Working Papers

FEDERAL RESERVE BANK OF BOSTON

No. 17-8

The Local Aggregate Effects of Minimum Wage Increases

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Abstract

This paper examines the effect of minimum wage changes on local aggregate economic outcomes besides employment and wages. Using variation in state-level minimum wages across locations, we find that minimum wage increases have a relatively modest effect on both city-level inflation and spending growth over the years following the change. The effects are larger in industries and locations that employ a large share of low-wage and minimum-wage workers. Increases in minimum wages also lower debt among households with low credit scores, raise auto debt, and appear to increase access to credit.

JEL Classifications: E21, E31, E64

Keywords: minimum wage increases; prices; consumption; local aggregate effects

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The authors extend special thanks to Giovanni Olivei for helpful suggestions and to David Brown, Chloe Lee, and Sarah Morse for excellent research assistance.

This version: July 2018; original version posted August 2017

1 Introduction

The minimum wage is one of the most popular, contentious, and frequently adjusted economic policies in the United States. Since its introduction at the federal level in 1938, the national minimum wage has been raised 22 times. State-level minimum wage changes have occurred more frequently—especially recently—with 18 states raising their minimum wages in 2018 alone (following 19 state-level increases in 2017). While a binding minimum wage raises the incentive for low-wage workers to work, it also reduces the incentive for employers to hire them. As a result, a binding minimum wage lowers employment in a competitive labor market, although it can raise employment in a monopsonistic labor market. A voluminous literature measures the causal microeconomic effects of the minimum wage on the outcomes of low-wage workers by, for example, comparing similar workers in the same labor market but subject to different minimum wages (see, Card and Krueger, 1994), or comparing employment rates of different types of workers shortly after changes in minimum wages, controlling for city-level economic conditions. These microeconomic studies largely conclude that (observed) increases in the minimum wage lead to at most very small reductions in low-wage employment and poverty.

In this paper, we measure the local general equilibrium effects of a change in the minimum wage on a labor market's (MSA's) price level, consumer spending, and household debt. We find that overall inflation increases modestly not only in the year that a minimum wage change occurs, but by a similar amount in the following year. This slow local-aggregate price adjustment comes from rapid adjustment in the prices for goods, such as food away from home, which are produced using a larger share of low-wage workers, and slower (and typically smaller) adjustment in the prices for goods produced using fewer local low-wage workers. Consistent with this interpretation, price adjustment is also larger in cities where ex ante there are more workers earning at or near the minimum wage.

Further, although less well measured, we find that increases in minimum wages lead to nominal consumption gains. Increases in food consumption—especially food away from home—are well measured and appear larger than the rise in food prices, suggesting that equilibrium aggregate income effects exceed substitution effects and lead to greater real food consumption. We also find evidence that durable goods purchases rise *in advance* of a change in the minimum wage.

Finally, consistent with this reaction of purchases of durable goods, we show that auto loans increase in response to an increase in the minimum wage, with larger effects among likely constrained borrowers such as subprime and young individuals. Also, consistent with the relaxation of payment-to-income constraints on borrowing, credit appears to become easier to obtain when the minimum wage increases, as measured by the number of open accounts relative to credit inquiries (success rate). Overall, however, there is little change in debt for the average household, and households with low credit scores decrease their debt levels when the minimum wage rises, suggesting the effects of debt repayment dominate those of new borrowing for bigger ticket items.

We reach these conclusions by using the variation in minimum wages across states and over time.[1] We measure the responses of growth rates in local economic outcomes the year before, the year during, and one year after a change in the minimum wage. Many previous studies focused on the more immediate effects over a few months, which measure well the direct impact of the increase in the cost of low-wage labor, but omit medium-term responses to the prices of intermediate inputs (from other firms) as the local economy converges to a new equilibrium. On the other hand, we do not focus purely on the long-run relationship between minimum wages and local outcomes because the long-run propensity of a state to have a high minimum wage seems likely to be related

[1]Where relevant, we population weight state-level data to conform to the city-level geography that we focus our analysis on—geography that is based on the boundaries that the Bureau of Labor Statistics (BLS) uses to construct its MSA-level CPI indices (our measure of inflation).

to other policies or the standard of living in that state. For instance, a state with a high long-run growth rate may raise its minimum wage more than a low-growth state due to increases in relative wages and costs of living. Also to avoid such bias, we condition our analysis on the long-run growth rate in each locality by including location fixed effects in our regressions (along with aggregate time effects). As a final control for the possibility that minimum wage changes are to some extent predicated on transient local economic conditions, we incorporate exogenous controls for economic conditions by including a Bartik-style measure of local employment growth that, by construction, is orthogonal to changes in the local minimum wage and city-specific factors.

Quantitatively, an increase in the minimum wage leads to modest (and not always significant) gains in city-level prices: a 10 percent increase in the minimum wage increases the local-aggregate CPI by around 0.1 percentage points in the year of the increase. This city-level inflation effect is persistent, and the total price effect of the minimum wage increase—taking into account the lead and the lag change—amounts to roughly a 0.3 percentage-point gain in prices for a 10 percent hike in the minimum wage.

Second, we find that price increases are larger and more significant across expenditure categories and cities where the share of low-wage workers is greater. These are the same locales where there are likely larger cost increases caused by a higher minimum wage. Across cities, we find that for a 10 percent increase in the minimum wage, inflation (excluding energy) rises 0.83 percentage points cumulatively in areas with a one-standard deviation higher share of low-wage workers, as compared to prices rising 0.33 percentage points in areas with an average share of low-wage workers. The price adjustment is larger, and more rapid, for goods and services that are produced using a greater share of local, low-wage workers such as food consumed at home.

Third, minimum wage increases also affect aggregate consumer spending, presumably directly through income and employment, but also through relative prices and other

channels as the local economy adjusts to the higher minimum wage. For food away from home, we show that minimum wage increases lead to nominal spending increases that are larger than the price increases, suggesting that consumers raise the quantity of food that they consume at and away from home when the minimum wage rises. Analyzing constructed real spending data confirms this result. Spending also goes up on other nominal consumption components, but the gains are less precisely estimated, and are roughly in line with the corresponding price changes.

Fourth, we find that spending on durable goods increases in advance of the minimum wage change. Spending on durable goods increases prior to the minimum wage change possibly in anticipation that durable goods prices will rise due to higher (retail) sales costs when the minimum wage change takes effect.[2] This result is broadly consistent with intertemporal substitution behavior by households.

Finally, the increase in durable spending is also consistent with minimum wage increases leading to improved credit availability for low-income workers. Credit bureau data show higher success rates for credit applications following an increase in the minimum wage—particularly for young and subprime borrowers. Dettling and Hsu (2017) further document more direct-mail credit card offers for low-income individuals following minimum wage increases. There is also a sizeable increase in auto loans in response to a minimum wage change, which points towards a demand-driven explanation for the gain in durable good prices that we document. However, among households with low credit scores, minimum wage hikes reduce the stock of household debt outstanding.

Our estimate that inflation rises 0.3 percentage points cumulatively in response to a 10 percent increase in minimum wages is consistent with early work by Wolff and Nadiri (1981), who find that a 10–25 percent increase in the minimum wage raises prices by 0.3 to 0.4 percentage points, a relatively modest effect. Lemos (2004) finds that minimum

[2]Minimum-wage workers are often involved in the sale of durable goods at retailers, even though such goods are often produced by higher-skilled laborers.

wage increases in Brazil had similarly small price effects.[3] These results are also related to the (partial-equilibrium) analysis in Aaronson (2001)[4] and Card and Krueger (1994) of relative local restaurant prices in the months following an increase in the minimum wage.

We focus on the price, spending, and debt effects of minimum wage changes and not the employment effects because the latter has been extensively researched in the literature. Typically, the effects on employment are found to be small, even for teenage employees and other low-wage worker groups (for recent examples, see Neumark, Salas, and Wascher, 2014; Dube, Lester, and Reich, 2016).[5] Our results on the importance of the share of low-wage workers—across cities and in goods production—are consistent with the existing literature that focuses on the employment effects of minimum wage changes for teenage and/or fast-food workers or restaurant-industry price changes (see, for example, Aaronson, French, and MacDonald, 2008; Card and Krueger, 1994; Basker and Kahn, 2016). Similarly, Aaronson, Agarwal, and French (2012) examine the changes in household income that occur in response to minimum wage changes for households with minimum-wage workers, but that do not occur for households with no minimum-wage workers. MaCurdy (2015) argues that a minimum wage increase is an ineffective method to help the working poor, because increases in the national minimum wage raise consumer prices across goods in a way that is more regressive than a typical state-level sales tax increase. He documents that the earnings gained from an increase in the federal minimum wage in 1996 ended up being evenly split across the income distribution. Our results on spending and credit access somewhat contradict MaCurdy's claim that minimum wage

[3]Lemos (2008) emphasized the limited work on the relationship between minimum wage changes and consumer prices. However, this is changing. Very recent work on the relationship between minimum wages and prices includes Ganapati and Weaver (2017), Leung (2018), MacDonald and Nilsson (2016), and Renkin, Montialoux, and Siegenthaler (2017).

[4]Aaronson (2001) examines the relationship between minimum wage changes and restaurant-price inflation *relative* to CPI inflation, not the local-aggregate effects of minimum wage changes.

[5]Our analysis also yielded negligible employment effects.

policy changes provide little benefit to the poor.

The remainder of the paper proceeds as follows. Section 2 discusses minimum wage changes in the United States along with our other data, Section 3 highlights our empirical approach, and Section 4 presents our results. Section 5 concludes.

2 Data

2.1 Minimum Wage Changes in the United States

Since its inception in 1938 as part of the Fair Labor Standards Act, policymakers at the federal, state, and local levels have debated the appropriate level of the minimum wage and often legislated changes. While minimum wages at the federal level (currently $7.25 per hour, and unchanged since 2009) serve as a floor for workers' wages (and the minimum wage in some states), many states set higher local minimum wages and recently there has been a push in some states toward a $15 per hour minimum ("living") wage.[6] As a result, there is substantial variation in the current minimum wages across states.[7] As of January 2018, minimum wages ranged from $7.25 per hour in states that follow the federal minimum wage rule like Pennsylvania, Texas, and Utah to $11.50 per hour in Washington State. As of July 1, 2018 the minimum wage in the District of Columbia is $13.25 an hour. In addition, while minimum wage changes are infrequent—especially at the federal level—they have recently increased in frequency at the state level. Eighteen states raised their minimum wages in early 2018, after 19 states increased their minimum

[6]Reich, Allegretto, and Montialoux (2017) examine the potential effects of raising California's minimum wage to $15 per hour by 2023.

