The Consumption Response to Minimum Wage Increases

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Abstract

This paper presents evidence that spending increases more than income, and thus debt rises, in households with minimum wage workers following a minimum wage hike. Furthermore, we show that the size, timing, persistence, and composition of spending are inconsistent with the basic certainty equivalent life cycle model. However, our findings are consistent with a model where households can borrow against part of the value of their durable goods.

1 Introduction

Many U.S. social insurance programs exist to overcome financial constraints faced by low income households. Yet there is little direct evidence linking such constraints to the spending and debt choices of low income populations. This paper provides new evidence based on the income increase caused by changes to the minimum wage. We develop and calibrate a model that matches 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.[1] These findings are based on several datasets, including the Consumer Expenditure Survey (CEX), Survey of Income and Program Participation (SIPP), Current Population Survey (CPS), and administrative bank and credit bureau records, that contain detailed information about spending, income, and debt, along with samples large enough to explicitly study households with adult minimum wage workers.

First, we find that the total spending response occurs within one quarter of when the minimum wage increases. Spending does not increase when the minimum wage hike is passed into law. Because minimum wage laws are typically enacted 6 to 18 months prior to the actual realization of the increase, it seems plausible that the minimum wage hike is known in advance. If minimum wages hikes are known in advance (and we provide some evidence that they are), the permanent income hypothesis implies that households should borrow against future income gains in order to finance current consumption as soon as the households learns about the minimum wage hike. However, if households are unable to borrow against future income in order to finance current spending, then spending will not rise until the minimum wage rises.

Second, the spending response is too large to be consistent with the permanent income

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[1] There is a large literature on the consumption response to anticipated income changes. Some recent examples include Shea (1995), Parker (1999), Souleles (1999), Browning and Collado (2001), Shapiro and Slemrod (2003), Hsieh (2003), Stephens (2003, 2008), Johnson, Parker, and Souleles (2006), Agarwal, Liu, and Souleles (2007), and Adams, Einav, and Levin (2007). With the exception of Shea, these papers primarily look at responses to transitory income changes. Typically, they cannot distinguish between models of liquidity constraints and buffer stock saving (see Deaton 1992 and Carroll 1997) and "rule of thumb" behavior (e.g. Lusardi 1996).

hypothesis. Following a $1 minimum wage hike, total spending increases by at least $500, and perhaps $900, per quarter in the near-term. This exceeds the roughly $250 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. These results are particularly surprising given that most individuals earning the minimum wage at a point in time make well above the minimum wage two years later. Thus, minimum wage hikes increase lifetime income by only about $2,000. If households were spreading that income gain over their entire lifespan, the short-run spending increases 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, this predicted response is still far smaller than what our estimates imply. Likewise, a model with no borrowing at all also predicts household spending increases that are far smaller than those that appear in the data. 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.

Third, high levels of spending (and debt) persist for several quarters after a minimum wage hike. We show that this 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.

Finally, the composition of spending changes before a minimum wage hike in a way that is consistent with forward looking behavior and borrowing constraints. Although total spending changes very little before the minimum wage hike, durables spending falls and non-durables spending rises. After the minimum wage hike, non-durables spending increases by only a small amount, but durables spending increases a great deal. Such a pattern would exist if households are aware of the minimum wage hike several quarters before it occurs, but face borrowing constraints and optimize accordingly. That is, households should increase non-durables spending immediately after learning about a future income gain, but cut durables spending if they are unable to borrow against future income. After the minimum wage hike, the household should optimally increase spending on durables, but leave non-durables

spending roughly at its new level. This pattern arises because a drop in durables spending for a short period of time only has a small effect on the durables stock and thus its corresponding service flow. Consequently, durables spending has higher intertemporal substitutability than non-durables spending.

Although much theoretical research focuses on non-collateralized debt (e.g., Kehoe and Levine 1993 and Chatterjee et al. 2007), we concentrate on collateralized debt for two reasons. First, roughly 90 percent of debt in the United States, including among the poorest families, is collateralized (table 11 of Bucks et al 2006). Second, our model that allows for borrowing against collateralized goods fits the data well. Furthermore, we find that most of the increase in debt after minimum wage hikes is in collateralized loans for autos and homes.

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 heterogeneous impact that the laws have on low wage workers by doing the same experiment on workers that are earning slightly beyond the minimum wage. Minimum wage laws have less bite on this group. We find that the minimum wage has small effects on the income and spending of workers making more than 120 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 scholars[2] 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 range between 5 and 20 percent of hourly wages. We show that in our sample, which uses several

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

data restrictions to identify adult low wage workers that are particularly sensitive to minimum wage hikes, family income increases by roughly $2,000 in the two years after a minimum wage increase in response to a $1 increase in the minimum wage. Many minimum wage hikes are closer to 50 cents, but this still means a $1,000 income gain over two years. Over, say, a twenty year work horizon, the permanent income hypothesis would predict a small $100 annual increase in spending. Rather, we observe roughly $2,000 in spending in the year after the minimum wage increase.

We should point out 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 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 before the minimum wage went up, 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 the 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

$$E_0 \sum_{t=0}^{T} \beta^t (c_t^{1-\theta} S_t^\theta)^{1-\gamma}/(1-\gamma) \tag{1}$$

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.[3] The asset accumulation equation is:

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

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

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

where δ is the depreciation rate of durables.

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

$$-A_t \leq (1 - \pi)S_t \tag{4}$$

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).

In order to see how equation (4) may affect spending behavior, assume that the borrowing constraint 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:

$$\pi I_t + c_t + (1 - \pi)(r + \delta)S_t = Y_t. \tag{5}$$

Households spend income on durables I_t, nondurables c_t, and interest payments on durables S_t. Note that the household only needs \$ π to purchase \$1 worth of durables. It is for this reason that the spending response may exceed the income response to minimum wage hikes.

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[3]For example, among Consumer Expenditure Survey (CEX) units with no adult minimum wage earners, the durables share of expenditures is roughly 17 percent. Among those units 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.

In this framework, durables play a dual role. They provide durables services of course, but they also serve as collateral for future durables purchases.

Finally, the income process is:

$$\ln Y_t = \alpha_t + P_t + u_t \tag{6}$$

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 factor u_t and the AR(1) factor P_t:

$$P_{t+1} = \rho P_t + \epsilon_{t+1} \tag{7}$$

where $\epsilon_t \sim N(0, \sigma_\epsilon^2)$ and $u_t \sim N(0, \sigma_u^2)$. The model above is complex, and thus we solve it numerically. We describe our calibration and results immediately below and the solution techniques in appendix A. For analytic results on more stylized models, see Campbell and Hercowitz (2003) and Browning and Crossley (2008).

2.1 Calibration of the model

Parameters are set to the values listed in table 1. Some of these parameters are standard so we highlight those that are less so. First, we pick θ to match non-residential durables share of aggregate non-residential expenditure $I_t/(I_t + C_t) = 0.15$. This is computed from the CEX, which we describe in more detail below. Second, for δ, we use Campbell and Hercowitz's (2003) estimate of quarterly depreciation rates for non-residential durable goods.[4] Third, we assume the downpayment rate, π, falls between 0.2 and 0.4. We look at a range for π because of its importance to the model and the difficulty of pinning it down with existing data. The Federal Reserve's G19 Consumer Credit release reports the loan-to-value ratio (1-π) 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 families with minimum wage earnings.[5] The rest of durables spending likely requires larger downpayments, including

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

[5]Used vehicles make up roughly 44 percent and the remainder is non-transportation durables. This data are computed from the CEX.

some products, such as small appliances, for which collateralized financing may not be readily available. A range of 0.2 to 0.4 seems to encompass reasonable assumptions about this hard-to-measure parameter.

Parameter	Quarterly value	Source
β	$\sqrt[4]{0.95}$	5 percent annual rate
γ	2	
θ	0.15	CEX, see text
T	200	50 years
r	$\sqrt[4]{1.03} - 1$	3 percent annual interest rate
δ	0.034	Campbell and Hercowitz (2003)
π	0.2 to 0.4	See text
α_0	8.196	SIPP, see footnote 6
α_1	0.0108	SIPP, see appendix C
ρ	0.970	SIPP, see appendix C
σ_ϵ^2	0.038	SIPP, see appendix C
σ_u^2	0.122	SIPP, see appendix C

Table 1: Parameters Used for Calibration

Finally, we estimate the parameters of the income process (α_0, α_1, ρ, σ_u^2, and σ_ϵ^2) using the Survey of Income and Program Participation (SIPP). We choose $\alpha_0 = 8.196$ to match the average income of SIPP minimum wage households.[6] We estimate α_1 using a fixed-effects regression of log income on age (for households with minimum wage workers), which shows that average quarterly income growth is 0.0108.[7] This is similar to income growth of 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 α_1=0.0108 for 80 quarters, then income does not grow thereafter. Lastly, we estimate ρ and the variance of income innovations σ_ϵ^2 and σ_u^2 to match the variance and autocovariances of income residuals (from a regression of log income on age) in our SIPP data using minimum distance procedures. We assume that income innovations are homoskedastic, although income itself may be non-stationary. Appendix C provides further details. Many studies (e.g. Meghir and Pistaferri 2004) find that income is well represented by the sum of a random walk and a white noise component. However, we find an AR(1) plus white noise provides the best fit to the SIPP data. In

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[6] Average log income at the time of minimum wage hikes is 8.520. Because we simulate the model for 30 periods before the minimum wage hike, we set $\alpha_0 = 8.520 - 30(.0108) = 8.196$.

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

particular, we estimate $\rho = 0.970$, $\sigma_u^2 = 0.122$ and $\sigma_\epsilon^2 = 0.038$.

