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Federal Reserve Bank of Chicago

The Spending and Debt Response to Minimum Wage Hikes

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THE SPENDING AND DEBT RESPONSE TO MINIMUM WAGE HIKES

Daniel Aaronson, Sumit Agarwal, and Eric French*

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Abstract

Following a minimum wage hike, spending increases more than income, and thus debt rises, in households with minimum wage workers. The size, as well as the timing, persistence, composition, and distribution of the spending response is inconsistent with the basic certainty equivalent life cycle model. However, the response is consistent with a model where households can borrow against part of the value of their durable goods.

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1 Introduction

Many U.S. social insurance programs exist to help smooth consumption of low-income households. However, there is little evidence on the spending responses to income fluctuations among these households. This paper provides new evidence based on the income increase caused by minimum wage changes. Using data from the Consumer Expenditure Survey (CEX), Survey of Income and Program Participation (SIPP), Survey of Consumer Finances (SCF), Current Population Survey (CPS), and administrative bank and credit bureau records, we document the magnitude, timing, composition, and distribution of spending and debt responses among households that receive a minimum wage hike.

We present four key empirical findings that are inconsistent with the basic certainty equivalent Life Cycle/Permanent Income Hypothesis but are consistent with an augmented buffer stock model where households can borrow against part, but not all, of the value of their durable goods.

First, the spending response is too large to be consistent with the permanent income hypothesis. Following a \$1 minimum wage hike, total spending increases by over \$800 per quarter in the near-term. This exceeds the roughly \$300 per quarter increase in family income following a similar-sized minimum wage hike. The high spending levels are corroborated by other data showing that debt rises substantially after a minimum wage hike, indicating that spending increases more than income. These results are particularly surprising given that most individuals earning the minimum wage at a point in time make well above the minimum two years later. All told, minimum wage hikes increase lifetime income by roughly \$1,500. If households were spreading that income gain over their lifetime, the short-run spending increase should be an order of magnitude smaller than what we observe in the data.

The majority of this additional spending is in durable goods, and vehicles in particular. While augmenting the permanent income model to account for durables increases the predicted short-term spending response, it is still far smaller than what our empirical estimates imply. Rather, our estimates are consistent with a model where households must make a small downpayment for their durables. Thus small income increases can generate small downpayments, which in turn can be used for a large durable goods purchase. Consistent with the model, we find that most of the debt increase is in collateralized debt, such as auto loans.

Second, high levels of durables spending and debt persist for several quarters after a minimum wage hike. This result is inconsistent with models that allow for unlimited borrowing, but is consistent with a model where households face a downpayment constraint that potentially binds for several periods.

Third, we find that the total spending response occurs within one quarter of a minimum wage increase. But minimum wage legislation is typically passed 6 to 18 months prior to its effective date.¹ So long as minimum wages hikes are known in advance, the permanent income hypothesis implies that households should borrow against future income gains in order to finance current consumption as soon as the household learns about the new wage. However, if households are unable to borrow against future income in order to finance current spending, spending will not rise until the minimum wage increases.

Finally, the composition of pre-hike spending is altered in a way that is consistent with forward-looking behavior and borrowing constraints. Prior to the minimum wage hike, durables spending falls and non-durables spending rises by roughly equal amounts, so the total spending response is almost 0. After the minimum wage hike, non-durables spending barely increases further, but durables spending increases significantly. In the face of borrowing constraints, this pattern is optimal because a short-run decline in durables spending has a small effect on the durables stock and its corresponding service flow. Households would like to borrow against future income to purchase durables, but the utility cost of delaying the durables purchase is small. Put simply, it is easier to postpone buying a car than food.

A large durables response is consistent with many papers that focus on sizable disposable income changes, including those based on tax refunds (Parker 1999, Souleles 1999), the EITC (Barrow and McGrannahan 2000, Adams, Einav, and Levin 2008), job loss (Browning and Crossley 2008), and other large income changes (Krueger and Perri 2008). Moreover, Adams, Einav, and Levin (2008) and Souleles (1999) also find evidence that much of this durables response is in vehicles. However, other papers find no durables response (e.g. Browning and Collado 2001, Hsieh 2003) or a highly imprecise response (e.g. Coulibaly and Li 2006). Our reading of the literature is that bigger durables responses tend to be found in papers based on large relative income gains among more liquidity constrained households.

¹For example, of the 19 state minimum wage changes between 2000 and 2004 (excluding CPI adjustments), the median time between legislation and enactment date is 9 months. Only two increases (California in 2001 and Rhode Island in 2000) occurred less than five months after the bills' passage. Even among those, legislative debate began well before passage.

Although models where households can borrow against durable goods are increasingly common (e.g., Carroll and Dunn 1997, Fernandez-Villaverde and Krueger 2002 and Campbell and Hercowitz 2003), there is little micro evidence on the quantitative importance of the constraint (see Kaboski and Townsend 2008 for an exception). Our paper provides such direct evidence.

We also consider how alternative models can fit these patterns. In particular, a model with an adjustment cost to durables transactions, as in Grossman and LaRoque (1990) and Eberly (1994), cannot by itself explain the size, timing, or composition of spending responses after a minimum wage hike. However, augmented with borrowing constraints, adjustment cost models can match the heavily skewed distribution of the spending responses, as well as the magnitude of those responses at the right tail of the minimum wage household spending distribution.

Our identification strategy is attractive relative to previous tests of the permanent income hypothesis. First and foremost, we use compelling, albeit standard, treatment and control groups from the minimum wage literature. That is, we compare households with minimum wage workers in states that experience a minimum wage increase to households with minimum wage workers in states that do not experience minimum wage hikes.

Additionally, we take advantage of the fact that minimum wage hikes should not affect income of workers making well above the minimum wage. We find that the minimum wage has small effects on the income and spending of workers making 120 to 200 percent of the minimum wage and no effect on workers that are at least double the minimum. Interestingly, this spending gradient provides new indirect evidence of the extent to which minimum wage increases spillover into the wage distribution.

The second attractive feature of our identification strategy is that minimum wage increases have a nontrivial impact on the short-run family income of minimum wage workers. Some previous scholars² have argued that rejection of the permanent income hypothesis is often a result of an income change that is too small in size or irregular in frequency. To such a small intervention, “households will not bother to change their consumption paths when the computational costs are large relative to the utility gains” (Hsieh 2003). Although minimum wage hikes are irregular, which helps us overcome the seasonality issue, they typically increase

²e.g. Browning and Collado (2001) and Hsieh (2003).

hourly wages by 5 to 20 percent. Specifically, we show that income in households with adult minimum wage workers rises by roughly \$1,500 in the two years after a \$1 increase in the minimum wage.³

It is important to underscore our focus on households who had a minimum wage job prior to an increase in the minimum wage. It is possible, perhaps even likely, that a minimum wage increase reduces the odds that those without a job will be able to find one. Moreover, we ignore most teenagers, where there is particularly compelling evidence of disemployment. Consequently, our estimates are silent about the aggregate effects of minimum wage hikes. However, for those adults who had a minimum wage job prior to a minimum wage hike, consumption, income, and debt rise afterwards.

The rest of the paper is organized as follows. Section 2 outlines a calibrated model of household spending responses to a minimum wage increase when borrowing constraints are present versus absent. Section 3 provides a detailed data description of the CEX, SIPP, and credit card data sets. Section 4 briefly describes the estimating equations. Section 5 describes the empirical results and section 6 concludes.

2 A Model with Durable Goods and Borrowing Limits

In this section, we describe the model that highlights our key empirical findings. As we point out below, understanding the consumption response to minimum wage hikes critically involves durable goods, and how those durable goods are financed.

Define C_t as consumption of non-durable goods at time t and S_t as the durables stock at time t . Households maximize

$$E_0 \sum_{t=t_0}^T \beta^t (C_t^{1-\theta} S_t^\theta)^{1-\gamma} / (1-\gamma) \quad (1)$$

given the equations below. Within period preferences are Cobb-Douglas between durables and non-durables. Thus, consistent with the evidence, expenditure shares are assumed constant.⁴

³Many minimum wage hikes are closer to 50 cents, but this still means a \$750 income gain over two years.

⁴For example, among Consumer Expenditure Survey (CEX) households with no adult minimum wage earners, the durables share of expenditures is roughly 17 percent. Among those households where income comes entirely from minimum wage labor, it is 12 percent. Fernandez-Villaverde and Krueger (2002) review the evidence on the substitutability of durables and non-durables and conclude that Cobb-Douglas is consistent with the evidence.

The asset accumulation equation is:

$$A_{t+1} = (1 + r)A_t + Y_t - C_t - I_t \quad (2)$$

where A_t denotes assets, r the interest rate, I_t investment in consumer durables, and Y_t income. The law of motion for durables is

$$S_{t+1} = (1 - \delta)S_t + I_t \quad (3)$$

where δ is the depreciation rate.

In contrast to much of the literature, but often observed in practice, we allow individuals to borrow against durable goods. We follow the approach of Fernandez-Villaverde and Krueger (2002) and Campbell and Hercowitz (2003) by requiring that assets satisfy the constraint

$$-A_t \leq (1 - \pi)S_t \quad (4)$$

where π is the downpayment rate, or the fraction of the value of newly purchased durable goods that do not serve as collateral. Such a constraint may exist because of limited enforcement, where collateral guards against the temptation to default (e.g. Kiyotaki and Moore 1997).

Finally, the income process is:

$$\ln Y_t = \alpha_t + P_t + u_t \quad (5)$$

where α_t is the life cycle profile of income. We assume that $\alpha_t = \alpha_0 + \alpha_1 t$ for the first 80 quarters of an individual's life, and is constant at $\alpha_t = \alpha_0 + \alpha_1 \times 80$ afterwards. The stochastic components of income are the white noise term u_t and the AR(1) term P_t :

$$P_{t+1} = \rho P_t + \epsilon_{t+1} \quad (6)$$

where $\epsilon_t \sim N(0, \sigma_\epsilon^2)$ and $u_t \sim N(0, \sigma_u^2)$.

The model is complex and thus we solve it numerically. We describe our calibration and results immediately below and the solution techniques in appendix A.

2.1 Calibration of the model

To calibrate the model, parameters are set to the values listed in table 1. Here, we highlight those that are less standard.

First, we pick θ to match the CEX's estimate of non-residential durables share of aggregate non-residential expenditure, $I_t/(I_t + C_t)$. Second, for δ , we use Campbell and Hercowitz's (2003) estimate of quarterly depreciation rates for non-residential durable goods, which is similar to those in Adda and Cooper (2000).⁵ Third, we assume the downpayment rate, π , is 0.4. The Federal Reserve's G19 Consumer Credit release reports that the loan-to-value ratio, $(1-\pi)$, on new cars averaged 90 percent between 1982 and 2005, the years in our CEX sample. However, new vehicles make up only 17 percent of non-housing durable spending for CEX households with minimum wage earnings.⁶ The rest of durables spending likely requires larger downpayments, including some products, such as small appliances, for which collateralized financing may not be readily available.

Finally, we estimate the parameters of the income process $(E(Y_0), \alpha_1)$ using the Survey of Income and Program Participation (SIPP). Average quarterly income among minimum wage households is \$2,900.⁷ We estimate $\alpha_1 = 0.0108$ through a household fixed effects regression of log income on age for households with minimum wage workers.⁸ Income growth of this magnitude is similar to income growth among higher wage workers of the same age. Thus we assume that the deterministic component of income growth is the same for all households, conditional on age. Because wage growth tapers off after 20 years in the labor force, we assume that income grows at rate $\alpha_1=0.0108$ for 80 quarters, then does not grow thereafter.

2.2 Initial Joint Distribution of the State Variables

We draw the initial joint distribution of the three state variables – the permanent component of income, assets,⁹ and the stock of durable goods – from the Survey of Consumer

⁵We focus only on non-durables and non-residential durables in this paper because our estimated residential spending responses were fairly small and extremely imprecise.

⁶Used vehicles make up roughly 44 percent and the remainder is non-transportation durables.

⁷ We choose α_0 to match the average income of SIPP minimum wage households. Because $E(Y_0) = \exp(\alpha_0 + (\sigma_P^2 + \sigma_u^2)/2)$, and earnings variance varies across specifications, we adjust α_0 , and thus α_{t_0} , across specifications. Because we simulate the model for 30 periods before the minimum wage hike (i.e., $t_0 = -30$), we set $\alpha_{t_0} = \alpha_0 - 30(0.0108)$.

⁸This translates into 4 percent average annual income growth, close to estimates for early career low-skill workers (e.g. French, Mazumder, and Taber 2006).

⁹More precisely, the state variable is cash-on-hand, which is the sum of assets and current income.

Finances (SCF). Appendix C and table A1 present some key descriptives. Unsurprisingly, many minimum wage households have very little in the way of assets, and are therefore likely to face binding borrowing constraints.

2.3 Modeling Minimum Wage Hikes

In order to assess the impact of the minimum wage, we simulate the model with and without a minimum wage hike. The hike is modeled as an innovation to the deterministic component of income, α_t . In particular, we assume that a minimum wage hike causes α_t to immediately increase by 10 percent, bumping average income from \$2,900 to \$3,200 per quarter. As we show in section 5.2, this is a typical sized income response observed in the SIPP and the Current Population Survey (CPS), and is consistent with other research as well.

The immediate \$300 gain is assumed to dissipate over time. In particular, rather than grow at 1.08 percent, α_t remains constant in the first ten periods after the hike for households receiving a minimum wage increase. This allows any income gain from the minimum wage to be eroded after $2\frac{1}{2}$ years, as in figure 1. After 10 quarters, income once again grows by 1.08 percent per period. Consequently, in total, a 10 percent minimum wage hike increases total discounted lifetime income by just over \$1,500.

Finally, we assume that households learn about the minimum wage hike three quarters before it occurs ($t=-3$). This is meant to be consistent with the observation that minimum wage legislation is typically passed into law at least three quarters before the minimum wage hike is implemented.