[7]Some cities such as Seattle have city-specific minimum wages that supersede state-level minimum wages. We focus primarily on state-level minimum wages since city-level data are limited, especially historically. However, a recent paper—Allegretto and Reich (2018)—examines the response of local prices around the 2013 implementation of a city-specific minimum wage in San Jose, CA.

wage in early 2017.[8]

Historical data on state minimum wages comes from three primary sources: the Tax Policy Center (TPC), the U.S. Department of Labor (U.S. DOL), and various state departments of labor (state DOL). Our final minimum wage dataset combines information from all three sources, and when possible, it accounts for the actual dates when the minimum wage changes occurred. Since our final unit of analysis is a year, we take the average annual minimum wage in states that have more than one minimum wage change in a year.[9] We further focus on the *effective* minimum wage in each state (hereafter minimum wage), which is the maximum between the posted state minimum wage and the federal minimum wage in each year.[10]

Figure 1 demonstrates how the federal minimum wage acts as a floor for state-level minimum wages. In particular, it plots the federal minimum wage (red line), the average minimum wage across states (black line), as well as the range of minimum wages across states in each year (blue boxes show the interquartile range). Figure 1 also shows that the dispersion of minimum wages across states has increased somewhat over time.

2.2 Additional Data Sources

The BLS publishes CPI data for 27 metropolitan areas (hereafter cities or CPI MSAs) for various subcategories of consumer spending at various frequencies (monthly, bimonthly,

[8]Minimum wage changes in a number of states (7 states in 2017 and 8 states in 2018) were very small, automatic increases tied to the cost-of-living. For more details on the most recent minimum wage changes see http://www.ncsl.org/research/labor-and-employment/state-minimum-wage-chart.aspx.

[9]Because most minimum wage changes occur at the start of the year, alternative approaches, such as taking the first or last minimum wage value of the year by state, yield very similar results.

[10]A handful of metropolitan counties and cities have started adopting minimum wages that are higher than their state minimum wage. To date, 41 localities have minimum wages above their corresponding state minimum wage, of which 30 are part of our CPI-MSA sample. In calculating minimum wages, we also take into account these locality-specific minimum wages. Results are very similar if we do not do this, because this policy change is relatively recent.

semiannual, and annual).[11] For consistency across locations and over time, we convert all data to an annual frequency by taking the average of the higher-frequency data where applicable. We calculate inflation as the percent change in the annualized CPI data. In addition, while the data for many cities start in 1970, a few locations have data starting more recently, such as Phoenix, AZ (2003). For our inflation analysis, we construct an unbalanced panel of the available price data.

State-level nominal personal consumption expenditures (PCE) data come from the Bureau of Economic Analysis (BEA). These data are reasonably accurate. Roughly 60 percent of expenditures are measured from receipts in years with economic censuses and are then interpolated using category-specific data on employment from the Quarterly Census of Employment and Wages.[12] The remaining categories are calculated from data on quantities and prices (housing, utilities, higher education and foreign travel), and from "other methods" (primarily financial services and insurance).[13]

We are also interested in the effect of minimum wage changes on real consumption spending in a city, but the state-level price data that the BEA uses to construct real state-level PCE data are interpolated over time and space from very limited information sources.[14] Were we concerned with longer-term trends, the state-level PCE deflators might be useful, but we are interested in identifying annual movements in real spending. Thus, we use the CPI to construct approximate real consumption data for select spending

[11]The BLS CPI MSA boundaries do not necessarily match the boundaries used by the Census Bureau for all locations. The Appendix contains a full list of these metropolitan areas.

[12]This employment-based interpolation is another reason to look at longer-term effects of the minimum wage. The interpolation also raises the concern that any effect of the minimum wage on employment would be included in the measured effect on consumption, correctly or incorrectly. However, there is little evidence that minimum wages affect employment, and analyzing labor market variables using our empirical approach (not shown) confirms this finding. Therefore, if the variation in the consumption data is driven by changes in employment, then it would work against us finding a minimum wage effect on consumption.

[13]The BEA assigns the local spending data to a household's state of residence, regardless of where the expenditures occur (see Awuku-Budu et al., 2016).

[14]For more information on the BEA's regional price indices see: https://www.bea.gov/regional/pdf/RPP2016_methodology.pdf.

categories where the nominal PCE data and CPI price categories line up reasonably well (see Section 4.4 for more details). The CPI has excellent price data, so the approximation underlying this approach comes from assuming that the weights used to aggregate price changes across different subcategories of goods and services are the same in the PCE data as in the CPI.

We use credit bureau data from the Federal Reserve Bank of New York Consumer Credit Panel (CCP) provided by Equifax to analyze the relationship between minimum wages and individuals' credit access and debt holdings. The CCP is a quarterly longitudinal dataset with credit bureau records for a large sample of individuals. The CCP is a nationally representative 5 percent random sample of individuals with credit records. In addition to this primary sample, the CCP also includes records for all household members associated with the primary sample member. The data include information on most aspects of credit and debt, including credit scores as well as balances on credit cards, auto loans, student debt, and mortgages. Importantly, the dataset also includes information on the number of credit inquiries (related to credit applications) and the number of open accounts in a given period, information which allows us to track whether individuals are successful in their credit applications.

Finally, minimum wage changes are likely to be more relevant and binding in locations with a larger share of low-wage workers. Therefore, we calculate the share of workers in each state that have hourly earnings (or effective hourly earnings if they are salaried) that are within 110 percent or less of the minimum wage in that state by using wage information from the March Current Population Survey (CPS) supplement. We convert these state-level measures to city-level data using the weighting approach discussed in Section 2.4.

2.3 Local Employment Growth

We construct a Bartik-style measure of local employment growth (hereafter Bartik growth) to control for local business cycle conditions. The Bartik approach captures shocks to local demand based on changes in industry-level employment at the national level and the shares of employment by industry in a given location (see Bartik, 1991, for more details). Employment data by state and industry come from the BEA, and we focus on the largest industries (2-digit NAICS codes) for our analysis. To ensure that local changes in employment—especially in large states—do not unduly influence the measure of national employment growth, we exclude employment growth in state i from the measure of national employment growth used to calculate the Bartik growth rate for state i.[15] Finally, for MSAs that span multiple states we convert the state-level Bartik growth data to city-level data using the population-based weighting approach that we describe next.

2.4 Reconciling Different Data Geographies

We conduct our analysis at the city (MSA) level. Whereas much previous research has studied outcomes at the state level, we are interested in local aggregate equilibrium effects. Markets for labor and a substantial fraction of consumption are defined by commuting distances and are thus better measured by MSA-level data than state-level data.

We follow the BLS' city boundaries for their CPI MSAs to construct city-level measures of minimum wages. Since a number of these BLS locations, like New York and Philadelphia, contain suburbs that extend across state lines we must appropriately convert state-level information into city-level data. First, we determine the share of the population belonging to each state in each location using Census population data and

[15]This approach has been used by Paciorek (2013) and others.

information from the BLS on the counties in each CPI MSA. We then population weight the state-level data to generate boundary-consistent city-level non-price measures. We follow this approach to construct city-level minimum wage, consumption, debt, low-wage worker shares, Bartik growth, and other data for our analysis. Alternative weighting schemes, such as using the minimum or maximum value of a given data measure among the states within each city's boundaries, yield similar results.

2.5 Sample Period and Relevant Summary Statistics

Our analysis focuses on the 27 CPI MSAs for which the BLS publishes city-level price data. These locations cover roughly half of the U.S. population and most of the population living in or near cities.[16]

Our baseline sample period runs from 1999 through 2014 and is determined by the availability of the PCE data (starting in 1997), NAICS industry employment data (growth rates starting in 1999), and county-level population data (available through 2014). The Appendix includes estimates of the effect of minimum wage changes on inflation using all the available CPI and minimum wage data (1983–2014).[17]

Figure 2 shows the number of CPI MSAs with a minimum wage change in a given year. Not surprisingly, most minimum wage changes occur in years when the federal minimum wage increases. However, many states adjust their minimum wage at other times, thus generating variation in the number of CPI MSAs with a minimum wage change within and across years. There are 160 specific changes in the minimum wage across 34 states *excluding* changes in the federal minimum wage during our sample period.[18]

[16] According to a 2015 Census Bureau report, 62.7 percent of the U.S. population lives in a city. See https://www.census.gov/newsroom/press-releases/2015/cb15-33.html.

[17] These estimates do not include controls for local economic conditions since the Bartik growth data are only available starting in 1999.

[18] Including changes in the federal minimum wage in 2007, 2008, and 2009, there are 247 minimum wage changes across all 50 states and the District of Columbia from 1999–2014. The largest increase was about 39 percent in Pennsylvania in 2007, while the minimum wage declined a touch in Colorado

The average change in the minimum wage in our sample is 6.2 percent (conditional on a change occurring) with a standard deviation of 6.1 percent. Figure 2 further highlights that state-driven changes in the minimum wage, and hence fluctuations in minimum wages across CPI MSAs, have become more frequent recently. All of this variation across locations helps us identify the effect of minimum wage changes on inflation, consumption growth, and household debt growth.

Figure 3 shows data on the share of low-wage workers over time (left panel) as well as the average low-wage worker share by state (right panel). There is substantial variation in the share of low-wage workers both across states (on average and within a year) and over time, with the shares ranging from around 10 percent in Nevada and Virginia to closer to 20 percent in states like Mississippi and Montana.

Finally, there is also reasonable variation in inflation, nominal consumption growth, and debt growth across our cities. Total CPI inflation ranges from –2.6 percent to 5.8 percent, with a mean of 2.4 percent and a standard deviation of 1.2 percent, whereas total nominal consumption growth ranges from –3.5 percent to 10.4 percent, with a mean of 4.5 percent and a standard deviation of 2.4 percent. Debt growth ranges from -10.1 percent to 119 percent with a mean of 7 percent and a standard deviation of 13 percent.[19] Tables A.5–A.7 in the Appendix provide additional summary statistics for the relevant components of inflation, consumption, and debt.

in 2010.

[19]The maximum for total debt growth (and auto loan growth) is for Chicago in 2000. We have verified our results are robust to excluding that observation or the year 2000 entirely from the regressions using the CCP data.

3 Empirical Framework

We examine the relationship between inflation (or PCE growth or changes in debt) and minimum wage changes by estimating the following reduced-form relationship:

$$\Delta x_{i,t}^{k} = \alpha_i + \nu_t + \sum_{j=-J_1}^{J_2} \beta(j) \Delta w_{i,t-j} + \eta \, y_{i,t} + e_{i,t}. \tag{1}$$

Here Δx_{it}^{k} is the (annualized) percent change in CPI prices (PCE growth or debt growth) for a given price (consumption or debt) category k (for example, food away from home) in city i between time t and $t-1$; $\Delta w_{i,t}$ is the percent change in the minimum wage (MWPC) for CPI MSA i between time t and $t-1$; α_i captures time-invariant differences across cities, including differences in long-run inflation or growth by location; v_t is a time fixed effect that captures macroeconomic trends across all CPI MSAs; y_{it} is a measure of local economic conditions; and J_2 and J_1 denote the number of lags and leads, respectively, of the MWPC.

