Recovery from the Great Depression: The Farm Channel in Spring 1933

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Abstract

In the four months following the trough of the Great Depression in March 1933, industrial production rose 57 percent. We argue that an important channel aiding recovery came through the direct effect of devaluation on farm prices, incomes, and consumption. We call this the farm channel. Using U.S. and British crop price data, we document that devaluation raised prices of traded crops and their close substitutes (other grains). And using state and county auto sales and income data, we document that recovery proceeded much more rapidly in farm areas. Our baseline estimates imply that a one standard deviation increase in the share of a state's population living on farms is associated with a 20–34 percentage point increase in auto sales growth from winter to fall 1933. This effect is concentrated in states producing traded crops (cotton, tobacco, wheat) or close substitutes, suggesting an important role for devaluation. In annual county data we show that the farm channel is strongest in counties with more indebted farmers. To map these cross-sectional estimates into an aggregate effect, we build an incomplete-markets model that explicitly incorporates both the benefits of the farm channel to farmers (higher farm income) as well as the costs to nonfarmers (higher prices paid for farm goods). The model suggests that by redistributing income to indebted farmers with a high marginal propensity to consume, the farm channel may explain 25-50% of the spring 1933 recovery.

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"[T]he depression in the manufacturing industry of the country is due chiefly to the fact that agricultural products generally have been selling below the cost of production, and thereby destroyed the purchasing power in the domestic market of nearly half of all our people. We are going to restore the purchasing power of the farmer." - Franklin D. Roosevelt, campaign speech in Atlanta, Georgia, 24 October 1932.[1]

1 Introduction

From its low point in March 1933, seasonally adjusted industrial production rose 57 percent in four months,[2] the most rapid four months of industrial production growth on record. As shown in figure 1, in these four months the U.S. economy recovered from two years of the Depression.[3] We argue that an important driver of this extraordinary recovery was the effect of devaluation on farm prices, incomes, and consumption. We call this mechanism the farm channel. This channel is distinct from the existing literature's emphasis on a change in expectations as the explanation for economic recovery (Temin and Wigmore, 1990; Eggertsson, 2008; Jalil and Rua, 2015; Taylor and Neumann, 2016).

As the quote beginning the paper suggests, the importance of farmers for recovery was much emphasized in the 1930s . But with the exception of Temin and Wigmore (1990)—which inspired this paper—it has not figured prominently in the modern literature. Our goal is to document the farm channel's operation and its relevance to the aggregate economy's recovery. We do so in three steps. First, we show that crop prices rose rapidly in spring 1933, and that this increase was in part caused by devaluation. Second, we show that auto sales and income grew much more in farm areas of the country, particularly in those areas most burdened by farm mortgage debt. Finally, we build an incomplete-markets model to translate our cross-sectional estimates into an aggregate effect.

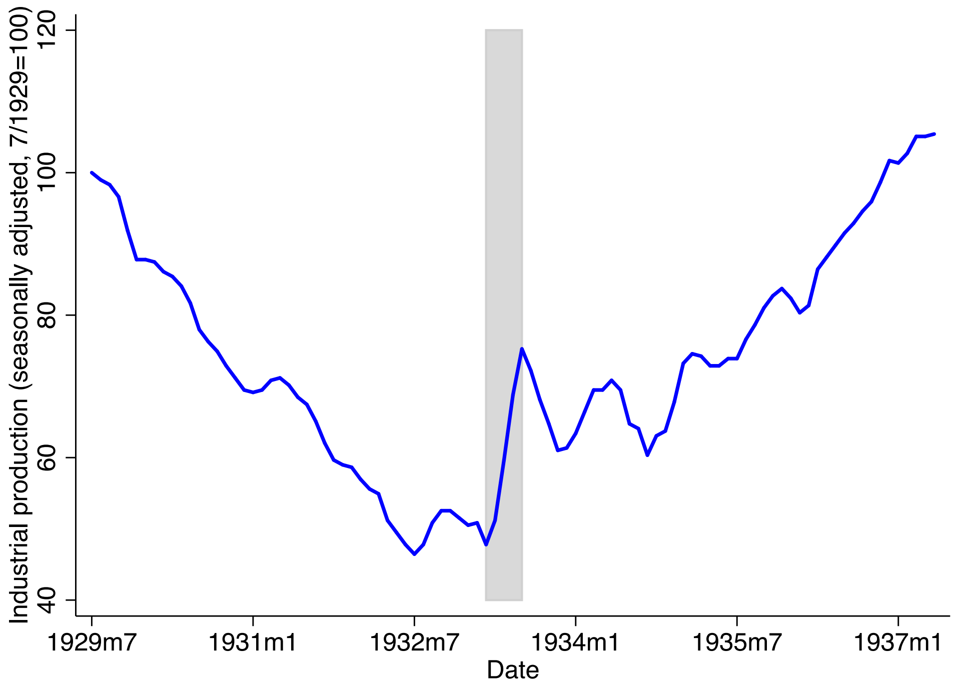
We start our analysis of the farm channel in section 2 by examining the 1933 path of prices and production of all major farm products. Monthly data show a large increase

[1]See http://teachingamericanhistory.org/library/document/campaign-speech/ for the complete speech.

[2]FRED series INDPRO, accessed on 10/3/2016.

[3]We verify in appendix A that rapid recovery is a feature not only of the industrial production data, but also of other aggregate economic indicators. Our conclusion that the economy indeed grew extraordinarily rapidly in spring 1933 matches that of Taylor and Neumann (2016).

Figure 1 – Industrial production, 1929-1937



Note: Shading indicates March-July 1933. Source: FRED series INDPRO.

in crop prices after devaluation, with much smaller price increases for livestock and dairy products. An analysis of daily farm spot and futures prices around the announcement of the U.S. departure from the gold standard provides evidence for a causal role of devaluation in driving crop price increases. Importantly, this was an increase in real crop prices, since the CPI rose only modestly from March to July 1933.

In section 3, we examine consumption choices in farm relative to nonfarm areas. Using monthly state and annual county auto sales data, we find that new auto sales in spring 1933 grew much more in farm areas of the country. Our baseline estimates imply that a one standard deviation increase in the share of a state's population living on farms was associated with a 20–34 percentage point increase in auto sales growth from winter to fall 1933. This effect is driven by areas growing the principle traded crops and close substitutes: cotton, tobacco, and cereals. We focus primarily on new car sales because they were (relatively) well measured, are correlated with broader measures of consumption, and are available at higher frequency and greater geographical detail than other economic indicators. But we obtain qualitatively similar results from annual state-level data on new truck sales, electric refrigerator sales, and personal income, as well as annual county-level data on income tax return counts.

It is itself of interest to know that the initial recovery from the Depression proceeded more rapidly in farm areas of the country. But these cross-sectional results do not establish that the farm channel from devaluation to farm prices, incomes, and consumption contributed to aggregate recovery. Given small contributions of net exports to GDP growth in 1933 and 1934, higher farm product prices primarily redistributed income to farmers from nonfarm households and corporations. It is not a priori obvious that this transfer would be beneficial for the aggregate economy. A plausible way that higher farm prices could have had aggregate benefits is if they redistributed income from low marginal propensity to consume (MPC) agents to high-MPC agents. A long-standing theoretical literature (e.g., Bewley, 1986; Aiyagari, 1994) and more recent empirical work, e.g. Mian, Rao, and Sufi (2013), suggest that debtors are likely to have a higher MPC than creditors. Since farmers had large mortgage debt burdens in early 1933, a transfer of income to farmers could well have raised aggregate demand. Consistent with this hypothesis, in section 4 we estimate that the farm channel's effect on consumption was largest in those areas most encumbered by farm mortgage debt.

Guided by the empirical evidence for a redistribution effect, in section 5 we build a simple incomplete-markets model that explicitly takes into account the farm channel's benefits to farmers and its costs to those purchasing farm goods. In our model, farmers are liquidity constrained, so their MPC is high relative to that of capitalists. Therefore, a redistribution of income from capitalists to farmers raises aggregate demand. There are no offsetting general equilibrium effects because final goods prices are sticky and (as in the data) the nominal interest rate is at the zero-lower bound. Under these conditions, the aggregate output effect of the farm channel is bounded below by our cross-sectional estimate multiplied by the aggregate farm income share. This product is 9–18%. Over the estimation window of our cross-sectional regressions, industrial production grew 32%. Thus the model suggests that the farm channel accounted for 25-50% of spring 1933 growth. Given the simplicity of the model, this range should be seen not as a precise quantitative estimate, but rather as an indicator of the possible magnitude of the farm channel's aggregate effects.

Like us, Friedman and Schwartz (1963), Edwards (2015), and Rauchway (2015) emphasize the priority that the Roosevelt administration put on raising the price of agricultural goods. According to Edwards (2015) p. 20, Henry Morgenthau, head of the farm relief administration and later treasury secretary, "believed that uncoupling the value of the dollar from gold was a requisite to increase agricultural prices and, in that way, bring relief to farmers. His main concern was not gold itself, but relative prices; for him the goal of policy - and a required step towards recovery - was increasing the price of agricultural products relative to manufacturing goods." This is consistent with the view of George Warren and Frank Pearson (Warren and Pearson, 1935), the former of whom was an important economic advisor to Roosevelt. Bessler (1996) summarizes Warren's views, and using VAR analysis, he estimates a tight link between the exchange rate and crop prices. That crop prices responded more – and more rapidly – than the overall price level to devaluation also fits with the current understanding that commodity prices are particularly flexible (Nakamura and Steinsson, 2008), a view that was formalized in Bordo (1980).

The literature on the initial recovery in spring 1933 includes Temin and Wigmore (1990), Eggertsson (2008), Jalil and Rua (2015), Taylor and Neumann (2016) and Sumner (2015). All argue that a regime change played a positive role. By taking the U.S. off the gold standard and explicitly voicing his desire for higher prices, these papers credit Roosevelt with inducing inflation expectations and reducing ex-ante real interest rates, thus stimulating demand for investment goods and consumer durables. The literature on the initial 1933 recovery has generally focused on expectations,[4] in part because there was little change in monetary policy. In spring and summer 1933, the high-powered money supply declined, and the broad money stock was essentially unchanged (Friedman and Schwartz, 1963, tables B-3 and A-1). Thus the mechanism emphasized by Eichengreen and Sachs (1985) for Europe, and Romer (1992) for the U.S., in which leaving the gold standard led to monetary expansion, could not have been operational in the initial months of the U.S. recovery.

Temin and Wigmore argue that a weaker dollar not only led to higher expected inflation, but also was expansionary through its effect on current and expected farm incomes.

[4] An exception is Taylor and Neumann (2016) who, like us, look beyond inflation expectations to explain the spring 1933 recovery. Though they do not consider the farm channel, they do find evidence of positive effects on some industries of dollar devaluation.

They were the first (and have remained the only) authors in the modern economics literature to emphasize the importance of farmers in 1933. But they are only to able to provide circumstantial evidence for the farm channel's importance.[5] We build on their work by providing econometric evidence for each stage of the farm channel's operation, and by explicitly considering the general equilibrium implications of higher farm product prices.

While not focussed specifically on the turn-around in spring 1933, Fishback, Horrace, and Kantor (2005) and Fishback and Kachanovskaya (2015) examine the effect of Agricultural Adjustment Administration (AAA) payments on recovery during the 1930s.[6] They find small or negative effects of AAA payments on county-level retail sales and state-level income. Like devaluation, AAA payments redistributed income from nonfarmers to farmers. But while devaluation encouraged farm production by raising the price of farm products, AAA payments were given to farmers in exchange for *lower* production. An important consequence was that the AAA, unlike devaluation, provided incentives for farmers to displace sharecroppers and tenants (Depew, Fishback, and Rhode, 2013). And whereas devaluation transferred income to farmers in spring 1933 when farmers were suffering from severe debt-deflation, AAA payments came primarily after 1933, when debt problems were less acute. Thus, that the AAA had negative effects on local areas is entirely consistent with our finding of positive effects from devaluation-driven higher farm product prices in spring 1933.

Our emphasis on the importance of farmers' debt positions in spring 1933 aligns with the literature emphasizing debt deflation as a cause of the Great Depression. Fisher (1932) and Fisher (1933) first argued for this mechanism as a cause of the Great Depression, and Fisher (1933) credits Roosevelt's policies with ending the debt-deflation cycle. Hamilton (1987, 1992) provides evidence that the deflation during the Great Depression was unanticipated, concluding that the contraction was caused by debt-deflation and bank-failures rather than

[5]Temin and Wigmore's principal evidence comes from a state-level regression of the level of auto sales in all of 1933 on farm income and other income in 1933. They interpret a larger coefficient on farm income as evidence in support of their hypothesis. While suggestive, this regression has three limitations: first, the left-hand side variable is the level of auto sales, while their hypothesis is about the *growth* of auto sales. Second, the farm income regression coefficient is positive and large for all years from 1932 to 1940, suggesting that these results are not necessarily informative about events in 1933 *per se*. Third, the regression uses annual data, hence it conflates auto sales in the period of interest, spring 1933, with sales later in the year.

[6]The industry equivalent of the AAA, the National Industrial Recovery Act (NIRA), encouraged firms to collude and raise prices and wages. The NIRA has been credited with both slowing recovery (Cole and Ohanian, 2004) and accelerating it (Eggertsson, 2012). Regardless, the effects of the NIRA were likely primarily felt after spring 1933, since the law was not enacted until June 16, 1933.

high ex-ante real interest rates. And Mishkin (1978) emphasizes the general importance of debt as a determinant of consumption in the 1930s, though he does not specifically focus on farmers or the MPC.

An older literature took seriously the core mechanism of our model in which devaluation has real effects by redistributing income between groups with different MPCs (e.g., Diaz Alejandro, 1965; Krugman and Taylor, 1978), although it did not consider the recovery from the Great Depression. A prominent recent literature has emphasized the importance of income redistribution for the propagation of monetary policy shocks (a partial list includes Auclert, 2015; Broer, Hansen, Krusell, and Öberg, 2016; Cloyne, Ferreira, and Surico, 2016; Kaplan, Moll, and Violante, 2016; McKay, Nakamura, and Steinsson, 2015; Werning, 2015). Our results are consistent with this emphasis, although we stress the redistribution effect of an exchange rate movement rather than a monetary policy shock.

This paper is also relevant to our understanding of macro policy at the zero lower bound. In the U.S. in spring 1933, short-term interest rates were near zero, and hence conventional monetary policy was ineffective. Economists continue to debate the extent to which unconventional monetary policy can stimulate an economy in these conditions (e.g., Woodford, 2012). In these debates, the U.S. experience in 1933 serves as an example of what policy may be able to achieve (Romer, 2014). For instance, the governor of the Bank of Japan, Haruhiko Kuroda, has used 1933 as a reference point for his ongoing attempts at a regime change in Japan (Kuroda, 2015). To the extent that recovery in spring 1933 was helped along by redistribution to high-MPC farmers, however, the spring 1933 analogy may be an overly optimistic guide to the effect of a monetary regime change alone (Hausman and Wieland, 2014, 2015).

2 Spring 1933: Relative farm prices rose

Central to our argument for the importance of agriculture in 1933 is the behavior of agricultural prices. Figure 2 graphs the overall CPI and the BLS index of farm product prices. From 1932 to 1934, there was relatively little change in the CPI, though it did rise 3% between June and July 1933. By contrast farm product prices rose 40% in these four months. The figure suggests a possible cause of this large price change: devaluation. In the three months following devaluation on April 19th, the dollar depreciated by 30 percent relative to the British pound; a third (10 percentage points) of this weakening occurred in the 48 hours between noon on April 18th and noon on April 20th (*Commercial and Financial Chronicle*, 4/22/1933, p. 2667). The exchange rate vis a vis many other currencies behaved similarly: against the French franc, the dollar depreciated 34%; against the German mark, 36%.[7] Since prices of traded farm products were set in world markets, when the dollar depreciated, the dollar price of many farm products rose.

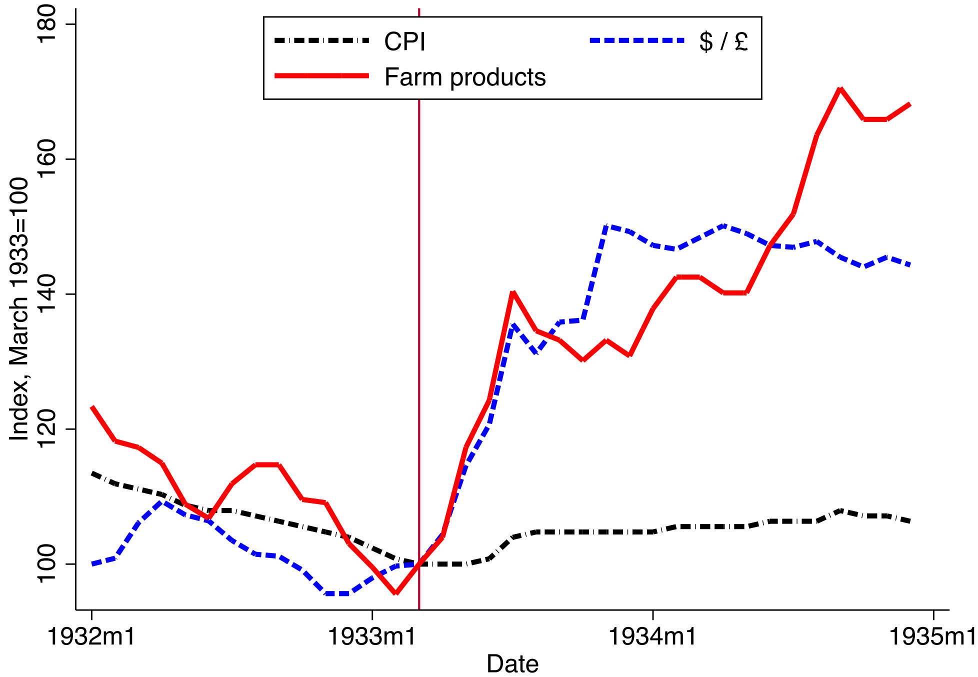
This effect of devaluation on farm prices was no accident; as discussed in the introduction, raising the relative price of agricultural products was an explicit goal of the Roosevelt administration. Roosevelt himself frequently and publicly emphasized this. The quote beginning the paper comes from a campaign speech given by Roosevelt in October 1932. As president, he repeated this message. For instance, in a fireside chat in October 1933, Roosevelt said: "I do not hesitate to say in the simplest, clearest language of which I am capable, that although the prices of many products of the farm have gone up and although many farm families are better off than they were last year, I am not satisfied either with the amount or the extent of the rise, and that it is definitely a part of our policy to increase the rise and to extend it to those products which have as yet felt no benefit. If we cannot do this one way we will do it another. Do it, we will."[8] Weakening the dollar was part of this strategy. As Friedman and Schwartz (1963), p. 465 put it: "The aim of the gold policy was to raise the price level of commodities, particularly farm products and raw materials . . ."

We show that the administration succeeded in this goal, in other words we identify a causal effect of devaluation on farm prices. To do this, we examine the announcement effect of the U.S. departure from the gold standard on daily spot and future prices. This approach complements the analysis in Bessler (1996). Bessler (1996) conducts a VAR analysis with daily data on gold, cotton, corn, hog, and lard prices; he concludes that gold price movements explain most of the 1933 increase in cotton, corn, and lard prices. We use a narrower

[7] *Survey of Current Business*, 12/1933, p. 31. The Canadian dollar also weakened against major currencies in spring 1933, so between March and July 1933, the U.S. dollar weakened only 12% against the Canadian dollar.

[8] Complete speech available at Fireside chat, 10/22/1933.

Figure 2 – The CPI, the exchange rate, and farm prices



Note: The vertical line indicates March 1933, the month before the U.S. devalued. Sources: CPI data from FRED series CPIAUCNS; exchange rate from *Survey of Current Business*, 12/1932 p. 32, 12/33 p. 31, 12/34 p. 32, 12/35 p. 33; farm product price index from *Federal Reserve Bulletin*, 12/1932 p. 788, 12/1933 p. 783, 4/1935 p. 237.

date range but a broader range of farm products. For the purpose of understanding the causal effect of devaluation on farm prices, this has the advantage that there are likely fewer confounding factors in a narrow time window, and that any product-specific shocks average out over a large range of products.

We examine daily data on the exchange rate and the price of wheat, cotton, corn, oats, lard, pork belly, hogs, steers, and lambs around the date of devaluation, April 19^{th}. These data are presented in figure 3. Between noon on April 18^{th} and noon on April 20^{th}, the dollar depreciated slightly more than 10%.[9] Over this period, most crop prices rose by a similar amount. The obvious exception was wheat, whose price was negatively affected by news on April 19^{th} of beneficial rains in winter wheat-growing areas (Wood, 1933).