2.4 Model Results without Uncertainty and Borrowing Constraints

We first describe the calibration results for the case when households face neither borrowing constraints (so the downpayment constraint parameter π is unimportant) nor income uncertainty ($\sigma_\epsilon^2 = 0$) to clarify the dimensions on which this model succeeds in describing the empirical facts. We use the parameters in table 1, with the exception that β is set to 1 to allow the model to generate a more plausible wealth distribution. When $\beta = \sqrt[4]{0.95}$, median

assets at the time of the minimum wage hike are implausibly low.¹⁰

Figure 2 shows the predicted spending response to a minimum wage hike. Three key features of the figure are worth highlighting.

First, the initial spending increase is \$60, followed by \$15 spending per quarter thereafter. The present value of this stream of spending is roughly \$1,500, the lifetime income gain from the minimum wage hike. As we show below, these estimates are much smaller in the near-term than what we observe in the spending data. To better understand the size of the spending responses, we use the parameter values in table 1 and formulas in appendix B to show that if T is large or there is a resale market for durables, the marginal propensity to consume (MPC) out of durables and non-durables given t are smaller than 1:

$$\left. \frac{\partial C_0}{\partial A_0} \right|_{S_0} = (1 - \theta) \left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r} \right)^{T+1}} \right] = 0.01, \quad (7)$$

$$\left. \frac{\partial I_0}{\partial A_0} \right|_{S_0} = (\beta(1+r))^{\frac{1}{\gamma}} \left(\frac{\theta}{r + \delta} \right) \left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r} \right)^{T+1}} \right] = 0.04 \quad (8)$$

where θ and $1 - \theta$ are the shares of lifetime expenditure devoted to non-durables and durables, respectively. The term $r + \delta$ is a user cost, or the per period price of durables relative to non-durables, and $\left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r} \right)^{T+1}} \right]$ is an annuitization factor.

Second, the household purchases large quantities of durables and more modest quantities of non-durables upon learning about the minimum wage hike. The reason for the durables increase is that if the household wishes to permanently increase the *service flow* of durables by a small amount, she must increase durables *spending* by a larger amount. After an initial jump, durables spending can decline again as the household only spends to maintain the new higher durables stock (Mankiw 1982).

Third, the spending response occurs when the household learns about minimum wage hike in quarter -3, not when the hike occurs in quarter 0.

As we show below, the magnitude, composition, and timing of these predictions are in-

¹⁰When $\beta = \sqrt[4]{0.95}$, households are more impatient, and spend more in the short-run. For example, the short-run spending response increases from \$60 when $\beta = 1$ to \$90 when $\beta = \sqrt[4]{0.95}$.

consistent with the data.

2.5 Model Results with Borrowing Constraints and Income Uncertainty

Next, we introduce borrowing constraints and income uncertainty to the model. Figure 3 plots the spending response to minimum wage hikes that emerges from this model. It illustrates several noteworthy, and ultimately testable, implications.

The first is the sheer magnitude of the spending increase. Total spending increases by over \$1,000 in the year after the minimum wage hike, which is larger than the gain in income in the first year, and an order of magnitude larger than the response in the no borrowing constraint case.

The second finding relates to timing. Much of the spending increase occurs at the date of the minimum wage change, not when the household learns about the impending hike in quarter -3. Between quarters -1 and 0, the total spending response increases from under \$100 to almost \$400.

The last two features of the results that we highlight have to do with the composition of spending before and after the minimum wage increase. Prior to its implementation but after its legislative enactment (quarters -3 to -1), there is a small increase in spending. This spending increase is heavily skewed towards nondurables. Indeed, durables spending declines slightly. However, once the minimum wage is implemented in quarter 0, durables spending soars by almost \$250, while nondurables spending continues along a relatively stable path that began at quarter -3.

That leads us to our final notable result – the persistence of durables spending. Although durables spending begins to decline after period 0, it remains elevated, and as high as the nondurables response, at least a year later.

One of the striking features of this model is that the MPC may exceed one in the near-term. To see the intuition behind this result, and why spending may be concentrated in durables expenditures, assume that the borrowing constraint (4) always binds, i.e. $A_t = -(1 - \pi)S_t$. Combining it with the asset accumulation equation (2) and the law of motion for durables, equation (3), it can be shown that:

$$\pi I_t + C_t + (1 - \pi)(r + \delta)S_t = Y_t. \tag{9}$$

Households spend income on durables I_t , nondurables C_t , and interest payments on durables S_t . Since the household only needs $\$ \pi$ to purchase $\$1$ worth of durables, spending gains can temporarily exceed income gains.

Below we show that the magnitude, timing, composition, and persistence of spending following a minimum wage increase are consistent with the model with borrowing constraints and income uncertainty, but inconsistent with a model without these features.

2.6 Robustness Checks

Table 2 describes a number of checks of our model predictions. In particular, we report how spending responses adjust to the size of the downpayment constraint, the income process, and the introduction of an adjustment cost to durables purchases. The particular way parameters are adjusted for each of these tests is explained in the first column. The next three columns report non-durables, durables, and total spending responses to minimum wage hikes with the new parameter values. These are estimated on the simulated data using a household fixed effect regression similar to that used in the empirical results below.¹¹ To further match the empirical methodology, we assume the share of minimum wage households that receive minimum wage hikes is similar to that in the data and we only report simulated spending effects using the three quarters before and after the minimum wage hike. The latter restriction is meant to reflect the data limitations inherent in the CEX.

The first row reviews our baseline borrowing constraint model, as described in section 2.5, table 1, and figure 3. Non-durables and durables spending rise by $\$113$ and $\$196$ per quarter or $\$309$ in total per quarter.

The next two rows explore the sensitivity of the results to changes in the downpayment rate, π . Reducing the downpayment rate from 40 to 20 percent leaves the total spending response largely unchanged at $\$299$. However, increasing the downpayment rate to 100 percent, as in the standard buffer stock model, reduces the spending response to $\$221$. The lower the downpayment rate, the more goods can be purchased with a given level of income. Thus, spending is more sensitive to income when the downpayment is lower. But the spending results do not strike us as particularly different within plausible ranges of π .

¹¹Specifically, we estimate equation (12), where $K = 0$ (ie, we only use the contemporaneous minimum wage) and X_{it} only includes an age trend.

The next two rows explore the sensitivity of the results to differences in the income process. When there is no income uncertainty, the total spending response rises to \$449 per quarter. However, allowing for moderately higher innovation variance ($\sigma_\epsilon^2=0.005$), as in Meghir and Pistaferri (2004), or Gourinchas and Parker (2002), leads to a reduced spending response of \$165.

The sensitivity of the spending response to the income process arises from the extent to which precautionary motives are important. When there is no income risk, there is little incentive for agents to hold precautionary wealth. When there is little precautionary wealth, the borrowing constraint is more likely to bind. For example, in the absence of income uncertainty, median assets net of durables debt is -\$9,078. Median “resources” available for spending (defined as $A_{it} + (1 - \pi)S_{it}$) is \$293.

But when income risk is high, agents hold larger amounts of wealth. Because of this precautionary behavior, borrowing constraints do not bind. Consequently, these households behave as if they are unconstrained and spend less in response to a minimum wage hike. Our assessment, after much experimentation of how the income process impacts the model’s predictions, is that the empirical facts best fit parameters that allow for modest levels of income uncertainty and innovation variance and a high degree of income persistence.

Next, we consider the possibility that households face a cost of adjusting their durables stock, as in Carroll and Dunn (1997) and Kaboski and Townsend (2008). Households might face transactions costs of adjusting their durables stock because, for example, it takes time to shop for a new car or the trade-in-value of a used car is less than the price of buying the same car off a used car lot. We follow Grossman and LaRoque (1990) and Eberly (1994) by assuming that in order to increase the durables stock, 5 percent of the previous stock would be lost.¹² This adjustment cost transforms equation (2) into:

$$A_{t+1} = (1 + r)A_t + Y_t - C_t - I_t - 0.05S_t \times 1\{I_t \neq 0\} \quad (10)$$

where $1\{I_t \neq 0\}$ is an indicator of when the individual either purchases or sells a durable good.

When we make this modification, but leave other parameters at the baseline, the total spending response falls to \$188 per quarter. Part of the reason for the decline is an artifact

¹²See also Attanasio (2000) and Bertola, Guiso, and Pistaferri (2005) for more evidence.

of timing. Households that face large adjustment costs accumulate wealth in order to buy the next durable good. Consequently, when they learn about the minimum wage hike, there is a large initial increase in spending, just like in the baseline model. But, as pointed out by Caballero (1993) and others, short-run spending tends to be more sluggish. Recall that in keeping with the spirit of the empirical results described below, we estimate the calibration's spending response using data only through the third quarter after the minimum wage hike. Because some of the spending response is delayed to later quarters, the mean effect looks smaller.

Regardless, we conclude that the model with adjustment costs does no better in terms of explaining large mean spending responses in the data. That said, adjustment costs have implications for the heterogeneity of spending that help to explain some patterns in the data. We return to this issue in section 5.5.

For completeness, the final three rows report spending responses in the model without borrowing constraints, as in section 2.4.¹³ As noted earlier, spending barely responds under this version of the model, a result that is invariant to the inclusion of adjustment costs. Assets on hand also are predicted to be much lower than in the borrowing constraint model or what appears in the SCF data (appendix C).

3 Data

This section describes the three datasets that we rely on to measure spending, income, and debt responses to minimum wage changes.

3.1 Consumer Expenditure Survey (CEX)

The CEX is a representative sample of U.S. consumer units, providing detailed information on household spending.¹⁴ We use surveys from 1982 to 2005, enabling us to study the impact from four federal and numerous state minimum wage increases.¹⁵

¹³As in section 2.4, we set $\beta = 1$ to generate a plausible wealth level.

¹⁴For ease of exposition, we refer to consumer units as households from here on out.

¹⁵Minimum wage histories are taken from various issues of the Monthly Labor Review. See, for example, Aaronson (2001).

Households are interviewed up to four times, spaced three months apart. In each interview, households are asked about detailed spending patterns for the previous three months. While this design provides monthly data, we take the standard approach to CEX data and aggregate to the quarterly frequency.

In the first interview, households are also asked about individual income and hours worked over the previous year. We use this information to calculate the hourly wage of the first two adult (greater than age 18) members of the household and construct w^* , the share of total before tax household income derived from salaries influenced by minimum wage laws:

$$w^* = (E_{11} \times I(w_{11} \leq w_{min,i1} \times L) + E_{21} \times I(w_{21} \leq w_{min,i1} \times L))/F_{.1}. \quad (11)$$

E_{11} and E_{21} are the salary income for persons 1 and 2 (typically, the head and spouse) in time period 1, $F_{.1}$ is total pre-tax non-asset income in the first period that the household is observed in the data, and $I(w_{11} \leq w_{min,i1} \times L)$ and $I(w_{21} \leq w_{min,i1} \times L)$ are indicators of whether persons 1 and 2 are adult minimum wage workers in the initial period. Previous research has shown that minimum wage hikes increase the wages of workers that make slightly above the minimum wage. Thus we set L to be 1.2 in equation (11) (i.e. 120 percent of the minimum wage) for most of our analysis but also experiment with 1.5 and 2.

The requirements to compute w^* are such that some households must be dropped. This is particularly important in two cases. The CEX does not report actual state of residence for those residing in smaller states. Because state codes are needed to know effective minimum wage levels, 19.9 percent of the full CEX sample is cut. Another 16.7 percent of the remaining sample must be dropped because their income responses are incomplete. We ultimately use 192,114 household-surveys, representing 58,404 households, that meet criterion on age, family composition, hourly wages, and self-employment status.¹⁶ Of these, 11.3 percent, or 21,695

¹⁶In particular, we exclude the self-employed (6.5 percent), households headed by those under 18 or over 64 (20.7 percent), households in the survey for only one period (11.4 percent), households without an initial wage for the head and spouse (13.7 percent), and households where either of the two member's hourly wage is only 60 percent (that is, implausibly low) or 40 times greater than the effective minimum wage in the initial survey (4.2 percent). We also exclude 2.5 percent of the remaining sample because of large changes in family composition (either the number of kids or the number of adults changes by more than 2), head's age (greater than two years) or head's gender. Finally, we exclude just over 3 percent of the remaining household-survey observations because of large (log change of 1.5 or greater) changes in log hourly wages between the initial survey and the last survey. At a wage of \$4 per hour in the first survey, this would require that hourly wages not rise beyond \$18 nine months later in the last survey. Many of these restrictions are meant to reduce the impact of measurement error or to exclude large and hard to model changes in circumstances unrelated to

household-surveys, are from households with some minimum wage income in the initial period (i.e. $w^* > 0$). Just under 15,200 are from families where minimum wage income makes up over 20 percent of total pre-tax income (i.e. $w^* \geq 0.2$).

Table A2 includes descriptive statistics of the key variables, including real total, durables, and nondurables and services spending, real family income, and selected demographics. The income measures for the $w^* \geq 0.2$ group line-up well with the SIPP, a survey that is specifically designed to measure income of low-wage populations and that we rely on for our estimates of income responses.¹⁷

3.2 Credit Card and Credit Bureau Data

We also use a unique, proprietary dataset from a large financial institution that issues credit cards nationally. The dataset contains two and half year overlapping panels of over 200,000 credit card accounts from 1995 to 2003. We are able to track spending, payments, balances, and debt levels, as well as APR and credit limits, at the monthly frequency. To this basic information, this institution appended credit bureau data about the card holders' mortgage, auto, home equity, and other credit card balances, as well as the credit risk (FICO) scores of the borrower. These credit bureau data are available quarterly. To identify longer spending and debt responses, we also use a separate sample of credit card accounts that begin in January 2000 and runs for four years.

Besides providing an independent source of spending information, there are advantages to the credit card data relative to the CEX. Measurement error is less of a concern,¹⁸ panels are longer, and, perhaps most importantly, high quality debt and credit limit information are available.

However, there are some drawbacks as well. Only one-third of spending appears on credit cards (Gross and Souleles (2002), Agarwal et al 2007). Moreover, minimum wage workers with credit cards are a selected sample of all minimum wage workers. According to the Survey

changes in the minimum wage. The percentages reported in this footnote are ordered in that each one reflects the share of excluded observations relative to the sample that remains up to that point.