As noted in the introduction, by using annual data and looking at responses over a couple of years, our specification strikes a balance between measuring only the very immediate response to a change in the minimum wage and estimating a response that is biased by possible correlations between other characteristics of a city and its average relative minimum wage. Cities may take a couple of years to fully adjust prices, because some sectors use other local goods as inputs, several sectors have significant strategic complementarities in price setting, and some others respond with investment, entry, or exit. However, the locality-specific fixed effects control for long-run differences in states, such as their general size of government, generosity of social insurance, or other highly-persistent factors that might affect economic outcomes and also correlate with the minimum wage. Finally, and related, in our baseline specification, we do not include as control variables any economic outcomes that are possibly affected by the minimum

wage. This approach is taken by previous studies that compare the outcomes of more affected firms or industries to those that are less affected (and makes the most sense and is most prevalent when measuring the immediate impact of a change in the minimum wage). Thus, our specification is designed to measure the local general equilibrium effect of the minimum wage.

We estimate equation (1) from 1999 to 2014 using one lead ($J_1 = 1$) and one lag (J_2=1) of the MWPC. The lead captures any anticipatory effects of the minimum wage change, while the lag helps determine the persistence of any effect. We are interested in both the initial effect of the change in the minimum wage, $\beta(0)$, and the total effect, $\sum_{j=-1}^{1} \beta(j)$.[20]

We include a control for local economic conditions in equation (1), y_{it}, to capture time-varying, city-specific factors that might affect inflation, consumption growth, or debt growth, but are independent of the minimum wage effect. Controlling for local economic conditions is important, since local demand conditions may spur changes in the minimum wage or minimum wage changes may affect the local economy. We use Bartik employment growth to control for local demand, since it is arguably exogenous with respect to changes in the minimum wage.[21] With Bartik growth as a control, the estimated minimum wage effect, $\sum_{j=-1}^{1} \beta(j)$, captures the pass-through of minimum wage changes to inflation, consumption growth, or debt growth that is orthogonal to changes in local economic conditions. Ultimately, our choice of control for local economic conditions

[20]Our estimation approach is similar to Aaronson (2001), who examines the impact of the minimum wage changes on prices in the restaurant industry. However, Aaronson's estimates capture the *relative* effect of minimum wage changes on restaurant price inflation since his empirical setup controls for overall inflation. In comparison, we are interested in the local aggregate effect of minimum wage changes on overall inflation. Our empirical framework is most similar to that in Lemos (2004).

[21]The industry share of employment within a state is relatively fixed over time, and national employment growth by industry should be independent of a given's state's minimum wage. The existing literature also shows that the employment effect of minimum wage changes is limited at best. Still, national employment growth data may be less exogenous in years when a large number of states change their minimum wage. However, our results are very similar if we exclude years from our sample when twelve or more states change their minimum wages.

has little effect on the estimated minimum wage effects; for example, including the local employment-to-population ratio or not having any control for local conditions yield very similar results.[22]

A potential concern with our estimation approach is reverse causality—minimum wages may rise in order to keep up with higher prices, especially in states that index their minimum wage to the annual change in the cost-of-living. Such indexing, however, is a relatively new approach. In 2018 only 8 states raised their minimum wage due to such indexation: Alaska, Florida, Minnesota, Missouri, Montana, New Jersey, Ohio, and South Dakota.[23] In the last few years, minimum wage changes due to inflation indexation also have been quite small compared to changes in states that do not index their minimum wages.[24] Also, unlike in Brazil where minimum wage changes are solely determined at the national level, and historically have been tied to large fluctuations in aggregate inflation, we have both cross-sectional and time-series variation in minimum wage changes. This variation helps us, among other things, to identify the effect of minimum wages on prices, since most of the legislated changes in minimum wages at the state-level are not necessarily enacted in response to inflationary pressures.

Finally, in some specifications we allow for the effect of the minimum wage change to be larger the more workers it affects. To do this, we include an interaction between the minimum wage change and the share of low-wage workers in the city.[25] This approach tests whether there is a differential minimum wage change effect in locations with a greater share of low-wage workers. Since the share of low-wage workers in a location

[22]In the Appendix, we further discuss alternative approaches to control for local economic conditions, including unobserved local factors that might impact our estimated minimum wage effects.

[23]In the past Arizona, Colorado, Nevada, and Washington State also indexed their minimum wage changes to inflation.

[24]See, for example, "Higher Minimum Wage May Have Losers," *New York Times* January 10, 2017; available at: https://www.nytimes.com/interactive/2017/01/05/business/economy/state-minimumwages.html.

[25]We calculate the share of minimum-wage workers based on the minimum wage that prevailed as of time $t-1$.

is arguably driven by long-run factors such as the composition of an MSA's industrial base, consistent identification of this heterogeneity requires weaker assumptions than are required to identify the average effect of a minimum wage change.

4 Results

4.1 Minimum Wage Changes and Inflation

Our baseline inflation results (Table 1) show that minimum wage changes have the most substantial, precisely estimated effect on food inflation—especially food away from home.[26,27] A 10 percent increase in the minimum wage leads to food away from home inflation that is about 0.3 percentage points higher on impact. Overall, food away from home inflation increases about 0.4 percentage points taking into account any anticipatory $(t+1)$ or lagged effects $(t-1)$.[28] A particularly strong inflation effect for food away is consistent with restaurants typically employing a lot of minimum-wage workers, and thus facing relatively greater cost pressures when minimum wages rise.

The estimates in Table 1 further show that a 10 percent increase in the minimum wage is associated with an overall (all items) inflation rate that is 8 basis points higher relative to the preceding year. This effect is small and not significant, especially given that a 10 percent minimum wage increase is nearly double the average MWPC in our sample. The

[26]The Bureau of Labor Statistics defines food away from home as all food purchases at restaurants, concession stands, vending machines, fast food establishments and other similar food purveyors, while food at home refers to expenditures at grocery stores excluding nonfood items. For more details see: https://www.bls.gov/cex/csxgloss.htm.

[27]There is also a substantial increase in inflation for household furnishings, but this increase is not statistically distinguishable from there being no effect.

[28]The memo lines in the result tables summarize the overall effect of a change in the minimum wage taking into account the lead and lag effects. The "two-year effect" includes the contemporaneous (t) and lagged $(t-1)$ minimum wage estimates to measure the cumulative impact of a minimum wage increase on prices, while the "total effect" is the two-year effect plus any anticipatory effect (the p-values for these estimates are in the square brackets). These two summary measures are similar since the anticipatory effects are limited. However, we include both measures for completeness.

cumulative, all items inflation effect is somewhat larger, but it is still insignificant. Core inflation, which excludes food and energy prices, and all items less energy exhibit similar responses to a minimum wage change.

The results also highlight differences in the speed with which prices adjust to a change in the minimum wage. The majority of the increase in food away prices occurs in the first year (impact effect), with a smaller gain occurring in the year after the change, suggesting that minimum wage changes have a rapid and largely transitory effect on food away inflation, and a permanent effect on prices.[29] The increase in the minimum wage is slower to feed through to prices outside of the food sector, with core CPI inflation rising almost twice as much in the year following the minimum wage change than it does on impact, a result driven in part by a strong lagged response of durable goods prices to the minimum wage change. Total CPI prices increase a bit less in the year following the minimum wage change, but exhibit a similar trend. However, the cumulative effects for core CPI inflation and total CPI inflation are not significant at conventional levels. Durable goods inflation is also cumulatively higher, due perhaps to the retail component of durable goods prices (low-wage workers sell durable goods in stores), or to increased demand, as shown in section 4.4. These broader price effects are larger, and more precisely estimated in MSAs with a greater share of low-wage workers, as we discuss in Section 4.5.

In addition, the estimates for Bartik growth in Table 1 suggest that higher employment growth is associated with greater local inflation. This effect is quite large for durable and nondurable goods as well as household furnishings. For example, 1 percent higher predicted local employment growth leads to 1.2 percentage points higher durable goods inflation (column 4). The employment effects on prices are also much larger than the minimum wage effects on prices.[30] However, controlling for local conditions using

[29]Including any anticipatory food away effect has little bearing on this finding other than introducing noise.

[30]The estimated Bartik growth effects are substantially larger than the employment growth effect estimates obtained using actual employment growth in a given city (not shown). Some of this difference

Bartik growth, has little effect on our estimated relationships between minimum wages and inflation. Indeed, our results are nearly identical when we do not control for local economic conditions (see Table A.3 in the Appendix).

4.2 Minimum Wage Pass-Through to Consumer Prices

The results in Table 1 imply a large pass-through effect of minimum wages to consumer prices. Indeed, the magnitude of our price effects are larger than can likely be reasonably attributed to the share of minimum wage workers salaries in firms' overall marginal costs, consistent with minimum wage hikes leading to increases in input prices and other local equilibrium effects.

If prices (in a sector or industry) increase by 3 percent for a given change in the minimum wage, but firms' marginal costs (in that sector) increase by 4 percent, then there is less than full pass-through. However, embedded in this calculation is an assumption regarding the share of low-wage workers' salaries in firms' overall costs. If the implied share of (low-wage worker) labor costs is unreasonably large given the observed increase in prices following a minimum wage hike, then there are likely local equilibrium effects of higher minimum wages that also impact the pass-through of the minimum wage to consumer prices. Ultimately, determining the pass-through of minimum wages requires knowing the effect of minimum wages on firms' labor costs (payroll), the effect of minimum wages on the cost of firms' production inputs (intermediate good prices) as well as the share of both these costs in firms' overall marginal costs.[31] We can calculate the effect of minimum wages on firms' labor costs by sector using industry-level payroll

is likely due to attenuation bias since actual employment growth is likely endogenous. The Bartik growth variable also controls for something slightly different than actual employment growth, so we would not expect the coefficient to be the same even if there was no endogeneity.

[31]Firms may respond to minimum wage changes by adjusting employment or employees hours. However, Basker and Kahn (2016) consider that managers in the fast-food sector may change employment levels in response to minimum wage changes, and find these employment effects to be negligible.

data from the Census' County Business Patterns (CBP) database. However, we do not observe the effect of minimum wages on firms' intermediate good costs, nor the labor share of firms' overall costs (by sector).[32] Instead, we judge the implied local-equilibrium effects of minimum wage changes based on our observed price increases, data on labor cost increases, and whether the implied labor share is reasonable.