[9]The *Commercial and Financial Chronicle* emphasized unusual conditions in the foreign exchange market in this period. They seemed to think or hope that the dollar's depreciation would not persist. In their words (4/22/1933, p. 2664): "[F]oreign exchange transactions in all markets except as they originate in speculative movements have been brought to a virtual standstill. Hence it follows that the present exceptionally high quotations for sterling and the major European currencies with respect to the dolar are largely nominal, not to say fictitious and unwarranted."

Beyond the close co-movement of crop prices with the exchange rate over this narrow time window, three additional pieces of evidence strongly suggest a causal role for devaluation. First, for cotton we observe Liverpool, England prices. As shown in figure 3, around the date of devaluation, Liverpool cotton prices expressed in sterling were nearly unchanged. This strongly suggests that the change in the dollar price of cotton was a causal effect of devaluation rather than a response to other shocks. Second, the prices of hogs, steers, and lambs did not respond to devaluation. This is likely because these animals were not traded internationally and did not have tradable substitutes (like wheat for corn and oats). So we would not expect their prices to be affected by devaluation, although we note that tradable derivative products (lard, pork belly) do respond. Third, narrative evidence attributes the increase in crop prices to devaluation. The *Chicago Tribune* (Wood, 1933) wrote "Yesterday's [April 19^{th}'s] commodity price advances were attributed almost entirely to the administration's announcement of its inflation program and the consequent decline of the dollar in foreign exchange." Similarly, the *Commercial and Financial Chronicle* (4/22/1933, pp. 2820, 2823) credited the U.S. departure from the gold standard with raising cotton and wheat prices.

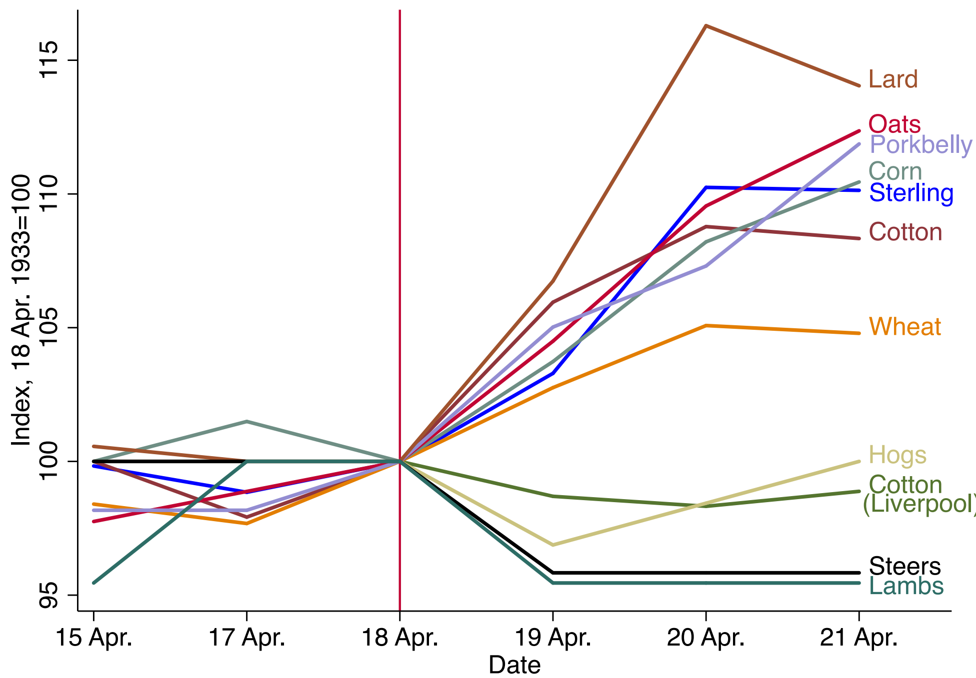
Figure 4 shows the behavior of wheat, cotton, corn, and oats futures prices around the day of devaluation. These are the same data used by Hamilton (1992) to measure inflation expectations in the 1930s. Like spot prices, wheat and cotton future prices rose significantly, even for the furthest dated contracts. This suggests that people believed the effect of devaluation on farm prices would be persistent.[10]

Thus far we have focused on an analysis of daily prices in a narrow window around devaluation, since this provides the best setting for identifying the causal effect of devaluation. But what mattered for farmers was the path of prices and production over the entire spring. Table 1 summarizes prices and production for the 11 farm products with greater than $100 million of farm value in 1932.[11] The top panel provides data for crops and the bottom panel for animal products. For reference, the first column shows the dollar / pound exchange rate.

[10]The behavior of farm land prices also suggests that at least some of the increase in farm prices and incomes was expected to be long-lasting. For the country as a whole, farm land prices rose 4% between March 1, 1933 and March 1, 1934 (Stauber and Regan, 1935b, table 1, pp. 6-7).

[11]Farm value is physical production times the producer price. In addition to the products in the table, butterfat had a farm value of greater than $100 million. We exclude it from the table because it is a by-product of milk production.

Figure 3 – The exchange rate and farm prices after devaluation



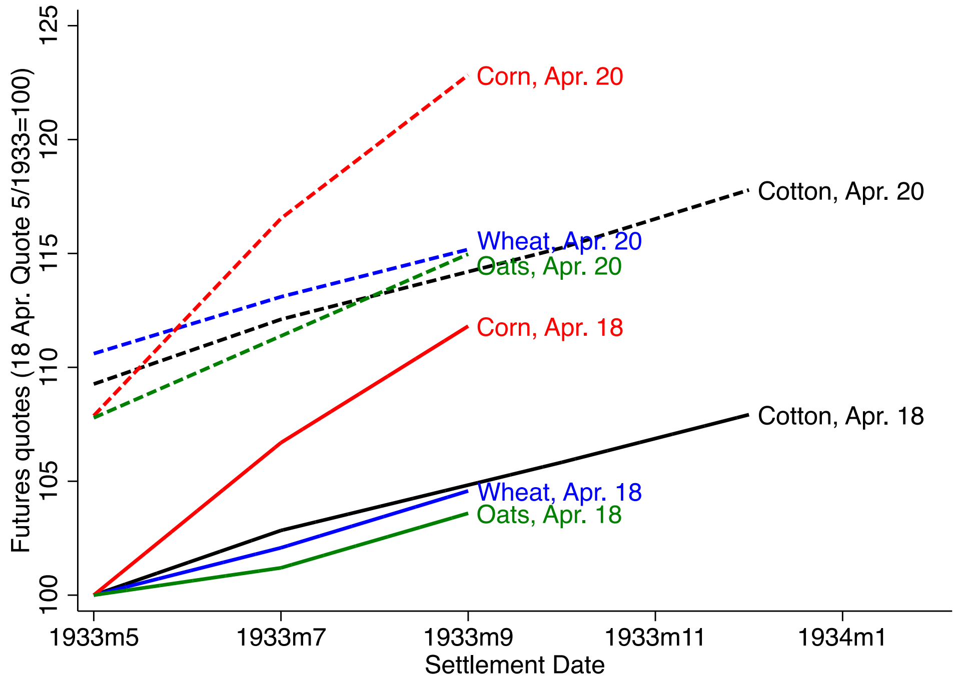
Note: The vertical line indicates April 18, 1933, the day before the U.S. devalued. All prices are indexed to 100 on that day. Sources: The exchange rate is the noon buying rate in New York; the U.S. cotton price is the New York price for Middling Upland, and the wheat price is the New York closing price for No. 2 red. These are from the *Commercial and Financial Chronicle*, 4/22/1933, p. 2667 (sterling), p. 2821 (cotton), and p. 2823 (wheat). The corn, lard, pork belly ("dry salted bellies") and hog spot prices are the low prices from *Annual Report of the Trade and Commerce of Chicago* for the year ended December 31, 1933 (1934), p. 98-99.

It makes clear that the greatest weakening of the dollar occurred from April to May and then again from May to June. The top panel shows that grain and cotton prices followed a similar pattern of large price increases between April and May and again between June and July.

The mechanism through which devaluation affected farm prices is clearest for the traded crops of cotton, wheat, and tobacco. As Friedman and Schwartz (1963), pp. 466 describe:

> The prices of [traded] commodities in foreign currencies were determined by world demand and supply and were affected by events in the United States only insofar as these, in turn, affected the amounts supplied and demanded by the United States. Even then, such prices were affected much less than in proportion to the changes in U.S. sales and purchases. Hence, the decline in the foreign exchange value of the dollar meant a roughly proportional rise in the dollar price of such

Figure 4 – Devaluation and futures prices



Notes: Devaluation occurred on 19 April, 1933. Source: *Commercial and Financial Chronicle*, 4/22/1933, p. 2820 for cotton and p. 2823 for wheat; low prices from *Annual Report of the Trade and Commerce of Chicago* for the year ended December 31, 1933 (1934), p. 99 for corn and oats. Our use of low prices follows that in Hamilton (1992).

> commodities, which is, of course, what did happen to the dollar prices of cotton, petroleum products, leaf tobacco, wheat, and similar items.

It is less obvious how devaluation raised the price of other crops. From the monthly data alone one might hypothesize that devaluation had no causal effect on the price of nontraded crops, with prices of products such as corn rising for independent reasons. But our analysis of daily spot and futures prices strongly suggests that devaluation did have a causal effect.

A likely channel through which devaluation affected the prices of the principal nontraded grains, corn and oats, was through substitution. For instance, wheat, corn, and oats could all be used as animal feed (Davis, 1935, p. 23; Taylor, 1932, p. 129). Substitution between grains meant that as a weaker dollar increased the price of traded grains such as wheat, it would also have put upward pressure on the price of nontraded grains such as oats and corn. Indeed, Taylor (1932, p. 170) identifies the price of wheat as one of the determinants of the price of corn.

Accepting that substitution may explain the response of nontraded crop prices to deval-

Table 1 – Farm product prices

Panel A: Crops

	\$ / £	Wheat	Corn	Oats	Cotton	Tobacco	Hay	Potatoes
Prices (Index, 3/1933=100)								
March	100	100	100	100	100	100	100	100
April	104	130	137	124	100	95	104	109
May	115	171	189	158	134	90	108	112
June	121	170	195	169	143	105	109	127
July	136	252	269	285	174	400	119	251
August	131	217	237	235	144	203	128	336
1932, average	102	110	154	115	107	164	105	101
1933, average	123	215	253	244	167	187	137	211
1934, average	147	246	396	350	203	280	234	120
Production								
1932 farm value (\$, millions)		284	925	195	424	108	516	141
1932-1933 change in quantity (%)		−29	−19	−41	0	34	−10	−11
1933 gross trade share, $\frac{(X+M)}{Y}$ (%)		9	0	0	62	39	0	1
AAA intervention in 1933		Yes	Yes	No	Yes	Yes	No	No

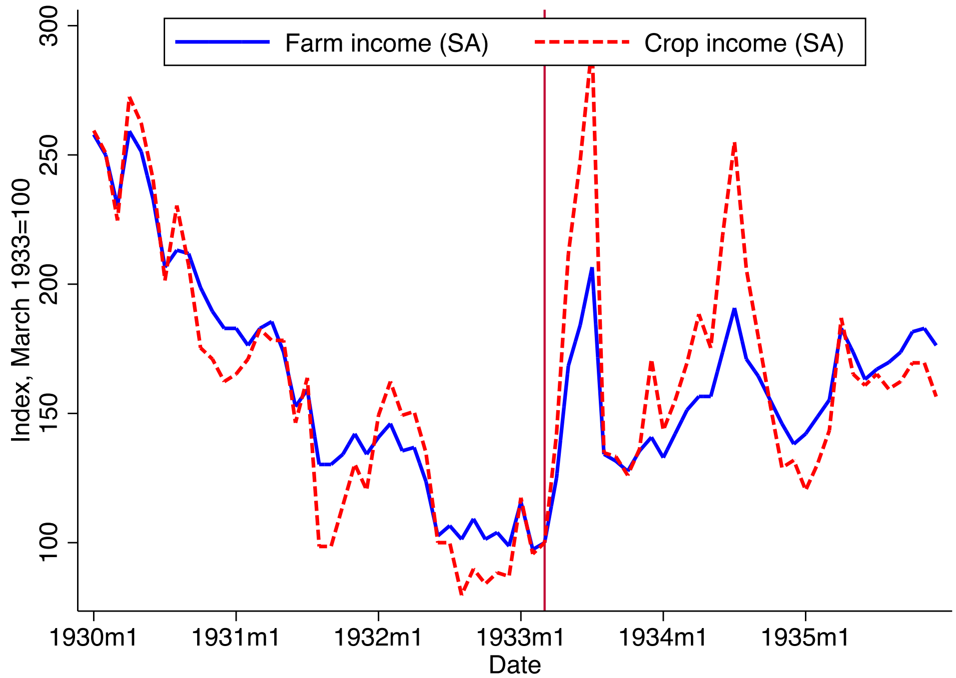
Panel B: Animal products

	\$ / £	Cattle	Hogs	Milk	Chickens	Eggs
Prices (Index, 3/1933=100)						
March	100	100	100	100	100	100
April	104	104	100	98	108	102
May	115	115	120	104	114	117
June	121	118	123	110	110	100
July	136	116	124	121	114	130
August	131	111	118	126	108	132
1932, average	102	119	107	117	122	141
1933, average	123	106	122	119	100	137
1934, average	147	113	130	138	123	168
Production						
1932 farm value (\$, millions)		503	540	1314	267	374
1932-1933 change in quantity (%)		8	8	3	1	−1
1933, gross trade share, $\frac{(X+M)}{Y}$ (%)		1	6	N/A	N/A	N/A
AAA intervention in 1933		Yes	Yes	Yes	No	No

Notes and sources: Prices are producer prices (prices received by farmers) with monthly prices as of the 15^{th} of the month and annual prices a weighted average for the crop season. Farm value equals physical production times the annual price. The presence or absence of AAA intervention is based on facts reported in Nourse, Davis, and Black (1937) and United States Department of Agriculture (1934a). For further notes and source details, see appendix B.

uation, a puzzle remains: why did crop prices rise more than the dollar weakened? One probable factor was the decline in production of most crops in 1933 (table 1). This decline

Figure 5 – Farm income



Note: The vertical line indicates March 1933, the month before the U.S. devalued. Sources: 1930-31: U.S. Department of Commerce, 1934, p. 19; 1932-35: U.S. Department of Commerce, 1936, p. 9.

was in large part due to drought (United States Department of Agriculture, 1934b,a), but Agricultural Adjustment Administration (AAA) programs to reduce acreage also contributed for some crops (indicated in the table). Another explanation is that economic recovery itself contributed to higher farm prices, since farm prices are expected to react quickly to aggregate demand (Bordo, 1980).

Panel B shows price and production behavior for animal products. Like corn, oats, and potatoes, animal products were mostly nontraded. But unlike corn and oats, animal products were perhaps less likely to be close substitutes, and their production did not decline in 1933. Thus unlike crop prices, animal product prices rose only moderately in spring 1933. This fits with the lack of response of hog, steer, and lamb prices to devaluation shown in figure 3. In the next section, we will take advantage of the quite different behavior of crop and livestock prices to examine the relationship between higher farm product prices and farmers' consumption.

Figure 5 shows that higher farm prices translated quickly into higher farm incomes. The Department of Agriculture's seasonally adjusted index of income from crops rose 193% from

March 1933 to July 1933, that of total farm income (crop and animal products) rose 107%. On a non-seasonally adjusted basis, total farm income was higher in June and July 1933 than it had been in any month after April 1931 (U.S. Department of Commerce, 1936, p. 9). Importantly, this increase occurred despite a decline in the production of most crops (table 1).

To sum up, the evidence strongly suggests that devaluation accounted for a significant part of the increase in crop prices, and thus the increase in farm income, in spring 1933. The evidence for this statement is strongest for traded crops, but other grains, such as corn and oats, also responded to devaluation. This conclusion matches that of Bessler (1996) and Friedman and Schwartz (1963). In the words of Friedman and Schwartz (1963) (p. 466): "The aim of the gold policy to raise prices of farm products and raw materials was therefore largely achieved."

3 Farm consumption

In this section, we explore the effect of higher farm prices on farm consumption. This is a partial equilibrium exercise in which we compare consumption in areas with more farmers or greater crop value per capita to areas with fewer farmers or less crop value per capita. Relatively higher consumption in farm-intensive areas is a necessary condition for a positive effect of higher farm prices on aggregate output. But it is not a sufficient condition, since aggregate effects also depended on the response of nonfarm areas to higher farm product prices. In sections 4 and 5, we will consider these general equilibrium effects of higher farm product prices.

3.1 Data We use new auto sales as our main outcome variable to measure the strength of the farm channel. Unlike other measures of consumption, auto sales were reported at the state and county level and at reasonably high frequency: monthly at the state level and annually at the county level. Of course, car sales are only one part of consumption, but they are a good measure for present purposes, because they are likely to have been correlated with overall consumption, and because auto sales were a significant driver of the recovery in industrial production. Between March and July 1933, seasonally adjusted auto production rose 152%. And while auto production itself had only a 4.8 percent weight in the Federal Reserve industrial production index (Federal Reserve (1940), p. 761), Temin and Wigmore (1990) argue that as a large consumer of steel and other inputs, developments in the auto industry had large effects on industrial production and the economy as a whole.[12]

We collected data on new passenger car sales by state from the *Automotive Daily News Review and Reference Book* (1935, pp. 22-23), and by county from *Sales Management.*[13] In what follows we use a combination of monthly state auto sales and annual county auto sales to establish the importance of the farm channel. We seasonally adjust the monthly state auto sales using twelve monthly dummies, excluding the year 1933 to avoid conflating the rapid recovery in spring with a seasonal effect. Since this leaves us with only five years to estimate seasonals (1929-32 and 1934), we also report outcomes for non-seasonally adjusted data.[14]

While the county data allow us to estimate the effect of many covariates in a way that is not possible with the 49 observations in a cross-state regression, the county data also come with three disadvantages. (1) They are annual rather than monthly, providing only an imperfect window into the crucial March-July 1933 period. (2) They suffer from some reporting error. We know this because uniquely for Wisconsin, we have official data on new car registrations by county to which we can compare the data in *Sales Management.* Across the 48 Wisconsin counties for which *Sales Management* provides data on 1932 sales, the correlation between the 1932-33 percent change in *Sales Management* and that in the official data is 0.85. This is high enough to reassure us that there is a strong signal in the *Sales Management* data, but it also indicates substantial reporting error.[15] Since the

[12]For further discussion of the macroeconomic importance of the auto industry in the 1930s, see Hausman (2016b).

[13]Data on the percent change in car sales between 1932 and 1933 are provided in *Sales Management*, 4/20/1934, pp. 363-404. Data on 1933 and 1934 sales are provided in *Sales Management*, 4/10/1935. We calculate the level of sales in 1932 by applying the percent change given in *Sales Management* to the 1933 level of sales.

[14]We do not have access to monthly data before 1929, and the seasonals are different after 1934, because in 1935 car manufacturers changed from introducing new models in January to introducing new models in October or November (Cooper and Haltiwanger, 1993).

[15]Official new car registration data for Wisconsin are from "Report of New Car Registrations for the Year 1932" and "Report of New Car Registrations for the Year 1933." Both are available at the Wisconsin State Historical Society. In the empirical work described below, we substitute the official data for the *Sales Management* data for Wisconsin.

change in auto sales will be our dependent variable, not our independent variable, this error is more likely to increase our standard errors than it is to bias our estimates. (3) The third disadvantage of the county relative to the state data is that it is incomplete. *Sales Management* provided data on 1932 sales for 2158 counties[16] out of a total of 3100 U.S. counties.[17] But *Sales Management* covered most counties with substantial population and auto sales. Thus while the data cover 70% of U.S. counties, they account for 86% of 1932 auto sales. Appendix figure 13 shows a map of the county sales data coverage.

