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Publication Date

2016

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Essays in Macroeconomic History and Policy

by

Jeremie Cohen-Setton

A dissertation submitted in partial satisfaction of the
requirements for the degree of
Doctor of Philosophy

in

Economics

in the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Barry Eichengreen, Chair
Professor Christina Romer
Associate Professor Yuriy Gorodnichenko
Professor Andrew Rose

Summer 2016

Essays in Macroeconomic History and Policy

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Abstract

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Doctor of Philosophy in Economics

University of California, Berkeley

Professor Barry Eichengreen, Chair

The Making of a Monetary Union: Evidence from the U.S. Discount Market 1914-1935

The decentralized structure of the Federal Reserve gave regional Reserve banks a large degree of autonomy in setting discount rates. This created repeated and continued periods of non-uniform discount rates across the 12 Federal Reserve districts. Commercial banks did not take full advantage of these differentials, reflecting the effectiveness of qualitative restrictions on the use of discount window liquidity in limiting the geographical movement of funds. While the choice of regional autonomy over complete financial integration was reasonable given the characteristics of the U.S. monetary union in the interwar period, the Federal Reserve failed to use this autonomy to stabilize regional economic activity relative to the national average. The diagnosis that the costs of decentralization outweighed the gains from regional differentiation motivated reforms that standardized and centralized control of Reserve bank discount policies.

Supply-Side Policies in the Depression: Evidence from France

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.

Fiscal Policy in the Depression: Evidence from Digging Holes and Filling Them

I use historical data on military spending on a strategic defense system - the Maginot Line - during the interwar period in France to estimate the effect of fiscal policy in a depressed economy. Planning for the construction of the defense system took place in the 1920s, while actual spending mostly occurred in the 1930s. Factors such as the natural local terrain, and the location of military threat generated variations in spending across space and time that were not related to current or expected levels of economic activity in these areas. I exploit these variations to estimate a local government spending multiplier that controls for aggregate shocks and aggregate policy, such as changes in distortionary taxes and aggregate monetary policy. I find a local multiplier of 1. Given the likely bias introduced by the use of fiscal data to proxy local economic activity and by the *ad-hoc* assumptions made to reconstruct a precise geographical allocation of border fortification spending, I see my result as evidence that the true local government spending multiplier is at least equal to 1.

To Yasmine

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Chapter 1

Introduction

In view of the magnitude of postwar recessions, the study of the dramatic collapse and rebound of the world economy in the 1930s had progressively become the private turf of economic historians. Macroeconomists and policymakers became more interested in understanding the whys and hows of the Great Moderation than in understanding the amplification mechanisms and policy mistakes that made the Great Depression possible. The speed and size of the economic contraction that started in 2007 made, however, clear that understanding the Great Depression remained the Holy Grail of macroeconomics. My thesis is an example of this renewed interest in the study of depressed economies.

It is organized in three essays. My first essay studies a mostly forgotten aspect of the history of the Federal Reserve: its experience with regionally differentiated monetary policies in the first 20 years of its existence. My second essay studies the effect of supply-side policies in a liquidity trap using an episode of French economic history: the introduction of the 40 hour workweek in 1936. My third essay studies the effect of fiscal policies in depressed economies using the construction of a border fortification system in France throughout the 1930s. These essays share a number of features that characterize my research approach.

The three essays are mostly empirical, but they are all motivated by striking theoretical predictions. The basic theoretical ingredient in a model of monetary unions is the trilemma constraint, or the idea that it is not possible to both have regionally differentiated monetary policies and unrestricted movements of funds across regions sharing a same currency. Given the conventional characterization of the United States as a monetary union with free movement of capital across regions, the US experience with regionally differentiated monetary policies is, at first sight, puzzling. By the same token, mainstream macroeconomic models have the striking and counterintuitive prediction that once the economy hit a lower bound on nominal interest rates, negative supply shocks become, in fact, expansionary. These models also predict a sharp change in the impact fiscal policy when the economy is depressed and in a liquidity trap.

A second common feature across the three essays is my approach to identification. In all three papers, I address the classical question of identifying the causal effects of policies by combining disaggregated data with narrative evidence. Using data at the regional level

(as in my first and third essays) or at the sectoral level (as in my second essay) allows one to difference out common macroeconomic factors that move contemporaneously with the policy variable under study. I complement this approach by exploiting external information on policymakers' motives to separate quasi-random changes in policy from those that were driven by macroeconomic conditions.

The last common feature is the use of economic history to answer current policy questions. This is certainly the aspect of my thesis that I expected the least when I started the program. But the world economy entered uncharted waters with the crisis that began in 2007 or more precisely returned to an environment that was last seen in the 1930s. Finding historical episodes documenting the use of demand and supply policies in the 1930s thus became of particular value for informing current policy debates. In the same way, the lack of clear progress towards a full-fledged banking and fiscal union in the eurozone made the US experience of dealing with asymmetric developments through regional monetary differentiation particularly relevant.

Chapter 2

The Making of a Monetary Union: Evidence from the U.S. Discount Market 1914-1935

2.1 Introduction

A monetary union,¹ like that in the United States, possesses three defining characteristics: (1) a single currency that eliminates the risk of changes in “exchange rates” between regions; (2) the absence of capital controls and other restrictions on the internal movement of funds; and (3) a reliable clearing and settlement system through which the claims of one region on another can be settled. The United States long had the first and second elements, but only from 1914, as [113] emphasizes, did it have the third. It was at this point, with the creation of the Federal Reserve and its Interdistrict Settlement System, that the U.S. became a fully functional monetary union.

Prior to 1914 when the Federal Reserve opened its doors, interregional settlements took place through a correspondent banking system in which banks in one region held balances with banks in other regions. In this setting, the failure of banks on either side of the transaction could disrupt interregional payments. The result could be different financial conditions and interest rates on otherwise comparable financial claims in different regions, as famously documented by [39].² The U.S. thus had the worst of all worlds. It had a single

¹I thank Barry Eichengreen, Yuriy Gorodnichenko and Christina Romer for exceptional advising and support. I also thank Pierre-Olivier Gourinchas, Matthias Hoelzlein, Andrew Jalil, Erik Johnson, Dmitri Koustas, Yusuf Mercan, Eric Monnet, Martha Olney, Gary Richardson, David Romer, Benjamin Schoefer, Shahin Vallée and seminar participants at the All-UC Graduate Student Workshop, Caltech, the Stanford-Berkeley Graduate Student Economic History Symposium, Stanford, the Macroeconomics, International Economics and Economic History seminars, UC Berkeley, and at the World Economic History Congress session on the Great Depression and Macroeconomic Policy in the 1930s, Kyoto for thoughtful suggestions. I am also grateful to Pamela Campbell (F.R.B of St. Louis) and Julie Sager (F.R.B. of New York) for their help with archival material.

²[39]’s work is widely seen as documenting the convergence of interest rates and integration of regional

monetary policy, as dictated by the rules of the gold standard, after 1879. But it lacked a reliable interregional settlement system, as a result of which monetary impulses were transmitted to and affected different regions differently. The result was chronic instability and pervasive regional problems.

The Federal Reserve System was established partly to address this instability. It was organized into districts in recognition of the existence of these regional problems.³ Its Interdistrict Settlement System guaranteed smooth and reliable settlement of the claims of one region on another. There was no possibility of a Reserve bank failing in the manner of a correspondent bank, and therefore no possibility of one region defaulting on its claims to another.

The result was strong convergence of interest rates across regions, in contrast to the situation under the earlier system. Interregional differentials in market interest rates after 1914 reflected differential risk, as shown by [18], not limits on effective capital mobility and settlement risk within the monetary union. With the founding of the Fed, the U.S. both possessed a common monetary policy (as before) and an efficient settlement mechanism ensuring that different regions were affected symmetrically by that policy. Only at this point did the country possess a fully-functioning monetary union.

Or so is the conventional wisdom. In this paper I argue for a different view. I show that the decentralized structure of the Federal Reserve System allowed Reserve banks to set different discount window policies.⁴ In the conventional view, the creation of the Fed retained the common monetary policy but fixed a flawed settlement mechanism. In fact, the creation of the Fed allowed for different monetary policies across regions.

Those different policies reflected the autonomy Reserve banks possessed when setting their discount rates, asymmetric information that gave individual Reserve banks superior information about borrowers within their districts, and de facto restrictions on the internal movement of funds implemented through administration of the discount window. While the then characteristics of the U.S. monetary union - preponderance of regional shocks, low labor mobility, absence of fiscal transfers - made the choice of regional monetary autonomy over complete financial integration reasonable, Reserve banks failed to stabilize regional economic activity relative to the national average because of inadequate monetary doctrines.

The diagnosis that the costs of decentralization outweighed the gains from regional differentiation motivated reforms that standardized and centralized control of Reserve bank discount policies.⁵ This eliminated the ambiguity about the operation of the Interdistrict Settlement System that remained because of policy conflicts, while other New Deal reforms (deposit insurance, fiscal transfers) made the attempt to absorb regional shocks with mone-

markets. In fact, his analysis shows that interregional interest rate differentials remained considerable.

³[87] explains how the Fed's decentralized structure also reflected populist antipathy toward a "central bank" dominated by either Wall Street bankers or federal government officials.

⁴The discount window is the Federal Reserve's facility for extending credit directly to eligible institutions.

⁵Decentralization was and is still seen as having contributed to an inadequate monetary policy response during the Great Depression [92, p. 470-486]. I document, in addition, that Reserve banks failed to systematically use regional autonomy in a stabilizing way to offset regional shocks.

tary tools no longer necessary. Thus, it was not the establishment of the Federal Reserve but the Great Depression that transformed the United States into a fully-functioning monetary union.

In section 2.2 I document that interbank borrowing through the correspondent system gave banks *the possibility* of taking advantage of discount rate differentials across districts. At the same time, the provision of liquidity through rediscounting gave Reserve banks extensive information on how banks operated, on the underlying reason for their discount applications and on how they intended to use the liquidity acquired. This provided a mechanism for policing the use of central bank liquidity and, in particular, for limiting interdistrict transactions, thereby allowing some regional monetary autonomy. Both internal documents from the Federal Reserve System and writings of contemporaries suggest that these restrictions on the use of funds were binding and helped make individual district policies effective.

After showing that the Federal Reserve Act was designed to provide for differentiated discount rates, I present in section 2.3 daily data on rates at the different regional discount windows to illustrate the extent to which Reserve banks made use of their autonomy. I show that the absence of a provision in the Federal Reserve Act to insure regional uniformity of discount rates translated into repeated and continued periods of non-uniformity before the New Deal Reform of the Federal Reserve.

After documenting specific episodes of regional deviations in monetary policy, I estimate in section 2.4 a monthly panel VAR in discount rates, discount window lending and correspondent balances. In line with the hypothesis that restrictions on the internal movement of funds were binding, I find that periods of discount rate differentials were not accompanied by large transfers of funds across Federal Reserve districts despite affecting the discounting behavior of member banks.

In section 2.5, I use empirical evidence to argue that the Reserve banks failed to stabilize regional economic activity relative to the national average. I also present narrative evidence in support of the view that this policy inconsistency was the result of conflicting monetary doctrines. Given the failure to materialize the gains from regional differentiation before the Great Depression and the contribution of decentralization policymaking to monetary mismanagement in the Great Depression, the reforms that standardized and centralized control of Reserve bank discount policies faced little opposition.

This paper relates to three different literatures. First, and most obviously, it speaks to the literature stemming from [39]’s work on regional financial integration in the United States. Contributions attempting to explain the pace and degree of convergence of interest rates between regions are too numerous to list in comprehensive fashion. Examples include [39], who stressed the extension of the commercial paper market, and [134], who attributed the narrowing of interest rate differentials to increased competition within the banking industry. In contrast to [18], who argued that interregional differentials in market interest rates after 1914 reflected differential risk, I show that the administration of the discount window created *de facto* restrictions on the internal movement of funds and therefore account for a portion of the remaining differentials. Controversies about the provision of accommodation between Reserve banks generated doubts about the operation of the Interdistrict Settlement System,

which further reinforced interest rate differentials in times of regional strains.

Second, this paper contributes to the vast literature on the role of the Federal Reserve in the fluctuations and crises of the 1920s and Great Depression years. While the intentions, constraints and consequences of monetary policy over the interwar period have been the subject of voluminous research for decades, only recently have scholars documented the existence and effects of non-uniform regional central bank policies [111, 71, 152]. This paper adds to this literature by focusing on deviations in discount rate policies, rather than deviations in emergency liquidity provision, to study the functioning of a monetary union. I show that deviations from uniform discount rates occurred both in normal times and recessions and present a mechanism that can help explain why these differentials did not lead to an unlimited uneven expansion of credit across districts.

Third, the paper contributes to our understanding of the trilemma constraint and how capital controls or indirect restrictions on the internal movement of funds can be used when regional monetary policy is constrained by fixed exchange rates. The historical literature contains much evidence consistent with the constraints of the trilemma. Countries with more flexible exchange rate regimes enjoy greater monetary autonomy [103, 76]. Conversely, countries with fixed exchange rates can regain some monetary autonomy by restricting capital movements [88]. In this paper, I show that the U.S. monetary union dealt with the trilemma constraint differently over its history. In the pre Depression-era, discount policies with the effect of limiting the internal movement of funds allowed for regional differences in monetary policy. While this framework provided for second-best policies in the absence of a fiscal and banking union [50], the Federal Reserve failed to use this autonomy to absorb asymmetric regional shocks.

2.2 The trilemma and discount window lending

According to the trilemma, a country that pegs its exchange rate and does not restrict capital flows loses its monetary autonomy. While the general idea of a trade-off between financial integration and regional monetary autonomy applies to the historical context under study here, a number of differences with the textbook case deserve to be highlighted.

First, it is important to note that the mechanism leading to this trade-off is different in a monetary union than in a fixed exchange rate system. In a fixed exchange rate system, the loss of monetary autonomy comes from the inability of the central bank to both keep the exchange rate constant and change its interest rate. If the central bank wants to fix a lower interest rate, it necessarily has to forgo its peg. In a monetary union, capital flows across regions following a deviation in regional monetary policy do not automatically threaten the survival of the system. But the mobility of funds across regions nonetheless limits the degree of regional monetary autonomy. A higher discount rate at the Chicago Reserve bank has no effect on commercial banks in the seventh district⁶ if central bank liquidity from other

⁶The Federal Reserve Act provided for a Reserve Bank Organization Committee that would designate no less than eight but no more than twelve cities to be Federal Reserve cities, and would then divide the

districts is available through cross-district private transactions. Since the Reserve bank with the lowest discount rate dictates the monetary stance for the union as a whole in this situation, regional monetary autonomy is limited unless technological or policy constraints prevent cross-district operations.

The second difference concerns the provision of Federal Reserve credit through the rediscount of bills during this period. In contrast to the orthodox doctrine of rediscounting, according to which discount window lending should remain an extraordinary or abnormal phenomenon [158, p.149],⁷ rediscounting was a primary method for providing member banks with reserves until the early 1930s (Figure 2.1a). Every year from 1920 to 1933, between four and seven thousand member banks were, in fact, accommodated through rediscounting.⁸ Willis and Steiner [158, p.149] instead consider that the “view to date” was that rediscounting was a perfectly natural phenomenon to secure an even distribution of funds across regions and sectors.⁹ Given that member banks helped the Federal Reserve in its mission to distribute funds for the needs of commerce and business, it was, furthermore, appropriate to provide banks with a small profit rather than a penalty to encourage the use of the facility.

In contrast to open market operations, the provision of Federal Reserve credit through the rediscount of bills provided regional Reserve banks with an opportunity to collect information about the applying commercial bank.¹⁰ Application forms for rediscounts typically included questions about the reasons for rediscounting and about the current operations of the bank [56, Appendix A., p.4].¹¹ In Figure 2.2, an application form of the Chicago Reserve bank shows that commercial banks applying for rediscounts in this district were required to detail whether their rediscounting need arose because of a decline in deposits, an increase in loan

nation into districts, each district to contain one Federal Reserve City. On April 2, 1914, the Reserve Bank Organization Committee announced its decision to establish twelve districts: Boston (1), New York (2), Philadelphia (3), Cleveland (4), Richmond (5), Atlanta (6), Chicago (7), St. Louis (8), Minneapolis (9), Kansas City (10), Dallas (11), San Francisco (12).

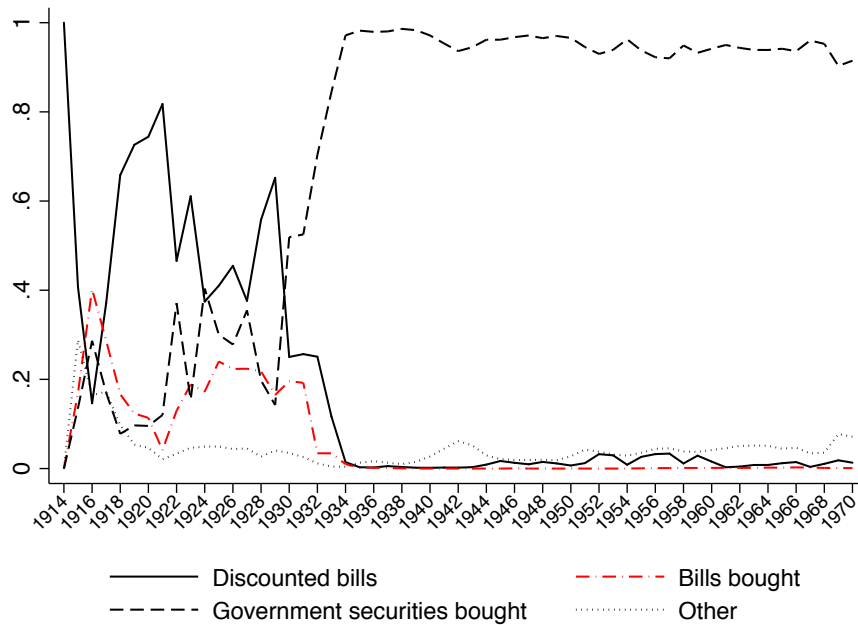
⁷In their preface, [158] explain that the objective of the book is to provide the first “handbook of practice for the banker” and “a ready means of reference to details of method and policy, besides explaining the actual experience under which present usage has developed.” One of the authors, H. Parker Willis, played a prominent role as adviser to Carter Glass, Chairman of the House Committee on Banking and Currency, in drafting the Glass-Owen Act that created the Federal Reserve System. For a historical account of the personalities behind the creation of the Federal Reserve, see [87].

⁸Table 18, Annual Report of the Board of Governors of the Federal Reserve System (1934).

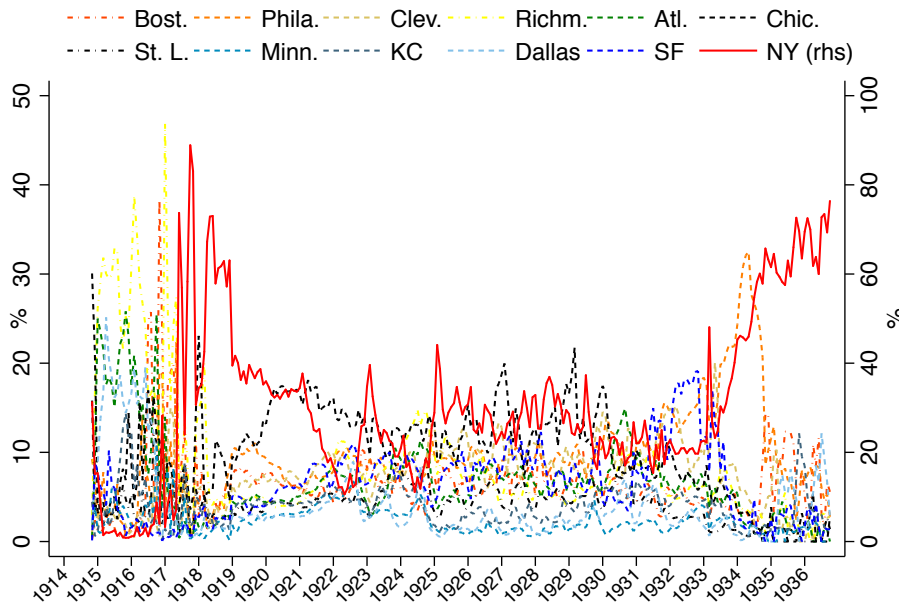
⁹Figure 2.1b shows that the provision of discount window lending was not limited to one or two districts. The share of New York (second district), for example, fluctuated around 30%.

¹⁰“The member banks should be required to make full disclosure of the lines of credit which it is extending, whether or not it is using the funds obtained from the Federal Reserve banks to purchase paper in the open market merely to increase the profits of the bank and particularly whether it is being used by non-member banks”. Board Circular X-1274, 11/19/1918, Box 120190, FRBNY.

¹¹The Federal Reserve Board directed its senior staff in April 1953 to undertake, with the help of the staffs of the Reserve banks, a comprehensive reexamination of the System’s Discount and Discount Rate Mechanism at a time when member bank borrowing re-emerged as a primary method of obtaining reserves. In addition to the report itself [56], it gave rise to a group of special studies [55], and to a collection of statements of F.O.M.C. economists before the Conference of Presidents of the Federal Reserve Banks [57].



(a) Shares of Total Federal Reserve Credit. Sources: 1914-1941: Banking and Monetary Statistics, 1943, Table 100. 1941-1970: Banking and Monetary Statistics, 1976, Table 10.1.



(b) Bills Discounted by Federal Reserve District. Sources: 1914-1921: Federal Reserve Annual Reports, various issues. Sources: 1922-1936: [143], Table 11A.

Figure 2.1

demand, or a desire to retire other indebtedness. A statement about their current liabilities was also required. Internal documents [56, Appendix A., p.12] as well as Reserve banks statements in a Senate Hearing¹² illustrate that this was just one in many ways of obtaining information on member banks operations. Additional information was, for example, obtained on applications considered “unusual” or questionable by means of conversations with officials of the borrowing bank.

Close relationships with member banks [135, p. 275] together with information collected through discount applications provided an opportunity to police the use of Federal Reserve credit. The Federal Act placed upon the directors and officers of individual Reserve banks responsibility “to keep [the Reserve bank] informed of the general character and amount of the loans and investments of its member banks with a view to ascertaining whether *undue use* is being made of bank credit”.¹³ In a circular on excessive rediscounts by member banks, the Board explains that the “directors of the Federal Reserve banks should exercise a reasonable prudence in extending accommodations [...] and should be satisfied, by proper inquiry or investigation, that the accommodation sought is for legitimate local requirements”.¹⁴

The Federal Reserve Act did not explicitly define “appropriate” and “inappropriate” uses.¹⁵ But based on the practice of Reserve banks over the first forty years of the Federal Reserve System, the 1953 Board policy memorandum on “appropriate and inappropriate uses of Reserve Bank credit” [55, p. V] concludes that:

To borrow primarily for “profit” - i.e., to take advantage of the arbitrage possibilities in the differential between the rate charged the member bank for Reserve bank credit and rates obtainable by member banks in the open market, or to use Reserve bank credit for the primary purpose of obtaining tax avoidance gains, or for any other such direct and primary “profit” motive.¹⁶

Given the fungibility of funds, a restriction of that sort necessarily raises key operational questions. At the same time, the threat that a Reserve bank might send examiners and

¹²Hearings on S. Res. 71, Appendix, Part 6. Questionnaire No.7. The Eligibility and Acceptability of Paper. Question 9: Does your institution habitually inquire into the use of the proceeds of the funds extended to member banks? Do your lending policies toward member banks vary according to the composition of the portfolio of the particular member bank? Is your bank examination department of assistance in the formulation of your lending policies?.

¹³F.R. Act, Section 4, paragraph 8. My emphasis.

¹⁴X-1274, 11/19/1918, Box 120190, FRBNY.

¹⁵As articulated by [66], this is not exactly the Real Bills doctrine but rather what one might call the Productive Credit doctrine. The Real Bill doctrine is concerned with whether the bill arose out of a commercial transaction. The Productive Credit doctrine is concerned with the purpose to which the debtor will use the money obtained. While conceptually important, this distinction was in practice mostly irrelevant since the two groups of adherents overlapped.

¹⁶The 1953 memorandums were used as inputs for the main 1954 Report on the Discount Rate Mechanism. This understanding of “inappropriate use” is repeated in the main report [56, p.29] where guiding principles for Reserve bank lending are presented. In particular, it states that “Federal Reserve credit should not be extended where it appears that the member bank’s principal purpose is to profit from rate differentials”.

open a "line of credit" investigation [63, p.18] limited the need for constant oversight.¹⁷ The Federal Reserve Act provided Reserve banks with the authority to conduct special examinations of both national and state member banks within their districts (Section 21). The incentive of bankers to comply with Federal Reserve guidelines on the appropriate use of liquidity was further reinforced by the severity of the punishment for banks found to be abusing the rediscount privilege as they could simply be suspended "from the use of the credit facilities."¹⁸

The extent to which these guidelines and corrective measures were in practice enough to police the behavior of member banks,¹⁹ helped limit cross-district operations, and thereby provided a certain degree of regional monetary autonomy to individual Reserve banks is ultimately an empirical question. Before addressing it, one should note that the technology for transferring short-term funds across districts was far from underdeveloped, especially given the system of correspondent relationships that had developed in the National Banking period. On the eve of the creation of the Federal Reserve System, 84% of the 7,454 national banks listed in the Rand McNally Directory had, for example, at least one New York City correspondent and 35% had at least one correspondent in Chicago [73].

To a much greater extent than was anticipated, the system of interbank credit relationship survived the establishment of the Federal Reserve system [149]. In supplementing the bankers' bank function of the Federal Reserve banks [130, p.282], correspondent relationships in different cities provided a technology to exploit discount rate differentials [62, p.299].²⁰ Contemporaries were aware that "the possibility of saving money by putting re-

¹⁷F.R. Board [56, Appendix A., p.12] mentions special studies and investigations as sources of information on the use of Reserve bank credit. New York Governor Benjamin Strong explains, for example, that Reserve bank "officers [made] inquiry of banks, which appear[ed] to be borrowing undue amounts" (Testimony before the Joint Commission of Agricultural Inquiry, Part 13, p.244.). The Cleveland Fed reports that "they have no hesitancy in conferring with the officers of member banks whenever it appears that borrowing from us is being resorted to for purposes inconsistent with the spirit of the Federal Reserve Act. [...] We have not knowingly permitted abuse of our facilities and when instances of abuse have come to our attention effective measures were applied" (Part VI, Hearings, p.724-25).

¹⁸The practice of suspending abusing banks from the use of credit facilities was only put into law in 1933 by an amendment of Section 4 of the Federal Reserve Act. But the amendment appears to have been driven by earlier practice.

¹⁹The archival evidence on the Discount Rate Mechanism and the writings of contemporaries confirm the view of [24] and Meltzer [92, p. 163] that the *reluctance of member banks to borrow* was a behavior imposed through administration of the discount window rather than a behavioral tradition. This is also recognized in the *Federal Reserve Bulletin*: "It [was] the policy of the Federal Reserve banks to maintain [a tradition against borrowing]" (F.R. Bulletin, March, 1929, p.177, quoted by Turner [142, p.76-77]).

²⁰The possibility of taking advantage of discount rate differentials through correspondents is also noted by Harris [63, p. 125]. [151] emphasizes that, in addition, large businesses of national scope could also seek their loans in the district in which they could obtain the most favorable rates. The Chicago Reserve bank reports, for example, that large commercial borrowers possessing borrowing facilities in both cities, have borrowed in the New York market rather than in the Chicago market when the New York discount rate was lower (Hearings on S. Res. 71, Appendix, Part 6, p. 778.). Similarly, the Philadelphia Bank reports that "when you find money at 6 per cent in Philadelphia and higher in New York, Chicago, Boston, and other places, the merchants will come down to Philadelphia because the rate is lower than it is elsewhere" (Minutes

discount applications through a member bank in another city” [156, p. 886] constrained regional monetary autonomy, but nonetheless favored discount rates that could differ across districts.²¹ This conflict between Reserve bank autonomy and the arbitrage made possible by the survival of the correspondent banking system was something that Federal Reserve officials would be forced to address.

2.3 The semi-autonomy of regional Reserve banks

In contrast with the Aldrich Bill,²² which stated that rates of discount “be uniform throughout the United States” (Section 30), the Federal Reserve Act had no special provisions to insure uniformity of discount rates district-to-district. After showing that none of the interim versions of the Federal Reserve Act provided for uniform rates, I document using Congressional Records the motivation of policymakers in allowing for such differentials. I then review the procedure and practice of setting discount rates and document the extent to which the possibility to differentiate discount rates regionally was used.

The history of Section 14 (d)

The changes in the prints of H.R. 7837²³ documented below illustrate that notwithstanding controversy over discount policy guidelines, the different versions of the bill all provided for the possibility of interdistrict differentials in discount rates. In addition, such investigation shows that while the bill originally introduced in 1913 provided for weekly review by the Federal Reserve Board, the clause did not become part of the bill when enacted.

1. House Bill, Section 15 (d), 09/18/1913

Every Federal Reserve bank shall have power: [...] to establish each week, or as much oftener as required, subject to review and determination of the Federal Reserve Board, a rate of discount to be charged by such bank for each class of paper, which shall be fixed with a view of accommodating the commerce of the country.

2. Senate Banking and Currency Committee, suggested changes.

of Conference with Federal Reserve Board of the Federal Advisory Council and the Class A Directors of the Federal Reserve banks, May 18, 1920, Senate Document No. 310, 67th Cong., 4th Sess., p.19.)

²¹Warburg [148, p.274] writes, for example, that “discount rates that may differ between districts, no doubt, are preferable.”

²²Officially referred as the National Reserve Association Bill.

²³This section is based on Federal Reserve Board, Office Correspondence from S.E. Seitz to the General Counsel, Changes in Section 14 (d) of Original Federal Reserve Act, 09/28/1927, Box 1240, NARA R.G. 82.

APPLICATION FOR REDISCOUNT

To the FEDERAL RESERVE BANK OF CHICAGO Date.....192.....

The..... Bank of..... hereby makes application for the rediscount of the notes, drafts or bills of exchange listed below aggregating \$..... You are authorized to charge to our account at maturity, all paper rediscounted by us, and to charge to our account at any time hereafter, any paper which you may determine ineligible or deem undesirable.

