Federal Reserve Bank of Dallas
Globalization and Monetary Policy Institute
Working Paper No. 226
http://www.dallasfed.org/assets/documents/institute/wpapers/2015/0126.pdf

The Asymmetric Effects of Deflation on Consumption Spending: Evidence from the Great Depression*

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February 2015

Abstract

Does expected deflation lead to a fall in consumption spending? Using data for U.S. grocery store sales and department store sales from 1919 to 1939, this paper shows that expected price changes have asymmetric effects on consumption spending. Department store sales (durable consumption) react negatively to the expectation of falling prices, but grocery store sales (non-durable consumption) do not react to expected price changes.

JEL codes: E20, N10

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1 Introduction

The renewed possibility of deflation in some major developed economies has led to renewed interest in the macroeconomic effects of deflation. In addition to the effects of downward nominal wage rigidity or the Fisher (1933) debt-deflation channel, the channel where the expectation of falling prices should lead customers to postpone purchases is intuitive and seems to arise in many discussions in the financial press.[1]

Christensen (2009) argues that through this channel whereby consumers postpone purchases in the expectation of lower prices in the future, sustained deflation will result in downward pressure on economic activity. De Long and Summers (1986) argue that "while a lower price level is expansionary, the expectation of falling prices is contractionary". Groth and Westaway (2009) discuss this channel and argue that it is a complication associated with the zero-lower-bound on nominal interest rates.

Empirically, Cargill and Parker (2004) find evidence that this channel has led to a contraction spending in the United States in the past, and Hori and Shimizutani (2005) find evidence of this channel in Japan in the 1990s, but Leamer (2011) argues that with the exception of home purchases, there is little evidence to support the theory that consumers postpone consumption in expectation of falling prices. "Is that true for food?", Leamer asks.

Intuitively, the expectation of a falling price level may lead buyers to postpone purchases of durable goods, but buyers are less likely to postpone purchases of non-durable goods. To test this conjecture, we estimate a consumption function for durable goods and non-durable goods in the United States from 1919-1939. The purpose of this is to test how durable and non-durable consumption reacted to the sharp deflationary period of the early 1930s. We use an index of department store sales to proxy for durable goods consumption and an index of grocery store sales to proxy for non-durable goods consumption. In line with the earlier intuition, there is an asymmetric response of different types of consumption to expected deflation; expected deflation led to a fall in department store sales but had no effect

[1] Leamer (2011) calls this "the favorite talking-head story".

on grocery store sales. In addition there is a second type of asymmetry in the response to expected price changes. Expected deflation leads to a fall in durable goods consumption as customers postpone purchases, but expected inflation does not lead to a subsequent increase in durable goods consumption. In terms of magnitude, we estimate that the response of durable goods consumption to an expected 1% fall in prices is similar to the response to a 1% fall in income.

2 Econometric methodology and data

In order to test how expected future price changes affect different types of consumption spending, we estimate the following regression using monthly data:

$$c_t^i = \phi^i + \sum_{j=1}^{2} \alpha_j^i c_{t-j}^i + \sum_{j=0}^{2} \beta_j^i y_{t-j} + \sum_{j=0}^{2} \gamma_j^i \pi_{t-j} + \lambda^i r_t + \theta^i \pi_{t+12}^e + \epsilon_t^i \tag{1}$$

where c_t^i is the month-over-month log change in consumption spending (either department store sales, $i = d$, or grocery store sales, $i = g$), y_t is the log change in industrial production, π_t is the log change in the price level, r_t is the nominal interest rate, and π_{t+12}^e is the expected log change in the price level over the next 12 months.

Of course, data for expected inflation or deflation is not available over the period in question, 1919-1939. Therefore we rely on the forecasting model in Barro (1978) to construct a series for expected changes in the price level. Bernanke (1983) uses the method to construct a series of expected price level change in the 1920s and 1930s. This method requires a two-step procedure, first we estimate the following using a 10-year moving window of monthly data:

$$\sum_{k=1}^{12} \pi_{\tau+k} = \psi + \sum_{j=0}^{4} \delta_j \pi_{\tau-j} + \sum_{j=0}^{4} \eta_j m_{\tau-j} + \sum_{j=0}^{4} \mu_j y_{\tau-j} + \varepsilon_\tau \tag{2}$$

where m_t is the month-over-month log change in the money stock. Thus in the first step we

