1};$$

$$\mu_{it} = \alpha^{-\alpha} (1-\alpha)^{-(1-\alpha)} (R_t^k)^\alpha \left(\frac{W_{it}}{P_t} \right)^{1-\alpha} \left(\frac{1}{\bar{H}_t} \right)^{1-\alpha} A_t^{-1}.$$

μ_{it} is the real marginal cost of production in sector i.

With the 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. This is because raising hours up to $\bar{H}_{it}$ is costless once the real wage for a worker $\frac{W_{it}}{P_t}$ is paid.

Each firm is subject to Rotemberg pricing frictions. It can reset its price subject to quadratic price adjustment costs. Quadratic price adjustment costs are rebated lump-sum

to households. The optimal reset price maximizes the expected discounted sum of profits,

$$\max_{\{P^*_{ij,t+s}\}} E_t \sum_{s=0}^{\infty} Q_{t,t+s} Y_{ij,t+s} \left[\frac{P^*_{ij,t+s}}{P_{t+s}} - \mu_{i,t+s} - \frac{\phi}{2} \left(\frac{P^*_{ij,t+s}}{P^*_{ij,t+s-1}} - 1 \right)^2 \right],$$

where $Q_{t,t+s} = (\prod_{k=1}^{s} \beta_{t+k}) \left(\frac{C_{t+s}}{C_t} \right)^{-\sigma}$ is the stochastic discount factor. Substituting the solution to the cost-minimization problem and the relative demand for variety j yields the following first order condition,

$$0 = Y_{i,t} \left[(1-\zeta) \left(\frac{P^*_{ijt}}{P_{i,t}} \right)^{1-\zeta} \left(\frac{P_{i,t}}{P_t} \right) + \zeta \mu_{i,t} \left(\frac{P^*_{it}}{P_{i,t}} \right)^{-\zeta} - \phi \left(\frac{P^*_{ij,t}}{P^*_{ij,t-1}} \right) \left(\frac{P^*_{ij,t}}{P^*_{ij,t-1}} - 1 \right) \right] +$$
$$Q_{t,t+1} Y_{i,t+1} \left[\phi \left(\frac{P^*_{ij,t+1}}{P^*_{ijt}} \right) \left(\frac{P^*_{ij,t+1}}{P^*_{ijt}} - 1 \right) \right].$$

The problem is symmetric for all j firms, so we drop the j subscripts. Given the optimal reset price, the evolution of gross inflation in each industry is $\Pi_{it} = \frac{P^*_{it}}{P_{i,t-1}} = \frac{P_{it}}{P_{i,t-1}}$, which we substitute back into the first order condition,

$$0 = Y_{i,t} \left[(1-\zeta) \left(\frac{P_{i,t}}{P_t} \right) + \zeta \mu_{i,t} - \phi \Pi_{i,t} (\Pi_{i,t} - 1) \right] + Q_{t,t+1} Y_{i,t+1} \left[\phi \Pi_{i,t+1} (\Pi_{i,t+1} - 1) \right].$$

Accordingly, industry-specific gross inflation Π_{it} is increasing in industry real marginal costs mu_{it}, decreasing in the industry's relative price $\frac{P_{it}}{P_t}$, and increasing in future inflation $\Pi_{i,t+1}$.

The evolution of aggregate gross inflation is a weighted average of industry-specific inflation rates

$$\Pi_t = \left[\sum_{i=1}^{I} \tau_{it} \left(\Pi_{it} \frac{P_{i,t-1}}{P_{t-1}} \right)^{1-\theta} \right]^{\frac{1}{1-\theta}}.$$

4.2.3 Capital-producing firms: A continuum $j \in [0,1]$ of capital-producing firms produce, own, and rent capital. Capital for the next period, $K_{j,t+1}$, is produced by using $1 + S(I_{jt}/I_{j,t-1})$ units of output today, where I_{jt} is current investment. Existing units of capital depreciate at rate δ. Additional units of capital can be purchased from other capital-producing firms in a competitive market at price P_t^k. Thus, a firms' new holdings of capital are

$$K_{j,t+1} = (1-\delta)K_{j,t} + I_{jt}[1 - S(I_{jt}/I_{j,t-1})] + X_{j,t},$$

36

where $X_{j,t}$ are net purchases of capital. The firms' objective is to maximize profits,

$$\max_{\{K_{j,t+1+s}, I_{j,t+s}, X_{j,t+s}\}} \sum_{s=0}^{\infty} Q_{t,t+s} \left(R_{t+s}^k K_{j,t+s} - P_{t+s}^k X_{j,t+s} - I_{j,t+s} \right).$$

The first-order conditions are symmetric for each firm and independent of the initial level of capital, so we drop the j-subscripts and consider a representative capital-producing firm,

$$P_t^k = Q_{t,t+1}[R_{t+1}^k + (1-\delta)P_{t+1}^k];$$

$$1 = P_t^k[1 - S(I_t/I_{t-1}) - I_t/I_{t-1}S'(I_t/I_{t-1})] + Q_{t,t+1}P_{t+1}^k(I_{t+1}/I_t)^2 S'(I_{t+1}/I_t);$$

$$K_{t+1} = (1-\delta)K_t + I_t[1 - S(I_t/I_{t-1})].$$

Finally, we follow the investment adjustment cost specification in Christiano, Eichenbaum, and Trabandt (2015),

$$S(I_t/I_{t-1}) = 0.5\exp[\sqrt{\psi}(I_t/I_{t-1} - 1)] + 0.5\exp[-\sqrt{\psi}(I_t/I_{t-1} - 1)] - 1.$$

4.2.4 Market Clearing: We require that all goods markets clear in equilibrium,

$$C_t + I_t = Y_t;$$

$$Y_t = \left[\sum_{i=1}^{I} \tau_{it}^{\frac{1}{\theta}} Y_{it}^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}.$$

4.2.5 Policy: As in the simple model we assume that the nominal interest rate is fixed at its steady-state level up until some finite time T,

$$i_t = \beta^{-1} - 1 \qquad t < T;$$

$$i_t = \beta^{-1} \Pi_t^{\phi_\pi} \qquad t > T,$$

where $\phi_\pi > 1$. In our simulation we let $T = 600$ months. In a robustness check, we allow nominal interest rates to respond to inflation as they do in the data, but because that response is in practice quite weak, we start with the simpler case of a constant nominal rate.[33]

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[33]An additional advantage is that our simulation results are comparable with other work emphasizing completely unresponsive monetary policy (e.g., Eggertsson et al., 2014).
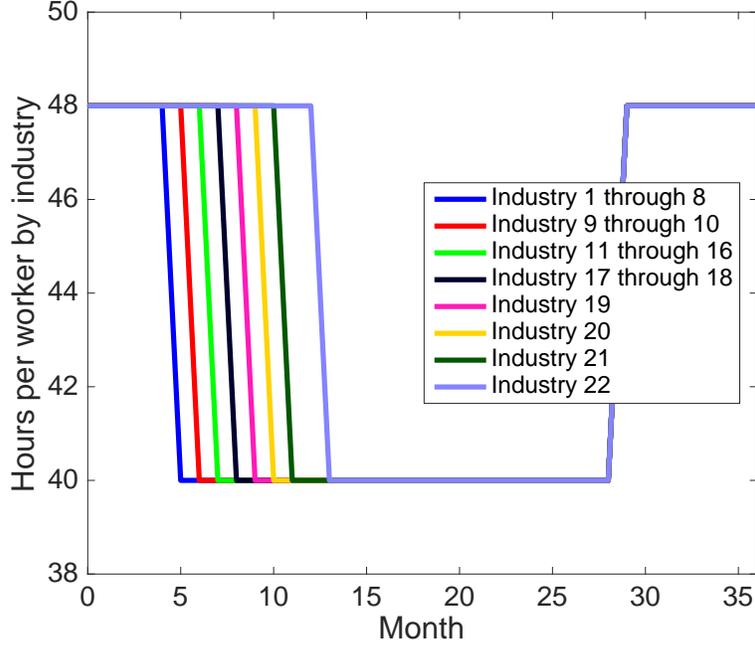
Figure 10 – Hours per worker in each industry in the model experiment. At $t = 0$ (June 1936) the implementation of the 40-hour law is announced. At $t = 5$ (November 1936), the first industry is subject to the 40-hour law. Thereafter, the model experiment is conducted such that the timing of the law's diffusion across industries matches that in the data. As in the data, at $t = 29$ (November 1938) the 40-hour law is abolished in all industries.