THE PROCEEDS OF THIS APPLICATION ARE REQUIRED FOR

}	1. Deposit Decline.....
	2. Loan Demand.....
	3. Retiring } Rediscounts..... Other Indebtedness.....

The liability of this bank at the present time, for borrowed money, exclusive of this offering, is as follows:

Rediscounts.....	\$.....
Bills payable.....	\$.....
Certificates of deposit issued for money borrowed.....	\$.....
Total.....	\$.....
Paper sold without recourse.....	\$.....
Total deposits as of this date.....	\$.....
Total loans and discounts as of this date.....	\$.....

MAKER AND ENDORSER <small>List Drawer and Acceptor in Case of Trade Acceptance</small>	ADDRESS	BUSINESS <small>Indicate Purpose for which Proceeds of each item were used. (See Paragraph 2 on Reverse Side of this Sheet)</small>	Rate Chgd. Bor- rower	Estimated Net Worth (In Thousands)	Maturity	Indicate Character Purchased Paper P Depositor D Member Bank M Nonmem- ber Bank NM	Have You Statement On File? Yes or No	AMOUNT <small>Interest to Date of Dis- count May Be Added to Face of Note If Desired</small>

Total \$.....

I certify that the notes, drafts and bills of exchange, listed in the foregoing schedule are notes, drafts or bills of exchange which have been issued or drawn, or the proceeds of which have been used, or are to be used in the first instance, in producing, purchasing, carrying or marketing goods (the word "goods" as here used includes goods, wares, merchandise, or agricultural products, including live stock) in one or more of the steps of the process of production, manufacture or distribution or for the purpose of carrying or trading in bonds or notes of the United States.

I further certify that the above list includes no notes, drafts or bills of exchange of any one borrower who is liable for borrowed money to this bank in an amount greater than ten percentum of the unimpaired capital and surplus of this bank (except loans made under amended Section 5200 U. S. R. S.), or will be permitted to become liable in excess of this amount while such notes or bills of exchange are under discount with the Federal Reserve Bank, unless in accordance with amended Section 5200 U. S. R. S.

(Official Signature).....
(Official Title).....

FORM 7-10 A
15M 7-25-23 D-23425

Figure 2.2: Application for Rediscount. Source: Willis and Steiner [158, p.196]

Every Federal Reserve bank shall have power: [...] to establish ~~each week, or as much oftener as required~~ from time to time, subject to review and determination of the Federal Reserve Board, a rates of discount to be charged by ~~such bank~~ the Federal Reserve branches for each class of paper, which shall be fixed with a view of accommodating the commerce of the country and promoting a stable price level.

3. Senate Banking and Currency Committee, adopted changes, 11/20/1913.

Every Federal Reserve bank shall have power: [...]to establish ~~each week, or as much oftener as required~~ from time to time, subject to review and determination of by the Federal Reserve Board, a rates of discount to be charged such bank for each class of paper, which shall be fixed with a view of accommodating the commerce of the country and promoting stability in business.

4. Senate Bill, Section 14 (d), 12/19/1913.

Every Federal Reserve bank shall have power: [...] to establish ~~each week, or as much oftener as required~~ from time to time, subject to review and determination of the Federal Reserve Board, a rates of discount to be charged by ~~such bank~~ the Federal Reserve bank for each class of paper, which shall be fixed with a view of accommodating ~~the commerce of the country~~ and business.

In contemplating the creation of a number of local discount markets subject to its own conditions of management and direction, “the belief [was] that the United States was large enough, and its interest sufficiently diverse, to warrant the creation of a number of central banks” [157, p.88]. In the following extract,²⁴ Congressman Phelan explains why uniform rates were then seen impractical:

This provision as to the discount rate is infinitely superior to that contained in the Aldrich plan. Under the Aldrich plan the rate of discount was to be uniform throughout the country [...] As a result, if the rate were high enough in one section, it would inevitably be too high in another section; vice versa, if it were low enough to suit the needs of one section, it would be so low that it would enable banks in some sections to receive a splendid and undeserved profit by the rediscount of paper. Under the present bill the Board can make the rate uniform if ever necessary or advisable, but there is no rigid requirement that it must be uniform.²⁵

The belief, that different monetary conditions were appropriate for different regions, is further illustrated by the following exchange between Senator Norris and Senator Owen during the debates in Congress at the time of the passage of the original Federal Reserve Act:

²⁴Congressional Record, Vol. 50, quoted in Office Correspondence, Federal Reserve Board, “Power conferred on Federal Reserve Board by the provision of Section 14(d) of the Federal Reserve Act, 09/24/1927, Box 1240, RG 82, NARA.

²⁵A similar view is expressed in *Wall Street Journal*, 01/14/1918.

Senator Norris: “I should like to inquire of the Senator whether the bill he proposes provides that the interest rate must be the same all over the country, or will it be different in different reserve regions?”

Senator Owen: “No, Mr. President; it is left primarily to the local board, and then to the final determination of the Federal Reserve Board. The reason for that is that it was believed that the conditions in one section of the country might be sufficiently different from those in another to justify at times a different interest rate.”

The debate over regular actions on discount rates.

As pointed out by the Federal Reserve Bank of New York, the Federal Reserve Act was “lamentably lacking in separating and defining the respective powers of the Board and the Banks [over discount rates].”²⁶ As shown below using internal correspondences and circulars,²⁷ the struggle between the Board and the Reserve banks centered around the frequency at which the Board could exercise its power to review and determination.

Initially, Reserve banks submitted rates on a weekly basis, providing the Board with continuous control over the establishment of discount rates. In a letter dated December 17, 1914, to all Federal Reserve agents, the Board advised that its Discount Committee met each week on Wednesday at 3 p.m. and considered and acted upon recommendations for changes in rates on Thursday mornings. It was therefore desired that the Federal Reserve banks time their communications to the Board on the question of discount rates with this fact in mind.

At a meeting on May 18, 1917, it was, however, called to the attention of the Board that most of the Federal Reserve banks had discontinued the transmission of the weekly discount rate sheet and were, instead, sending reports on discount rates to the Board only when they desired to make a change in some of their rates. With a letter dated April 11, 1918, there was forwarded to the Federal Reserve agents Form X-877 reproduced in Figure Figure 2.3 for use in submitting the weekly report of discount rates. The letter called attention to the fact that the new form provided for a statement each week of the rates in force whether changes were recommended or not.

In a memorandum dated March 3, 1920, it is pointed that the system of weekly reports appeared unnecessary given that the Discount Committee had become obsolete. As a result a letter was addressed to the banks stating that, since the Board no longer considered recommendations for changes in discount rates upon a stated day each week and was at all times prepared to consider such recommendations at its regular meetings it was requested that the practice of sending weekly reports be discontinued.

²⁶The Chicago Rate Controversy, Benjamin Strong Memorandum, 09/11/1927, Box 120133, FRBNY Archives.

²⁷This section draws heavily on Federal Reserve Board, Office Correspondence from Mr. Carpenter to Mr. Morrill, 10/17/1935, Box 1240, R.G. 82 NARA.

NOTE: To be forwarded to reach the Federal Reserve Board not later than Thursday a.m. each week.

X-677

_____ Date.

Federal Reserve Board,
Washington, D.C.

Sirs:

I have the honor to forward the recommendation that no change be made in the existing discount rates for the Federal Reserve Bank of _____ for the week ending Thursday _____ 191__

Respectfully,

Federal Reserve Agent and
Chairman of the Board.

I have the honor to request that the following rates be approved by the Federal Reserve Board for the Federal Reserve Bank of _____ to become effective Friday morning _____ 191__

DISCOUNTS									
CODE WORDS:	DAIS	DEAN	DINE	DOOR	DUAL	DRUM	DALE	DYRE	DWES
					Secured by U. S.				
	Within 16 to	61 to	Agricultural	certificates of	1 to	61 to	All		
Maturities:	15 days:	60 days:	90 days:	tural	indebtedness or	60 days:	90 days:	matur-	
	includ-	includ-	includ-	and live:	Liberty Loan	includ-	includ-	ities.	
in	ing	ive	ive	stock	bonds	ive	ive		
days	member			paper	Within 15:				
	banks'			over	days in-	16			
	collat-			90	cluding	to			
	eral			days	member	50			
	notes				banks'	days			
					collater-	includ-			
					al notes	ive			
Present									
rates									
Rates									
recommended:									

COMMODITY PAPER :
DESK : DIKE :
1-60 days:61-90 days:
inclusive:inclusive :
:
:
:
:
:
:

Respectfully,

Federal Reserve Agent and
Chairman of Board

Figure 2.3: Weekly submission report of discount rates. Source: see text.

On January 5, 1926 a letter²⁸ was addressed to all Federal Reserve agents requesting that be presented to the Directors each week a complete schedule of the rates prevailing at the bank for their consideration and action and that the Board be informed of the outcome either in approving the existing schedule of rates, or in recommending change in any one of the rates. Below is New York Deputy Governor George L. Harrison's reaction to the letter:

At best the language is loose since it may be construed to imply (1) that the rates are reestablished and "approved" at each meeting, and (2) that the directors in establishing a new rate merely "recommend a change". As you know, it has been our theory that the discount rate once established and approved by the Federal Reserve Board continues its effect until the directors of the Federal Reserve bank affirmatively act to change the rate [...] I hope the Board's letter is not a first step toward weekly actions by the directors, which will enable the Board to exercise its authority to review after each meeting of the directors.²⁹

The reaction of George L. Harrison not only help explain why there was eventually little response to the suggestion contained in that letter, but also why the 1919 Opinion of the Attorney General on the power of the Board in setting discount rates did not settle the issue throughout this period. The Board had requested an interpretation of Section 14 (d) [92, p. 102-103] soon after New York Governor Benjamin Strong had threatened to increase the discount rate without Board approval in December 1919. In its Opinion, the Acting Attorney General of the United States held that:

The Federal Reserve Board has the right, under the powers conferred by the Federal Reserve Act, to determine what rates of discount should be charged, from time to time by a Federal Reserve bank, and under their powers of review and supervision, to require such rates to be put into effect by such bank.³⁰

The persistence of a gap in interpretation between, on the one hand, Alex. C. King, Acting Attorney General, for whom "it [was] quite clear that the Federal Reserve Board is the ultimate authority in regard to rediscount rates to be charged by the several Federal Reserve banks and may prescribe such rates" and, on the other hand, George L. Harrison, Deputy Governor of the New York Fed, for whom "the discount rate [...] continues its effect until the directors of the Federal Reserve bank affirmatively act to change the rate" can certainly be explained by the lack of publicity that the Attorney General's Opinion had received. In a April 15, 1926 correspondence with Benjamin Strong, George L. Harrison reveals that he was, in fact, unaware of the mere existence of this Opinion: "I am completely surprised to learn that there is such an Opinion [from the Attorney General] and most of all to learn its conclusion!"³¹

²⁸Board Circular Letter X-4493, 01/05/1926, Box 120133, FRBNY Archives.

²⁹Letter to Benjamin Strong, 01/06/1026, Box 120133, FRBNY Archives.

³⁰Official Opinions of the Attorneys General of the United States, Vol. 32, pp. 81-4. Opinion by Alex. C. King, Acting Attorney General.

³¹Office Correspondence, Box 120133, FRBNY Archives.

The practice of setting discount rates thus was multifaceted.³² Sometimes, the initiative came from Reserve banks. At other times, it emanated from the Board³³ or resulted from both formal and informal contacts between the officials of the Board and the Reserve banks [151]. The tensions that arose with repeated Board suggestions for changing rates that were not followed by Reserve banks and repeated Board delays in approving changes initiated by the Reserve banks did not help to clarify the respective legal powers.³⁴

It was only in 1935 that the Banking Act “ended the Reserve banks’ ability to control their portfolios independently, creating the structure we know today” [92, p.17]. While early drafts of the legislation shifted decisions about discount rates to the Board, later versions of the act omitted formal changes in the decision process [110]. In amending Section 14 (d) of the 1913 Federal Reserve Act, Section 206(b) of the Banking Act of 1935 nonetheless provided the Board with more continuous control by requiring that:

Each such bank shall establish [discount] rates every fourteen days, or oftener if deemed necessary by the Board.

District-To-District discount rate differentials.

A possibility to does not mean that Reserve banks did, in practice, establish different discount rates over the period. This fact still has to be established. To document whether and to which extent Reserve banks made use of the semi-autonomy provided in the Federal Reserve

³²In only two occasions did the Board eventually exercise its statutory authority to impose a discount rate on a recalcitrant Reserve bank. In January, 1920, the Board refused to approve an increase in the discount rate for paper based on government securities proposed by New York, and instead ordered an increase in the rate applicable to discounts of commercial paper [20, p.216]. In September, 1927, Chicago was ordered to reduce its rate from 4 to 3.5%. The incident initially involved Chicago Governor McDougal and New York Governor Benjamin Strong. Strong was leading an effort to reduce discount rates. In a letter to Strong, the more conservative McDougal wrote that “it is understood that the governing factor [in the reduction in discount rates] is the international situation, and it seems to me that the desired result has already been attained through the reduction in your rate.” The disagreement between New York and Chicago erupted into a controversy when the Federal Reserve Board sided with New York and ordered Chicago to reduce its rate on September 6 [60]. For a complete account of this episode, see *The Chicago Rate Controversy*, Benjamin Strong Memorandum, 09/11/1927, Box 120133, FRBNY Archives.

³³The decrease in rates from 4% to 3.5% in Summer 1927 appears, for example, to fall in that category according to a memorandum found in the Archives of the Board (Box 1240, R.G. 82, NARA): “I am unwilling to approve the reduction of the rediscount rate in the Dallas district from 4 to 3.5 per cent at this time; first, because it was not made in response to any local demand or because of any local condition but because of the Board’s request for uniformity at a lower rate.”

³⁴On September 23 1925 the Boston bank had requested permission to raise its rate, but the Board held the matter under consideration for more than six weeks and approval was not granted until November 10 (Stabilization Hearings, 69th Cong., 1st Sess. on H. R. 7895, pp. 640-1). On February 14 1929 the New York bank requested permission to raise its rate from 5 to 6%. The Board refused, and thereafter until May 23 there were nine additional applications, all of which were refused (Hearings on S. Res. 71, p. 172.). Over the same period, Boston [135, p.271] and Chicago also made applications for increases that were denied by the Board (Hearings on S. Res. 71, p. 755-756).

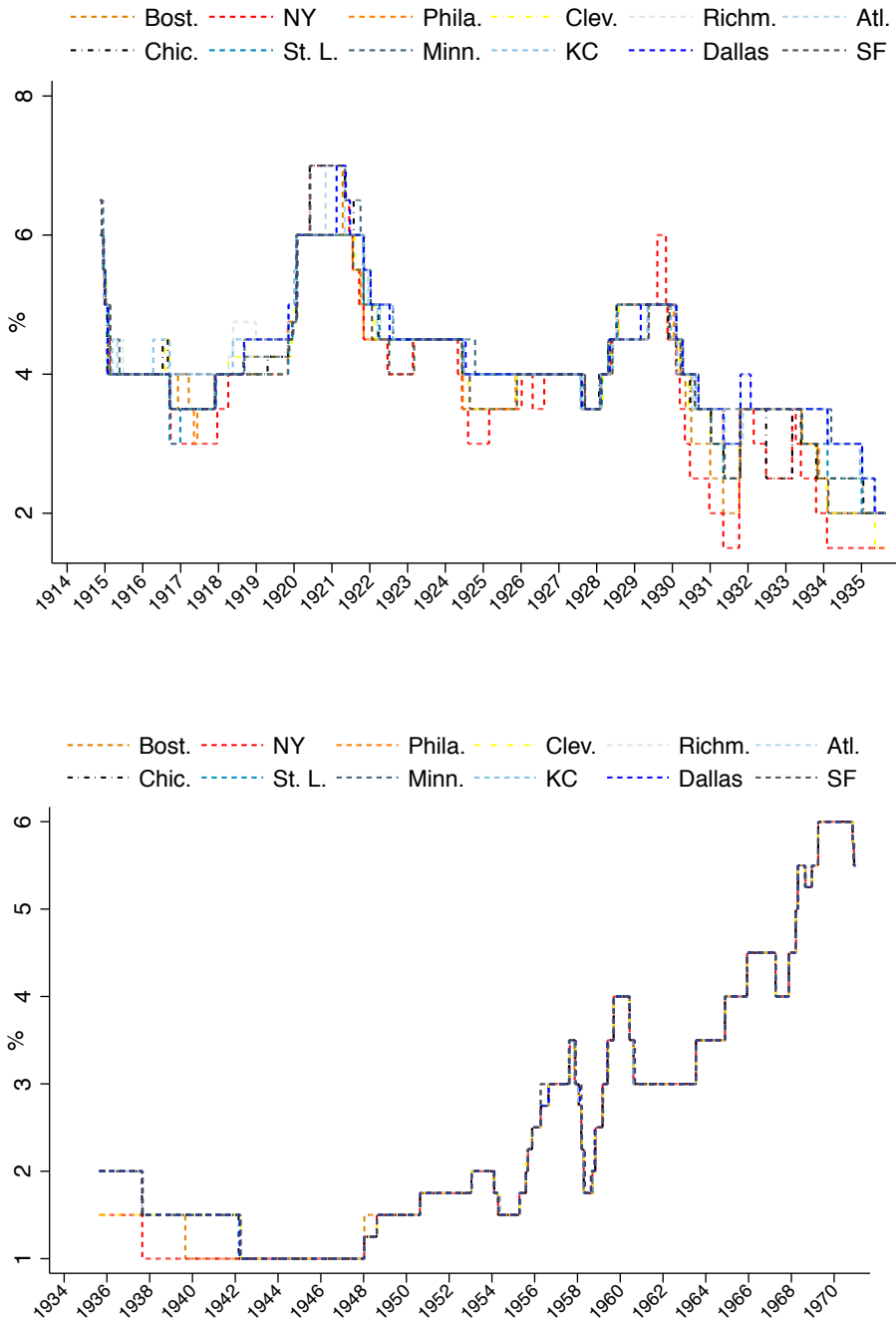


Figure 2.4: Daily discount rates of 12 Federal Reserve banks before and after New Deal reform of the Fed. Sources: 1914-1941: Banking and Monetary Statistics, 1943, Table 115. 1941-1970: Banking and Monetary Statistics, 1976, Table 12.1.A. The signature date of the 1935 Banking Act is used to separate the two periods.

Act, I collected daily data on discount rates charged by the twelve Reserve banks from Table 115 (resp. Table 12.1.A.) of the 1943 (resp. 1976) edition of *Banking and Monetary Statistics*. Several conclusions stand out from an examination of Figure 2.4, which shows discount rates before and after the New Deal reforms of the Federal Reserve and from the summary statistics reported in Appendix A.1.

First, it is evident that the absence of a provision to insure uniformity of discount rates translated into repeated and continued periods of non-uniformity. From the establishment of the Federal Reserve to the passage of the second Banking Act in 1935, rates were uniform only 22% of the time. Rather than being the exception, non-uniform rates were the norm during both crisis and normal times. Rates were uniform 31% of the time during NBER recessions and 16% otherwise. After the New Deal reform of the Federal Reserve, uniform rates became the norm and occurred 75% of the time.³⁵ Interestingly, Figure ?? as well as Figure A.1 in Appendix A.1, which reports the range of discount rates over the entire period, reveals that non-uniform rates did not completely disappear despite the more continuous control of the Board provided by the Banking Act of 1935. As discussed by [22], non-uniformities arose sporadically in 1955, 1958 and 1968.³⁶

Second, Figure 2.4 reveals that discount rate differentials from district-to-district were large. Average discount rate differentials with New York ranged from 20 basis points for the Boston district to 50 basis points for the Minneapolis district. The histograms in Appendix A.1 illustrate that New York had generally, but not always, the lowest rate in the System (87% of the time). During the 1920-1921 recession, New York had, for example, a discount rate 100-150 basis points lower than most other Reserve banks. This was also true between May 1931 and October 1931 when the New York rate was, for example, 200 basis points lower than that of Minneapolis. Between July 1928 and May 1929, the New York rate was, on the other hand, 50 basis higher than those of Minneapolis, Kansas City, and San Francisco.

Despite the decentralized structure of the Federal Reserve System, Reserve banks could

³⁵This may underestimate the degree of actual uniformity as the differences persisting in the late 1930s reflect inertia at a time when excess reserves made the discount mechanism largely dormant [55, pp. IV - 1]

³⁶In the summer of 1955, the Federal Reserve concluded that the recession of 1953-54 was over. But there was a difference of opinion within the System about the vigor of the recovery. The Board and the Reserve Bank of Cleveland favored a 50 basis points increase to bring the discount rate to 2.25%, while the 11 other Reserve banks supported a more gradual approach in two steps. It took almost two months for discount rates to settle at a uniform level. The 1958 episode closely paralleled the 1955 experience. The economy was recovering from the 1957-58 recession, but the pace of recovery was uneven among districts. San Francisco requested an increase in its discount rate on August 13. At the FOMC meeting of August 19, only two Presidents endorsed the move. Boston was the last to advance its rate generating a total delay of 39 days between the first and last advance in discount rates. In 1968, the Board approved a decrease by 25 basis points by Minneapolis to bring the discount rate into alignment with money market conditions. The other Reserve banks did not believe a reduction in discount rate was necessitated and expressed disagreements in delaying their advances. Today, the Reserve banks often submit new discount rates to "review and determination" by the Board to signal their views on System policy. In August 31, 2015, for example, six Reserve banks requested to maintain the existing rate; Minneapolis requested a decrease; Philadelphia, Cleveland, Richmond, Kansas City, and Dallas requested an increase. The existing rate was maintained. See <http://www.federalreserve.gov/newsevents/press/monetary/20151013a.htm>.

decide to change discount rates simultaneously if they faced similar economic conditions, shared a similar monetary doctrine (e.g. liquidationist, real bills, or counter-cyclical), and wanted or were forced to comply with what was seen as the policy of the System. While I will come back to this question more systematically in Section 2.5, it is interesting to consider Figure 2.5, which shows the correlation of discount rate changes across districts, together with the regional grouping suggested by [105] based on the similitude of regional business cycles. The correlation matrix shows that the districts classified in a same region (North East,³⁷ Great Lakes,³⁸ Great Plains,³⁹ South,⁴⁰ and Pacific⁴¹) changed discount rates together more often than not, suggesting that they both shared similar economic developments and/or monetary doctrines.

Figure 2.5 reveals, in addition, that the correlation of discount rate changes with New York is less than one might have expected given the city's central role as financial center. The more pro-active approach to monetary policy that New York had over the period as well as its central role for international gold movements meant that it was often the only Reserve bank changing its rate. Until the New Deal reform of the Fed, New York changed its discount rate 47 times, while the other Reserve banks only changed rates 30 times on average (Table A.1). The correlation is, however, higher (0.7) with Chicago, illustrating the connection between the two main financial centers in the country.

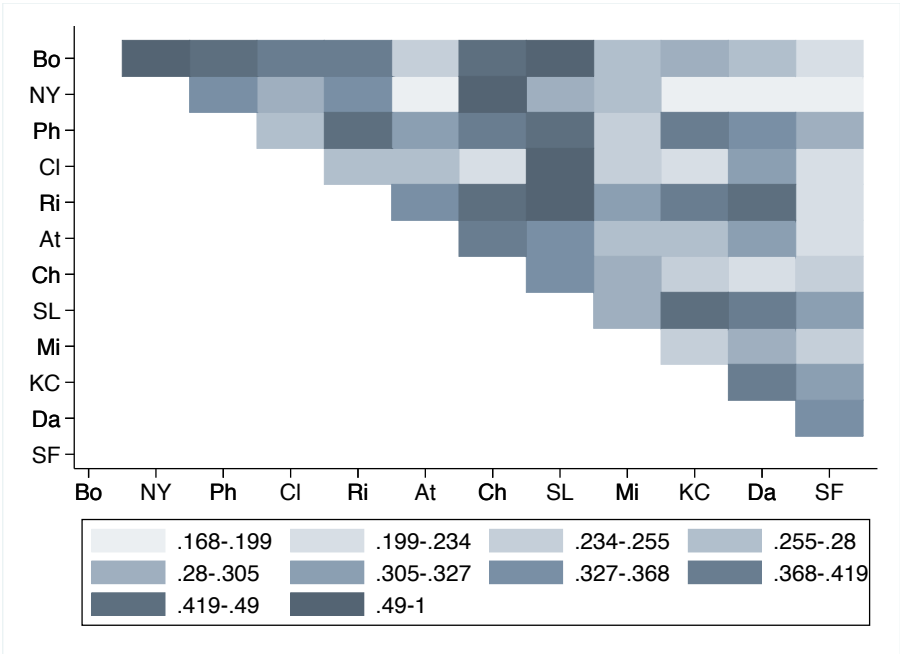
³⁷Boston, New York, Philadelphia.

³⁸Cleveland, Chicago.

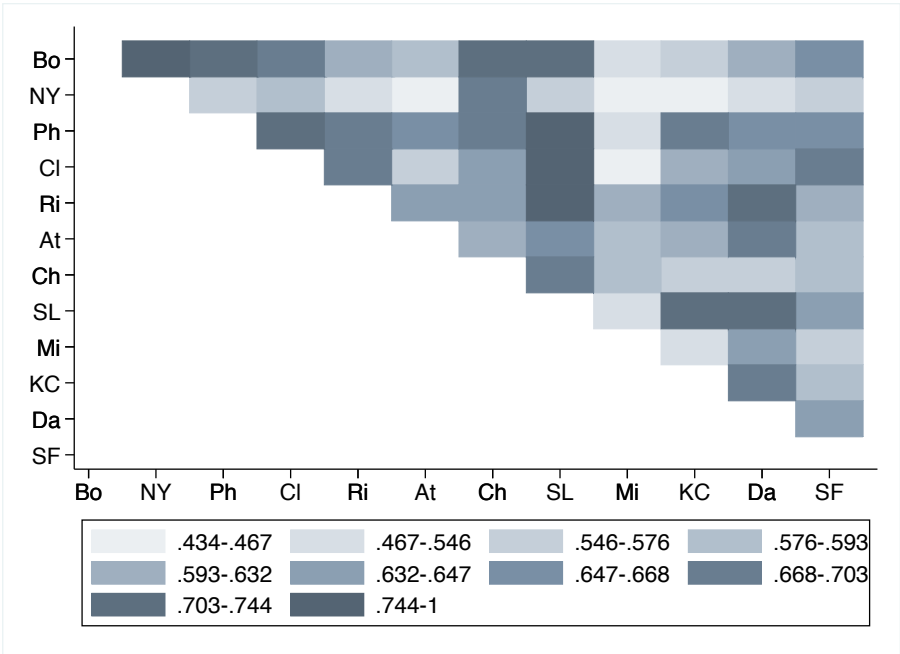
³⁹St. Louis, Minneapolis, Kansas City.

⁴⁰Richmond, Atlanta, Dallas.

⁴¹San Francisco.



(a) Weekly changes



(b) Monthly changes

Figure 2.5: Correlation between discount rate movements. The cutpoints are the min, max and 10 other percentiles. Weekly and monthly averages calculated from daily data. Sources: see Figure 2.4.

2.4 Discount borrowing and the inter-district flow of funds

An ideal test for the hypothesis that regional monetary conditions mattered for regional economies or, equivalently, that financial integration was incomplete would relate exogenous deviations in regional monetary policy to deviations in regional financial and economic activity. If financial integration was incomplete and regional monetary conditions mattered, we would expect these regional deviations in policy to translate into deviations in regional outcomes such as market interest rates and commercial bank lending. If, on the other hand, banks were always in a position to access liquidity at its lowest price regardless of location, we would not expect to see these deviations in regional outcomes.

This test is difficult to perform because it is hard to trace back the motivations of policymakers in establishing discount rates and thus to separate deviations that responded to different regional developments from those that did not.⁴² The minutes of the meetings of the Federal Reserve Board do not contain detailed discussions on discount rates decisions. While reference is made to decisions of the Discount Committee of the Board or to the Board Committee on Discount and Open Market Policy, the materials of these Committees could not be located in Research Group 82 at the National Archives and Records Administration. Similarly, the minutes of the Board of Directors of the regional Reserve banks, in addition to being particularly difficult to access, do not appear either to provide a detailed account of the reasons motivating changes in discount rates.⁴³

This difficulty in identifying the motivations behind discount rate changes is not just the result of the difficulty in retrieving relevant material on these episodes today. Statements on the reasons for requesting changes in discount rates were seldom made to the public. In a letter dated March 3, 1925 New York Federal Reserve Agent and Chairman, for example, stated that “we have never given out a statement of the reasons for any change in our rate except perhaps some very general statement in our Monthly Review”.⁴⁴ They were also poorly communicated within the System between the regional Reserve banks and the Board as this October 5, 1928 circular Board letter reveals:⁴⁵

Prior to the last several months the Federal Reserve Board in the exercise of its function of “review and determination” over rates of discount established by the directors of the Federal Reserve banks has been obliged to rely upon [...] scattered information

⁴²Regional Reserve banks could, for example, disagree on the appropriate overall stance of monetary policy for the U.S. economy, on whether and to what extent international considerations should be taken into account, and on how strong the monetary transmission mechanism was. The F.R. Bank of Boston, for example, favored large and infrequent changes [98, p. 27]. The F.R. Bank of Minneapolis also considered that financial stability is best supported by infrequent changes in the discount rate (Hearings on S. Res. 71, Appendix, Part 6, p. 760).

⁴³At least for the minutes of the Board of Directors of the FRBNY that I could access.

⁴⁴Letter to Samuel E. Royburn from Pierre Jay, Box 120223, FRBNY Archives.

⁴⁵Source: X-6151 available on page 302 of https://fraser.stlouisfed.org/scribd/?item_id=510007&filepath=/docs/historic

received from the Federal Reserve banks [...] The Board feels that it would be of very great assistance to it, if at the time the directors of the Federal Reserve Bank vote to make a change in the rediscount rate they would authorize the Chairman in advising the Board of their action to inform it also of the reasons which actuated them in making the change.

Given these limitations, I propose an empirical strategy that does not rely on a narrative approach, but rather combine information on discount window borrowing together with information on interbank borrowing. To illustrate this approach, consider the impact of a lower discount rate in the second district (New York) under complete and incomplete financial integration. Under complete financial integration, member banks in the second district would not only increase their borrowings at the New York Fed's window to expand their local activities, but also to provide banks outside of the second district access to the cheaper liquidity. We should therefore see higher discount window borrowing in the second district, lower discount window borrowing in the 11 other districts, and higher interbank borrowing through correspondent relationships.