¹⁷For $w^* \geq 0.2$, average real total family income before taxes in the SIPP is \$20,382 (in 2000 dollars), or 8.8 percent higher than in the CEX. Real salary income for the top two adult members of the household is only 1 percent higher in the SIPP. Nonsalary income is also quite close. The majority of the roughly \$1,500 difference is from salary of other household members.

¹⁸See footnote 2 in Gross and Souleles (2002).

of Consumer Finances, only 43 percent of households in the bottom quintile of the income distribution own a credit card (Johnson 2007).

Finally, wage and demographic information are limited. We only have information for individual card-holders, not the unit of interest, the household.¹⁹ Even among card-holders, we do not have earnings and hours information necessary to compute hourly wages. The only income data available is self-reported annual earnings of the account holder at the time of the credit card application.

In order to compute the probability, P_i , that an account holder is a minimum wage worker, we use the CPS to estimate a probit model of whether a worker was within 120 percent of the minimum wage. Covariates are a quartic in annual earnings, a quartic in age, an age times the annual earnings quartic, female, married, and female times married. The estimated probit model reveals that 70 percent of all individuals earning less than \$15,000 per year are minimum wage workers, whereas virtually no one earning over \$20,000 per year is a minimum wage worker.

Table A3 provides summary statistics for the main credit card variables. For a more complete data description, see Agarwal et al (2007).

3.3 The Survey of Income and Program Participation (SIPP)

We estimate the income response to minimum wage hikes using the SIPP. Besides providing larger samples and longer panels, the main advantage to the SIPP is that it is specifically designed to collect high-quality earnings and income information, including an hourly wage measure for workers paid by the hour.²⁰ The first SIPP panel we use begins in 1986 and the last ends in 2003. Each panel lasts between two and four years and provides interviews with between 12 and 40 thousand households. Households are interviewed every four months during the time they remain in a panel. While they are asked to recall labor market information for each month between interviews, we only use the current month information. Nevertheless, this still allows us to collect long panels of 4 month increments for thousands of households.

¹⁹We partially circumvent this limitation when using the debt data, since debt contracts are typically written at the household level. Therefore, the credit bureau data are often, but not always, household level data.

²⁰The CEX has hours and earnings information at an annual frequency, and only at the first and last survey. Consequently, it can only be used to identify income responses from households that do not attrite from the sample. Moreover, it cannot identify the short-run quarterly income dynamics that are a crucial part of the model's predictions.

Variables are coded, and wage, self-employment, and family composition restrictions are introduced, to be as close as possible to the CEX sample.²¹ Like the CEX analysis, the numerator on w^* (total income from minimum wage earners) is also computed on the household head and, when applicable, spouse, only in the first period that we observe them.

Based on a computed wage measure (monthly earnings divided by monthly hours), there are 80,700 households, and 546,474 household-survey observations remaining after our sample restrictions²², of which 11.1 percent report some minimum wage earnings and 8.7 percent report at least 20 percent of their total household nonproperty income from minimum wage earners. About 390,000 household-survey observations are available when we use the hourly wage measure from workers paid by the hour. Table A4 provides summary statistics for the key variables.

4 Estimating Equations

Our empirical strategy is standard. We estimate equations of the form:

$$Z_{it} = f_i + \sum_{k=-K}^K \phi_k w_{min,it+k} + \omega' X_{it} + u_{it} \quad (12)$$

where $Z_{it} = \{C_{it}, I_{it}, Y_{it}, \Delta debt_{it}\}$ is either spending in non-durables or durables, income or change in debt, and $w_{min,it+k}$ is the minimum wage rate for the state that individual i resides in at time $t+k$.²³ X_{it} includes year and quarter dummies or a full set of month dummies.²⁴

Since the credit card and debt data do not include detailed wage information. To overcome this problem, we predict the probability P_i that an individual is a minimum wage worker using the CPS and the methods described in section 3.2. Thus for the credit card and debt regressions, we weight the minimum wage variable $w_{min,it+k}$ in equation (12) by the

²¹Because the CEX does not follow households after they move, we provide results that include and exclude movers.

²²The definition of a household is not as straightforward as in the CEX. We rely on the variable *ppentry* to define families. Experimentation with other methods, such as holding composition fixed (stable families), does not qualitatively change the results.

²³When using quarterly CEX data, $w_{min,it+k}$ is the average value of the minimum wage over the quarter.

²⁴In our SIPP and CEX estimates, we also condition on the number of adults and the number of kids in the household in order to be consistent with other research (e.g. Johnson, Parker, and Souleles 2006). However, once the household fixed effect, f_i , is included, we find no observable covariates in the CEX or the credit card data that substantively impact our coefficients of interest, ϕ_k .

probability that the holder is a minimum wage worker.²⁵ The regression becomes

$$Z_{it} = f_i + \sum_{k=-K}^K P_i \phi_k w_{min,it+k} + \omega' X_{it} + u_{it}. \quad (13)$$

5 Results

5.1 The Magnitude of the Total Spending Response

We begin by quantifying the size of the spending response to a minimum wage increase. These first results concentrate on total spending and ignore dynamics. In particular, we only include the contemporaneous minimum wage (i.e., we set $K = 0$) when estimating equations (12) and (13). Findings from both the CEX and the credit card data are presented in turn.

5.1.1 CEX

Table 3 reports the basic CEX results. The rows in the tables are stratified by w^* .²⁶ Results are reported for two samples. The “all” sample (column 1) include all household-surveys. The “high school graduates and dropouts” sample (column 2) excludes households headed by someone with any post-secondary educational experience.²⁷ Each cell in the table represents a different regression. The top number is the point estimate, the second number is the standard error corrected for within-household serial correlation, and the third is the sample size.

Although the magnitudes and precision vary across samples, the qualitative response is robust. Total spending increases by an economically and usually statistically significant amount for households that derive income from minimum wage labor. For example, total spending in households where minimum wage labor is the source of at least 20 percent of total income ($w^* \geq 0.2$) rises by \$885 (standard error of \$537) per quarter, representing 15 percent of an

²⁵In other words, we assume spending is as in equation (12) with probability P_i and is equal to $f_i + \omega' X_{it} + u_{it}$ with probability $(1 - P_i)$, which gives rise to equation (13).

²⁶Recall that we define an individual as a minimum wage worker if her average annual wage is within 120 percent of her state’s effective minimum wage during the initial survey. We have also used the last survey to compute minimum wage workers but there are two problems with this rule. First, it requires us to restrict the sample to non-attriters. Second, it is potentially impacted by the policy treatment. That said, the results are similar whether we stratify the sample by minimum wage gaps in the first survey or the last.

²⁷We have also run the models with only high school dropouts. The point estimates are quantitatively similar although less precisely estimated.

average quarter’s spending level. Consistent with attenuation bias introduced by mismeasurement, the effects from the non-college sample are even larger. These basic patterns are robust to many perturbations of the statistical model, including controlling for other covariates such as time trends (rather than year dummies), the age of the head, survey fixed effects, or state unemployment rates, deleting a small number of negative expenditure values, removing all data restrictions on family composition, age, and wage levels and changes, or running the regressions in first differences.²⁸ In contrast, for households without minimum wage workers ($w^* = 0$), spending rises by a statistically insignificant \$123 (\$171) per quarter, representing less than 2 percent of average quarterly spending (shown in the final two columns).

Next, we show the impact of a minimum wage increase among households where adults earn just above the new minimum wage in the initial period. This exercise offers a new approach to measuring the extent to which minimum wage increases cause wage (and thus spending) increases for those making slightly above the minimum (e.g. Wellington 1991, Card and Krueger 1995, and Lee 1999). We are primarily interested in this exercise because it provides a strong robustness test of our results. Households just above the minimum wage should adjust spending at a lower level than those directly impacted by a minimum wage increase.

We estimate spending responses for households with someone making 120 to 200 percent of the minimum wage in column 3 and for households with someone making 200 to 300 percent of the minimum in column 4. We find that the spending effect recedes quickly once we get beyond 120 percent of the minimum. For $w^* \geq 0.2$, spending falls from our baseline of \$885 in column 2 to \$393 (\$264) and -\$145 (\$267) when using the 120 to 200 percent and 200 to 300 percent minimum wage definitions, respectively. That is, without a household member that is very close to the minimum wage, the spending effects dwindle, to the point where they are nonexistent when wages are at least twice the minimum. These results corroborate the comparison between households with and without minimum wage earners by showing that they are likely not confounded by state-specific unobservable trends in consumption that are specific to low-wage families.

²⁸One noteworthy exception is the use of some nonlinear specifications, such as quantile regressions; see section 5.5.

5.1.2 Credit Cards

We find an economically and statistically significant spending response in the credit card accounts as well. Table 4 shows that a \$1 minimum wage increase results in a \$176 (\$60) increase in average quarterly credit card spending for the quarters that follow the minimum wage increase that we observe.²⁹ Again, we find no spending response for account holders with annual income above \$20,000, virtually all of whom earn above the minimum wage.³⁰ The second column in the table shows that credit card holders with credit lines of \$2,000 or less, are more likely to increase spending after a minimum wage increase.³¹ For this group, the spending response to the minimum wage increase is \$247 (\$78), about 40 percent larger than the \$176 effect for all low earners.

Since the above analysis only looks at credit card spending on one card and a typical low income consumer has 2.1 cards, we follow Agarwal, Liu, and Souleles (2007) and try to determine the response of the minimum wage change on all credit cards. We define a balance ratio as the balance on our card relative to the balance on all other cards held by the account-holder, as reported by the credit bureau. We only focus on credit card holders that have a significantly high balance ratio and therefore predominantly use our card. The last column in Table 4 presents such results for card holders with a balance ratio greater than 2. In this case, the spending response to a \$1 minimum wage increase is \$248 (\$219), an estimate that we interpret as being consistent with the total credit card spending response, at least for the subset of account holders that heavily use cards from the financial institution to which we have data.

On the whole, both the CEX and the credit card data depict similar qualitative, if not quantitative, spending responses to a minimum wage change, despite clear differences in sample composition, time period, available conditioning covariates, and data instrument (administrative data versus self-reported survey). If we assume that credit cards represent one-third of total spending,³² our estimates suggest that a \$1 minimum wage hike increases spending

²⁹We multiply all monthly estimates by 3 for comparability with the quarterly CEX results.

³⁰Based on the CPS regressions, an individual earning \$20,000 annually is essentially assigned a 0 percent probability of being a minimum wage worker. The results are also robust to using a \$15,000 cutoff instead. For comparison, the 120 percent wage to minimum wage threshold that we use with the CEX data would include similar workers to those used here.

³¹withdraw. The results are similar if we use \$3,000 or \$1,000.

³²Although Gross and Souleles (2002) estimate that one-third of aggregate consumer spending is on credit cards, they do not estimate this parameter for a population like ours.

by $\$248 \times 3 = \744 per quarter. By comparison, the total CEX spending response shown in Table 3 is $\$885$. There are some differences in spending composition, particularly in the inability of vehicle purchases to be financed by credit cards, which could lead to higher effects in the CEX. We return to this issue below. Nevertheless, in both datasets, there appears to be an economically significant increase in near-term spending after a minimum wage increase that is likely at least $\$700$ per quarter.

5.2 The Income Response

Suppose that a worker’s wage was bumped up by $\$1$ after a minimum wage increase. If she worked 1,500 hours in a year, roughly the average for minimum wage workers in the CPS, her income would increase by $\$1,500/4=\375 per quarter under the new wage, roughly half our estimated average short-term spending response. However, the change in the minimum wage may be different from the change in household income if there is disemployment or hours reductions due to the minimum wage hike, if the individual is not covered by minimum wage legislation, or if she is misclassified as a minimum wage worker due to measurement error.

Rather than rely on these rough calculations, we turn to estimating the impact of a minimum wage increase on family income. A small handful of studies have done this within a standard empirical framework comparable to equation (12). Recent examples include Draca, Machin, and Van Reenen (2008), Addison, Blackburn, and Cotti (2008), and Neumark, Schweitzer, and Wascher (2004, 2005). Each of these studies finds evidence that the contemporaneous earnings impact of a minimum wage increase is positive.

Table 5 reports our income estimates from the SIPP.³³ Analogous to the spending results, we find that income rises in response to a minimum wage increase for households with minimum wage workers but not for households without such earners. In particular, using the sample of workers that report an hourly wage for hourly earnings, quarterly household income increases by $\$255$ ($\$177$) for $w^* \geq 0.2$. Columns 2 and 3 show that the earnings response declines for higher waged workers, much like the spending results in table 3. Results are

³³In the CEX, income rises by rises by roughly $\$1,000$ in the first year after a minimum wage increase, but with a standard error that exceeds the point estimate. We are hesitant to draw too much from these calculations because of data limitations and the imprecision of the estimates. Nevertheless, the point estimate is similar in magnitude to the SIPP results.

higher, \$462 (\$198), when we exclude households that move in order to be analogous to the CEX sample design, although the point estimates are not statistically different from each other. Moreover, the results are not sensitive to the inclusion of movers when we use the computed wage to calculate w^* (i.e. columns 6 and 7). The results are also similar when we exclude households headed by someone with college experience.

Virtually identical results are found in the CPS, shown in the final two columns of the table. Again, we find a large total income response in households with minimum wage earnings but no impact on non-minimum wage households or households with earners just above the minimum (not shown).³⁴

The long-run effect of the minimum wage on income is more difficult to measure. The Neumark et al papers find that any income gain from a minimum wage increase dissipates substantially, perhaps even evaporates, within two years. This result is consistent with the empirical finding that most individuals who earn the minimum wage at a point in time will earn well above the minimum wage two years later (Smith and Vavrichek 1992). Indeed, roughly 38 percent of SIPP workers within 120 percent of their state's effective minimum wage are still within that range a year later. Two years later, only 28 percent are within 120 percent of the minimum wage.