4.2.6 Experiment We implement hours restrictions sequentially across twenty-two industries. The number of industries as well as the implementation dates mirror the actual 40-hour law in France (table 1),

$$\Psi_{it} = \frac{5}{6} \begin{cases} 5 \leq t \leq 28, & i = 1, ..., 8 \\ 6 \leq t \leq 28, & i = 9, 10 \\ 7 \leq t \leq 28, & i = 11, ..., 16 \\ 8 \leq t \leq 28, & i = 17, 18 \\ 9 \leq t \leq 28, & i = 19 \\ 10 \leq t \leq 28, & i = 20 \\ 11 \leq t \leq 28, & i = 21 \\ 13 \leq t \leq 28, & i = 22; \end{cases}$$

$$\Psi_{it} = 1 \quad \text{otherwise.}$$

These hours restrictions are plotted in figure 10. Note that time $t = 0$ corresponds to June 1936 when the 40-hour law is announced and $t = 5$ to November 1936, when the 40-hour law is first implemented in an industry.

We solve the model under perfect foresight. Thus we can solve the *full non-linear model* as in Christiano et al. (2015). This is important because linear approximation can yield misleading results (Braun, Körber, and Waki, 2012).

4.2.7 Calibration: We calibrate the model to a monthly frequency. Because we lack detailed pre-World War II data to inform parameter values, we set our parameters to typical values used in the post-war literature.

Standard parameters are $\alpha = 0.33$ to match a capital income share of 33%, and a depreciation rate of $0.1/12$ to match an annual depreciation rate of 10%. We set the investment adjustment cost to $\psi = 4$ following Christiano et al. (2015). The discount factor is calibrated to $\beta = 0.97^{\frac{1}{12}}$ to match the average 3% real consol yield from 1926 to 1935.[34]

We use middle-of-the-road values for the intertemporal elasticity of substitution, $\sigma^{-1} = 1$, and the Frisch labor supply elasticity, $\eta^{-1} = 1$. For example, Smets and Wouters (2007) set $\sigma^{-1} = 0.7$ and $\eta^{-1} = 0.5$; Altig, Christiano, Eichenbaum, and Linde (2011) set $\sigma^{-1} = 1$ and $\eta^{-1} = 1$; Christiano et al. (2015) set $\sigma^{-1} = 1$ and $\eta^{-1} = \infty$; and Eggertsson et al. (2014) set $\sigma^{-1} = 2$ and $\eta^{-1} = 0.5$. We set the elasticity of substitution across varieties to $\zeta = 10$, a standard value that matches the 10% price mark-up over marginal costs in post-war data (Basu and Fernald, 1997).

As we show below, matching our cross-sectional estimates requires a price adjustment cost of $\phi = 577$. This corresponds to an average price duration of 4 months under Calvo pricing frictions and firm-specific labor.[35] The prices in our model are thus relatively flexible compared to standard calibrations of the new Keynesian model, where the average price duration is between 9 and 12 months following Nakamura and Steinsson (2008).

We let all industries be the same size $\tau_i = \frac{1}{I}$ and set the elasticity of substitution across

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[34]This is the average annual nominal consol yield (Global Financial Data series IGFRA10D) deflated by annual cost-of-living inflation from Mitchell (1980), table I2.

[35]The mapping is $\phi = (\zeta - 1)\frac{1-\xi}{[1-(1-\xi)\beta]\xi}\left(1 + \frac{\zeta\eta(1-\alpha)}{1+\alpha\eta}\right)$, where $\xi = 0.266$ is the Calvo probability that a price can be adjusted.

industry goods to $\theta = 10$. This is the largest elasticity of substitution typically employed in the literature (see Coibion, Gorodnichenko, and Wieland, 2012). For lower elasticities of substitution we require even more flexible prices to match our cross-sectional estimates. In turn, more flexible prices further amplify the output expansion from the 40-hour law. Thus our choice of a high elasticity of substitution biases us against the prediction of a large output expansion from the 40-hour law.

4.2.8 Cross-sectional estimates: To verify that we make an appropriate comparison of the model with the data, we check that that the model can match our cross-sectional estimates. We run the regression (1) with industry and time fixed effects on our model output. Thus, as in the data, the variation that identifies the cross-sectional effect of the 40-hour law comes from the differential timing. We target a cross-sectional output decline of -4.5%, which is at the lower end of the coefficients in panels A and B of table 2.

Table 4 reports the coefficients with output growth, employment growth, and hours-per-capita growth as the dependent variable. By construction, the coefficient on the hours restriction is -4.5 when output growth is the dependent variable. Thus, the model produces cross-sectional estimates in line with our empirical estimates.

Table 4 – Cross-sectional effects of hours-restrictions in multi-sector new Keynesian model

	Dependent Variable		
	Output Growth	Employment Growth	Hours Growth
Δ 40-hour restriction	-4.50	5.80	-18.23
95% CI	[-4.99,-4.01]	[5.43,6.17]	[-18.23,-18.23]
Time-FE	Yes	Yes	Yes
Industry-FE	Yes	Yes	Yes

Notes: Estimates of the cross-sectional effect of the hours-restrictions in medium-scale multi-sector new Keynesian model. Based on the regression specification (1) with time and industry fixed-effects. The price adjustment cost parameter ϕ in the model is calibrated to yield a coefficient of -4.5 in the first column.

As in Nakamura and Steinsson (2014), our cross-sectional estimates are informative because they restrict the plausible parameter space of the model. In the model, the 40-hour law must significantly move relative prices in order to on impact reduce relative output by 4.5%. The necessary relative price movement requires that firms can easily adjust their prices. The high degree of price flexibility in turn implies that the hours restriction generates a large

increase in prices under a fixed nominal interest rate policy.

4.2.9 General equilibrium results: Figure 11 shows the impact of the 40-hour law on aggregate output, inflation, consumption and investment in the model. The 40-hour law significantly raises the rate of inflation, as firms increase their prices given higher marginal costs of production. The large increase in expected inflation implies a large decline in expected real interest rates given fixed nominal interest rates. As in the simple new-Keynesian model, the decline in expected real interest rates raises output and consumption. The expansion is very large: the model predicts that output more than doubles (a 150% increase) when the 40-hour law is announced.
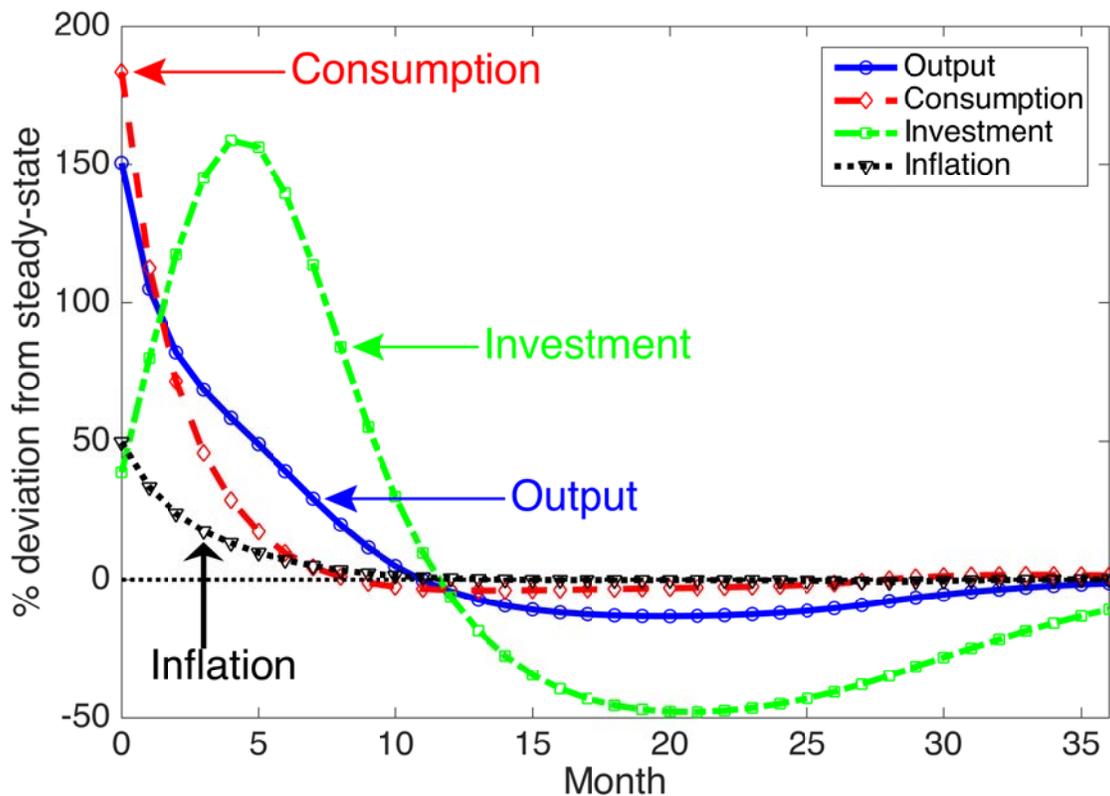
Figure 11 – Impulse response function of output, prices, consumption and investment to the hours restrictions in figure 10 in the medium-scale, multi-sector new Keynesian model. Month 0 is when the 40-hour law is announced.