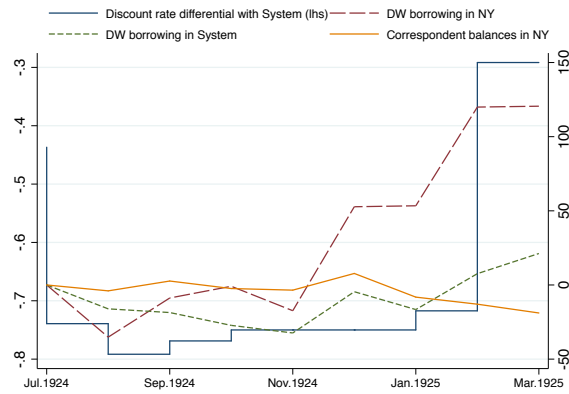
Under incomplete financial integration on the other hand, banks from the other 11 districts would not use their correspondent relationships with New York banks to access the cheaper central bank liquidity available in the second district. Therefore, we should neither see lower discount window borrowing in the 11 districts other than New York nor higher interbank borrowing through correspondent relationships in New York. Member banks in the second district would increase their borrowings at the discount window because local liquidity is cheaper, but this increase would be limited in the absence of a geographical reallocation of the provision of liquidity for the rest of the System.

Specific episodes

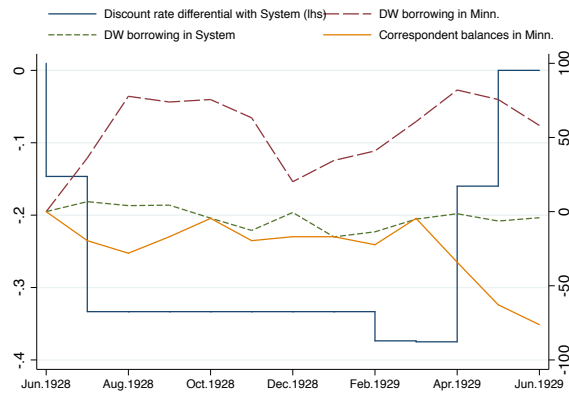
I start by describing a number of specific episodes. These episodes were selected because the deviations were relatively long lasting and illustrate both the case when one Reserve bank deviates or a group of Reserve banks deviate from the rest of the System.

In each panel of Figure 2.6, the solid blue line shows the paths of the deviation in discount rate policy. The dashed red line shows the paths of the log of discount window lending in the deviating district. The green dashed line shows the paths of the log of total discount window lending in the System. The orange solid line shows the paths of the log of member banks' correspondent balances in the deviating district. In these episodes, discount window lending increased (resp. decreased) more in the district where the discount rate was lower (resp. higher), while no clear pattern emerges in the paths of bankers balances. This provides evidence that restrictions in the use of discount window liquidity were effective in preventing a geographical reallocation in the provision of liquidity.

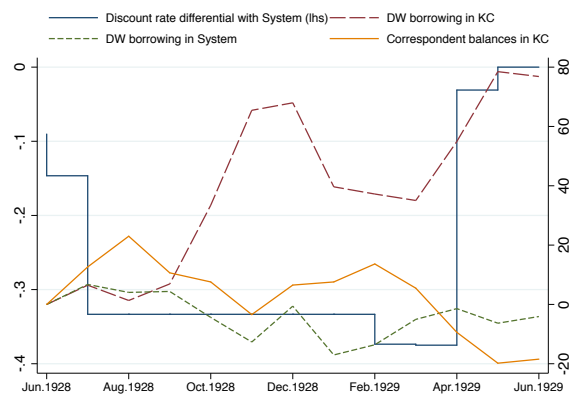
At the beginning of 1924, a uniform rate of 4.5% had prevailed for 15 months. Starting in May 1924, a general downward movement in rates was implemented. Discount rates



(a) New York, 1924



(b) Minneapolis, 1928



(c) Kansas City, 1928

Figure 2.6: Episodes of deviations from System policy. *Notes:* The blue solid line shows the differential discount interest rate of a district with the rest of the System. The red dashed line shows member bank borrowings in the deviating district. The green dashed line shows total member borrowings in the System. The orange solid line shows bankers' balances in the deviating district. Sources: See text.

were lowered by 50 basis points at most interior Reserve banks.⁴⁶ Eastern Reserve banks,⁴⁷ Cleveland and San Francisco lowered their rates by 100 basis points to 3.5%. New York reduced its rate further by an additional 50 basis points on August 8 and kept its rate below the level current in the rest of the country until February 27 1925 when it was brought back to 3.5%.⁴⁸ Figure ?? shows that while discount borrowing slightly decreased in the rest of the System, rediscounts in New York increased by 50%. Correspondent balances in New York banks did not, however, decrease.

The traditional narrative of [32] emphasizes the role of central banks cooperation in this episode. New York Governor Benjamin Strong wanted to facilitate sterling's return to gold by adopting a lower discount rate. According to this narrative, the New York rate remained below those of other Reserve banks because the rate in New York was seen as more important for influencing international gold movements and because Strong was not persuasive enough to convince the other Governors. This deviation would, therefore, represent a good example of an exogenous policy deviation.

A more detailed look at the available evidence suggests, however, that even in this case this interpretation is problematic. In motivating these changes in rates, Boston mentioned the conditions in the shoe, leather and cotton industries in New England (p.753).⁴⁹ Chicago emphasized that there was little speculative demand for credit and that a lower rate might help business, which was reported as being "rather dull" (p.756). San Francisco emphasized that one its principal considerations for lowering rates was that "it was clear that there had been a real recession in business activity". Cleveland pointed to the sharp drop during the previous 60 days in the volume of discounted bills (p.757). Dallas reported that it would fit nicely with the wheat movement and have a good effect during the movement of cotton crop (p.758). All together, while international conditions surely mattered for the average level of rates in the country, it is far from clear that it drove the discrepancies in regional rates.

At the end of 1927, rates had been quasi uniform for 18 months at 4% and then 3.5%. Restrictive policies were first introduced by Chicago and Richmond in January 1928 and then spread to the rest of the System to curb excessive stock market speculation [27, p. 39-46].⁵⁰ Rates settled at 5% in August 1928, except in Minneapolis, Kansas City, Dallas and San Francisco where they remained at 4.5%.⁵¹ The "exogenous interpretation" is that these four Reserve banks were less concerned by these financial developments and/or were

⁴⁶Richmond, Atlanta, Chicago, St. Louis, Minneapolis, Kansas City, and Dallas.

⁴⁷Boston, New York, Philadelphia

⁴⁸The split between the two groups remained effective until January 1926 where all rates settled at 4%.

⁴⁹The references come from Hearings on S. Res. 71, Appendix, Part 6. Only the page number is provided for clarity. For San Francisco, the reference comes from a telegram dated 05/01/1924 from John Perrin to FRBNY, FRBNY Archives, Box 120133.

⁵⁰In a letter to Edmund Platt dated July, 13 1928, FRBNY Deputy Governor J.H. Case explains that "certain of the considerations mentioned during the discussions were the continued large speculative use of credit, [and] the lack of clear evidence that the increase in the total volume of credit has been checked.", FRBNY Archives, Box 120224.

⁵¹Figure ?? and Figure ?? show the developments in Minneapolis and Kansas City, but the patterns are qualitatively the same for Dallas and San Francisco.

skeptical about the usefulness of discount rate changes to curb speculation.

But here again there is evidence suggesting that these regional deviations were not unrelated to specific economic conditions in the respective districts. In justifying the increase from 4 to 4.5%, Kansas City and Dallas noted that credit conditions in their districts did not call for a higher rate, but did not want to interfere with the desired effect of the increased rates in the other districts (p.760, p.758).⁵² I could not find evidence explaining why their Boards of Directors did not request a further increase to 5% in the same way than most other Reserve banks did. But since they were already reluctant to implement the first rate increase given local credit conditions in their districts, it is easy to imagine that this same reason motivated the absence of a second request. Both Figure ?? and Figure ?? clearly show, however, that correspondent balances held in Minneapolis and Kansas City remained stable for more than 8 months following the relative decline in the discount rates of these districts.

Panel VAR evidence

These episodes illustrate my empirical evidence on the absence of inter-district flows of funds during periods of inter-district discount rate differentials. To see if these patterns generalize to more cases, I aggregate the experience of the 12 districts using a panel-data vector autoregressive (pVAR) model. Panel VARs combine the traditional VAR approach of treating all the variables in the system as endogenous with the panel-data approach, which allows for unobserved individual heterogeneity. Specifically, I estimate the reduced form of the following structural model:

$$A_0 Y_{i,t} = A(L) Y_{i,t} + \gamma_i + \lambda_t + \eta_{i,t}$$

where $Y'_{i,t} = [C_{i,t}, B_{i,t}, D_{i,t}]$ is a vector containing the three endogenous variables of my system. The subscript i indexes districts; t indexes months. D stands for the Reserve bank's discount rate, B is the log of member banks borrowings at the discount window, and C stands for the correspondent balances of member banks.⁵³ In applying the VAR procedure to panel data, one needs to impose that the underlying structure is the same for each cross-sectional unit. Heterogeneity is limited to fixed effects, denoted γ_i , on the levels of the variables. Given the lags of the dependent variables in each equation, the fixed effects are correlated by construction with the regressors. I therefore eliminate them before the estimation using the 'Helmert procedure', which removes the forward mean of all future observations available (i.e. the Helmert observation for time t is the original observation for time t minus the mean of observations time $t + 1$ through T) for each cross-sectional unit. The time dummies, λ_t , capture aggregate macro developments that affect districts in the same way. I also eliminate

⁵²Minneapolis justified its April 24 increase because it was out of line with the rate of the Chicago district (p.760).

⁵³Net correspondent balances are calculated as correspondent balances due to (liabilities) minus correspondent balances due from (assets).

these time fixed-effects before the estimation by subtracting the cross-sectional means of each variable in each period.

A_0 is a nonsingular matrix, which captures the contemporaneous relationship between the endogenous variables and is given by:

$$A_0 = \begin{pmatrix} 1 & -a^{B,C} & -a^{D,C} \\ -a^{C,B} & 1 & -a^{D,B} \\ -a^{C,D} & -a^{B,D} & 1 \end{pmatrix}$$

where, for example, $-a^{B,D}$ gives the contemporaneous impact of member banks borrowings on the discount rate. $A(L)$ is the matrix capturing the relationships between the endogenous variables and their different lags. Following the Akaike Information criterion (AIC), the Hannan-Quinn criterion (HQ), and the usual recommendation of including a year's worth of lags if the data permits (namely to deal with seasonal effects), I include 12 lags in the model. $\eta_{i,t}$ contains the mutually uncorrelated structural shocks to each endogenous variables. In other words, the variance-covariance matrix of the structural disturbances is scalar, $V(\eta_{i,t}) = \mathbb{I}$.

After removing the cross-sectional and time fixed effects, I estimate all equations of the reduced-form system independently using least-squares. There is, in fact, no efficiency gain in using *SUR* over *OLS* equation by equation since all the RHS variables are identical.

$$Y_{i,t} = A_0^{-1}A(L)Y_{i,t} + A_0^{-1}\eta_{i,t}$$

Identification and Data

I use impulse-response functions to describe the reaction of one variable to the innovations in another variable in the system, while holding other shocks equal to zero. Since the variance-covariance matrix of the disturbances of the reduced-form model $A_0^{-1}\eta_{i,t}$ is not necessarily diagonal, further restrictions need to be imposed to trace out the impact of a shock in a variable of the system while keeping other shocks equal to zero. If we consider the reduced-form disturbances $u_{i,t} = A_0^{-1}\eta_{i,t}$ and the associated positive definite non-scalar variance-covariance matrix $E(uu') = \Sigma$, one can choose a factorization matrix F , where $FF' = \Sigma^{-1}$, such that $V(Fu) = \mathbb{I}$.

The standard orthogonalization is the Cholesky ordering where the factorization matrix is lower triangular, therefore allocating any correlation between the disturbances of two elements to the variable that comes first in the ordering. Several Cholesky decompositions can be obtained by reordering the variables of the model. For example, imposing the following structure on A_0 , generates a factorization matrix (here equal to A_0^{-1}):

$$A_0 = \begin{pmatrix} 1 & 0 & 0 \\ -a^{C,B} & 1 & 0 \\ -a^{C,D} & -a^{B,D} & 1 \end{pmatrix}$$

This allows to identify the parameters of the structural model from the reduced-form model and thus trace out impulse response functions. The particular restrictions I impose on A_0 assumes that the Reserve bank can respond contemporaneously to the behavior of member banks, but that member banks only react to the new policy with a one month delay.⁵⁴ There is, a priori, no reason to prefer this ordering over an ordering that would imply that member banks react contemporaneously to new policies while Reserve banks respond to member banks behavior with a lag. Fortunately here, the ordering of the variables is of no consequence for my results.⁵⁵ There is, therefore, no need to motivate a particular ordering over another.

The same source as in Figure 2.4 is used for discount rates, but I collapse its frequency by computing monthly averages of daily figures. Data for member bank borrowings come from [143], Table 11A, “Total holdings by FR Bank of Bills discounted for Member Banks, monthly averages of daily figures,” expressed in millions of dollars. The data run from January 1922 to October 1936. To get these data, the author relies on unpublished data supplied by the Division of Bank Operations, Board of Governors of the Federal Reserve System; and on various issues of the *Annual Reports of the Federal Reserve Board* and of the *Federal Reserve Bulletin*.

Data on correspondents’ balances are taken from various issues of the *Federal Reserve Annual Report* and the *Federal Reserve Bulletin*. The 1925 Annual Report contains monthly data for the years 1920-1925. The Annual Report for the year 1926 didn’t publish data on correspondents’ balances so I collected them from the monthly issues of the *Federal Reserve Bulletin* of that year. Since the data overlap with data published for previous and ulterior years in the Annual Report, I was able to verify that the change of primary source didn’t affect the continuity of the series. The data for the years 1927-1931 were collected using the corresponding issues of the Annual Report.

Baseline result and robustness

Equipped with these assumptions, we can investigate the effects of a deviation in the discount rate of a Reserve bank (from the average System policy) on the behavior of its member banks. Figure 2.7 shows the cumulative impulse response functions of member bank borrowings and member bank correspondent balances following a 10 basis points decrease in the discount rate. The solid line is the point estimate of the response, and the dashed lines show the 95 percent confidence interval around that estimate created using Monte Carlo simulations with ten thousand repetitions.

Since the variables are centered on the average System policy, the shock corresponds to a 10 basis points deviation from the average policy in the System. Similarly, the responses of member banks are expressed as deviations from the average behavior of member banks in the System. Because of the triangular normalization of the model, first-period responses

⁵⁴This particular ordering, thus, assumes $a^{D,B} = 0$ and $a^{D,C} = 0$. I also assume that discount window lending does not impact contemporaneously the correspondent balances of member banks, $a^{B,C} = 0$.

⁵⁵More on this below.

in all the responses are by construction zero. Overtime we, however, see that a 10 basis points decrease in the discount rate compared to average System policy leads to a relative 4 percent increase in member banks borrowings and no change in correspondent balances over the next twelve months.

These patterns confirm the behavior documented in a few particular episodes and fit with the dynamics of an economy under incomplete financial integration where local deviations in policies are not completely exported to the rest of the System and therefore mattered for local economic conditions. Although data are expressed as deviations from the rest of the System, the relative increase in discount borrowing of member banks in the deviating district is not driven by a decrease in discount borrowings in other districts (not shown). We can also see that the balances of member banks with correspondents are not affected.

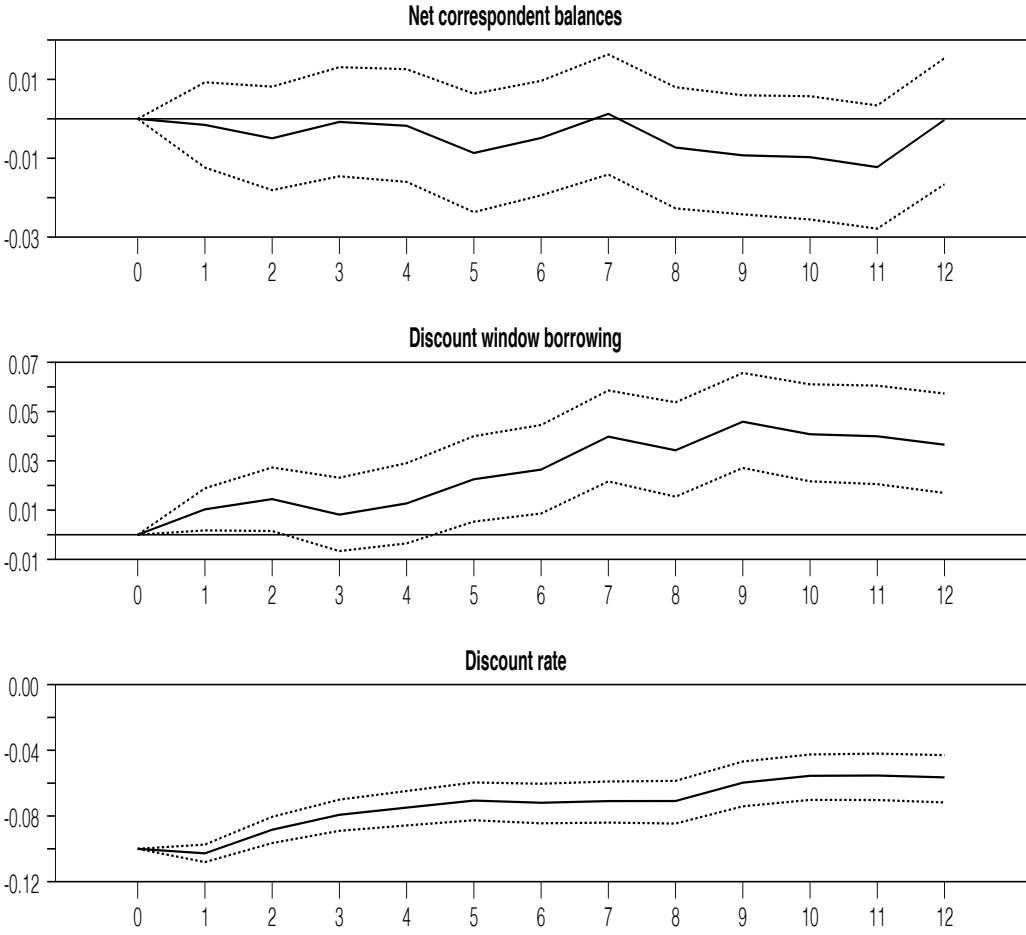
A possible concern with my results is that causality ran in the other direction: perhaps the path of (relative) discount window lending drove the timing and magnitude of (relative) deviations in discount rate policies rather than vice-versa. The use of lags allay many of these concerns as it allows to control for past deviations in the path of discount window lending. In other words, my estimated effects do not rely on episodes of discount rate deviations that would have been expected given past deviations in discount window borrowing. This is important because the narrative evidence of Section 2.5 suggests that, when policymakers considered regional conditions to motivate discount rate decisions, they considered either past developments or future but predictable developments such as regional specific, but recurring seasonal factors.

The narrative evidence of Section 2.5, furthermore, suggests that my results are certainly a lower-bound⁵⁶ of the true relationship between discount rates and discount lending if future unpredictable (relative) discount window lending developments drove some of the observed (relative) deviations in discount rate policies. If a Reserve bank increases its discount rate because it expects “increased member bank borrowings”, this creates a positive relationship between discount rates and discount lending that biases my results toward zero. Similarly, if a Reserve bank “adjust[s] rates of rediscount to [expected] market rates of interest” and that these expected movements in market rates are driven by expected money demand shocks, this would also tend to create a positive relationship between discount rates and discount lending if rediscounting requests increase in the face of money demand shocks.⁵⁷

The results are robust to different Cholesky orderings, reflecting that, in this particular application, the reduced-form shocks are only weakly correlated. In other words, given that the unrestricted variance-covariance matrix of the disturbances of the reduced-form model is almost diagonal, the impulse-response functions are largely invariant to the particular choice of restrictions on A_0 that is used to make the variance-covariance matrix exactly diagonal.

⁵⁶In the sense biased towards zero.

⁵⁷I focus my discussion on expected movements in market rates, rather than actual past movements in market rates despite the fact that Reserve banks appeared to react to regional asset market developments in a backward rather than forward looking way because I have experienced with including a measure regional commercial bank lending rates in my VAR and my results are robust to controlling for past movement in market rates.



Responses to Discount rate

Figure 2.7: Cumulative Impulse Response Functions of (relative) discount window lending and (relative) interbank balances following a (relative) 10 basis point decrease in monthly discount rate. 95% confidence bands calculated by 10000 Monte Carlo draws. Sources: see text.

The robustness of results to different Cholesky orderings is not uncommon,⁵⁸ reflecting that in many applications the interaction between variables is sluggish rather than immediate [128].

In Appendix A.2, Figure A.4 provides evidence that this lack of relationship between discount rate differentials and the inter-district movement of funds is robust to an alternative measure of capital movements across districts. Based on [159], I collected bilateral transit clearings data from the Gold Settlement Fund, i.e. the set of accounts that recorded the flow of funds among Federal Reserve districts. While these accounts omit cheque clearing that go directly through correspondent banks and inter-district currency flows, they are believed to provide an accurate picture of the overall direction of private funds during this period [112]. Figure A.4 confirms, for the San Francisco district, the lack of relationship between discount rate differentials and the direction of transit clearings.

2.5 The elusive gains of regional monetary stabilization

Optimal restrictions on the movement of funds

The choice of regional autonomy of monetary policy over complete financial integration was a priori reasonable given the characteristics of the then U.S. monetary union. Regional shocks were still pervasive [79], consistent with the fact that many districts remained either primarily agricultural or industrial in character.⁵⁹ Federal programs that transfer income from regions that are doing well to regions that are not, such as unemployment insurance or agricultural price support programs, did not exist on a modern scale [113]. The constitutions of states included balanced budgets requirements thereby limiting the scope for counter cyclical state

⁵⁸The ordering choice is critical in two literatures that have dominated macroeconomic conversations, namely the identification of government spending shocks and the identification of Fed Funds rate shocks, generating the misleading impression that the ordering choice is critical in most applications.

⁵⁹F.R. Board [55, pp. IV - 12-13] considers that while the lack of diversification in regional economies provided a basis for differentials in discount rates in the first half of the century, a growing diversification had already taken place by the 1950s. “In years past, depressed conditions in agriculture might have justified independent action to assist banks in carrying the credit needs of farmers. While such needs might still arise, the growing diversification that has taken place within all Federal Reserve districts over the past two decades makes it difficult to classify very many districts any longer as primarily agricultural in character [...] The growing diversification as among industry and agriculture throughout the nation has [...] tended to remove the basis for differentials which existed when System policy could effectively distinguish between the predominantly agricultural and the predominantly industrial sections of the country.”

fiscal policy⁶⁰ and labor mobility between regions was limited [113].⁶¹

The environment of 1920s and 1930s was thus conducive for experimenting with regional monetary stabilization. Restrictions on the movement of funds created a wedge in the arbitrage condition central to the trilemma and allowed regions to regain some control over the intertemporal allocation of spending. [50] study optimal capital controls in a fixed exchange rate regime or monetary union.⁶² The authors work with explicit capital controls, where τ_t (resp. τ_t^i) is a tax on capital inflows or a subsidy on capital outflows in the home region (resp. in region i) giving the following condition for a monetary union:

$$1 + i_t = \frac{1 + \tau_t}{1 + \tau_t^i} (1 + i_t^i)$$

Importantly, the authors' central result that optimal capital controls lean against transitory regional shocks is not limited to the use of explicit capital controls and expands naturally to indirect restrictions on the movement of funds.

This leads to the question of whether Reserve banks used their regional monetary autonomy to stabilize regional economies around the national average. The view of [104] that the genesis of stabilization policy long predated the Employment Act of 1946,⁶³ suggests this possibility. But the number of conflicting doctrines influencing monetary policy makers over this period [47] provide reason to worry about how regional monetary autonomy was, in fact, used. If used as a guiding principle for regional policies, the real bills doctrine,⁶⁴ for example, provided for a procyclical rather than for a countercyclical regional policy. According to this doctrine, a Reserve bank adjusts credit to accommodate the legitimate needs of commerce,

⁶⁰A study by HM Treasury [139] made for analyzing the UK Government's decision on Economic and Monetary Union (EMU) membership provides a good overview of the literature on the characteristics of the U.S. as a monetary union in the postwar period. This literature finds that the US federal tax and benefit system acts to offset around 15 per cent of shocks to regional output.

⁶¹[113] argues that there were important cultural barriers to the mobility of labor. African Americans faced enormous racial discrimination wherever they went. Even white Southerners were branded as lazy and inferior workers.

⁶²As capital controls introduce a wedge between the intertemporal prices for households in different regions, they create an allocative inefficiency. For this reason, the term optimal refers to a second best policy.

⁶³The Employment Act of 1946 formally introduced the dual objective of price stability and maximum growth. The The New York Fed, for example, explains using Figure A.3 shown in Appendix A.1, that "it has been the policy of this bank to exercise its influence toward restraint at times when business and speculative activity appeared to be excessive, and to remove credit restraints at times of business depression in the hope that this policy might aid in avoiding the extremes of business expansion and contraction and encourage greater business stability" (Hearings on S. Res. 71, Appendix, Part 6, p. 761). Similarly, in its history of the San Francisco Fed, Willis [159, p.126] writes that "with exception to the war period, it has been the policy of the San Francisco bank to attempt to exert a restraining influence when business and speculative activity appear to be excessive and to remove the restraints in times of depression."

⁶⁴[47] writes that the doctrine was particularly influential in shaping the views of Federal Reserve Board member Adolph Miller and Reserve bank governors George Norris of Philadelphia and James McDougal of Chicago.

thereby increasing high powered money in regions experiencing economic booms, rather than in regions experiencing downswings.

Decentralization and the practice of regional monetary stabilization

I investigate how Reserve banks used their monetary autonomy using both empirical and narrative evidence. My empirical evidence shows that the Reserve banks did not use their regional monetary autonomy to stabilize regional economies around the national average. My narrative evidence suggests that this result is not surprising given the lack of consistent principle guiding discount policy throughout this period.

In each of the diagrams in Figure 2.8 and Figure 2.9, an indicator of relative regional economic activity is shown against the district discount rate and the average discount rate for the System. The indicator of relative regional economic activity is constructed using data on retail trade and inflation. The data on retail trade come from [105].⁶⁵ Indicators on the evolution of local prices come from the Retail Price Division of the Bureau of Labor Statistics [26]. For each district, I de-trend retail trade using an HP filter. I then express the cyclical component as a gap from its trend value ($\frac{y_i - \bar{y}_i}{\bar{y}_i}$ where y_i is retail trade for district i). I add the inflation rate (π_i) to $\frac{y_i - \bar{y}_i}{\bar{y}_i}$ to get a single measure summarizing developments in the output market of district i . Finally, I scale the district measure $\pi_i + \frac{y_i - \bar{y}_i}{\bar{y}_i}$ by that same measure calculated for the aggregate U.S. monetary union $\frac{\pi_i + \frac{y_i - \bar{y}_i}{\bar{y}_i}}{\pi_{US} + \frac{y_{US} - \bar{y}_{US}}{\bar{y}_{US}}}$.⁶⁶

Figure 2.8 and Figure 2.9 reveal that Reserve banks did not use individual discount rates to stabilize regional economies around the national average. The National Bureau of Economic Research determined that four business cycles occurred in the United States between 1919 and 1935. During the business cycle in 1920-1921,⁶⁷ Philadelphia acted in a stabilizing way by limiting the increase in its discount rate in the face of relatively lower economic activity. But Cleveland and Boston did the opposite, the first one failing to increase its discount rate more than elsewhere in the face of relatively higher economic activity, the second one increasing its discount rate more than elsewhere in the face of relatively poorer economic performance.

During the business cycle of 1923-1924,⁶⁸ Dallas acted in a stabilizing way by limiting the impact of oil strikes, which lowered income in oil producing regions [105]. So did Richmond in the face of relatively stronger recovery. The larger decrease in discount rates in New York

⁶⁵The authors document that aggregate fluctuations in retail trade coincided closely with aggregate fluctuations in other business cycle indicators.

⁶⁶The variation in this overall index is, in fact, almost entirely driven by variations in the retail trade index. This illustrates that price developments, as measured by the evolution of the BLS index of costs of living, were uniform across districts over this period.

⁶⁷From January 1920 to July 1921.

⁶⁸From May 1923 to July 1924.

did not, however, appear justified from a regional stabilization point of view. During the business cycle of 1926-1927,⁶⁹ discount rates remained uniform despite varied experiences in Federal Reserve districts. During the contraction from 1929 to 1933,⁷⁰ Cleveland, Atlanta, Chicago, St. Louis, Minneapolis and Dallas failed to provide extra monetary stimulus to their regional economies despite performing worse than the national average.

In the course of an investigation into the workings of the National and Federal Banking systems authorized by the U.S. Senate in 1930, the Senate Banking and Currency Committee sent to all Federal Reserve banks questionnaires in which the rate question featured prominently, providing a useful reference point for understanding the motivations of Reserve bank policymakers.⁷¹ The digest of replies received from the different Federal Reserve banks summarizes the reasons cited for increases and decreases in rates of rediscount. Among the reasons given for rate increases were:

1. A rise in open-market rates.
2. A decline in gold reserves, particularly below the level for the entire system.
3. A decline in deposits and an expansion in the loans of member banks.
4. Increases in rates of rediscount in other Federal Reserve districts.
5. Increased member bank borrowings.
6. An increase in security loans with no increase in commercial loans.
7. The growth of speculation.
8. An absence of seasonal liquidation in credit.
9. Misapplication of Federal Reserve credit.
10. A more rapid increase in credit volume than in business.
11. A use of local funds on brokers' loan market.
12. Higher rates of interest in the East that shifted borrowing demand to interior banks.

⁶⁹From October 1926 to November 1927.

⁷⁰From August 1929 to March 1933.

⁷¹Questionnaire No. 8. The Discount Rate Policy. Question 1: List the various more important considerations which induced your board of directors, on the occasion of each change in rates of rediscount since January, 1924, to vote for such changes. Hearings on S. Res. 71, Appendix, Part 6.