Our estimates suggest that a \$1 minimum wage increase boosts family income in the first year by around \$300 per quarter. Assuming the income gain slowly disappears after two or three years, a \$1 minimum wage increase lifts the net present value of total family income by about \$1,500. As we pointed out in section 2.4, this would still only imply about a \$25 per quarter increase in spending, according to a model without borrowing constraints, far less than what appears in the data. Thus the size of the income and spending responses are clearly inconsistent with the PIH.

Disemployment effects could potentially cause an increase in the probability of having zero income after minimum wage hikes, which might cause greater precautionary saving. To test this we estimate the probability of zero income, given that $w^* \geq 0.2$ (i.e., the household had significant minimum wage income when first interviewed) and the household had positive income in the previous interview. The probability of having zero income given these conditions

³⁴Defining earnings between 120 to 200 and 200 to 300 percent as minimum wage earnings, as in columns 2 and 3, the spending response for households with $w^* \geq 0.2$ are \$139 (\$77) and \$-22 (\$84). The spending response for households with $w^* = 0$ are \$-75 (70) and \$-50 (\$115).

and no minimum wage increase is 0.0417, not statistically different from 0.0413, which is the probability of zero income given a minimum wage increase.³⁵

5.3 Composition and Timing of Spending

The next set of tables and figures explores the composition and timing of spending and relates it to other key results from the calibration exercises. Recall the three central model implications. First, non-durables spending begins to rise once households learn about the upcoming wage increase, and remains high thereafter. But the higher nondurables spending may be partly offset by lower durables spending. Second, durables spending spikes upward after the minimum wage increase. Finally, durables spending remains high for several quarters after the hike.

To test these model predictions, we take advantage of the detailed spending breakdown in the CEX. Furthermore, we present some evidence from the credit card and credit bureau data that corroborates the key findings from the CEX.

5.3.1 Composition of Spending Responses

Table 6 shows that durables spending spikes following a minimum wage increase. Households with $w^* \geq 0.2$ increase durables spending by \$894 (\$463) per quarter following a \$1 increase in the minimum wage, an amount that, on average, doubles the typical household's quarterly spending on durables. Again, households with no minimum wage income report no additional durables spending after the minimum wage hike.

By contrast, the impact on nondurables and services is close to 0. The results are particularly striking when considering that non-durables and services comprises 85 percent of total spending, on average.

Since most of the spending response is in durables, the rest of the table decomposes this category more finely. In particular, we classify goods into eight categories: furniture, floors and windows, household items, large appliances, electronics, leisure activities, miscellaneous household equipment, and net outlays on transportation (i.e., the difference between the price

³⁵Relative to the literature on disemployment and the minimum wage, keep in mind that these results are based on household heads and spouses, not teenagers. The results are the same when we look at zero income conditions two interviews (8 months) hence.

of the vehicle purchased and the vehicle sold).³⁶ At the bottom of the table, we report the average amount spent by category.

For most categories, the impact is small and often hard to distinguish from zero. The notable exception is transportation goods. For example, households in the full sample with $w^* \geq 0.2$ spend an additional \$764 (\$457) on transportation durables, representing 85 percent of the total spending response. The importance of transportation durables shows up in near identical fashion among non-college households and different thresholds of w^* (not reported).

Table 7 further decomposes transportation spending. For households with $w^* \geq 0.2$, spending on new cars, used cars, new trucks, used trucks, and all other transportation goods rises by \$123, \$25, \$308, -\$6, and \$314. Thus, most of the spending is on new vehicles, which are relatively easy to debt finance. The final 5 columns of table 7 present estimates from linear probability models that show the increased probability of a transportation purchase after a minimum wage hike. For example, the probability of purchasing a new truck rises by 0.014, and the increased probability of purchasing any vehicle rises by 0.029 per quarter after a minimum wage increase. The additional 2.9 percent of households purchasing high-priced transportation items drives the large spike in total spending following a minimum wage increase.

Rough breakdowns on durables, nondurables, and services spending can be derived in the credit card data for a shorter sample (2000 to 2003) as well.³⁷ Of course, the largest component of durables, vehicles, are typically ineligible for credit card purchase. Nevertheless, we find that durables spending rises by \$52 (\$33) per quarter, a substantial increase compared to baseline credit card spending on durables of about \$22.

³⁶Floors and windows include carpets, rugs, curtains, drapes, blinds. Household items include clocks, lamps, linens, silverware, plates, glasses, decorative items, and outdoor equipment. Large appliances include kitchen and laundry appliances. Electronics includes televisions, VCRs, DVDs, stereo and sound equipment, computers, telephones, PDAs, antennas, and satellite dishes. Leisure activities include musical instruments, sports equipment, bikes, camping equipment, toys, games, playground equipment, arts and crafts, CDs, and DVDs. Miscellaneous household equipment includes small appliances, smoke alarms, cleaning equipment, tools, lawn equipment, window air conditioners, and portable heaters and coolers. Transportation includes cars, trucks, vans, motorcycles, and boats. These purchases are net of trade-ins.

³⁷We assign durables or nondurable status to most stores based on their sales codes. For big box retailers, we use 10-k annual reports to designate the fraction of purchases from each spending category. To take two examples, approximately 35 and 43 percent of Walmart and Costco sales are in durables.

5.3.2 Timing of Spending

The timing of the spending response is explored in figure 4. These plots are based on equation (12) where we allow for three quarters of lags and leads of the minimum wage ($K=3$). We find that the results line up well with key implications of the model with borrowing constraints, as discussed in section 2.5 and shown in figure 3.

First, the initial spending increase happens primarily in the contemporaneous quarter of the minimum wage change. There is little evidence that total spending increases prior to the minimum wage change, even though the new minimum wage is typically passed months in advance.

Second, the timing of the composition of spending is consistent with the borrowing constraint model. Prior to the minimum wage increase, total spending is flat. However, this masks an offsetting increase in nondurables and services and a decline in durables spending. However, the quarter that it is implemented, durables spending spikes up. Meanwhile, non-durables and service spending increases two quarters before the hike but does not increase further during the quarter of the hike.

Third, spending does not revert back to pre-hike levels after that initial increase. It bounces around \$1,000 per quarter for several quarters, before starting to decline by quarter 4. By comparison, there is no increase in spending among the non-minimum wage households ($w^* = 0$).

Similar patterns arise in the credit card data, displayed in figure 5, when we estimate the model with three quarters of lags and leads. Again, we find that the most of the spending response occurs during the quarter (and even month, albeit not shown here) of the minimum wage change and the quarters that immediately follow. We find no evidence that spending increases prior to the minimum wage change or among account holders with income well beyond minimum wage levels (\$20,000). Spending starts to revert to its original level three quarters after the hike.

5.4 Debt

If spending rises more than income after a minimum wage increase, it follows that net worth declines. Although we do not have panel data on assets, the credit bureau supplies panels on household debt. Table 8 shows quarterly changes in debt after a minimum wage

hike, broken into subcategories: vehicle loans, home equity loans, mortgages, and credit card debt. The final two columns provide sums of total and collateralized (vehicle and home) debt.³⁸ In each category, debt increases after a minimum wage increase, but particularly in collateralized loans tied to vehicles and homes. We estimate that a \$1 minimum wage increase causes auto loan balances to increase by \$184 (\$76). Furthermore, home equity lines rise \$125 (\$75), which can be used to purchase vehicles.³⁹ Total collateralized debt increases by \$460 (\$285) and total debt by \$565 (\$299).⁴⁰ There is no increase in debt among higher income individuals.

Are these results consistent with the spending on autos? Table 7 shows that outlays for new cars and trucks increase by \$431 per quarter after a \$1 minimum wage hike. The purchase and debt figures will not correspond exactly because of downpayments, as well as loan demand captured through personal arrangements not recorded by the credit bureaus and other loans not typically intended for car purchases. Yet the auto loan data provide confirming evidence that much of the rise in debt comes from auto purchases. Both suggest an increase in vehicle purchases following a minimum wage increase.

Figure 6 displays the dynamics of total household debt in the nine quarters that follow a minimum wage increase. This figure is based on the sole cohort of accounts that are followed for four years starting in January 2000. Three series are plotted: auto and home equity debt, those two debt instruments plus mortgage debt (or total collateralized debt), and those three instruments plus credit card debt (or total debt). The figures show total debt rising by \$550 per quarter in the first year after a minimum wage increase. Over 80 percent of this increase comes from collateralized sources. In subsequent quarters, debt rises by less, to the point that by the ninth quarter, debt is beginning to fall slightly. This provides direct evidence that much of the early consumption response is in fact debt-financed, as the completely independent measures of income and consumption from the SIPP and CEX

³⁸The rise in debt comes from both the increase in current spending relative to payments and interest accumulation on debt.

³⁹ According to CNW Research, home equity lines were used in 12 to 14 percent of vehicle purchases made between 2003 and 2007. These data were generously provided to us by CNW. They are based on monthly phone and mail interviews of more than 14,000 households.

⁴⁰The estimated credit card debt response of \$105 (\$80) is based only on our institution. However, if we use accounts where the balance ratio is high, and therefore the individual relies primarily on only our card, the change in debt following a minimum wage increase is similar (\$125 (\$206)) but less precisely estimated. Our total debt also excludes loans not recorded by the credit bureau, including educational debt.

suggest.⁴¹ Again, this is further confirmation of the potential importance that downpayment constraints play among the spending patterns of liquidity constrained households.

5.5 Distribution of Spending Responses

Because much of the spending increase comes from vehicles, there is considerable heterogeneity in spending after a minimum wage increase. This point is displayed in figure 7, which graphs a set of quantile regressions of total spending, ranging from 0.10 to 0.95 (the quantile is shown on the x-axis) for households where either $w^* = 0$ (connected by the dashed line) or $w^* \geq 0.2$ (solid line).⁴² The key insight is that, for minimum wage households, the mean response is much bigger than the median response, the latter of which is not statistically or economically different from 0. In particular, the average effect reported in earlier tables appears to be substantially driven by the tails of the spending response distribution, especially households beyond the 90th percentile of the distribution.

Contrast these results to the spending response predicted by our model. Figure 8 plots the quantile spending response for minimum wage households in two versions of the model: the baseline model with (connected by the dotted line) and without (solid line) adjustment costs. The baseline model predicts roughly the same sized effect throughout the spending distribution and thus underpredicts the spending response at the 90th and 95th percentile relative to what is seen in the data. However, the baseline model with adjustment costs displays a significant spike in spending at the top end of the spending distribution. In particular, for those at the 95th percentile, the spending response is \$1,700 per quarter, almost identical to what is observed in the data.

This result comes about because households upgrade their durables stock periodically in the adjustment cost model. The model predicts that purchases occur every 12 quarters, which is consistent with actual vehicle expenditures in the CEX. Thus, for the majority

⁴¹Despite the rise in debt, we find no evidence to date of increases in default rates from the credit bureau data. If anything, default rates fall by a statistically insignificant 0.3%. However, this result should be read with a fair degree of caution since the sample period covers a relatively short period after the minimum wage hike. We might reasonably expect that an outcome like default would take considerable time to play out.

⁴²The estimates are presented without leads or lags of the minimum wage (i.e., $K = 0$ in equation (12)). In order to remove the fixed effect, we first demeaned all variables, then used standard quantile estimation techniques. Because a quantile estimator is not a linear model, demeaning the data will generate inconsistent estimates. However, when we performed our procedure on our simulated data, we found that this problem is very minor. More importantly, we perform the same procedures on the simulated data, so the estimates on actual and simulated data are comparable.

of households, the durables spending response is 0 in any given quarter. Conditional on a minimum wage increase, the probability of a durables purchase, as well as the amount spent conditional on a purchase, rises. This causes the spending response to be very large at the 95th percentile but small below that. Consequently, the model with adjustment costs better matches the right tail of the spending distribution than the model without them. That said, the adjustment cost model does no better in terms of explaining the mean response, as shown in the calibrated results presented in table 2.

6 Discussion

We estimate the spending, income and debt responses to minimum wage hikes. We show that a life cycle consumption model where households can borrow against durable goods fits the data better than a standard permanent income model.

First, spending increases substantially after the hike, with most of the spending occurring on durable goods, and in particular transportation goods. This near-run spending increase, perhaps in the order of \$800, exceeds the \$300 or so per quarter of additional family income caused by a minimum wage hike. Using different data, we find that debt rises about \$550 per quarter, which corroborates the spending and income evidence. This is particularly surprising given that minimum wage hikes likely increase income of minimum wage workers for a short period, about two to three years according to some research. If households were spreading the income gain over their entire lifespan, the spending increases should be far smaller than what we observe in the data. Augmenting the permanent income model to account for durable goods increases the short term spending response, but is still far smaller than what our estimates imply. As we show, however, our estimates are consistent with a model where households must make a small downpayment for their durables. Thus small increases in income can generate large increases in durables spending.

Second, we find that the spending response occurs within one quarter of the actual increase in the minimum wage, although minimum wage increases are typically passed into law 6 to 18 months prior to their effective date. This result is found in both the CEX and credit card accounts. We interpret this finding as evidence that households respond to current, not lifetime, income, a result that can be reconciled with models that allow for borrowing constraints.

Third, the composition of spending is consistent with forward looking behavior and borrowing constraints. In particular, non-durables and services spending rises before the minimum wage hike, although there is an offsetting decline in durables spending. However, there is a pronounced jump in durables spending near the date that the wage actually increases.

Fourth, the high levels of spending and debt appear to persist for longer than the permanent income hypothesis would imply. Again, this persistence is consistent with a model where households are borrowing constrained for several periods after the minimum wage hike.

Finally, we show that the borrowing constraint model augmented with an adjustment cost to durables transactions can help explain the distribution of spending responses.

It is appropriate to emphasize again that we focus only on households who had a minimum wage job before the minimum wage went up. It is possible, perhaps even likely, that a minimum wage increase reduces the odds that those without a job will be able to find one. Moreover, we ignore teenagers, where there is particularly compelling evidence of disemployment. Consequently, our estimates are silent about the aggregate effects of minimum wage hikes. However, for those adults who had a minimum wage job before the minimum wage went up, there is compelling evidence that consumption, income, and debt rise afterwards, and that these responses are consistent with the existence of borrowing constraints and the important role of durables in the borrowing process.