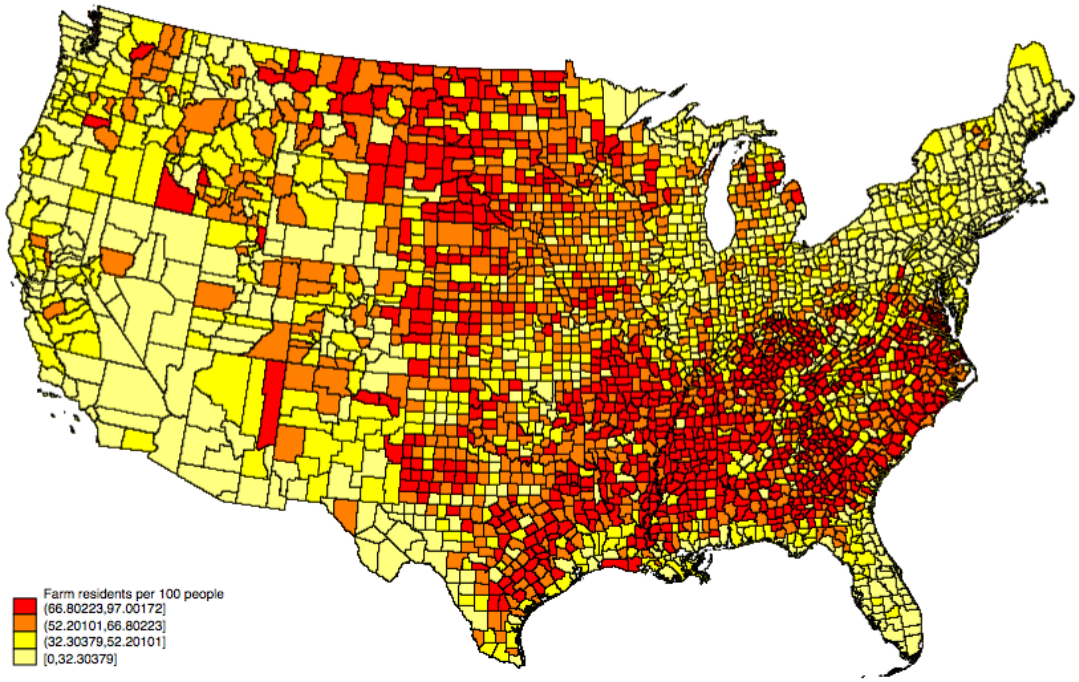
Our independent variables of interest measure the agricultural intensity of a state or county. Figure 6a shows the share of each county's population living on farms in 1930. Darker shading indicates more of the population living on farms. States with large cities, such as Illinois or New York, had small shares of their population on farms. States in the Great Plains and the South had high shares. There is also substantial variation within states between rural and urban areas and between rural farm and rural nonfarm areas. For instance, the upper peninsula of Michigan was a rural area with few farmers. Of course, many farmers were engaged in the production of livestock products whose prices moved relatively little in 1933. Thus, as an alternative measure of the importance of a channel from devaluation to consumer demand, we look at the value of crops sold per capita in 1929. Variation across counties in this variable is shown in figure 6b. For this variable, the highest values are in the Great Plains. Like farm share, the value of crops sold per capita is on average low in urban states.

3.2 Cross-state results Figure 7a shows a scatter plot of the farm share of the population and the seasonally-adjusted change in car sales from the October 1932-March 1933 average to the July-December 1933 average. We show the change between six-month averages since single month (or quarter) values have large amounts of noise that is more likely due to idiosyncratic variation than it is to macro shocks. There is a clear positive relationship, with auto sales growing faster in farm areas. Figure 7b replaces farm share with the per capita value of crops sold in 1929. There is again a positive relationship.

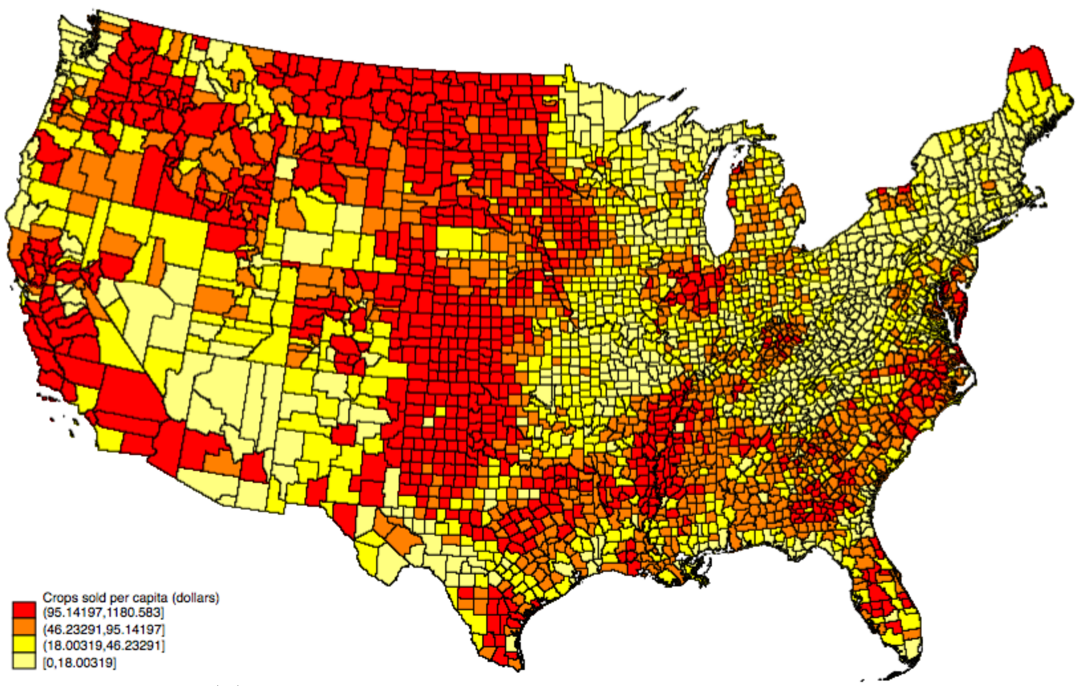
[16] With the addition of the official new registrations data from Wisconsin, we cover 2181 counties.

[17] This is the number of counties in 1930, minus 2, because Campbell and Milton county Georgia merged with Fulton county Georgia at the end of 1931.

Figure 6 – Agricultural intensity by county



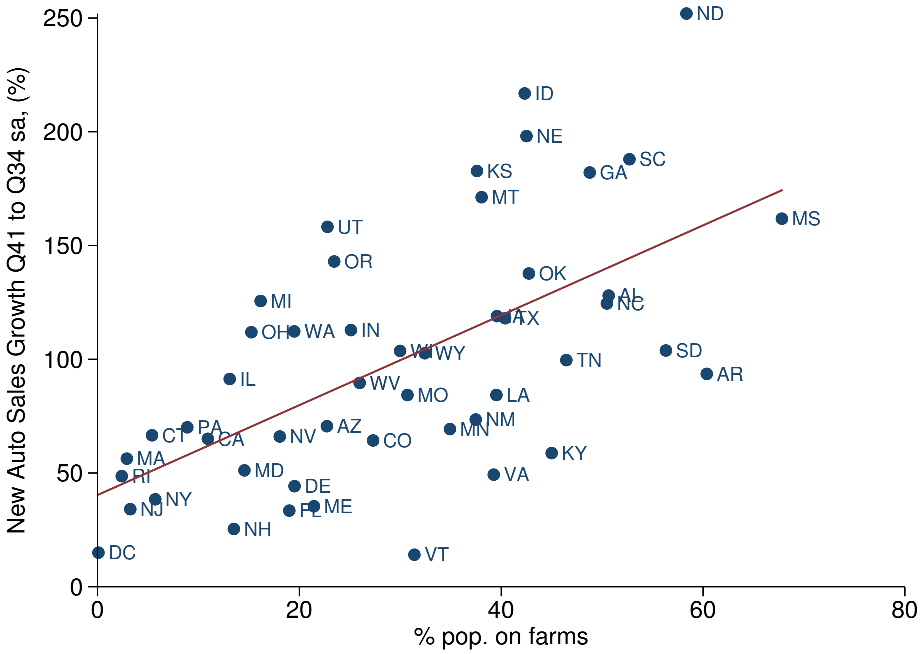
(a) Farm residents per 100 people in 1930



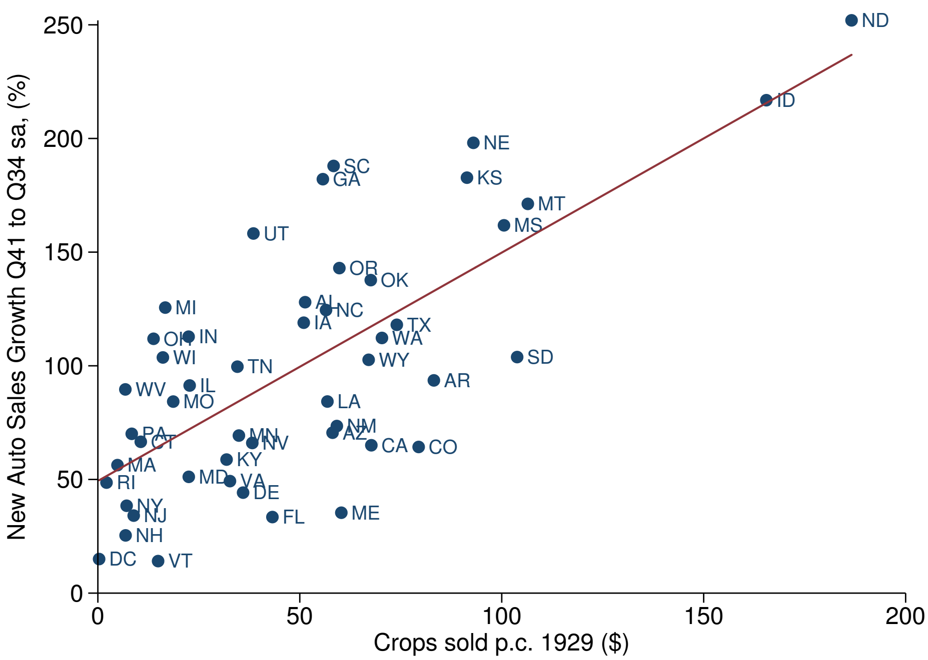
(b) Value of crops sold or traded per capita in 1929

Note: Darker colors denote more farm residents or a larger dollar value of crops sold per capita in a county. Source: Farm population data are from the 1930 Census as reported in Haines and ICPSR (2010). Crops sold are from the 1940 Census as reported in Haines et al. (2015).

Figure 7 – Percent change in car sales and farm channel exposure



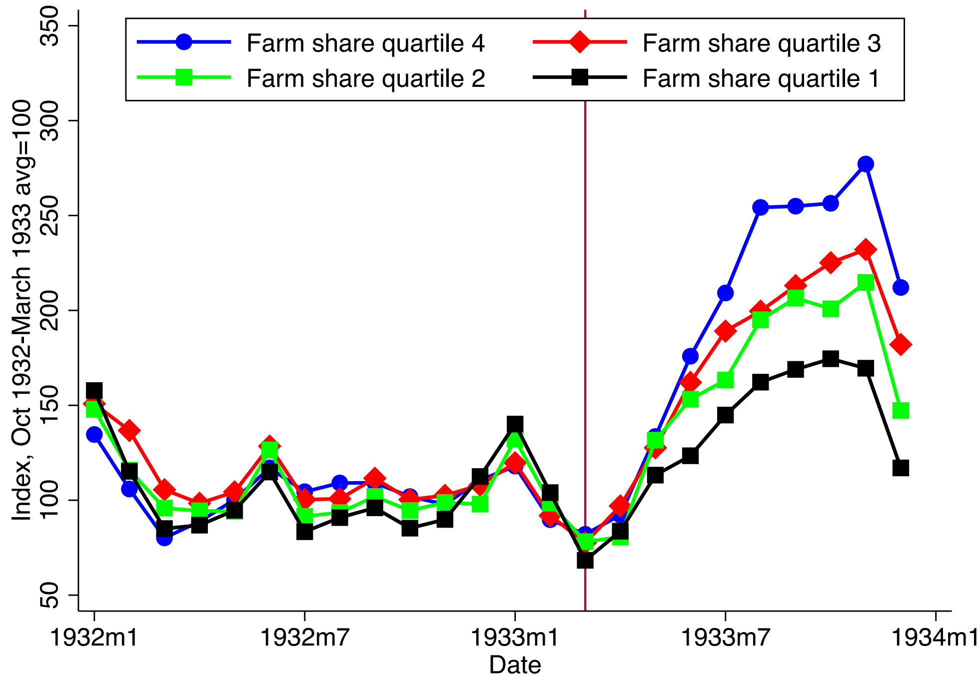
(a) Farm population share



(b) Crops sold per capita

Note: Auto sales growth is measured as the percent change in seasonally-adjusted auto sales from the October 1932-March 1933 average to the July-December 1933 average. The straight line is the OLS regression line. Sources: Auto sales - see text. Farm share - the 1930 Census as reported in Haines and ICPSR (2010). Crops sold - the 1940 Census as reported in Haines et al. (2015).

Figure 8 – Auto sales by farm share quartile



Note: Quartiles are based on 1930 farm share. They are constructed by first indexing each state to 100 for October 1932-March 1933 and then averaging across states in a quartile. Sources: Auto sales - see text. Farm share - the 1930 Census as reported in Haines and ICPSR (2010).

The scatter plots already highlight several features of the farm channel. First, with the exception of Utah, the ten states with the most rapid auto sales growth were all either in the top quintile of wheat production per capita (North Dakota, Kansas, Montana, Idaho, Nebraska, and Oregon) or in the top quintile of cotton production per capita (Mississippi, South Carolina, Georgia). Relatedly, the most rapid auto sales growth was not concentrated in one specific region of the country, and there was substantial variation within regions. Second, farm share of the population and crops sold per capita do not strongly correlate with population; Texas was a large-population state highly exposed to the farm channel, whereas New Hampshire and Vermont were small-population states little exposed to the farm channel. The overall correlation between farm share and state population was -0.28; between crops sold per capita and state population, -0.34.

As an alternative visualization, we group states into quartiles based on their 1930 farm population share. We then base each states' auto sales at 100 for October 1932-March 1933 and average across all states in the quartile. Figure 8 plots the evolution of auto sales in each quartile in 1932 and 1933. While low farm-share states and high farm-share states followed roughly similar trends up to March 1933, thereafter there is a clear divergence, as auto sales in more agricultural states grew faster.

A concern is that this strong bivariate relationship is driven by a third variable. Hence we estimate cross-sectional regressions of the form:

$$\%\Delta\text{Auto sales}_i = \beta_0 + \beta_1 \text{Agricultural indicator}_i + \gamma' X_i + \varepsilon_i, \tag{1}$$

where "Agricultural indicator" is an indicator of a state i's exposure to the farm channel, and X is a set of control variables.

The first four columns of the top panel of table 2 show results from a regression of the percent change in seasonally adjusted auto sales on the share of a state's population living on farms and four different sets of control variables. Column 1 corresponds to figure 7a and is a univariate regression without controls. The coefficient on the farm share of the population is positive, statistically significant, and economically large. It implies that a one standard deviation increase in the farm share (17%) raises auto sales growth in the 1933 recovery by 34.1 percentage points ($1.98 \cdot 17.2 = 34.1$). As another benchmark, a coefficient of 1.98 means that if a state's farm share rose from 11 percent (that in California) to 50 percent (that in North Carolina), then auto sales growth would be 77.2 percentage points higher ($(50 - 11) \cdot 1.98 = 77.2$).

Column 2 includes state population levels, new cars sold per capita in 1929, the black population share, and census region fixed effects. We add these control variables to ensure that we do not conflate the farm channel with other variables that could correlate with a recovery. For example, farm states tended to be smaller and, at least in the south, had a higher black population share. The number of new cars sold per capita is also lower in the south, but otherwise does not correlate strongly with the farm population share. Further, by including region fixed effects, we check that the results are not driven by one region, such as the south. The fact that the coefficient in column 2 is essentially the same as that in column 1 suggests these concerns are unwarranted.

In column 3 we include 6 lags of the dependent variable. We believe that these lags are likely an over-control, because farm areas did worse in the Great Depression, and we are

Table 2 – Auto sales growth in spring 1933 (% changes)

Panel A: Farm population share

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
% pop. on farms	1.98***	2.04***	1.16***	1.07*	1.78***	2.21***	2.01***	1.51**
	(0.35)	(0.54)	(0.43)	(0.59)	(0.51)	(0.70)	(0.45)	(0.65)
Population (millions)		2.29		0.56		−2.13		−0.65
		(1.74)		(2.19)		(1.73)		(2.74)
New cars p.c. 1929 (1000s)		0.47		−0.86		0.14		−0.98
		(0.99)		(1.09)		(1.15)		(1.01)
% pop. black		0.82		0.40		0.90		1.74
		(0.74)		(0.87)		(1.02)		(1.13)
Seasonally Adjusted Auto Sales	Yes	Yes	Yes	Yes	No	No	No	No
Region Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Lagged Dependent Variable	No	No	Yes	Yes	No	No	Yes	Yes
R^2	0.38	0.54	0.66	0.68	0.25	0.38	0.62	0.68
Observations	49	49	49	49	49	49	49	49

Panel B: Crops sold or traded per capita

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Crops sold p.c. 1929 ($)	1.00***	0.89***	0.57***	0.59***	0.86***	0.94***	0.71***	0.61***
	(0.099)	(0.13)	(0.14)	(0.17)	(0.18)	(0.17)	(0.16)	(0.17)
Population (millions)		1.65		0.45		−2.94*		−1.50
		(1.84)		(1.92)		(1.49)		(2.35)
New cars p.c. 1929 (1000s)		−0.89		−1.41		−1.36		−1.91**
		(0.80)		(0.86)		(0.99)		(0.81)
% pop. black		0.72		0.20		0.80		1.60
		(0.76)		(0.84)		(1.05)		(1.08)
Seasonally Adjusted Auto Sales	Yes	Yes	Yes	Yes	No	No	No	No
Region Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Lagged Dependent Variable	No	No	Yes	Yes	No	No	Yes	Yes
R^2	0.52	0.64	0.67	0.73	0.31	0.47	0.53	0.69
Observations	49	49	49	49	49	49	49	49

Robust standard errors in parentheses. * $p < .10$, ** $p < .05$, *** $p < .01$

Note: The dependent variable is the percent change in auto sales from the October 1932-March 1933 average to the July-December 1933 average. In specifications controlling for lags of the dependent variable, we include the percent change in auto sales from April-September 1932 to January-June 1933, from October 1931-March 1932 to July-December 1932, and so on back to October 1929-March 1930 to July 1930-December 1930. Sources: Monthly auto sales - see text; 1929 auto sales - *Automotive Industries*, 2/22/1930, p. 267; population, percent of population on farms, and percent of population black - the 1930 Census as reported in Haines and ICPSR (2010); value of crops sold per capita - the 1940 Census as reported in Haines et al. (2015).

measuring farm exposure in spring 1933 with error by using farm exposure in 1929 / 1930. Thus, we expect some part of the farm channel to be picked up by our lagged dependent variables, biasing the coefficient on farm share downward. Consistent with this hypothesis, the coefficient on farm share shrinks when lagged dependent variables are added, but it remains economically large and statistically significant. In particular, even though column 3 contains the smallest coefficient in panel A, it implies that a one standard deviation increase in farm share would increase the growth rate of auto sales by a substantial 20 percentage points. A similar result emerges in column 4, which includes both lagged dependent variables and the time-invariant controls used in column 2.

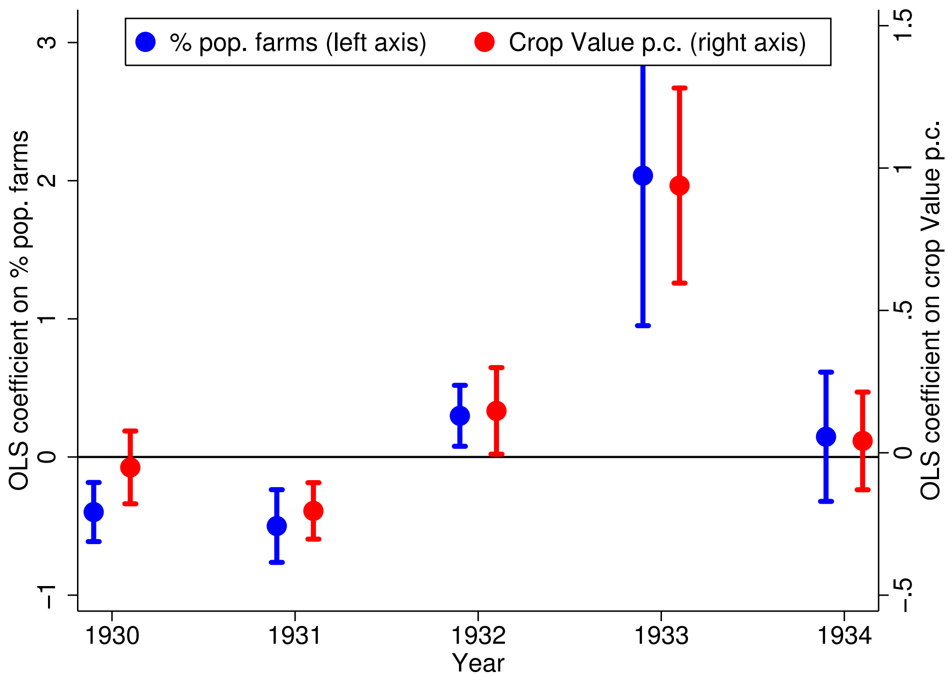
Columns 5 through 8 repeat the same set of regressions for non-seasonally adjusted auto sales growth; coefficients are similar. Thus, throughout panel A we a find strong evidence for the quantitative importance of the farm channel.