In the medium-scale model an increase in investment also contributes to the expansion in output. Firms find it attractive to add capital for two reasons. First, the return to capital is high: Higher consumption demand raises output, which raises the marginal product of capital. Second, the real return on bonds, the alternative investment, is low. Both

41

factors contribute to investment more than doubling. Compared to the consumption impulse response function, the investment impulse response function has a hump-shaped pattern because the investment adjustment cost penalizes large swings in investment.

A $t = 12$ the 40-hour law becomes contractionary, although the magnitude of the contraction is much smaller than the magnitude of the earlier expansion. This is because the agents in the model anticipate that the 40-hour law will end at $t = 29$ (November 1938). Thus, at $t = 12$ they expect lower prices in the future, knowing that firms will more efficiently produce once the 40-hour law is abolished. Thus, the earlier intuition applies in reverse: Expected inflation is (slightly) negative, expected real interest rates are high, and so consumption contracts. Further, the return to capital is low so investment falls below its steady-state value.

As this discussion makes clear, the contraction is driven by the correct anticipation of the termination of the 40-hour law. While it is plausible that most people in France considered the 40-hour law to be temporary given its controversial politics, it seems less likely that they correctly anticipated when it ended. Thus, in appendix F.1, we capture the notion that the law was expected to be eventually abolished at an unknown future date by letting the expected hours restriction follow an AR(1) process after $t = 29$. Thus agents *expect* the law to eventually be terminated, although in a less abrupt way than was actually the case. Once the simulation reaches $t = 29$, the hours restriction is still abolished, but this is now a surprise to the agents in the model. In that sense there is less foresight in this simulation compared to our baseline. In this set-up the expansion from the 40-hour law is even larger because the 40-hour law is expected to last longer. Further, the expansion is more prolonged while the following contraction is shallower.

In appendix F.2 we conduct additional robustness checks. First, we allow nominal interest rates to respond to the 40-hour law as they do in the data. Because this empirical response is weak — at most a 3 percentage point increase for commercial paper (and less for other interest rates) relative to the 40 percentage point increase in inflation — the results are very similar to our baseline calibration. We also run simulations with price indexation, habit formation and nominal wage rigidity. In each case, the model predicts at least a doubling of output after reparameterizing pricing frictions to match our cross-sectional estimates. In

another exercise, we feed a smaller hours restriction into the model to match the actual 12% decline in hours in the data. After reparameterizing, the model predicts a tripling of output from the 40-hour law because the greater required price flexibility more than compensates for the smaller shock. We also run a simulation in which the economy is first in a recession before the hours restriction is implemented. Even when the initial recession is as deep as a 15% decline in output, the new Keynesian model still predicts a large expansion due to the 40-hour law. In short, in each exercise we find that the model predicts a large economic expansion at odds with the French experience.

5 Can other factors explain the model-data disconnect?

In this section we consider possible explanations for the disconnect between the new Keynesian model's prediction and the French data. If a large negative shock hit the French economy at the same time as the 40-hour law, then the expansionary effects of hours restrictions predicted by the new Keynesian model might not be visible in the data. Here we consider possible candidates for such a shock. A full consideration of the many shocks affecting the French economy in the mid-1930s is outside the scope of any single paper. But we argue here that none of the obvious candidate shocks is likely to explain the underperformance of the French economy relative to the model.

One reason is simple: any negative shock that reconciles the model with the data must have been enormous; the model predicts that the 40-hours law would more than double French output. Thus for a negative shock to explain why the French economy does not match the data, the shock must have reduced French output by more than 100%.

Perhaps the most obvious concern is that worries about war with Germany, or political instability in Europe more generally, discouraged consumption and investment. Cross-country data suggests, however, that this was not a large negative shock. Figure 12 shows industrial production growth and the change in wholesale 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. There is a strong positive relationship between the change in inflation and output growth.[36] Importantly, with the exception of France, this relationship holds for countries that left the Gold Standard in the mid-1930s, when one might have most expected a depressing influence from political events. Belgium and the Netherlands grew strongly after their devaluations in 1935 and 1936 despite their proximity to Germany.[37] This is evidence against the view that fears of war with Germany substantially reduced French output in 1936-38.
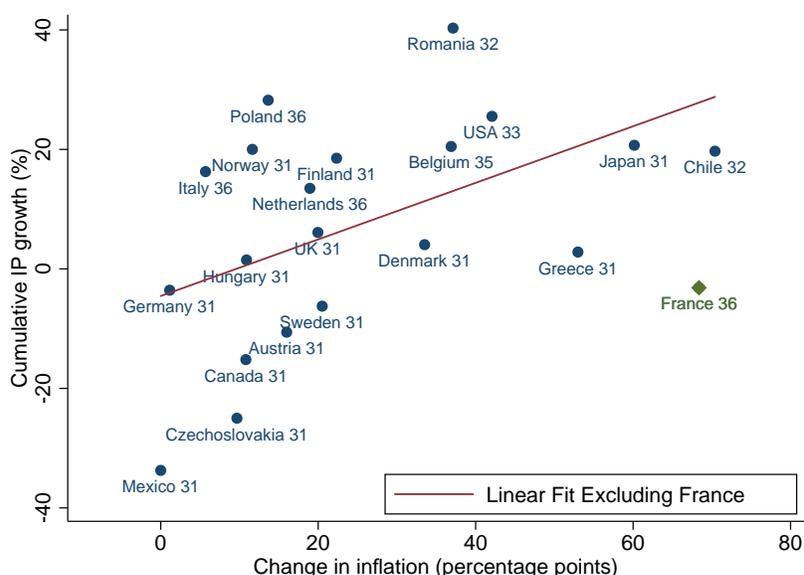

Figure 12 – Industrial production growth and the change in wholesale price inflation two years after leaving the gold standard. *Notes:* The two digits after the country name are the year in which the country left the gold standard. Sources: Industrial output and wholesale prices for European countries: 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.

Another possible explanation for poor economic performance between 1936 and 1938 is

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[36]Including France, the relationship among the 21 countries is statistically significant at the 10% level; excluding France, it is significant at the 5% level.

[37]The cross-country evidence is also inconsistent with the view 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. But figure 12 provides little evidence for this view. The Netherlands also devalued in 1936, and its recovery fits neatly with the general association between higher inflation and higher growth.

the breakdown of factory discipline that followed the May-June 1936 strikes (Prost, 2002). Even after the initial wave of strikes subsided, 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.[38]

Furthermore, an explanation emphasizing strikes is equally problematic for the new Keynesian model. In the new Keynesian model, these strikes ought to have raised French output by leading to higher consumption demand in anticipation of higher prices. Appendix D provides a proof in the simple model (section 4.1). Thus, strikes cannot resolve the disconnect between the new Keynesian model and the data.

Other authors (e.g., Jackson, 1988) have blamed poor economic performance on a lack of business confidence and capital flight. But the national accounts data provide little support for this view. Between 1935 and 1937, overall French GDP was flat, but business investment grew 43% (Villa data, series PIBVOL and IZE).[39] 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.

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[38]A real business cycle style model, for instance, might be able to match the decline in output that followed the May-June 1936 strikes and the implementation of the 40-hour law in 1937. But it would be unable to explain the large increase in French output that followed devaluation.