regress the year-over-year change in the price level, $\sum_{k=1}^{12} \pi_{t+k}$ on lagged values of inflation, money growth, and industrial production. In order to construct the expected inflation measure at time t, π^e_{t+12}, we estimate this forecasting equation only using data available up to period t (thus in each period this equation is reestimated with a new 10-year window; the first observation in the window is given by $\tau = t - 132$ and the last observation is given by $\tau = t - 12$). After estimating the parameters of the forecasting equation, the expected inflation measure is simply given by:

$$\pi^e_{t+12} = \hat{\psi} + \sum_{j=0}^{4} \hat{\delta}_j \pi_{t-j} + \sum_{j=0}^{4} \hat{\eta}_j m_{t-j} + \sum_{j=0}^{4} \hat{\mu}_j y_{t-j} \tag{3}$$

The expected inflation series, π^e_{t+12}, and observed year-over-year inflation $\sum_{k=1}^{12} \pi_{t+k}$ are plotted in the top panel of figure 1. The expected inflation series performs well in tracking observed inflation and deflation, especially the dramatic deflationary period in the early 1930s. Over the period from 1919 to 1939, the expected inflation series has a mean-square-forecast-error of 5.65%. This compares to a mean-square-forecast-error of 8.73% for a random walk forecast (where the expectation for inflation over the next 12 months is simply equal to observed inflation over the last 12 months).

2.1 Data

The data used in this study is all taken from the NBER Macro-history Database. Prices are given by the index of the general price level, which is available monthly beginning in 1860. Industrial production is given by the Index of Industrial Production and Trade and is available monthly beginning in 1875. The money stock is available from 1907. The data necessary to run the forecasting equation (2) is available starting in 1907, and thus the constructed expected inflation series begins in 1918.

The nominal interest rate is simply the interest rate on long-term U.S. government bonds. Our two consumption measures are the Index of Department Store Sales and the Index of Grocery Store Sales. These indices are available monthly from 1919. They are both seasonally adjusted with an X-12 adjustment. These two indices are plotted in the bottom panel of figure 1. The figure shows that while grocery store sales tend to be fairly steady, department store sales are very cyclical. Grocery store sales fell by 10% between October 1929 and March 1933; department store sales fell by nearly 50% over the same period. As we will show in the next section, part of this is simply due to the fact that department store sales are far more income elastic, and thus vary more over the cycle. However, unlike grocery store sales, department store sales fall in response to expected deflation, and thus the sharp fall in department store sales in the early 1930s is in part due to the fact that buyers were expecting severe deflation throughout the early 1930s.

3 Results

The results from the estimation of consumption functions for department store sales and grocery store sales are presented in table 1. The table presents the results for 3 specifications of the regression model in (1) for both department store sales and grocery store sales as the dependent variable. The first specification (columns 1 and 4) does not include expected inflation. The second specification (columns 2 and 5) includes expected inflation. And the third specification (columns 3 and 6) includes both expected inflation and an indicator variable that is equal to one if expected inflation is positive and zero otherwise.

Since one of the regressors in the consumption function is itself generated from a forecasting equation, normal OLS standard errors will suffer from generated regressor bias as in Pagan (1984). This bias has been corrected for using the estimation procedure described in Murphy and Topel (1985).

The coefficients on the two lags of the dependent variable are negative and significant,

indicating significant mean reversion in both types of consumption. The coefficient of industrial production is positive and significant for department store sales but not significantly different from zero for grocery store sales, indicating that department store sales are much more income elastic. The coefficient of 0.3 on industrial production implies that if industrial production growth increases by 1 percentage point, department store sales increase by about 0.3 percentage points. The coefficients on current and lagged inflation are insignificant in all specifications where grocery store sales is the dependent variable. These coefficients are positive and significant for department store sales in the first specification, but become either insignificant or much smaller when expected inflation is included in the regression. Finally, the nominal interest rate is not significant in any specification.

When expected inflation is included in the regression (columns 2 and 5), the coefficient is positive and significant when department store sales is the dependent variable, but it is not significant when grocery store sales is the dependent variable. Expected deflation over the next year should cause department store sales to fall as buyers postpone durable goods purchases in anticipation of lower prices in the future. At the same time, buyers do not postpone grocery purchases in anticipation of lower future prices.