2.2 Initial Joint Distribution of the State Variables

This section 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, assets, and the stock of durable goods. Table XX shows some key descriptives on the

2.3 Modeling Minimum Wage Hikes

A minimum wage hike is modeled as an innovation to the deterministic component of income, α_t. In particular, we assume that a minimum wage change causes α_t to immediately increase by 10 percent, a typical sized jump observed in the SIPP and similar to that found in the literature using other data (e.g. Neumark, Schweitzer, and Wascher (2004, 2005), Draca, Machin, and Van Reenen (2008), Addison, Blackburn, and Cotti (2008)). For the first ten periods thereafter, α_t is assumed to remain constant, rather than grow at $\alpha_1 = .0108$. Therefore, any income gain is eroded after 2 1/2 years (Neumark et al 2004, 2005). At that point, α_t once again grows by 1.08 percent per period. These estimates are 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). Thus the original minimum wage increase will not affect that individual's wage $2 \frac{1}{2}$ years later.

In order to predict the impact of minimum wage hikes, we simulate the model with and without one. In the figures below, we take the difference in spending between households that receive minimum wage hikes and those that do not as our treatment response. For example, figure 1 shows the growth in income implied by our model. The initial quarterly income gain from the minimum wage hike is roughly $400. That gain dissipates over time such that total discounted lifetime income increase by slightly over $2,000.

2.4 Model Results without Borrowing Constraints

We begin by describing the model with certainty and no borrowing constraints to clarify the dimensions on which this baseline succeeds in describing the empirical facts presented later. To give the model the best chance of fitting the data, we assume that the household

learns about the minimum wage hike when it occurs. Figure 2 shows the predicted spending response to a minimum wage hike. Three key features are worth highlighting.

First, the household purchases large quantities of durables and more modest quantities of non-durables in the first period in order to keep the ratio of nondurables to durables constant. To increase the durables stock by a small amount (in percentage terms), durables investment must increase by a large amount (in percentage terms). After an initial jump, durables spending declines, as first pointed out by Mankiw (1982). To provide intuition for this result, appendix A shows that the nondurables to durable ratio is

$$\frac{c_t}{S_t} = \left(\frac{1-\theta}{\theta}\right)\left(r + \delta\right) \tag{8}$$

where $\left(\frac{1-\theta}{\theta}\right)$ is the share of expenditure devoted to non-durables versus durables. The term $r + \delta$ is a user cost: i.e., the price of durables relative to non-durables.

Second, the spending increase is $120 in the quarter of the minimum wage hike. Afterwards, spending falls back to $25 per quarter. The present value of this stream of spending is roughly $2,000, which is the lifetime income gain from the minimum wage hike.

Third, because we assume the household learns about the minimum wage hike only when the minimum wage actually increases, the composition of spending does not change until then.

As we show below, these three implications are inconsistent with the data.

2.5   Model Results with Borrowing Constraints and Income Uncertainty

Next, we introduce borrowing constraints and income uncertainty to the model. We also assume that households learn about the minimum wage increase three quarters before it is implemented. Figure 3 illustrates several noteworthy, and ultimately testable, implications of the model.

The first notable implication is the sheer magnitude of the spending increase. Recall again that the lifetime income gain from the minimum wage hike is about $2,000, roughly the present value of a $25 per quarter rate of spending. Yet, the increase to spending, particularly after the minimum wage is implemented in quarter 0 far exceeds this prediction. In particular, total spending increases by over $1,500 in the seven quarters reported in figure 3.

The second interesting 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 impulse increases from under $100 to almost $500.

The last two features of the results that we highlight have to do with the composition of spending. Note that there is some increase to spending after the household learns about the minimum wage increase but prior to its implementation (quarters -3 to -1). This spending is heavily skewed towards nondurables. In fact, the impulse to durables barely budges and may even be a slight offset to total spending. However, once the minimum wage is implemented in quarter 0, durables spending shoots up to close to $350, 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 that initial increase at the implementation of the new minimum wage, it remains elevated at least three quarters later. In fact, the quarter 3 impulse is still as high for durables as nondurables.

All four of these implications – magnitude, timing, composition, and persistence – are testable with current data. We will turn to those tests soon.

2.6 Model Results: no borrowing constraints or uncertainty, with adjustment costs

But first we investigate whether durables adjustment costs, as in Grossman and LaRoque (1990), Eberly (1994), Attanasio (2000), Adda and Cooper (2000), Bertola, Guiso, and Pistaferri (2005), can also replicate some of the key empirical findings. We follow Grossman and LaRoque (1990) and Eberly (1994) by assuming that in order to increase the durables stock at all, 5 percent of the previous durables stock would be lost. This is meant to capture transactions costs associated with buying and selling durables, particularly large items like cars. To add an adjustment cost, equation (2) is modified as

$$A_t = (1 + r)A_{t-1} + Y_t - c_t - I_t - 0.05S_{t-1} \times 1\{I_t \neq 0\} \tag{9}$$

where $1\{I_t \neq 0\}$ is an indicator when the individual either purchases or sells the durable good. In this section we simulate the model, assuming no uncertainty or borrowing constraints as

in section 2.4, but changing the asset accumulation equation as in equation (9).

The next version of the paper will include calibration results that allow for adjustment costs. Preliminary findings suggest that this model will not match most of the key empirical facts.

2.7 Model Results: with borrowing constraints and uncertainty, with adjustment costs

In this section we show results from the model that allows for both income uncertainty and adjustment costs. The next version will provide the details but preliminary findings suggest that this model fits the key facts well and is also able to better fit the distribution of the consumption responses that we document below.

2.8 The Spending Response to Transitory Income Hikes

Numerous studies have estimated the spending response to truly transitory income gains, such as tax rebates (see footnote 1). These studies indicate that the consumption response is usually at least 0.3, but almost always less than 1. Thus, on the surface, it may seem that our estimated response, which suggest that consumers spend more than they earn in the short-run, are out-of-line with the rest of the literature. But a minimum wage increase should not be thought of as a transitory increase. Indeed, our calibrated model generates a spending response of less than 1 in response to a purely transitory (i.e. one period) income hike. Rather, a minimum wage hike entails an initial boost to household income that we assume, but test below, to be about $400 in the first quarter and roughly $2,000 in the long-run. Recall that the model expects this wage hike to cause a $500 per quarter spending gain for the first few quarters after the minimum wage hike. Thus, the dynamic programming model highlights the behavior of forward looking but liquidity constrained households.

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 Data

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

The CEX is organized by consumer units, which are typically households. Consumer units are interviewed up to four times, spaced three months apart. In each interview, units 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 unit and construct w^*, the share of total before tax consumer unit income derived from salaries influenced by minimum wage laws:

$$w^* = (E_{11} \times I(w_{11} \leq w_{min,i1} \times L) + E_{21} \times I(w_{21} \leq w_{min,i1} \times L))/F_1. \tag{10}$$

E_{11} and E_{21} are the salary income for persons 1 and 2 (typically, the head of the unit and spouse) in time period 1, F_1 is total pre-tax income in the first period that the unit 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.[8] 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 (10) (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 consumer units must be dropped. This is particularly important in two cases. First, the CEX does not report actual state of residence for those residing in smaller states. Because we need state codes to know effective minimum wage levels, 19.9 percent of the full CEX sample must be dropped. Second, another 16.7 percent of the remaining sample must be dropped because their income responses are incomplete. We ultimately use 192,114 CU-surveys, representing 58,404 consumer units, that

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[8]We exclude asset income from F_1. Minimum wage histories are taken from various issues of the Monthly Labor Review. See, for example, Aaronson (2001).

meet criterion on age, family composition, hourly wages, and self-employment status.[9] Of these, 11.3 percent, or 21,695 CU-surveys, are from units 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.

Table 2 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 impulses.[10]

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. Each account is followed for up to 30 months. We are able to track spending, payments, balances, and debt levels, as well as APR and credit limits, at the monthly frequency (also see Agarwal, Liu, and Souleles 2007). 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.

We also collect a second separate sample of credit bureau accounts that are not tied to credit card accounts and run for four, rather than two and a half, years. IN particular, this

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[9]In particular, we exclude the self-employed (6.5 percent), CUs headed by those under 18 or over 64 (20.7 percent), CUs in the survey for only one period (11.4 percent), CUs without an initial wage for the head and spouse (13.7 percent), and CUs 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) or head's age (greater than two years) or the head's gender changes. Finally, we exclude just over 3 percent of the remaining CU-survey observations because of large changes in log hourly wages between the initial survey and the last survey. In particular, we excluded any log changes of 1.5 or greater, which at a wage of $4 per hour in the first survey would require that hourly wages rise to $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 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.

[10]For $w* \geq 0.2$, average real total family income before taxes in the SIPP is $20,676 (in 2000 dollars), or about 10 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 $2,000 difference is from salary of other members in the household.

sample begins in January 2000 and ends in November 2003. These data obviously do not include the direct spending information that the credit card accounts provide. But the longer view of debt usage is useful, and it can benchmark the importance of selection based on credit card usage for our main samples.

Besides providing a second independent source of spending information, there are a few other advantages of these datasets relative to the CEX. First, measurement error is less of a concern.[11] Second, the panels are longer. Third, spending is reported at a monthly frequency. Finally, and most importantly, the credit card and credit bureau data provide high quality debt and credit limit information not available in the CEX.

However, there are some drawbacks. First, credit cards only cover about a third of total spending (Agarwal, et. al. 2007). Second, minimum wage workers with credit cards are a selected sample of all minimum wage workers (this is not true of our four year credit bureau only sample). Only 43 percent of households in the bottom quintile of the income distribution own a credit card (Johnson (2007)). Third, the analysis is on individual card holders, rather than the unit of interest, the household.[12]

Finally, wage and demographic information are limited. Of particular note, 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 that an account holder is a minimum wage worker, we use a probit model and the Current Population Surveys to predict whether the worker was within 120% of the minimum wage. Covariates are a quartic in annual earnings, a quartic in age, age times the annual earnings quartic, female, married, and female times married. These coefficients are used to compute a probability P that a credit card account holder is a minimum wage worker. Of our 200 thousand accounts, 18,882 have a positive value for P.

Table 3 provides summary statistics for the main credit card variables. For a more complete data description, see Agarwal et. al. (2007).

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[11]See footnote 2 in Gross and Souleles (2002).

[12]We partially circumvent this limitation when using the debt data, since debt contracts are typically written jointly among spouses. Therefore, the credit bureau would tie the debt of family members together. Of course it is not hard to imagine many family situations where this might not be true.