[39]One can also look to the stock market for an indication of business sentiment. Deflated by consumer prices (Sauvy (1984), v. 3, p. 356.), the historical CAC40 index constructed by Le Bris and Hautcoeur (2010) fell 24% between the Popular Front's election in May 1936 and devaluation in September 1936. It then rose 42% increase in the 5 months following devaluation. This is consistent with positive effects of devaluation on the French economy, and it suggests at least the possibility of optimism about the French economy under the Popular Front. The interpretation of stock prices movements is, however, complicated by several factors. First, these movements reflect in some combination the effects of the 40-hour law, other factors affecting dividend expectations, and movements in discount rates. Second, a significant portion of the French stock market was made up of companies whose primary activities occurred outside France. The most important of these was the Suez canal company (Canal maritime de Suez). The Suez canal company shares did particularly well in 1936 (Le Bris and Hautcoeur, 2010).

6 Conclusion

In 1936, the Popular Front embarked France on a radical experiment with supply-side policies. It raised wages by fiat and restricted the work week to 40 hours. We show that the stagnation of French output coincided with the timing of these policies, particularly the 40-hour law. We also exploit quasi-exogenous variation in the timing of the 40-hour law's implementation across industries to estimate its effect on production and prices. We find that it reduced production and raised prices in affected industries by roughly 5%. To see whether these cross-sectional estimates can be consistent with the aggregate expansion predicted by the standard new Keynesian model, we calibrate a medium-scale, multi-sector new Keynesian model to match the cross-sectional output decline. The model implies that by raising inflation expectations and reducing real interest rates, the 40-hour law ought to have more than doubled French output. Since the aggregate data rule out an effect of this magnitude, we conclude that the new Keynesian model is a poor guide to the effect of supply-side policies in depressed economies.

These results are relevant both to current debates about structural reforms, particularly in Europe, and to economists' understanding of the effects of supply-side policies in the U.S. during the 1930s. Many academics and policymakers have advocated structural reforms as a solution to anemic growth in the Eurozone periphery (Fernández-Villaverde et al., 2014; Lo and Rogoff, 2015). But as pointed out by Eggertsson et al. (2014), and as we verify in this paper, standard new Keynesian models imply that structural reforms are likely to lower output in depressed economies.

The debate over the effects of supply-side policies is unresolved in part because of a lack of empirical evidence. Our paper contributes some such evidence from an earlier period in Europe's history. In France in 1936, as in Europe today, output was depressed and nominal interest rates were mostly unresponsive to fluctuations in output and inflation. We show that in these circumstances, a large supply-side shock—the 40-hour law—affected output in the normal way. It lowered output. Conversely, the removal of the 40-hour law raised output. Of course, caution is needed in applying results from the 1930s to policy today, but at a minimum the effect of the 40-hour law suggests that further research is needed before

concluding that supply-side reforms will lower output in Europe today.

Our results also support criticism of the supply-side elements of the U.S. New Deal, in particular the NIRA (e.g. Friedman and Schwartz (1963) Alchian (1969), Eichengreen (1992), Bordo et al. (2000), and Cole and Ohanian (2004)). If, as argued by Eggertsson (2012), 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 polices in the United States, while not uniformly helpful [the NIRA], were at the same time insufficient to neutralize devaluation's stimulative effects." Thus, the U.S. may have been fortunate that unlike Léon Blum, Franklin Roosevelt was ultimately more committed to demand expansion than to supply restriction.

Overall, our results thus suggest a nuanced view of inflation expectations in depressed economies: demand-side policies that raise inflation expectations may be expansionary (e.g., devaluation) while supply-side policies that raise inflation expectations may be contractionary (e.g., 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. We hope that future work will consider how the new Keynesian model might be modified to better match the observed consequences of supply shocks.

References

Alchian, Armen A., "Information Costs, Pricing, and Resource Unemployment," *Economic Inquiry*, 1969, *7* (2), 109–128.

Altig, David, Lawrence J Christiano, Martin Eichenbaum, and Jesper Linde, "Firm-specific capital, nominal rigidities and the business cycle," *Review of Economic Dynamics*, 2011, *14* (2), 225–247.

Angrist, Joshua D. and Jörn-Steffen Pischke, *Mostly Harmless Econometrics: An Empiricist's Companion*, Princeton University Press, 2008.

Archives Nationales, "Les Lois sur la Durée du Travail Conservées aux Archives Nationales: Sources Conservées aux Archives nationales," http://www.archivesnationales. culture.gouv.fr/chan/chan/pdf/F22-2187-2317.pdf 2003.

Asselain, Jean-Charles, "Une Erreur de Politique Économique: La Loi des Quarante Heures de 1936," *Revue Économique*, 1974, *25* (4), 672–705.

_ , "La Dévaluation Française de 1936: Essai d'Approche Comparative Internationale," in "Du Franc Poincaré à l'Écu" Animation de la Recherche, Comité pour l'Historie Économique et Financière de la France, 1993, pp. 239–268.

Basu, Susanto and John G Fernald, "Returns to Scale in US production: Estimates and Implications," *Journal of Political Economy*, 1997, *105* (2), 249–283.

Beaudry, Paul and Franck Portier, "The French Depression in the 1930s," *Review of Economic Dynamics*, 2002, *5* (1), 73–99.

Bernard, Philippe and Henri Dubief, *The Decline of the Third Republic, 1914-1938*, Cambridge University Press, 1988.

Board of Governors of the Federal Reserve System, *Banking and Monetary Statistics, 1914-1941*, Board of Governors of the Federal Reserve System, 1943.

Bordo, Michael D., Christopher J. Erceg, and Charles L. Evans, "Money, Sticky Wages, and the Great Depression," *American Economic Review*, 2000, *90* (5), 1447–1463.

Braun, R. Anton, Lena Mareen Körber, and Yuichiro Waki, "Some Unpleasant Properties of Log-linearized Solutions when the Nominal Rate is Zero," Federal Reserve Bank of Atlanta Working Paper 2012-05 2012.

Bris, David Le and Pierre-Cyrille Hautcoeur, "A Challenge to Triumphant Optimists? A Blue Chips Index for the Paris stock exchange, 1854–2007," *Financial History Review*, 2010, *17* (02), 141–183.

Bundick, Brent, "Real Fluctuations at the Zero Lower Bound," Technical Report, Mimeo 2014.

Chatriot, Alain, *La Démocratie Sociale à la Française: L'Expérience du Conseil National Économique 1924-1940,* Collection "L'Espace de l'Histoire", La Découverte, 2002.

_ , Patrick Fridenson, and Éric Pezet, "La Réduction du Temps de Travail en France Entre Réglementation Tutélaire et Négociation Encadrée (1814-1978)," *Revue de l'IRES*, 2003, *42* (2), 1–33.

Christiano, Lawrence J., Martin S. Eichenbaum, and Mathias Trabandt, "Understanding the Great Recession," *American Economic Journal: Macroeconomics*, 2015, *7* (1), 110–167.

Cogley, Timothy and Argia M. Sbordone, "Trend Inflation, Indexation, and Inflation Persistence in the New Keynesian Phillips curve," *American Economic Review*, 2008, *98* (5), 2101–2126.

Coibion, Olivier, Yuriy Gorodnichenko, and Johannes Wieland, "The Optimal Inflation Rate in New Keynesian Models: Should Central Banks Raise Their Inflation Targets in Light of the Zero Lower Bound?," *Review of Economic Studies*, 2012, *79* (4), 1371–1406.

Cole, Harold L. and Lee E. Ohanian, "New Deal Policies and the Persistence of the Great Depression: A General Equilibrium Analysis," *Journal of Political Economy*, 2004, *112* (4), 779–816.

de Bromhead, Alan, Barry Eichengreen, and Kevin H. O'Rourke, "Political Extremism in the 1920s and 1930s: Do German Lessons Generalize?," *Journal of Economic History*, 2013, *73* (2), 371–406.

Donald, Stephen G. and Kevin Lang, "Inference with Difference-in-Differences and Other Panel Data," *Review of Economics and Statistics*, 2007, *89* (2), 221–233.

Dupor, William and Rong Li, "The Expected Inflation Channel of Government Spending in the Postwar U.S," *Federal Reserve Bank of St. Louis Working Paper 2013-026* 2013.

Eggertsson, Gauti B., "Great Expectations and the End of the Depression," *American Economic Review*, September 2008, *98* (4), 1476–1516.

_ , "Was the New Deal Contractionary?," *American Economic Review*, February 2012, *102* (1), 524–555.

_ and Paul. Krugman, "Debt, Deleveraging, and the Liquidity Trap: a Fisher-Minsky-Koo Approach," *Federal Reserve Bank of New York, unpublished manuscript, February*, 2011.