Appendix A: Solving the model

In order to reduce the number of state variables, we follow Deaton (1991) and redefine the problem in terms of cash-on-hand:⁴³

$$X_t = (1 + r)A_t + Y_t. \quad (14)$$

Assets and cash-on-hand follow:

$$A_{t+1} = X_t - C_t, \quad (15)$$

$$X_{t+1} = (1 + r)(X_t - C_t - I_t) + Y_{t+1}. \quad (16)$$

Thus, the borrowing constraint becomes

$$-\left(\frac{X_t - Y_t}{1 + r}\right) \leq (1 - \pi)S_t. \quad (17)$$

Note that all of the variables in X_t are known at the beginning of period t . We can thus write the individual's problem recursively, using cash-on-hand as a state variable. In recursive form, the household's problem is to choose non-durables consumption and durables investment to maximize :

$$V_t(Z_t) = \max_{C_t, I_t} \{(C_t^{1-\theta} S_t^\theta)^{1-\gamma} / (1 - \gamma) + \beta \int V_{t+1}(Z_{t+1}) dF(Z_{t+1} | Z_t, C_t, I_t, t)\} \quad (18)$$

subject to the constraint in equation (17), where the state variables of the model are $Z_t = (X_t, S_t, P_t)$, and $F(\cdot | \cdot)$ gives the conditional cdf of the state variables, using equations (3), (5), (6), and (16). Solving the model gives optimal consumption and durables investment decision rules.

The source of uncertainty in the model is from income. We integrate over the distribution of income by discretizing P_t using discrete state Markov Chains (Tauchen 1986).

To simulate the model, we take the initial joint distribution of the state variables from the data. We then take draws of income from the data generating process of income. Given the initial joint distribution of (X_0, S_0, P_0) that we observe in the data, we use the decision

⁴³Using cash-on-hand allows us to combine assets and the transitory component of income u_t into a single state variable.

rules to obtain C_0, I_0 , which gives us a value of (X_1, S_1) . We take a draw for P_1 , which then gives income. We repeat this for $T = 200$ periods. The figures presented are based on 5,000 simulations of the model.

Appendix B: Model results: certainty and no borrowing constraints

Using assets instead of cash on hand as the state variable, Bellman's equation (18) without uncertainty is:

$$V_t(A_t, S_t, P_t) = \max_{C_t, I_t} \{U(C_t, S_t) + \beta V_{t+1}(A_{t+1}, S_{t+1}, P_{t+1})\}. \quad (19)$$

The only constraints in this case are the law of motion for assets (equation 2) and durables (equation 3) and that final period assets must be non-negative. The first order conditions for non-durables consumption and durables investment are, respectively:

$$\frac{\partial U_t}{\partial C_t} = \beta \frac{\partial V_{t+1}}{\partial A_{t+1}} \quad (20)$$

$$\frac{\partial V_{t+1}}{\partial A_{t+1}} = \frac{\partial V_{t+1}}{\partial S_{t+1}}. \quad (21)$$

Differentiating with respect to assets and the durables stock and using the envelope condition yields, respectively:

$$\frac{\partial V_t}{\partial A_t} = \beta(1+r) \frac{\partial V_{t+1}}{\partial A_{t+1}} \quad (22)$$

$$\frac{\partial V_t}{\partial S_t} = \frac{\partial U_t}{\partial S_t} + \beta \frac{\partial V_{t+1}}{\partial S_{t+1}}(1-\delta). \quad (23)$$

Combining equations (21), (22), and (23) yields

$$\beta(1+r) \frac{\partial V_{t+1}}{\partial A_{t+1}} = \frac{\partial U_t}{\partial S_t} + \beta \frac{\partial V_{t+1}}{\partial A_{t+1}}(1-\delta). \quad (24)$$

Combining equations (20) and (24) yields

$$(r+\delta) \frac{\partial U_t}{\partial C_t} = \frac{\partial U_t}{\partial S_t}. \quad (25)$$

Inserting the specific functional forms for the utility function from equation (1) into equation (25) yields

$$(r + \delta) \left(\frac{1 - \theta}{\theta} \right) S_t = C_t. \quad (26)$$

Combining equations (20), (22), and (26) yields the Euler Equation

$$C_{t+1} = C_t (\beta(1 + r))^{\frac{1}{\gamma}}. \quad (27)$$

Define

$$PV \equiv A_0 + \sum_{t=0}^T \left(\frac{1}{1 + r} \right)^t Y_t \quad (28)$$

as “full wealth”, i.e., the present value of lifetime income plus wealth. Given that the present value of lifetime spending is equal to full wealth (and given that the annual cost of durables is $(r + \delta)$), the lifetime budget constraint is

$$\sum_{t=0}^T \left(\frac{1}{1 + r} \right)^t (C_t + (r + \delta) S_t) = PV. \quad (29)$$

Inserting equation (26) into equation (29) yields

$$\sum_{t=0}^T \left(\frac{1}{1 + r} \right)^t \left(C_t + \left(\frac{\theta}{1 - \theta} \right) C_t \right) = PV. \quad (30)$$

Combining equation (27) with equation (30) yields

$$\sum_{t=0}^T \left(\frac{1}{1 + r} \right)^t \left(\left(1 + \left(\frac{\theta}{1 - \theta} \right) \right) C_0 (\beta(1 + r))^{t/\gamma} \right) = PV. \quad (31)$$

Using the formula for an infinite sum and rearranging yields

$$C_0 = (1 - \theta) \left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r} \right)^{T+1}} \right] PV \quad (32)$$

where $(1 - \theta) \left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r} \right)^{T+1}} \right]$ is the marginal propensity to consume non-durables. Inserting equation (26) into equation (32) yields

$$S_0 = \left(\frac{\theta}{r + \delta} \right) \left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r} \right)^{T+1}} \right] PV. \quad (33)$$

Holding last period's durables stock fixed, increases in this period's durables stock can only come from increases in investment. Thus

$$\left. \frac{\partial I_0}{\partial PV} \right|_{S_0} = \left. \frac{\partial S_1}{\partial PV} \right|_{S_0} = (\beta(1+r))^{\frac{1}{\gamma}} \left(\frac{\theta}{r + \delta} \right) \left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r} \right)^{T+1}} \right] \quad (34)$$

is the marginal propensity to spend on durables. Inspection of equation (29) shows that the marginal propensity to spend is the same for increases in assets and the present value of lifetime income. In order to get time period 1 non-durables and durables spending, note that equation (27) shows that consumption grows at rate $(\beta(1+r))^{\frac{1}{\gamma}}$, and thus the marginal propensity to consume non-durables at time 1, given an increase in full wealth at time 0, is $(\beta(1+r))^{\frac{1}{\gamma}} (1 - \theta) \left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r} \right)^{T+1}} \right]$. To derive the time 1 durables spending response, note that the ratio of durables to non-durables is a constant, and thus the durables stock grows at a rate $(\beta(1+r))^{\frac{1}{\gamma}}$. Using this result, the law of motion for durables, and equation (34) yields the marginal propensity to spend on durables at time 1:

$$\begin{aligned} \left. \frac{\partial I_1}{\partial PV} \right|_{S_0} &= \left. \frac{\partial S_2}{\partial PV} \right|_{S_0} - (1 - \delta) \left. \frac{\partial S_1}{\partial PV} \right|_{S_0} \\ &= (\beta(1+r))^{\frac{1}{\gamma}} \left. \frac{\partial S_1}{\partial PV} \right|_{S_0} - (1 - \delta) \left. \frac{\partial S_1}{\partial PV} \right|_{S_0} \\ &= [(\beta(1+r))^{\frac{1}{\gamma}} - (1 - \delta)] \left. \frac{\partial S_1}{\partial PV} \right|_{S_0} \\ &= [(\beta(1+r))^{\frac{1}{\gamma}} - (1 - \delta)] (\beta(1+r))^{\frac{1}{\gamma}} \left(\frac{\theta}{r + \delta} \right) \left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r} \right)^{T+1}} \right]. \quad (35) \end{aligned}$$

Solving for time period 2 spending propensities is straightforward.

Appendix C: The Survey of Consumer Finances

This appendix provides descriptive information on the initial joint distribution of the state variables used in the dynamic programming problem. The three state variables are the permanent component of income P_{it} , cash on hand (which is the sum on income and assets net of durable goods A_{it}), and the stock of durable goods S_{it} . We assume that permanent income is the same as current income, and define the durables stock as the sum of vehicles plus the stock of non-vehicle durables. We define assets net of durables as net financial assets less debt against durable goods.

Table A1 shows key descriptives about these three variables from the 2004 SCF. The table also includes total debt and assets (last two rows) which contain other assets, such as housing and business wealth, to provide a more complete picture of household balance sheets.

We present means for both minimum wage households ($w^*=0$) and above minimum wage households ($w^* \geq .2$). To compute w^* , we use a methodology very similar to the CEX (described in section 3.1). First, we define someone as a minimum wage worker if that individual makes between 60 and 120 percent of the minimum wage. Next, if an individual is a minimum wage worker, we multiply that individual's hourly wage by hours per week times weeks per year. Because the SCF reports pay at frequencies chosen by the respondent, we compute the wage using given pay and frequency of pay, adjusted appropriately by hours per year. Finally, we take total household income from minimum wage workers and divide through by total household wage income (where wage income is the income of respondent and spouse and is derived using the procedure described above) which gives w^* , the share of income from minimum wage workers.

Table A1 shows that for minimum wage households⁴⁴, mean income, durables, debt, and financial wealth are all about one third as large as for non-minimum wage households. Although, on average, financial assets are high, the distribution is skewed. Median financial wealth for minimum wage households is \$359. Another thing to note is that our definition of assets and durables excludes housing and business wealth. Roughly 35 percent of all minimum wage households own their home. For these households, housing represents close to 50 percent of all wealth and over 50 percent of all debt.

⁴⁴Similar to the CEX, the unit of observation in the SCF is the "primary economic unit", which is usually a household. In order to preserve confidentiality of respondents, noise is added to SCF data. Each responding economic unit is turned into five observations.

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Parameter	Quarterly value	Definition
β	$\sqrt[4]{0.95}$	Discount factor
γ	2	Coefficient of relative risk aversion
θ	0.15	Utility weight on durables
$T - t_0$	200	Number of time periods
r	$\sqrt[4]{1.03} - 1$	Quarterly interest rate
δ	0.034	Durables depreciation rate
π	0.4	Downpayment rate
$E(Y_0)$	\$2,900	Average income of minimum wage households
α_1	0.0108	Income growth
ρ	0.995	Autocorrelation of income
σ_ϵ^2	0.002	Variance of AR(1) innovations
σ_u^2	0.000	Variance of transitory innovations

Table 1: Parameters Used for Calibration

Parameters	Non-durables Spending	Durables Spending	Total Spending	Median assets	Median resources**
Baseline*	113	196	309	-5,298	262
$\pi = 0.2$	134	165	299	-7,367	352
$\pi = 1.0$	81	140	221	241	241
$\sigma_\epsilon^2 = 0, \pi = 0.2$	151	298	449	-9,078	293
$\sigma_\epsilon^2 = 0.005, \pi = 0.2$	87	78	165	-6,093	857
Adjustment cost = 0.05	73	116	188	-4,199	700
$\beta = 1.0, \sigma_\epsilon^2 = 0, \text{ no borrowing constraints}$	9	17	26	-20,999	na
$\beta = 1.0, \sigma_\epsilon^2 = 0, \text{ adjustment cost} = 0.05, \text{ no borrowing constraints}$	11	-10	1	-22,798	na
* Baseline parameters shown in table 1					
** Median resources defined as $A_{it} + (1 - \pi)S_{it}$					

Table 2: Robustness Checks

Table 3
Total Spending Response to Change in the Minimum Wage
CEX, 1983-2005

<u>w*</u>					<u>Real average quarterly spending</u>	
					<u>All</u>	<u>HS dropouts and grads</u>
	<u>All</u>	<u>HS dropouts and grads</u>	<u>All, by "minimum wage cutoff"</u>		<u>All</u>	<u>HS dropouts and grads</u>
0	123 (171) 170,419	36 (231) 64,073	69 (209) 122,878	244 (294) 70,951	9,865	8,533
>0	869 (469) 21,695	1249 (603) 12,976	312 (263) 47,485	-226 (268) 51,927	6,878	6,538
>=0.2	885 (537) 15,192	1330 (713) 9,524	393 (264) 40,506	-145 (267) 48,813	5,795	5,819
Minimum Wage threshold used ¹ :	<=120%	<=120%	120-200% ²	200-300% ³		

Notes

Each cell represents a separate regression. W* is the share of pre-tax total consumer unit income from near minimum wage salaries earned by the top two adults in the consumer unit. Near minimum wage is defined in the last row. See the text for details. All standard errors are cluster corrected by consumer unit.

¹ The minimum wage threshold is based on the gap between the wage (of the top 2 earners in each consumer unit) and the minimum wage at the beginning of the sample. For example, "<=120%" means that we assume labor income for a CU member is minimum wage income if their wage is within 120 percent of the state's effective minimum at the beginning of the sample (typically, survey 2)

² This sample throws out any units with a worker less than or equal to 120 percent of the minimum wage at the beginning of the sample period.

³ This sample throws out any units with a worker less than or equal to 200 percent of the minimum wage at the beginning of the sample period.

Table 4
Total Credit Card Spending Response to Change in the Minimum Wage
Credit Card Data, 1995-2003

<u>Income at credit card application</u>	<u>All</u>	<u>Credit Limit <\$2,000</u>	<u>Balance ratio>2</u>
>=\$20,000	3 (26) 2,528,372	8 (30) 173,019	11 (18) 684,197
<\$20,000	176 (60) 308,117	247 (78) 47,911	248 (219) 30,882

Notes:

Each cell represents a separate regression. All standard errors are cluster corrected by account holder. For income < \$20,000, observations are weighted by P, the probability that an individual account holder is a minimum wage worker. See text for details.