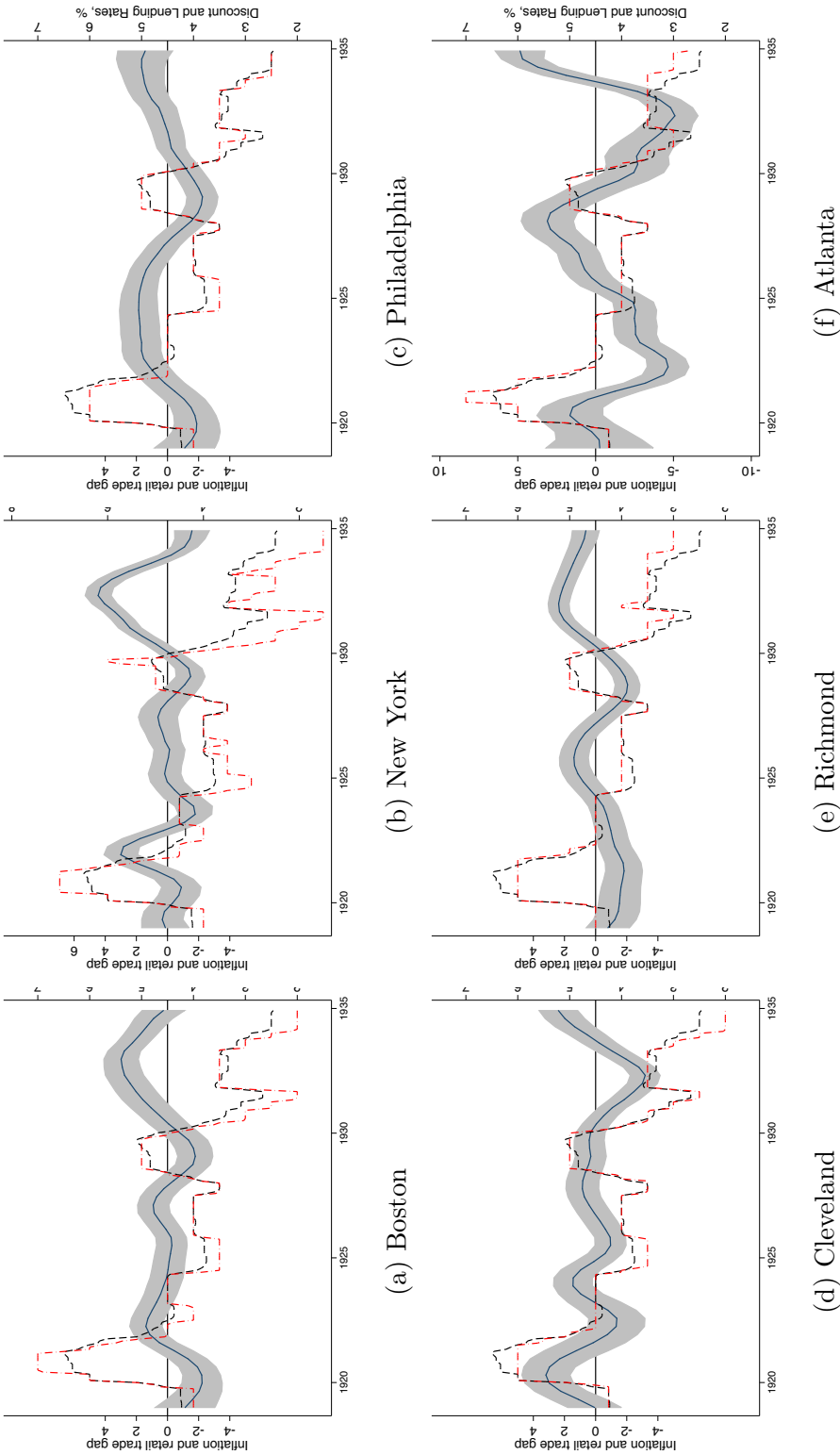


Figure 2.8: District and Average System Discount Rates against Gaps in Retail Trade and Inflation. Note: In each graph, the black dashed (resp. dotted) line shows the average discount (resp. lending) rate for the System. The red dashed (resp. dotted) line shows the discount (resp. lending) rate for the district. The blue line shows the cyclical component of retail trade and inflation index of a district expressed in deviation from the retail trade and inflation index for the System with 95% confidence intervals. Sources: see text.

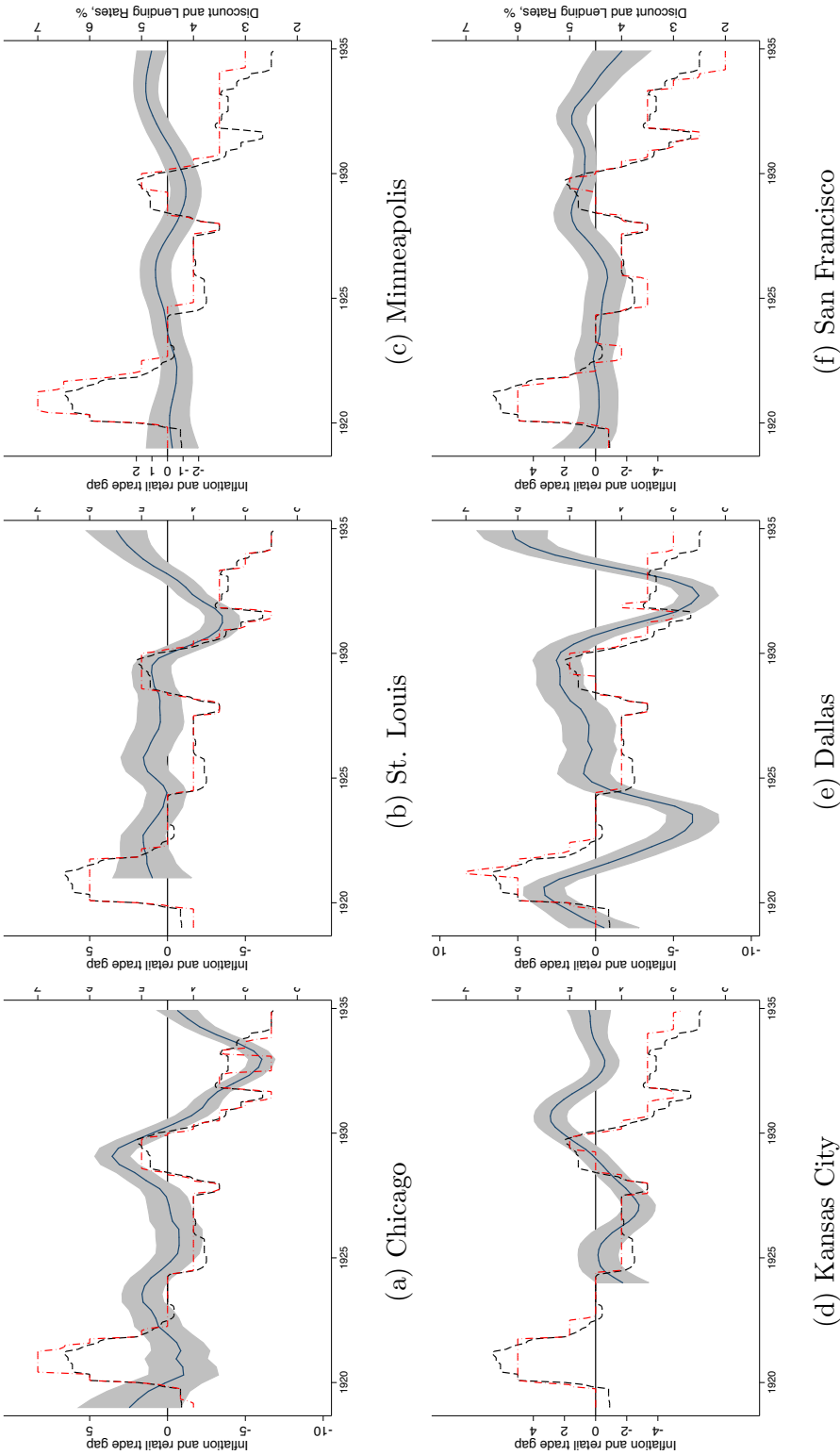


Figure 2.9: District and Average System Discount Rates against Gaps in Retail Trade and Inflation. Note: In each graph, the black dashed (resp. dotted) line shows the average discount (resp. lending) rate for the System. The red dashed (resp. dotted) line shows the discount (resp. lending) rate for the district. The blue line shows the cyclical component of retail trade and inflation index of a district expressed in deviation from the retail trade and inflation index for the System with 95% confidence intervals. Sources: see text.

Among the reasons given for rate reductions were:

1. Decline in member bank borrowings.
2. A reduction of rates of interest in other Federal Reserve districts.
3. Ability of large member banks to borrow from banks in financial centers.
4. To bring policy in line with action of open-market investment committee.
5. A desire to adjust rates of rediscount to market rates of interest.
6. Declining business, employment, and commodity prices.
7. The liquidation of member bank credit.
8. To remove all obstacles to business recovery.
9. To repel gold imports and relieve tension in the international money markets.
10. To encourage use of credit facilities.
11. To stimulate a growth in credit equal to the Nation's needs.
12. To meet the request of the Federal Reserve Board.

As pointed out by [157] and [62], the fair conclusion to be drawn from this group of unrelated answers is that no clear principle for guiding discount rate policy in general, and deviations of regional discount rates in particular, emerged throughout the period. Against this background, it is not surprising that the belief that different monetary conditions were appropriate for different regions, which was central in the arguments of those opposing the centralization of monetary policy in 1913 when the Federal Reserve was created, almost completely disappeared in the Hearings of the Banking Act of 1935.⁷²

While the experience of the Federal Reserve failed to illustrate the potential gains of regional differentiation of monetary policy, it clearly demonstrated the pitfalls of decentralization. Already in 1919-1920, there was considerable controversy among the Reserve banks concerning the provision of accommodation for other Reserve banks, thereby creating ambiguity about the operation of the Interdistrict Settlement System.⁷³ [152] even documents that Board member Harding threatened to reveal to the public the overextended position of the Atlanta Reserve bank, its extremely low gold ratio in the absence of accommodation from other Reserve banks, and the possibility to allow for a "depreciation" if Atlanta did not change its liberal discount window lending policy.

The experience of the Great Depression revealed further how decentralization generated policy paralysis. The Depression reached its trough in the winter of 1933 when several Reserve banks refused to cooperate with system-wide open market policies or to rediscount assets of other Reserve banks [110]. Against this background, Congress and the Roosevelt

⁷²Banking Act of 1935, Hearings before the Committee on Banking and Currency, House of Representatives, 74 Congress.

⁷³F.R. Board [55, p. I-7] notes that "Reserve banks in the West and South objected to taking over acceptances purchased at the initiative of the Eastern Reserve banks, while the latter objected to having to buy and hold the preponderance of acceptances when most of them originated elsewhere." Lending Reserve banks also objected when the discount rates of borrowing Reserve banks were lower than their own. On this topic, the Federal Advisory Council advised that "where Federal Reserve banks are fairly regular rediscounters with other Federal Reserve banks their discount rates should not be permitted to be lower than those prevailing with the Federal Reserve Banks granting the rediscounts" (Feb. 22, 1921, Topic N.2.).

administration responded by enacting the Banking Act of 1935 to centralize authority and to avoid that the U.S. run again “the real risk of having no policy at all.”⁷⁴

2.6 Conclusion

I present evidence that commercial banks did not take full advantage of the non-uniformity in discount rates across Federal Reserve districts in the first twenty years of the Federal Reserve System. In other words, the implicit restrictions on the internal movement of funds implemented through administrating the discount window helped provide a certain degree of regional monetary autonomy. The choice of regional monetary autonomy over complete financial integration was a priori reasonable given the characteristics of the then U.S. monetary union, which lacked interregional transfer programs and high labor mobility.

The absence of clear principles for guiding discount rate policy in general, and deviations of regional discount rates in particular, meant that the early practitioners of the Federal Reserve policy failed to use this regional autonomy in a stabilizing way. At the same time, the decentralized power structure created policy paralysis and ambiguity about interdistrict settlements, which naturally led to the diagnosis that the costs of decentralization outweighed the gains from regional differentiation. This motivated reforms that standardized and centralized control of Reserve bank discount policies.

If asymmetric regional shocks in part motivated the initial decision to create a decentralized Federal Reserve System in which each Reserve bank controlled its own discount policy, then how were these asymmetric shocks dealt with after 1935? Definitively answering this question is beyond the scope of the present paper (it is a topic for the author’s future research). One hypothesis is that the expansion of government and development of a federal fiscal system in response to the Great Depression and, especially, World War II resulted in interregional fiscal transfers that provided partial insurance against these shocks. Another hypothesis is that labor recruitment during the war broke down preexisting barriers to interregional labor mobility especially between southern and northern U.S. regions (as emphasized by [161] in his book “Old South, New South”). Still another is that asymmetric shocks declined in importance with the spread of manufacturing from the Midwest and Northeast to parts of the South and Far West [55, p. IV].

Despite policy mistakes, the U.S. precedent with non-uniform discount rates presents interesting lessons for monetary unions. It suggests, first, that monetary unions have a degree of freedom in the combination of regional monetary differentiation and financial integration that they choose. It also indicates that irrespective of the degree of regional differentiation chosen, a monetary union requires the centralization of monetary power to remove ambiguity over interregional settlements. Last, the recent eurozone experience has been illustrating the risk created by uniform nominal rates when regional developments create divergent real rates [72].

⁷⁴The pitfalls of a decentralized structure were stressed in August 1931 by New York Governor Harrison: “Direction of system policies by a conference of twelve men who must also consult the Federal Reserve Board means [...] that [...] we run the real risk of having no policy at all” [58, p. 380].

In the absence of clear progress towards a full-fledged fiscal and banking union, restrictions in the free movement of funds may have to be considered to help address these asymmetric developments.

Chapter 3

Supply-Side Policies in the Depression: Evidence from France

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3.1 Introduction

The output effects of supply-side policies in depressed economies are controversial.¹ Much of the debate has focused on the U.S. New Deal’s supply-side elements, in particular the National Industrial Recovery Act (NIRA).² Standard new Keynesian models used for policy analysis imply that the NIRA ought to have been expansionary given economic conditions during the Great Depression [44], but many economists have suggested otherwise [59, 19, 37]. More recently, this debate has resurfaced in the context of whether structural reforms would be helpful or harmful for the Eurozone periphery [e.g., 25, 45, 51, 85].

¹We are grateful for insightful comments from Eugene White and Carolyn Moehling, our discussants at the September 2014 Economic History Association meetings. Hoyt Bleakley, Michael Bordo, Alain Chatriot, Javier Cravino, Brad DeLong, Barry Eichengreen, Chris House, Andy Jalil, Miles Kimball, Eric Monnet, Christina Romer, Elyce Rotella, Matthew Shapiro and seminar participants at the LSE Interwar Economic History Workshop, the University of California, Berkeley, the University of Michigan, the University of Toronto, and Rutgers University also gave us excellent advice and encouragement. We are indebted to David Le Bris for providing us with French stock price data. Walid Badawi, Marwan Bekri, Chris Boehm, and Matthew Haarer provided superb research assistance.

²For a general overview of the New Deal, including its supply-side elements, see [52]. 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 [137], [115], and [43]; on fiscal policy, see [54] and [64]. For a view of U.S. recovery that does not emphasize aggregate demand policies, see [37].

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 [41, 154].

We present cross-sectional and time-series evidence that French wage and hour restrictions, in particular the 40-hour work week, contributed to the lack of French recovery from the Great Depression. 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 3.3, 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 [120], [123] and [131], 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

equilibrium 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 [99] 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 [129] 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 [99], 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 3.5 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 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 [74] 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 [48], that the benefits of devaluation in France were nullified by the Popular Front's supply-side policies.³ 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

³This is also the view of [91], [119], and [147], among others.

is a large literature on the supply-side elements of the U.S. New Deal, in particular the NIRA. [44] 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, [19] and [37] 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 [136] and [102]. 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, 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., [49], [115], [43]).

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 [51] and [25], who suggest that structural reforms raise output and that restricting aggregate supply is counter-productive. As in [45] (their figure 8), in our medium-scale new Keynesian model, efficiency-increasing structural reforms substantially *reduce* output when nominal interest rates are fixed.⁴ 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”) [65]. 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 [154] 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 [154]

⁴Indeed, our parameterization implies an even larger negative effect of structural reforms than that in [45], 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 [46] and [150].

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.⁵

3.2 The Great Depression and the Popular Front

The Great Depression in France lasted 7 years.⁶ Figure 3.1a 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 3.1b 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% [93].

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 [69]. Thus, from December 1930 to December 1935, the French money supply (M2) declined 14% [106, table A.2].

As in many countries, the severity and duration of the Depression in France led to political instability and extremism [23]. Between 1929 and 1934, France had twelve prime ministers. Quasi-paramilitary fascist 'leagues' became popular.⁷ 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.⁸ In June 1936, there were over 12,000 strikes and 1.8 million strikers (out of a total French population of 41 million). The cause of these strikes continues to be debated. [108] and [70] 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 [140, p. 6].

⁵While some have argued (e.g. [133]) 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.

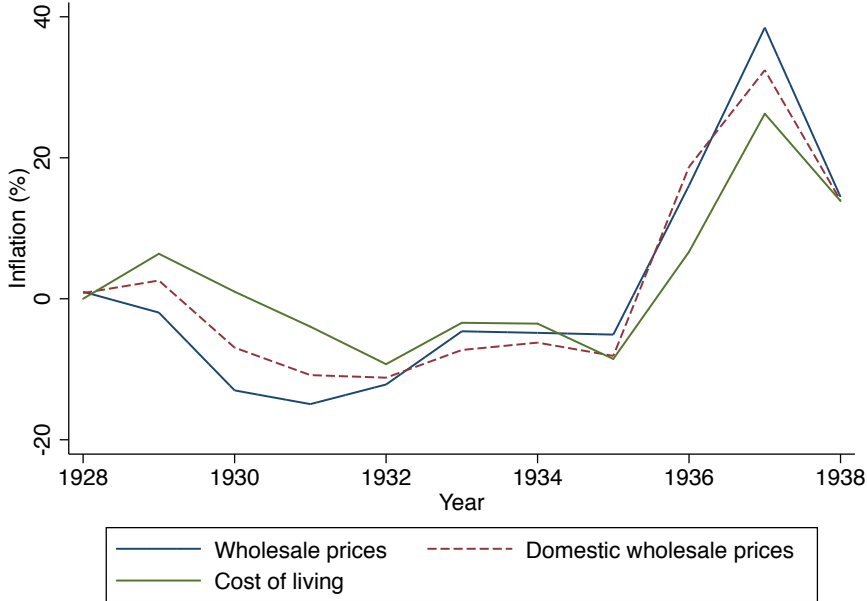
⁶For further discussion of the Great Depression in France, see [48], [96], and [14].

⁷Unless otherwise noted, the facts that follow are drawn from [70].

⁸For 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 3.1: Annual output and inflation. Sources: GDP and IP: Villa data series PIBVOL and IPIND. Wholesale prices: [93] table I1; domestic wholesale prices: [119], v. 3, table 2, p. 348; cost-of-living index: [93] table I2.

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% [119]. 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 [15, 8]. 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 [15, 96, 70, 89]. 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 [15, 89]. 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 3.2a 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.⁹ As desired, the Popular Front's policies then led both nominal and real wages to rise. Unlike Roosevelt's NIRA, the Popular Front's high wage policies were not accompanied by parallel efforts to raise prices.¹⁰ 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%.¹¹ [74] ascribes this real wage increase to the stickiness of housing rents and food prices.

Devaluation

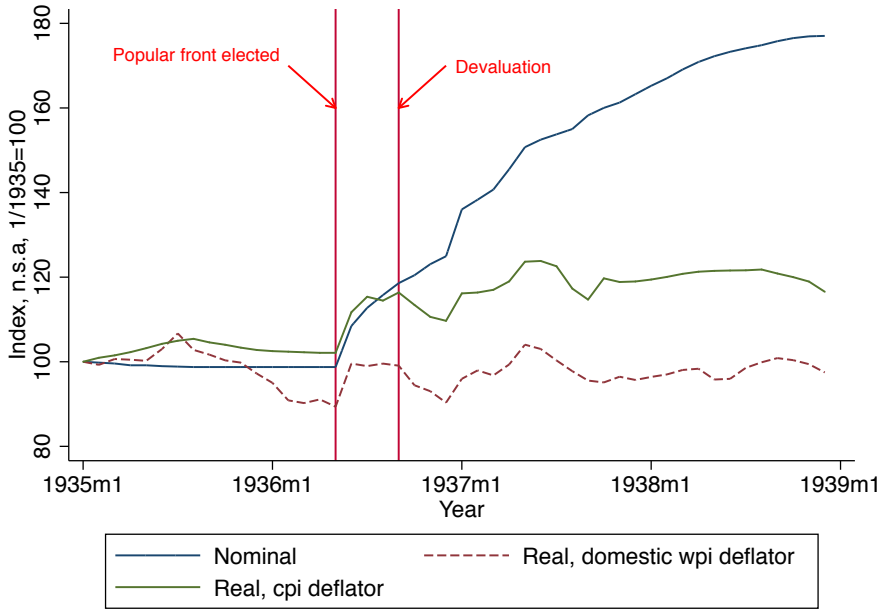
Devaluation was an unpopular prospect, and the Popular Front hoped to ignite recovery without it.¹² However, the Blum government soon faced a choice between its expansionary objectives and its commitment to an overvalued Franc. Under pressure from the government,

⁹The extreme flatness in 1935 and the first half of 1936 is due to interpolation [122].

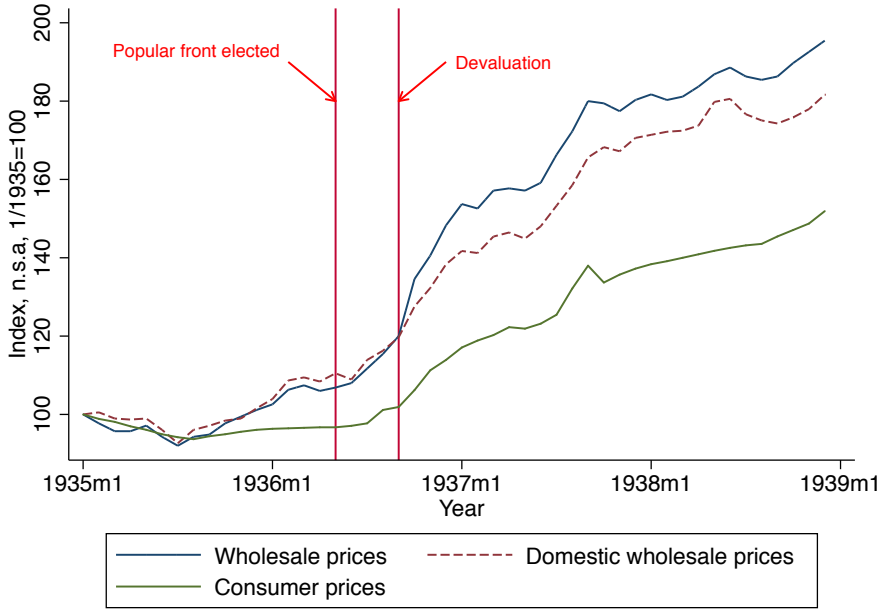
¹⁰An exception was the price of wheat, which was fixed at a high level by the newly created Office National Interprofessionnel du Blé [15].

¹¹In 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).

¹²Despite 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



(a) Nominal and real hourly wages 1935-38



(b) Wholesale and consumer prices 1935-38

Figure 3.2: 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: [119], v. 3, pp. 350, 351, 356, 377.

between June 23 and July 9, 1936 the Bank of France lowered its discount rate from 6% to 3% [96]. 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 ([17], 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 [48, 70, 89].

With the external constraint removed, a rapid monetary expansion began (figure 3.3a). 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 4.0% to 6.3%.¹³ Much of this increase was financed by advances from the Bank of France [97].

Initially, devaluation and the ensuing money supply growth led to a significant recovery. Figure 3.3b 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 1937.¹⁴ And four-quarter growth in new car sales increased from 18 percent in the second quarter of 1936 to 45 percent in the fourth ([131], p. 160).

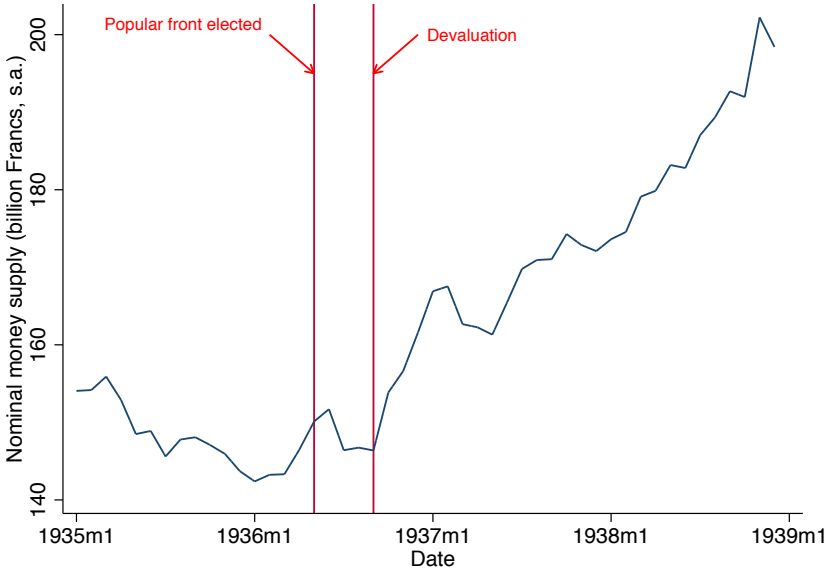
Implementation of the 40-hour law

The expansion that followed devaluation was short-lived. After June 1937, industrial production fell back to its pre-devaluation level (figure 3.3b). 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 3.1b). This increase in inflation was not accompanied by a significant change in nominal interest rates. Figure 3.4 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.

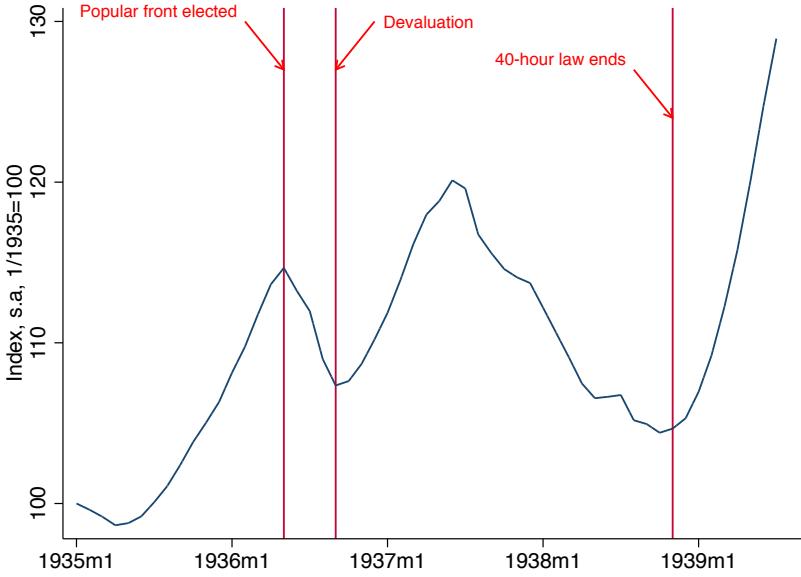
was French popular opinion [70, 89].

¹³Revenue and expenditure data are from [119], v. 3, p. 380. Nominal GDP data are from Villa data, series PIBVAL.

¹⁴Unemployment data are from [131], 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 [116].



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



(b) Industrial production 1935-1939

Figure 3.3: 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): [106], table A-2; panel (b): Villa data, series LIPIND38.

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.

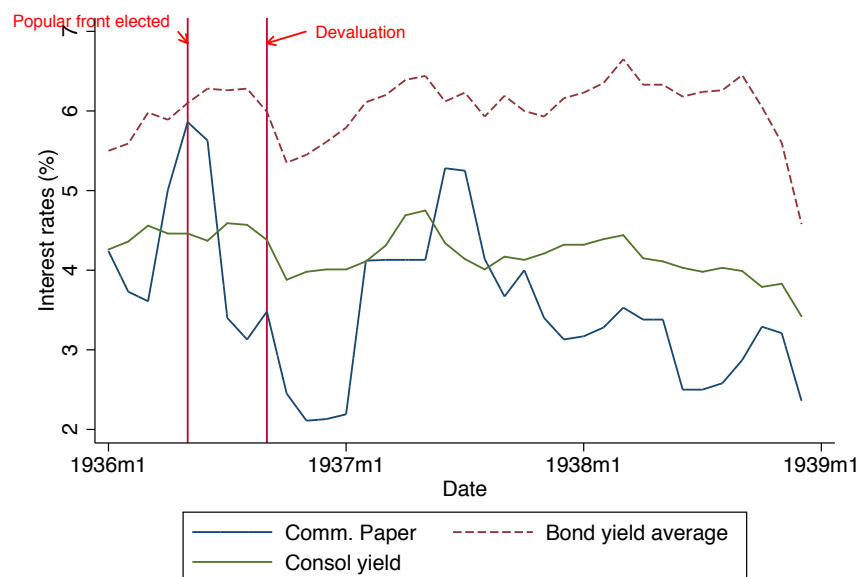


Figure 3.4: Nominal interest rates 1936-1938. *Notes:* The first vertical line indicates May 1936, when the Popular Front government was elected. The second vertical line indicates September 1936, when France left the Gold Standard. The bond yield average includes 3 government, 2 mortgage, 12 railway, and 19 industrial bonds. Sources: commercial paper rate and average bond yield: [81, 82, 83]; consol yield: Global Financial Data, series IGFRA10D.

Of course, what is relevant for economic activity is the *ex ante* real rate, which depends on expected inflation. We do not directly observe expected inflation, but reports of contemporary observers suggest that the direction and the order of magnitude of price changes were expected. Already in May 1936, the authors of *L'Observation Économique* worried about the degree of pass-through from higher costs to higher prices.¹⁵ 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

¹⁵Appendix B.1 provides references as well as full quotes in French and English and further narrative evidence.