_ , Andrea Ferrero, and Andrea Raffo, "Can Structural Reforms Help Europe?," *Journal of Monetary Economics*, 2014, *61*, 2–22.

Eichengreen, Barry, *Golden Fetters: The Gold Standard and the Great Depression, 1919-1939*, Oxford University Press, 1992.

_ and Jeffrey Sachs, "Exchange Rates and Economic Recovery in the 1930s," *Journal of Economic History*, 1985, *45* (4), 925–946.

Fernández-Villaverde, Jesús, Pablo Guerrón-Quintana, and Juan F Rubio-Ramírez, "Supply-Side Policies and the Zero Lower Bound," *IMF Economic Review*, 2014, *62* (2), 248–260.

Fishback, Price V., "New Deal," in Steven N. Durlauf and Lawrence E. Blume, eds., *The New Palgrave Dictionary of Economics*, Palgrave Macmillan, 2008.

_ and Valentina Kachanovskaya, "The Multiplier for Federal Spending in the States During the Great Depression," *Journal of Economic History*, 2015, *75* (1), 125–162.

Friedman, Milton and Anna Jacobson Schwartz, *A Monetary History of the United States, 1867-1960*, Princeton University Press, 1963.

Hausman, Joshua K, "Fiscal Policy and Economic Recovery: The Case of the 1936 Veterans' Bonus," Working Paper 2014.

Hausman, Joshua K. and Johannes F. Wieland, "Abenomics: Preliminary Analysis and Outlook," *Brookings Papers on Economic Activity*, 2014, *2014* (1), 1–63.

Huber, Michel, *Cours de Statistique Appliquée aux Affaires*, Vol. III of *Actualités Scientifiques et Industrielles*, Hermann & Cie, 1944.

_ , *Cours de Statistique Appliquée aux Affaires*, Vol. IV of *Actualités Scientifiques et Industrielles*, Hermann & Cie, 1946.

Irwin, Douglas A, "The French Gold Sink and the Great Deflation of 1929–32," *Cato Papers on Public Policy*, 2012, *2*, 1–56.

Jackson, Julian, *The Popular Front in France: Defending Democracy, 1934-38*, Cambridge University Press, 1988.

Kalecki, Michał, "The Lesson of the Blum Experiment," *Economic Journal*, 1938, *48* (189), 26–41.

Klenow, Peter J. and Benjamin A. Malin, "Microeconomic Evidence on Price-Setting," *Handbook of Monetary Economics*, 2010, *3*, 231–284.

Krugman, Paul R., "Currency Regimes, Capital Flows, and Crises," 2013. Paper presented at the 14th Jacques Polak Annual Research Conference hosted by the International Monetary Fund.

League of Nations Economic Intelligence Service, *Statistical Year-Book of the League of*

Nations 1936/37, League of Nations, 1937.

＿ , *Statistical Year-Book of the League of Nations 1937/38*, League of Nations, 1938.

＿ , *Statistical Year-Book of the League of Nations 1938/39*, League of Nations, 1939.

Lo, Stephanie H. and Kenneth Rogoff, "Secular Stagnation, Debt Overhang and Other Rationales for Sluggish Growth, Six Years On," 2015.

Margairaz, Michel, *L'État, les Finances et l'Économie. Histoire d'une Conversion 1932-1952*, Comité pour l'Histoire Économique et Financière de la France, 1991.

Marjolin, Robert, in Groupe d'Études des Sciences Sociales, ed., *Les Sciences Sociales en France*, P. Hartmann, 1937, chapter La Statistique.

＿ , "Reflections on the Blum Experiment," *Economica*, 1938, *5* (18), 177–191.

Mitchell, B. R., *European Historical Statistics, 1750-1975*, Facts on File, 1980.

＿ , *International Historical Statistics: The Americas and Australasia*, Gale Research Co., 1983.

＿ , *International Historical Statistics: Africa, Asia, and Oceania 1750-2005*, Palgrave Macmillan, 2007.

Mouré, Kenneth, *Managing the Franc Poincaré*, Cambridge University Press, 1991.

＿ , *The Gold Standard Illusion: France, the Bank of France, and the International Gold Standard, 1914-1939*, Oxford University Press, 2002.

Nakamura, Emi and Jón Steinsson, "Five Facts about Prices: A Reevaluation of Menu Cost Models," *Quarterly Journal of Economics*, 2008, pp. 1415–1464.

＿ and ＿ , "Fiscal Stimulus in a Monetary Union: Evidence from US Regions," *American Economic Review*, 2014, *104* (3), 753–792.

Neumann, Todd C., Jason E. Taylor, and Price V. Fishback, "Comparisons of Weekly Hours over the Past Century and the Importance of Work-Sharing Policies in the 1930s," *American Economic Review*, 2013, *103* (3), 105–110.

Patat, Jean-Pierre and Michel Lutfalla, *A Monetary History of France in the Twentieth Century*, Palgrave Macmillan, 1990.

Prost, Antoine, "Les Grèves de Mai-Juin 1936 Revisitées," *Le Mouvement Social*, 2002, (3), 33–54.

Romer, Christina D., "What Ended the Great Depression?," *Journal of Economic History*, 1992, *52* (4), 757–784.

Salais, Robert, "Why was Unemployment so Low in France during the 1930s?," in Barry Eichengreen and T. J. Hatton, eds., *Interwar Unemployment in International Perspective*, Springer, 1988, pp. 247–288.

Sauvy, Alfred, "La Production Industrielle en France: Calcul d'un Nouvel Indice Mensuel," *Bulletin de la Statistique Générale de la France*, October-December 1937, *XXVII* (1), 119–147.

＿ , *Essai Sur la Conjoncture et la Prévision Économiques*, Éditions du Centre Polytechnicien d'Études Économiques, 1938.

＿ , "Statistique Générale et Service National de Statistique de 1919 à 1944," *Journal de la Société Française de Statistique*, 1975, *116*, 34–43.

＿ , *Histoire Économique de la France Entre les Deux Guerres*, Economica, 1984.

___ and O. Magnin, "La Production Industrielle en France depuis 1928: Révision des Indices et Nouvelles Sources de Documentation," *Bulletin de la Statistique Générale de la France*, April-June 1939, *XXVIII* (3), 467–494.

___ and Pierre Depoid, *Salaires et Pouvoir d'Achat des Ouvriers et des Fonctionnaires entre les Deux Guerres* Travail Humain. Pub., Sec., A:12, Paris: Institut National d'Étude du Travail et d'Orientation Professionnelle, 1940.

Schwob, Philippe, "Opinions sur la Conjoncture Française," *Revue d'Economie Politique*, 1937, *51* (1), 146–151.

Seidman, Michael, "The Birth of the Weekend and the Revolts against Work: The Workers of the Paris Region during the Popular Front (1936-38)," *French Historical Studies*, 1981, *12* (2), 249–276.

Smets, Frank and Rafael Wouters, "Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach," *American Economic Review*, 2007, *97* (3), 586–606.

Statistique Générale, *Mouvement Économique en France de 1929 à 1939*, Imprimerie Nationale, 1941.

Swanson, Eric T. and John C Williams, "Measuring the Effect of the Zero Lower Bound on Medium-and Longer-Term Interest Rates," *American Economic Review*, 2014, *104* (10), 3154–3185.

Taylor, Jason E., "Work-Sharing During the Great Depression: Did the 'President's Reemployment Agreement' Promote Reemployment?," *Economica*, 2011, *78* (309), 133–158.

Temin, Peter and Barrie A. Wigmore, "The End of One Big Deflation," *Explorations in Economic history*, 1990, *27* (4), 483–502.

Trotsky, Leon, *Whither France?*, Merit Publishers, 1968.

Villa, Pierre, "Une Explication des Enchaînements Macroéconomiques sur l'Entre-Deux-Guerres," *Le Mouvement Social*, 1991, pp. 213–243.

Werning, Iván, "Managing a Liquidity Trap: Monetary and Fiscal Policy," NBER Working Paper 17344 2011.

White, Eugene N., "The French Revolution and the Politics of Government Finance, 1770-1815," *Journal of Economic History*, 1995, *55* (2), 227–255.

Wieland, Johannes F, "Are Negative Supply Shocks Expansionary at the Zero Lower Bound?," Working Paper, University of California–San Diego 2015.

Woodford, Michael, *Interest and Prices: Foundations of a Theory of Monetary Policy*, Princeton University Press, 2003.