We calculate pass-through for food away and durable goods—two sectors with different shares of low-wage workers where we find significant and economically meaningful price effects from minimum wage changes. Using the CBP database, which contains yearly industry-level (NAICS-based) payroll data, we estimate that payroll growth in the food away from home sector increases about 0.5 percentage point[33] for a 10 percent increase in the minimum wage.[34] Basker and Kahn (2016) determine that payroll costs account for about half of firms' marginal costs in the fast-food sector. If we assume that labor costs similarly account for half of firms' marginal costs in the food away from home sector, then the cumulative price increase we observe (0.4 percentage points for a 10 percent minimum wage change) represents more than a full pass-through of the minimum wage change—suggesting that these firms also likely face rising product costs and other costs as a result of the higher minimum wage. If instead we focus on a narrower definition of food away from home for our payroll cost estimates, such as "full service restaurants" (0.85 percentage point payroll growth increase for a 10 percent increase in the minimum wage) or "limited service restaurants" (1.15 percentage point increase), then our results

[32]It is possible to estimate the labor share for certain years and industries, but obtaining estimates of the cost share for intermediate goods is difficult.

[33]This estimate is based on using payroll growth for "Food Services and Drinking Places" (NAICS 722). Unfortunately, the NAICS industry categories do not line up exactly with the food away from home category in the CPI, so we have to choose a NAICS industry (or industries) that is (are) reasonably close. If we instead use "Full Service Restaurants" (NAICS 7221) or "Limited Service Restaurants" (NAICS 7222), the payroll effects are larger.

[34]We estimate payroll effects using a specification similar to equation (1), but with payroll growth as the dependent variable and without any leads or lags of the minimum wage change (the other controls are unchanged). This approach is similar to the one in Basker and Kahn (2016), but we use growth rates instead of levels (of payrolls and the minimum wage) to be more consistent with the setup for our baseline estimates. These estimates are not shown, but they are available upon request.

would imply less than full pass-through.

We further find that payroll growth at motor vehicle and parts dealers—which account for a large share of consumer durable purchases—rises about 0.6 percentage points for a 10 percent increase in the minimum wage,[35] whereas our baseline results show that durable good inflation increases 0.4 percentage points cumulatively for the same minimum wage change. Full pass-through of this labor cost increase, assuming no other cost changes at motor vehicle and parts dealers due to the change in the minimum wage, would imply a labor share in that sector of about 65 percent, which is unrealistically high. Most likely these firms face other costs associated with minimum wage increases and have a low-wage labor share of marginal costs that is lower than 65 percent, especially since durable goods firms likely employ less low-wage workers than firms in the food service industry. A lower labor share along with additional costs associated with minimum wages could imply less than full pass-through of a minimum wage increase.

Overall, our results suggest large pass-through effects of minimum wages to consumer prices—a finding that is broadly consistent with the recent literature. In particular, Basker and Kahn (2016) find full pass-through of minimum wage changes to prices in the fast-food sector (limited-service restaurants; NAICS 7222). In addition, using Nielsen retail scanner data Leung (2018) finds large pass-through elasticities of minimum wages for grocery stores, although not for drugstores or general merchandise stores.[36] In contrast, Ganapati and Weaver (2017) find much more limited pass-through of minimum wages to grocery store and wholesale club prices.[37]

[35]We follow the same estimation approach as with the food away from home sector.

[36]Leung argues that the differences across store types are likely the result of differences in their price-setting behavior.

[37]Unlike others in the literature, Ganapati and Weaver (2017) find little evidence of minimum wages affecting labor costs, even in the grocery store (food) sector.

4.3 Minimum Wage Changes and Nominal Consumption Growth

Similar to our price results, we find the largest and most precisely-estimated effect of minimum wages on nominal expenditures for food away consumption. Table 2 reports these results.[38] A 10 percent increase in the minimum wage raises nominal food away consumption growth by nearly 0.8 percentage points (on impact and cumulatively). Whereas the impact effect of a minimum wage change on nominal food at home expenditures is positive but insignificant, the cumulative effect is similar in mangnitude to the food away effect and is precisely estimated.

Nominal nondurable expenditures rise in response to a minimum wage increase along with the rise in food spending, but the effect is not significant. Total consumption and durable consumption also increase on impact, but these effects are also insignificant. As expected, consumption growth is also positively related to local economic conditions, with the estimated effects for the Bartik controls somewhat larger than those for inflation.[39]

Our estimated food away and food at home consumption effects in Table 2 are much larger than the respective food price effects in Table 1, suggesting that nominal food consumption increases more than the amount that would be implied by higher prices alone. That is, consumers appear to adjust the *quantity* of food that they consume when the minimum wage rises, with the effect on food away from home being more immediate, and the effect on food at home occurring over time. Since restaurant spending is discretionary and a relative luxury for many consumers—especially low-wage earners—it is not terribly surprising that food away spending increases when incomes rise. In addition, the quantity adjustment for food at home spending suggests that low-income households spent less on more necessary food items than they desired prior to the minimum wage change, or that they shift their food consumption basket toward more expensive products

[38]The sample size for the consumption growth results is slightly larger than for the inflation results because the price data for Phoenix, AZ starts in 2003.

[39]Again, controlling for local economic conditions has little effect on our minimum wage results.

as their incomes rise.

Our estimates also show that consumers increase their nominal spending on durable goods in anticipation of a minimum wage change (p-value 0.147).[40] This finding is consistent with research by Dettling and Hsu (2017) showing that minimum wage increases help relax credit constraints as well as work by Aaronson, Agarwal, and French (2012) that documents an increase in automobile purchases by low-income individuals when minimum wages increase. Since minimum wage changes are announced in advance, minimum wage workers may have a somewhat easier time financing purchases of durable goods after the announcement. Our examination of the relationship between minimum wages and consumer debt holdings in Section 4.6 supports this idea.

The minimum wage effects for the other consumption categories in Table 2 are similar in size to the price effects in Table 1, suggesting that the quantity adjustment for food consumption spending is somewhat unique. Overall, these findings suggest that some workers are better off when minimum wages rise—a finding that challenges the conclusion in MaCurdy (2015) that minimum wage changes provide little benefit to the poor.

4.4 Minimum Wage Changes and Real Consumption Growth

Consistent with the evidence in the previous section that higher minimum wages increase the *quantity* of certain consumer expenditures, we find that real consumption rises following an increase in the minimum wage. In particular, real spending on food away increases about 0.5 percentage points for a 10 percent increase in the minimum wage. Real consumption of food at home also increases—especially on a cumulative basis and perhaps even a bit in advance of the minimum wage change.

As we discussed in Section 2, the BEA's data on state-level real consumption expen-

[40] Alternative specifications yield more precise estimates of this anticipatory effect. See Tables A.1 and A.2 in the Appendix.

ditures are unreliable. Therefore, these results are based on real consumption data that we construct using nominal expenditures from the BEA along with CPI inflation data for categories where there is reasonable overlap between the spending and price data. In particular, the CPI and PCE coverage for food away, food at home, and durables are reasonably similar.[41] We also combine total CPI data with nominal PCE data to study total real consumption spending despite the fact that the treatment of some goods and services, notably housing and health care, are quite different between the NIPA and CPI. Thus, these constructed real spending data are reasonable (albeit imperfect) for some categories, and not as good for others.

Table 3 reports a full set of results for minimum wage changes and real consumption expenditures. Despite the increase in real food away expenditures following a minimum wage hike, overall real PCE growth is essentially unchanged—a finding that is consistent with our earlier evidence that overall inflation and overall nominal PCE rise by similar amounts. Real spending on durable goods rises in advance of the minimum wage change, but the effect is not precisely estimated. Overall, our results are broadly consistent with Alonso (2016) and Leung (2018), studies that also find some evidence of increases in real (nondurable) sales following a minimum wage hike. These authors take different approaches to generating real consumption, with the approach in Leung (2018) most similar to ours.

In addition, our results raise two relevant questions. First, how do price increases lead to more real food consumption? Ultimately, the increase in the minimum wage affects the local economy in many ways. Spending on food presumably rises because low-wage workers have higher incomes following a minimum wage increase, and these individuals tend to spend a higher share of their budget on food. As a result, they spend more money on food despite the higher prices (the income effect outweighs the substitution effect from

[41] Real consumption growth is the difference between annual nominal expenditure growth and annual inflation for these categories.

higher prices). The second question is why, if these consumers' food price elasticities are so low, were restaurants and other food stores not raising prices already? The answer again concerns equilibrium effects. In a competitive industry, the elasticity of demand for a single firm increasing its price can be very large (infinite in theory), even when the elasticity of demand for an industry-wide increase is very low. Our results suggest a low elasticity for an industry-wide food price increase.

4.5 Are the Effects Bigger When More Workers are Affected?

The effect of a change in the minimum wage should depend on the number of workers it affects in a given location. When minimum wage changes impact a limited number of workers, then we would expect relatively small effects, whereas we would expect larger effects when many workers are affected. Indeed, when we allow the effect of the minimum wage (on prices or consumption) to vary with the share of low-wage workers by location, we find differentially larger effects—especially for prices—in areas where the low-wage worker share is larger.[42] This finding is consistent with labor costs increasing more in locations with a greater proportion of low-wage workers, leading firms in these locations to raise their prices more to offset their higher costs.

Table 4 reports these results, with the estimates for prices in the upper panel and the estimates for (nominal) consumption growth in the lower panel. Rather than show all the estimates for both the direct minimum wage effects and the incremental (interaction) effects for low-wage workers, we report only the contemporaneous (impact) effects and their respective cumulative effects. The heterogenous treatment effect (HTE) has been standardized so that its coefficient can be interpreted as the differential effect of the

[42] As discussed in Section 2, low-wage workers are those whose wages are within 110 percent of the minimum wage in a given location at beginning of the period over which the minimum wage change is measured, $t-1$, to avoid potential endogeneity. Our results are robust to alternative (higher) cut-offs for defining low-wage workers. We use a threshold above the local minimum wage to account for potential spill over effects to workers earning somewhat more than the minimum wage.

minimum wage change for locations with a one standard deviation larger share of low-wage workers relative to the mean.

In general, prices rise more on impact (positive HTE effect) in locations with a greater share of low-wage workers. Whereas not all the HTEs are statistically significant, the point estimates suggest total price effects on impact for areas with a greater share of low-wage workers that are double or more the size of the effect in areas with fewer low-wage workers. The HTE for durable goods prices, is particularly large—especially compared to the small direct durable goods price effect—and is significant at the 10 percent level. Interestingly, there is no parallel HTE for durable goods consumption (lower panel), so perhaps the prices of durable goods across all locations are catching up to the large (direct) increase in durable consumption spending that occurs in advance of the minimum wage change. Core prices and total prices excluding energy also exhibit large and statistically significant HTEs, in comparison to the more limited overall price effects obtained when we do not control for the share of low-wage workers.