3.3   The Survey of Income and Program Participation (SIPP) Data

Finally, to derive income impulses from minimum wage changes, it would be natural to use the income, earnings, and hours questions in the CEX as a complement to the consumption analysis. However, that survey reports these variables at an annual frequency, and only at the first and last survey. Consequently, it can only be used to identify income responses from units that do not attrite from the sample. Moreover, it cannot identify the short-run dynamics that are a crucial part of the model's predictions.

Therefore we concentrate on results obtained from the SIPP, which provides larger samples, longer panels, and higher response frequencies. Relative to the CEX, it is also specifically designed to collect high quality earnings and income information, including an hourly wage measure for workers paid by the hour. The first SIPP panel that we use began in 1986 and the last ends in 2003. Each panel, which lasts between two and four years, 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.

Variables are coded and sample restrictions are introduced to be as close as possible to the CEX. In particular, we use the same restrictions on wages, wage changes, self-employment, and family composition changes described above.[13] Like the CEX analysis, the numerator on the w^* measure (total income derived 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 roughly 77 thousand household-surveys observations remaining after our sample restrictions[14], of which almost 12 percent report some minimum wage earnings and about 9.4 percent report at least 20 percent of their total household nonproperty[15] income from minimum wage earners. About 55 thousand household-survey observations are available when we use the

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

[14]The definition of a household unit 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.

[15]Property income is excluded from our total household income measure. This is the most comparable measure to our CEX nonasset income measure. However, none of the results are sensitive to this alteration.

hourly wage measure from workers paid by the hour. Of these observations, 11.7 and 9.2 percent are from units with at least some or 20 percent of their total nonproperty income coming from minimum wage earners in the initial period.

4   Estimating Equations

Our empirical strategy is standard. We estimate a consumption equation of the form:

$$c_{it} = f_i + \sum_{k=-K}^{K} \delta_k w_{min,it+k} + \beta' X_{it} + u_{it} \tag{11}$$

where c_{it} is spending, broadly defined at this point, and $w_{min,it+k}$ is the state minimum wage that individual i resides in at time $t + k$.[16] X_{it} includes year and quarter dummies or a full set of month dummies. We also experiment with other conditioning variables, but once the unit fixed effect, f_i, is included, we found no observable covariates in the CEX or the credit card data that substantively impact our coefficients of interest, δ_k. Nevertheless, to be consistent with previous CEX research (e.g. Johnson, Parker, and Souleles 2006), we include controls for the number of adults and the number of kids as well. Importantly, for the credit card regressions, we add the probability P that a card holder is a minimum wage worker as an interaction to the minimum wage variable $w_{min,it+k}$ in equation (11) so that accounts are weighted by the likelihood that the holder is a minimum wage worker.

The percent change in the minimum wage may be different from the change in household income if there are disemployment or hours reductions due to the minimum wage hike, a household also contains workers earning above the new minimum wage, an individual is not covered by minimum wage legislation, or she is misclassified as a minimum wage worker due to measurement error. Consequently, we also estimate analogous income regressions:

$$y_{it} = g_i + \sum_{k=-K}^{K} \omega_k w_{min,it+k} + \Gamma' X_{it} + e_{it} \tag{12}$$

where y_{it} is pre-tax non-asset income. Note that in the simple case where income and con-

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

sumption are specified in levels and there are no leads or lags (i.e., δ_k and ω_k are 0 for all k not equal to 0), the marginal propensity to consume is $\frac{\delta_0}{\omega_0}$.

Throughout, we report two general sets of estimates. Some assume a constant post-minimum wage response. But in order to get a picture of the timing and persistence of the spending, debt, and income responses we also estimate models with leads and lags.

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. Findings from both the CEX and the credit card data are presented in turn.

5.1.1 CEX

Table 4 reports the basic CEX results. The rows in the tables are stratified by w^*, the share of pre-tax consumer unit income earned from minimum wage jobs.[17] Results are reported for two samples. The "all" sample (e.g. column 1) include all unit-survey periods. The "high school graduates and dropouts" sample (e.g. column 2) excludes units headed by someone with any post-secondary educational experience.[18] 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 clustering at the consumer unit level, and the third is the sample size.[19]

Although the magnitudes and precision vary across samples, the qualitative response is quite robust. As expected, there is no statistically significant spending response to a minimum wage increase among families with no minimum wage income ($w* = 0$). Point estimates are

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[17]Recall that we define 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. 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.

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

[19]If we pool the data, standard errors drop by about 10 percent. We prefer our stratified results because they allow for a full range of interactions. Given trends in income inequality, we believe it is important to allow for heterogeneity in time trends by family income level. There is also compelling evidence that seasonal patterns in spending differ by family income level (e.g. Barrow and McGranahan 2000).

always economically small, representing 2 percent or less of total quarterly spending (shown in the final two columns), and statistically indistinguishable from zero.

But total spending increases by an economically and usually statistically significant amount for units that derive income from minimum wage labor. For example, for units where minimum wage labor is the source of at least 20 percent of total income ($w^* \geq 0.2$), total quarterly spending rises by \$885 (standard error of \$656) per quarter. Consistent with attenuation bias introduced by mismeasurement, the effects from the non-college sample are even larger. Relative to typical patterns, the additional spending caused by a minimum wage increase represents 15 to 22 percent of an average quarter's spending level. These basic patterns are robust to many perturbations of the statistical model, including controlling for common 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.[20] Further constraining the sample using standard proxies of liquidity constraints, such as liquid assets (Johnson et al 2006), age, or homeownership results in similar patterns.[21]

These results rely on a comparison of the additional spending response in minimum wage units after a minimum wage increase relative to those units with no minimum wage earners and consequently where no such spending response should be observed. A related experiment is reported in columns 3 to 6. Here, we look at the effect of a minimum wage increase among units that include low wage adults earning just above the new minimum wage in the initial period. This exercise could be connected to calculations of the extent to which minimum wage increases spillover into higher ranges of the wage distribution (e.g. Wellington 1991, Card and Krueger 1995, and Lee 1999). The consumption response offers a new way to look at this question. But it also provides a strong robustness test of our results by allowing us to compare the spending response of our treated group to similar units, even in the same state, headed by low wage workers.

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[20]One noteworthy exception is the use of some nonlinear specifications, such as logs or quantile regressions, which result in smaller elasticities. This is driven by the distributional and compositional aspects of the spending response. We return to these issues below.

[21]To take one example, if we limit the sample to those who qualify under any of three conditions – the head is 35 of younger, liquid assets are less than \$1,000, or the unit does not own their own home – the point estimate and standard error is \$81 (\$225) for $w* = 0$ and \$851 (\$508) for $w* \geq 0.2$. The results for each of these three restrictions estimated separately are similar.

Several representative results are reported in the table. We first allow earnings to be classified as "impacted by minimum wage laws" if they are within 150 (column 3) or 200 percent (column 4) of the minimum. As expected, the spending impulse becomes muted as more and more workers are captured by these definitions. The next two columns make this particularly clear. These results look specifically at workers that earn 120 to 200 percent (column 5) or 200 to 300 percent (column 6) of the minimum wage.[22] We find that the spending effect recedes quickly once we get beyond 120 percent of the minimum. For $w* \geq 0.2$, consumption falls from \$885 when using the 120 percent minimum wage definition to \$393 (\$318) for 120 to 200 percent and -\$176 (\$323) for 200 to 300 percent minimum wage definitions. That is, without a unit 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 units 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. It also may limit the likelihood that the findings are due to states endogenously responding to labor market conditions by raising the minimum wage. For the latter to be valid, these states would have to be targeting only those families with the lowest earnings, but not those just slightly above.

5.1.2 Credit Cards

Next, we compare the basic CEX results to those derived from our second source of spending data – credit card accounts. Recall that the credit card data does not include detailed information about income, hours, or education. Consequently, we cannot stratify the sample based on exposure to minimum wage labor income. Instead, we rely on self-reported annual income from the initial credit card application and derive a probability that the applicant is a minimum wage worker based on the relationship between annual earnings and hourly wages from the Current Population Survey.

Despite this potential attenuation concern, we find an economically and statistically significant spending response in the credit card accounts as well. Table 5 shows that a \$1 minimum wage increase results in a \$176 (\$62) increase in average quarterly (we multiply all monthly estimates by 3 for comparability with the CEX results) credit card spending for

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[22]In the former case, we exclude any unit that has income less than 120 percent of the minimum wage. In the latter case, we exclude any unit with income less than 200 percent of the minimum wage.

the quarters that follow the minimum wage increase that we observe. Again, we find that no such effect exists for account holders that are well out of range of the minimum, defined in the second row as those account holders with annual income above $20,000.[23] The third row in the table shows that credit card holders with low lines of credit, say $2,000 or less, are more likely to spend after a minimum wage increase.[24] For this group, the spending response to the minimum wage increase is $247 ($83), 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 divided by the balance on all cards, as reported by the credit bureau. Next, we only focus on credit card holders that have a significantly high balance ratio and therefore predominantly use our card. The last row in Table 5 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 ($224), 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, we believe that both data sets 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). To be a bit more concrete, consider the total credit card spending response among holders of one card (high balance ratio sample) when we allow the increase to endure for three quarters. If we assume that credit cards represent one-third of total spending,[25] our estimates suggest that a $1 minimum wage hike increases spending by $248 * 3 quarters * 3 = $2,232. By comparison, total CEX spending over three quarters for $w* \geq 0.2$ is $2,655. 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

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[23]Based 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 (L in equation (10)) that we use with the CEX data would include similar workers to those used here.

[24]The results are similar if we use $3,000 or $1,000.

[25]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 though.

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 $2,000.

5.2   How Does The Spending Effect Compare to Income Gains

In both datasets, the sheer magnitude of the short-run spending increase is quite notable. 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 Current Population Survey average for minimum wage workers) and this full increase persisted for two full years, the present discounted value of this stream of earnings would be just under $3,000. But over a lifetime, this would still only imply about a $40 per quarter increase in spending, according to a model without borrowing constraints, far less than what appears in the data.

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). Useful 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, although the Neumark et al papers find that any income gain from a minimum wage increase dissipates substantially, perhaps even evaporates, within two years. Obviously, their estimates would make our spending effects look even more stunning.