For Online Publication

A 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.[40] 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 economic outlook, the publication displayed, in a series of tables classified by topics, the latest economic data together with explanatory notes. These often included statements about the most likely future movements in those 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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[40]The monthly *X-crise*, published by the *Centre Polytechinicien 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 Polytechinicien 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.*"[41] [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.*"[42] 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.*"[43] 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.*"[44] 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] parait s'orienter vers une politique de hausse [des prix] dans tous les domaines.*"[45] [The government] seems to be moving towards a general policy of higher prices.

- "*[Les] facteurs qui sont a l'origine de cette hausse [des prix] [...], en simple logique économique, doivent continuer à agir dans le même sens.*"[46] 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.*"[47] 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 interieurs.*"[48] We believe this experiment will eventually lead to a substantial increase in domestic prices on the order of 30%.

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[41] *L'Observation Économique*, May 1936, p. 162.

[42] *L'Observation Économique*, June 1936, p. 203.

[43] *La Conjoncture Économique et Financière*, June 1936, p. IV.

[44] *La Conjoncture Économique et Financière*, June 1936, p. IX.

[45] *L'Activité Économique*, N. 6, 7/31/1936, p. 101.

[46] *L'Observation Économique*, July-August 1936, p. 243.

[47] *La Conjoncture Économique et Financière*, July 1936, p. V.

[48] *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.*"[49] 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 a 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.*"[50] 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.*"[51] 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.*"[52] It seems unavoidable that the increase in prices will continue.

- "*On se trouve, en realité, 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%.*"[53] 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 categories de prix [...] s'est poursuivie, comme on devait s'y attendre.*"[54] 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.*"[55] 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*

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[49]*La Conjoncture Économique et Financière*, July 1936, p. VI.
[50]*La Conjoncture Économique et Financière*, July 1936, Graphique 31.
[51]*L'Observation Économique*, September-October 1936, p. 323.
[52]*L'Observation Économique*, September-October 1936, p. 323.
[53]*La Conjoncture Économique et Financière*, August-September 1936, p. V.
[54]*L'Observation Économique*, October-November 1936, p. 354.
[55]*La Conjoncture Économique et Financière*, November 1936, p. V.

à Paris [...] se poursuivra dans les mois suivants."[56] 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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[56]*La Conjoncture Économique et Financière*, December 1936, Graphique N. 31.

B Data: sources and treatment of measurement error

B.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.

B.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).[57]

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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[57]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?
Mining	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
Chemical products	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.
Paper	Papier	Jan-28	Jul-39	[1] except Jan.-Jul. '39 from [2].	Yes
Textiles	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
Leather	Cuir	Jan-28	Jul-39	[1] except May-Jul. '39 from [2].	Yes
Metallurgy	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
Metal working	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
Construction	Bâtiment	Jan-28	Jul-39	[1] except Jul. '35 and May-Jul. '39 from [2].	Yes
Gas and electricity	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.
Misc. industries	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?
Minerals and Metals	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
Chemical products	Produits Chimiques, Huiles, Mat. Grasses	Jan-31	Aug-39	[1] Table 29, pp. 177-178.	Yes
Paper	Papier	Jan-31	Aug-39	[1] Table 29, pp. 177-178.	Yes
Textiles	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
Leather	Cuirs et Peaux	Jan-31	Aug-39	[1] Table 29, pp. 177-178.	Yes
Metallurgy	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 monthly supplement of the *Bulletin de la Statistique Générale de la France.*

60

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

Excludes industries with severe measurement error

Specification	Ind-FE + time-FE		Ind-FE + time-FE + lags		Ind-FE		Ind-FE + lags	
	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative
Δ 40-hour restriction	$-0.068**$	$-0.065**$	$-0.066**$	$-0.066**$	$-0.058**$	$-0.060**$	$-0.059**$	$-0.063**$
	(0.023)	(0.021)	(0.020)	(0.019)	(0.012)	(0.012)	(0.011)	(0.011)
Δ Devaluation					$0.096**$	$0.096**$	$0.114**$	$0.114**$
					(0.013)	(0.013)	(0.018)	(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.

C The standard new Keynesian model

This appendix describes the model used in section 4.1. The derivation follows that of the standard model in Woodford (2003).

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

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

where β is the discount factor, C_t is consumption, N_t is the number of employed workers, each of whom supplies up to $\bar{H}$ hours worker per worker, σ^{-1} is the intertemporal elasticity of substitution and η^{-1} is the elasticity of labor supply. The parameter Ξ_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, and Π_t are profits rebated by firms.

The household's first order conditions are:

$$C_t^{-\sigma} = \lambda_t.$$
$$\Xi_t N_t^{\eta} = \lambda_t \frac{W_t}{P_t}.$$
$$\lambda_t = E_t \beta \lambda_{t+1}(1 + i_{t+1} - \pi_{t+1}),$$

where λ_t is the Lagrange multiplier on the (real) budget constraint, and π_t is inflation. We model a strike in reduced form as a rise in Ξ_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 $P_t = \left[\int_0^1 P_{it}^{1-\theta} di \right]^{\frac{1}{1-\theta}}$.

C.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,

$$\min_{H_{it} \leq \bar{H}, N_{it}} \frac{W_t}{P_t} N_{it}$$

$$\text{s.t.} \ A_t N_{it} H_{it} = Y_{it}.$$

The first-order conditions are:

$$\frac{W_t}{P_t} N_{it} H_{it} = \mu_t Y_{it}.$$

$$0 = \mu_t Y_{it}, \quad \text{or} \quad H_{it} = \bar{H}.$$

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,

$$H_{it} = \bar{H};$$

$$N_{it} = \left(\frac{Y_{it}}{A_t \bar{H}} \right).$$

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

$$H_{it} = \Psi_t \bar{H};$$

$$N_{it} = \frac{Y_{it}}{A_t \Psi_t \bar{H}}.$$

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

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

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

We solve this problem for the general case in which Ψ_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

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

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

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

C.3 Market Clearing We require that all goods-markets clear in equilibrium,

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

C.4 Log-linearized equilibrium conditions We log-linearize the equilibrium conditions around the zero-inflation steady-state as in Woodford (2003):

$$c_t = E_t c_{t+1} - \sigma^{-1}(i_t - \pi_{t+1}). \tag{7}$$
$$\pi_t = \beta E_t \pi_{t+1} + \kappa mc_t. \tag{8}$$
$$mc_t = \omega_t - a_t - \psi_t. \tag{9}$$
$$\omega_t = \xi_t + \sigma c_t + \eta n_t. \tag{10}$$
$$y_t = c_t. \tag{11}$$

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.

D Proofs

D.1 Hours restrictions are expansionary

Proof Let T_ψ be the duration of the hours restrictions, so the hours restrictions end at $t + T_\psi$.

Let Δy_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, $\Delta y_{t+T_\psi} = 0$.

Given that nominal interest rates are unchanged, the solution for Δy_t is given by the recursion:

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

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

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

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

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 Δy_t and $-\psi_t > 0$, it follows that an hours restrictions is unambiguously expansionary. ∎

D.2 Strikes are expansionary

We allow for time-variation in the willingness to supply labor Ξ_t. The first order condition for labor supply is then $\frac{W_t}{P_t} = \Xi_t L_t^\eta C_t^\sigma$. Thus, if $\xi_t = \log(\Xi_t)$ rises, then firms would have to pay workers higher real wages induce the same amount of labor supply. The simple new Keynesian model can then be written as,

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

We next prove that strikes, modeled as an increase in ξ_t, are expansionary under fixed nominal interest rates.

Proof Let T_ξ 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 $s = 0, ..., T_\xi$. We assume, as was the case in France in 1936-38, that nominal interest rates do not change during the strike.

Let Δy_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, $\Delta y_{t+T_\xi} = 0$.