In terms of cumulative inflation effects, we find differentially larger cumulative estimated (HTE) effects for food at home, food away from home, and nondurable goods. These results lend credence to our main findings. Were it not the case that these effects were larger when the minimum wage change directly impacts more workers, then we would be concerned that our baseline food-sector correlations might be picking up a lower frequency trend or endogeneity between minimum wage changes and expected economic performance.

In addition, the increase in durable goods prices in areas with a larger share of low-wage workers persists, and there is somewhat of an anticipatory effect as well since the total HTE is a bit larger than the two-year HTE. Again, this finding is broadly consistent with minimum wage increases relaxing credit constraints, especially for low-income workers. Incorporating HTEs into our analysis also aides in identifying some of the direct

minimum wage effects, as the precision of the estimates increases for some categories. Overall, the CPI results presented in Table 4 (top panel) suggest that minimum wage changes have larger price effects in locations with a greater concentration of such workers.

In comparison to the price effects, the nominal consumption estimates in the lower panel of Table 4 are generally smaller—both the direct effects and HTEs—and less precisely estimated with the exception of food expenditures. That said, the average effects of minimum wage changes on consumption are similar to what we observe in our baseline estimates (Table 2), even after controlling for low-wage workers. In addition, the response of food away spending in the first year and cumulatively remains strong, and there continues to be a relatively large (direct) anticipatory spending effect for durable goods to the minimum wage change. Consistent with prices, there is also a much larger impact effect of minimum wages on durable consumption in areas with a greater share of low-wage workers, but this effect is not precisely estimated.

While the standard errors are large, beyond durables and perhaps nondurables, we do not see much evidence of an HTE on consumption that is consistent with the observed rise in prices for areas with a greater proportion of low-wage workers. Perhaps low-wage workers do not purchase enough of the goods and services that experience a differential price increase for us to also observe a differential spending effect. Alternatively, the data may be too aggregated to completely tease out the HTE for consumption.

4.6 Minimum Wage Changes and Debt

We use the CCP data to show that households with low credit scores decrease total debt in response to minimum wage increases, whereas auto loan debt increases temporarily. Also, credit appears to become easier to obtain, as measured by the number of open accounts relative to credit inquiries (success rate).

Since we are interested in local-equilibrium effects, we aggregate the individual-level

CCP data to the CPI MSA level for our debt and credit measures of interest. We separately examine people by their creditworthiness: everyone (the most inclusive group), subprime borrowers (those with Equifax risk/credit scores below 660, about 40 percent of the sample), young individuals (people 35 years old or younger, 27 percent), and subprime and young combined (14 percent). For each city and year, we calculate total debt (or auto loans) by adding the debt balances of all individuals within the city borders, and compute the city-level annual percentage change in debt.[43] We calculate a credit inquiry success rate by taking the city average of the ratio of an individual's number of open accounts in the last 12 months relative to his/her number of credit inquiries over the same horizon.[44] We run regressions that parallel our specification for prices and consumption (equation 1) with the following dependent variables: (1) percentage change in total debt; (2) percentage change in auto loans; (3) success rates.

Table 5 summarizes the results for total debt, which is little changed when minimum wages rise for the population as a whole (column 1) and for the young (column 3). In contrast, total debt balances decline (even in advance of the minimum wage change) for subprime borrowers (column 2).[45] There are several potential explanations for this finding. First, minimum-wage workers are not necessarily subprime borrowers, but to the extent that some of them are, lower debt balances could indicate that minimum wage increases allow some borrowers to repay debt. Alternatively, if credit supply is fixed, non-minimum wage subprime borrowers could face more competition for credit from minimum-wage borrowers with better credit scores and improved income prospects following a minimum wage hike. Finally, it is also possible that the proportion of subprime

[43]The CCP data are quarterly, therefore we average debt balances over the four quarters in a given year. Our findings are similar if we only use data from the last quarter of each year instead. Results are also similar if we use average debt instead of total debt in a given city to compute the city-level percent changes.

[44]Our definition of success rates follows Amromin, Nardi, and Schulze (2017). Unfortunately, the CCP data do not allow us to easily determine the type of account opened.

[45]Although not tabulated, both mortgage debt as well as credit card balances, which in Equifax are a hybrid of current spending and revolving balances, decrease for this group.

individuals changes with the minimum wage, and debt for the group declines simply because there are fewer of them.

Turning to auto loans (debt incurred for the purchase of vehicles) in Table 6, there is a clear increase in this type of debt when minimum wages rise—a 10 percent increase in the minimum wage results in a 9.3 percent increase in auto debt in the year the minimum wage changes—with a clear reversal the following year. The increase is slightly larger for the subprime and the young groups, 12.4 percent and 11.4 percent, respectively. Also, consistent with the findings in Aaronson, Agarwal, and French (2012), we do not find any anticipatory effects of minimum wage changes for auto debt. The increase in auto loans is further consistent with the positive, but not always statistically significant, effect of minimum wages on durable goods purchases (a broader category than autos) that we documented in Section 4.3. Greater demand for autos could partly explain the positive relationship between minimum wage changes and durable goods prices presented in Section 4.1.

In Table 7, we document that minimum wage increases correlate with higher success rates at the city level, consistent with an increase in credit availability following a minimum wage hike. We do not count individuals who do not apply for credit, but there seems to be an actual increase in credit supply since we do not observe significant changes in the share of people with credit inquiries associated with minimum wage changes. That is, more people who apply for credit seem to receive it following a minimum wage increase. The estimates in Table 7 further show that the success rate effects are particularly large for the subprime-young group. Also, the effects seem to start even before the minimum wage changes (possibly with the minimum wage change announcements), indicating that lenders may be more optimistic about borrowers' repayment abilities once they know minimum wages will increase in the future. Given our previous result that durable goods purchases increase in advance of an increase in the minimum wage but auto loan debt does

not, it is possible consumers finance some (non-auto) durable good purchases through unsecured debt. Note also that success rates continue to increase over time, suggesting that the effect of minimum wages is persistent. Overall, it appears minimum wage increases relax credit constraints. Finally, column (5) of Table 7 shows that there is a small decline in the share of the population with subprime credit scores just before, during, and after a minimum wage change.

Our debt-related findings are consistent with Aaronson, Agarwal, and French (2012), which documents that debt, in particular collateralized debt tied to vehicles, increases with minimum wages for low-income individuals.[46] Our results are also consistent with Dettling and Hsu (2017), which also uses the CCP and shows that increases in minimum wages cause a decrease in credit card delinquency, an increase in the number of credit cards, and an increases in credit scores for likely minimum-wage workers—defined as individuals in census tracts where the majority of adults have less than a high school education.[47] Dettling and Hsu (2017) further documents that minimum wage increases correlate with additional direct-mail credit card offers and better terms for low-income individuals. The authors conclude that minimum wage increases alleviate borrowing constraints in unsecured credit markets, improving low-income borrowers' finances and credit scores. Their findings, as well as our own, suggest that cost-benefit analyses of social policies such as an increase in the minimum wage should consider interactions with credit markets and financial well-being more generally.

[46] Aaronson, Agarwal, and French (2012) also use credit bureau data, but their sample is not nationally representative in the sense that borrowers must have a credit card to be included. Compared to their data, the CCP is a nationally representative sample, but it lacks information on income.

[47] Dettling and Hsu (2017) find no effect on card balances or utilization.

5 Conclusion

While there has been much debate about the effect of minimum wage increases on the economy, and especially employment, the estimated effects are typically small. In this paper, we focus on the less-studied relationship between minimum wage increases and inflation, minimum wage increases and consumption growth, and minimum wage increases and household debt growth. We find small but significant effects of minimum wage changes on prices and household spending. Prices and consumption increase, especially in economic sectors such as food and services, where firms tend to employ a large number of minimum- and low-wage workers. This finding suggests that when minimum wages rise, companies at least partially offset their higher labor costs by increasing their prices. We also find that households increase the *quantity* of food that they consume at home and away from home following minimum wage hikes. Finally, increases in the minimum wage reduce the debt of households with low credit scores, presumably that of minimum wage workers, while increasing access to consumer credit and car loans for the general population.

Besides focusing on inflation and consumption, our research contributes to the minimum wage literature by examining the broader but local aggregate implications of minimum wage changes. The effect that minimum wage increases have on the macroeconomy is likely going to become more relevant as more local governments debate raising minimum wages. Indeed, we have already observed many states starting or continuing to raise their minimum wages toward $15 per hour. When thinking about the impact of higher minimum wages on the overall economy, one should keep in mind that while the estimated price and spending effects are relatively small, these findings are based on historical changes in the minimum wage that are also not large (averaging about 6 percent annually, conditional on a change occurring).

There is some concern that there could be so-called threshold effects associated with

increases in the minimum wage. That is, the effect of the minimum wage on the economy will be differentially (nonlinearly) larger when the size of the change in the minimum wage increase or the level of the minimum wage itself grows. Indeed, Jardim et al. (2017) find some evidence of threshold effects when examining recent changes in the city-level minimum wage in Seattle. By taking into account the share of low-wage workers in a given location, we effectively upweight the impact of the minimum wage change. We do not find a big effect, however, which argues against the presence of large threshold effects in the observed range of minimum wages changes (relative to market wages) in our analysis. Note as well, that so far states have continued to increase their minimum wages at a gradual pace. This does not mean, however, that minimum wage changes will continue to be small. Should the changes become much larger, the local aggregate inflation (and consumption) implications of these changes could be more substantial and may require more attention from monetary policymakers.