Table 6 reports our income estimates from the Survey of Income and Program Participation (SIPP).[26] 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 $249 ($183) for $w* \geq 0.2$. Columns 2 and 3 show that these earnings effects disappear, much like the spending results in table 4, when higher wage workers are defined as minimum wage earners. Results are

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[26]In 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.

similar when we exclude households that move in order to be analogous to the CEX sample design, exclude households headed by someone with college experience, or use a computed wage rather than the reported hourly wage to calculate $w*$.

These estimates suggest that minimum wages increase family income in the first year by roughly $1,000. Assuming a half-life of two or three years, a $1 minimum wage increase boosts the net present value of total family income by just under $2,000. The size of the income and spending impulses are clearly inconsistent with the PIH . Next, we turn to the composition and timing of spending increases to show that the model augmented for durables adjustments is consistent with the patterns we have shown thus far.

5.3 Composition and Timing of Spending

The next set of tables and figures explores the composition of spending and relates it to other key results from the calibration exercises. Recall, three central model implications. First, spending begins to rise once households learn about the upcoming wage increase. But the spending occurs in nondurables spending, and may even by slightly offset by lower durables spending. Second and perhaps most strikingly, upon implementation of the new minimum wage, durables spending spikes upward. Finally, durables spending remains elevated several quarters thereafter. Nondurables spending continues at a stable but modified path that began at the announcement of the policy change.

For this particular analysis, we take advantage of the detailed spending breakdown in the CEX. The credit card data provides information about stores but not about individual purchases and therefore is less useful for this purpose. However, we present some evidence from the credit card and credit bureau data that corroborates the key findings from the CEX.

5.3.1 Compositional Differences in the CEX

That key finding is the spike in durables spending following a minimum wage increase. Table 7 shows that units with $w* \geq 0.2$ expand durables spending by $894 ($566) per quarter immediately following a minimum wage increase, an amount that, on average, doubles the typical unit's quarterly spending. Again, units with no minimum wage income report no additional durables spending after the new law is enacted.

By contrast, the impact on nondurables and services is smaller, both relative to the

durables response and to the size of average spending in this category. Although non-durables and services spending appear to rise, the estimates are highly imprecise. Given that this category encompasses 85 percent of total average spending, the response is clearly a much smaller fraction of typical spending than those derived for durables.

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 of the vehicle purchased and the vehicle sold).[27] At the bottom of the table, we report the average amount spent for all CEX units.

For most categories, the impact is small and often hard to distinguish from zero. The notable exception is transportation goods. For example, units in the full sample with $w* \geq 0.2$ spend an additional \$764 (\$558) 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 units and different thresholds of $w*$ (not reported).

Because of the importance of transportation spending, table 8 further decomposes this category into new and used cars, new and used trucks, and all other transportation goods. The additional spending comes primarily from the first three of these categories. Notably, the probability of a transportation purchase rises by 0.029 and 0.040 for $w* \geq 0.2$ and $w* > 0$ after a minimum wage increase. By comparison, that same probability rises by a statistically insignificant 0.012 for $w* = 0$. The additional 2 to 3 percent of households purchasing high-priced transportation items drives the large spike in total spending following a minimum wage increase.

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[27]Floors 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.

5.3.2 Compositional Differences in the Credit Card Accounts

Rough breakdowns on durables, nondurables, and service spending can be derived in the credit card data for a shorter sample (2000 to 2003) as well.[28] We find that durable spending rises by \$51 (\$33) per quarter, a substantial increase compared to baseline credit card spending on durables. Typically, consumers purchase 14 percent of their durables with credit cards, but a minimum wage increase results in an additional 22 percent of durable spending. Moreover, large transportation goods are generally ineligible for credit card purchase, so the credit car results understate the total durables spending impulse.

That said, we have information on auto loans that corroborate the CEX transportation results. We report these findings in table 9. Those data show that a \$1 minimum wage increase causes auto loan balances to increase \$184 (\$80). We also see a \$125 (\$76) increase in home equity lines, that at least partly may be used to finance vehicles.[29]

Are these results plausible? If we assume that car and truck purchases, of all vintages, increase by roughly 3 percent after a \$1 increase in the minimum wage[30], the implied average auto loan increased by \$184/0.03 = \$6,100. By comparison, average quarterly net outlays of cars and trucks (not all of which are financed) in the 2000 to 2002 CEX is about \$14,750.[31] These figures will not correspond exactly because poorer households likely purchase less expensive vehicles, some loan demand will come from home equity lines and other loan arrangements, some of which might not be captured by the credit bureaus, and the market for loans on used cars and trucks might be limited. Moreover, this 3 percent figure is imprecisely estimated. Yet it provides some confirming evidence that even the subcategory spending patterns in the two datasets are similar.[32] Both suggest an increase in vehicle

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[28]We 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.

[29]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.

[30]The 3 percent estimate is roughly the difference in the sum of the transportation goods coefficients in table 8 between the families with and without minimum wage earners.

[31]The average net outlay of used and new cars was \$5,322 and \$14,607. The average net outlay of used and new trucks was \$7,922 and \$19,186. To compute an average net outlay for all vehicles, we take the weighted average of purchases recorded in the CEX. Approximately 64, 7, 25, and 3 of new purchases are new cars, used cars, new trucks, and used trucks, respectively.

[32]We are not the first to find that low income households buy vehicles following income shocks. Adams, Einav, and Levin (2007) use seasonal patterns in Earned Income Tax Credit payments to show that vehicle spending spikes up in February and March of every year, in accordance with the preponderance of tax refund payments.

purchases following a minimum wage increase.

Taken together, the results thus far are consistent with the model outlined above where households must make a small downpayment for their durables. Consequently, small increases in income can generate large increases in durables spending.

5.3.3   Timing of Spending

The timing of the spending response is explored in figure 4. These plots are based on equation (11) where we allow for three quarters of lags and leads of the minimum wage (K=3).

Again, we find that the results line up quite well with key implications of the model. First, the initial burst of spending in reaction to the minimum wage happens primarily in the contemporaneous quarter of the change (period 0). There is little evidence that total spending increases prior to the minimum wage change, even though the new wage is typically passed months in advance.[33] 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.

Second, spending does not revert back to pre-policy levels after that initial increase. It bounces around at roughly the same level for several quarters thereafter, before starting to decline around quarter 4. By comparison, there is no increase in spending among the non-minimum wage units ($w^* = 0$). Again, this persistence is consistent with a model where households are borrowing constrained because of the downpayment constraint.

Finally, even the timing of the composition of spending is consistent with the durables adjustment model. Durables spending is flat, perhaps even negative prior to the date that the minimum wage is put in place. However, the quarter that it is implemented, durables spikes up and remains there in the year thereafter. Meanwhile, nondurables and service spending increases two quarters earlier, and no discontinuity in the quarter that the minimum wage takes affect is observed. The pre-period effect on total spending is flat because the increase in nondurables and services is offset by a decline in durables spending. Although the standard errors around these estimates are large, the point estimates at least are consistent with

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[33]For 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.

forward looking behavior and borrowing constraints.

These results suggest that the per quarter increase in spending reported in table 4 is a fairly accurate representation of the short-term dynamic estimates from the distributed lag model. Given the shortness of the CEX panel, we have little confidence in estimates beyond three quarters but the model predicts that eventually these effects dissipate. That seems to be the case in the data to some degree, although the rate of reversion is imprecisely estimated.

Similar inferences can be drawn from the credit card impulse responses, shown in figure 5. Again, we include three quarters of lags and leads and once more find that the spending reaction is particularly noteworthy in 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 (not shown). In this case, the spending response is showing some signs of decline by the third quarter.

5.4 Distributional Implications

That much of the spending increase comes from durables, and in particular big-ticket durable purchase like vehicles, implies that the mean effects that we have concentrated on in this paper mask heterogeneity in the marginal propensity to consume after an income shock. This point is displayed in figure 6, which graphs a set of quartile regressions of total spending, ranging from 0.10 to 0.95 (the quantile is conveyed on the x-axis). For units with $w* \geq 0.2$, the mean response clearly does not match the median response, which is not statistically or economically different from households with no minimum wage income. Rather, the OLS average effect is driven by the tails of the spending distribution, and in particular those households beyond the 80th quantile of spending. In the next version of the paper, we will flesh these details out further and attempt to explain them with adjustment costs augmented to the model.

5.5 Debt

Finally, we have argued that near-term spending rises faster than near-term income gains after a minimum wage increase, implying that debt increases as well. We discussed some evidence of this with regard to vehicle loans. But it is worth pointing out that other forms

of debt rise in the short-run as well. In particular, table 5 shows that the \$176 increase in quarterly credit card spending is accompanied by only a \$65 (71) increase in payments. Consequently, credit card debt rises by \$105 (84). There is no such impact among higher income individuals. Moreover, debt particularly rises among accounts with low credit limits and high balance ratios.[34]

Figure 7 displays the dynamics of total household debt (excluding mortgages) in the nine quarters that follow a minimum wage increase. This figure is based on our second sample of credit bureau accounts that are unconnected to credit card usage. The figure shows debt rising by \$181 and \$278 in the first two quarters after a minimum wage increase.[35] 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 suggest.[36] Again, this is further confirmation of the potential importance that durables adjustments and downpayment constraints play among the spending patterns of liquidity constrained households.

6 Discussion

We provide a model of durables adjustments that make a number of predictions about consumption and debt that line up better with the data than standard life cycle or "rule of thumb" models.

First, we find that the spending response occurs within one quarter of the actual increase in the minimum wage, despite a 2 to 6 quarter lag in the passage of the legislation. 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.

Second, spending increases substantially after the hike, with most of the spending oc-

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[34]The rise in debt accounts for both the increase in current spending and interest accumulation on debt.

[35]The results are similar when we use the credit card sample.

[36]Despite 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 it only encompasses a very short period after minimum wage changes. We might reasonably expect that an outcome like default would take considerable time to play out and may even help to lower default proceedings in the short-term.

curring on durable goods (and in particular transportation goods). This spending increase, perhaps in the order of $800 to $1000 exceeds the $250 or so per quarter of additional family income caused by a minimum wage hike in the near term. Consequently, debt rises, and by a level that we roughly observe in a credit bureau data. 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.