Table 5
Total Household Nonproperty Income Response to Change in the Minimum Wage

w*	SIPP, 1986-2003					CPS, 1979-2006			
	Hourly wage of hourly workers					hourly workers			
	All			HS dropouts and grads		Computed wage³		HS dropouts and grads	
	<120%	120-200%¹	200-300%²	<120%	<120%	<120%	<120%	<120%	<120%
0	-42 (69) 347,514	-168 (93) 203,856	-261 (153) 91,389	-69 (81) 280,544	6 (78) 183,714	-36 (60) 486,018	-21 (66) 420,720	-36 (52) 566,602	-25 (64) 316,920
>0	156 (159) 43,474	195 (99) 138,972	-72 (108) 110,360	198 (183) 32,639	1 (180) 29,533	69 (117) 60,472	48 (126) 50,396	419 (123) 100,034	250 (140) 65,766
>=0.2	255 (177) 33,716	210 (99) 119,471	36 (105) 104,062	462 (198) 24,769	222 (189) 23,993	177 (117) 47,674	249 (135) 39,107	336 (126) 79,140	313 (138) 54,266

Includes movers where households remain intact yes yes yes no yes yes no no no

Notes:

Each cell represents a separate regression. W* is the share of pre-tax total consumer unit income from near minimum wage salaries earned by the top two adults in the consumer unit. Near minimum wage is defined in the last row.

All standard errors are cluster corrected by consumer unit.

¹ This sample throws out any units with a worker less than or equal to 120 percent of the minimum wage at the beginning of the sample period.

² This sample throws out any units with a worker less than or equal to 200 percent of the minimum wage at the beginning of the sample period.

³ The computed wage is monthly earnings divided by monthly hours worked.

Table 6
Decomposition of Spending Response
CEX, 1983-2005

<u>w*</u>	<u>Nondurables</u> <u>& Services</u>	<u>Durables subcomponents</u>									
		<u>Durables</u>	<u>Furniture</u>	<u>Floors</u> <u>and</u> <u>windows</u>	<u>HH</u> <u>items</u>	<u>Big</u> <u>appl.</u>	<u>Electr.</u>	<u>Leisure</u> <u>activities</u>	<u>Misc</u> <u>HH</u> <u>equip.</u>	<u>Transp.</u>	<u>Non-</u> <u>Transp.</u>
0	93 (84)	30 (144)	3 (21)	1 (8)	-7 (7)	5 (8)	-3 (13)	-4 (10)	-4 (6)	38 (139)	86 (94)
>0	130 (176)	739 (419)	7 (37)	13 (11)	-1 (11)	54 (43)	12 (32)	-19 (45)	30 (14)	642 (406)	227 (199)
>=0.2	-9 (212)	894 (463)	-4 (40)	11 (10)	6 (8)	8 (15)	35 (35)	16 (15)	58 (17)	764 (457)	121 (220)
Real average amount spent (2000\$):											
0	8,209	1,656	150	33	90	42	202	101	51	987	8,878
>=0.2	4,995	800	61	8	33	21	109	49	22	498	5,297
Conditional on purchase (2000\$):											
0		1,772	543	314	162	612	269	157	186	10,511	
>=0.2		963	338	137	84	389	196	101	127	5,967	

Notes

Each cell represents a separate regression. All standard errors are cluster corrected by consumer unit.

Table 7
Decomposition of Transportation Spending Response
CEX, 1983-2005

w*	Amount of purchase					Probability of a purchase				
	<u>New cars</u>	<u>Used cars</u>	<u>New trucks</u>	<u>Used trucks</u>	<u>Other transp.</u>	<u>New cars</u>	<u>Used cars</u>	<u>New trucks</u>	<u>Used trucks</u>	<u>Other transp.</u>
0	-12 (82)	52 (54)	36 (73)	30 (43)	-69 (50)	0.000 (0.004)	0.009 (0.006)	-0.001 (0.003)	0.005 (0.004)	-0.001 (0.003)
>0	204 (132)	178 (175)	277 (161)	-14 (100)	-3 (276)	0.018 (0.009)	0.017 (0.024)	0.013 (0.008)	-0.002 (0.013)	-0.006 (0.009)
>=0.2	123 (144)	25 (218)	308 (184)	-6 (115)	314 (322)	0.012 (0.010)	0.009 (0.032)	0.014 (0.008)	-0.003 (0.016)	-0.003 (0.008)
Real average amount spent (2000\$):										
0	319	277	189	138	64	0.018	0.044	0.009	0.016	0.011
>=0.2	82	239	51	98	29	0.006	0.056	0.003	0.016	0.005
Conditional on purchase (2000\$):										
0	17,475	6,332	20,220	8,611	6,031					
>=0.2	13,767	4,226	18,579	6,071	5,544					

Notes

Probability of a purchase is estimated with a linear probability model with individual fixed effects.

Each cell represents a separate regression. All standard errors are cluster corrected by consumer unit.

Table 8
Debt Response to Change in the Minimum Wage
Credit Bureau and Credit Card Data, 1995-2003

<u>Income at credit card application</u>	<u>Auto debt</u>	<u>Home equity debt</u>	<u>Mortgage debt</u>	<u>Credit card debt</u>	<u>Total debt</u>	<u>Collateralized debt</u>
>=\$20,000	18 (103)	11 (91)	7 (139)	-12 (8)	24 (117)	36 (124)
<\$20,000	184 (76)	125 (75)	151 (351)	105 (80)	565 (299)	460 (285)

Notes:

Collateralized debt (auto+home equity+mortgage) are from the credit bureau. Credit card debt is based on cards from our institution. All observations are weighted by P, the probability that an individual account holder is a minimum wage worker. See text for details. Sample sizes are 2,528,372 and 308,117 for account holders with income of at least \$20,000 and income less than \$20,000. Each cell represents a separate regression. All standard errors are cluster corrected by account holder.

Figure 1
Simulated Income Change Around a Minimum Wage Increase

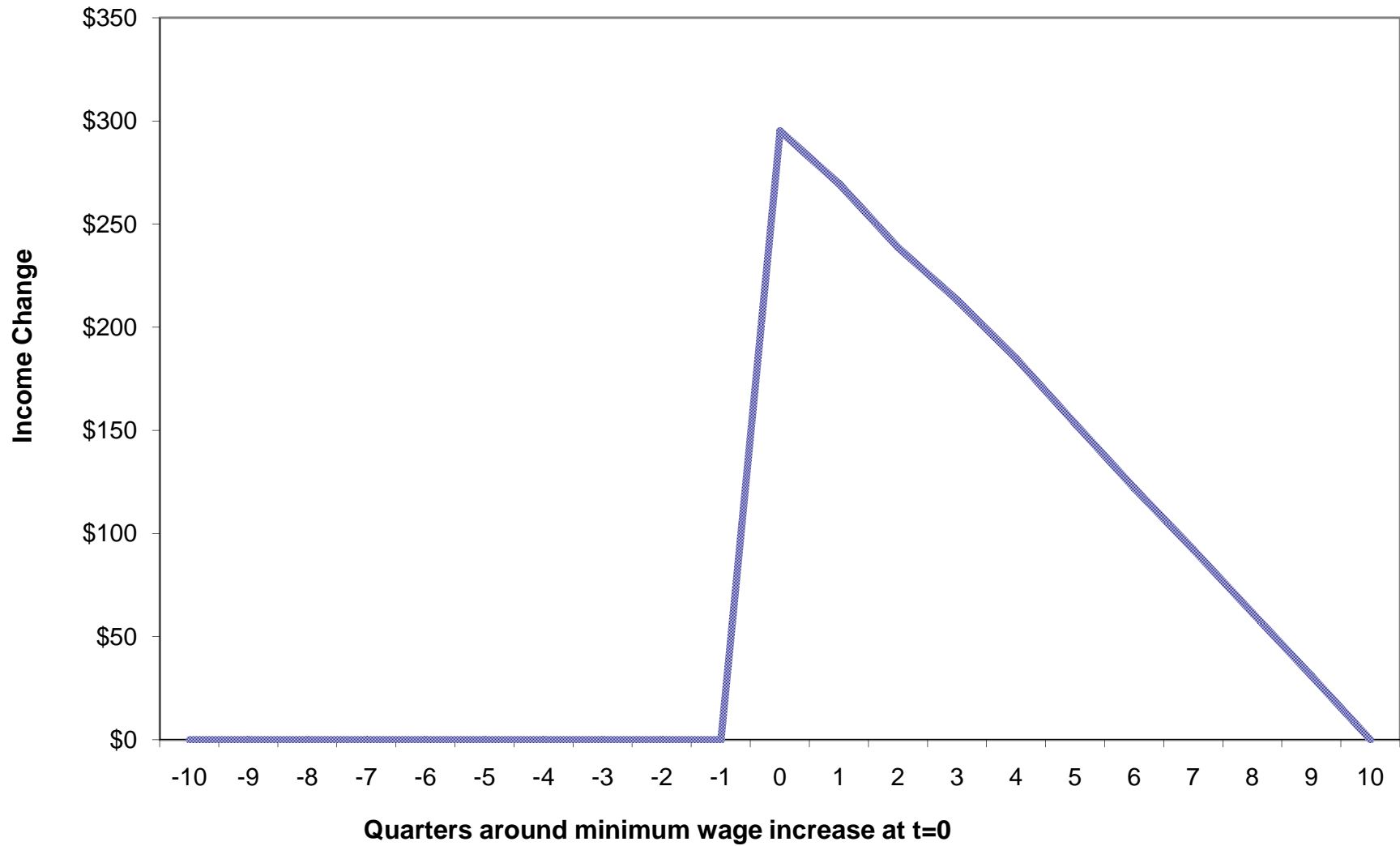


Figure 2
Spending Change Around a Minimum Wage Increase
Simulation without Borrowing Constraints

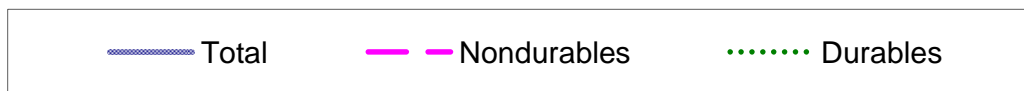
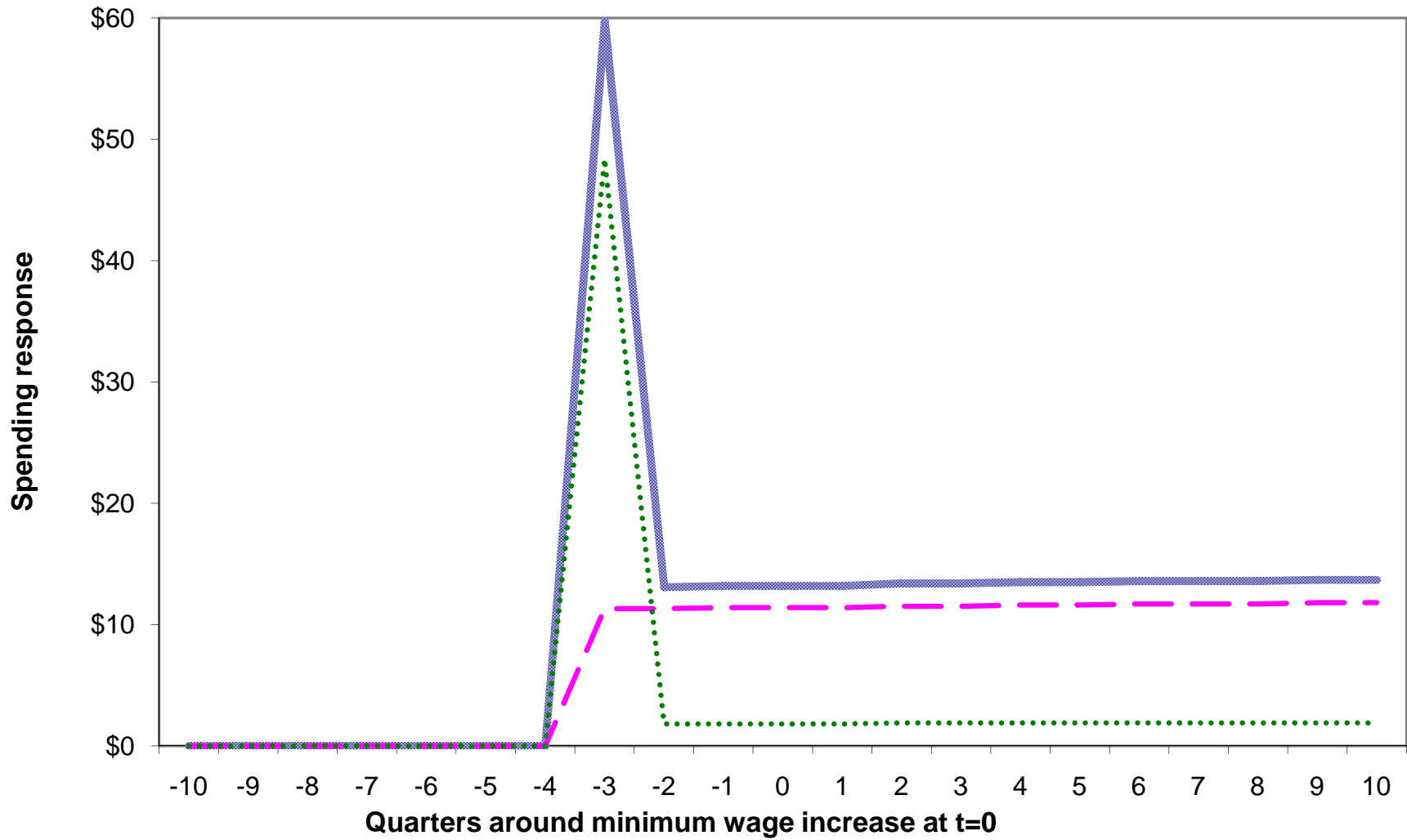


Figure 3
Spending Change Around a Minimum Wage Increase
Simulation with Borrowing Constraints