The lower panel of table 2 reproduces panel A replacing farm share with the per capita value of crops sold in a state in 1929. Again, the coefficients suggest economically significant effects. The smallest coefficient in the table, 0.57 in column (3), implies that a $1 increase in the value of crops sold per capita would increase car sales by 0.57 percentage points. The standard deviation of the per capita value of crops sold was $40, so the range of coefficients in panel B suggests that a one standard deviation increase in crops sold per person would correspond to a 23-40 percentage point increase in spring 1933 auto sales growth. This is quantitatively similar to the effect of farm share documented in panel A.

A natural question is whether auto sales always grew more rapidly in spring in states with large populations living on farms or high crop values per person. If farm states saw more rapid auto sales growth in years when there was no dollar devaluation or change in crop prices, then the preceding results would not be evidence about the effects of these policies in spring 1933. Figure 9 shows coefficients and two standard error bands from placebo tests, regressions of spring auto sales growth on farm share or crops sold for each year from 1930 to 1934 using the specification in column 2 of table 2. The large, positive, and statistically significant effect on auto sales growth is unique to 1933. This is strong evidence that the relationship between agriculture and auto sales growth reflects something specific to the 1933 recovery rather than a general relationship between agriculture and auto sales.

This finding is also consistent with our model in section 5, in which the cross-sectional estimates directly depend on the change in farm prices and farm income. In figure 5, spring

Figure 9 – Placebo regressions for the farm channel



Note: The figure plots the point estimate and 95% confidence interval from a regression of the percent change in auto sales on either the farm population share or crop value per capita. The specification is that in column (2) of panels A and B in table 2. Source: See text.

1933 stands out for the uniquely large increase in farm income; given this, the model predicts a large positive cross-sectional estimate like we see in the data. Similarly, when in 1930 and 1931 farm income falls, the negative estimates in the placebo regressions fit with the model's predictions.

Another potential concern is that the positive relationship between new car sales and agricultural exposure is only driven by small states. Based on a visual inspection of the scatter plot, we noted above that this was unlikely. A more formal test is to estimate regression (1) using population-weighted OLS. We document in appendix table 6 that our estimates are largely unchanged.[18] A third concern is that payments through the Agricultural

[18] Instead of as a percent change, one can specify the dependent variable in specification (1) as the per capita change in auto sales in spring 1933. However, if the specification in growth rates (1) is correct, then the corresponding specification in per capita changes is biased because the level of car sales per capita and its interaction with farm exposure is an omitted variable. In fact, even when $\beta_1 > 0$, this bias is so large as to yield (on average) a negative effect of agricultural exposure on car sales. We can test if our specification is correct by checking whether car sales per capita and its interaction with farm exposure are significant in the per-capita regressions; we find that this is the case. (These results are available upon request.)

Conversely, if the specification in per capita changes is correct, then our specification in growth rates is biased. But in this case the level of population-to-car-sales and its interaction should enter significantly in our specification with growth rates; we find that this is not the case. Thus, in our view the evidence favors

Adjustment Act (AAA) rather than higher farm income through farm prices caused faster recovery in agricultural states. In appendix table 7 we provide evidence that this is not the case. To avoid capturing AAA payments, which were nearly non-existent before September 1933,[19] we define the dependent variable to be the percent change in auto sales from the October 1932-March 1933 average to the July-August 1933 average. Results are generally unchanged.

3.3 Cross-county results The state-level regressions establish that there was a strong positive relationship between auto sales growth and farm exposure in spring 1933. But the variation in farm product prices discussed above suggests that these effects were likely not uniform across farmers. In particular, to understand the specific effects of devaluation, we want to examine how farmers of traded crops versus farmers of nontraded crops and livestock responded in 1933. To do this, we turn to the county-level auto sales data.

We group major crops into three categories. We group tobacco and cotton together, since a significant fraction of these crops was traded internationally (panel A, table 1). Next we use the cereals category from the Census of Agriculture, which included "[c]orn for grain; sorghums for grain; and all wheat, rye, oats, barley, emmer and spelt, buckwheat, rice, and 'mixed' gains threshed (or combined)" (United States Department of Commerce, 1942, p. IX). Among these, significant shares of the production and / or consumption of wheat, rye, barley, and rice were internationally traded, while corn, oats, and the other grains were essentially nontraded. But as discussed in section 2, corn and oat prices responded sharply to devaluation on April 18th, and the ability of users to substitute between grains provides an economic rationale for price comovement among traded and nontraded grains. Among the other major crops, we group hay and potatoes together, since they were both largely nontraded and are not obviously substitutable for tradable grains. We also measure the amount of livestock sold and the amount of dairy sold in each county. Thus in total we have five farm exposure measures.

We believe that an analysis of these five different farm product categories is best done at

our specification (1).

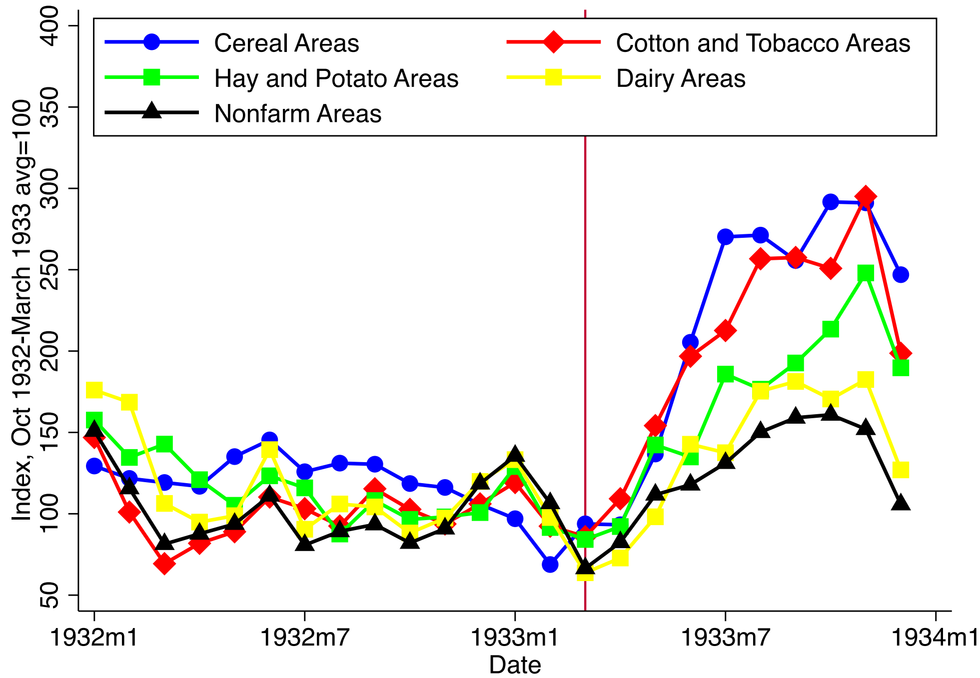
[19] United States Department of Agriculture (1935a) (table 6, p. 10) shows that before August 1933 there were no government payments to farmers for "emergency sales and rental and benefit payments." And in August 1933, these payments totaled just $8 million or 1.9% of farm cash income in that month.

the county level, where the large number of observations allows for precise inference. But as a benchmark, the first column of table 3 shows state level results. The dependent variable is again the percent change in seasonally adjusted auto sales from the August 1932-March 1933 average to the July-December 1933 average. There are strong and statistically significant positive effects in states producing cotton, tobacco, and cereals. The coefficient on hay and potato exposure is positive but very imprecisely estimated, and there is little evidence that states producing dairy or livestock products gain. Overall, the cross-sectional effects line up well with the response of prices to devaluation we documented in section 2. We find the largest gains among traded crops and close substitutes, whose prices moved closely with the exchange rate after devaluation (figure 3). By contrast, exposure to livestock or dairy, which saw less price movement after devaluation, was not associated with an improvement in auto sales.

For a direct comparison with the annual county data, in column (2) we rerun this specification using annual data. The dependent variable is now the growth rate of new auto sales from 1932 to 1933. The estimates are smaller using annual data, particularly for cereals. This decline reflects two disadvantages of the annual data in measuring the farm channel in spring 1933. First, annual data for 1933 auto sales averages the high level of auto sales in the second half of 1933 with weak sales in the first quarter of 1933 and growing but still low sales in the second quarter (figure 8). This averaging underestimates the impact of the farm channel on car sales. Second, in hay, potato and, particularly, cereal-growing areas, the average level of car sales in 1932 is higher than the October 1932-March 1933 average. This again leads us to underestimate the impact of the farm channel, particularly in cereal growing areas.

To illustrate these disadvantages, in figure 10, we plot indices of car purchases for cotton / tobacco, cereals, hay / potatoes, dairy, and nonfarm areas. Each index is calculated by taking the six states with the highest production value per-capita in each category or the six states with the lowest farm-share, indexing each state to 100 for the October 1932-March 1933 average, and then averaging across the six states. In the monthly state data, the growth of car sales is rapid across all crop-producing categories: auto sales growth from the October 1932-March 1933 average to the July-December 1933 average is 145.2%

Figure 10 – Auto sales by crop type



Note: Each category is based on the six states with the highest per capita value of the indicated farm product, the highest dairy value per capita or the lowest farm share. Indices are constructed by first indexing each state to 100 for October 1932-March 1933 and then averaging across the six states in a category. Sources: Auto sales - see text. Crop values and farm share - the 1930 Census as reported in Haines and ICPSR (2010).

in cotton/tobacco growing states, 101.1% in hay / potato growing states, and 171.1% in cereal growing states. However, the respective 1932-1933 annual growth rates are 80.4%, 24.0%, and 41.9%. Thus the annual data are not ideal for analyzing the farm channel in cereal-growing and hay / potato growing areas, since the growth rates drop by a factor of 4 or more. By contrast, auto sales growth in cotton / tobacco growing areas is less attenuated using annual data, suggesting that the county data will be more useful for assessing the sensitivity and mechanisms for these crops.

Column 3 presents the baseline results for the county data. Using the same five measures of farm exposure, we estimate effects similar to those seen in the annual state data. The main difference is that the standard errors are roughly cut in half, even though we conservatively cluster at the state level.[20] In column 4 we control quasi-non-parametrically for population size. We group counties into 25 population bins and include these as dummies

[20]To check for non-linearities and outliers, appendix figure 14 shows a binned scatter plot for the cotton / tobacco value per capita effect in column 3. We find that the effect of higher cotton / tobacco exposure on new car sales is monotonic and that a linear specification matches well.

in the regression. This has little impact on the farm exposure coefficients, suggesting that we are not conflating the farm channel with an effect of county population size.

In column 5, we add several control variables to the regression: population, black population share, democratic vote share, AAA transfers from 1933 to 1939, rural nonfarm share, average percent of bank deposits suspended between 1930 to 1932, and the percent of farms mortgaged. In addition, we control for drought in each month of 1932 and 1933 using Palmer drought indicators. We discussed the rationale for the first two controls in our state-level regressions. An advantage of the county data is that we can control for a number of other confounding variables that are difficult to separate from the farm channel. For example, by definition AAA payments and farm mortgage relief efforts disproportionally benefited farm areas,[21] farm areas were (slightly) more likely to experience bank failures, and farm areas tended to be more democratic.[22] In the county data we can separate out these effects, since the farm channel primarily benefited cotton, tobacco and, in the monthly data, cereal-growing areas, as opposed to all farmers. With these controls the coefficient on cotton and tobacco value per capita falls slightly, but remains highly significant.

Columns 6 through 8 repeat the same regressions with state fixed effects. While we find the cross-state estimates in table 2 compelling, it is reassuring to see that essentially the same relationship holds *within* states. The coefficient of 0.53 on traded crops per capita means that *within a state*, counties producing a dollar more cotton or tobacco per capita in 1929 saw 0.53 percentage point more auto sales growth between 1932 and 1933. Overall, our estimates of the farm channel within states are quantitatively similar to (and statistically indistinguishable from) our estimate of the farm channel across states.

[21] For more on these efforts to help indebted farmers, see Rucker and Alston (1987) and Rose (2013).

[22] In a simple regression across counties of bank failures from 1930-32 as a share of the number of 1929 banks on the farm share of the population, the coefficient on farm share is negative but statistically insignificant; in a regression of Roosevelt's 1932 vote share on farm share, the coefficient on farm share is economically and statistically significant.

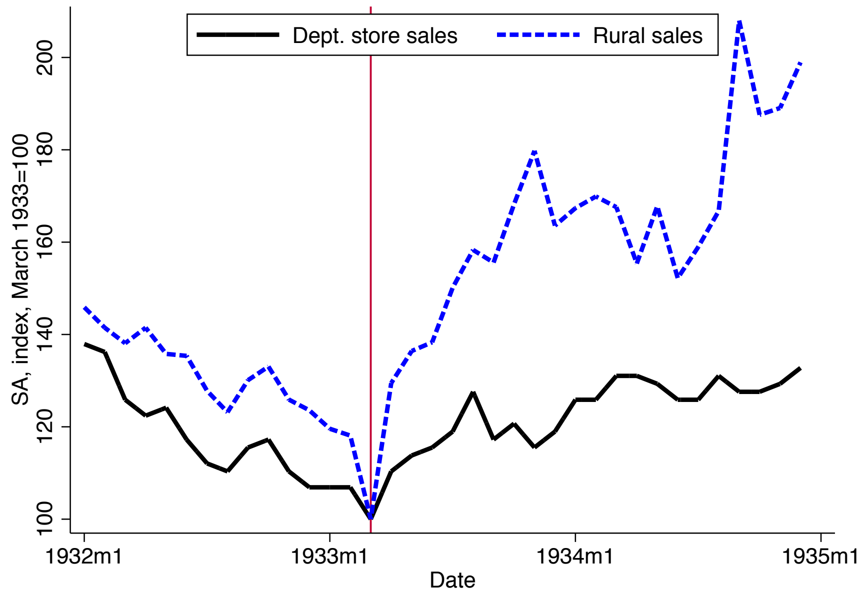
Table 3 – Car sales growth from Oct 1932-March 1933 avg to July-Dec 1933 avg (monthly) or 1932 to 1933 (annual)

	State		County Annual					
	Monthly	Annual						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cotton and tobacco value p.c. 1929 ($)	0.89***	0.66***	0.74***	0.75***	0.45***	0.53***	0.55***	0.31***
	(0.23)	(0.13)	(0.089)	(0.090)	(0.098)	(0.099)	(0.11)	(0.098)
Cereal value p.c. 1929 ($)	0.91***	0.17*	0.040	0.045	−0.21*	0.036	0.032	−0.20*
	(0.16)	(0.086)	(0.031)	(0.037)	(0.12)	(0.038)	(0.046)	(0.11)
Hay and potato value p.c. 1929 ($)	0.86	0.062	0.093	0.072	0.10	0.15**	0.15**	0.13**
	(0.63)	(0.22)	(0.13)	(0.13)	(0.10)	(0.065)	(0.064)	(0.060)
Livestock value sold p.c. 1929 ($)	−0.31	−0.054	0.10	0.074	0.055	0.097	0.063	0.071*
	(0.23)	(0.097)	(0.077)	(0.053)	(0.048)	(0.070)	(0.050)	(0.039)
Dairy value sold p.c. 1929 ($)	−0.30	−0.38***	−0.44***	−0.37***	−0.43***	−0.26**	−0.17**	−0.27***
	(0.41)	(0.12)	(0.11)	(0.076)	(0.094)	(0.10)	(0.067)	(0.086)
Population (millions)					3.78			10.8**
					(5.27)			(4.68)
FDR Vote % 1932					0.70***			0.43**
					(0.18)			(0.18)
% pop. black					−0.35*			−0.22
					(0.18)			(0.19)
AAA Transfers p.c. ($)					0.39*			0.34
					(0.20)			(0.20)
% pop. rural nonfarm					0.16			0.24*
					(0.13)			(0.13)
Deposits suspended 1930-32 (%1929 deposits)					0.059			0.15***
					(0.061)			(0.055)
% farms mortgaged 1930					0.69**			1.13***
					(0.30)			(0.34)
State Fixed Effects	No	No	No	No	No	Yes	Yes	Yes
Population Bins	No	No	No	Yes	No	No	Yes	No
1932 & 1933 monthly drought indicators	No	No	No	No	Yes	No	No	Yes
R^2	0.54	0.53	0.24	0.26	0.30	0.35	0.37	0.39
Observations	49	49	2,060	2,060	2,035	2,060	2,060	2,035

Standard errors clustered at the state level in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ Notes: The dependent variable is indicated in the table header. County regressions exclude counties with fewer than 500 1928 car registrations. Population bins are 25 quantiles by population; these specifications include dummy variables for each quantile. 1933 monthly drought indicators are monthly dummy variables for whether a county was in a severe or extreme drought, per the Palmer drought index. The number of observations drops in columns (5) and (8) because of some missing data in the control variables, e.g. banking data are unavailable for Wyoming in Federal Deposit Insurance Corporation (2001).

Sources: Monthly auto sales: See text. Annual auto sales: *Automotive Industries* 2/25/1933, p. 224 and 2/24/1934, p. 220. Value of farm products sold per capita - the 1940 Census as reported in Haines et al. (2015); FDR vote percentage - ICPSR (1999); population and % of population black and rural nonfarm - the 1930 Census as reported in Haines and ICPSR (2010); AAA transfers - dataset accompanying Fishback, Kantor, and Wallis (2003); deposits suspended - Federal Deposit Insurance Corporation (2001); % of farms mortgaged - Haines et al. (2015); drought indicators for U.S. climate divisions from National Climate Data Center. We match climate divisions to counties using the maps at Climate Prediction Center. If a county is included in multiple climate divisions, we average drought indicators across each division containing part of the county.

Figure 11 – Department store sales and rural general merchandise sales



Note: The vertical line indicates the month before devaluation, March 1933. Source: U.S. Department of Commerce (1936), pp. 27-28.

3.4 Other outcome measures A possible concern with our focus on car sales is that farm-intensive areas may have a general tendency to purchase cars in a recovery. We have already seen reason to doubt that such a tendency fully explains our findings, since placebo tests (figure 9) show no similar effects during the recovery in 1934. Furthermore, it is not obvious why a tendency for farmers to purchase more cars would line up, as our results do, with a distinction between traded and nontraded farm products. Still, to firmly establish that our findings are not idiosyncratic to car purchases, we examine the evolution of other measures of consumption and farm and total income.

We start by comparing department store sales to rural sales of general merchandise (figure 11). We consider department store sales to be a rough proxy for urban consumption, since department stores were located in cities. Both department store and rural retail sales followed a similar downward path in 1932. Department store sales then rose 19% between March and July 1933, while rural sales of general merchandise rose 50%. The very rapid growth of rural sales was in part driven by a sharp drop in March that was reversed in April. But the relatively more rapid growth of rural sales does not depend on this single observation: February to July, department store sales grew 11% while rural sales grew 27%;

Table 4 – Other state-level outcomes 1932-1933 (annual data)

	Sales growth			Income growth		
	Cars	Trucks	Fridges	Total	Farm	#Tax
	(1)	(2)	(3)	(4)	(5)	(6)
Cotton/tobacco val. p.c. 1929 ($)	0.66***	0.97***	0.72***	0.14***	0.44**	0.078***
	(0.13)	(0.24)	(0.16)	(0.033)	(0.17)	(0.017)
Cereals value p.c. 1929 ($)	0.17*	0.15	−0.018	−0.061***	−0.34**	−0.0036
	(0.086)	(0.16)	(0.12)	(0.022)	(0.16)	(0.0085)
Hay/potato value p.c. 1929 ($)	0.062	0.46	−0.15	0.017	−0.054	0.041
	(0.22)	(0.50)	(0.21)	(0.042)	(0.42)	(0.037)
Livestock value sold p.c. 1929 ($)	−0.054	−0.16	0.29*	0.0043	0.22	0.001
	(0.097)	(0.21)	(0.15)	(0.023)	(0.18)	(0.0092)
Dairy value sold p.c. 1929 ($)	−0.38***	−0.12	−0.30	−0.075**	−0.57	−0.071**
	(0.12)	(0.26)	(0.39)	(0.037)	(0.37)	(0.033)
R^2	0.53	0.43	0.30	0.57	0.23	0.03
Observations	49	49	48	49	48	2491

Notes: The dependent variable is indicated in the table header. For refrigerator sales, DC and Maryland are combined. For farm income regressions we drop South Dakota, which reports negative farm income in 1933. Column 6 excludes counties with fewer than 30 tax returns filed in 1932. Robust standard errors in parenthesis in columns 1 through 5, and clustered at the state level in column 6. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Sources: Auto sales and independent variables: see text and table 3. Truck sales: *Automotive Daily News Almanac for 1937*, p. 62. Refrigerator sales: *Edison Electric Institute Bulletin*, March 1936, Volume IV, no. 3, p. 80. Unfortunately, the refrigerator sales data lack documentation, and it is unclear whether they are retail or wholesale sales. Total and farm income: Bureau of Economic Analysis state personal income data, table SA04. Tax return counts: IRS Statistics of Income.