Third, 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 because of the downpayment constraint.

Finally, the composition of spending is consistent with forward looking behavior and borrowing constraints. In particular, the patterns between non-durables and services spending, which begins to rise early and typically closer to when legislation is passed, and durables spending, which rises near the date that the wage actually increases, is striking.

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 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 (1992) and redefine the

problem in terms of cash-on-hand:[37]

$$X_t = (1 + r)A_t + y_t. \tag{13}$$

Assets and cash-on-hand follow:

$$A_{t+1} = X_t - c_t, \tag{14}$$

$$X_{t+1} = (1 + r)(X_t - c_t - I_t) + Y_{t+1}. \tag{15}$$

Thus, the borrowing constraint becomes

$$-\left(\frac{X_t - Y_t}{1 + r}\right) \leq (1 - \pi)S_t. \tag{16}$$

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

$$V_t(Z_t) = \max_{c_t, I_t} \{ (c_t^{1-\theta} S_t^{\theta})^{1-\gamma}/(1 - \gamma) + \beta \int V_{t+1}(Z_{t+1}) dF(Z_{t+1}|Z_t, C_t, I_t, t) \} \tag{17}$$

subject to the constraint in equation (16), where the state variables of the model are $Z_t = (X_t, S_t, P_t)$, and $F(.|.)$ gives the conditional cdf of the state variables, using equations (15), (3), (6) and (7). 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 for each individual, we use the decision 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

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

are based on 5,000 simulations of the model.

Appendix B: Model Results: no borrowing constraints

Using assets instead of cash on hand as the state variable, Bellman's equation (17) when there is no uncertainty is:

$$V_t(A_t, S_t, P_t) = \max_{c_t, I_t}\{U(c_t, S_t) + \beta V_{t+1}(A_{t+1}, S_{t+1}, P_{t+1})\} \tag{18}$$

The only constraints in this case are the law of motion for assets (equation (2)) and the law of motion for 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:

$$\frac{\partial U_t}{\partial c_t} = \beta \frac{\partial V_{t+1}}{\partial A_{t+1}} \tag{19}$$

$$\frac{\partial V_{t+1}}{\partial A_{t+1}} = \frac{\partial V_{t+1}}{\partial S_{t+1}} \tag{20}$$

and the first order conditions with respect to assets and the durables stock are, respectively:

$$\frac{\partial V_t}{\partial A_t} = \beta(1+r)\frac{\partial V_{t+1}}{\partial A_{t+1}} \tag{21}$$

$$\frac{\partial V_t}{\partial S_t} = \frac{\partial U_t}{\partial S_t} + \beta \frac{\partial V_{t+1}}{\partial S_{t+1}}(1-\delta). \tag{22}$$

Combining equations (20), (21), and (22) yields

$$\beta(1+r)\frac{\partial V_{t+1}}{\partial A_{t+1}} = \frac{\partial U_t}{\partial S_t} + \beta \frac{\partial V_{t+1}}{\partial A_{t+1}}(1-\delta). \tag{23}$$

Combining equations (19) and (23) yields

$$(r+\delta)\frac{\partial U_t}{\partial c_t} = \frac{\partial U_t}{\partial S_t}. \tag{24}$$

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

$$(r + \delta)\left(\frac{1 - \theta}{\theta}\right)S_t = c_t. \tag{25}$$

Combining equations (19), (21), and (25) yields the Euler Equation

$$c_{t+1} = c_t(\beta(1 + r))^{\frac{1}{\gamma}}. \tag{26}$$

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

$$\sum_{t=0}^{T}\left(\frac{1}{1+r}\right)^t (c_t + (r + \delta)S_t) = PV. \tag{27}$$

Inserting equations (25) and (26) into equation (27) yields

$$\sum_{t=0}^{T}\left(\frac{1}{1+r}\right)^t \left(c_t + \left(\frac{\theta}{1-\theta}\right)c_t\right) = PV \tag{28}$$

$$\sum_{t=0}^{T}\left(\frac{1}{1+r}\right)^t \left(\left(1 + \left(\frac{\theta}{1-\theta}\right)\right)c_0(\beta(1+r))^{t/\gamma}\right) = PV \tag{29}$$

Using the formula for an infinite sum and rearranging yields

$$c_0 = (1 - \theta)\left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}\right)^{T+1}}\right]PV \tag{30}$$

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 (25) into equation (30) yields

$$S_0 = \left(\frac{\theta}{r + \delta}\right)\left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}\right)^{T+1}}\right]PV. \tag{31}$$

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

$$\frac{\partial I_0}{\partial PV}\bigg|_{S_0} = \frac{\partial S_1}{\partial PV}\bigg|_{S_0} = (\beta(1+r))^{\frac{1}{\gamma}}(\frac{\theta}{r+\delta})\left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}\right)^{T+1}}\right] \qquad (32)$$

is the marginal propensity to spend on durables. In order to get time period 1 non-durables and durables spending, note that equation (26) shows that consumption grows at rate $(\beta(1+r))^{\frac{1}{\gamma}}$, and thus the marginal propensity to consume 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 (32) yields

$$\begin{aligned}
\frac{\partial I_1}{\partial PV}\bigg|_{S_0} &= \frac{\partial S_2}{\partial PV}\bigg|_{S_0} - (1-\delta)\frac{\partial S_1}{\partial PV}\bigg|_{S_0} \\
&= (\beta(1+r))^{\frac{1}{\gamma}}\frac{\partial S_1}{\partial PV}\bigg|_{S_0} - (1-\delta)\frac{\partial S_1}{\partial PV}\bigg|_{S_0} \\
&= \left[(\beta(1+r))^{\frac{1}{\gamma}} - (1-\delta)\right]\frac{\partial S_1}{\partial PV}\bigg|_{S_0} \\
&= \left[(\beta(1+r))^{\frac{1}{\gamma}} - (1-\delta)\right](\beta(1+r))^{\frac{1}{\gamma}}(\frac{\theta}{r+\delta})\left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}\right)^{T+1}}\right] \qquad (33)
\end{aligned}$$

and thus the marginal propensity to spend on durables at time 1 is $\left[(\beta(1+r))^{\frac{1}{\gamma}} - (1-\delta)\right](\beta(1+r))^{\frac{1}{\gamma}}(\frac{\theta}{r+\delta})\left[\frac{1 - \frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}}{1 - \left(\frac{(\beta(1+r))^{\frac{1}{\gamma}}}{1+r}\right)^{T+1}}\right]$. Solving for time period 2 spending propensities is straightforward.

Appendix C: The income process

Our approach to estimating the income process is standard. Using equation (6) and adding i subscripts for notational clarity, we rewrite the income residuals as:

$$R_{it} = \ln Y_{it} - \hat{\alpha}_t = P_{it} + u_{it} \qquad (34)$$

where $\hat{\alpha}_t$ is the estimated value of α_t, which we obtain using a fixed effects regression of log family income on age (measured in months) from the SIPP. Recall from equation (7) that $P_{t+1} = \rho P_t + \epsilon_{t+1}$, and also recall that $\epsilon_t \sim N(0, \sigma_\epsilon^2)$ and $u_t \sim N(0, \sigma_u^2)$. Define $Var(P_{it}) = \sigma_{P_t}^2$. We then estimate the following 4 parameters $(\sigma_{P_t}^2, \sigma_u^2, \sigma_\epsilon^2, \rho)$ by matching 15 $(5 \times (5+1)/2)$ moment conditions derived from the variances and covariances of earnings for five observations per household. Tables A1, A2 and A3 give the implied moment conditions, the empirical covariance matrix, and the fitted covariances from the estimated model. We obtain our estimates by GMM, using a diagonal weighting matrix. The procedure accounts for the unbalanced nature of the data, as in French and Jones (2004).

Parameter estimates are shown in table A4. The overidentification statistic shows that the model fits the data well. The $p - value$ on the overidentification test statistic is 0.780. We experimented with more complex models that allow for a person-specific fixed effect, MA(1) innovations, and heteroskedastity in the innovations. None of these enhancements significantly improved the fit. On the other hand, chi-square tests rejected the hypothesis that $\rho = 1$ as well as the hypothesis that $\sigma_u^2 = 0$.

Relative to other studies of income dynamics that use PSID data (Gourinchas and Parker (2002), Meghir and Pistaferri (2004), Storesletten et. al. (2004)), we find that income is somewhat less persistent. We can clearly reject that $\rho = 1$ in our data. Although our results are not directly comparable to these other papers because the data in the PSID is annual, it seems that our estimated variance of both transitory and AR(1) innovations is greater than what is estimated in these other papers.