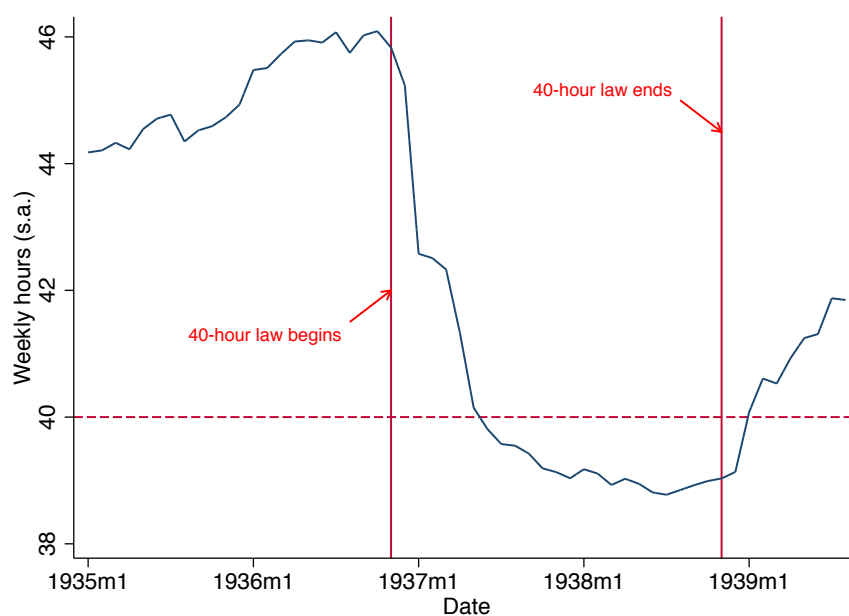


Figure 3.5: Weekly hours 1935-1939. *Notes:* The first vertical line indicates November 1936, when the 40-hour law began to bind. The second vertical line indicates November 1938, when the 40-hour law was relaxed. Source: [131], p. 158.

was anticipated. In July 1936, the author expected the increase in the wholesale price index to be between 15 and 20%. In September 1936, the author worried that wholesale price inflation could eventually reach 50%. This narrative evidence from leading French research institutes leads us to believe that expected inflation significantly rose, and thus that *ex ante* real interest rates significantly fell.¹⁶

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 3.5 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.¹⁷ Still, the series conveys a striking message. It suggests that the 40-hour law was binding. Average hours worked fell quickly when the 40-hour law began to take effect in November 1936 (the first vertical line). As we discuss

¹⁶This contrasts with France's experience during the French Revolution, when in the mid 1790s high inflation coexisted with incorrect expectations of imminent monetary stabilization [153]. 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 [153].

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

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.¹⁸ 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 1938.¹⁹

3.3 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.

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.

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*.²⁰ The National Archives inventory “*Les Lois sur la Durée du Travail Conservées aux Archives Nationales*” [6] organizes these

¹⁸This paragraph draws on [70].

¹⁹Unfortunately, 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.

²⁰[119], 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, [119], 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 [121]. Thus, Sauvy had a life-long interest in arguing that the 40-hour law had negative effects on the French economy.

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*.²¹ 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.

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.²² 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. [120] 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. [123] is an extension of [120] and provides monthly production data for 1928 to 1939. For industries for which monthly production data are unavailable for the 1928-1935 period, the monthly series is constructed using data on hours worked [123, 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.2.

[131] contains further description of the industrial production index and some data unavailable in [123].²³ We check that the series documented in both [123] and [131] match. With the exception of a few typos, they are in all cases identical. Combining the data from [123] and [131], 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 B.2 provides further details on the individual series.

²¹Except 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.

²²See <http://www.insee.fr/fr/ppp/sommaire/imet104d.pdf>, p. 52.

²³In particular, [131] extends several series through July 1939, and it provides data on rayon production that were not reported in [123].

Prices

Industry specific price data are somewhat sparser and of lower quality than production data. Nonetheless, from various editions of the monthly supplement to the *Bulletin de la Statistique Générale de la France*, it is possible to recover prices for 87 of the 126 products in the French wholesale price index (figure 3.2b). 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 [131]. Appendix table B.3 details the 12 price series we use and their source.

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

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 [28], 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 3.1 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 1936.²⁴

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

²⁴For some industries, a second announcement date is listed when the announcement occurred in different months in sub-sectors.

that the length of this negotiation process was correlated with industry performance. But the description of these negotiations provided in [29] suggests not.

First, [29] find that negotiations were easier in industries such as mining in which there was a long history of dialogue between representatives of employers and employees than in industries such as metallurgy in which this type of negotiation was new. The last column of table 3.1 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 3.1: 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 3.2, 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, [29] 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. [29] 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.”²⁵ 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.”²⁶ 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.”²⁷

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 [131], 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 ([131], p. 23-24; [68], vol. III, pp. 181-182). More problematic, and as mentioned above, the 40-hour law mechanically changed how firms reported hours worked.

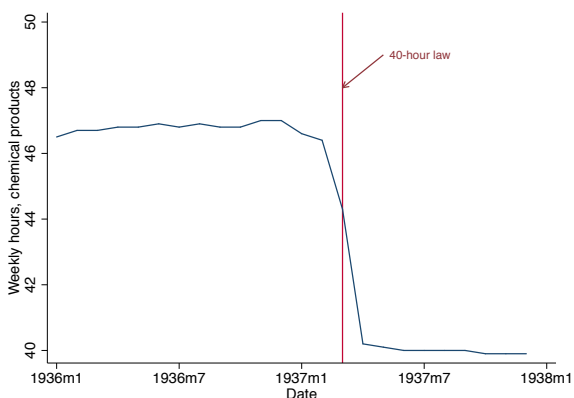
Despite these problems, we believe it is informative to see the correlation between hours worked and the application of the 40-hour law. Figure 3.6 shows the path of hours in these industries along with vertical lines indicating the application of the 40-hour law in the industry. In all cases, (reported) hours worked fell to just below 40 when or within a month of the law’s application.²⁸

²⁵*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.*”

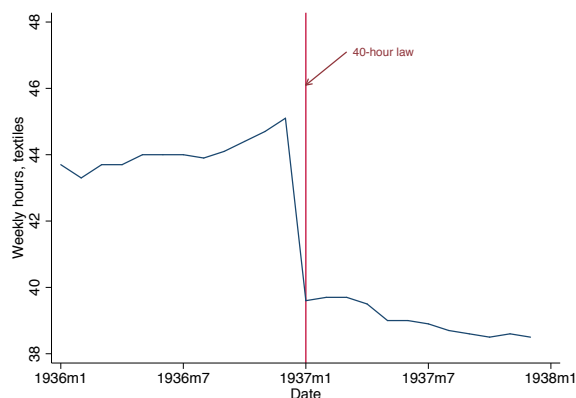
²⁶*La Revue Politique et Parlementaire*, October 1936, p. 343. The French is: “*Les producteurs font leur possible pour satisfaire leur clientèle, mais pour pousser leur production ils éprouvent des difficultés qui vont encore s’accroître avec l’application de la loi de quarante heures, par suite de la pénurie de main d’œuvre qualifiée.*”

²⁷Quoted by [124], p. 150. The French is: “*En face d’une demande réveillée, tout le problème se ramène actuellement à l’élasticité de l’offre.*”

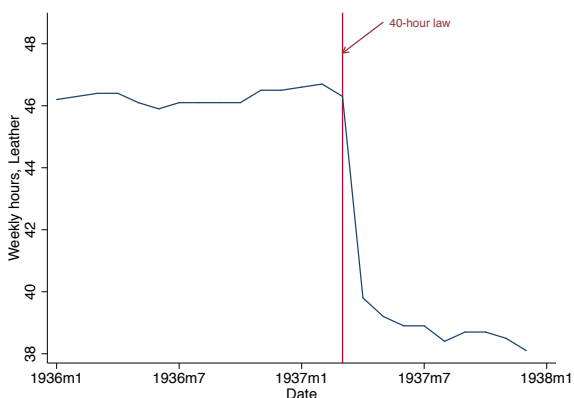
²⁸The abrupt application of the hours restrictions was not so much the product of ill-designed decrees as argued by [119], but rather the product of difficult labor relations. Consultation with worker organizations was required before making use of exemptions allowed by the application decrees, but these organizations often considered these requests misguided [89, p. 400].



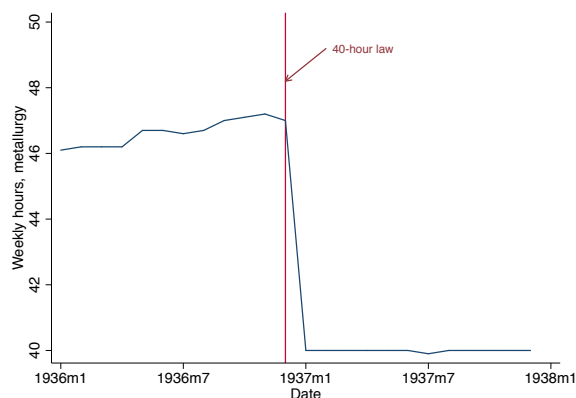
(a) Chemical products



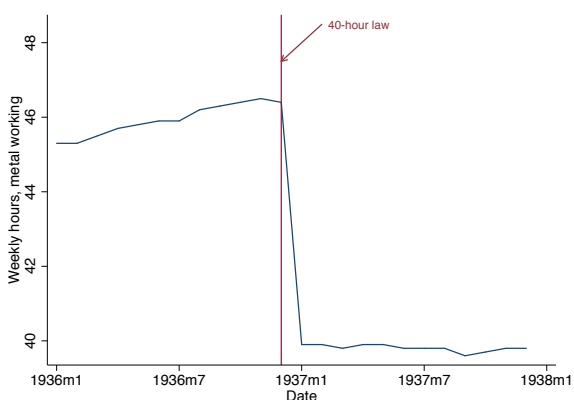
(b) Textiles



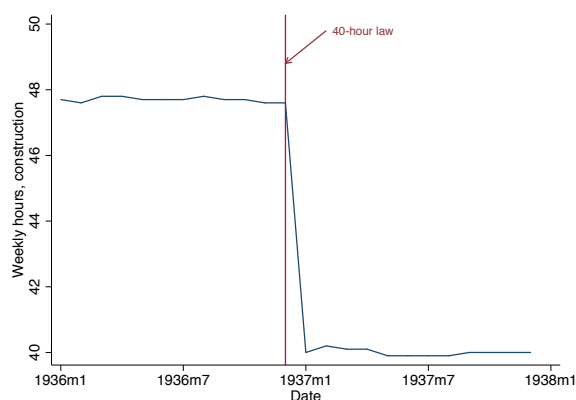
(c) Leather



(d) Metallurgy

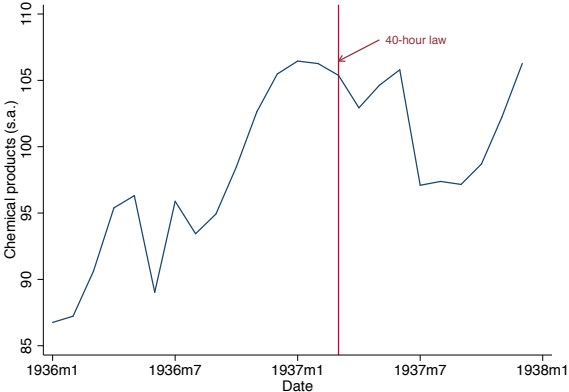


(e) Metal working

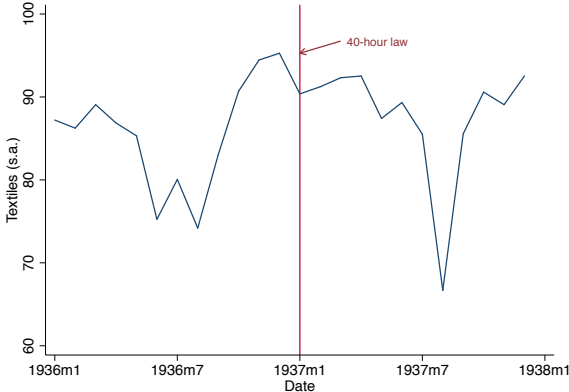


(f) Construction

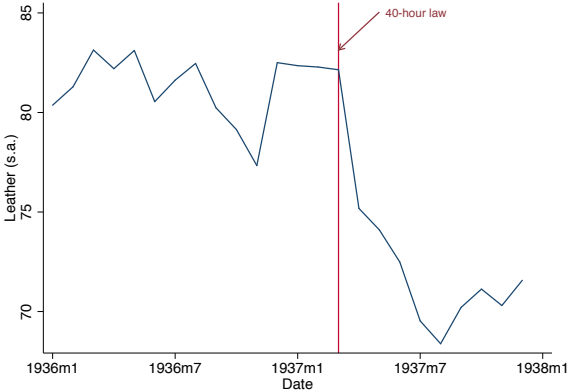
Figure 3.6: Weekly hours. *Notes:* These graphs show weekly hours worked as measured on the 1st of the month. The red vertical line indicates the month the 40-hour law took effect. If the law took effect after the 22nd day of the month, the vertical line indicates the following month. Sources: See text.



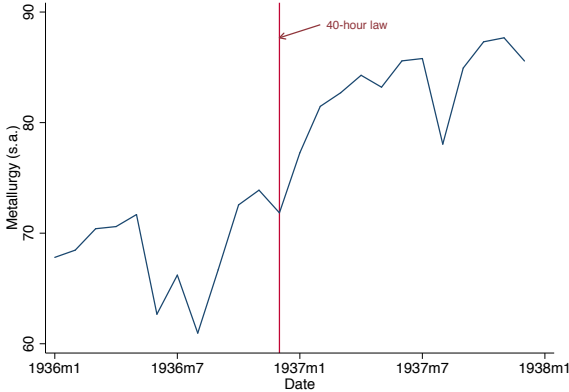
(a) Chemical products



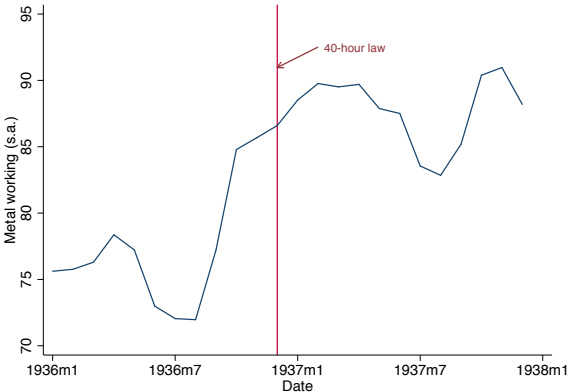
(b) Textiles



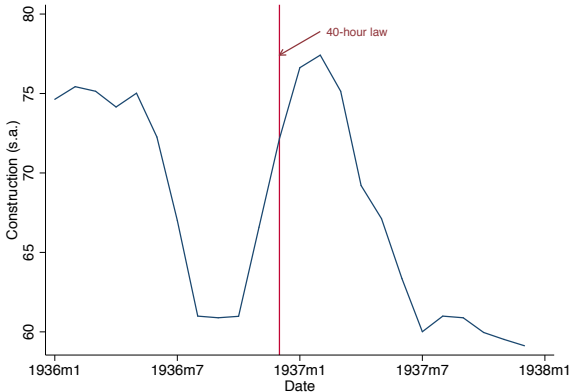
(c) Leather



(d) Metallurgy



(e) Metal working



(f) Construction

Figure 3.7: 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.

Industrial production: graphical evidence

To understand the effect of the 40-hour law on production, we start with graphical evidence. Figure 3.7 shows the path of seasonally adjusted industrial production in 6 industries.²⁹ 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.

Industrial production: regression evidence.

A natural way to aggregate the data from all 22 industries while controlling for idiosyncratic factors affecting production is to estimate

$$\Delta \log IP_{i,t} = \beta_1 \Delta 40\text{-hr}_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t}, \quad (3.1)$$

where $IP_{i,t}$ is seasonally adjusted industrial production in industry i in month t , $40\text{-hr}_{i,t}$ is a dummy variable equal to 1 when the 40-hour week restriction took effect in industry i ,³⁰ and $X_{i,t}$ are control variables. $40\text{-hr}_{i,t}$ switches from 0 to 1 at different times in different industries because of the timing variation discussed above. It switches back to 0 in November 1938 in all industries, since at that time the 40-hour restriction was relaxed. 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.

²⁹Due to space constraints, we do not show all 22 industries in our sample. Instead, we show the major industry groups (except mining).

³⁰If the 40-hour restriction took effect after the 22nd day of the month, we code it as occurring the following month.

Table 3.2: 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	Yes	Baseline	Cumulative	Yes	Baseline	Cumulative	Yes	Baseline	Cumulative	Yes
Δ 40-hour restriction	-0.057** (0.021)	-0.055** (0.019)	Yes	-0.057** (0.018)	-0.056** (0.017)	Yes	-0.049** (0.011)	-0.052** (0.011)	Yes	-0.050** (0.010)	-0.053** (0.010)	Yes
Δ Devaluation			Yes			Yes	0.084** (0.012)	0.085** (0.012)	Yes	0.101** (0.017)	0.101** (0.017)	Yes
Time-FE			Yes			Yes			No			No
Industry-FE			Yes			Yes			Yes			Yes
12-mth cumulative effect	-	-0.073	Yes	-	-0.049	Yes	-	-0.185	Yes	-	-0.148	Yes
Decree lags	0	12	Yes	0	12	Yes	0	12	Yes	0	12	Yes
Dep. var. lags	0	0	Yes	12	12	Yes	0	0	Yes	12	12	Yes
N	2827	2827	2563	2563	2563	2827	2827	2827	2827	2563	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	Yes	Baseline	Cumulative	Yes	Baseline	Cumulative	Yes	Baseline	Cumulative	Yes
Δ 40-hour restriction	-0.039+ (0.023)	-0.039+ (0.023)	Yes	-0.035+ (0.021)	-0.036+ (0.020)	Yes	-0.048** (0.013)	-0.051** (0.013)	Yes	-0.047** (0.012)	-0.052** (0.012)	Yes
Δ devaluation			Yes			Yes	0.068** (0.014)	0.068** (0.014)	Yes	0.082** (0.024)	0.082** (0.024)	Yes
Time-FE			Yes			Yes			No			No
Industry-FE			Yes			Yes			Yes			Yes
12-mth cumulative effect	-	-0.059	Yes	-	-0.03	Yes	-	-0.2	Yes	-	-0.167	Yes
Decree lags	0	12	Yes	0	12	Yes	0	12	Yes	0	12	Yes
Dep. var. lags	0	0	Yes	12	12	Yes	0	0	Yes	12	12	Yes
N	1781	1781	1625	1625	1625	1781	1781	1781	1625	1625	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 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.

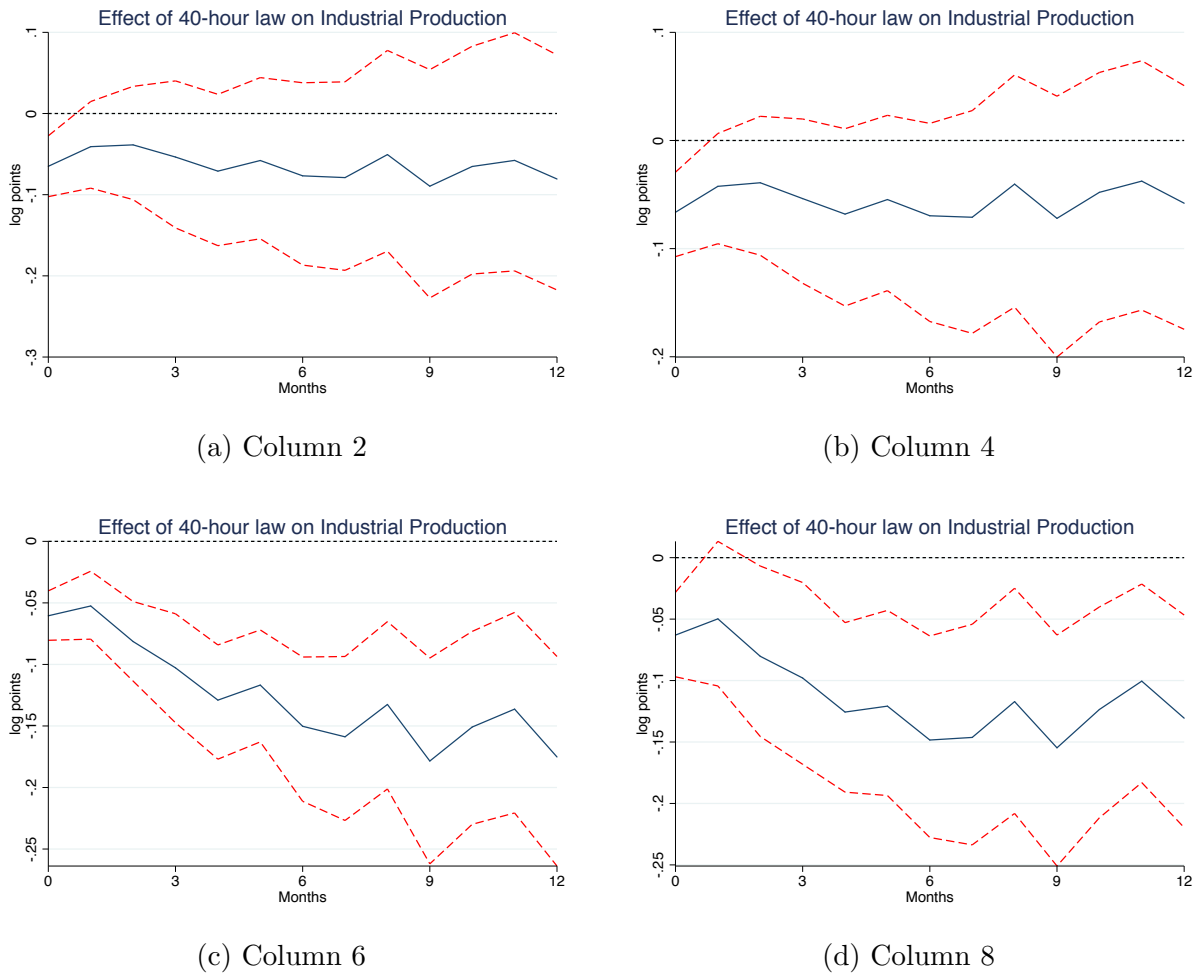


Figure 3.8: Impulse response functions of log industrial production to the 40-hour law taking effect. Columns refer to the regression specification plotted from Panel A of table 3.2. Point-wise 95% confidence intervals are constructed using the parametric bootstrap with variance-covariance matrix from the corresponding regression specification. Sources: See text.

Results are shown in table 3.2. 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 3.8 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 3.8a and 3.8b), the impulse response function is flat, implying a level drop in output from the 40-hour law. Without time fixed effects (figures 3.8c and 3.8d), there appears to be a further decline in industrial production after the 40-hour law takes effect.

In the specifications in table 3.2 without time fixed effects, we are able to explore the effects of a dummy for devaluation equal to 1 in October 1936 and after.³¹ 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 3.9 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 3.2, 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 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 [5] and [40]. 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 3.2. Standard errors are only slightly larger. Thus, despite some decline in the size of the coefficient on the 40-hour

³¹In 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.

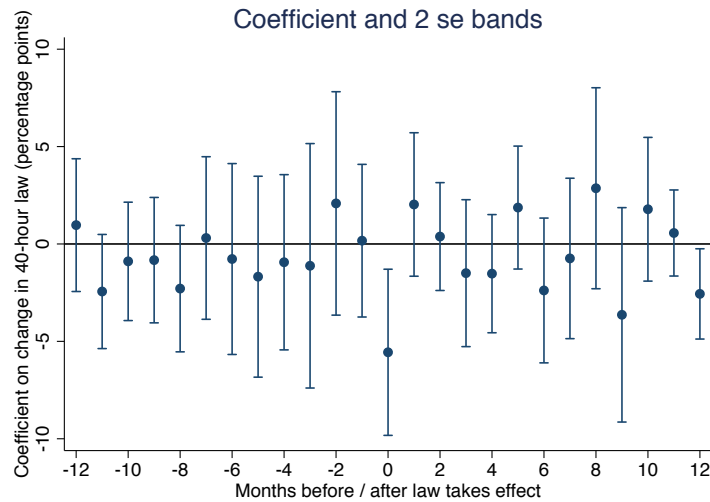


Figure 3.9: Coefficients and standard errors on leads and lags of the change in the 40-hour law. The dependent variable is the change in the log of seasonally adjusted industrial production. The specification controls for date and time fixed effects. See text for sources and further description.

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 [119], 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.2 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.

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 3.1), but with the log difference of prices rather than production on the left hand side. Table 3.3 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.

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.

3.4 The French experience and the new Keynesian model

Our approach is similar to that used in [99] 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 3.3: 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** (0.019)	0.062** (0.018)	0.056** (0.019)	0.057** (0.020)	0.019 (0.013)	0.017 (0.012)	0.019 (0.012)	0.018 (0.012)
Δ Devaluation					0.086** (0.032)	0.087** (0.032)	0.081* (0.033)	0.082* (0.033)
Time-FE	Yes	Yes	Yes	Yes	No	No	No	No
Industry-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12-mth cumulative effect	-	.173	-	.181	-	-.044	-	-.027
Decree lags	0	12	0	12	0	12	0	12
Dep. var. lags	0	0	12	12	0	0	12	12
N	1234	1234	1078	1078	1234	1234	1078	1078

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

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 [160]; the model is described in more detail in appendix B.3. Because this model is now standard in macroeconomics, we directly study the log-linearized equations:

$$y_t = E_t y_{t+1} - \sigma^{-1} E_t (i_t - \pi_{t+1}). \quad (3.2)$$

$$\pi_t = \beta E_t \pi_{t+1} + \kappa [(\sigma + \eta) y_t - (1 + \eta) a_t - \psi_t]. \quad (3.3)$$

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,³²

$$y_t = -\sigma^{-1} E_t \sum_{s=0}^{\infty} (i_{t+s} - \pi_{t+1+s}). \quad (3.4)$$

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.³³ 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,

$$\pi_t = \kappa E_t \sum_{s=0}^{\infty} \beta^s \underbrace{[(\sigma + \eta) y_{t+s} - (1 + \eta) a_{t+s} - \psi_{t+s}]}_{\text{real marginal costs}}, \quad (3.5)$$

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

³²In solving forward, we assume that output reverts to trend, $\lim_{T \rightarrow \infty} y_T = 0$, which will occur if shocks are temporary.

³³This result depends 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.)

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:

$$\begin{aligned} \Psi_t &= 1 & t < 5; \\ \Psi_t &= \frac{5}{6} & 5 \leq t \leq 28; \\ \Psi_t &= 1 & t \geq 29. \end{aligned} \tag{3.6}$$

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 (3.6) in the standard new Keynesian model with fixed nominal interest rates. Then output is unambiguously higher while the hours restriction is in place,*

$$\begin{aligned} \Delta y_t &> 0, & t < 29; \\ \Delta y_t &= 0, & t \geq 29. \end{aligned}$$

Proof. See appendix B.4. □

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 [129] that is better suited to providing such an answer.

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 B.5 lists the set of equilibrium conditions of the model.

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:

$$\begin{aligned} C_t^{-\sigma} &= \lambda_t; \\ \Xi \tau_i^\eta N_{it}^\eta &= \lambda_t \frac{W_{it}}{P_t}; \\ \lambda_t &= E_t \beta_{t+1} \lambda_{t+1} (1 + i_{t+1} - \pi_{t+1}). \end{aligned}$$

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

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

Consumption-goods firms:

Firms producing consumption goods are indexed by $j \in [0, 1]$ within each industry $i = 1, \dots, I$. 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,

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

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

$$\begin{aligned} \min_{H_{ijt} \leq \bar{H}_{it}, N_{ijt}, K_{ijt}} \quad & \frac{W_{it}}{P_t} N_{ijt} + R_t^k K_{ijt} \\ \text{s.t.} \quad & A_t (N_{ijt} H_{ijt})^{1-\alpha} K_{ijt}^\alpha = Y_{ijt}. \end{aligned}$$

\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

$$\begin{aligned} H_{ijt} &= \bar{H}_{it}; \\ \frac{N_{ijt}}{K_{ijt}} &= \frac{(1-\alpha)}{\alpha} \left(\frac{W_{it}/P_t}{R_t^k} \right)^{-1}; \\ \mu_{it} &= \alpha^{-\alpha} (1-\alpha)^{-(1-\alpha)} (R_t^k)^\alpha \left(\frac{W_{it}}{P_t} \right)^{1-\alpha} \left(\frac{1}{\bar{H}_{it}} \right)^{1-\alpha} A_t^{-1}. \end{aligned}$$

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,

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

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

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

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

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

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

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

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,

$$\begin{aligned} P_t^k &= Q_{t,t+1}[R_{t+1}^k + (1 - \delta)P_{t+1}^k]; \\ 1 &= P_t^k[1 - S(I_t/I_{t-1}) - I_t/I_{t-1}S'(I_t/I_{t-1})] + Q_{t,t+1}P_{t+1}^k(I_{t+1}/I_t)^2S'(I_{t+1}/I_t); \\ K_{t+1} &= (1 - \delta)K_t + I_t[1 - S(I_t/I_{t-1})]. \end{aligned}$$

Finally, we follow the investment adjustment cost specification in [31],

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

Market Clearing:

We require that all goods markets clear in equilibrium,

$$\begin{aligned} C_t + I_t &= Y_t; \\ Y_t &= \left[\sum_{i=1}^I \tau_{it}^{\frac{1}{\theta}} Y_{it}^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}. \end{aligned}$$

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 ,

$$\begin{aligned} i_t &= \beta^{-1} - 1 & t < T; \\ i_t &= \beta^{-1} \Pi_t^{\phi_\pi} & t > T, \end{aligned}$$

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.³⁴

³⁴An additional advantage is that our simulation results are comparable with other work emphasizing completely unresponsive monetary policy [e.g., 45].