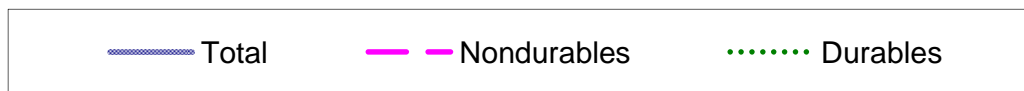
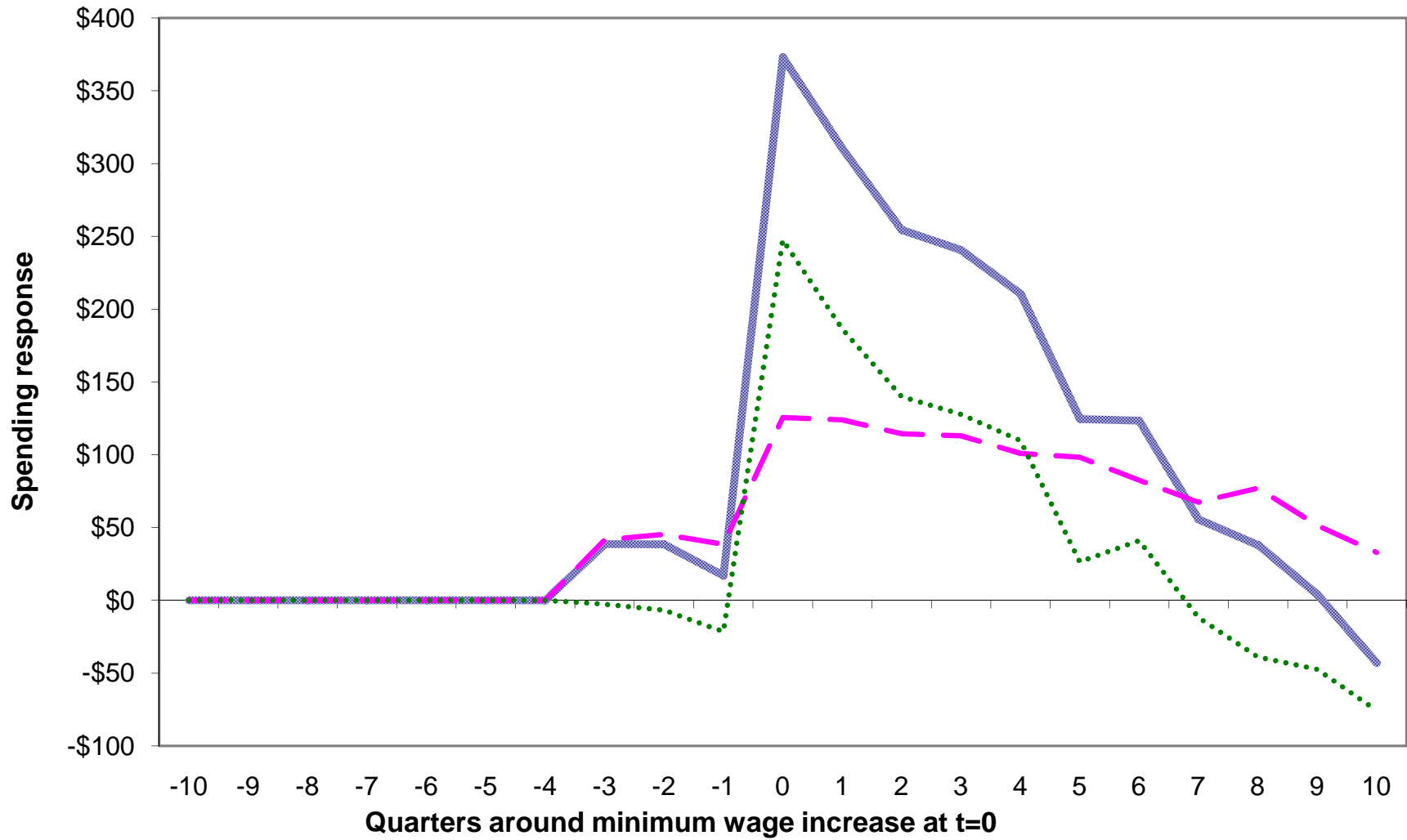


Figure 4
Spending Response to a Change in the Minimum Wage , CEX

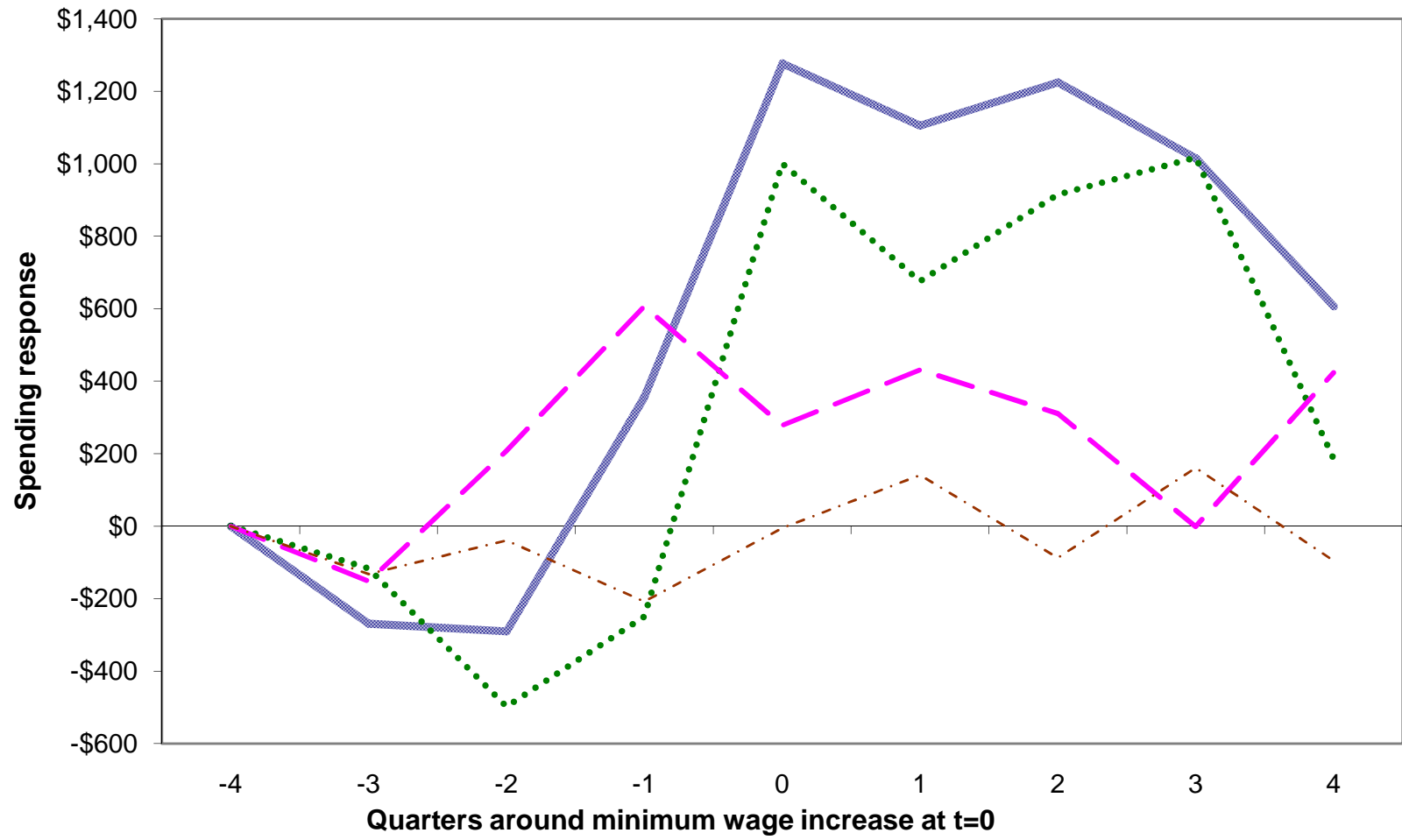


Figure 5
Spending Response to Change in the Minimum Wage, Credit Card Data

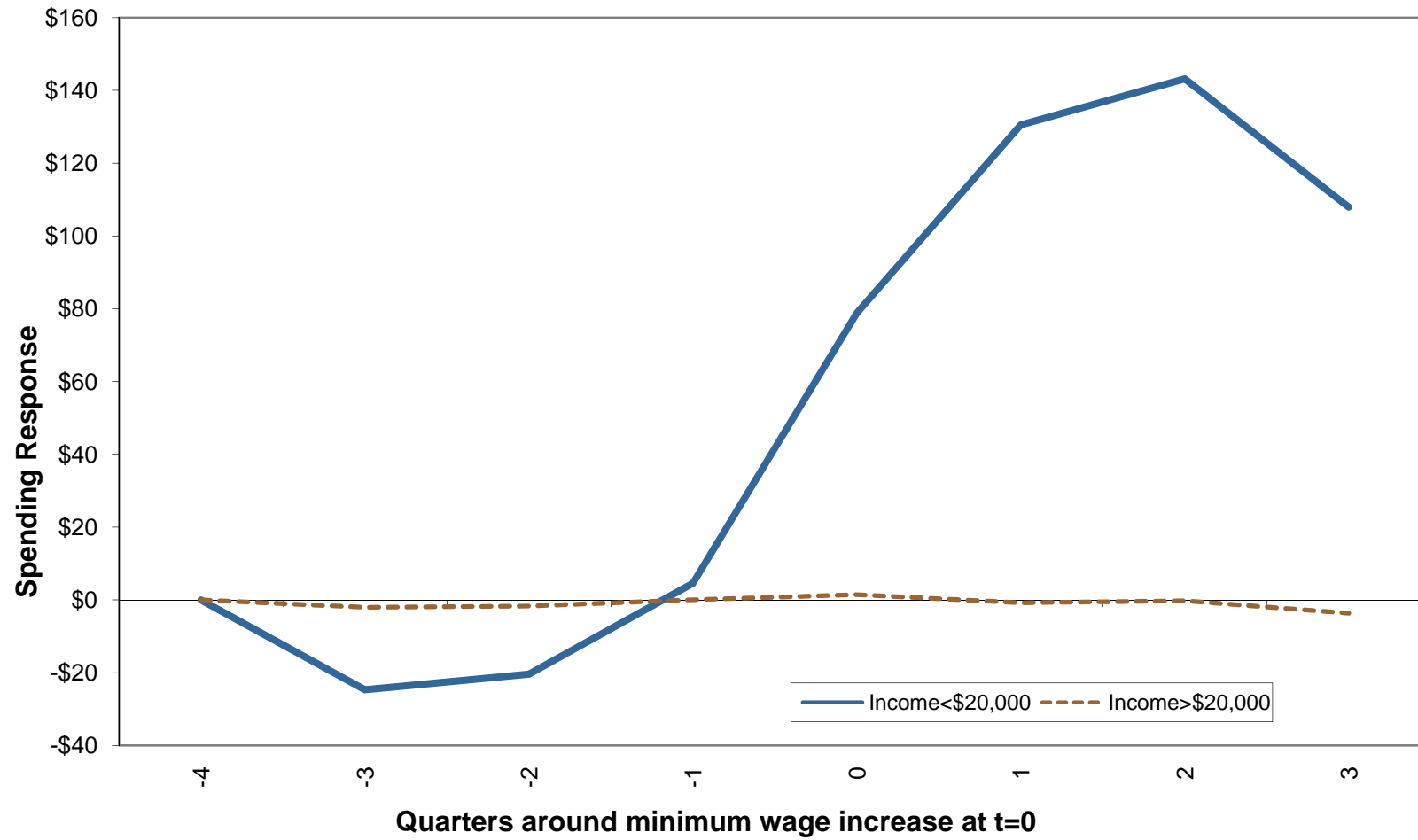


Figure 6
Debt Response to a Change in the Minimum Wage
Credit Card and Credit Bureau Data