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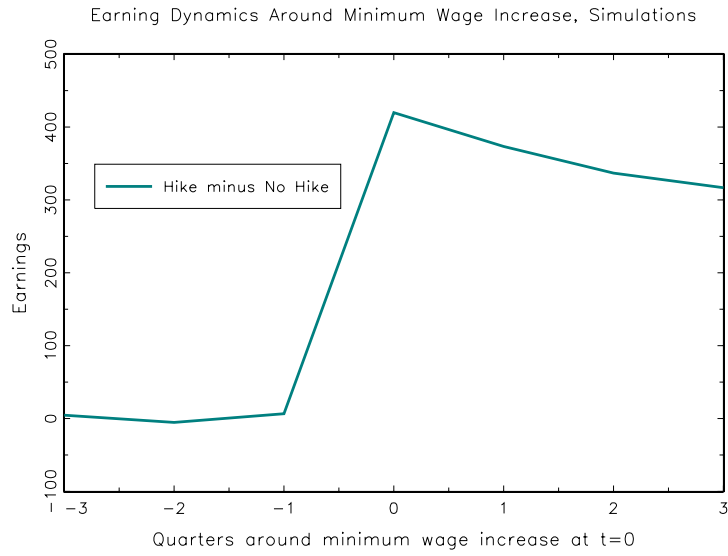
Figure 1: ASSUMED INCOME GAIN FROM MINIMUM WAGE HIKE USED FOR SIMULATIONS
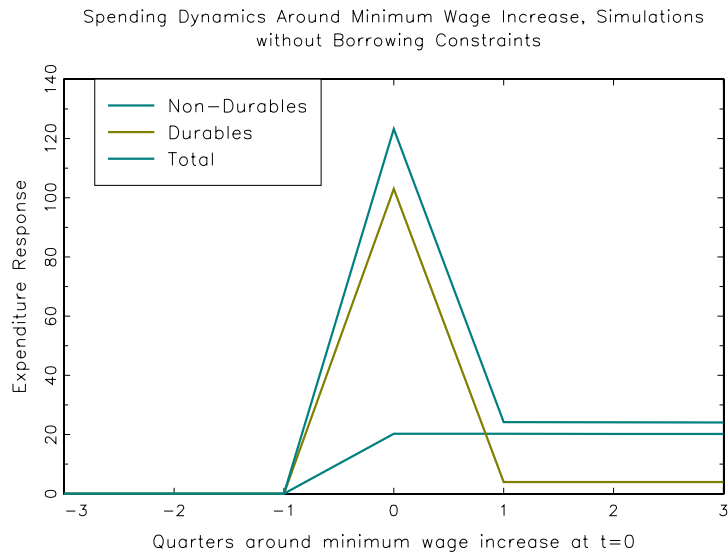
Figure 2: SPENDING RESPONSES, NO BORROWING LIMITS
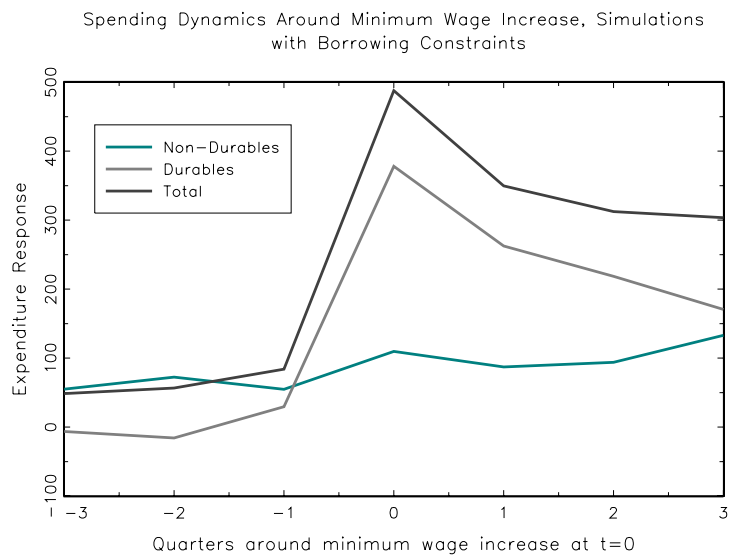
Figure 3: Spending Responses, With Borrowing Limits

Figure 4
CEX Spending Dynamics Around a Minimum Wage Increase,
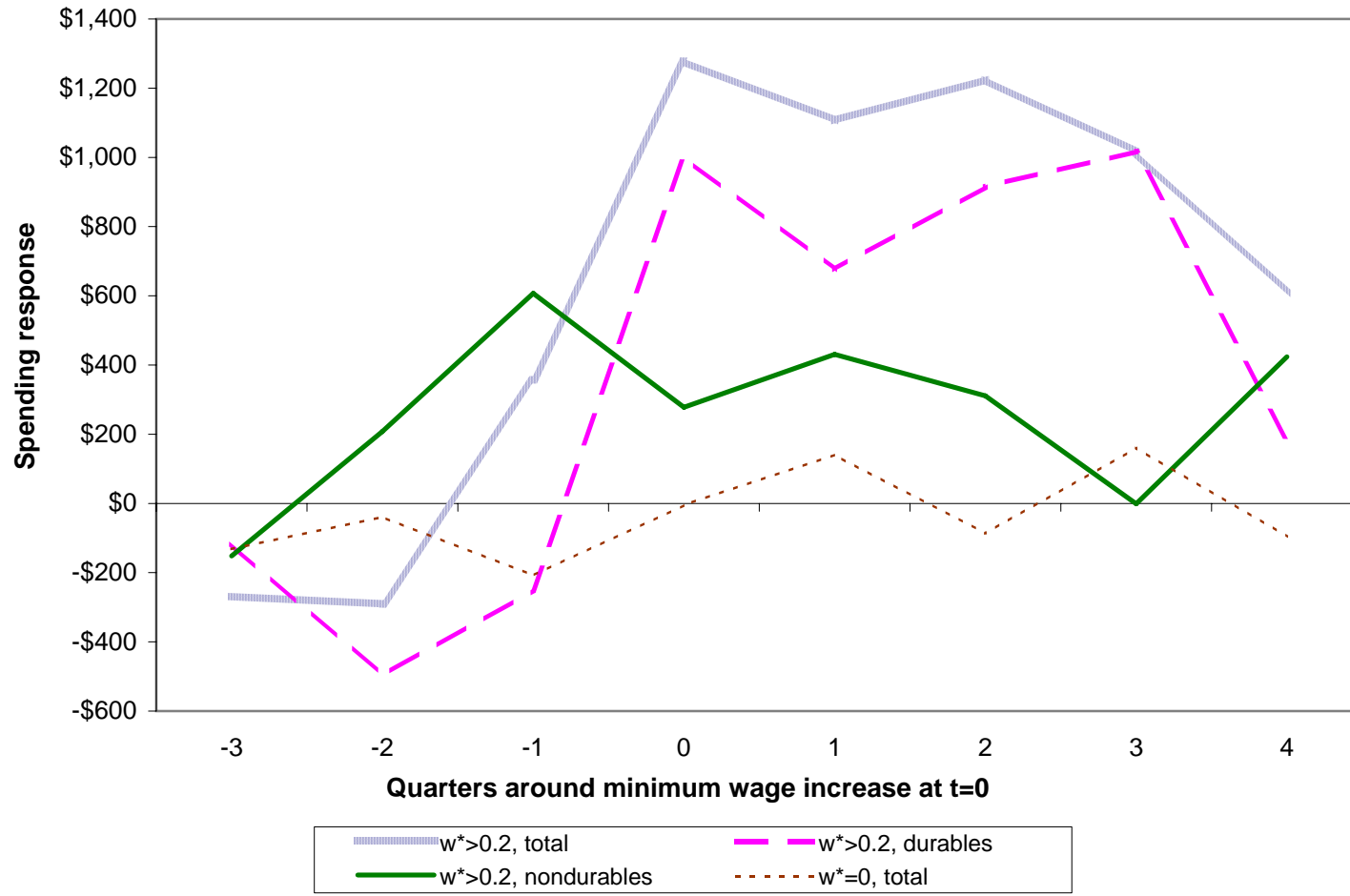
Figure 5:
Spending Response to a Minimum Wage Change, Credit Card Data