In addition to the asymmetric reaction of department and grocery store sales to expected inflation, the regression specifications in columns 3 and 6 test if consumer's responses to expected future inflation is simply the opposite of their reaction to expected deflation. Since this specification includes the interaction with an indicator variable that is equal to one if expected future inflation is positive, the coefficient of π^e_{t+12} measures the response to the expectations of falling prices and the sum of the coefficients of π^e_{t+12} and $I_t * \pi^e_{t+12}$ measures the response to the expectation of rising prices. The response of department store sales to expectations of falling prices is positive and significant. The coefficient of 0.22 implies that 1% expected deflation over the next year should cause department store sales to fall by about 0.22 percentage points as buyers postpone durable goods purchases in anticipation of lower prices in the future. At the same time, the sum of the coefficients of π^e_{t+12} and $I_t * \pi^e_{t+12}$ is

0.07 and has a p-value of 0.38 (the p-value is not reported in the table). This implies that while buyers postpone durable goods purchases in the anticipation of falling prices, they do not increase purchases in the anticipation of rising prices.

4 Conclusion

The fact that customers should postpone purchases in anticipation of lower prices in the future is intuitive, and this naturally leads to a channel where deflation should depress consumption. While this explanation is intuitive, it is incomplete. It is easy to postpone some purchases, but difficult to postpone others.

Using data on department store sale and grocery store sales during one of the most famous deflationary episodes in history, the United States in the early 1930s, this paper shows that there are asymmetric effects of expected changes in the price level on consumer purchases. Department store sales react to expected price changes, but grocery store sales do not. In addition within department store sales there is a further asymmetric response. Sales react negatively to expected deflation as customers postpone purchases of durable goods, but do not react to expected inflation. Indicating that customers do not move forward consumption in anticipation of higher prices in the future.

As discussed by Groth and Westaway (2009), this tendency to shift consumption in response to nominal price changes in a side-effect of the zero-lower-bound on nominal interest rates. Given that interest rates in many developed economies are currently at or near the zero lower bound, and inflation is falling, a promising direction for further research would be to study exactly how this asymmetric response of consumption to expected inflation or expected deflation arises.

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Table 1: Results from regression of department or grocery store sales index on current and lagged industrial production, current and lagged inflation, interest rates, and expected inflation.

	Department	Department	Department	Grocery	Grocery	Grocery
c^i_{t-1}	-0.771^{***}	-0.791^{***}	-0.793^{***}	-0.737^{***}	-0.737^{***}	-0.737^{***}
	(0.059)	(0.063)	(0.069)	(0.059)	(0.059)	(0.059)
c^i_{t-2}	-0.384^{***}	-0.410^{***}	-0.411^{***}	-0.418^{***}	-0.418^{***}	-0.418^{***}
	(0.059)	(0.062)	(0.069)	(0.059)	(0.059)	(0.059)
y_t	0.327^{***}	0.294^{***}	0.293^{***}	0.077	0.077	0.077
	(0.090)	(0.095)	(0.105)	(0.092)	(0.093)	(0.093)
y_{t-1}	-0.076	-0.065	-0.082	-0.086	-0.086	-0.085
	(0.098)	(0.102)	(0.114)	(0.099)	(0.099)	(0.101)
y_{t-2}	0.126	0.098	0.086	0.134	0.134	0.135
	(0.088)	(0.093)	(0.103)	(0.089)	(0.090)	(0.091)
π_t	0.528^{**}	0.216	0.253	0.094	0.097	0.095
	(0.256)	(0.302)	(0.334)	(0.259)	(0.292)	(0.294)
π_{t-1}	0.529^{*}	0.317	0.335	-0.330	-0.328	-0.329
	(0.270)	(0.298)	(0.328)	(0.271)	(0.288)	(0.289)
π_{t-2}	0.690^{***}	0.526^{*}	0.537^{*}	0.105	0.107	0.107
	(0.260)	(0.282)	(0.310)	(0.263)	(0.274)	(0.274)
r_t	0.277	-0.048	0.055	0.126	0.129	0.124
	(0.268)	(0.315)	(0.360)	(0.270)	(0.304)	(0.317)
π^e_{t+12}		0.150^{**}	0.220^{**}		-0.002	-0.006
		(0.067)	(0.098)		(0.063)	(0.086)
$I_t{*}\pi^e_{t+12}$			-0.145			0.008
			(0.136)			(0.120)
Adj. R^2	0.438	0.449	0.451	0.392	0.389	0.387
Obs.	248	248	248	248	248	248

Notes: c^i is the lag of the dependent variable. Standard errors in parenthesis. * denotes significance at the 10% level, ** denotes significance at the 5% level, *** denotes significance at the 1% level.