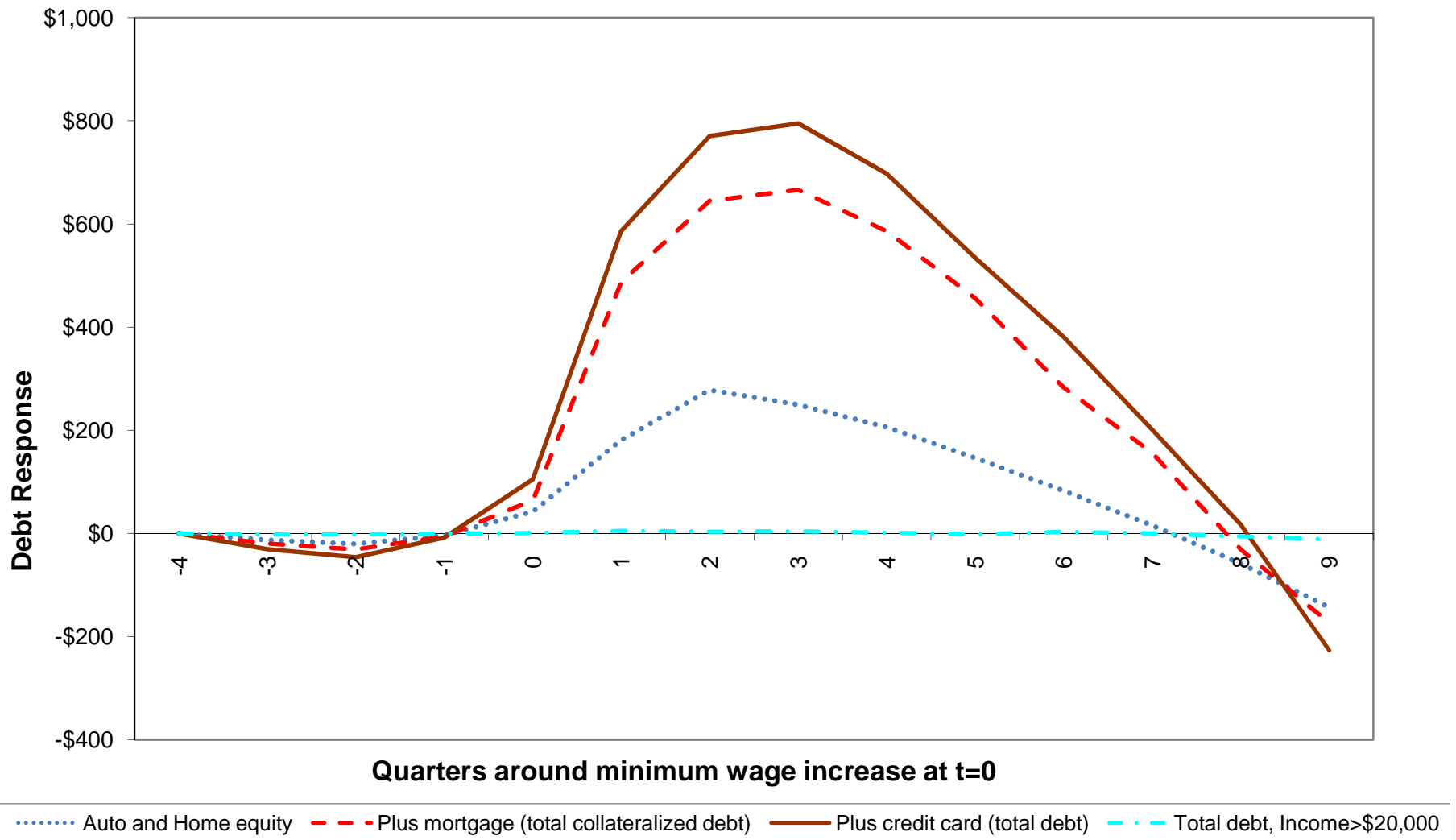


Figure 7
Spending Response to Change in Minimum Wage, CEX
Quantile Regression

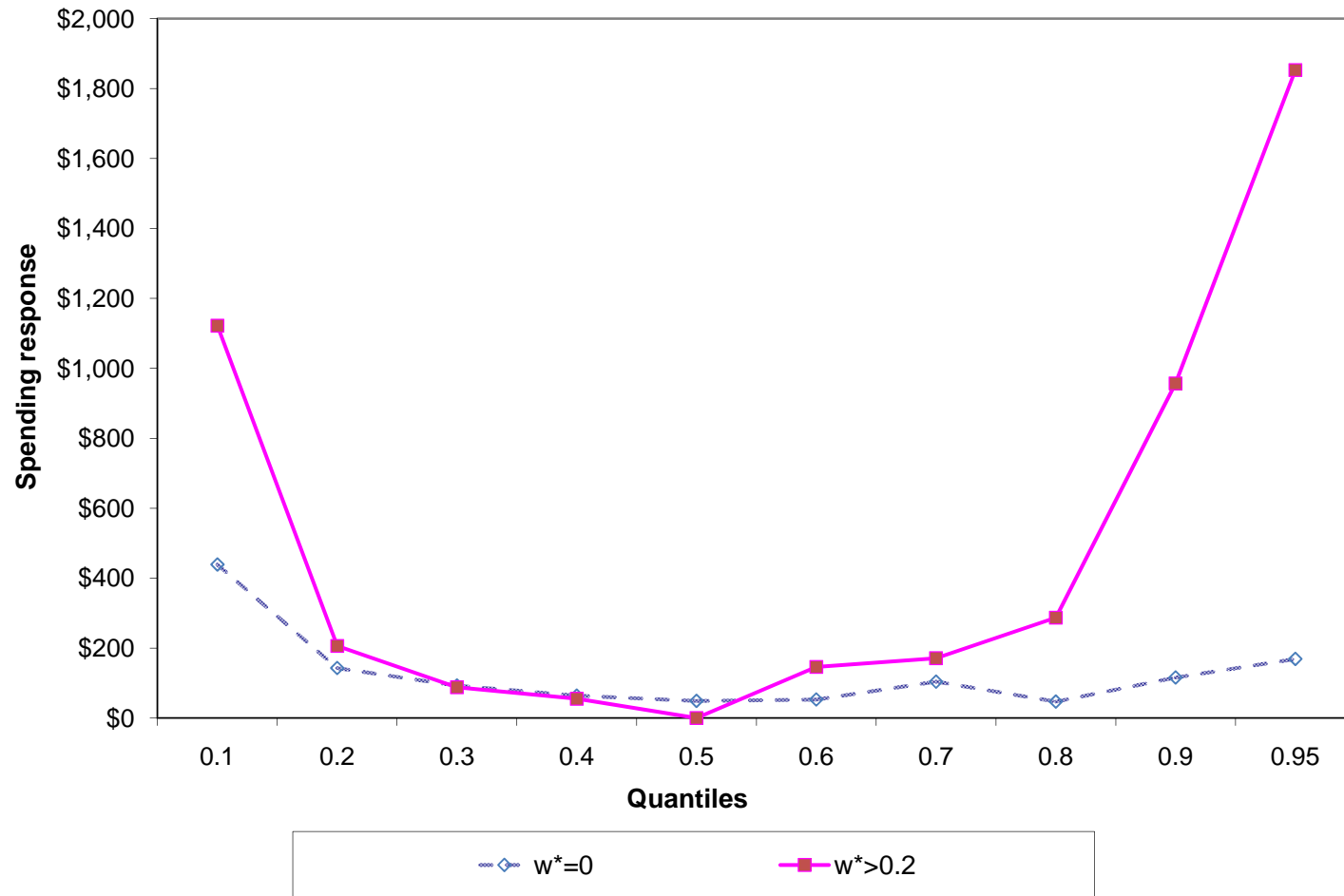


Figure 8
Model Predicted Spending Response to Change in Minimum Wage
with and without Adjustment Costs
Quantile Regressions

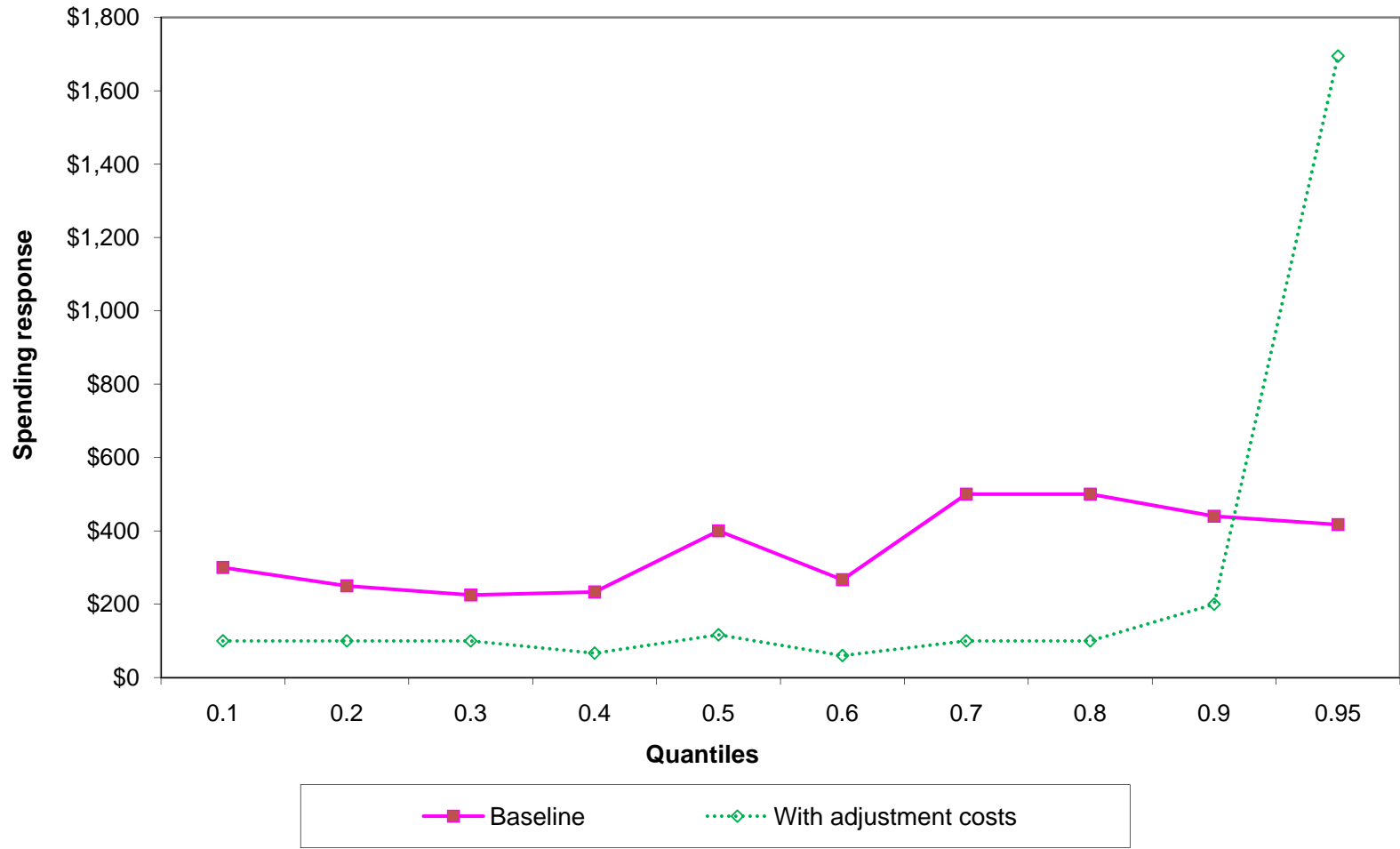


Table A1
Summary Statistics, 2004 Survey of Consumer Finances

Variable	All units		Households with $w^*=0$		Households with $w^*\geq 0.2$	
	Mean	Median	Mean	Median	Mean	Median
Family income	51,592	36,910	53,241	38,755	16,188	11,996
Value of durables (S(it))	19,167	12,700	19,585	13,000	8,852	4,800
Value of loans against durables	6,327	0	6,483	0	2,646	0
Net financial assets	121,239	11,996	125,485	13,657	32,281	369
Assets net of durables debt (A(it))	114,912	7,164	119,002	8,397	29,635	18
Homeowner (=1 if yes)	0.63	1.00	0.64	1.00	0.35	0.00
Age of head	42.1	42.0	42.3	42.0	36.3	34.0
Number of households	13,324		12,642		568	

Notes: Real income, assets, and debt in 2000 dollars. All descriptive statistics are weighted. All units include observations where w^* is between 0 and 0.2. Income variable is pre-tax earnings of husband and wife. Net financial wealth includes stocks, bonds, checking and money market accounts, less liabilities against these. Net financial wealth excludes business and housing, and durables wealth, as well as liabilities against these.

Table A2
Summary Statistics, 1983-2005 Consumer Expenditure Survey

Variable	All units		Units with $w^*=0$ in initial survey		Units with $w^*\geq 0.2$ in initial survey	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Real average quarterly spending in survey 2	9,523	6,889	9,865	7,001	5,795	4,235
Real Durables	1,583	4,331	1,656	4,441	800	2,779
Real Nondurables and services	7,940	4,644	8,209	4,708	4,995	2,733
Real before tax family nonasset annual income in survey 2	52,462	38,645	55,761	38,983	18,737	14,217
Share of income from MW earners	0.06	0.21	0.00	0.00	0.68	0.31
Share with no college experience (member 1)	0.41	0.49	0.38	0.49	0.63	0.48
Member 1 age	39.9	11.3	40.3	11.1	35.5	12.7
Number of adults	1.92	0.82	1.92	0.81	1.80	0.85
Number of kids under 18	0.86	1.14	0.84	1.12	0.88	1.22
Number of unit-surveys	192,114		170,419		15,192	
Number of units	58,404		51,445		5,001	

Notes: Real spending and income in 2000 dollars. All descriptive statistics are weighed using CEX weights. All units include observations where w^* is between 0 and 0.2 in the initial survey.

Table A3
Summary Statistics, 1995-2003 Credit Card data

Variable	All accounts		Income >= \$20,000 at application		Income < \$20,000 at application	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Card Variables						
Salary income at application	63,464	45,512	69,625	45,625	12,906	8,774
Credit line	8,217	3,429	8,538	3,447	5,577	3,230
Current balance	2,293	3,650	2,324	3,653	2,040	3,132
Monthly purchases	293	549	310	553	146	459
Monthly payments	320	1,039	336	1,044	184	635
Debt	1,816	2,034	1,907	2,041	1,068	2,476
APR	15.5	2.6	15.2	2.6	18.3	6.2
Credit Bureau Variables						
Fico Score	732	82	736	82	699	67
Active Credit Cards	2.7	2.3	2.8	2.4	2.1	2.6
Credit Bureau Balance	5,508	7,266	5,632	7,285	4,488	4,355
Home Equity Balance	676	5,272	672	5,312	717	7,869
Mortgage Balance	20,002	157,295	19,050	158,489	27,816	110,607
Auto Balance	3,166	8,187	3,163	8,197	3,189	6,795
Number of observations	2,836,489		2,528,372		308,117	
Number of consumers	201,935		183,053		18,882	

Notes: Real spending and income in 2000 dollars.

Table A4
Summary Statistics, 1986-2005 Survey of Income and Program Participation

Variable	All households		Households with $w^*=0$ in initial survey		Households with $w^*\geq 0.2$ in initial survey	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Real before tax family nonproperty annual income in initial survey	47,752	34,706	50,581	35,133	20,382	13,262
Share of income from MW earners	0.07	0.22	0.00	0.00	0.67	0.31
Share with no college experience (Head)	0.46	0.50	0.44	0.50	0.69	0.46
Head age	39.8	11.2	40.1	11.0	36.9	12.2
Number of adults	1.81	0.79	1.80	0.78	1.71	0.74
Number of kids under 18	0.89	1.13	0.86	1.11	1.01	1.24
Number of household-surveys	546,474		486,018		47,674	
Number of households	80,700		71,264		7,719	

Notes: Real income in 2000 dollars. All descriptive statistics are weighed. "All units" includes observations where w^* is between 0 and 0.2 in the initial survey.

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