Quarters around minimum wage increase at t=0
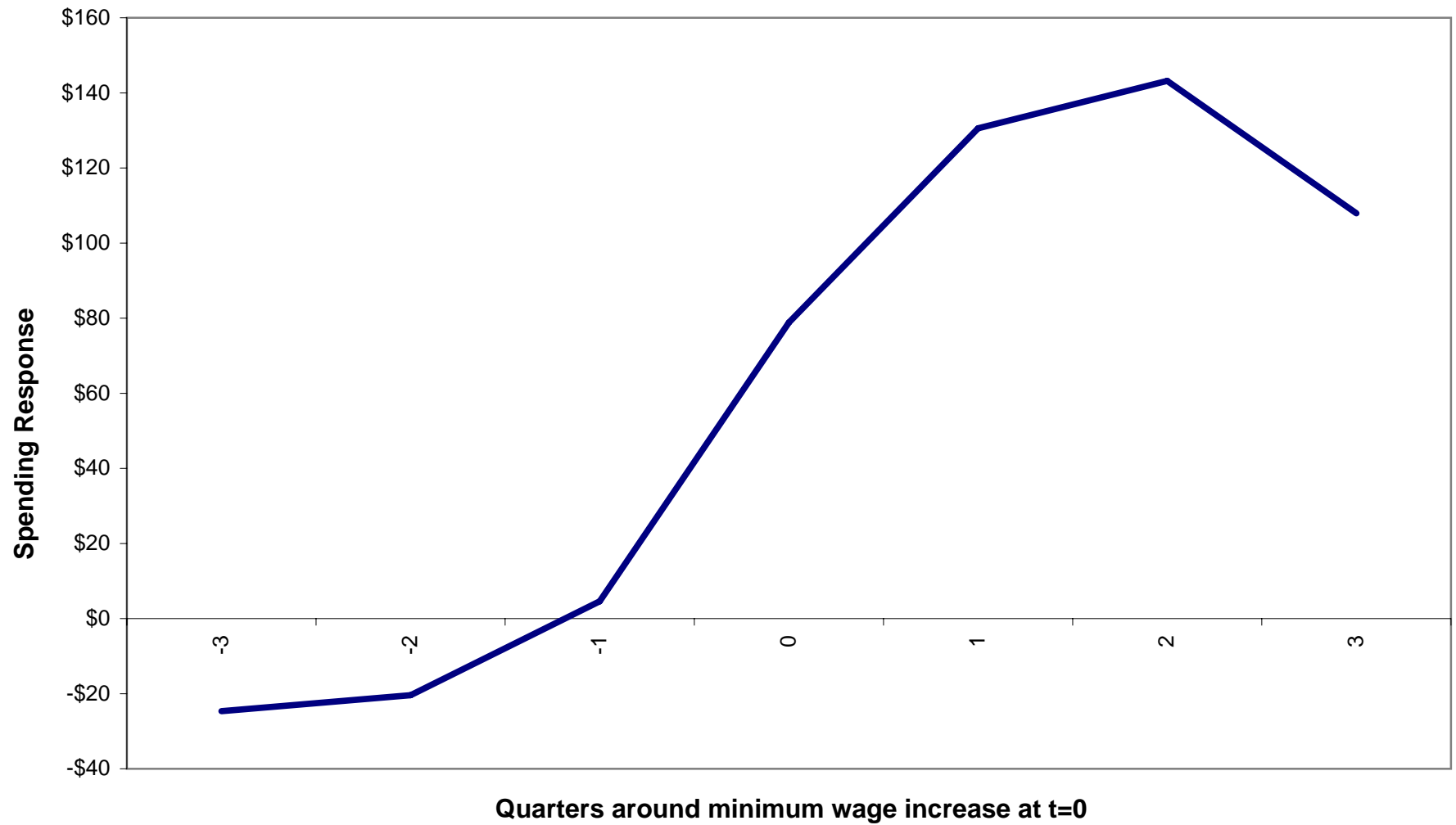
Figure 6
Spending Response to Minimum Wage Hike,
Quantile Regressions
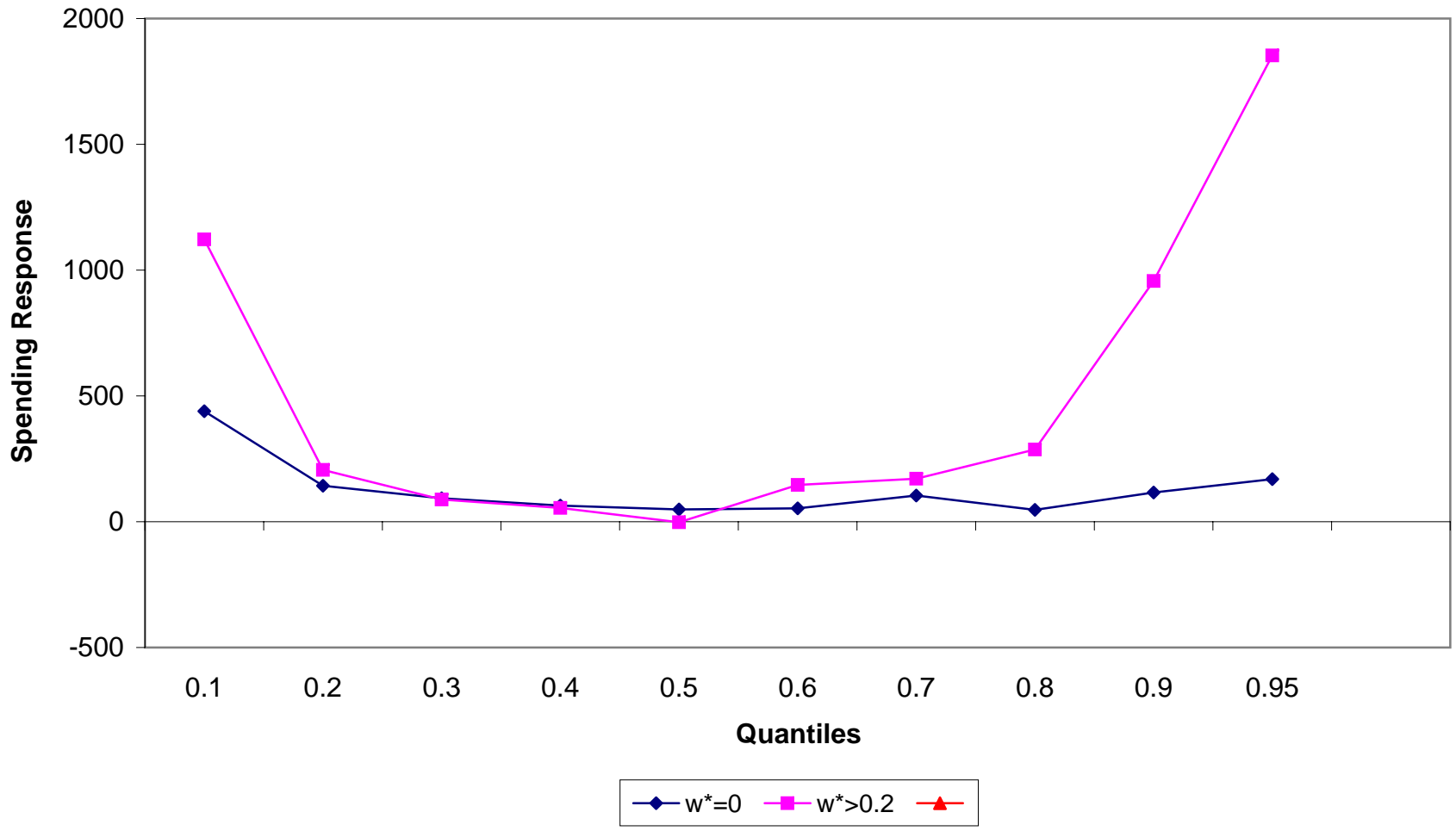
Figure 7
Debt Response to a Minimum Wage Change, Credit Bureau Data
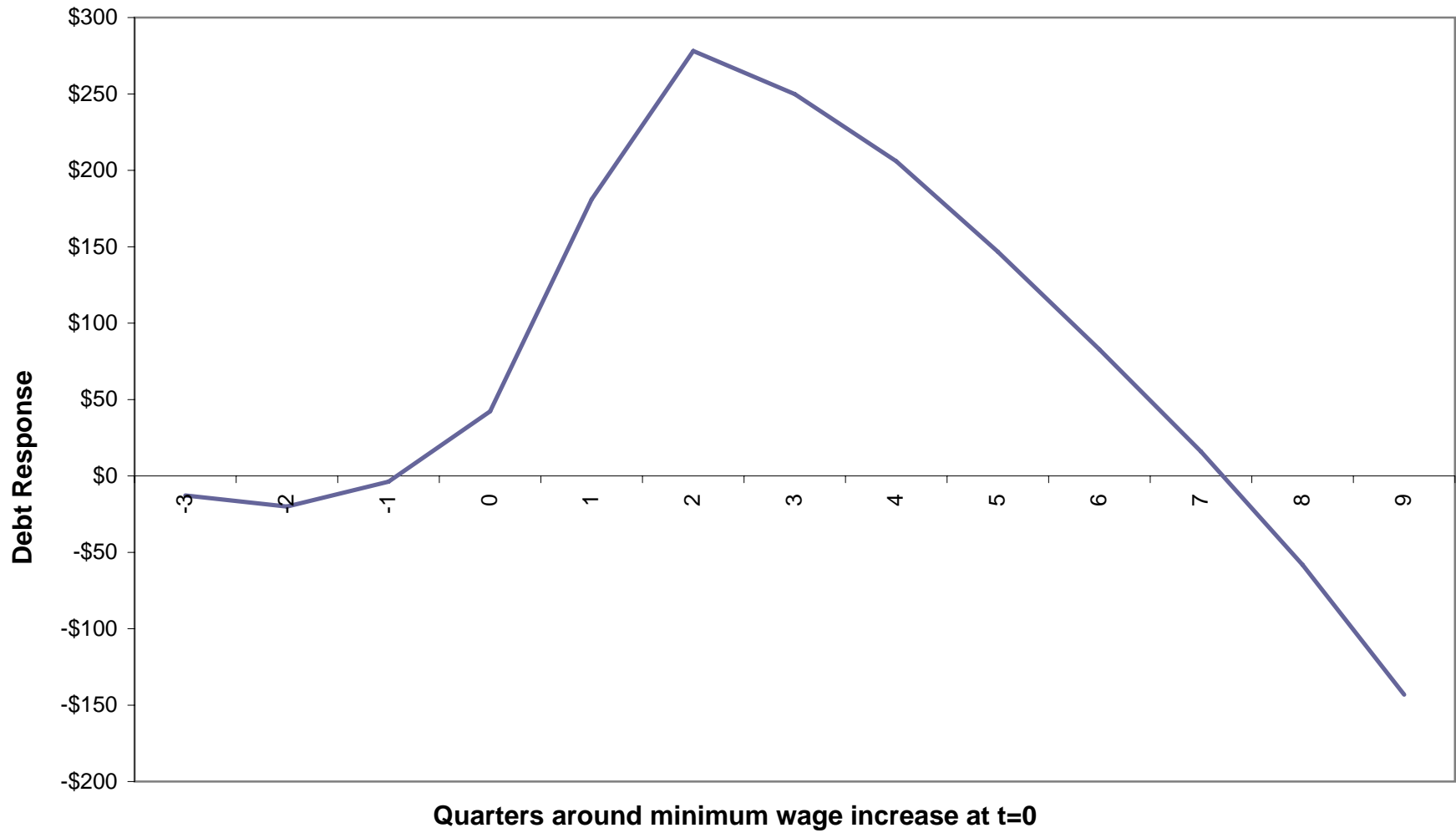
Table 2
Summary Statistics, 1983-2005 Consumer Expenditure Survey

Variable	All units Mean	All units Std Dev	Units with w*=0 in initial survey Mean	Units with w*=0 in initial survey Std Dev	Units with w*>=0.2 in initial survey Mean	Units with w*>=0.2 in initial survey 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
Real salary annual income in survey 2 for members 1 and 2	45,699	35,540	48,891	35,783	14,470	12,091
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	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 includes 6,503 unit-surveys where w* is between 0 and 0.2 in the initial survey.

Table 3
Summary Statistics, Credit Card Data

Variable	Mean	Std Dev
Credit Bureau Variables		
Fico Score	699	67
Active Credit Cards	2.1	2.6
Credit Bureau Balance	4,488	4,355
Home Equity Balance	717	7,869
Mortgage Balance	27,816	110,607
Auto Balance	3,189	6,795
Card Variables		
Credit Line	5,577	3,230
Current Balance	2,040	3,132
Monthly Purchases	146	459
Monthly Payments	184	635
Debt	1,068	2,476
APR	18.3	6.2

Number of Observations	308,117
Number of Consumers	18,882

Notes: Sample of credit card borrowers with income less than $15,000.
See text for details. Data covers two year panels from 1995 to 2003.