April to July, department store sales grew 8% while rural sales grew 16%. The relatively rapid increase in rural consumption fits with the argument of this paper that recovery in spring 1933 was in part driven by farm demand.

Table 4 presents state-level evidence from annual data on how agricultural intensity affected consumption and income. As discussed above, annual data obscures the working of the farm channel in cereal, and hay / potato growing areas, so we focus on the exposure to cotton and tobacco instead. In column 1, we again show the regression for car sales as a point of reference. Column 2 shows the result for truck sales, which are perhaps best thought of as an investment made by farmers. This effect is very similar, and perhaps slightly stronger, than that for cars. Similarly, we find a large relative increase in the purchase of electric refrigerators in areas most exposed to the farm channel (column 3). Overall, we find that car sales appear to be representative of the purchases of other durable investment and consumption goods.

In the remaining columns of table 4, we use measures of income as outcome variables. This allows us to check that the farm channel indeed increased local income. (We already know from figure 5 that aggregate farm income rose rapidly in spring 1933.) In column 4 we find that areas producing cotton / tobacco saw significantly larger increases in income than other areas. We see in column 5 that this reflects a disproportionate increase in farm income.

Further, in column 6 we use the number of tax filings as a measure of how many individuals had income above the exemption threshold. While this is only an indirect measure of income, it is available at the county level. We find strong evidence that the number of tax filings increased in counties with more cotton / tobacco value per capita. Results with control variables are very similar for the outcome variables in columns 1-6 (not reported).

In short, we find that the effect of the farm channel on new car purchases is representative of the effect on other consumption and investment goods. And there is evidence that the relative increase in consumption in farm areas was at least in part driven by a relative increase in income.

4 Mechanisms

We find that in 1933 agricultural areas experienced faster consumption growth and income growth. But these cross-sectional effects do not necessarily imply that the farm channel was expansionary for the U.S. economy as a whole. The positive effects on farm consumption could have been offset by declines in nonfarm consumption. Insofar as higher farm product prices made farmers richer, they ought also to have made others poorer. If higher farm prices were passed through to higher food prices, they made urban workers poorer. If they were not passed through, they lowered the profits of food wholesalers and manufacturers. Whether through poorer urban workers or lower profits, higher farm income and consumption demand ought to have been matched by lower urban income and consumption demand. Thus the channel leading from farm prices to farm income could explain the much larger growth in car sales in farm areas without explaining *any* of the nationwide growth in car sales in spring 1933. Sales could have risen a lot in Iowa and fallen slightly in New York with no net aggregate effect.

In standard international macro models, devaluation is expansionary for the home country in part because foreign economies switch expenditure towards domestic goods.[23] An extensive literature focusses on whether leaving the gold standard had beggar-thy-neighbor effects through such expenditure-switching (see Obstfeld and Rogoff, 1996, p. 626-630 for a survey). However, changes in net exports only made small contributions to U.S. growth in 1933 (-0.11 percentage points) and 1934 (0.33 percentage points).[24] Thus, the farm channel is unlikely to have had large effects on aggregate GDP through this mechanism.

In this section we consider a second mechanism through which redistribution of income to farmers via higher crops prices could have been expansionary for the U.S. economy. Standard incomplete market models (Bewley, 1986; Aiyagari, 1994) predict that households in debt have a particularly high MPC out of income shocks. This occurs because consumers subject to a sequence of temporary negative income shocks (e.g., lower crop prices) run up against a borrowing constraint, which prevents them from smoothing consumption. At the borrowing constraint, consumers spend all of any increase in income in order to move closer to the consumption smoothing solution. Consistent with this logic, Mian et al. (2013) estimate significantly higher MPCs for indebted households in the Great Recession. Thus, insofar as the farm channel redistributed from low-MPC nonfarmers to high-MPC farmers, it would have increased overall aggregate demand and been expansionary for the U.S. economy as a whole.

Data limitations make a precise comparison of farm and nonfarm household and corporate debt burdens difficult, but a comparison of mortgage debts suggests that debt problems were more severe among farmers. In 1933, total agricultural mortgage debt equaled $7.7 billion (Goldsmith, Lipsey, and Mendelson (1963), table Ia, pp. 80-81). This was 24% of the value of farm structures and land and 270% of farm personal income. Nonfarm residential mortgages totaled $23.1 billion (Snowden, 2006a) in 1933, or 29% of the value of nonfarm residential structures and land (Snowden, 2006d) and 52% of nonfarm personal income.[25]

[23] Bernanke and Carey (1996) and Schmitt-Grohé and Uribe (2013a,b) also emphasize the importance of such expenditure switching in relaxing downward nominal wage constraints.

[24] NIPA table 1.1.2 accessed on 2 July 2016.

[25] The value of farm structures and land is from Goldsmith et al. (1963), table Ia, pp. 80-81. Farm and nonfarm personal income data are from the Bureau of Economic Analysis, personal income data, table SA4,

Presumably because of the much more unfavorable debt-to-income ratios, foreclosure problems were far more severe among farmers than among nonfarmers. Between 15 March 1932 and 15 March 1933, foreclosures exceeded voluntary farm sales by a ratio of more than 2 to 1. There were 38.8 foreclosures per 1000 farms or nearly 100 per 1000 mortgaged farms.[26] No exact comparison exists for nonfarm residential housing. But among all nonfarm structures—residential and nonresidential—the foreclosure rate per 1000 mortgaged structures in 1933 was just 13.3, one-eighth that for farms (Snowden, 2006b).[27]

As noted above, redistribution towards farmers came not only from nonfarm households, but also from corporations. It is not obvious what the appropriate metric is for comparing corporate debt burdens with household debt burdens. But the available evidence suggests that the debt problems of nonfarm corporations were mild relative to those afflicting households. In his treatment of U.S. debt problems Clark (1933) (p. 172) writes: "The facts show that the debt situation in industry, though serious, is not cataclysmic nor is it a mass problem." Quantitative support for this view comes from a comparison of business failures with farm and nonfarm foreclosures. Business failures in 1932 exceeded those in 1929 by 39%; by contrast, over this three-year period, farm foreclosures rose by 98%, and nonfarm foreclosures rose 84%.[28]

Our data allow us to directly test whether, as hypothesized, higher farm debt burdens were associated with higher MPCs. In that case, the farm channel ought to have been stronger in areas with more farm debt. We measure this exposure using (1) the percent of farms mortgaged in a county and (2) the average farm leverage in a county.[29] We interact

downloaded on 20 June, 2016.

[26] Stauber and Regan (1935b), table 12, p. 38 document that between 15 March 1932 and 15 March 1933, there were 16.6 "voluntary sales or trades" and 38.8 "foreclosure of mortgages, bankruptcy, etc." per 1000 farms. The foreclosure percentage is approximate, since it uses the 1930 percentage of farms mortgaged (40%). Using the 1935 share of farms mortgaged (34%) results in a slightly higher ratio of foreclosures per 1000 mortgaged farms. Data on the total number of farms and the number of farms mortgaged are from U.S. Department of Commerce (1975) series K162 and K154. For more on farm foreclosures in the interwar period, see Alston (1983).

[27] Despite this large difference in foreclosure rates, mortgage delinquency rates were if anything higher in urban areas (Clark, 1933, p. 20). This points to the difficulty of making precise comparisons of farm and nonfarm debt burdens.

[28] Data on business failures are from Sutch (2006); farm foreclosures per 1000 farms are from Alston (1983), table 1, p. 888, and the total number of farms are from Olmstead and Rhode (2006); nonfarm business failures are from Snowden (2006c).

[29] We define farm leverage in a county as $V/(V-D)$ where V is the total value of farm land and buildings, and D is total farm mortgage debt.

both farm debt variables with the value of traded crops per capita, since this is where the farm channel is visible in the annual data. We begin by estimating the linear regression

$$\begin{aligned}\%\Delta\text{Auto sales}_i = \beta_0 + \beta_1 \text{Traded crop value p.c.}_i \times \text{Farm debt variable}_i \\ + \beta_2 \text{Traded crop value p.c.}_i + \beta_3 \text{Farm debt variable}_i + \gamma' X_i + \varepsilon_i.\end{aligned} \tag{2}$$

The coefficient on the interaction term, β_1, shows how local farm debt conditions affect the strength of the farm channel.

As a second specification we relax the linear structure in equation (2), and instead group counties into quintiles based on the value of the farm debt variable. We then interact the traded crop value per capita (p.c.) with these quintiles,

$$\begin{aligned}\%\Delta\text{Auto sales}_i = \beta_0 + \sum_{j=2}^{5} \gamma_j \text{Traded crop value p.c.}_i \times \text{Quintile } j\text{: Farm debt}_i \\ + \beta_1 \text{Traded crop value p.c.}_i + \sum_{j=2}^{5} \delta_j \text{Quintile } j\text{: Farm debt}_i + \gamma' X_i + \varepsilon_i.\end{aligned} \tag{3}$$

In this specification, the effect of the farm channel is β_1 in the lowest quintile, $\beta_1 + \gamma_2$ in the second quintile, $\beta_1 + \gamma_3$ in the third quintile, and so on. Using quintiles allows us to assess whether the farm channel becomes monotonically weaker or stronger based on local farm debt, without imposing that this relationship is linear. The cost is that it is less precise if the true relationship is indeed linear.

Panel A of table 5 shows the estimates of the linear interaction (equation (2)) with the percent of farms mortgaged and farm leverage. Panel B shows the estimates using quintiles of percent of farms mortgaged and farm leverage (equation (3)). For percent of farms mortgaged, we find a statistically significant and positive linear interaction coefficient in all specifications. Furthermore, in panel B, the effect generally grows monotonically larger across quintiles of percent of farms mortgaged.

Table 5 – Auto sales growth in spring 1933 (% changes) and farm debt

Panel A: Linear interaction

Interaction with	% farms mortgaged				Farm leverage			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Linear Interaction	0.17**	0.26***	0.23***	0.27***	0.025	0.079	0.071	0.078*
	(0.071)	(0.051)	(0.063)	(0.046)	(0.059)	(0.055)	(0.054)	(0.045)
Cotton and tobacco value p.c. 1929 ($)	0.62***	0.17	0.38***	0.12	0.71***	0.40***	0.55***	0.39***
	(0.083)	(0.11)	(0.11)	(0.11)	(0.078)	(0.090)	(0.074)	(0.095)
State Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Control Variables	No	No	Yes	Yes	No	No	Yes	Yes
1932 & 1933 monthly drought indicators	No	No	Yes	Yes	No	No	Yes	Yes
R^2	0.23	0.39	0.30	0.40	0.21	0.35	0.27	0.37
Observations	2,060	2,060	2,035	2,035	2,060	2,060	2,035	2,035

Panel B: Interacted quintiles

Interaction with	% farms mortgaged				Farm leverage			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Traded Crop Value × Quintile 2	0.26*	0.21**	0.23**	0.18*	0.063	0.24**	0.094	0.16**
	(0.14)	(0.086)	(0.11)	(0.091)	(0.10)	(0.092)	(0.075)	(0.060)
Traded Crop Value × Quintile 3	0.19	0.23*	0.16	0.18	0.18	0.41***	0.24*	0.35***
	(0.19)	(0.12)	(0.16)	(0.12)	(0.14)	(0.15)	(0.12)	(0.098)
Traded Crop Value × Quintile 4	0.19	0.38***	0.27*	0.37***	0.26	0.53***	0.35**	0.47***
	(0.17)	(0.077)	(0.14)	(0.074)	(0.17)	(0.18)	(0.15)	(0.15)
Traded Crop Value × Quintile 5	0.54**	0.78***	0.67***	0.78***	0.31	0.61***	0.48***	0.56***
	(0.20)	(0.16)	(0.18)	(0.15)	(0.22)	(0.22)	(0.18)	(0.15)
Cotton and tobacco value p.c. 1929 ($)	0.38***	−0.12	0.12	−0.15*	0.51***	−0.0089	0.27**	0.025
	(0.12)	(0.092)	(0.14)	(0.083)	(0.12)	(0.13)	(0.11)	(0.086)
State Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Control Variables	No	No	Yes	Yes	No	No	Yes	Yes
1932 & 1933 monthly drought indicators	No	No	Yes	Yes	No	No	Yes	Yes
R^2	0.24	0.39	0.30	0.40	0.21	0.35	0.28	0.37
Observations	2,060	2,060	2,035	2,035	2,060	2,060	2,035	2,035

Standard errors clustered at the state level in parentheses. * $p < .10$, ** $p < .05$, *** $p < .01$. Notes: In panel A, % of farms mortgaged / farm leverage is scaled to be in standard deviation units. The coefficient of 0.17 in column (1), for instance, means that a 1 standard deviation increase in the % of farms mortgaged increases the effect on auto sales of traded crop value per capita by 0.17. All regressions exclude counties with fewer than 500 1928 car registrations. In panel B, all specifications include dummy variables for each quintile. Control variables and drought indicators are the same as those in table 3. Sources: Farm leverage from Haines et al. (2015). Other variables, see table 3.

The estimates for the linear farm leverage interaction in panel A, while also positive, are not statistically significant. Here the data favor the less restrictive specification in panel B: the effect of the farm channel becomes monotonically stronger as farm leverage increases, and many of these interactions are statistically significant. However, the increase in the coefficients is not as large as would be expected based on a linear relationship, giving rise to the imprecision in panel A. Overall, these results suggests an important role for farm indebtedness in the propagation of the farm channel.

5 Aggregate implications

We next present a model that allows us to translate our cross-sectional estimates of the effects of higher crop prices into an aggregate effect on the U.S. economy. The model explicitly takes into account that the farm channel helped farmers, but hurt agents purchasing farm goods. To transparently highlight this distributional effect, we deliberately simplify the model along a number of dimensions. Thus, one should interpret our results not as a precise estimate, but rather as a guide to the farm channel's quantitative importance.

The key assumption of the model, for which we provided some empirical evidence above, is that farmers faced more severe debt problems than corporations. Conditional on this assumption, the model shows that aggregate output growth, $\frac{dY_t}{Y_t}$, can be bounded below by the coefficient on farm share in our cross-state regression b (panel A of table 2) multiplied by the farm income share s_t^f,

$$\frac{dY_t}{Y_t} \geq b s_t^f. \tag{4}$$

The range of estimates of b in panel A of table 2 runs from 1.16 to 2.21. Combined with $s_t^f = 8.2\%$ based on the 1932 share of farm business GDP in business GDP,[30] this implies an increase in output of 9–18%. Therefore, the model suggests that the farm channel can explain 25-50% of the 32% increase in industrial production between the October 1932 - March 1933 average and the July - December 1933 average.

We now turn to the derivation of formula (4).

[30]NIPA table 1.3.5, downloaded on 9/29/2016.

5.1 Model set-up Time is discrete, running from 1 to infinity, and there is perfect foresight. There are three types of consumers: farmers (f), workers (w), and capitalists (c). Each consumer's type is fixed, and the respective population shares are ϕ^f, ϕ^w, and $1 - \phi^f - \phi^w$. There is no heterogeneity within types, so we solve the optimization problem for a representative consumer of each type.

Each representative consumer has the same utility function,

$$\sum_{t=1}^{\infty} \beta^{t-1} \left[\ln c_t + \psi \ln d_t \right],$$

where c_t and d_t are distinct consumption goods, β is the discount factor, and ψ is the relative weight on the d good. In our regional analysis below, c_t is a nontraded good, and d_t is a traded good, but this distinction can be ignored when analyzing aggregate quantities. We call these goods bread and cars respectively. Both goods are nondurable; in appendix C.4 we show that the same formula (4) holds when d_t is a durable good. There is no disutility of labor, in accord with the low opportunity cost of employment during the Great Depression.

The budget constraint for each type of agent is

$$a_t = (1 + r_{t-1}) a_{t-1} + y_t - c_t - d_t - \frac{\zeta}{2} a_t^2 \mathbb{1}_{\text{capitalist}} + \Pi_t \mathbb{1}_{\text{capitalist}}.$$

a_t are real asset holdings, r_t is the real interest rate, and y_t is real income. In our model, consumer types differ by their income process. The only tradable asset is a one-period real loan, so financial markets are incomplete. To ensure that the wealth distribution is stationary, we also include a quadratic asset holding cost for capitalists, $\frac{\zeta}{2} a_t^2$, as in Schmitt-Grohé and Uribe (2003) and Broer et al. (2016). The asset holding cost is paid to a financial intermediary, which is owned collectively by capitalists and which rebates the profits $\Pi_t = \frac{\zeta}{2} a_t^2$.

The prices of the two consumption goods are fixed. In effect, we assume that nominal final goods prices are perfectly sticky, as in Caballero, Farhi, and Gourinchas (2015), Farhi and Werning (2012, 2014), and Korinek and Simsek (2016). We make this assumption because it simplifies the model, because final goods prices appear sticky in the data, and because it imparts no obvious bias to our estimate of the aggregate effects of the farm channel. Empirically, the CPI was unchanged from March to May 1933 and then rose only 0.7% in

June (FRED series CPIAUCNS). Even the retail price of bread was unchanged from March 1933 to June 1933 despite a 49% increase in the price of wheat.[31] On the other hand, the retail price of lard rose 21% between March and June 1933.[32] An endogenous response of final goods price to farm prices would change the aggregate effects predicted by the model in two ways. (1) By reducing the income of constrained workers, it would lower output growth. (2) Consumers would expect higher inflation, which lowers real interest rates and raises output growth (Eggertsson, 2010; Wieland, 2015). Hausman (2013) documents narrative evidence from newspaper advertisements that higher farm product prices increased inflation expectations in spring 1933. And since the CPI did not rise for the first few months of spring 1933, we conjecture that the second channel was quantitatively more important than the first. Thus, the assumption of fixed final goods prices is likely conservative.

Each consumer $x \in \{f, w, c\}$ faces a limit on borrowing,

$$a_t^x \geq s^x \bar{a},$$

where $\bar{a} \leq 0$, and s^x is the consumers' steady-state income share. So the amount each type can borrow is commensurate with their income (in steady-state). Such a borrowing limit arises naturally in incomplete market models like Aiyagari (1994) and Bewley (1986), but here we simply exogenously impose it. The borrowing limit will prevent consumption smoothing for the most-indebted consumers, making their consumption very sensitive to their current income.

The first order conditions for each consumer are

$$\begin{aligned} d_t &= \psi c_t; \\ \lambda_t &= c_t^{-1}; \\ \lambda_t &= \beta(1 + r_t)\lambda_{t+1} + \mu_t - \lambda_t \zeta a_t \mathbb{1}_{\text{capitalist}}, \end{aligned}$$

where λ and μ are the Lagrange multipliers on the budget constraint and on the borrowing constraint respectively. Our log-preference specification means that consumers' relative

[31] NBER macrohistory series m04001a and m04022.

[32] NBER macrohistory series m04027. This can be compared to a 38% increase in the wholesale price of lard over the same period (NBER macrohistory series m04026a).

spending on cars and bread is given by ψ. If the borrowing constraint is not binding, then consumers follow a standard Euler equation, with the exception of capitalists who also face a wealth holding cost.

Farmers earn income by selling farm products X_t to capitalists, workers earn income by selling labor L_t to capitalists, and capitalists earn profits by producing and selling bread and cars. The production function for each good is

$$C_t = \min\{\alpha^{-1}X_t, (1-\alpha)^{-1}L_{c,t}\};$$
$$D_t = L_{d,t},$$

where $L_{d,t} + L_{c,t} = L_t$, and C and D denote aggregate quantities. Bread production requires farm products (e.g., wheat) and labor, whereas cars are produced using labor alone. Workers can supply labor up to a maximum (full-employment) amount $\bar{L}$, and farms can supply farm products up to a maximum (full-employment) amount $\bar{X}$. We assume that $\frac{\bar{X}}{\bar{L}} = \frac{\alpha}{1-\alpha+\psi}$, so that both inputs can be simultaneously fully-employed.

With fixed prices, the amount produced of each good, and thus the quantity of farm goods and labor in production, is demand-determined. This is meant to capture the situation in 1933 with high unemployment in which the marginal cost of providing labor was close to zero. Let $p_{x,t}$ be the real price of farm products, and $w < 1$ be the fixed real wage.[33] Then income for each consumer is

$$y_t^f = p_{x,t}X_t = \frac{\alpha}{1+\psi}p_{x,t}Y_t \equiv s_t^f Y_t;$$
$$y_t^w = wL_t = w\left[1 - \frac{\alpha}{1+\psi}\right]Y_t \equiv s^w Y_t;$$
$$y_t^c = C_t + D_t - wL_t - p_{x,t}X_t = \left[1 - \frac{\alpha p_{x,t} + w(\psi+1-\alpha)}{1+\psi}\right]Y_t \equiv s_t^c Y_t,$$

where s_t^x is the income share of type $x \in \{f, w, c\}$, and Y_t is total output in the economy:

$$Y_t = C_t + D_t = y_t^f + y_t^w + y_t^c.$$

[33] CPI-deflated average hourly earnings in manufacturing were roughly flat in spring 1933, with the exact percent change being quite sensitive to the time window used: between March and July 1933, they fell 4.4%, whereas measured between the first and third quarter of 1933, they rose 4.5%. (Average hourly earnings data are from NBER macrohistory series m08142; CPI data are from FRED series CPIAUCNS.) Neither of these measures adjusts for changes in the composition of the workforce.