Given that nominal interest rates are unchanged, the solution for Δy_t is then given by

the recursion:

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

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

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

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

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 Δy_t and $\xi_t > 0$, it follows that the strike is unambiguously expansionary. See Wieland (2015) 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. ∎

E Multi-sector new Keynesian model

This appendix lists the model equations we use in Dynare.

$$Y_{it} = \tau_{it} \left(\frac{P_{it}}{P_t}\right)^{-\theta} Y_t$$

$$Y_{it} = A_t (N_{it} \bar{H}_{it})^{1-\alpha} K_{it}^{\alpha}$$

$$\frac{N_{it}}{K_{it}} = \frac{(1-\alpha)}{\alpha} \left(\frac{W_{it}/P_t}{R_t^k}\right)^{-1}$$

$$\frac{W_{it}}{P_t} = \Xi N_{it}^{\eta} \lambda_t^{-1}$$

$$\mu_{it} = \alpha^{-\alpha}(1-\alpha)^{-(1-\alpha)}(R_t^k)^{\alpha} \left(\frac{W_{it}}{P_t}\right)^{1-\alpha} \left(\frac{1}{H_{it}}\right)^{1-\alpha} A_t^{-1}$$

$$0 = Y_{i,t} \left[(1-\zeta)\left(\frac{P_{i,t+s}}{P_{t+s}}\right) + \zeta\mu_{i,t+s} - \phi\Pi_{i,t}(\Pi_{i,t}-1)\right] + Q_{t,t+1} Y_{i,t+1} \left[\phi\Pi_{i,t+1}(\Pi_{i,t+1}-1)\right]$$

$$\Pi_{it} = \Pi_t \left(\frac{P_{it}/P_t}{P_{i,t-1}/P_{t-1}}\right)$$

$$H_{it} = \Psi_{it}\bar{H}$$

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

$$N_t = \left[\sum_{i=1}^{I} \tau_{it}^{-\eta} N_{it}^{1+\eta}\right]^{\frac{1}{1+\eta}}$$

$$K_t = \sum_{i=1}^{I} K_{it}$$

$$1 = Q_{t,t+1}(1 + i_{t+1})\Pi_{t+1}^{-1}$$

$$Q_{t,t+1} = \beta\frac{\lambda_{t+1}}{\lambda_t}$$

$$\lambda_t = C_t^{-\sigma}$$

$$K_{t+1} = (1-\delta)K_t + I_t[1 - S(I_t/I_{t-1})]$$

$$P_t^k = Q_{t,t+1}[R_{t+1}^k + (1-\delta)P_{t+1}^k]$$

$$1 = P_t^k[1 - S(I_t/I_{t-1}) - I_t/I_{t-1}S'(I_t/I_{t-1})] + Q_{t,t+1}P_{t+1}^k(I_{t+1}/I_t)^2 S'(I_{t+1}/I_t)$$

$$S(I_t/I_{t-1}) = 0.5\exp[\sqrt{\psi}(I_t/I_{t-1}-1)] + 0.5\exp[-\sqrt{\psi}(I_t/I_{t-1}-1)] - 1$$

$$S'(I_t/I_{t-1}) = 0.5\sqrt{\psi}\left(\exp[\sqrt{\psi}(I_t/I_{t-1}-1)] - \exp[-\sqrt{\psi}(I_t/I_{t-1}-1)]\right)$$

$$R_t = \beta^{-1}$$

$$Y_t = C_t + I_t$$

F Alternative model exercises

F.1 Imperfect foresight of 40-hour law termination Whereas in our baseline experiment agents in the model correctly anticipate the end of the 40-hour law, in the following experiment we capture the notion of imperfect foresight. Specifically, agents anticipate a gradual relaxation of the 40-hour law,

$$
\Psi_{it}^e = \frac{5}{6} \quad \begin{cases} 5 \le t \le 28, & i = 1, ..., 8 \\ 6 \le t \le 28, & i = 9, 10 \\ 7 \le t \le 28, & i = 11, ..., 16 \\ 8 \le t \le 28, & i = 17, 18 \\ 9 \le t \le 28, & i = 19 \\ 10 \le t \le 28, & i = 20 \\ 11 \le t \le 28, & i = 21 \\ 13 \le t \le 28, & i = 22 \end{cases}
$$

$$
\Psi_{it}^e = \Psi_{i,t-1}^{\rho_\Psi} \qquad \text{otherwise}
$$

Thus after $t = 28$, the hours restrictions are expected to follow an AR(1) process. These are plotted in figure 13.
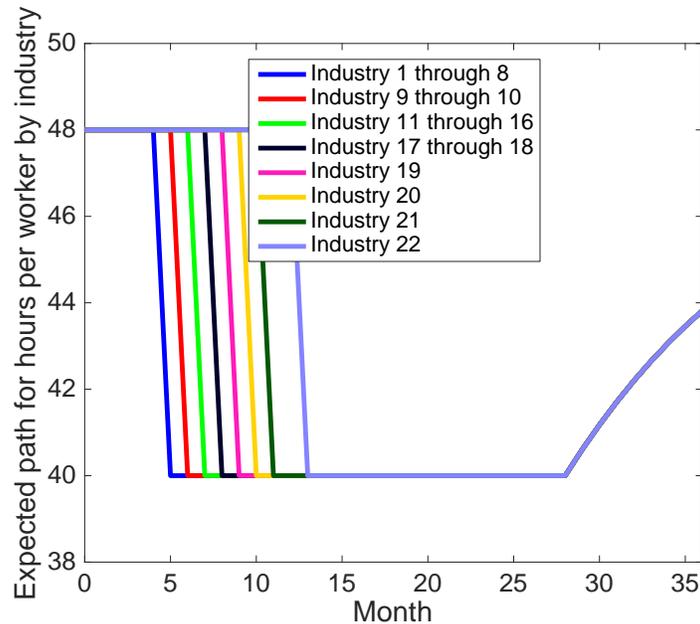

Figure 13 – Expected hours per worker in each industry in the model experiment where the 40-hour law is expected to be more persistent.

At $t = 29$ it is then revealed that the hours restrictions are immediately abolished, so that the agents expectations were incorrect. This captures the notion that the timing of the termination of the 40-hour law was a surprise. Note that the actual path of the 40-hour law is then the same as in the baseline experiment (figure 10), only the expectations of agents are different.

In figure 14 we plot the implied output, consumption, investment, and inflation paths. Relative to the baseline experiment each variable exhibits a stronger response because the

shock is larger (more persistent). Note that at $t = 29$ there is a discrete deterioration in economic condition when news arrives that the 40-hour law will be immediately abolished. This is because terminating the 40-hour law early implies less expected inflation, higher expected real interest rates and thus a weaker consumption and investment response.
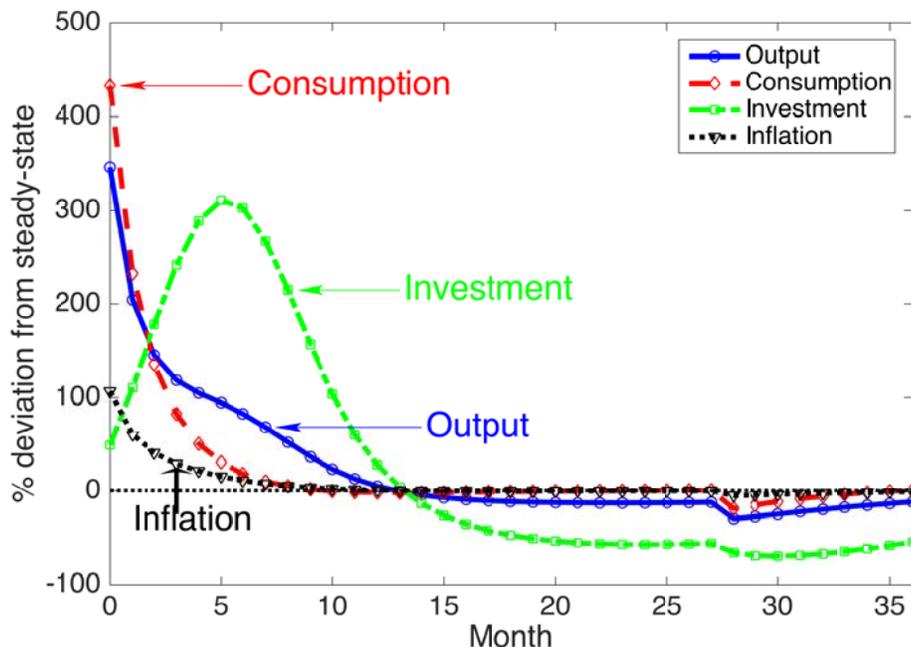

Figure 14 – Impulse response function of output, prices, consumption and investment to the expected hours restrictions in figure 13 when the realized path follows the baseline experiment (figure 10). Month 0 is when the 40-hour law is announced.