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TABLE 1: Baseline: Minimum Wage Changes and Inflation

	(1) All	(2) All x Energy	(3) Core	(4) Dur	(5) Nondur	(6) Serv	(7) Food at Home	(8) Food Away	(9) HH Furnish
Pct. Chg. Min. Wage (t)	0.008	0.010	0.008	–0.000	0.007	0.009	0.002	0.030**	0.031
	(0.008)	(0.009)	(0.011)	(0.013)	(0.007)	(0.012)	(0.015)	(0.011)	(0.020)
Pct. Chg. Min. Wage (t–1)	0.011	0.014	0.016	0.033*	–0.002	0.009	–0.009	0.011	0.037
	(0.010)	(0.010)	(0.012)	(0.017)	(0.013)	(0.015)	(0.015)	(0.017)	(0.032)
Pct. Chg. Min. Wage (t+1)	0.006	0.007	0.008	0.007	–0.018*	0.015	–0.008	0.002	0.014
	(0.012)	(0.012)	(0.013)	(0.020)	(0.010)	(0.016)	(0.011)	(0.012)	(0.023)
Bartik Emp. Growth	0.237	0.167	0.161	1.204***	0.654**	–0.238	0.240	–0.019	1.425*
	(0.349)	(0.326)	(0.348)	(0.389)	(0.294)	(0.524)	(0.284)	(0.427)	(0.722)
Memo:									
Two-year Min. Wage Effect†	0.020	0.023	0.025	0.033	0.005	0.018	–0.006	0.041	0.068
P-value	[0.191]	[0.137]	[0.150]	[0.122]	[0.779]	[0.417]	[0.725]	[0.063]	[0.092]
Total Min. Wage Effect‡	0.025	0.030	0.033	0.040	–0.014	0.033	–0.014	0.043	0.082
P-value	[0.242]	[0.177]	[0.162]	[0.173]	[0.526]	[0.279]	[0.542]	[0.132]	[0.074]
Observations	401	401	401	401	401	401	401	401	401
Adjusted R^2	0.647	0.343	0.291	0.474	0.898	0.425	0.696	0.317	0.255

Notes: The estimates are based on the baseline equation $\Delta x^k_{i,t} = \alpha_i + \nu_t + \sum_{j=-1}^{1} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$ where the dependent variable is inflation (price growth) for the CPI category indicated at the top of each column. The annual data cover 1999–2014. The estimates include location (CPI MSA) fixed effects as well as year effects. The percent change in the minimum wage when a CPI MSA spans different states is calculated based on the average (population-weighted) minimum wage in each location and year as discussed in the text. †Cumulative effect of the minimum wage change measured over two years (sum of contemporaneous and lagged effects). ‡Total effect of the minimum wage change including any anticipatory effect (sum of contemporaneous, lagged, and lead effects). Standard errors clustered by CPI MSA are in parentheses: * p<0.10, ** p<0.05, *** p<0.01.

TABLE 2: Minimum Wage Changes and Nominal Consumption Growth

	(1) Total PCE	(2) Core PCE	(3) Dur.	(4) Nondur.	(5) Serv.	(6) Food at Home	(7) Food Away
Pct. Chg. Min. Wage (t)	0.013	0.005	0.012	0.023	0.013	0.027	0.076***
	(0.011)	(0.011)	(0.035)	(0.017)	(0.008)	(0.017)	(0.011)
Pct. Chg. Min. Wage (t–1)	0.006	0.005	0.019	0.013	0.000	0.026	–0.002
	(0.014)	(0.014)	(0.032)	(0.018)	(0.009)	(0.018)	(0.022)
Pct. Chg. Min. Wage (t+1)	0.008	0.008	0.060	0.009	–0.007	0.025	0.003
	(0.015)	(0.014)	(0.040)	(0.016)	(0.012)	(0.020)	(0.026)
Bartik Emp. Growth	0.641*	0.568	3.349***	1.028**	–0.094	1.187***	–0.327
	(0.338)	(0.348)	(0.722)	(0.431)	(0.319)	(0.406)	(0.493)
Memo:							
Two-year Min. Wage Effect†	0.020	0.010	0.030	0.036	0.013	0.053	0.074
P-value	[0.366]	[0.661]	[0.610]	[0.215]	[0.380]	[0.096]	[0.012]
Total Min. Wage Effect‡	0.027	0.017	0.090	0.045	0.005	0.078	0.076
P-value	[0.333]	[0.526]	[0.288]	[0.203]	[0.786]	[0.049]	[0.099]
Observations	405	405	405	405	405	405	405
Adjusted R^2	0.862	0.833	0.794	0.859	0.868	0.604	0.735

Notes: The estimates are based on the baseline equation $\Delta x^k_{i,t} = \alpha_i + \nu_t + \sum_{j=-1}^{1} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$, where the dependent variable is the percent change in consumption growth for the expenditure category indicated at the top of each column. The annual data cover 1999–2014. Core PCE excludes food and energy consumption. The estimates include location (CPI MSA) fixed effects as well as year effects. The percent change in the minimum wage when a CPI MSA spans different states is calculated based on the average (population-weighted) minimum wage in each location and year as discussed in the text. †Cumulative effect of the minimum wage change measured over two years (sum of contemporaneous and lagged effects); ‡Total effect of the minimum wage change including any anticipatory effect (sum of contemporaneous, lagged, and lead effects). Standard errors clustered by CPI MSA are in parentheses: * p<0.10, ** p<0.05, *** p<0.01.

TABLE 3: Minimum Wage Changes and Real Consumption Growth

	(1) Real PCE	(2) Real Core PCE	(3) Durables	(4) Services	(5) Food Away	(6) Food at Home
Pct. Chg. Min. Wage (t)	0.010	0.000	0.016	0.007	0.051***	0.030
	(0.010)	(0.013)	(0.039)	(0.011)	(0.014)	(0.020)
Pct. Chg. Min. Wage (t–1)	–0.007	–0.014	–0.020	–0.011	–0.016	0.027
	(0.014)	(0.013)	(0.036)	(0.014)	(0.029)	(0.024)
Pct. Chg. Min. Wage (t+1)	0.002	–0.001	0.051	–0.023	0.002	0.029
	(0.017)	(0.019)	(0.045)	(0.018)	(0.031)	(0.018)
Bartik Emp. Growth	1.060**	1.055*	4.049***	0.716	0.748	1.089**
	(0.504)	(0.540)	(1.083)	(0.492)	(0.657)	(0.462)
Memo:						
Two-year Min. Wage Effect†	0.003	–0.014	–0.004	–0.004	0.035	0.057
P-value	[0.872]	[0.490]	[0.954]	[0.836]	[0.309]	[0.057]
Total Min. Wage Effect‡	0.005	–0.014	0.047	–0.027	0.037	0.086
P-value	[0.846]	[0.603]	[0.615]	[0.326]	[0.485]	[0.009]
Observations	402	402	402	402	402	402
Adjusted R^2	0.716	0.743	0.739	0.639	0.709	0.450

Notes: The estimates are based on the baseline equation $\Delta x_{i,t}^k = \alpha_i + \nu_t + \sum_{j=-1}^{1} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$, where the dependent variable is the percent change in real consumption growth for the expenditure category indicated at the top of each column. The annual data cover 1999–2014. Core PCE excludes food and energy consumption. The estimates include location (CPI MSA) fixed effects as well as year effects. The percent change in the minimum wage when a CPI MSA spans different states is calculated based on the average (population-weighted) minimum wage in each location and year as discussed in the text. †Cumulative effect of the minimum wage change measured over two years (sum of contemporaneous and lagged effects); ‡Total effect of the minimum wage change including any anticipatory effect (sum of contemporaneous, lagged, and lead effects). Standard errors clustered by CPI MSA are in parentheses: * p<0.10, ** p<0.05, *** p<0.01.

TABLE 4: Robustness: Controlling for the Share of Low-Wage Workers

Panel A: Inflation Results

	(1) All	(2) All x Energy	(3) Core	(4) Dur	(5) Nondur	(6) Serv	(7) Food at Home	(8) Food Away	(9) HH Furnish
Pct. Chg. Min. Wage (t)	0.015*	0.017*	0.016	0.010	0.014*	0.014	0.009	0.034**	0.038*
	(0.007)	(0.009)	(0.010)	(0.012)	(0.008)	(0.012)	(0.016)	(0.013)	(0.022)
Heterogenous Treatment Effect [HTE] (t)	0.019	0.024*	0.027*	0.034*	0.010	0.022	0.010	0.016	0.031
	(0.014)	(0.013)	(0.015)	(0.018)	(0.015)	(0.021)	(0.015)	(0.019)	(0.029)
Bartik Emp. Growth	0.194	0.111	0.104	1.130***	0.607*	–0.276	0.184	–0.071	1.408*
	(0.365)	(0.342)	(0.366)	(0.400)	(0.308)	(0.548)	(0.276)	(0.436)	(0.727)
Memo:									
Two-year Min. Wage Effect†	0.028	0.033	0.034	0.046	0.021	0.022	0.010	0.049	0.068
P-value	[0.057]	[0.031]	[0.041]	[0.031]	[0.202]	[0.313]	[0.611]	[0.053]	[0.154]
Total Min. Wage Effect‡	0.028	0.033	0.034	0.046	0.021	0.022	0.010	0.049	0.068
P-value	[0.057]	[0.031]	[0.041]	[0.031]	[0.202]	[0.313]	[0.611]	[0.053]	[0.154]
Two-year HTE†	0.032	0.040	0.040	0.052	0.048	0.022	0.049	0.032	0.011
P-value	[0.204]	[0.110]	[0.144]	[0.104]	[0.017]	[0.535]	[0.046]	[0.207]	[0.841]
Total HTE‡	0.039	0.050	0.049	0.065	0.052	0.028	0.064	0.055	–0.010
P-value	[0.203]	[0.090]	[0.136]	[0.033]	[0.021]	[0.517]	[0.071]	[0.094]	[0.880]
Observations	401	401	401	401	401	401	401	401	401
Adjusted R^2	0.648	0.350	0.295	0.476	0.900	0.423	0.699	0.319	0.252

Panel B: Consumption Growth Results

	(1) PCE	(2) Core	(3) Dur	(4) Nondur	(5) Serv	(6) Food at Home	(7) Food Away
Pct. Chg. Min. Wage (t)	0.008	0.000	0.006	0.014	0.010	0.021	0.070***
	(0.012)	(0.011)	(0.038)	(0.017)	(0.008)	(0.018)	(0.013)
Heterogenous Treatment Effect [HTE] (t)	0.003	–0.001	–0.028	0.018	–0.001	0.011	0.012
	(0.011)	(0.011)	(0.031)	(0.016)	(0.009)	(0.021)	(0.015)
Bartik Emp. Growth 0.633*	0.572	3.397***	1.012**	–0.094	1.173***	–0.369	
	(0.345)	(0.363)	(0.692)	(0.437)	(0.339)	(0.404)	(0.480)
Memo:							
Two-year Min. Wage Effect†	0.016	0.007	0.030	0.030	0.011	0.049	0.068
P-value	[0.492]	[0.760]	[0.638]	[0.335]	[0.471]	[0.165]	[0.029]
Total Min. Wage Effect‡	0.022	0.012	0.077	0.041	0.002	0.074	0.069
P-value	[0.477]	[0.679]	[0.370]	[0.286]	[0.931]	[0.082]	[0.161]
Two-year HTE†	–0.011	–0.018	–0.058	–0.008	–0.010	–0.007	0.005
P-value	[0.611]	[0.452]	[0.305]	[0.773]	[0.597]	[0.815]	[0.796]
Total HTE‡	0.007	–0.001	–0.012	–0.001	0.003	0.003	0.030
P-value	[0.840]	[0.983]	[0.866]	[0.973]	[0.911]	[0.935]	[0.343]
Observations	405	405	405	405	405	405	405
Adjusted R^2	0.863	0.834	0.796	0.859	0.868	0.602	0.735

Notes: The estimates are based on the baseline equation $\Delta x^k_{i,t} = \alpha_i + \nu_t + \sum_{j=-1}^{1} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$. where the dependent variable is inflation (top panel) or the percent change in consumption growth (panel B) for the category noted at the top of each column. The annual data cover 1999–2014. Core PCE excludes food and energy consumption. The estimates include location (CPI MSA) fixed effects as well as year effects. The percent change in the minimum wage when a CPI MSA spans different states is calculated based on the average (population-weighted) minimum wage in each location and year as discussed in the text. †Cumulative effect of the minimum wage change measured over two years (sum of contemporaneous and lagged effects); ‡Total effect of the minimum wage change including any anticipatory effect (sum of contemporaneous, lagged, and lead effects). Standard errors clustered by CPI MSA are in parentheses: * p<0.10, ** p<0.05, *** p<0.01.