Table 4
Total Spending Response to Change in the Minimum Wage
CEX, 1983-2005

		All	HS dropouts and grads	All, by "minimum wage cutoff"				Real average quarterly spending All	HS dropouts and grads
share of pre-tax total income due to	**0**	123 (205) 170,419	36 (278) 64,073	149 (219) 152,415	69 (250) 122,934	69 (250) 122,878	244 (350) 70,951	9,865	8,533
salaries coming from close to the min wage	**>0**	869 (570) 21,695	1249 (731) 12,976	403 (382) 39,699	478 (278) 69,180	312 (316) 47,485	-226 (320) 51,927	6,878	6,538
in initial survey (w*)	**>=0.2**	885 (656) 15,192	1330 (868) 9,524	425 (408) 29,875	533 (285) 56,545	393 (318) 40,506	-176 (323) 50,922	5,795	5,819

Minimum Wage theshold used[1]:   <=120%   <=120%   <=150%   <=200%   120-200%[2] 200-300%[3]

Notes
Each cell represents a separate regression. 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] throws out any units with a worker less than or equal to 120 percent of the minimum wage at the beginning
of the sample.
[3] throws out any units with a worker less than or equal to 200 percent of the minimum wage at the beginning
of the sample.

Table 5
Response of Minimum Wage Increase on Credit Card Spending, Payments, and Debt

	Spending	Payments	Change In Debt
All	176	65	105
	(62)	(71)	(84)
	308,117		
Income > 20,000	3	18	-12
	(28)	(15)	(9)
	2,528,372		
Limit < 2000	247	57	266
	(83)	(83)	(116)
	47,911		
Balance Ratio > 2	248	99	125
	(224)	(174)	(210)
	30,882		

Notes:
Each cell represents a separate regression. See the text for details. All standard errors
are cluster corrected by account holder. Data covers two year panels from 1995 to 2003.

Table 6
Quarterly Household Nonproperty Income Response to Change in the Minimum Wage
SIPP, 1986-2003

		Hourly wage of hourly workers				HS dropouts and grads	Computed wage[3] All	
		All			<120%	<120%	<120%	<120%
		<120%	120-200%[1]	200-300%[2]				
share of	**0**	-45	-174	-258	-87	12	-51	-21
pre-tax total		(75)	(102)	(168)	(81)	(84)	(66)	(75)
income		48,405	27,900	12,350	49,214	26,708	67,581	68,181
due to								
salaries	**>0**	183	189	-93	156	36	369	48
coming from		(174)	(111)	(117)	(186)	(198)	(132)	(138)
close to the		6,413	19,854	15,264	6,612	4,510	8,985	9,250
min wage								
in initial	**>=0.2**	249	195	9	366	228	123	249
survey (w*)		(183)	(108)	(117)	(201)	(207)	(132)	(147)
		5,046	17,217	14,425	5,219	3,689	7,170	7,401
Includes movers where households remain intact[4]		yes	yes	yes	no	yes	yes	no

Notes:
Each cell represents a separate regression. See the text for details. All standard errors
are cluster corrected by household. Minimum wage earnings are based on initial wage in sample.
[1] throws out any units with a worker less than or equal to 120 percent of the minimum wage
  at the beginning of the sample.
[2] throws out any units with a worker less than or equal to 200 percent of the minimum wage
  at the beginning of the sample.
[3] The computed wage is monthly earnings divided by monthly hours worked.
[4] Columns 4 and 7 include only non-movers.

Table 7
Decomposition of Spending
CEX, 1983-2005

		Nondurables & Services	Durables	Furniture	Floors and windows	HH items	Big appls.	Electr.	Leisure activities	Misc HH equip.	Transp.	Non-Transp.
						Durables subcomponents						
share of pre-tax total income due to	**0**	93 (100)	30 (172)	3 (25)	1 (0)	-7 (0)	5 (10)	-3 (16)	-4 (12)	-4 (8)	38 (166)	86 (112)
salaries coming from close to the min wage	**>0**	130 (213)	739 (509)	7 (45)	13 (13)	-1 (13)	54 (52)	12 (39)	-19 (54)	30 (17)	642 (493)	227 (242)
in initial survey (w*)	**>=0.2**	-9 (259)	894 (566)	-4 (49)	11 (12)	6 (10)	8 (18)	35 (43)	16 (19)	58 (21)	764 (558)	121 (268)

Real average amount spent (2000$):

		Nondurables & Services	Durables	Furniture	Floors and windows	HH items	Big appls.	Electr.	Leisure activities	Misc HH equip.	Transp.	Non-Transp.
	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$):

		Durables	Furniture	Floors and windows	HH items	Big appls.	Electr.	Leisure activities	Misc HH equip.	Transp.
	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

These regressions break down the results in column (1) of table 8. See the text for detailed descriptions of each category.

Table 8
Detailed Transportation Spending Response to Change in the Minimum Wage
CEX, 1983-2005

		Amount of purchase					Probability of a purchase				
		New cars	Used cars	New trucks	Used trucks	Other transp.	New cars	Used cars	New trucks	Used trucks	Other transp.
share of	**0**	-12	52	36	30	-69	0.000	0.009	-0.001	0.005	-0.001
pre-tax total		(98)	(64)	(88)	(52)	(60)	(0.005)	(0.007)	(0.004)	(0.005)	(0.004)
income											
due to											
salaries	**>0**	204	178	277	-14	-3	0.018	0.017	0.013	-0.002	-0.006
coming from		(161)	(212)	(196)	(121)	(335)	(0.011)	(0.030)	(0.009)	(0.016)	(0.011)
close to the											
min wage											
in initial	**>=0.2**	123	25	308	-6	314	0.012	0.009	0.014	-0.003	-0.003
survey (w*)		(176)	(266)	(225)	(0)	(393)	(0.012)	(0.039)	(0.009)	(0.019)	(0.009)

Real average amount spent (2000$):

		New cars	Used cars	New trucks	Used trucks	Other transp.	New cars	Used cars	New trucks	Used trucks	Other transp.
	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$):

		New cars	Used cars	New trucks	Used trucks	Other transp.
	0	17,475	6,332	20,220	8,611	6,031
	>=0.2	13,767	4,226	18,579	6,071	5,544

Notes
Each cell represents a separate regression. See the text for details. All standard errors are cluster corrected by consumer unit.
Probability of a purchase is estimated with a linear probability model with individual fixed effects.

Table 9

Response of Minimum Wage Increase on Auto, Mortgage, and Home Equity

	Auto Debt	Home Equity Debt	Mortgage Debt
Minimum Wage Increase	184	125	151
	(80)	(76)	(373)

Notes
Each cell represents a separate regression. See the text for details. All standard errors
are cluster corrected by consumer unit. Data covers two year panels from 1995-2003

Table A1
Covariance Matrix of Log Family Income Residuals Implied by the Model

with residuals in	Model covariance of residuals in				
	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
Wave 2	$\sigma_{P_1}^2 + \sigma_u^2$				
Wave 3	$\rho\sigma_{P_1}^2$	$\rho^2\sigma_{P_1}^2 + \sigma_\epsilon^2 + \sigma_u^2$			
Wave 4	$\rho^2\sigma_{P_1}^2$	$\rho^3\sigma_{P_1}^2 + \rho\sigma_\epsilon^2$	$\rho^4\sigma_{P_1}^2 + (\rho^2+1)\sigma_\epsilon^2 + \sigma_u^2$		
Wave 5	$\rho^3\sigma_{P_1}^2$	$\rho^4\sigma_{P_1}^2 + \rho^2\sigma_\epsilon^2$	$\rho^5\sigma_{P_1}^2 + \rho(\rho^2+1)\sigma_\epsilon^2$	$\rho^6\sigma_{P_1}^2 + (\sum_{j=0}^2 \rho^{2j})\sigma_\epsilon^2 + \sigma_u^2$	
Wave 6	$\rho^4\sigma_{P_1}^2$	$\rho^5\sigma_{P_1}^2 + \rho^3\sigma_\epsilon^2$	$\rho^6\sigma_{P_1}^2 + \rho^2(\rho^2+1)\sigma_\epsilon^2$	$\rho^7\sigma_{P_1}^2 + \rho(\sum_{j=0}^2 \rho^{2j})\sigma_\epsilon^2$	$\rho^8\sigma_{P_1}^2 + (\sum_{j=0}^3 \rho^{2j})\sigma_\epsilon^2 + \sigma_u^2$

Table A2
Empirical Covariance Matrix of Log Family Income Residuals

with residuals in	Empirical covariance of residuals in				
	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
Wave 2	0.7554	0.7965	0.7734	0.7662	0.7440
	(0.0139)				
	[9774]				
Wave 3	0.6017	0.7554	0.8284	0.7890	0.7779
	(0.0112)	(0.0149)			
	[7129]	[7370]			
Wave 4	0.5858	0.6274	0.7594	0.8279	0.7940
	(0.0122)	(0.0129)	(0.0152)		
	[5628]	[5637]	[5821]		
Wave 5	0.5880	0.6055	0.6370	0.7797	0.8192
	(0.0135)	(0.0138)	(0.0146)	(0.0191)	
	[4580]	[4563]	[4598]	[4732]	
Wave 6	0.5632	0.5888	0.6026	0.6300	0.7585
	(0.0143)	(0.0151)	(0.0149)	(0.0158)	(0.0194)
	[3763]	[3762]	[3771]	[3768]	[3883]

Model Predicted Covariances of the Residuals
of log Family Income, Waves 2-6
Covariances lie below the diagonal, correlations above
Standard errors in parentheses
Sample sizes in brackets

Table A3
Fitted Covariance Matrix of Log Family Income Residuals

	Fitted covariance of residuals in				
	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
with residuals in					
Wave 2	0.7602				
Wave 3	0.6195	0.7602			
Wave 4	0.6010	0.6195	0.7602		
Wave 5	0.5830	0.6010	0.6195	0.7602	
Wave 6	0.5655	0.5830	0.6010	0.6195	0.7602
Fitted Covariances of the Residuals					
of log Family Income, Waves 2-6					

Table A4
Estimates of the Income Process

Parameter	Estimate	Standard Error
σ^2_{Pt}	0.639	0.012
σ^2_{ε}	0.038	0.025
σ^2_{u}	0.122	0.006
ρ	0.970	0.005
Chi-square statistic: 8.067		
Degrees of freedom:12		
p-value of chi-square test: 0.780		