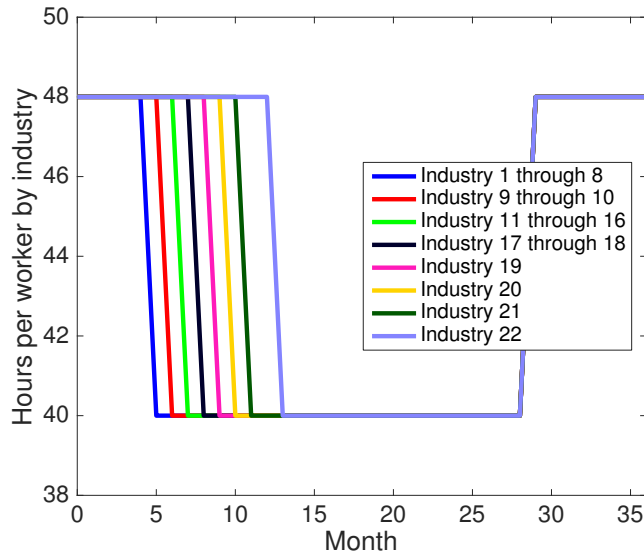


Figure 3.10: Hours per worker in each industry in the model experiment. At $t = 0$ (June 1936) the implementation of the 40-hour law is announced. At $t = 5$ (November 1936), the first industry is subject to the 40-hour law. Thereafter, the model experiment is conducted such that the timing of the law's 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.

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 3.1),

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

These hours restrictions are plotted in figure 3.10. 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 [31]. This is important because linear approximation can yield misleading results [21].

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 [31]. The discount factor is calibrated to $\beta = 0.97^{\frac{1}{12}}$ to match the average 3% real consol yield from 1926 to 1935.³⁵

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, [129] set $\sigma^{-1} = 0.7$ and $\eta^{-1} = 0.5$; [4] set $\sigma^{-1} = 1$ and $\eta^{-1} = 1$; [31] set $\sigma^{-1} = 1$ and $\eta^{-1} = \infty$; and [45] 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 [11].

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.³⁶ 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 [101].

We let all industries be the same size $\tau_i = \frac{1}{I}$ and set the elasticity of substitution across industry goods to $\theta = 10$. This is the largest elasticity of substitution typically employed in the literature [see 36]. 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.

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 (3.1) 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 3.2.

Table 3.4 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.

³⁵This is the average annual nominal consol yield (Global Financial Data series IGFRA10D) deflated by annual cost-of-living inflation from [93], table I2.

³⁶The 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.

Table 3.4: 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 (3.1) 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 [99], 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.

General equilibrium results:

Figure 3.11 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.

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 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.

At $t = 12$ 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

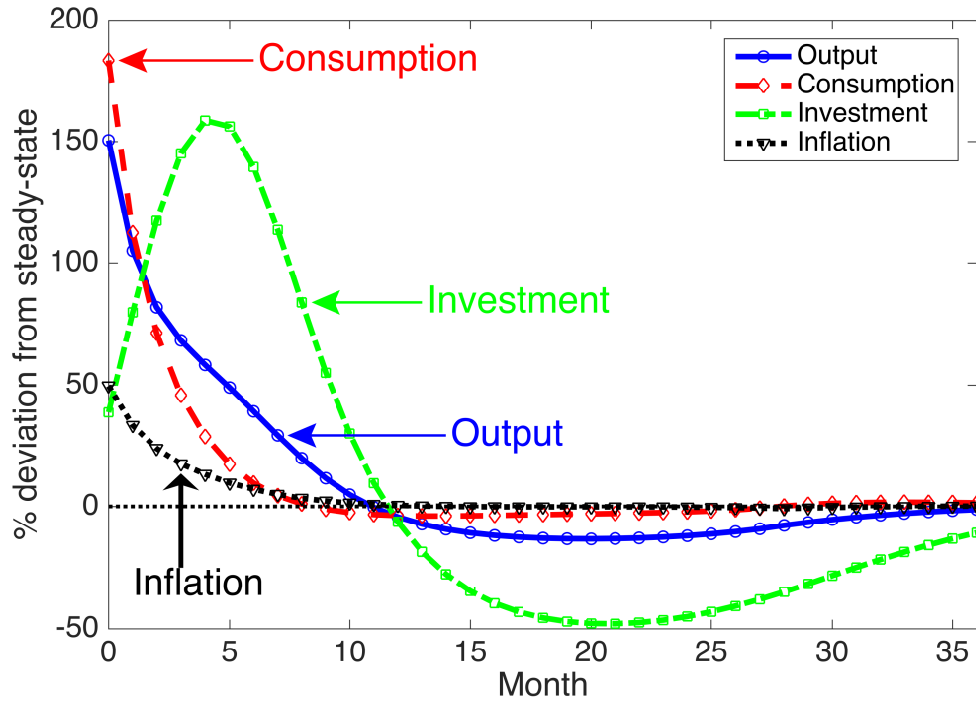


Figure 3.11: Impulse response function of output, prices, consumption and investment to the hours restrictions in figure 3.10 in the medium-scale, multi-sector new Keynesian model. Month 0 is when the 40-hour law is announced.

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 B.6, 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 B.6 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.

3.5 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 3.12 shows industrial production growth and the change in wholesale price inflation following departure from the gold standard for the countries for which [93, 95, 94] 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.³⁷ Importantly, with

³⁷Including France, the relationship among the 21 countries is statistically significant at the 10% level; excluding France, it is significant at the 5% level.

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.³⁸ This is evidence against the view that fears of war with Germany substantially reduced French output in 1936-38.

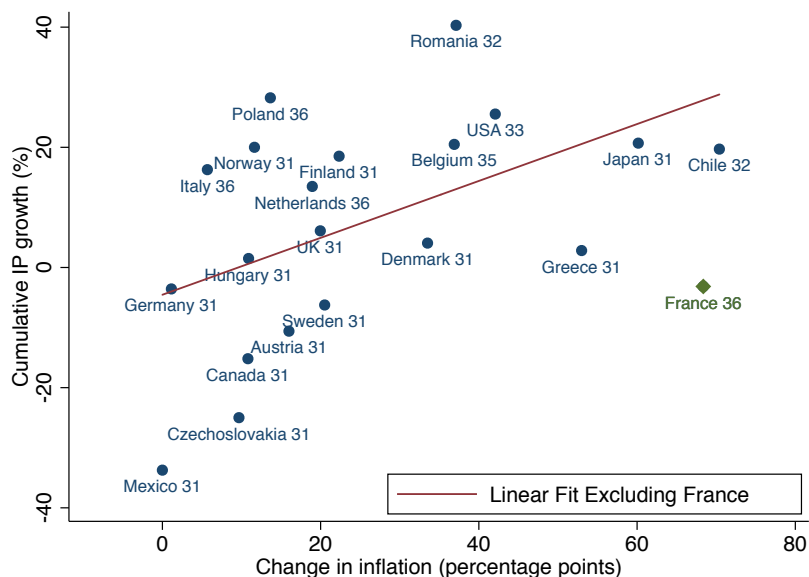


Figure 3.12: Industrial production growth and the change in wholesale price inflation two years after leaving the gold standard. *Notes:* The two digits after the country name are the year in which the country left the gold standard. Sources: Industrial output and wholesale prices for European countries: [93] tables E1 and I1; for the U.S: FRED series INDPRO and PPIACO; for Canada, Chile, and Mexico: [95] tables E1 and I1; for Japan: [94] tables D1 and H1. Gold standard departure dates: [48], table 7.1.

Another possible explanation for poor economic performance between 1936 and 1938 is the breakdown of factory discipline that followed the May-June 1936 strikes [108]. Even after the initial wave of strikes subsided, workers resisted the reintroduction of factory hierarchies and work regimentation [70, 125]. 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

³⁸The cross-country evidence is also inconsistent with the view that France simply devalued too late [7]. 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 3.12 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.

is a puzzle for any model that seeks to explain French economic performance with only supply-side factors.³⁹

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 B.4 provides a proof in the simple model (section 3.4). Thus, strikes cannot resolve the disconnect between the new Keynesian model and the data.

Other authors [e.g., 70] 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).⁴⁰ 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 [78]. 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.

3.6 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

³⁹A 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.

⁴⁰One can also look to the stock market for an indication of business sentiment. Deflated by consumer prices ([119], v. 3, p. 356.), the historical CAC40 index constructed by [80] 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 [80].

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 [51, 85]. But as pointed out by [45], 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. [59] [2], [48], [19], and [37]). If, as argued by [44], 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 [48]'s (p. 344) view that “[I]n contrast to the situation in France three years later, accompanying policies 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.

Chapter 4

Fiscal Policy in the Depression: Evidence from Digging Holes and Filling Them

4.1 Introduction

The difficulty of finding variations in government spending that are both exogenous in the sense that they do not respond to economic conditions and are not associated with other contemporary shocks has made answering the classic question of the size of the government spending multiplier notoriously hard.¹

A traditional empirical macroeconomics literature, which relies on time-series variation (e.g. [16]) has sometimes used a narrative approach to identify and exploit changes in military expenditures that were not driven by economic conditions ([61], [10], [109]). While this literature typically finds that higher government spending crowds out rather than crowds in other components of GDP, these military spending episodes mostly happened against the backdrop of contractionary tax and monetary policies that tend to offset the effects of increases in government military purchases [114].

A new empirical literature was developed to deal with such problems [30, 33, 53, 100, 126, 127], which relies on cross-sectional variation in government spending at the subnational level. Since regions, states, and districts share a common monetary and tax policy, this approach allows to difference out common macroeconomic factors by including time fixed effects.

¹I thank Barry Eichengreen, Yuriy Gorodnichenko and Christina Romer for exceptional advising and support. I also thank Josh K. Hausman, Pierre-Cyrille Hautcoeur, Philip T. Hoffman, J.E. Kauffmann, Annie Loeser, Atif Mian, Eric Monnet, Martha Olney, Thomas Piketty, Gilles Postel-Vinay, James L. Powell, David Romer, Jean-Laurent Rosenthal, Andrew K. Rose, Emmanuel Saez, Johannes F. Wieland, Yury Yatsynovich, Owen Zidar and seminar participants at the Berkeley Economic History Lunch and the Economic History Association meetings for their comments and suggestions. The All-UC Group in Economic History provided financial support. I also thank Jean Pisani-Ferry, Vincent Aussilloux and the Economics Department of France Stratégie for welcoming me in their offices in the summer of 2016.

In this paper, I also use a cross-sectional approach to estimate local government spending multipliers.² In contrast with recent papers, I identify an expenditure shock - the construction of the Maginot Line - that provides local variations in government expenditures that were not driven by current or expected local economic conditions using narrative evidence. I find that when relative government spending in a *département* increases by 1 percent of GDP, relative *département* GDP rises by 1 percent.

A local government spending multiplier of 1 is below what is typically found in this literature with estimates between 1.5 and 2. But the imperfection of French interwar fiscal data to proxy local economic activity and the additional assumptions introduced to reconstruct a precise geographical allocation of border fortification spending are shown to likely bias my estimates towards zero. I thus see my findings as evidence that the true local multiplier is at least equal to 1. This result suggests that, when it was tried, fiscal policy was effective at stimulating the French economy during the Depression.

The remainder of the paper is organized as follows. Section 2 provides background on the Maginot Line. I use new archival material to document the factors that influenced the size, coverage and timing of this military program. Section 3 presents a new fiscal data set used for documenting economic activity in French local districts (*départements*).³ Section 4 presents the empirical analysis and results. Section 5 concludes.

4.2 The Maginot Line

Background.

What came to be known as the Maginot Line was a largely subterranean fortification system composed of concrete fortifications, tank obstacles, artillery casemates, machine gun posts, and other defenses, that France constructed along its Eastern borders, in light of World War I experience and in the run-up to World War II. The French established the fortification to

²The terminology “local government spending multiplier” used in the literature is somewhat confusing. It could, in fact, be understood as the effect of a relative increase in local government spending together with the associated relative increase in local tax liabilities. But in most papers and mine in particular ([33] is an exception), the recipient regions do not experience a relative increase in local tax liabilities as the increase in spending is financed at the national level. [100] use a more explicit terminology and call that object the “open economy relative multiplier.” They contrast it with the conventional government multiplier that they call the “closed economy aggregate multiplier.” The authors provide a framework for relating the two estimates.

³[38] explain that “the division of France into *départements* was adopted in 1790 during the French Revolution. They were designed to replace the old *provinces*, which exhibited significant variations in tax systems, population and land areas. In contrast, the new administrative division aimed to create more homogeneous and regular spatial units under a common central legislation and administration. Their size was chosen so that individuals from any point in the *département* could make the round trip by horse to the capital city in no more than two days, which translated into a radius of 30 to 40 km. Initially, France included 83 *départements*, the number of which was gradually increased to 100 (94 continental) *départements*.”

provide time for their army to mobilize in the event of an attack.⁴

Although its name suggests a rather thin and continuous fortification, the line was in fact deep and discontinuous. It varied in depth from between 12 to 16 miles and had many holes as illustrated in Figure 4.1. The French army classified frontier segments into three categories of strength: fortified regions (RF, ‘*région fortifiée*’), fortified sectors (SF, ‘*secteur fortifié*’), and defense sectors (SD, ‘*secteur défensif*’). The Maginot Line only extended marginally through the Ardennes Forest (point 5 in Figure 4.1) - which was believed to be impenetrable by Commander in Chief Maurice Gamelin. As is well known, history proved Gamelin wrong as Germany precisely launched its attack against France through this section of the border in 1940.

Ten years separate the decision to fortify French borders and the actual start of construction. The national security debate in the 1920s focused on developing a strong defensive-based approach. At War Minister André Lefèvre’s request in early 1920, the War Council (‘*Conseil Supérieur de la Guerre*’) began exploring how to best secure the French Eastern border. The rapid improvement of France’s fiscal position in 1927 offered an opportunity to end the neglect of long term military programs. In 1928, War Minister Paul Painlevé had already obtained limited funds to initiate work on high priority sites. But the pivotal moment occurred when War Minister André Maginot addressed the French Chamber of Deputies on December 10, 1929 to vote for a 5 year credit plan. In 1934, another law was voted to extend funding.

Although the bulk of spending was allocated to digging holes and erecting fortification buildings, the development of an infrastructure - extending railroads, building new roads - was necessary to implement this spending [145, p. 13]. According to Vial [145, p. 126-127], the project was gigantic. The leveling work was of the same order than what would have been necessary for the creation of a large canal between Paris and Bordeaux. The underground galleries linking the different forts had the same length than the galleries of the Paris *Métro* lines in the early 1950s. While the total length of the roads and railways that were built was equivalent to the distance between Calais with Paris, the phone cables connecting the different sites could have been used to establish a direct phone line from Calais to Nice.

Identifying variation.

The construction of the fortification barrier followed several phases, which correspond to changes in the level of military threat coming from neighboring countries. Envisaged in the early 1920s as a response to the economic and demographic superiority of Germany, the construction of the Line actually started along the Italian border as concerns about Mussolini grew in the late 1920s. As the German threat increased over the 1930s, the emphasis shifted towards the possible invasion ‘*routes*’ from Germany. The Belgium border was initially neglected as a Franco-Belgian military agreement had been signed early in the decade, according to which the French army would operate on Belgium territory in

⁴This section draws on [132], [75] and [141].

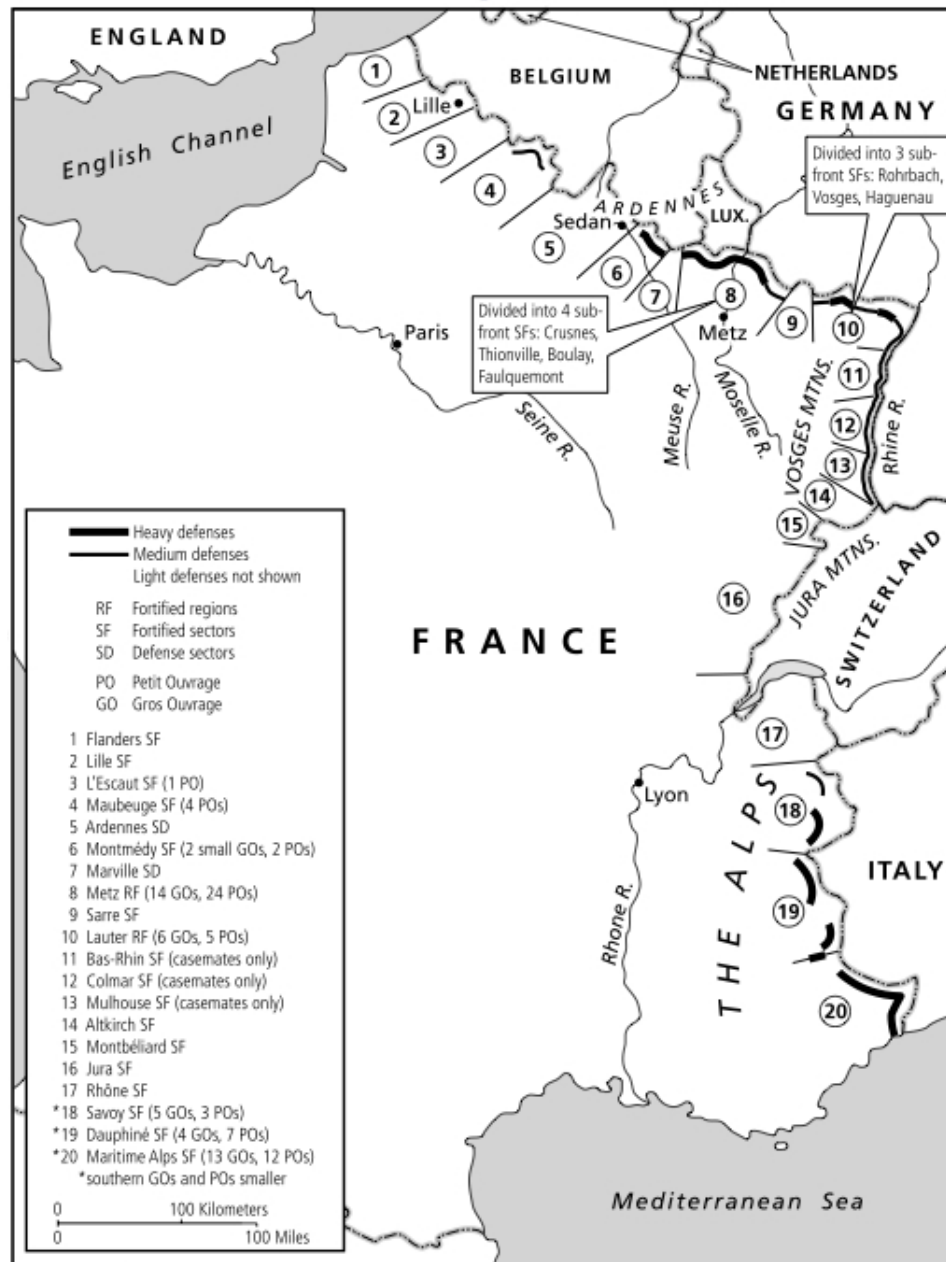


Figure 4.1: French Frontier Sectors with Key Fortified Areas, 1940. Source: [132].

case of a German attack. In 1936, however, Belgium abrogated the treaty and declared neutrality forcing the French authority to rethink its strategy and extend the construction of the Maginot Line along this part of the border. The Swiss border was also marginally affected as Germany and Italy could violate Switzerland's neutrality in order to attack France. The paragraphs below provide more details for the different segments of the French border and organize the evidence collected in Table 4.1.

Italian border: The mountainous terrain along most of the 219-mile border as well as Italy's limited military capacity made Italy a secondary concern in the planning phase of the Line in the early 1920s. But the Italian threat to annex parts of the French territory (Nice and Savoy) lead to the construction of several fortified works between Menton and Modane as early as 1928. Work continued but did not speed up in the early 1930s. It almost completely stopped in 1935 following a military agreement between the two countries. Against concessions, France had hoped for Italian support in case of a German aggression. It was only after Mussolini's Ethiopian adventure and the creation of the Axis in 1936, that the French leadership became convinced that there was again a real threat on France's South Eastern border and sped up construction. In 1937, the Berlin-Rome axis made the so far neglected Jura SF (area 16 in Figure 4.1) a natural route for invading France and received as a result an increase in expenditures to reinforce existing fortifications.

German border: Although the Maginot Line was envisaged in the early 1920s as a response to the expected economic and demographic superiority of Germany, it was not seen as an immediate threat until the early 1930s. [3] notes, in particular, that "Weimar Germany had taken significant steps in 1925-26 to establish more normal and friendly relations with its neighbors, through the signature of the Locarno Treaty and the conclusion of the Thoiry agreements," in which Germany agreed to make no attempt to alter by force its Western frontiers. Germany had also been admitted to the League of Nations in 1926. But by the late 1920s, the attempted accommodation between French Foreign Minister Aristide Briand and his German counterpart, Gustav Stresemann, began losing momentum. The early withdrawal of Rhineland agreed under the Young Plan (1929) for 1930 instead of 1935 also increased the level of threat felt by the French. After a plebiscite held on 13 January 1935, Saarland - which had been occupied and governed by Britain and France from 1920 to 1935 under a League of Nations mandate - was restored to Germany. Sterling [132, p. 206] notes that the French reacted by extending the Western end of the Lauter RF (area 10 in Figure 4.1). Vial [145, p. 72] also notes that, following the plebiscite, credits were redirected to the L'Escaut SF and Maubeuge SF (areas 3 and 4 in Figure 4.1).

Belgium border: According to the Franco-Belgian Military Accord of 1920, the French army would operate in Belgium in case of a German invasion. This accord was aligned with the view in Paris that diplomatic and topographical factors made erecting fortifications in the North almost impossible (Sterling [132, p. 232], Vial [145, p.10]). In the words of the *Commission de Défense des Frontières*: "La Région du Nord se défend en Belgique" [145, p. 65].⁵ But the military measures taken by Hitler, the Sanois problem and the death of

⁵The Northern region gets defended in Belgium.

Albert 1er decreased French confidence in this plan and lead to a first round of spending along this border in 1934. After Belgium's unilateral abrogation of the military agreement and declaration of neutrality in 1936, military expenditures increased.

Swiss border: The border with Switzerland was only lightly fortified. The main fortification areas - areas 14 and 15 in Figure 4.1 - correspond to the valley between the Vosges mountains and the Jura mountains, which was considered a potential invasion 'route' to France [35].

Spanish border: The end of the Civil War in Spain and the uncertain attitude of General Franco attracted the attention of French Army's top Generals. But the importance of other sectors, the weakness of Spain, and the natural characteristics of the *Pyrénées* mountains limited the efforts to fortify this part of the border. Only potential road and dam destructions were thus considered.

Table 4.1: Chronology of Events

Year	Bordering country	Events
1920		At War Minister request, the War Council begins exploring options to secure the Eastern border in light of WWI experience and the expected economic and demographic superiority of Germany by the end of the decade.
1925		The Government decides to build the “Wall (<i>muraille</i>) of France.”
1928		The CORF - Commission for Organizing the Fortified Regions - begins exploratory constructions.
1928		War Minister Paul Painlevé obtains funds to initiate work on high priority sites (Ministerial Notes dated 04/28/1928 and 05/03/1928).
1928	Italy	Mussolini threatens to annex parts of the French territory (Savoie and Nice), making these sites high priorities [145, p.28].
1929	Germany	As part of the Young Plan for the settlement of German reparation debts, France agrees on an early withdrawal from Rhineland in 1930 instead of 1935 [132, p.205 and p.214].
1929		War Minister André Maginot addresses the National Assembly on December 10, 1929 to vote a 5 year credit plan.
1934		War Minister Philippe Pétain makes the National Assembly vote a new Budget Law to complete the construction of the Line and to finance overdue payments.
1934	Italy	A Franco-Italian military agreement stipulating Italian support in case of a German aggression is signed. General Gamelin decides to stop construction along the Italian border [145, p.68-69]. A ministerial note dated June 12, 1935 explains that fortification construction in the Alps was, in fact, put to rest (“ <i>mis en sommeil</i> ”) following this change in Italian policy [145, p. 71].
1934	Belgium	The so far unconstructed Belgium border (a 1920 military agreement with France stipulated that the French army would operate on Belgium’s territory in case of a German invasion [145, p.65]) becomes an area of concern following the death of Albert 1er. New funds are allocated to this part of the border (Vial [145, p.68], and War Minister Letter, Annex 5, Box 8N35-4).
1935	Germany	After a plebiscite, Saarland - which had been occupied and governed by Britain and France from 1920 to 1935 under a League of Nations mandate - is restored to Germany (Army Secretary Letter, Annex 4, Box 8N35-4).
1936	Germany	On March 7, 1936 Hitler announces in the Reichstag that the Treaty of Locarno, which planned for the demilitarization of Rhineland, is obsolete. As part of its remilitarization effort, Germany institutes a 2 year mandatory military service (Box 8N106).
1936	Belgium	Belgium abrogates the Military Accord of 1920 with France and declares neutrality.

Continued on next page

Table 4.1 – continued from previous page

Year	Bordering country	Events
1936	Italy	The Ethiopian war and the creation of the Axis in 1936 make the military agreement with Italy obsolete. Construction, which had stopped following the agreement, is relaunched ([75, p.23], [145, p.77-78]).
1937	Switzerland	The Berlin-Rome axis (military alliance agreed on November 1, 1936) makes the so far neglected Swiss border a natural route for invading France. Funds get reallocated to this area.
1938	Switzerland - Belgium	The loss of the Tchecho-Slovak counter weight makes possible an invasion strategy that would simultaneously go through Belgium and Switzerland [145, p.79-80].
1939	Germany	The Department of War request for more credits for border fortification following the annexation of Austria into Nazi Germany is accepted [42].
1939	Spain	Vial [145, p. 85-86].

Total military expenditures and geographical distribution.

I use an unpublished 1955 memo from the War Department written by Colonel [145] to document military spending on border fortification and its geographical allocation. The author builds on a 1942 memo realized by the Direction of Accounting of the War Department,⁶ which documents the credits requested by the Army and voted by the National Assembly for a series of military programs. Using complementary information, Colonel [145] estimates actual yearly expenditures and describes with precision when and where the construction work on the Maginot Line took place over the years.

One difficulty in documenting the amounts spent on the Maginot Line comes from the variety of its funding sources. Realizing such a program required a modification of the principle of annual spending accounts, which was incompatible with construction works scheduled to last over several years. While fortification spending before 1930 was covered on an annual basis, the Law of January 14, 1930 split the financing of budgetary work over 5 years. This solution remained, nonetheless, insufficient as the commitment authorization to incur a total spending of 3.3 billion Francs was only covered by a 1 billion payment appropriation.⁷ It was therefore necessary to complement this payment appropriation through the creation of special accounts to provide parallel financing (Laws of July 20, 1931 and of January 4, 1934). In 1936, fortification expenditures became a chapter of the weapons program, whose accounts were managed through the Weapons Fund (*'Fonds d'Armement'*) and then through the Capital Investment Accounts (*Comptes des Investissements en Capital*) for the years 1937 to 1939.

The year by year expenditure amounts are reproduced in Table 4.2. Because of forecasts errors, unexpected inflation, and the front loading of construction, Vial [145, p. 32] explains that the total amount of actual expenditures executed often differed from the credit authorizations that had been allocated to the project.

Overall, the military expenditures on fortification barriers accounted for respectively 1/40 of the military budget and 1/200 of the national budget over the period from 1926 to 1929, 7% and 1.5% for the 1930-1935 period, and 3.3% and 1% for the 1936-1939 period. This was therefore a relatively small shock at the national level. In contrast with the enormous military buildups and drawdowns used in [10] where defense purchases account for up to 20 percent of GDP in certain years, the yearly impulse of the Maginot Line shock is never higher than 0.35 percent of GDP. But the shock is concentrated enough geographically (with only 17 out of 90 *départements* affected) to provide meaningful variations in government spending at the local level.

⁶War Department Archives, Box 8N35-4, Général Briat, 81 pages.

⁷Payment appropriations represent "the upper limit of expenditure that can be scheduled or paid during the year to cover the commitments undertaken in the framework of commitment authorizations." They support settlement of the expenses incurred in advance.

Table 4.2: Military expenditures on the Maginot Line. Millions of Francs.

Year	Amount	Observations
1926	5	Reported on the 1927 budget [145, p.28].
1927	15.2	34 of the 49.2 allocated to 1927 were not spent and were thus reported to 1928 [145, p.28].
1928	256.2	34 carried forward from 1927. 41 from Finance Law. 15 in application of the 12/19/1926 Law. A report quoted in [145] provides that funds engaged as of 11/13/1929 were equal to 517.63. Given that 20.2 were spent over 1926-27, 497.43 were spent over 1928-1929. Subtracting the amounts known for 1928 and 1929, 332.4 remains to be allocated. I divide that sum equally between these two years.
1929	241.2	60.74 from Finance Law. 14.9 from Law of 12/27/1929. 166.2 imputed as explained above.
1930	450	Vial [145, p.59].
1931	900	Vial [145, p.59].
1932	1200	Vial [145, p.59].
1933	400	Vial [145, p.65] writes that the amount was the same than in 1932 but that construction work was almost finished. Most of the funding went to Artillery. Because this type of spending was typically not spent locally I remove this amount from the total. A progress report dated 10/01/1932 also points out that the bulk of actual construction work was already done by that time.
1934	670	Vial [145, p.68].
1935	550	Vial [145, p.71]. The author simply writes "more than half a billion."
1936	582.2	Appropriations carried forward to and opened in 1936. Amount not including Artillery.
1937	539.4	Idem.
1938	577.7	Idem.
1939	720.5	Idem.

Sources: [145]

To perform my empirical exercise that relates changes in military expenditures to changes in economic activity at the *département* level in the next section, I need to have an amount of spending per year per *département*. With the exception of a few years, this information is not directly available in the form of a table from the Archives. I, therefore, have to break down expenditure amounts to the different *départements* using the information provided by [145] and additional assumptions. The author provides a detailed description of when and where construction (from p.55 to p.89) took place over the period, organizing his description of the different phases of construction by fortified regions. The timing and the location of expenditures can thus precisely be identified from that description. But the exact allocation across fortified sectors is somewhat imprecise. For the year 1934, for example, Vial [145, p.68-69] only explains that the bulk of the 670 million Francs were spent on the Sectors of Rohrbach (in Moselle *département*), Montmedy and Maubeuge (in Meuse *département*), Ardennes (in Ardennes *département*), and Conde (in Nord *département*). Additional assumptions are thus needed in cases like that to provide a specific breakdown across *départements*. The inventories of construction for the years 1932 and 1939 respectively available in Vial [145, p.59-60] and Vial [145, p.94-96] are, often, useful to provide guidelines.