F.2 Robustness of the baseline experiment In this section we conduct five robustness exercises. First, we allow nominal interest rates in the model to respond to the 40-hour law as in the data, second we add price indexation to the model, third we add habits in consumption, fourth we add wage rigidity, and fifth we set the hours restrictions to match the actual decline in hours. In each case, we reparameterize the price adjustment cost ϕ, such that the model replicates the cross-sectional estimates in table 4.

F.2.1 Match empirical nominal interest rate response We allow the central bank reaction function to respond to inflation, $R_t = \bar{R}\Pi_t^{\phi_\pi}$, where we set $\phi_\pi = 0.075$. This matches the 3 percentage point commercial paper rate increase from January 1937 to May 1937 as inflation climbed to 40% (figure 4). Other nominal interest rates were less responsive, so this is likely an upper bound. To match the cross-sectional impact of the 40-hour law, under this calibration we parameterize the price adjustment cost to $\phi = 555$. As shown in figure 15, the predicted expansion in output is essentially unchanged relative to our baseline with fixed nominal interest rates. This reflects the small change in nominal interest rates relative to the large change in inflation.
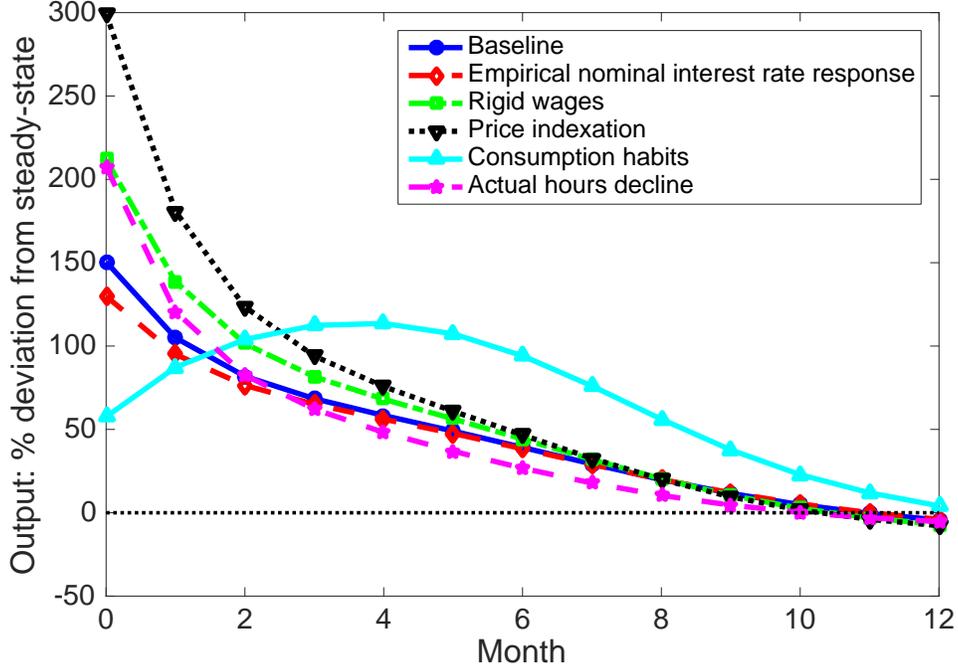
Figure 15 – Impulse response function of output for variations of our baseline exercise. See section F.2 for details.

F.2.2 Price indexation To capture automatic price indexation to last period inflation, we assume that the quadratic price adjustment cost is now $\frac{\phi}{2}\left(\Pi_{i,t} - \Pi_{i,t-1}^{\chi}\right)^2$, where χ captures the degree of indexation. Thus updating prices to a fraction of last periods inflation $\Pi_{i,t} = \Pi_{i,t-1}^{\chi}$ incurs no cost. In that case, the new Keynesian Phillips curve of the model becomes,

$$0 = Y_{i,t}\left[(1-\zeta)\left(\frac{P_{i,t+s}}{P_{t+s}}\right) + \zeta\mu_{i,t+s} - \phi\Pi_{i,t}\left(\Pi_{i,t} - \Pi_{i,t-1}^{\chi}\right)\right] + Q_{t,t+1}Y_{i,t+1}\left[\phi\Pi_{i,t+1}\left(\Pi_{i,t+1} - \Pi_{i,t}^{\chi}\right)\right].$$

We parameterize $\chi = 0.5$ to capture an intermediate degree of indexation. Micro-evidence suggests an absence of indexation (e.g. Klenow and Malin, 2010) and Cogley and Sbordone (2008) find that the aggregate data do not reject zero indexation once one accounts for trend inflation. However, standard DSGE models tend to estimate indexation in the range from $\chi = 0.5$ to $\chi = 0.8$.

To best match the cross-sectional estimates we parameterize $\phi = 1076$, which corresponds to an average duration of 5 months in a Calvo model. As shown in figure 15, the model with price indexation predicts a quadrupling of output.

F.2.3 Consumption habits We allow for external habits in consumption, so that the marginal utility of consumption is now given by

$$\lambda_t = \left(\frac{C_t - hC_{t-1}}{1-h}\right)^{-\sigma}$$

70

where h is the habit parameter. We set $h = 0.833$ in line with Smets and Wouters (2007) and reparameterize price adjustment costs to $\phi = 840$. The resulting impulse response function of output in figure 15 is more persistent and hump-shaped, but still predicts more than a doubling of output at the peak.

F.2.4 Wage rigidity We implement nominal wage rigidity following Bordo et al. (2000). There is a continuum of labor types j that are substitutable with degree ζ_w. The relative demand for each type of labor in industry i is

$$N_{ikt} = \left(\frac{W_{ikt}}{W_{it}} \right)^{-\zeta_w} N_{it}$$

Nominal wages are reset each period subject to a quadratic wage adjustment cost. Each type of labor bargains for a wage that solves,

$$\max_{\{W_{ikt}\}} \sum_{s=0}^{\infty} Q_{t,t+s} \left[(1+\tau_w) N_{ikt} \frac{W_{ikt}}{P_t} - \Xi_t \lambda_t^{-1} \tau_i^\eta \frac{N_{ikt}^{1+\eta}}{1+\eta} - \frac{\phi_w}{2} \left(\frac{W_{ikt}}{W_{ik,t-1}} - 1 \right)^2 \right].$$

The parameter τ_w is a subsidy to eliminate the monopoly distortion and thus facilitate the comparison to the competitive labor market in the baseline model.

The first order condition is,

$$0 = N_{it} \left[(1+\tau_w)(1-\zeta_w) \left(\frac{W_{ikt}}{W_{it}} \right)^{1-\zeta_w} \frac{W_{it}}{P_t} + \zeta_w \Xi_t \lambda_t^{-1} \tau_i^\eta N_{it}^\eta \left(\frac{W_{ikt}}{W_{it}} \right)^{-\zeta_w} - \phi_w \frac{W_{ikt}}{W_{ik,t-1}} \left(\frac{W_{ikt}}{W_{ik,t-1}} - 1 \right) \right]$$
$$+ Q_{t,t+1} N_{i,t+1} \phi_w \frac{W_{ik,t+1}}{W_{ikt}} \left(\frac{W_{ik,t+1}}{W_{ikt}} - 1 \right).$$

Using the symmetry of the problem, we have $W_{ikt} = W_{it}$ and $\Pi_{it}^w = \frac{W_{it}}{W_{i,t-1}}$, and letting $(1+\tau_w) \equiv \frac{\zeta_w}{\zeta_w - 1}$ we get the wage Phillips curve of the model,

$$0 = N_{it} \left[-\zeta_w \frac{W_{it}}{P_t} + \zeta_w \Xi_t \lambda_t^{-1} \tau_i^\eta N_{it}^\eta - \phi_w \Pi_{it}^w (\Pi_{it}^w - 1) \right] + Q_{t,t+1} N_{i,t+1} \phi_w \Pi_{i,t+1}^w (\Pi_{i,t+1}^w - 1).$$

We set $\phi_w = 30.5$, which corresponds to wages resetting on average every 3 months in a Calvo model, and we set $\phi = 542$ to again match the cross-sectional estimates. As shown in figure 15, allowing for wage rigidity further amplifies the output expansion from the 40-hour law relative to the baseline model.

F.2.5 Matching actual decline in hours The actual decline in hours was 12% in the data. We therefor set $\Psi_{it} = 0.88$ whenever the hours restrictions are binding. The timing is unchanged from figure 10. To match the cross-sectional estimates we set $\phi = 292$, which corresponds to an average duration of prices of 3.7 months in the Calvo model. The impulse response function in figure 15 for this exercise displays a tripling of output.