We describe central bank decisions with an interest rate rule that respects the zero-lower bound constraint,

$$r_t = \max\{r_t^n - \phi(Y_t - \bar{Y}), 0\},$$

where $\bar{Y}$ is the level of output at which farmers and workers are fully-employed, $X = \bar{X}$ and $L = \bar{L}$. The variable r_t^n is the natural real rate of interest, so that when $r_t = r_t^n$, output is at full-employment $Y_t = \bar{Y}$. (Note that nominal and real interest rates are identical since there is no inflation in the model.)

Throughout, the real price of farm products $p_{x,t}$ is exogenous. This allows for a clean analysis of the effect of changes in farm product prices on economic activity. The importance of the farm channel can be analyzed by considering the effects of an increase in $p_{x,t}$. Of course, in practice the increase in $p_{x,t}$ was an endogenous response to devaluation. But by making $p_{x,t}$ exogenous, we can avoid modeling international trade explicitly and instead focus on the distributional consequences of changing farm prices.

5.2 Steady-state In steady-state, we let the real price of farm products be constant and equal to the wage, which is equal in turn to the inverse of the mark-up m, $p_x = w = m^{-1} < 1$. The zero-lower bound is not binding in steady-state, so $\bar{Y}$ is the level of output, and the steady state discount rate satisfies, $\beta(1 + r) = 1$. Net asset holdings are then zero, and borrowing constraints are not binding. The steady-state income shares are

$$s^f = m^{-1}\frac{\alpha}{1+\psi}, \qquad s^w = m^{-1}\left[1 - \frac{\alpha}{1+\psi}\right], \qquad s^c = 1 - m^{-1},$$

and spending choices for each consumer $x \in \{f, w, c\}$ are

$$d^x = \psi c^x = \frac{\psi}{1+\psi} s^x \bar{Y}.$$

We assume that the population shares of each type are equal to the income shares, $\phi^x = s^x,\ x \in \{f, w, c\}$. This implies that no consumer has an incentive to switch type in the long-run.

5.3 Timing Period $t = 1$ is meant to capture spring 1933. We set the real farm product price to a value sufficiently low for the zero lower bound on nominal interest rates and the borrowing constraint on all farmers and workers to bind.[34] (In appendix C.2 we extend the model to allow for a fraction of unconstrained workers and farmers.) Farmers and workers borrow from capitalists up to the borrowing limit. In setting up the model in this way, we do not intend to argue that a decline in farm prices caused the Great Depression (though it could have contributed). Rather, within the context of the model, this is a simple way of generating two key features of spring 1933: some consumers cannot borrow as much as they would like, and the central bank is constrained by the zero lower bound. What is important for our results are these characteristics of spring 1933, not what brought them about.

In periods $t \geq 2$, we assume real farm prices are at their steady state value, $p_{x,t} = m^{-1}$, and thus the borrowing constraints on farmers and workers are no longer binding. The zero-lower bound constraint is also no longer binding, so output is at its full-employment value $Y_t = \bar{Y}$. The distribution of income and consumption is, however, not at steady-state since workers and farmers have to repay their debt. Thus, for $t \geq 2$ we have to solve for the transition path to the steady-state.

These timing assumptions are stylized, but we make them in order to simplify the dynamics of the model and in particular to make the outcome in period $t = 1$ (our period of interest) more transparent. By simplifying timing in this way, we are able to solve the model analytically while retaining the core elements needed to understand the macroeconomic effects of redistribution to farmers.

5.4 Solution: $t \geq 2$ We solve the model backwards, starting with $t \geq 2$. In these periods, the borrowing constraint will never bind. Further, the policy rule implies $Y_t = \bar{Y}$, the income paths are constant, $y_t^x = s^x \bar{Y},\ x \in \{f, w, c\}$, and the agricultural price is $p_x = 1 - s^c$. For

[34]These condition arise when the real farm product price $p_{x,1}$ is low enough that

$$s_1^c > s^c \frac{\bar{Y}}{\bar{Y} + \beta \kappa_1 \bar{a}},$$

where κ_1 is the stable root from the $t \geq 2$ problem in appendix C.1. The inequality is strict to ensure that the borrowing constraints are tight. Note that when the borrowing limits are zero, $\bar{a} = 0$, this expression simplifies to $s_1^c > s^c$ and thus $p_{x,1} < m^{-1}$. Allowing for borrowing, $\bar{a} < 0$, implies that the real farm product price must fall more to satisfy this condition.

farmers and workers to repay debt, it follows that they consume less than their income, while capitalists consume more than their income. An above steady-state real interest rate induces this behavior.

The first order conditions for each consumer are

$$\lambda_t^f = \beta(1 + r_t)\lambda_{t+1}^f;$$
$$\lambda_t^w = \beta(1 + r_t)\lambda_{t+1}^w;$$
$$\lambda_t^c = \beta(1 + r_t)\lambda_{t+1}^c - \lambda_t^c \zeta a_t^c,$$

where consumption choices must add up to the full-employment level of output,

$$\bar{Y} = (1 + \psi)(c_t^f + c_t^w + c_t^c),$$

and the budget constraints of each agent must be satisfied.

We relegate the details of solving this problem to appendix C.1 and simply state the solution here:

$$\begin{aligned} a_t^c &= \kappa_1 a_{t-1}^c; \\ c_t^c + d_t^c &= (\beta^{-1} - \kappa_1)a_{t-1}^c + s^c \bar{Y}; \\ c_t^f + d_t^f &= -\frac{s^f}{1 - s^c}(\beta^{-1} - \kappa_1)a_{t-1}^c + s^f \bar{Y}; \\ c_t^w + d_t^w &= -\frac{s^w}{1 - s^c}(\beta^{-1} - \kappa_1)a_{t-1}^c + s^w \bar{Y}, \end{aligned}$$

where $0 < \kappa_1 < 1$ if the asset holding cost, ζ, is small but positive. Thus, the economy gradually converges to the original steady-state. In the derivation we make use of several approximations, which are, however, exact when $\zeta = 0$. Thus, we can make the approximation error arbitrarily small by lowering ζ, which is why we state the equations as equalities.

The solution implies that high asset holdings by capitalists raise their consumption, and, through higher real interest rates set by the central bank, lower worker and farmer consumption. These results give us the information we need to link up to the capitalists' Euler equation at $t = 1$.

5.5 Solution: $t = 1$ At $t = 1$ we assume that each consumer has zero initial assets. Combining the Euler equation of the capitalist with the budget constraint $a_1^c = y_1^c - c_1^c - d_1^c$ yields,

$$c_1^c + d_1^c = mpc^c y_1^c + \beta^{-1}(1 - mpc^c)s^c \bar{Y},$$

where $mpc^c = \frac{\beta^{-1}(\beta^{-1}-\kappa_1+\zeta)}{1+\beta^{-1}(\beta^{-1}-\kappa_1+\zeta)} < 1$ is the capitalists' MPC out of current income. As the asset holding cost parameter ζ converges to zero, this MPC converges to $mpc^c \to \frac{r(1+r)}{1+r(1+r)}$. For small discount rates, this is approximately equal to the steady-state net interest rate r. Thus, capitalists typically have a low MPC in the model. This is because they are not borrowing constrained and, thus they follow the permanent income hypothesis. Interpreting capitalists as owners of corporations, this result is in line with the above-cited view of Clark (1933) that debt problems were relatively less severe for corporations.

By contrast, farmers and workers are borrowing constrained and thus have a high MPC. For each type $x \in \{f, w\}$, their consumption choices are given by,

$$c_1^x + d_1^x = y_1^x - s^x \bar{a}.$$

Thus, their MPC out of current income is 1. Intuitively, because their current income is relatively low, farmers and workers would like to smooth consumption by borrowing more. They will spend any additional income on current consumption in order to move closer to the consumption smoothing optimum. The historical interpretation is that farmers and workers in spring 1933 expected higher future income and had pent-up demand for consumption goods. Thus they were likely to spend a high proportion of income increases. Consistent with our model, Hausman (2016a) documents that at least in 1936, recovery in the 1930s was associated with high MPCs.

Combining all consumption choices yields aggregate output,

$$Y_1 = \frac{1}{s_1^c(1 - mpc^c)} \left[-(1 - s^c)\bar{a} + \beta^{-1}(1 - mpc^c)s^c \bar{Y} \right]. \tag{5}$$

The intuition for this equation is the Keynesian cross. The denominator is one minus the income-weighted MPC, $1 - s_1^c \times mpc^c - (1 - s_1^c) \times 1$. The numerator is autonomous consumption by workers and farmers $-(1 - s^c)\bar{a} \geq 0$ plus autonomous consumption by capitalists $\beta^{-1}(1-$

$mpc^c)s^c\bar{Y}$.

From equation (5), it follows that output rises if farm product prices increase.

$$\frac{dY_1/Y_1}{dp_{x,1}/p_{x,1}} = \frac{s_1^f}{s_1^c} > 0$$

Higher farm product prices redistribute income from capitalists to farmers. This raises output because the MPC of a farmer is higher than that of a capitalist. This aggregate effect is entirely a function of (1) the importance of farming in the economy, s_1^f, and (2) the importance of high-MPC consumers in the economy, $s_1^c = 1 - s_1^f - s^w$. The MPC of capitalists drops out because the decline in their income share is exactly offset by the increase in aggregate income, leaving their total income $s_1^c Y_1$ unchanged per equation (5).

5.6 Cross-section We next show how our cross-sectional regressions are informative about the aggregate effect of higher farm prices. To do so, we consider an agricultural location a and a manufacturing location m. Farm products X and cars D are fully tradable across the two locations, but bread C is nontraded. We then distribute the mass of consumers over two locations, splitting workers into bakers (b) producing the nontradable bread C and laborers (l) producing tradable cars D. The agricultural area has farmers, bakers, and capitalists. The manufacturing area has bakers, laborers, and capitalists. The fraction of capitalists living in the agricultural area is $\nu \in [0, 1]$. We assume that the location of capitalists is proportional to the steady-state area income shares, $\nu = s_a = \frac{Y_a}{Y}$ and $1 - \nu = s_m = \frac{Y_m}{Y} = 1 - s_a$.

The incomes of each type of consumer are

$$y_{a,t}^f = s_t^f Y_t, \qquad y_{a,t}^b = s^b s_{a,t} Y_t, \qquad y_{m,t}^b = s^b s_{m,t} Y_t, \qquad y_{m,t}^l = s^l Y_t, \qquad y_t^c = s_t^c Y_t,$$

where $s_{a,t} = \frac{Y_{a,t}}{Y_t}$ and $s_{m,t} = \frac{Y_{m,t}}{Y_t}$ are the local income shares, and $s^b = w(\frac{1-\alpha}{1+\psi})$ and $s^l = w(\frac{\psi}{1+\psi})$ are the income shares of bakers and laborers (so $s^w = s^b + s^l$). By combining incomes within the same location we derive local income shares,

$$\begin{aligned} s_{a,t} &= \frac{1}{1-s^b}\left[(1-s_a)s_t^f + s_a(1-s^b-s^l)\right] \\ s_{m,t} &= \frac{1}{1-s^b}\left[s_a s^l + (1-s_a)(1-s_t^f-s^b)\right]. \end{aligned}$$

Note that higher farm prices redistribute towards the agricultural area by raising the farm income share s_t^f.

Expenditure on cars at $t = 1$ for each consumer type is then analogous to our aggregate solution, where borrowing-constrained consumers have a high MPC, and unconstrained capitalists have a low MPC.

$$
\begin{aligned}
d_{a,1}^f &= \frac{\psi}{1+\psi}(y_{a,1}^f - s^f \bar{a}), & d_{a,1}^b &= \frac{\psi}{1+\psi}(y_{a,1}^b - s^b s_a \bar{a}) \\
d_{m,1}^b &= \frac{\psi}{1+\psi}(y_{m,1}^b - s^b s_m \bar{a}), & d_{m,1}^l &= \frac{\psi}{1+\psi}(y_{m,1}^l - s^l \bar{a}) \\
d_{a,1}^c &= s_a \frac{\psi}{1+\psi}\left[mpc^c y_1^c + \beta^{-1}(1-mpc^c)s^c \bar{Y}\right] & d_{m,1}^c &= \frac{1-s_a}{s_a} d_{a,1}^u.
\end{aligned}
$$

Summing over all consumers' local car expenditure and substituting the solutions for income we can derive a simple expression for total car expenditure,

$$
D_{a,1} = \frac{\psi}{1+\psi} s_{a,1} Y_1; \qquad D_{m,1} = \frac{\psi}{1+\psi} s_{m,1} Y_1.
$$

This implies that, locally, a fraction $\frac{\psi}{1+\psi}$ of income is spent on cars, and another fraction $\frac{1}{1+\psi}$ is spent on bread. Thus, total local spending equals total local income. There is no net borrowing across the two locations, in line with the fact that most bank lending in the Great Depression was conducted by local banks (Calomiris and Mason, 2003, p. 941).

We capture the redistribution effect of devaluation with an increase in real farm prices $dp_{x,1} > 0$. We then compare car sales in the equilibrium with higher farm prices at $t = 1$ with car sales in the equilibrium with lower farm prices at $t = 1$, analogous to Werning (2011) and Wieland (2015). Thus, the effect on car sales in each area of higher farm prices is,

$$
\begin{aligned}
\frac{\frac{dD_{a,1}}{D_{a,1}}}{\frac{dp_{x,1}}{p_{x,1}}} &= \frac{1}{1-s^b}\left(1-s_a\right)\frac{s_1^f}{s_{a,1}} + \frac{\frac{dY_1}{Y_1}}{\frac{dp_{x,1}}{p_{x,1}}}; \\
\frac{\frac{dD_{m,1}}{D_{m,1}}}{\frac{dp_{x,1}}{p_{x,1}}} &= -\frac{1}{1-s^b}(1-s_a)\frac{s_1^f}{s_{m,1}} + \frac{\frac{dY_1}{Y_1}}{\frac{dp_{x,1}}{p_{x,1}}}.
\end{aligned}
$$

The first term in each expression captures the redistribution effect: it is positive for the agricultural area and negative for the manufacturing area, and it exactly cancels out at the aggregate level after weighting by local income shares. The size of the redistribution effect depends on the size of the farm sector s_1^f, how large the agricultural area is relative to the manufacturing area $1 - s_a$, and a local income multiplier from nontraded goods $\frac{1}{1-s^b}$. The second term is the aggregate output effect from higher farm prices. Note that this effect is symmetric in the two areas and will therefore be differenced out in a cross-sectional regression.

Specifically, the model counterpart of our cross-sectional regression is,

$$\frac{dD_{i,1}}{D_{i,1}} = k + b\frac{s_i^f}{s_i}, \qquad i = a, m$$

where $\frac{s_i^f}{s_i}$ is the steady-state farm income share, which equals the steady-state farm population share $\frac{\phi_i^f}{\phi_i}$ in the model. To match the difference in auto sales growth across locations, the coefficient b in the model is,

$$\begin{aligned} b &= \frac{dp_{x,1}}{p_{x,1}} \frac{\frac{\frac{dD_{a,1}}{D_{a,1}}}{\frac{dp_{x,1}}{p_{x,1}}} - \frac{\frac{dD_{m,1}}{D_{m,1}}}{\frac{dp_{x,1}}{p_{x,1}}}}{\frac{s_a^f}{s_a} - \frac{s_m^f}{s_m}} \\ &= \frac{dp_{x,1}}{p_{x,1}} \frac{1}{1-s^b} \frac{\frac{s_1^f}{s_{a,1}}}{\frac{s_a^f}{s_a}} \frac{1-s_a}{1-s_{a,1}} \\ &\leq \frac{dp_{x,1}}{p_{x,1}} \frac{1}{1-s^b}, \end{aligned}$$

where the last inequality follows from the fact that farmers and farm areas did worse during the Great Depression (and also in the model due to the decline in $p_{x,1}$).[35] Importantly, the cross-sectional estimate is a function of the change in farm product prices. If farm prices fall, then the cross-sectional estimate ought to be negative and vice-versa. Intuitively, if real farm product prices fall then farm areas ought to do worse, but if farm product prices rise then farm areas ought to do better. Thus the cross-sectional estimate b is informative about (1) the sign and size of farm product price changes and (2) the local income multiplier $\frac{1}{1-s^b}$. In particular, it provides a lower bound on the product of the two.

This property makes our cross-sectional estimate informative about aggregate effects.

[35] The share of farm business GDP in total business GDP fell from 9.9% in 1929 to 8.2% in 1932 (NIPA table 1.3.5, downloaded on 9/29/2016).

From equation (5) it follows that the aggregate output effect is bounded by equation (4),

$$\frac{dY_1}{Y_1} \geq b s_1^f.$$

The lower bound follows from the fact that the cross-sectional estimate is only informative about the local income multiplier $\frac{1}{1-s^b}$ as opposed to the larger aggregate income multiplier $\frac{1}{s_1^c} = \frac{1}{1-s^b-s_1^f-s^l}$. Further, as shown above, the coefficient b is also a lower bound on the local income multiplier.

Thus, the naive calculation of multiplying the cross-sectional estimate with the aggregate farm exposure turns out to be a useful measure. This result is, however, specific to spring 1933 when there was no increase in interest rates and little change in final product prices. By contrast, in the environment of Nakamura and Steinsson (2014) and Farhi and Werning (2012) with active monetary policy and terms-of-trade effects, our formula (4) would not hold.

In appendix C.2 we show that we obtain the same formula (4) when we allow some fraction of farmers and workers to be unconstrained. In that extension, we also show that more indebted areas respond more strongly in line with our results in table 5. In appendix C.3 we also derive the same formula (4) after moving all capitalists to the manufacturing region and eliminating any risk sharing across regions that we have in the baseline model.

6 Conclusion

This paper provides evidence on the sources of U.S. recovery in spring 1933. We document the importance of the farm channel: devaluation raised prices of traded crops and close substitutes, raising income and consumption in agricultural areas. Our estimates imply that a one standard deviation increase in the share of a state's population living on farms was associated with a 20–34 percentage point increase in auto sales growth from winter to fall 1933. Annual data on truck sales, refrigerator sales, and income show that these indicators also grew more in agricultural areas producing traded crops.

In the cross-section of U.S. counties, we find that the farm channel is strongest in areas with high farm debt. This suggests that the farm channel could have been expansionary for the U.S. economy as a whole by redistributing income to indebted, high-MPC farmers. Guided by these results, we build an incomplete-markets model to translate our cross-sectional estimates of the farm channel into an aggregate effect. The model explicitly recognizes that some agents (those purchasing farm goods) lost when farmers gained. Disciplined by our cross-sectional estimates, the model implies that the farm channel raised aggregate output by 9–18%. This corresponds to 25-50% of industrial production growth between the October 1932 - March 1933 average and the July - December 1933 average, suggesting that the farm channel played an important role in spring 1933's rapid growth.

To the extent that the farm channel contributed to overall recovery in the U.S., it means that the lessons of 1933 for macroeconomic policy are more nuanced than often assumed. In particular, our work points to the importance of redistribution as a channel for macroeconomic policy. Japan's recent efforts to raise inflation expectations and end two decades of output stagnation (so-called "Abenomics") provide an illustrative example. When Japan embarked on Abenomics, the U.S. success in 1933 was invoked to predict success in Japan (Romer, 2014; Kuroda, 2013). Just like the U.S. in 1933, Japan in 2013-14 weakened its currency and raised inflation expectations. But whereas devaluation in 1933 redistributed income to indebted farmers with a high MPC, the weakening of the yen may have redistributed income from workers to large, exporting corporations with a low marginal propensity to spend.[36] Thus an appreciation of the farm channel may help economists understand why Abenomics has (as of 2016) failed to produce sustained, rapid growth.

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[36] Hausman and Wieland (2014, 2015) document a decline in real wages in Japan under Abenomics. Kato and Kawamoto (2016) argue that the weakening of the yen contributed to record high corporate profits, but that these higher corporate profits translated into little business investment.

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A Checking data consistency in spring 1933

Such rapid growth rates over a short period naturally lead to questions of data quality: should one believe that seasonally adjusted industrial production rose 57 percent in spring 1933 or might this reported increase be a result of data construction problems? We argue the former. Since our conclusion is in line with Taylor and Neumann (2016), our analysis in this appendix is brief.