TABLE 5: Total Debt and Minimum Wage Changes

	(1) All	(2) Subprime	(3) Young	(4) Subprime Young
Pct. Chg. Min. Wage (t)	–0.042	–0.201***	0.007	–0.115*
	(0.042)	(0.068)	(0.048)	(0.056)
Pct. Chg. Min. Wage (t–1)	–0.051	–0.214*	0.039	–0.051
	(0.048)	(0.110)	(0.059)	(0.099)
Pct. Chg. Min. Wage (t+1)	–0.108	–0.311**	–0.043	–0.188*
	(0.073)	(0.115)	(0.088)	(0.100)
Bartik Empl. Growth	–1.486	–0.670	0.678	0.699
	(3.814)	(2.901)	(4.384)	(2.892)
Memo:				
Two-year Min. Wage Effect†	–0.093	–0.415	0.046	–0.166
P-Value	[0.254]	[0.021]	[0.641]	[0.255]
Total Min. Wage Effect‡	–0.201	–0.726	0.003	–0.354
P-Value	[0.151]	[0.010]	[0.985]	[0.124]
Observations	405	405	405	405
Adjusted R^2	0.686	0.630	0.676	0.651

Source: NY Fed Consumer Credit Panel/Equifax.

Notes: The estimates are based on the baseline equation $\Delta x^k_{i,t} = \alpha_i + \nu_t + \sum_{j=-1}^{1} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$, where the dependent variable is the percent change in total debt balances for the borrower group indicated at the top of each column. The annual data cover 1999–2014. The estimates include location (CPI MSA) fixed effects as well as year effects. The percent change in the minimum wage when a CPI MSA spans different states is calculated based on the average (population-weighted) minimum wage in each location and year as discussed in the text. †Cumulative effect of the minimum wage change measured over two years (sum of contemporaneous and lagged effects); ‡Total effect of the minimum wage change including any anticipatory effect (sum of contemporaneous, lagged, and lead effects). Standard errors clustered by CPI MSA are in parentheses: * p<0.10, ** p<0.05, *** p<0.01.

TABLE 6: Auto Loans and Minimum Wage Changes

	(1) All	(2) Subprime	(3) Young	(4) Subprime Young
Pct. Chg. Min. Wage (t)	0.093**	0.124**	0.114**	0.126**
	(0.044)	(0.046)	(0.046)	(0.051)
Pct. Chg. Min. Wage (t–1)	–0.131*	–0.160**	–0.137	–0.126
	(0.072)	(0.075)	(0.083)	(0.085)
Pct. Chg. Min. Wage (t+1)	0.008	–0.054	–0.004	–0.075
	(0.098)	(0.092)	(0.097)	(0.091)
Bartik Empl. Growth	0.021	–0.277	1.001	0.724
	(3.222)	(2.626)	(3.782)	(3.291)
Memo:				
Two-year Min. Wage Effect†	–0.038	–0.037	–0.023	–0.000
P-Value	[0.684]	[0.704]	[0.808]	[1.000]
Total Min. Wage Effect‡	–0.030	–0.091	–0.027	–0.075
P-Value	[0.847]	[0.569]	[0.860]	[0.648]
Observations	405	405	405	405
Adjusted R^2	0.743	0.734	0.735	0.740

Source: NY Fed Consumer Credit Panel/Equifax.

Notes: The estimates are based on the baseline equation $\Delta x^k_{i,t} = \alpha_i + \nu_t + \sum_{j=-1}^{1} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$, where the dependent variable is the percent change in auto loan balances for the borrower group indicated at the top of each column. The annual data cover 1999–2014. The estimates include location (CPI MSA) fixed effects as well as year effects. The percent change in the minimum wage when a CPI MSA spans different states is calculated based on the average (population-weighted) minimum wage in each location and year as discussed in the text. †Cumulative effect of the minimum wage change measured over two years (sum of contemporaneous and lagged effects); ‡Total effect of the minimum wage change including any anticipatory effect (sum of contemporaneous, lagged, and lead effects). Standard errors clustered by CPI MSA are in parentheses: * p<0.10, ** p<0.05, *** p<0.01.

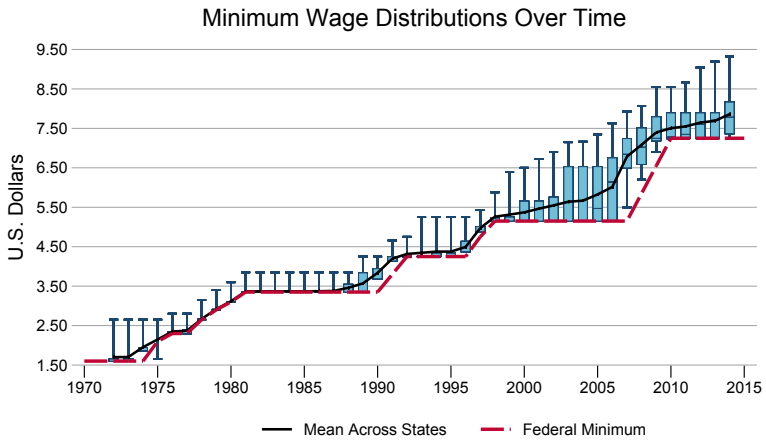
TABLE 7: Success in Credit Applications, the Subprime Share, and Minimum Wage Changes

	(1)	(2)	(3)	(4)	(5)
	Success Rate				Change
	Total Sample	Subprime	Young	Subprime Young	Subprime Share
Pct. Chg. Min. Wage (t)	0.059**	0.061*	0.092**	0.087**	–0.011*
	(0.027)	(0.030)	(0.034)	(0.037)	(0.006)
Pct. Chg. Min. Wage (t–1)	0.051	0.087*	0.093*	0.111**	–0.012**
	(0.040)	(0.047)	(0.050)	(0.048)	(0.006)
Pct. Chg. Min. Wage (t+1)	0.073*	0.063*	0.143***	0.147***	–0.015**
	(0.037)	(0.035)	(0.045)	(0.045)	(0.006)
Bartik Empl. Growth	–3.761	–2.418	–3.943	–2.064	–0.068
	(2.431)	(2.383)	(2.968)	(2.460)	(0.154)
Memo:					
Two-year Min. Wage Effect†	0.111	0.148	0.185	0.198	–0.023
P-Value	[0.079]	[0.049]	[0.024]	[0.019]	[0.028]
Total Min. Wage Effect‡	0.184	0.211	0.328	0.345	–0.038
P-Value	[0.032]	[0.028]	[0.004]	[0.003]	[0.008]
Observations	405	405	405	405	405
Adjusted R^2	0.915	0.875	0.890	0.857	0.530

Source: NY Fed Consumer Credit Panel/Equifax.

Notes: The estimates are based on the baseline equation $\Delta x^k_{i,t} = \alpha_i + \nu_t + \sum_{j=-1}^{1} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$, where the dependent variable is the credit application success rate for the borrower group indicated at the top of each column. The annual data cover 1999–2014. The estimates include location (CPI MSA) fixed effects as well as year effects. The percent change in the minimum wage when a CPI MSA spans different states is calculated based on the average (population-weighted) minimum wage in each location and year as discussed in the text. †Cumulative effect of the minimum wage change measured over two years (sum of contemporaneous and lagged effects); ‡Total effect of the minimum wage change including any anticipatory effect (sum of contemporaneous, lagged, and lead effects). Standard errors clustered by CPI MSA are in parentheses: * p<0.10, ** p<0.05, *** p<0.01.

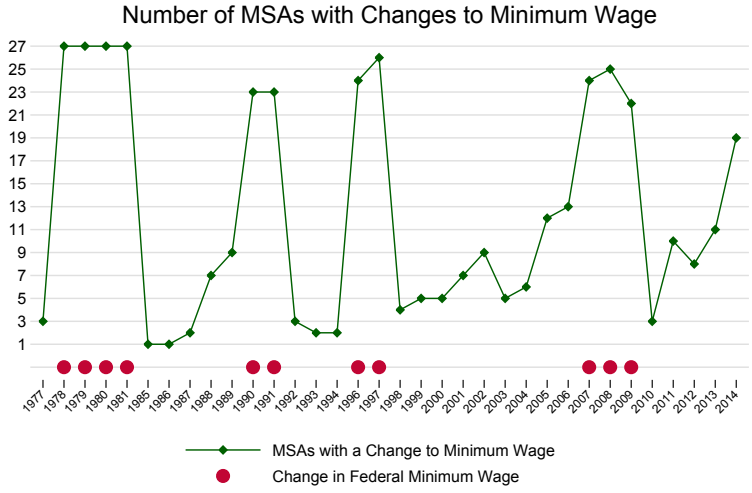
FIGURE 1: The Effective (Nominal) Minimum Wage over Time



Note: The bars indicate the 25th, 50th, and 75th percentiles of the minimum wage across all 50 states, and the whiskers indicate minimum and maximum values.