I also have to assume a time path for spending across the years in a given *département* when the break down unclear. If I only know that a certain amount of spending was allocated to a *département* for a given time period, I break down the total amount across the years using the following rule: 10% in year 1, 25% in year 2, 40% in year 3 and 25% in year 4. This assumption intends to reproduce a hump shaped spending impulse, which is not only plausible, but also supported by a 1938 letter to the War Council where the General Inspection of Engineering and Fortification details the time necessary to build different types of fortifications.⁸ Of the spending amounts referred to in Table 4.2, I also assume that only 80% was spent locally.

4.3 Measuring local economic activity with fiscal data

The French fiscal system was deeply transformed in the aftermath of WWI. Old direct taxes based on external signs (*signes extérieurs de richesse*) were replaced in 1914 and 1917 by income taxes, which followed more closely economic activity.⁹ While this paper is not the

⁸2 to 3 years for bunkers (*Casemates d'infanterie*), 3.5 years for small fortifications (*Petits ouvrages*) and 4 to 5 years for large fortifications (*Grands ouvrages*). Letter, 02/10/1938, Box 9N321, War Department Archives. The same letter also indicates that it was not reasonable to build such high quality but also time consuming fortifications in the later part of the decade given the urgency of the geopolitical situation. It was therefore decided to erect fortifications of lower quality. For this reason, I assume the following time path after 1937: 25% in year 1, 50% in year 2, 25% in year 3.

⁹In addition to fiscal data, unemployment and employment data could, in principle, be used to measure local economic developments. French interwar unemployment data have, however, been shown to be particularly problematic, both because of the extent of under-recording [117] and because unemployment relief centers were established in response to local economic developments [84]. A 1930 circular of the Department of Labor recognized these deficiencies and intended to fill that gap by establishing a new monthly employ-

first one to use fiscal data to approximate local economic activity at the level of French *départements*,¹⁰ the approach is new enough to warrant a detailed discussion.

Background.

In the French income tax defined by the Laws of July 15, 1914 and July 31, 1917, incomes were first taxed according to their origin (wages, profits, interest on securities, ...) by separate proportional taxes¹¹ and then aggregated and taxed as a whole by a general progressive income tax above a certain level. The *Renseignements Statistiques Relatifs aux Contributions Directes*, a yearly publication of the Department of Finance, gives the annual amount of tax collected, along with the number of taxpayers and the amount of taxable income at the *département* level, for the income taxes collected by the direct tax administration.¹²

Of the various proportional taxes, the tax on industrial and commercial profits (*bénéfices industriels et commerciaux* or *BIC*) is arguably the most convenient to proxy local economic activity given its large tax base. In contrast with the proportional tax on wages whose tax base was limited to the top of the income distribution, nearly all industrial and commercial profits were liable to the income tax.¹³ Table 4.3 shows the changes in the definition of the tax base over the years and illustrates the quasi absence of exemptions and tax breaks. Vasseur [144, p. 129-130] points that the coverage was, in fact, broader than what the name of the tax suggested. As the tax rate was highest on this income category, the legislator defined it broadly and encompassed most of what we would consider agricultural income. As a result any agricultural income that was generated by doing more than just selling the produces of one's harvest was for tax purposes considered an industrial and commercial profit by the tax authority. It is therefore not surprising that the *BIC* tax represented between 69% and 80% of all the proportional taxes collected by the direct tax administration.

ment survey for firms with more than 100 employees. These reports were established in a harmonized way by the regional offices of Labor Inspectors and could therefore constitute an additional source of information on local economic developments. Only the national aggregated results were, however, published by the Department of Labor and I was not able to locate the original disaggregated files either at the National Archives or at the Archives of the Department of Labor.

¹⁰[13] uses the *patente*, a business tax levied upon non-agricultural businesses in proportion to their presumed profitability, to calculate non-agricultural value-added of French *départements* and derives an approximation of gross domestic product per *département* for each decade from 1840 to 1910. [86] uses the same data that I collected to assess the importance of regional specialization in explaining the evolution of regional incomes during the Great Depression.

¹¹Tax on properties' income (5%), tax on securities' income (6%), tax on agricultural profits (3.75%), tax on industrial and commercial profits (4.5%), tax on non-commercial profits (3.75%), and tax on wages (3.75%).

¹²Taxes on properties' income and on securities' income were collected by another administration.

¹³[107] illustrates this difference in treatment between wage earners and small storekeepers by calculating that in the early 1920s, a storekeeper with earnings equal to two average incomes had to pay the equivalent of one month of profits in taxes, while an executive earning the exact same amount as wages would not pay any tax.

The data on taxable industrial and commercial profits was already used in the 1930s by Dugé de Bernonville to estimate aggregate interwar profits in a series of articles in the *Revue d'Économie Politique*. To estimate actual profits from the *BIC* series, I apply the same corrections that de Bernonville made at the aggregate level. In particular, I add the taxes paid in the previous year to taxable profits in the current year since taxes paid in the previous year were deductible. While Dugé de Bernonville corrects for fraud and tax evasion, I neglect such corrections.¹⁴ As long as the extent of tax evasion does not vary with military expenditures on fortifications, this assumption will not, in fact, bias my empirical results.

¹⁴Dugé de Bernonville observes a big discrepancy between the number of taxpayers as reported in the *Renseignements Statistiques Relatifs aux Contributions Directes* and the number of firms and independent workers reported in the *Census*. He sees this as a sign of significant fraud and tax evasion and treats the missing taxpayers as if their income was the average income of industrial workers. Vasseur [144, p.81-82] is more skeptical of the extent of tax evasion as the legislator set up and relied on departmental Commissions ('*Commissions consultatives*') composed by a small number of local industrials and traders, which helped the tax authority keep itself informed of the contributive faculty of small shop owners in each area.

Table 4.3: Evolution of tax base and rates on commercial and industrial profits

Year*	Definition of tax base	Rate	Taxpayers
1918	General regime: no exemption. Special regimes - workers, craftsman's widows, trolley man, fisherman: fraction of income below 1500 francs exempted.	4.5	773
1919-1923	No change.		
1924	General regime: no change. Special regimes - workers, craftsman's widows, etc. transferred to the wage income category.	9.6	1540
1925	General regime: no change. Special regimes - special rules for calculating taxable income for insurance companies.	14.4	1527
1926	No change.	9.6	1545
1927	General regime: system of categories for income smaller than 50 000 francs (e.g. 10 to 800; pay 22.5; 801 to 1500, pay 45; etc.). The rate of 15% applies to income above 50000. Special regimes: no change	15	1510
1928	No change.	15	1474
1929	General regime: no change. Special regimes - tax relief for storekeepers.	15	1172
1930	General regime: no change. Special regimes - Tax exemption for storekeepers and industrials who work only with the help of family members (wife, non-married children, ...) and whose income is below 5000. Reduced tax liabilities for those with income above 5000.	15	798
1931-1933	No change.		
1934	General regime: no change. Special regimes - increases in amounts due for very specific categories.	15	737
1935	General regime: abolition of the system of categories for income below 50000 introduced in 1927. Special regimes: abolition of specificities applied to insurance companies introduced in 1925; abolition of tax reliefs for storekeepers and entrepreneurs working only with the help of family members introduced in 1929 and 1930. The tax reliefs are replaced by reduced rates.	12	1399
1936	No change.	12	1453
1937	No change.	12	1485
1938	No change.	14	1484

* The year applies to the rules used to calculate the income tax. The number of taxpayers and income amounts correspond to year $t - 1$.

Fiscal data and economic activity.

Thanks to their large tax base, taxable industrial and commercial profits provide a possible proxy for economic activity. To have a first idea of the relationship between industrial and commercial profits and GDP, I compare their aggregate paths over the years 1926 to 1938 in Figure 4.2a. Both series reproduce known patterns of French economic history like the 1927 recession following the *de-facto* Poincaré stabilization of the Franc in 1926, the long decrease in economic activity during the Great Depression, and the slow recovery following the departure of France from the Gold Standard in 1936. But Figure 4.2a also points to some discrepancies. The decline of commercial and industrial profits came earlier and was steeper than that of GDP in the early years of the Depression. It also ended earlier with a strong rebound in 1934 that is not recorded by GDP.

A closer look at Figure 4.2a and Table 4.3, however, reveals that at least a part of this discrepancy can be explained by important tax reforms that occurred during the period. Small storekeepers started to receive tax relief in 1929 and became completely exempt from the tax starting in 1930. They were then reintegrated in the tax base in 1935.¹⁵ At the aggregate level, such reforms make fiscal data an imperfect proxy for economic activity. But the problem is less severe when using fiscal data at the disaggregated level for regression analysis. If these reforms affected *départements* in a uniform way, these changes will be precisely picked up by time fixed effects. If these reforms affected *départements* in a non-uniform way, these changes will create noise, affecting the precision of one's estimates. But as long as the impact of such reforms does not correlate with the right hand side variable of interest (in my case, military expenditures on fortifications), these reforms won't create a bias in a regression analysis.¹⁶

Another way to check the reliability of fiscal data as a proxy for economic activity is to compare how correlated its growth rate was with other measures of economic activity.¹⁷ Over the period 1923-1938, the correlation between the real annual growth rate of industrial and commercial profits and that of real GDP is higher (0.67 with a *pvalue* of 0.006) than the correlation between the growth of industrial production and that of real GDP (0.55 with a *pvalue* of 0.03).¹⁸

¹⁵The exemption was for industrials and shop owners who were not subject to the progressive income tax, who only run their firms with the help of their wife, children (aged less than 18), and at most one employee, and who did not make more than a certain threshold of income [144, p. 325-326]. They represented around 10% of *BIC* declared.

¹⁶For this reason, I keep every available year in my empirical analysis in the next section.

¹⁷A comparison of local non fiscal data with local fiscal data for the postwar period would further this understanding. Unfortunately, this comparison cannot be done for the tax considered in this paper since the proportional tax on industrial and commercial profits was suppressed in 1948.

¹⁸I start the comparison in 1923 because there is no data for industrial and commercial profits for the *départements* of Moselle, Haut-Rhin and Bas-Rhin before that time. For the sub period 1928-1938, the respective values are 0.60 with a *pvalue* of 0.05 and 0.61 with a *pvalue* of 0.04. Nominal GDP is from Villa [146, p.142]. I use the same deflator for *BIC* and GDP, namely Villa [146, p.143]. Industrial production is NBER series n. 01008B.

Figure 4.2b shows commercial and industrial profits in six broad regions, normalized to 100 at the beginning of the crisis.¹⁹ It illustrates that while regions followed a similar national pattern, a non negligible amount of interregional variation existed and can thus be exploited. Commercial and industrial profits were, for example, between 50 and 60 per cent of their 1929 level in 1933 for the North-East, South-East and Ile-de-France regions, while they remained at 70 per cent of their 1929 level in the North-West, South-West and Center regions.

4.4 Estimates of local fiscal multipliers

Empirical specification and main results.

Before estimating multipliers, I follow [13] in transforming the fiscal data collected in estimates of French *départements*' GDP. To build a bridge between both variables I use a constant coefficient of proportionality (ρ) thanks to national series.²⁰ Let Y_t be national GDP, and BIC_t be the amount of taxable commercial and industrial profits used to proxy non-agricultural value-added. The coefficient of proportionality for a given year is simply $\rho_t = \frac{Y_t}{BIC_t}$. I then average this coefficient over my period of interest to obtain a constant coefficient of proportionality: $\rho = \frac{1}{11} \sum_{t=1928}^{1938} \rho_t$.

A *département* i 's non-agricultural valued-added is then approximated by multiplying ρ with the amount of taxable commercial and industrial profits in a given year t : $NAVA_{i,t} = BIC_{i,t}\rho$. The strict equivalent to [13]'s approach would be to combine these estimates of non-agricultural value-added obtained from fiscal data with estimates of *départements*' agricultural value-added obtained from a secondary source to obtain an approximation of *départements*' GDP as $Y_{i,t} = A_{i,t} + \frac{BIC_{i,t}Y_t}{BIC_t}$.²¹ In my case, I am more interested in exploiting variations in growth rates than in approximating the actual level of *départements*' GDP. I therefore ignore the term $A_{i,t}$. This does not create a problem of bias in my estimation as long as there is no correlation between military expenditures and the growth rate of agricultural value-added at the *département* level.

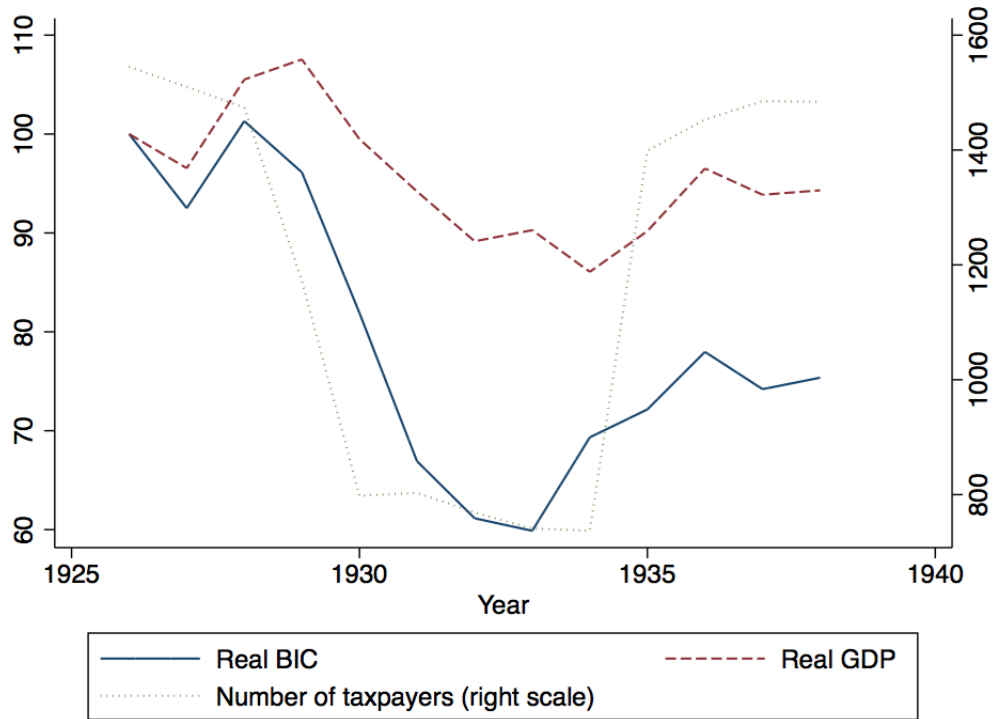
My empirical specification follows [100] and uses variations in military expenditures across *départements* to identify the effect of government spending on output. It is given by

$$\frac{Y_{i,t} - Y_{i,t-1}}{Y_{i,t-1}} = \gamma_t + \beta \frac{G_{i,t} - G_{i,t-1}}{Y_{i,t-1}} + \lambda C_i + \epsilon_{i,t},$$

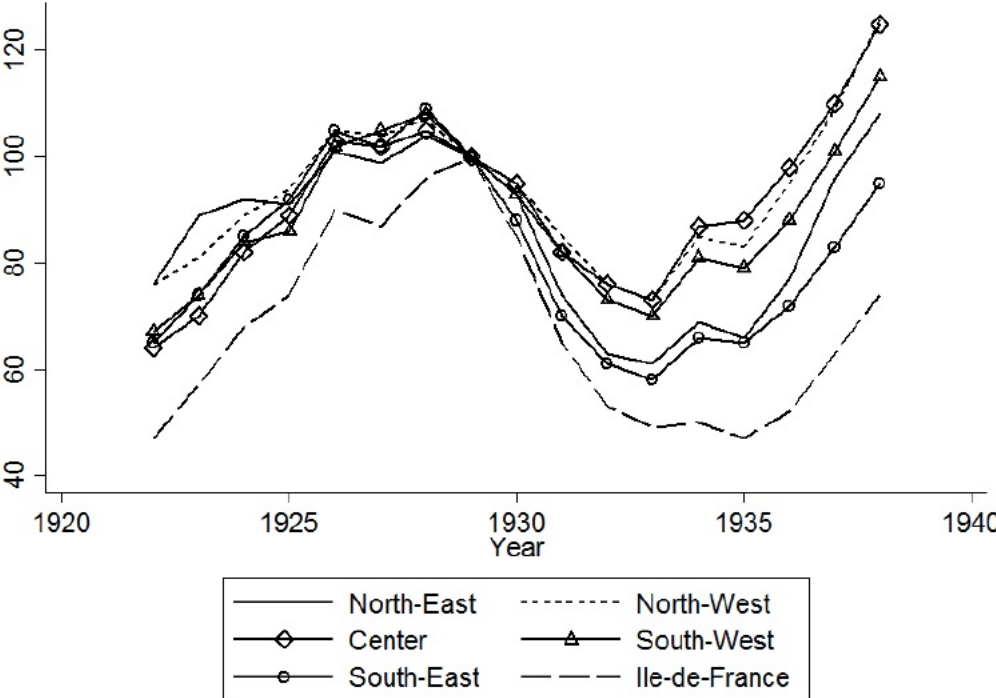
¹⁹North-East: Picardie, Champagne-Ardenne, Franche-Comté, Lorraine, Nord-Pas-de-Calais, Alsace; North-West: Basse-Normandie, Haute-Normandie, Bretagne, Pays-de-la-Loire; Center: Auvergne, Centre, Limousin, Bourgogne; South-West: Midi-Pyrénées, Languedoc-Roussillon, Poitou-Charentes, Aquitaine; South-East: Rhône-Alpes, Provence-Alpes-Côte-d'Azur; Île-de-France.

²⁰I use [107]'s Tables G-1, G-2, and G-9 to obtain this coefficient of proportionality.

²¹[13] uses [138]'s estimates.



(a) GDP, Industrial and Commercial Profits, and the Number of Taxpayers (in 1000s). Sources: GDP: [146]. BIC: *Annuaire de la S.G.F.*



(b) Regional Indices of Industrial and Commercial Profits. Source: [86].

Figure 4.2

where $Y_{i,t}$ is my estimate of *département* i 's GDP in year t , $G_{i,t}$ is military expenditures on border fortification in *département* i and year t , C_i is a set of *département* control variables, and $\epsilon_{i,t}$ is a disturbance term. The inclusion of time fixed effects, γ_t , allows to control for aggregate shocks and aggregate policy - such as changes in national taxes and aggregate monetary policy. The inclusion of *département* fixed effects or *département* specific control variables allow for *département* specific trends in output and military expenditures. In contrast with [100], I run my regression on annual rather than biannual data given the short time span of my data (1925-1938).

Results are shown in Table 4.4. All columns include time fixed effects. Column 1 includes *département* fixed effects, while the other columns do not. Column 3 controls for population growth over the previous 30 years. This ensures that my results are not driven by the fact that secular growing *départements* may have received more military expenditures. Column 4 adds the share of manufacturing employment in 1931 (the closest Census year) to control for differences in growth rates driven by different sectoral compositions. Column 5 adds the average annual growth in the five years before the start of border fortification to control for recent past economic performance. Column 6 includes all control variables.

The estimates of local government spending multipliers range between 0.9 to 1.2 across different specifications. This implies that when relative government spending in a *département* increases by 1 percent of GDP, relative *département* GDP rises by between 0.9 and 1.2 percent of GDP. This effect is statistically significant at the 1 percent level with Newey-West standard errors. Figure 4.3 gives a visual representation of my main specification from Column 1. Specifically, I regress both *départements*' GDP and military expenditures at time t on time and *département* fixed effects and then plot the residuals of the GDP regression (on the y-axis) against the residuals of the military expenditures regression (on the x-axis). Most points in the figure are located in the northeast and southwest quadrants, leading to a positive coefficient. The figure also demonstrates that the relationship is not driven by outliers.

The results with control variables rather than *département* fixed effects provide another way for controlling for specific *département* developments. The results suggest that *départements* with higher population growth, lower shares of manufacturing employment, and higher growth in the five years preceding the construction of the Maginot Line grew at a higher rate during the period. A disadvantage of that approach is that I lose in Columns 3 and 6 three *départements* - *Bas-Rhin*, *Haut-Rhin*, and *Moselle* - that received substantial amounts of fortification expenditures but were not part of France from 1871 to 1918.

My results are on the lower end of what the literature on local government spending multipliers has found.²² [127] estimates a state-level multiplier above 2 using windfall shocks to state finances. [30] also find a local multiplier around 2 using formula-driven variations in Federal transfers to states in 2009. [100] find a state-level multiplier of 1.5 using regional variation in military spending. As I argue below, my estimates are, however, likely to be

²²[53] find a multiplier of 1.1 using an annual panel for the 48 US states from 1930 through 1940, but the exogenous variation in government spending is less established than in the other studies mentioned.

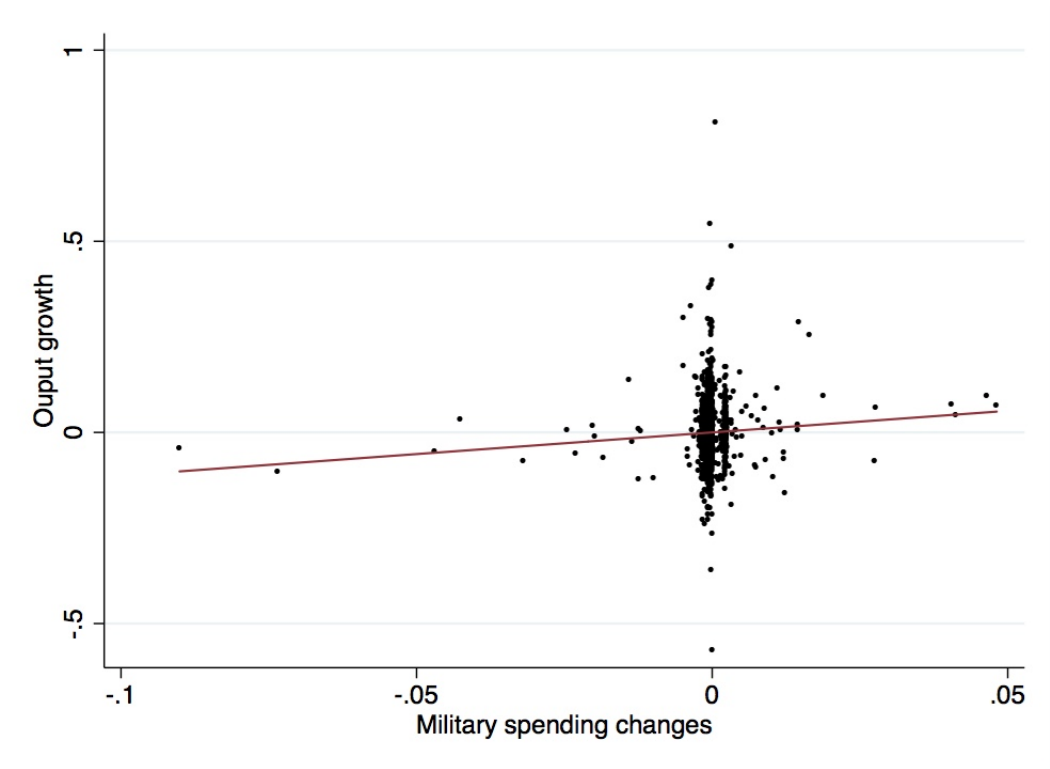


Figure 4.3: Partial association plot between military spending changes and output growth

biased toward zero and are better characterized as lower bounds for the true value of the parameter of interest.

Table 4.4: Regression results

	(1)	(2)	(3)	(4)	(5)	(6)
Military spending	1.175*** (0.328)	1.216*** (0.374)	0.915*** (0.185)	1.215*** (0.375)	1.229*** (0.372)	0.937*** (0.185)
Population growth between 1896 and 1931			0.00585 (0.007)			0.0117* (0.007)
Manufacturing employment				-0.0314** (0.015)		-0.0466*** (0.013)
Avg. annual growth of income between 1923 and 1928					0.233*** (0.031)	0.179*** (0.032)
<i>Département</i> FE	Yes	No	No	No	No	No
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,260	1,260	1,218	1,246	1,260	1,218
R-squared	0.615	0.608	0.613	0.612	0.611	0.617

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Possible bias.

A first concern with my estimates comes from using taxable industrial and commercial profits as a proxy for local economic activity. In contrast with older taxes like the *patente*, the tax on industrial and commercial profits was not levied at the establishment level, but at the head office of the firm [12]. This likely generates a downward bias in my estimates if military contractors with a head office outside where border fortification took place generated a profit as this would increase the amount of industrial and commercial profits recorded in *départements* of the control group.

A second concern with my estimates is the presence of measurement error in the military expenditures data.²³ If this measurement error is randomly distributed, this will create an attenuation bias and shrinks my estimates towards zero. But given the additional assumptions I had to make to allocate military spending across space and time, there is reason to believe that the measurement errors are, in fact, non random. To investigate the direction of the bias that my assumptions created, I modify them one by one and compare the results obtained to my baseline estimate reproduced in Column 1 of Table 4.5.

The first alternative assumption that I consider in Column 2 of Table 4.5 concerns the geographical allocation of military expenditures for the period 1928-1933. In my baseline case, the *départements* along the Belgium and Swiss borders do not receive any military expenditures over that time period. Military expenditures are then equally divided between the following three groups of *départements*: those along the Italian border, those along the Rhine river, and those between the Rhine river and the Luxembourg border. As an alternative assumption, I allocate a lower share of expenditures to the *départements* along the Italian border ($\frac{1}{4}$ instead of $\frac{1}{3}$) and reallocate these extra funds to the other two groups of *départements* that received military expenditures in equal proportion. Since this increases my estimate of the multiplier, my baseline choice was, in fact, conservative.

In Column 3, I modify the geographical allocation of expenditures for the 1934-1938 period. Instead of having 30% of border fortification spending allocated to the *départements* along the Belgium border, 10% to those along the Swiss border, 10% to those along the Italian border, 16% to those along the Rhine river and 33% to those on the remaining part of the North Eastern border, I attribute the same percentage to the two latter groups. This alternative assumption barely affects my estimate of the multiplier.

In Columns 4 and 5, I modify my baseline assumption for the time path of spending, which was 10% in year 1, 25% in year 2, 40% in year 3 and 25% in year 4. This assumption was intended to reproduce a hump shaped spending impulse. In Column 4, I front load the spending and modify the time path to 20% in year 1, 25% in year 2, 30% in year 3 and 20% in year 4. In Column 5, I back load the spending and modify the time path to 5% in year 1, 25% in year 2, 45% in year 3 and 25% in year 4. Again this barely affects my estimate, suggesting that the measurement errors induced by these additional assumptions did not generate a strong bias.

²³Possible measurement errors in my dependent variable are less problematic as it only increases standard errors.

A final concern arises if the *départements* receiving large amounts of military spending were more cyclically sensitive than the other *départements*. Higher cyclical sensitivity together with the fact that the bulk of military spending occurred during the downturn part of the cycle would bias my estimates towards zero. To investigate whether this is likely to be the case, I compare the economic evolution of the average treated *département* (referred to as the Border) with two different control groups in Figure 4.4.

Table 4.5: Robustness checks

	(1)	(2)	(3)	(4)	(5)
Baseline	1.175*** (0.328)				
Alternative geographical allocation of spending for 1928-1933		1.514*** (0.395)			
Alternative geographical allocation of spending for 1934-1938			1.181*** (0.318)		
Alternative time allocation of spending (front loaded)				0.963** (0.416)	
Alternative time allocation of spending (back loaded)					1.048*** (0.305)
<i>Département</i> FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	1,260	1,260	1,260	1,260	1,260
R-squared	0.615	0.616	0.615	0.614	0.615

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4.6: Summary statistics of affected and non-affected *départements*

	Border	Non-border	Synthetic Control
Number of <i>départements</i>	17	72	
Sectoral shares			
Manufacturing employment	39.4	28.7	39.4
Manufacturing value-added	48.2	38.1	48.3
Agricultural employment	34.7	47.0	35.0
Agricultural value-added	22.1	35.7	22.3
Services employment	25.9	24.2	26.0
Services value-added	29.7	26.2	29.8
Pre-trends			
Population ratio (1931 over 1896)	1.03	0.94	1.03
Growth of manuf. employ. share (1896-1931)	33.3	13.0	33.3

Source: Own calculations based on [38].

The top panel of Figure 4.4 uses all other *départements* to construct a control group while the bottom panel uses a synthetic control group generated by the [1] methodology. The synthetic control method provides a data-driven procedure to construct control units based on a combination of comparison units that approximates the characteristics of the unit exposed to the intervention. It can therefore be used to find out the average behavior of a control group that resembles the groups of *départements* that received fortification spending. While the methodology can not provide an estimate for local spending multipliers, it has the advantage of not relying on the additional assumptions discussed above.

Table 4.6 reports the summary statistics associated with three different groups of *départements*: those that were not affected by fortification spending, those that were, and those that are used to construct the synthetic control. The last column shows that the methodology manages to construct a comparison group whose Pre-Maginot Line characteristics match those of the treated unit. One can then see on Panel B of Figure 4.4 that the *départements* with similar characteristics than those that received military expenditures experienced a sharper and larger decrease in income than the *départements* that received military expenditures during the period. This suggest that, if anything, the control group in my regressions produces conservative estimates of multipliers.

4.5 Conclusion

Over the interwar, France designed and constructed an important fortification barrier along its Eastern border: The Maginot Line. It generated quasi-exogenous variations in military expenditures that I exploit to measure the impact of government spending in an era of depressed economic activity. A time-series approach to estimate a conventional aggregate



(a) Border and non-border *départements* (dashed line)



(b) Border and synthetic non-border *départements* (dashed line)

Figure 4.4: Basic control group vs. synthetic control group

multiplier would run into the difficulty that this parameter is highly sensitive to the monetary and tax regimes. This would be particularly problematic for the time period in consideration as it experienced both procyclical and countercyclical macroeconomic policies.

Instead, I estimate a local multiplier that differences out aggregate shocks and aggregate policy by including time fixed effects in the regression. I find that when relative government spending in a *département* increased by 1 percent of GDP, relative *département* GDP rose by 1 percent. While my point estimate is below the 1.5-2 range typically found in this literature, I argue that my findings more likely represent a lower bound for the true value of the parameter given the specific data issues I had to deal with.