The first check is to consider the behavior of non-seasonally adjusted production. This is shown in figure 12a. The rapid increase in industrial production is also present in the raw, non-seasonally adjusted data and is not a regular seasonal phenomena. Only in 1933 does one see such a dramatic increase in spring. A second check on data quality is to see whether the rapid production increase is driven by outliers. It appear not. Of the 19 individual industry production series comprising durable manufacturing published in Federal Reserve (1940), eight saw seasonally adjusted production rise more than 100% between March and July 1933; all but one (railroad car production) of the 19 saw production rise more than 20%.

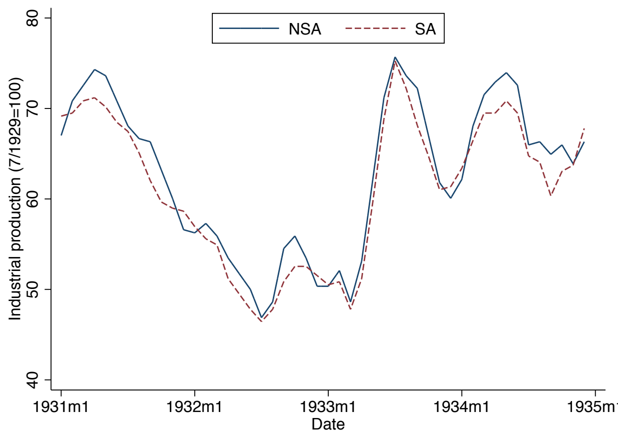
A.1 Other production indicators A further check on the industrial production data is to consider alternative indicators of economic activity. Figure 12b shows two such indicators: the Federal Reserve index of freight car loadings and nonagricultural employment (Federal Reserve, 1941). Freight car loadings measure the real quantity of shipments by rail, with underlying data from the railroads themselves. The broad picture is similar to that for industrial production. After reaching a trough in March 1933, seasonally adjusted freight car loadings grew rapidly through July. In these four months, the seasonally adjusted series rose 40 percent.

It is also natural to examine the evolution of employment. Caution is necessary since the employment data are not entirely independent of the industrial production data. For some industries, the industrial production figures rely heavily on the Bureau of Labor Statistics establishment survey, which is the employment data's source (Federal Reserve, 1940, p. 761). Nonetheless, it is reassuring that, like industrial production, employment rose rapidly in spring 1933. Total, seasonally adjusted, nonagricultural employment grew from 26.7 million in March 1933 to 28.4 million in July.[37] Seventy-three percent of this employment increase was accounted for by an astonishing 20 percent increase in manufacturing employment.[38]

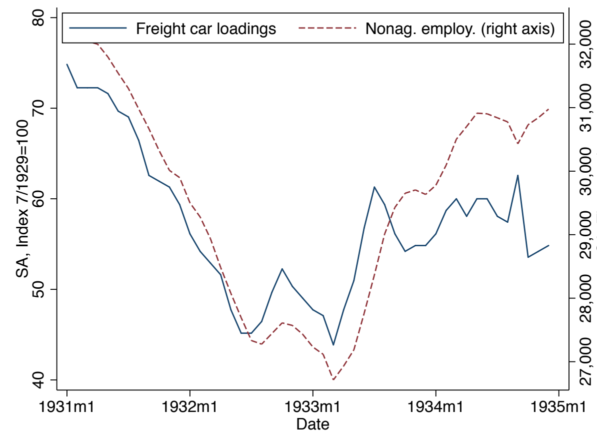
A.2 Sales Together, the data on industrial production, employment, and freight car loadings leave little doubt that output rose rapidly in spring 1933. But was the recovery of production due to contemporaneous consumer demand or to expectations of future demand? If the former, the historians' task is to explain the increase in consumption. If the latter, to explain why firms expected higher future sales. Therefore we examine the behavior of sales in spring 1933. Figure 12c shows seasonally adjusted passenger car sales and produc-

[37] Note that these employment data exclude relief workers. Data are from Federal Reserve (1941) p. 534.

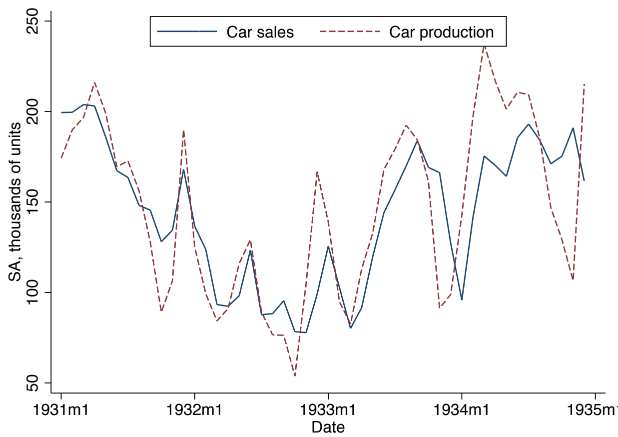
[38] Manufacturing employment rose from 6.12 million in March to 7.36 million in July (Federal Reserve, 1941, p. 534).



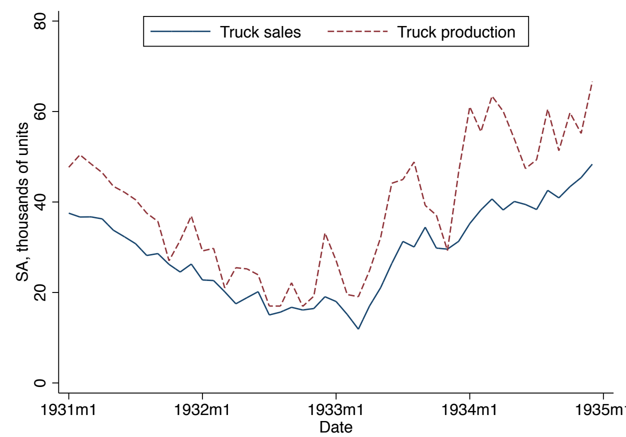
(a) Non-seasonally adjusted and seasonally adjusted industrial production



(b) Freight car loadings and employment



(c) Car sales and production



(d) Truck sales and production

Figure 12 – Notes: See text for details on the seasonal adjustment of car and truck sales / production. Sources: Industrial production: Federal Reserve Board, G.17 data release. Freight car loadings and employment: Federal Reserve (1941). Cars: Sales data are from NBER macrohistory series m01109; production data are from NBER series m01107a. Trucks: Sales data are from NBER macrohistory series m01146a; production data are from NBER series m01144a.

tion from 1931 through 1934.[39] Seasonally adjusted sales behave similarly to production in spring 1933, roughly doubling from March to July. Figure 12d presents the analogous data for trucks. Interestingly, the recovery of truck sales is even more rapid than that of car sales in spring 1933: they rise 163 percent from March to July.[40] Unfortunately, the more rapid growth of truck sales does little to distinguish between the overall inflation expectations channel and a farm specific channel. It is consistent both with high demand for trucks from businesses and from farmers.

As with cars, the difference between truck production and sales is not obviously anomalous in spring 1933. Figures 12c and 12d suggest a roughly parallel movement in production and sales of cars and trucks. Thus explanations of the recovery, at least of this important sector, must explain a rise not only in production, but also in consumer and investment demand.[41] This mirrors the finding of Taylor and Neumann (2016) that manufacturing inventories behaved normally in spring 1933.

B Notes and sources for farm product data in table 1

- The exchange rate: The source is *Survey of Current Business*, 12/1933, p. 31.

- Wheat: U.S. producer prices are from United States Department of Agriculture (1936), table 15, p. 19 (monthly) and table 1, p. 6 (annual). Liverpool prices in dollars are from United States Department of Agriculture (1936), table 19, p. 21. Production, farm value, and trade data are from United States Department of Agriculture (1936), table 1, p. 6. Trade quantities are for the trade year beginning July.

- Corn: U.S. producer prices are from United States Department of Agriculture (1936), table 45, p. 39 (monthly) and table 37, p. 33 (annual). Liverpool prices in dollars are from United States Department of Agriculture (1936), table 47, p. 40. Production, farm value, and trade data are from United States Department of Agriculture (1936), table 37, p. 33. Trade quantities are for the trade year beginning July.

- Oats: U.S. producer prices are from United States Department of Agriculture (1936), table 60, p. 50 (monthly) and table 53, p. 44 (annual). Production, farm value, and trade data are from United States Department of Agriculture (1936), table 53, p. 44. Trade quantities are for the trade year beginning July.

[39] Sales data are from NBER macrohistory series m01109; production data are from NBER series m01107a. Neither series was seasonally adjusted by the source. We seasonally adjust the series by regressing the natural logarithm of each series on monthly dummies and monthly dummies interacted with a post 1935 dummy variable. The second set of dummies are necessary since the date of new model introduction - an important determinant of car sales and production - changed in 1935 (Cooper and Haltiwanger, 1993). The sample period for the regression is January 1925 to December 1940. The series graphed in figure 12c is $e^{\hat{\varepsilon}_t} \cdot \frac{\bar{y}}{\bar{x}}$, where $\hat{\varepsilon}_t$ are the residuals from the regression of the natural log of sales or production on the monthly dummies, $\bar{y}$ is the mean of non-seasonally adjusted sales over the period, and $\bar{x}$ is the mean of $e^{\hat{\varepsilon}_t}$.

[40] Sales data are from NBER macrohistory series m01146a; production data are from NBER series m01144a. The seasonal adjustment procedure is identical to that for passenger cars. See footnote above.

[41] This casts doubt on Kindleberger's (1973) statement that recovery in spring 1933 was "[b]ased on inventory accumulation rather than long-term investment" (p. 233).

- Cotton: U.S. producer prices are from United States Department of Agriculture (1936), table 106, p. 82 (monthly) and table 98, p. 76 (annual). Production, farm value, and trade data are from United States Department of Agriculture (1936), table 98, p. 76. Trade quantities are for the trade year beginning August.

- Tobacco: U.S. producer prices are from Stauber and Regan (1935a), table 5, p. 14 and Stauber and Regan (1935a), table 5, p. 13. Production, farm value, and trade data are from United States Department of Agriculture (1936), table 143, p. 104. Trade quantities are for the trade year beginning July.

- Hay: U.S. producer prices are from United States Department of Agriculture (1936), table 274, p. 190. Production and trade data are from United States Department of Agriculture (1936), table 270, p. 187. Trade quantities are for the trade year beginning July. Production of hay is the sum of tame hay and wild hay production. Farm value is tame hay production multiplied by the December 1 price (given in United States Department of Agriculture (1936), table 270, p. 187) plus wild hay production multiplied by the December 1 price (also given in United States Department of Agriculture (1936), table 270, p. 187).

- Potatoes: U.S. producer prices are from United States Department of Agriculture (1936), table 229, p. 162 (monthly) and table 222, p. 157 (annual). Production, farm value, and trade data are from United States Department of Agriculture (1936), table 222, p. 157. Trade quantities are for the trade year beginning July.

- Cattle: U.S. producer prices are from United States Department of Agriculture (1934b), table 320, p. 587 (monthly) and United States Department of Agriculture (1936) table 307, p. 213 (annual). Production data are from United States Department of Agriculture (1934b), table 324, pp. 590-591, and United States Department of Agriculture (1935b), table 327, pp. 562-563. We calculate farm value as production multiplied by the producer price. Trade data are from United States Department of Agriculture (1936) table 312, p. 217. Trade quantities are for the calendar year. The trade data are for beef and beef products; thus they are an upper bound on trade in beef itself.

- Hogs: U.S. producer prices are from United States Department of Agriculture (1936), table 321, p. 224. Production data are from United States Department of Agriculture (1934b), table 340, p. 601, and United States Department of Agriculture (1935b), table 342, p. 572. Farm value is from United States Department of Agriculture (1934b), table 340, p. 601. Trade data are from United States Department of Agriculture (1936) table 331, p. 229. Trade quantities are for the calendar year. The trade data are for hog products; thus they are an upper bound on trade in pork itself.

- Milk: U.S. producer prices are from United States Department of Agriculture (1936), table 376, p. 267. Production data are from United States Department of Agriculture (1934b), table 383, p. 628, and United States Department of Agriculture (1936), table 368, p. 259. Farm value is production multiplied by the producer price. These USDA publications provide no trade data, presumably because little milk was traded.

- Chickens: U.S. producer prices are from United States Department of Agriculture (1936), table 410, p. 286. Production and farm value data refer to the number of chickens raised; data are from United States Department of Agriculture (1936), table 403, p. 281. United States Department of Agriculture (1936) provides no trade data, presumably because little chicken was traded.

- Eggs: U.S. producer prices are from United States Department of Agriculture (1936), table 419, p. 291. Production and farm value data are from United States Department of Agriculture (1936), table 403, p. 281. United States Department of Agriculture (1936) provides no trade data, presumably because few eggs were traded.

C Model appendix

C.1 Consumption choices $t \geq 2$

Taking logs of each consumers Euler equation yields,

$$\begin{aligned} \ln \lambda_t^f &= \ln \beta + \ln(1+r_t) + \ln \lambda_{t+1}^f \\ \ln \lambda_t^w &= \ln \beta + \ln(1+r_t) + \ln \lambda_{t+1}^w \\ \ln \lambda_t^c + \ln(1+\zeta a_t^c) &= \ln \beta + \ln(1+r_t) + \ln \lambda_{t+1}^c \end{aligned}$$

We next multiply each equation by the consumers steady-state income share and sum over the consumers, using the approximation $\sum_{x \in \{f,w,c\}} s^x \ln \frac{c_t^x}{c^x} \approx \ln \frac{C_t}{C} = 0$,

$$\begin{aligned} s_c \ln(1+\zeta a_t^c) &= \ln \beta + \ln(1+r_t) \\ \Rightarrow \qquad \beta(1+r_t) &\approx 1 + s_c \zeta a_t^c \end{aligned}$$

So the real interest rate is increasing in the asset holdings of the capitalist. We note that these derivations are exact when $\zeta = 0$, for then the economy immediately settles at the new steady-state where $\frac{c_t^x}{c^x} = \frac{C_t}{C} = 0$. Thus, we can make the approximation error arbitrarily small by choosing a sufficiently small asset holding cost ζ.

Substituting the solution for the interest rate back into the Euler equation yields,

$$\begin{aligned} c_t^f &\approx c_{t+1}^f - c^f s_c \zeta a_t^c \\ c_t^w &\approx c_{t+1}^w - c^w s_c \zeta a_t^c \\ c_t^c &\approx c_{t+1}^c + c^c (1 - s_c) \zeta a_t^c \end{aligned}$$

Again these equations are exact when $\zeta = 0$.

The asset accumulation equation for capitalists is approximately,

$$a_t \approx \beta^{-1} a_{t-1} - (1+\psi) c_t^c + s^c \bar{Y}$$

which is also exact when $\zeta = 0$.

This yields a system of two equations,

$$\begin{aligned}
a_t &= \beta^{-1} a_{t-1} - (1+\psi) c_t^c + s^c \bar{Y} \\
c_{t+1}^c &= -c^c (1 - s_c) \zeta a_t^c + c_t^c
\end{aligned}$$

which we can solve using standard Eigenvalue-Eigenvector decomposition.

The Lagrange multipliers are:

$$\kappa_{1,2} = \frac{1+\beta^{-1}}{2} \pm \sqrt{\left(\frac{1+\beta^{-1}}{2}\right)^2 - \beta^{-1} + (1+\psi) c^c (1 - s_c) \zeta}$$

For small but positive $\zeta > 0$, $0 < \kappa_1 < 1$ and $\kappa_2 > 1$. The transversality condition then selects the initial condition to eliminate the explosive root κ_2. Thus, the solution to the system of equations is,

$$\begin{aligned}
a_t^c &= \kappa_1 a_{t-1}^c \\
c_t^c &= \frac{\beta^{-1} - \kappa_1}{1+\psi} a_{t-1}^c + \frac{1}{1+\psi} s^c \bar{Y} \\
c_t^f &= -\frac{s^f}{1-s^c} \frac{\beta^{-1} - \kappa_1}{1+\psi} a_{t-1}^c + \frac{1}{1+\psi} s^f \bar{Y} \\
c_t^w &= -\frac{s^w}{1-s^c} \frac{\beta^{-1} - \kappa_1}{1+\psi} a_{t-1}^c + \frac{1}{1+\psi} s^w \bar{Y}
\end{aligned}$$

C.2 Fraction of unconstrained workers and farmers

We first modify the aggregate deviations before turning to the cross section.

C.2.1 Aggregate economy We group all unconstrained consumers together. This implicitly assumes perfect risk sharing among the unconstrained, but the upshot is that we only have to change the income processes and not solve again for the policy functions,

$$\begin{aligned}
y_t^{cf} &= \frac{\theta^{cf} \alpha}{1+\psi} p_{x,t} Y_t \equiv \theta^{cf} s_t^f Y_t \\
y_t^{cw} &= \theta^{cw} w \left[\frac{\psi + 1 - \alpha}{1+\psi}\right] Y_t \equiv \theta^{cw} s^w Y_t \\
y_t^u &= \left[1 - \frac{\alpha p_{x,t} (1 - \theta^{cf}) + w(1 - \theta^{cw})(\psi + 1 - \alpha)}{1+\psi}\right] Y_t \equiv s_t^u Y_t
\end{aligned}$$

We now only need to substitute these new expressions into the aggregate income equation,

$$
\begin{aligned}
Y_t &= (1+\psi)(c_t^{cf} + c_t^{cw} + c_t^u) \\
&= (1-s_t^u)Y_t + mpc^u s_t^u Y_t - (1-s^u)\bar{a} + \beta^{-1}(1-mpc^u)s^u\bar{Y}
\end{aligned}
$$

which implies aggregate output is equal to

$$
Y_t = \frac{1}{s_t^u(1-mpc^u)}\left[-(1-s^u)\bar{a} + \beta^{-1}(1-mpc^u)s^u\bar{Y}\right]
$$

This is the same equation as before, but with a different group of unconstrained consumers. The aggregate effect of raising p_x is then,

$$
\frac{dY_t/Y_t}{dp_{x,t}/p_{x,t}} = \frac{\theta^{cf}s_t^f}{s_t^u}
$$

C.2.2 Cross-section As in our baseline model, farm products (X) and cars (D) are fully traded, but bread (C) is nontraded. As in extension I, we denote by θ^x the fraction of constrained farmers cf, bakers cb, and laborers cl. We assume that these fractions are identical in both location a and m. We denote by ν the fraction of capitalists living in area a.

Then the incomes of each type of consumer are,

$$
\begin{aligned}
y_{a,t}^{cf} &= \theta^{cf}\frac{\alpha}{1+\psi}p_{x,t}Y_t \equiv \theta^{cf}s_t^f Y_t \\
y_{a,t}^{cb} &= \theta^{cb}\left(\frac{1-\alpha}{1+\psi}\right)wY_{a,t} \equiv \theta^{cb}s^b s_{a,t}Y_t \\
y_{m,t}^{cb} &= \theta^{cb}\left(\frac{1-\alpha}{1+\psi}\right)wY_{m,t} \equiv \theta^{cb}s^b s_{m,t}Y_t \\
y_{m,t}^{cl} &= \theta^{cl}\left(\frac{\psi}{1+\psi}\right)wY_t \equiv \theta^{cl}s^l Y_t \\
y_t^u &= \left[1-\theta^{cf}s_t^f - \theta^{cb}s^b - \theta^{cl}s^l\right]Y_t \equiv s_t^u Y_t.
\end{aligned}
$$

The total share of unconstrained income going to areas a and m is,

$$
\begin{aligned}
\frac{s_a^u}{s^u} &= \frac{\nu(1-s^l) + (1-\nu-\theta^{cf})s^f + (1-\nu-\theta^{cb})s^b}{1-\theta^{cf}s^f - \theta^{cb}s^b - \theta^{cl}s^l} \\
\frac{s_m^u}{s^u} &= 1 - \frac{s_a^u}{s^u}.
\end{aligned}
$$

We set ν such that the share of unconstrained income in each area is commensurate to the steady-state area income share, $\frac{s_a^u}{s_u} = s_a$ as in our baseline model.

The corresponding solution for area income shares are,

$$s_{a,t} = \frac{1}{1-\theta^{cb}s^b}\left\{\theta^{cf}\left(1-s_a\right)s_t^f + s_a[1-\theta^{cb}s^b - \theta^{cl}s^l]\right\}$$
$$s_{m,t} = \frac{1}{1-\theta^{cb}s^b}\left\{\theta^{cl}s_a s^l + (1-s_a)[1-\theta^{cf}s_t^f - \theta^{cb}s^b]\right\}$$

where $s_{a,t} + s_{m,t} = 1$. Higher farm prices again redistribute towards the agricultural area as in our baseline model.