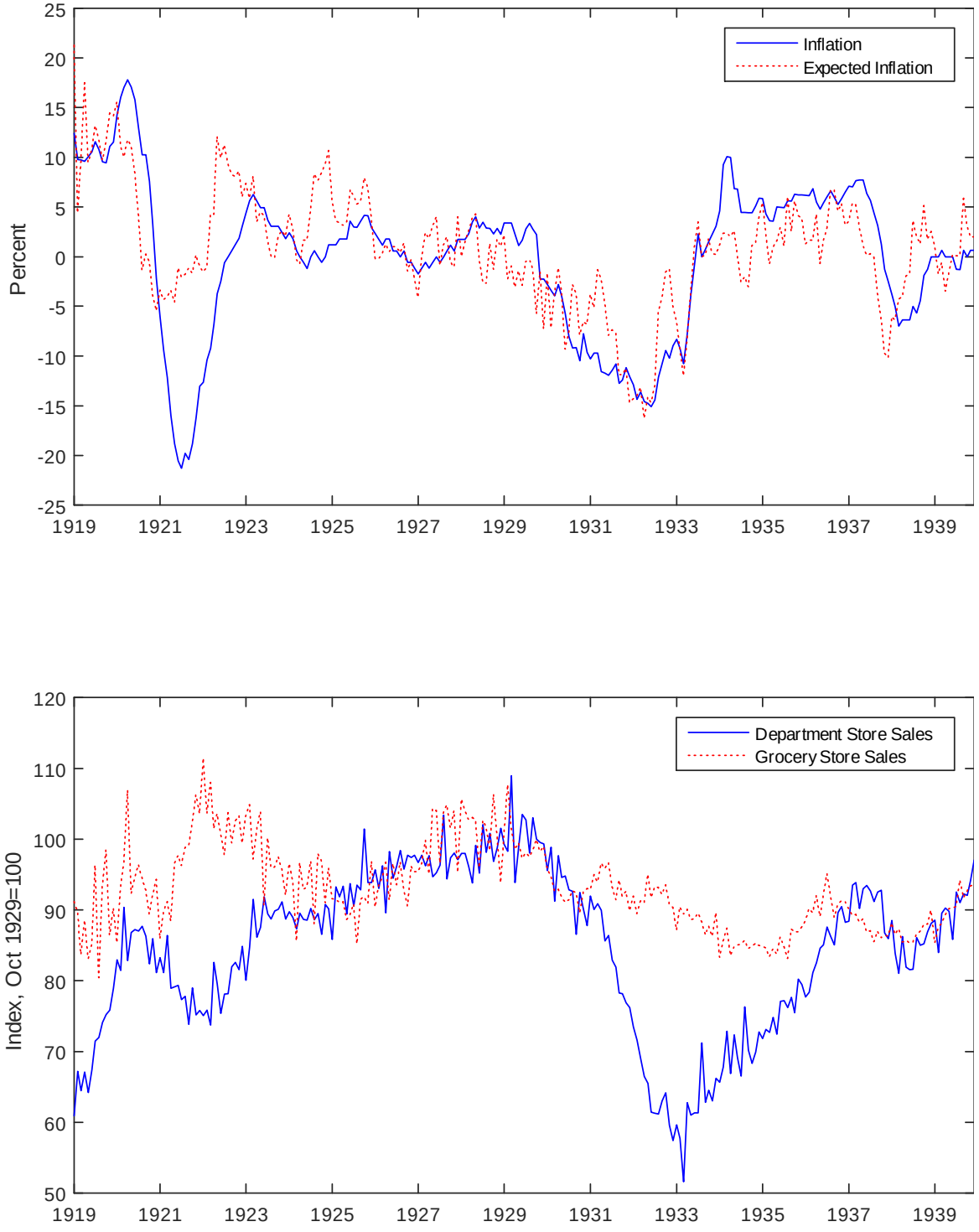

Figure 1: Inflation and our constructed measure of expected inflation (top panel) and the indices of department store sales and grocery store sales (bottom panel) from 1919 to 1939.