A reader might wonder why local relative multipliers tend to be higher than conventional aggregate multipliers. After all, positive spillovers across *départements* should make local multipliers smaller than aggregate multipliers. First and as already noted, recipient *départements* experience a relative increase in government spending but no relative increase in tax liabilities. This is in contrast with aggregate government spending increases. To the extent that Ricardian effects exist, this makes local multipliers bigger than conventional aggregate multipliers. Second, as relative monetary policy between two *départements* is held fixed, the local multiplier is akin to the aggregate multiplier for a relatively accommodative aggregate monetary policy. Recent time-series studies that manage to isolate this type of environment, in fact, find conventional aggregate multipliers that are also higher than 1 [9, 155].

My result suggests that, when it was tried, fiscal policy was effective at stimulating the French economy during the Depression. These results are relevant to both current debates about the impact of fiscal policies and to economists' understanding of the effect of fiscal policies during the 1930s. To the extent that these debates were partly unresolved because of a lack of empirical evidence, my paper adds to the growing body of empirical evidence on the impact of fiscal policy using an earlier period in Europe's history.

Appendix A

The Making of a Monetary Union

A.1 Summary statistics: discount rate changes and differentials

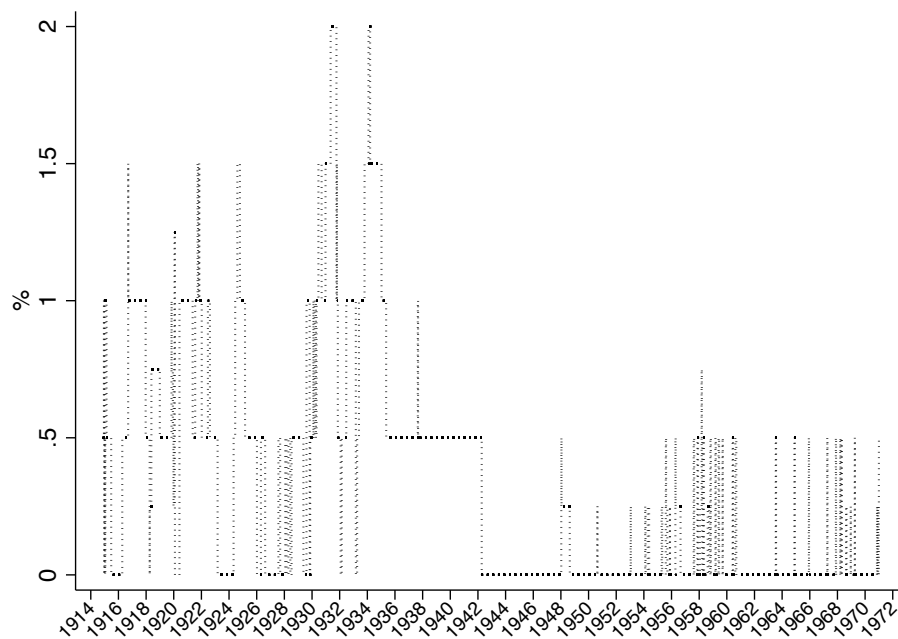


Figure A.1: Range (Max - Min) of daily discount rates of 12 Federal Reserve banks. Sources: 1914-1941: Banking and Monetary Statistics, 1943, Table 115. 1941-1970: Banking and Monetary Statistics, 1976, Table 12.1.A.

	Number of discount rate changes		Differential with NY				Differential with average			
	All	Recessions	Mean	Std	Min	Max	Mean	Std	Min	Max
Boston (1)	34	17	0.20	0.34	-1.00	1.00	-0.10	0.27	-1.00	0.75
New York (2)	47	25					-0.30	0.44	-1.42	0.92
Philadelphia (3)	27	12	0.24	0.52	-1.00	1.50	-0.05	0.19	-0.71	0.69
Cleveland (4)	32	13	0.23	0.45	-1.00	1.50	-0.07	0.19	-0.83	0.67
Richmond (5)	29	13	0.42	0.59	-1.00	2.00	0.12	0.22	-0.50	0.83
Atlanta (6)	30	15	0.37	0.55	-1.25	2.00	0.08	0.20	-0.92	0.88
Chicago (7)	33	16	0.30	0.40	-1.25	1.50	0.00	0.25	-0.92	0.83
St. Louis (8)	26	11	0.28	0.51	-1.25	1.50	-0.01	0.17	-0.83	0.58
Minneapolis (9)	26	11	0.50	0.60	-1.25	2.00	0.20	0.26	-0.77	0.96
Kansas City (10)	26	12	0.42	0.63	-1.00	2.00	0.12	0.25	-0.54	0.79
Dallas (11)	30	17	0.41	0.60	-1.00	2.00	0.11	0.22	-0.81	0.79
San Francisco (12)	32	14	0.20	0.49	-1.25	1.50	-0.10	0.19	-1.06	0.83

Table A.1: Summary statistics for daily discount rates from Nov. 16 1914 to Aug. 23 1935. Source: See Figure 2.4; NBER.



Figure A.2: Histograms of daily discount rate differential with the New York district before the New Deal reform of the Fed. Sources: 1914-1941: Banking and Monetary Statistics, 1943, Table 115.

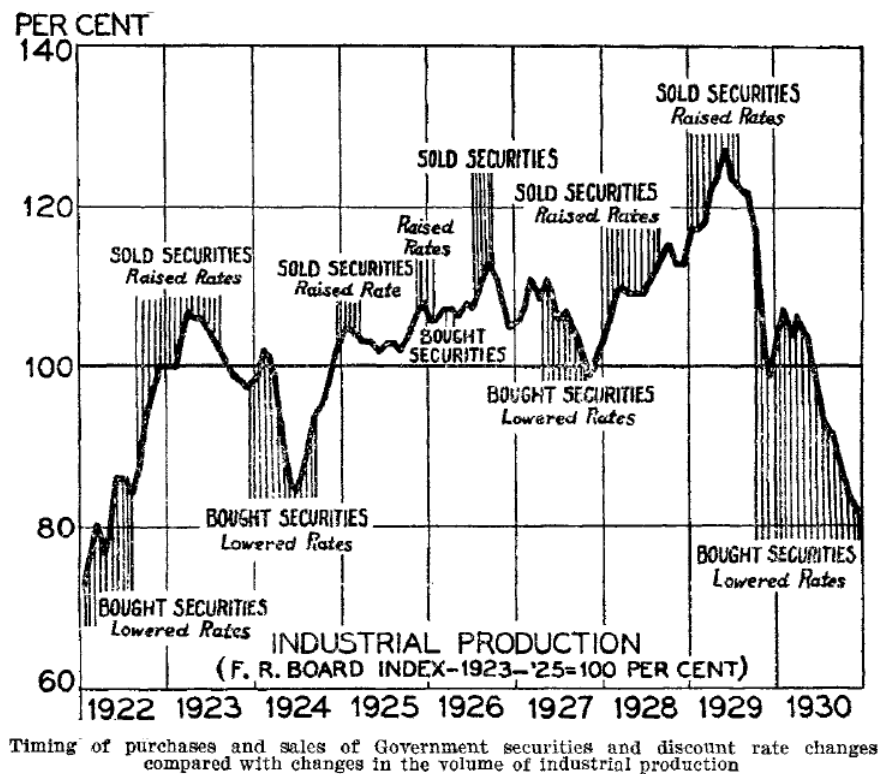
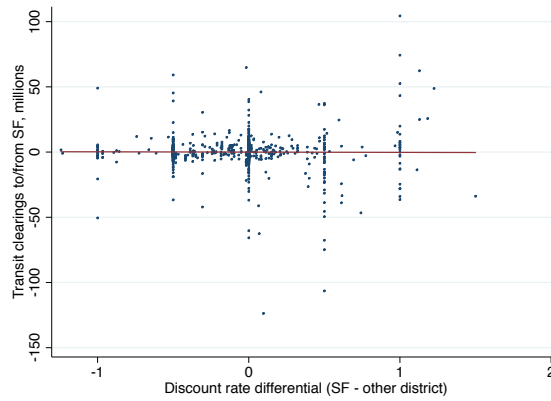
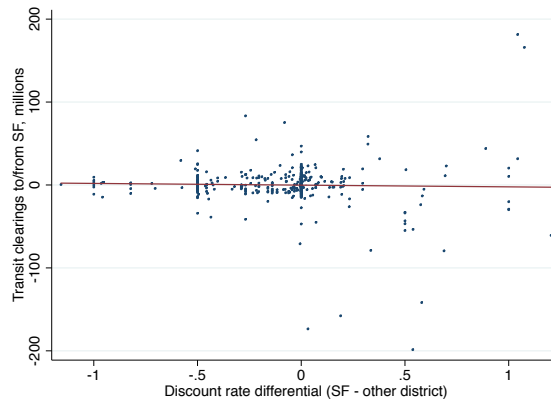


Figure A.3: Industrial Production and New York Fed policies. Source: Hearings on S. Res. 71, Appendix, Part 6, p. 761.

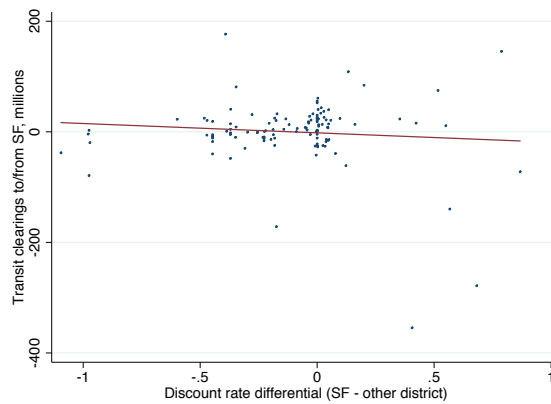
A.2 Transit clearings



(a) Monthly Frequency



(b) Quarterly Frequency



(c) Yearly Frequency

Figure A.4: Transit clearings and discount rates differentials with the San Francisco district. The Figure displays the residuals of the regression of $Transit_{SF/i,t} = \gamma_i + \lambda_t + u_{i,t}$ against the discount rate differential. Source: [159].

Appendix B

Supply-Side Policies in the Depression

B.1 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 B.1. To construct it, we relied on four authors who provide information on the actors of this field in the 1930s: an essay by [118] on the state of economic forecasting in France and abroad; a statistical textbook by [68]; a report on the state of the statistics field in France by [90]; and an article by [124] 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.¹ 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

¹The monthly *X-crise*, published by the *Centre Polytechnicien d'Études Économiques*, was also mentioned by these four authors. But the author of the commentary on the economic outlook is the same as in *La Conjoncture Économique et Financière* for our period of interest.

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.

Table B.1: 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 [118]; source [2] is [68]; source [3] is [124]; source [4] is [90]. B.N.F., Bibliothèque Nationale de France; I.E.P., Institut d'Études Politiques; S.E.I.E., Société d'Études et d'Informations Économiques; I.S.R.E.S., Institut Scientifique de Recherches Économiques et Sociales; I.S.U.P., Institut Statistique de l'Université de Paris; C.P.E.E., Centre Polytechnicien d'Études Économiques; O.D.E., Office de Documentation Économique; C.A.E., Centre d'Analyse Économique; D.S.E.S., Documentation de Statistique Économique et Sociale; R.P.P., Revue Politique et Parlementaire.

May-June 1936

- “[*Les mesures*] se traduiront par une surcharge extrêmement lourde brusquement imposée [...] C’est dire que se poseront de complexes questions de rajustement de prix.”² [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.”³ 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.”⁴ 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.”⁵ One should, of course, expect [...] a substantial increase in cost prices, which will by the way continue to develop in the upcoming period.

July-August 1936

- “[*Le gouvernement*] paraît s’orienter vers une politique de hausse [*des prix*] dans tous les domaines.”⁶ [The government] seems to be moving towards a general policy of higher prices.
- “[*Les*] facteurs qui sont à l’origine de cette hausse [*des prix*] [...], en simple logique économique, doivent continuer à agir dans le même sens.”⁷ 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.”⁸ 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.

² *L’Observation Économique*, May 1936, p. 162.

³ *L’Observation Économique*, June 1936, p. 203.

⁴ *La Conjoncture Économique et Financière*, June 1936, p. IV.

⁵ *La Conjoncture Économique et Financière*, June 1936, p. IX.

⁶ *L’Activité Économique*, N. 6, 7/31/1936, p. 101.

⁷ *L’Observation Économique*, July-August 1936, p. 243.

⁸ *La Conjoncture Économique et Financière*, July 1936, p. V.

- “*Nous croyons que cette aventure ne pourra être dénouée finalement [...] que par une hausse importante de l'ordre de 30% au moins de nos prix intérieurs.*”⁹ We believe this experiment will eventually lead to a substantial increase in domestic prices on the order of 30%.
- “*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.*”¹⁰ Approximative evaluation (of the impact of the recent social laws): [...] We reach the conclusion of a 18% increase in industrial prices within a short period of time. This is certainly a minimum given the optimistic hypotheses that we used.
- “*On peut s'attendre à une hausse importante de [l'indice des prix de gros] dans le semestre suivant. Il est vraisemblable que la hausse générale des prix de gros atteindra assez rapidement une amplitude de l'ordre de 15-20% dans l'ensemble.*”¹¹ 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.*”¹² 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.*”¹³ It seems unavoidable that the increase in prices will continue.
- “*On se trouve, en réalité, devant la menace d'une hausse considérable des prix [...] hausse des prix de gros de l'ordre de 50%, et une hausse du coût de la vie de l'ordre de 30%.*”¹⁴ We are facing the threat of considerably higher prices [...] on the order of 50% for wholesale prices and 30% for the cost of living.
- “*La hausse de grandes catégories de prix [...] s'est poursuivie, comme on devait s'y attendre.*”¹⁵ Price increases have continued as one should have expected.

⁹ *La Conjoncture Économique et Financière*, July 1936, p. VI.

¹⁰ *La Conjoncture Économique et Financière*, July 1936, p. VI.

¹¹ *La Conjoncture Économique et Financière*, July 1936, Graphique 31.

¹² *L'Observation Économique*, September-October 1936, p. 323.

¹³ *L'Observation Économique*, September-October 1936, p. 323.

¹⁴ *La Conjoncture Économique et Financière*, August-September 1936, p. V.

¹⁵ *L'Observation Économique*, October-November 1936, p. 354.

- “*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.*”¹⁶ 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 à Paris [...] se poursuivra dans les mois suivants.*”¹⁷ 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.

¹⁶*La Conjoncture Économique et Financière*, November 1936, p. V.

¹⁷*La Conjoncture Économique et Financière*, December 1936, Graphique N. 31.

B.2 Data: sources and treatment of measurement error

Data details

Appendix table B.2 presents additional information on the industrial production data we use. Appendix table B.3 presents additional information on the industrial price data we use.

Measurement error

We use [120], [123], [131], and [119] 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 ([123], 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” ([123], 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).¹⁸

Given these problems, we redid the estimates in panel A of table 3.2 excluding the steel working industry, the copper working industry, the leather industry, and the construction industry. Results are shown in table B.4 .

¹⁸Excluding 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 [125].

Table B.2: Industrial production data details

Industry	French name	Start	End	Source	In baseline regressions?
Mining	Mines	Jan-28	Jul-39	[1], 05-07/39 [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], 05-07/39 [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], 01-07/39 [2]	Yes
Textiles	Textiles	Jan-28	Jul-39	[1], 04-07/39 [2]	No, use subindexes.
Cotton	Coton	Jan-28	Jul-39	[1], 05-07/39 [2]	Yes
Wool	Laine	Jan-28	Jul-39	[1], 05-07/39 [2]	Yes
Silk	Soie	Jan-28	Jul-39	[1], 05-07/39 [2]	Yes
Rayon	Rayonne	Jan-31	Jul-39	[1], 05-07/39 [2]	Yes
Linen	Lin	Jan-28	May-39	[2]	Yes
Hemp	Chanvre	Jan-28	May-39	[1]	Yes
Leather	Cuir	Jan-28	Jul-39	[1], 05-07/39 [2]	Yes
Metallurgy	Métallurgie	Jan-28	Jul-39	[1], 05-07/39 [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], 04-07/39 [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], 05-07/39 [2]	Yes
Construction	Bâtiment	Jan-28	Jul-39	[1], 07/35, 05-07/39 [2]	Yes
Gas and electricity	Gaz et Électricité	Jan-28	Jul-39	[1], 04/33, 05-07/39 [2]	No.
Natural gas	Gaz	Jan-28	May-39	[1]	No, data not monthly.
Electricity	Électricité	Jan-28	Jul-39	[1], 05-7/39 [2]	No, data too poor.
Misc. industries	Industries Diverses	Jan-28	Jul-39	[1], [2]	No, no 40-hour law data.

Source [1] is [123]; source [2] is [131].

Table B.3: 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	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	Yes
Chemical products	Produits Chimiques, Huiles, Mat. Grasses	Jan-31	Aug-39	[1] Table 29	Yes
Paper	Papier	Jan-31	Aug-39	[1] Table 29	Yes
Textiles	Textiles	Jan-31	Aug-39	[1] Table 29	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	Cuir et Peaux	Jan-31	Aug-39	[1] Table 29	Yes
Metallurgy	Métallurgie	Jan-31	Aug-39	[1] Table 29	No, use products.
Cast iron	Fonte	Jan-31	Aug-39	[1] Table 32	Yes
Steel	Acier	Jan-31	Aug-39	[1] Table 32	Yes

Source [1] is [131]; source [2] is various issues of the monthly supplement of the *Bulletin de la Statistique Générale de la France*.

Table B.4: Effects of 40-hour restriction on growth of industrial production

Specification	Excludes industries with severe measurement error							
	Ind-FE + time-FE		Ind-FE + time-FE + lags		Ind-FE			
	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative		
Δ 40-hour restriction	-0.068** (0.023)	-0.065** (0.021)	-0.066** (0.020)	-0.066** (0.019)	-0.058** (0.012)	-0.060** (0.012)	-0.059** (0.011)	-0.063** (0.011)
Δ Devaluation				0.096** (0.013)	0.096** (0.013)	0.096** (0.013)	0.114** (0.018)	0.114** (0.018)
Time-FE	Yes	Yes	Yes	Yes	No	No	No	No
Industry-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12-mth cumulative effect	-	-0.081	-	-0.058	-	-0.175	-	-0.131
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 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.

B.3 The standard new Keynesian model

This appendix describes the model used in section 3.4. The derivation follows that of the standard model in [160].

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:

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

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 $P_t = \left[\int_0^1 P_{it}^{1-\theta} di \right]^{\frac{1}{1-\theta}}$.

Firms

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

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

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

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

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

The first-order conditions are:

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

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

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

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

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

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

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

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

where $Q_{t,t+s} = \beta^s \left(\frac{C_{t+s}}{C_t} \right)^{-\sigma}$ 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

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

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

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

Market Clearing

We require that all goods-markets clear in equilibrium,

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

Log-linearized equilibrium conditions

We log-linearize the equilibrium conditions around the zero-inflation steady-state as in [160]:

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

$$\pi_t = \beta E_t \pi_{t+1} + \kappa m c_t. \quad (\text{B.2})$$

$$m c_t = \omega_t - a_t - \psi_t. \quad (\text{B.3})$$

$$\omega_t = \xi_t + \sigma c_t + \eta m_t. \quad (\text{B.4})$$

$$y_t = c_t. \quad (\text{B.5})$$

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

B.4 Proofs

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:

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

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

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. \square

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

Let 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:

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

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 [154] 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. \square

B.5 Multi-sector new Keynesian model

This appendix lists the model equations we use in Dynare.

$$\begin{aligned}
Y_{it} &= \tau_{it} \left(\frac{P_{it}}{P_t} \right)^{-\theta} Y_t \\
Y_{it} &= A_t (N_{it} \bar{H}_{it})^{1-\alpha} K_{it}^\alpha \\
\frac{N_{it}}{K_{it}} &= \frac{(1-\alpha)}{\alpha} \left(\frac{W_{it}/P_t}{R_t^k} \right)^{-1} \\
\frac{W_{it}}{P_t} &= \Xi N_{it}^\eta \lambda_t^{-1} \\
\mu_{it} &= \alpha^{-\alpha} (1-\alpha)^{-(1-\alpha)} (R_t^k)^\alpha \left(\frac{W_{it}}{P_t} \right)^{1-\alpha} \left(\frac{1}{H_{it}} \right)^{1-\alpha} A_t^{-1} \\
0 &= Y_{i,t} \left[(1-\zeta) \left(\frac{P_{i,t+s}}{P_{t+s}} \right) + \zeta \mu_{i,t+s} - \phi \Pi_{i,t} (\Pi_{i,t} - 1) \right] + Q_{t,t+1} Y_{i,t+1} [\phi \Pi_{i,t+1} (\Pi_{i,t+1} - 1)] \\
\Pi_{it} &= \Pi_t \left(\frac{P_{it}/P_t}{P_{i,t-1}/P_{t-1}} \right) \\
H_{it} &= \Psi_{it} \bar{H} \\
P_t &= \left[\sum_{i=1}^I \tau_{it} P_{it}^{1-\theta} \right]^{\frac{1}{1-\theta}} \\
N_t &= \left[\sum_{i=1}^I \tau_{it}^{-\eta} N_{it}^{1+\eta} \right]^{\frac{1}{1+\eta}} \\
K_t &= \sum_{i=1}^I K_{it} \\
1 &= Q_{t,t+1} (1 + i_{t+1}) \Pi_{t+1}^{-1} \\
Q_{t,t+1} &= \beta \frac{\lambda_{t+1}}{\lambda_t} \\
\lambda_t &= C_t^{-\sigma} \\
K_{t+1} &= (1-\delta) K_t + I_t [1 - S(I_t/I_{t-1})] \\
P_t^k &= Q_{t,t+1} [R_{t+1}^k + (1-\delta) P_{t+1}^k] \\
1 &= P_t^k [1 - S(I_t/I_{t-1}) - I_t/I_{t-1} S'(I_t/I_{t-1})] + Q_{t,t+1} P_{t+1}^k (I_{t+1}/I_t)^2 S'(I_{t+1}/I_t) \\
S(I_t/I_{t-1}) &= 0.5 \exp[\sqrt{\psi}(I_t/I_{t-1} - 1)] + 0.5 \exp[-\sqrt{\psi}(I_t/I_{t-1} - 1)] - 1 \\
S'(I_t/I_{t-1}) &= 0.5 \sqrt{\psi} \left(\exp[\sqrt{\psi}(I_t/I_{t-1} - 1)] - \exp[-\sqrt{\psi}(I_t/I_{t-1} - 1)] \right) \\
R_t &= \beta^{-1} \\
Y_t &= C_t + I_t
\end{aligned}$$

B.6 Alternative model exercises

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,

$$\Psi_{it}^e = \frac{5}{6} \left\{ \begin{array}{ll} 5 \leq t \leq 28, & i = 1, \dots, 8 \\ 6 \leq t \leq 28, & i = 9, 10 \\ 7 \leq t \leq 28, & i = 11, \dots, 16 \\ 8 \leq t \leq 28, & i = 17, 18 \\ 9 \leq t \leq 28, & i = 19 \\ 10 \leq t \leq 28, & i = 20 \\ 11 \leq t \leq 28, & i = 21 \\ 13 \leq t \leq 28, & i = 22 \end{array} \right.$$

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

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

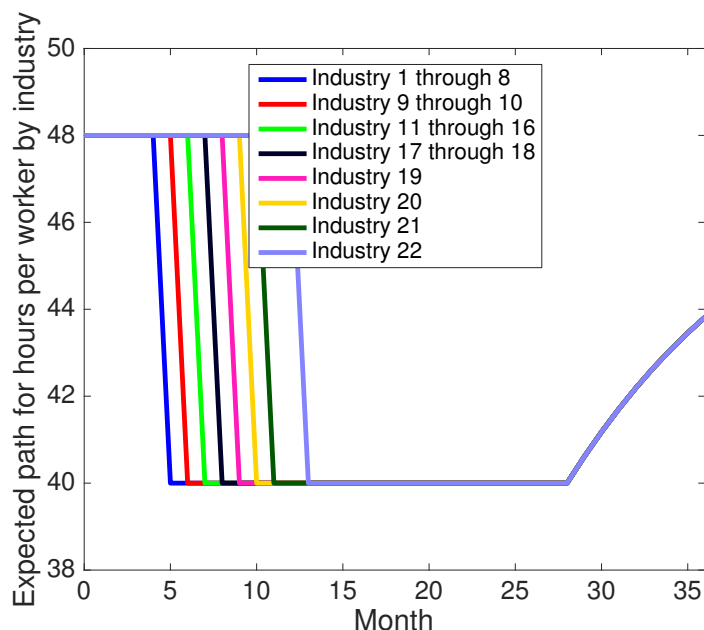


Figure B.1: Expected hours per worker in each industry in the model experiment where the 40-hour law is expected to be more persistent.

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 3.10), only the expectations of agents are different.

In figure B.2 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.

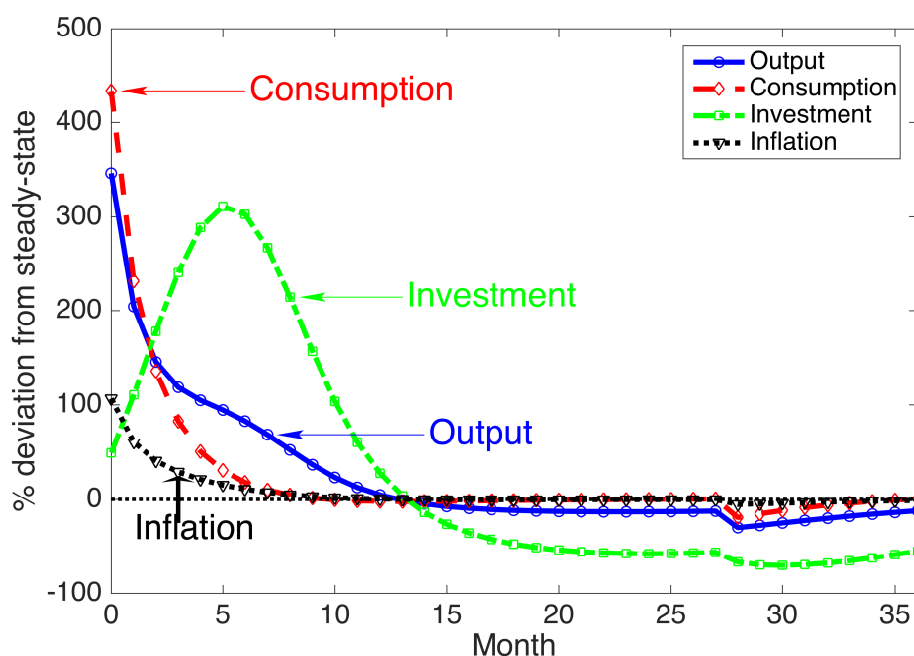


Figure B.2: Impulse response function of output, prices, consumption and investment to the expected hours restrictions in figure B.1 when the realized path follows the baseline experiment (figure 3.10). Month 0 is when the 40-hour law is announced.

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 3.4.

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 3.4). 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 B.3, 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.

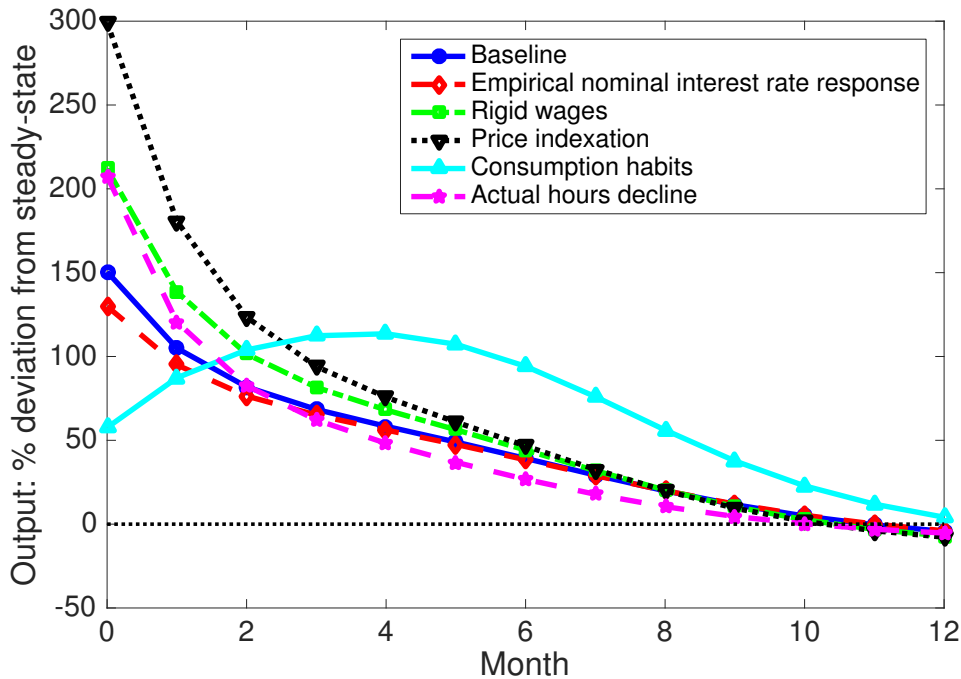


Figure B.3: Impulse response function of output for variations of our baseline exercise. See section B.6 for details.

Price indexation

To capture automatic price indexation to last period inflation, we assume that the quadratic price adjustment cost is now $\frac{\phi}{2} (\Pi_{i,t} - \Pi_{i,t-1}^\chi)^2$, 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,

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

We parameterize $\chi = 0.5$ to capture an intermediate degree of indexation. Micro-evidence suggests an absence of indexation [e.g. 77] and [34] 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 B.3, the model with price indexation predicts a quadrupling of output.

Consumption habits

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

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

where h is the habit parameter. We set $h = 0.833$ in line with [129] and reparameterize price adjustment costs to $\phi = 840$. The resulting impulse response function of output in figure B.3 is more persistent and hump-shaped, but still predicts more than a doubling of output at the peak.

Wage rigidity

We implement nominal wage rigidity following [19]. 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 B.3, allowing for wage rigidity further amplifies the output expansion from the 40-hour law relative to the baseline model.

Matching actual decline in hours

The actual decline in hours was 12% in the data. We therefore set $\Psi_{it} = 0.88$ whenever the hours restrictions are binding. The timing is unchanged from figure 3.10. 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 B.3 for this exercise displays a tripling of output.

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