The car expenditure functions for each type of worker are now,

$$d_{a,t}^{cf} = \frac{\psi}{1+\psi}(y_{a,t}^{cf} - \theta^{cf}s^f\bar{a})$$
$$d_{a,t}^{cb} = \frac{\psi}{1+\psi}(y_{a,t}^{cb} - \theta^{cb}s^b s_a\bar{a})$$
$$d_{m,t}^{cb} = \frac{\psi}{1+\psi}(y_{m,t}^{cb} - \theta^{cb}s^b s_m\bar{a})$$
$$d_{m,t}^{cl} = \frac{\psi}{1+\psi}(y_{m,t}^{cl} - \theta^{cl}s^l\bar{a})$$
$$d_{a,t}^{u} = \frac{s_a^u}{s^u}\frac{\psi}{1+\psi}\left[mpc^u y_t^u + \beta^{-1}(1-mpc^u)s^u\bar{Y}\right]$$
$$d_{m,t}^{u} = \frac{s_m^u}{s_a^u}d_{a,t}^u$$

Combining all expenditure and income expressions, we can again write local durable car expenditure as

$$D_{a,t} = \frac{\psi}{1+\psi}s_{a,t}Y_t$$
$$D_{m,t} = \frac{\psi}{1+\psi}s_{m,t}Y_t$$

The growth in durables in the agricultural area is

$$\frac{\frac{dD_{a,t}}{D_{a,t}}}{\frac{dp_{x,t}}{p_{x,t}}} = \frac{\theta^{cf}}{1-\theta^{cb}s^b}\left(1-s_a\right)\frac{s_t^f}{s_{a,t}} + \frac{\frac{dY_t}{Y_t}}{\frac{dp_{x,t}}{p_{x,t}}}$$
$$\frac{\frac{dD_{m,t}}{D_{m,t}}}{\frac{dp_{x,t}}{p_{x,t}}} = \frac{\frac{dY_{m,t}}{Y_{m,t}}}{\frac{dp_{x,t}}{p_{x,t}}} = -\frac{\theta^{cf}}{1-\theta^{cb}s^b}(1-s_a)\frac{s_t^f}{s_{m,t}} + \frac{\frac{dY_t}{Y_t}}{\frac{dp_{x,t}}{p_{x,t}}}$$

Relative to the baseline model, the main difference is that the local income multiplier effect is now $\frac{\theta^{cf}}{1-\theta^{cb}s^b}$ as opposed to $\frac{1}{1-s^b}$.

Now following exactly the same steps as in our baseline model, we can bound our cross-sectional estimate of the farm channel by,

$$b \leq \frac{\Delta p_{x,t}}{p_{x,t-1}} \frac{\theta^{cf}}{1-\theta^{cb} s^{b}}$$

which in turn implies that the aggregate effect is bounded below by,

$$\frac{dY_t}{Y_t} \geq b s_t^f$$

This is the same formula as in our baseline model.

C.3 No risk sharing across regions

A possible concern in our baseline set-up is that the unconstrained agents share the income changes across areas. Since they are proportionally represented, this decline in income gets differenced out. To show that this is not what is driving our results, we solve the model when there are no capitalists in the agricultural area, $s_a^u = 0$. In this case, we set the borrowing limit to $\bar{a} = 0$, so there is no borrowing across areas. A simple interpretation is that consumers cannot borrow now since lending markets are local and there are no unconstrained agents to borrow from.

The new area income shares are now,

$$s_{a,t} = \frac{s_t^f}{1-s^b}$$
$$s_{m,t} = \frac{1-s_t^f-s^b}{1-s^b}$$

Further, given $\bar{a} = 0$, we can again write car expenditure as a function of local income only,

$$D_{a,t} = \frac{\psi}{1+\psi} s_{a,t} Y_{a,t}$$
$$D_{m,t} = \frac{\psi}{1+\psi} s_{m,t} Y_{a,t}$$

Thus, relative to our baseline set-up, we now push all losses on the manufacturing area, but do not otherwise change the marginal propensity to consume out of local income.

The implied coefficient in our regressions is

$$
\begin{aligned}
b &= \frac{\frac{\frac{dD_{a,t}}{D_{a,t}}}{\frac{dp_{x,t}}{p_{x,t}}} - \frac{\frac{dD_{m,t}}{D_{m,t}}}{\frac{dp_{x,t}}{p_{x,t}}}}{\frac{1}{\frac{\Delta p_{x,t}}{p_{x,t-1}}}\frac{s_a^f}{s_a} - \frac{1}{\frac{\Delta p_{x,t}}{p_{x,t-1}}}\frac{s_m^f}{s_m}} \\
&= \frac{\Delta p_{x,t}}{p_{x,t-1}} \frac{s_t^f}{1-s^b} \frac{\left[\frac{1}{s_{a,t}} + \frac{1}{s_{m,t}}\right]}{\frac{s^f}{s_a} - 0} \\
&= \frac{\Delta p_{x,t}}{p_{x,t-1}} \frac{\frac{s_t^f}{s_{a,t}}}{\frac{s^f}{s_a}} \frac{1}{1-s^b} \frac{1}{1-s_{a,t}} \\
&= \frac{\Delta p_{x,t}}{p_{x,t-1}} \frac{\frac{s_t^f}{s_{a,t}}}{\frac{s^f}{s_a}} \frac{1}{1-s^b} \frac{1}{1-\frac{1}{1-s^b}s_t^f} \\
&\leq \frac{\Delta p_{x,t}}{p_{x,t-1}} \frac{1}{1-s^b-s_t^f}
\end{aligned}
$$

The local multiplier $\frac{1}{1-s^b-s_t^f}$ is again a lower bound on the aggregate multiplier. So we can use the same bounds as before,

$$
\frac{dY_t}{Y_t} \geq b s_t^f
$$

C.4 D as durable good

We now modify the baseline model such that cars D are durable. We assume they depreciate at a rate δ. The optimization problem for each consumer then becomes,

$$
\max_{c_t, d_t, z_t, a_t} \sum_{s=0}^{\infty} \beta^s \left[\ln c_t + \psi \ln d_t\right]
$$

$$
\begin{aligned}
\text{s.t. } \lambda: \quad & a_t = (1+r_{t-1})a_{t-1} + y_t - c_t - z_t - \frac{\zeta}{2} a_t^2 \mathbb{1}_{\text{capitalist}} \\
\xi: \quad & d_t = z_t + d_{t-1}(1-\delta) \\
\mu: \quad & a_t \geq s\bar{a}
\end{aligned}
$$

where z_t are now car expenditures and d_t is the effective value of the car.

The new first order conditions are

$$\begin{aligned}
\zeta\lambda_t &= \frac{1}{c_t} \\
\lambda_t &= \xi_t \\
\xi_t &= \psi\frac{1}{d_t} + \beta(1-\delta)\xi_{t+1} \\
\lambda_t &= \beta(1+r_t)\lambda_{t+1} + \mu_t - \zeta a_t \mathbb{1}_{\text{capitalist}}
\end{aligned}$$

The new steady-state durable and non-durable consumption choices are now,

$$\begin{aligned}
d^x &= \frac{\psi}{1-\beta(1-\delta)} c^x \\
z^x &= \frac{\psi\delta}{1-\beta(1-\delta)} c^x \\
c^x &= \left[1 + \frac{\psi\delta}{1-\beta(1-\delta)}\right]^{-1} s^x \bar{Y}
\end{aligned}$$

where s^x is again the steady-state income share.

Following the same steps as in appendix C.1 we arrive at the linear difference equations for capitalists,

$$\begin{aligned}
a_t &= \beta^{-1} a_{t-1} - \left[1 + \frac{\psi\delta}{1-\beta(1-\delta)}\right] c_t^c + s^c \bar{Y} \\
c_{t+1}^c &= -c^c(1-s_c)\zeta a_t^c + c_t^c
\end{aligned}$$

This system is very similar to our baseline set-up, but with $\delta < 1$.

The Lagrange multipliers are:

$$\kappa_{1,2} = \frac{1+\beta^{-1}}{2} \pm \sqrt{\left(\frac{1+\beta^{-1}}{2}\right)^2 - \beta^{-1} + \left[1 + \frac{\psi\delta}{1-\beta(1-\delta)}\right] c^c(1-s_c)\zeta}$$

For small but positive $\zeta > 0$, $0 < \kappa_1 < 1$ and $\kappa_2 > 1$. The transversality condition then selects the initial condition to eliminate the explosive root κ_2. Thus, the solution to the system of equations is,

$$\begin{aligned}
a_t^c &= \kappa_1 a_{t-1}^c \\
c_t^c + z_t^c &= (\beta^{-1} - \kappa_1) a_{t-1}^c + s^c \bar{Y} \\
c_t^f + z_t^f &= -\frac{s^f}{1-s^c}(\beta^{-1} - \kappa_1) a_{t-1}^c + s^f \bar{Y} \\
c_t^w + z_t^w &= -\frac{s^w}{1-s^c}(\beta^{-1} - \kappa_1) a_{t-1}^c + s^w \bar{Y}
\end{aligned}$$

Relative to the baseline model, the introduction of $\delta < 1$ only affects the fraction of income going to car expenditures $\frac{\psi\delta}{1-\beta(1-\delta)}$ and the change in the convergence rate κ_1. Following the steps in the baseline model, we can now calculate total spending by capitalists at $t = 1$,

$$c_t^c + z_t^c = mpc^c y_t^c + \beta^{-1}(1 - mpc^c)s^c\bar{Y}$$

where $mpc^c = \frac{\beta^{-1}(\beta^{-1}-\kappa_1+\zeta)}{1+\beta^{-1}(\beta^{-1}-\kappa_1+\zeta)} < 1$.

For farmers and workers $x \in \{f, w\}$, the consumption choices are

$$z_t^x = \frac{\psi\delta}{1-\beta(1-\delta)} c_t^x$$
$$c_t^x = \left[1 + \frac{\psi\delta}{1-\beta(1-\delta)}\right]^{-1} (y_t^x - s^x\bar{a})$$

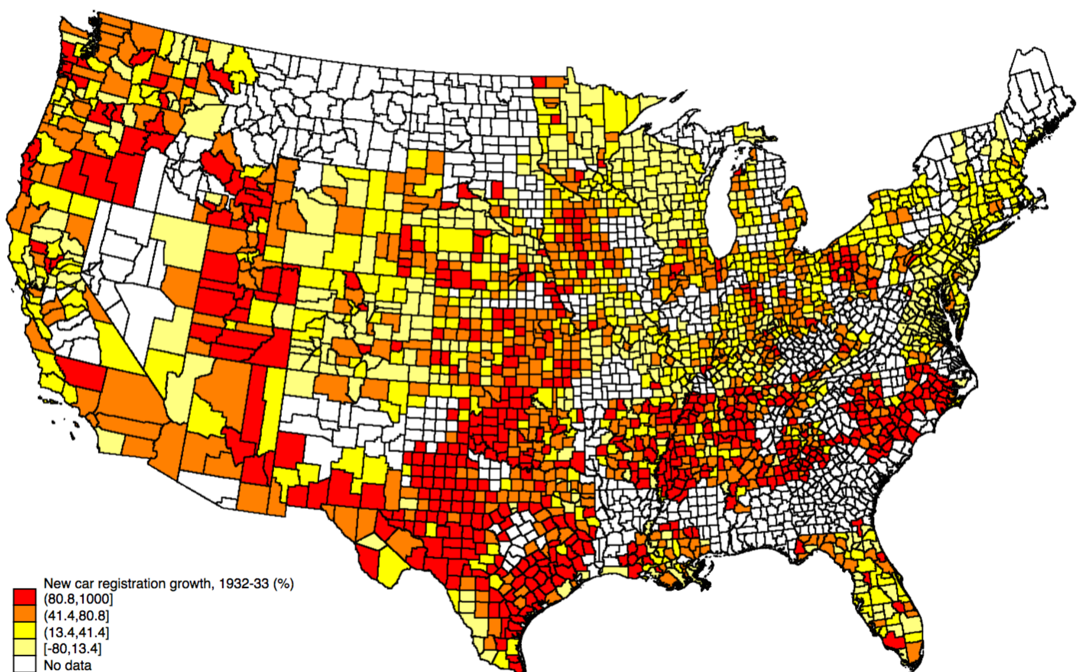
Combining these choices for all consumers yields an expression analogous to equation (5),

$$Y_t = \frac{1}{s_t^c(1-mpc^c)}\left[-(s^f + s^w)\bar{a} + \beta^{-1}(1 - mpc^c)s^c\bar{Y}\right]$$

So durability in itself does not add to the propagation or amplification.

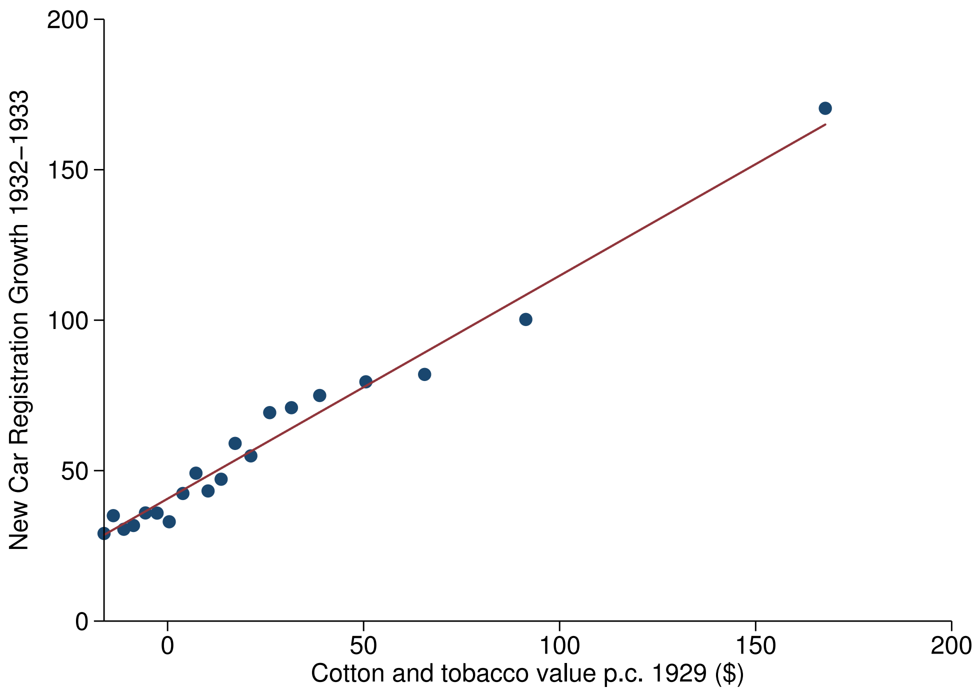
D Appendix Figures

Figure 13 – County auto sales, 1932-33



Note: Darker colors denote faster 1932-1933 growth of new car purchases in a county. Sources: see text.

Figure 14 – Percent change in car sales and farm channel exposure at the county level



Binned scatter plot of 1932-33 county-level car sales growth against 1929 cotton / tobacco crop value per capita, conditional on the control variables used in column 3 of table 3. The straight line is the OLS regression line. Each point in the figure shows the mean percent change in auto sales for the traded crop per value per capita in each bin of cotton / tobacco values per capita after orthogonalizing the controls. There are 20 bins. The plot is made using the user-written STATA command, "binscatter." For details, see Stepner (2014).

E Appendix Tables

Table 6 – Auto sales growth in spring 1933 (% changes): Population-weighted estimates

Panel A: Farm population share

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
% pop. on farms	1.64***	1.93***	0.93**	0.93*	1.56***	2.09***	1.93***	1.29*
	(0.29)	(0.44)	(0.40)	(0.49)	(0.41)	(0.69)	(0.48)	(0.65)
Population (millions)		0.87		−1.02		−1.54		−0.54
		(1.25)		(1.46)		(1.59)		(2.19)
New cars p.c. 1929 (1000s)		1.44**		0.021		1.06		0.46
		(0.70)		(0.83)		(1.03)		(0.91)
% pop. black		1.25*		0.70		1.44		2.33**
		(0.69)		(0.88)		(0.95)		(1.06)
Seasonally Adjusted Auto Sales	Yes	Yes	Yes	Yes	No	No	No	No
Region Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Lagged Dependent Variable	No	No	Yes	Yes	No	No	Yes	Yes
R^2	0.43	0.61	0.69	0.72	0.28	0.39	0.60	0.67
Observations	49	49	49	49	49	49	49	49

Panel B: Crops sold or traded per capita

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Crops sold p.c. 1929 ($)	0.90***	0.84***	0.37*	0.44**	0.81***	0.98***	0.86***	0.66**
	(0.17)	(0.15)	(0.21)	(0.18)	(0.24)	(0.28)	(0.28)	(0.27)
Population (millions)		−0.25		−1.39		−2.64*		−0.97
		(1.23)		(1.36)		(1.46)		(1.91)
New cars p.c. 1929 (1000s)		0.20		−0.43		−0.31		−0.16
		(0.79)		(0.81)		(1.07)		(0.89)
% pop. black		1.10		0.55		1.24		2.10**
		(0.71)		(0.87)		(0.97)		(0.96)
Seasonally Adjusted Auto Sales	Yes	Yes	Yes	Yes	No	No	No	No
Region Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Lagged Dependent Variable	No	No	Yes	Yes	No	No	Yes	Yes
R^2	0.41	0.63	0.65	0.73	0.24	0.43	0.49	0.68
Observations	49	49	49	49	49	49	49	49

Robust standard errors in parentheses. * $p < .10$, ** $p < .05$, *** $p < .01$

Note: The dependent variable is the percent change in auto sales from the October 1932-March 1933 average to the July-December 1933 average. In specifications controlling for lags of the dependent variable, we include the percent change in auto sales from April-September 1932 to January-June 1933, from October 1931-March 1932 to July-December 1932, and so on back to October 1929-March 1930 to July 1930-December 1930.

Sources: Auto sales - see text; population, the percent of population on farms and the percent of population black - the 1930 Census as reported in Haines and ICPSR (2010); value of crops sold per capita - the 1940 Census as reported in Haines et al. (2015); FDR vote percentage - ICPSR (1999).

Table 7 – Auto sales growth in spring 1933 (% changes from the October 1932-March 1933 average to the July-August 1933 average)

Panel A: Farm population share

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
% pop. on farms	1.73***	1.65***	0.97**	0.46	1.79**	2.78***	2.49***	1.75**
	(0.43)	(0.56)	(0.41)	(0.60)	(0.76)	(0.97)	(0.71)	(0.77)
Population (millions)		1.35		−1.71		−4.23		−0.82
		(1.71)		(2.16)		(2.74)		(3.64)
New cars p.c. 1929 (1000s)		0.51		−1.47		0.67		−1.79
		(0.89)		(0.98)		(1.76)		(1.49)
% pop. black		1.26*		1.09		0.45		1.70
		(0.73)		(0.75)		(1.46)		(1.33)
Seasonally Adjusted Auto Sales	Yes	Yes	Yes	Yes	No	No	No	No
Region Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Lagged Dependent Variable	No	No	Yes	Yes	No	No	Yes	Yes
R^2	0.30	0.47	0.66	0.71	0.11	0.36	0.69	0.74
Observations	49	49	49	49	49	49	49	49

Panel B: Crops sold or traded per capita

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Crops sold p.c. 1929 ($)	0.86***	0.73***	0.37**	0.29	1.13***	1.23***	0.99***	0.84***
	(0.17)	(0.19)	(0.16)	(0.18)	(0.38)	(0.35)	(0.31)	(0.30)
Population (millions)		0.84		−1.53		−5.07**		−1.08
		(1.70)		(1.85)		(2.22)		(2.97)
New cars p.c. 1929 (1000s)		−0.59		−1.61**		−1.18		−2.61**
		(0.78)		(0.70)		(1.45)		(1.23)
% pop. black		1.18		1.00		0.31		1.42
		(0.77)		(0.78)		(1.52)		(1.34)
Seasonally Adjusted Auto Sales	Yes	Yes	Yes	Yes	No	No	No	No
Region Fixed Effects	No	Yes	No	Yes	No	Yes	No	Yes
Lagged Dependent Variable	No	No	Yes	Yes	No	No	Yes	Yes
R^2	0.40	0.54	0.65	0.72	0.23	0.43	0.66	0.76
Observations	49	49	49	49	49	49	49	49

Robust standard errors in parentheses. * $p < .10$, ** $p < .05$, *** $p < .01$

Note: The dependent variable is the percent change in auto sales from the October 1932-March 1933 average to the July-August 1933 average. In specifications controlling for lags of the dependent variable, we include the percent change in auto sales from April-September 1932 to January-February 1933, from October 1931-March 1932 to July-August 1932, and so on back to October 1929-March 1930 to July 1930-August 1930.
Sources: Auto sales - see text; population, the percent of population on farms and the percent of population black - the 1930 Census as reported in Haines and ICPSR (2010); value of crops sold per capita - the 1940 Census as reported in Haines et al. (2015); FDR vote percentage - ICPSR (1999).