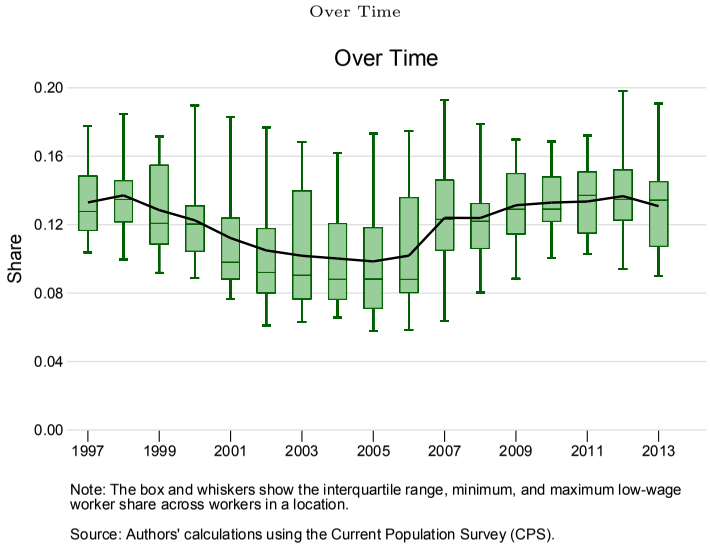
Source: Minimum wage data come from the Tax Policy Center (Urban Institute and Brookings Institution) and Federal and State Departments of Labor.

FIGURE 2: The Timing of Minimum Wage Changes



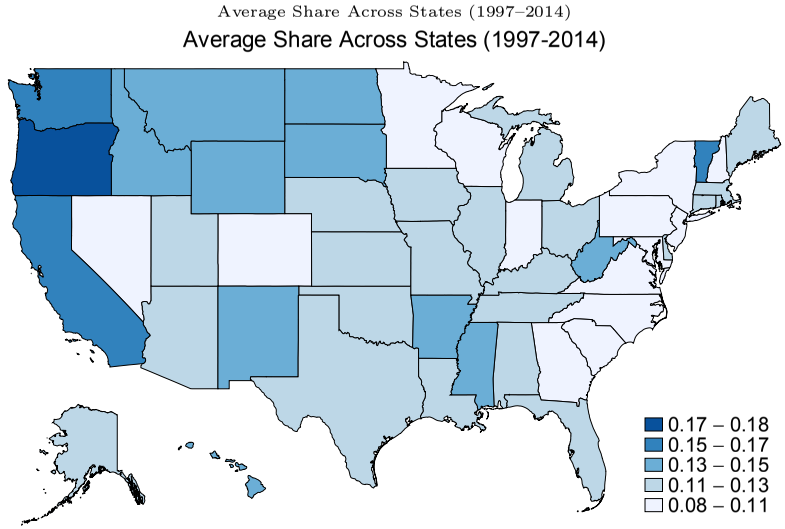
Source: Minimum wage data come from the Tax Policy Center (Urban Institute and Brookings Institution) and federal and state departments of labor.

FIGURE 3: Share of Low-Wage Workers



Note: The box and whiskers show the interquartile range, minimum, and maximum low-wage worker share across workers in a location.

Source: Authors' calculations using the Current Population Survey (CPS).



Source: Authors' calculations using Current Population Survey (CPS) data.

A Appendix

List of Metropolitan Statistical Areas with CPI Data

(1) Anchorage, (2) Atlanta, (3) Boston-Brockton-Nashua, (4) Chicago-Gary-Kenosha, (5) Cincinnati-Hamilton, (6) Cleveland-Akron, (7) Dallas-Fort Worth, (8) Denver-Boulder-Greeley, (9) Detroit-Ann Arbor-Flint, (10) Honolulu, (11) Houston-Galveston-Brazoria, (12) Kansas City, (13) Los Angeles-Riverside-Orange County, (14) Miami-Fort Lauderdale, (15) Milwaukee-Racine, (16) Minneapolis-St. Paul, (17) New York-Northern New Jersey-Long Island, (18) Philadelphia-Wilmington-Atlantic City, (19) Phoenix-Mesa, (20) Pittsburgh, (21) Portland-Salem, (22) San Diego, (23) San Francisco-Oakland-San Jose, (24) Seattle-Tacoma-Bremerton, (25) St. Louis, (26) Tampa-St. Petersburg-Clearwater, and (27) Washington-Baltimore.

Alternative Controls for Local (Potentially Unobserved) Economic Conditions

In this Appendix, we consider alternative controls for local economic conditions. A potential concern with our analysis is that, while there is a lot of variation in minimum wages across the United States, minimum wage levels and policy changes may not be randomly distributed across states or time. States and/or regions of the country may differ along dimensions other than their minimum wage policies, so there are potential drawbacks to using MSA-level (or state-level) data to estimate the effects of minimum wage changes. In particular, unobserved regional or national factors that are correlated with inflation or consumption may also drive changes in minimum wages. Two-way fixed effects models (with a fixed effect for each year and for each MSA or state)—like in our baseline specification—have been the traditional approach used in the literature to deal with these confounding factors. However, such models do not control for any type of pre-existing, location-specific trends in the explanatory variable of interest (for example, employment growth). Indeed, much of the recent debate in the minimum wage and employment literature focuses on whether one should control for pre-existing trends in the data or whether doing so "throws away" too much valid identifying information—see, for example, the debate between Neumark, Salas, and Wascher (2014) and Allegretto et al. (2017). Typically, controlling for pre-trends in a two-way fixed effects model lowers the estimated employment effect of a given minimum wage increase.

Totty (Forthcoming) approaches controlling for unobserved factors somewhat differently by relying on factor model estimators (interactive effects as opposed to additive effects) following the work of Pesaran (2006) and Bai (2009). In a macroeconomic setting, interactive fixed effects capture common shocks with potential heterogeneous effects on the cross-sectional unit being analyzed. Bai (2009) estimates the common (shocks) factors (and factor loadings) directly, and one difficulty in implementing his method is

choosing the correct number of factors.[48] In contrast, Pesaran (2006) uses additional regressors to proxy for the common factors. His estimator calls for the inclusion of the cross-sectional averages of the dependent and independent variables as additional controls.

We check the robustness of our results to unobserved factors using two alternative estimation approaches: (1) including census region-by-period fixed effects instead of just time fixed effects in our baseline estimates; (2) using the estimator proposed by Bai (2009).[49] The results in Table A.1 Panel A incorporate region-by-period fixed effects in our estimates, in addition to the CPI-MSA fixed effects.[50] The estimated impact of a minimum wage change on food prices barely changes when including these additional controls; however, we obtain larger (and statistically significant) minimum wage effects for the broader CPI categories (all, all excluding energy, and core) and services—more consistent with the regressions that allowed for HTE. Nevertheless, the estimated effects of minimum wage increases on local-aggregate prices remain small. The largest estimated price effect (including leads and lags) is for services: a 10 percent increase in the minimum wage leads to services that are priced about 0.8 percent higher over a two-year period.[51]

The results using the proposed estimator by Bai (2009) are reported in Panel B of Table A.1. We use four common factors in the regressions to avoid over-identification, but the results are not very sensitive to the exact number of factors used (particularly for the food inflation categories).[52] The estimated impact of minimum wage changes on

[48] In Bai (2009), the estimation model is $Y_{it} = X'_{it}\beta + u_{it}$ and $u_{it} = \lambda'_i F_t + \epsilon_{it}$, where λ'_i is a vector of factor loadings and F_t is a vector of common factors. The two-way fixed effects model is a special case of this more general interactive effects model with $F_t = \left[\begin{smallmatrix} 1 \\ v_t \end{smallmatrix}\right]$, and $\lambda_i = \left[\begin{smallmatrix} \alpha_i \\ 1 \end{smallmatrix}\right]$.

[49] The method in Pesaran (2006) requires a large N and a large T setting, and may not be best suited for our relatively small panel.

[50] MSA or state-specific time trends are often added as well if the independent variable is in levels. Since our independent variable (inflation or consumption growth) is already a growth rate, the MSA-level fixed effects should capture pre-existing, MSA-specific growth trends.

[51] This larger effect contrasts with the typical smaller effects obtained when including region by period fixed effects with employment as the outcome of interest.

[52] We use the *regife* command in Stata to implement Bai (2009).

food away prices are of very similar magnitude to our previous estimates for the two-year period. The main difference compared to our baseline results is that we now obtain a more distributed effect over the year following a minimum wage increase.

Applying these methods to the consumption growth regressions, shown in Table A.2, does not really affect our conclusions. The estimated effect of minimum wage changes on food spending are remarkably similar to our baseline specification. In addition, the effects of a minimum wage increase on food spending do not become smaller when using these alternative methods. Finally, the effect of minimum wage increases on durable purchases is more precisely estimated.

TABLE A.1: Minimum Wage Changes and Inflation. Further Robustness Analysis

	(1) All	(2) All x Energy	(3) Core	(4) Dur	(5) Nondur	(6) Serv	(7) Food Home	(8) Food Away	(9) HH Furn.
	PANEL A: REGION × YEAR FIXED EFFECTS AND CPI-MSA FIXED EFFECTS								
Pct. Chg. Min. Wage (t)	0.018*	0.024**	0.025*	0.002	0.008	0.026	–0.002	0.033**	0.026
	(0.010)	(0.011)	(0.013)	(0.014)	(0.008)	(0.016)	(0.015)	(0.012)	(0.028)
Pct. Chg. Min. Wage (t–1)	0.023**	0.025**	0.030**	0.026*	0.001	0.030*	–0.008	0.011	0.036
	(0.010)	(0.011)	(0.013)	(0.015)	(0.012)	(0.016)	(0.016)	(0.015)	(0.030)
Pct. Chg. Min. Wage (t+1)	0.011	0.014	0.018*	–0.003	–0.015	0.025	–0.011	0.003	–0.007
	(0.010)	(0.009)	(0.010)	(0.019)	(0.010)	(0.018)	(0.012)	(0.015)	(0.024)
Bartik Emp. Growth	0.289	0.136	0.192	1.337***	0.531*	–0.066	0.039	–0.484	1.970***
	(0.430)	(0.406)	(0.431)	(0.343)	(0.294)	(0.631)	(0.354)	(0.486)	(0.611)
Memo:									
Two-year Min. Wage Effect†	0.041	0.049	0.055	0.028	0.009	0.056	–0.009	0.044	0.062
P-value	[0.016]	[0.014]	[0.015]	[0.073]	[0.569]	[0.057]	[0.603]	[0.062]	[0.151]
Total Min. Wage Effect‡	0.051	0.064	0.073	0.025	–0.006	0.081	–0.020	0.048	0.056
P-value	[0.017]	[0.009]	[0.007]	[0.339]	[0.766]	[0.044]	[0.325]	[0.113]	[0.288]
R^2	0.736	0.507	0.463	0.600	0.931	0.561	0.783	0.462	0.436
	PANEL B: COMMON FACTOR MODEL. BAI (2009)								
Pct. Chg. Min. Wage (t)	–0.005	–0.002	–0.012	–0.007	0.005	–0.017	0.001	0.019*	0.003
	(0.011)	(0.014)	(0.016)	(0.019)	(0.011)	(0.014)	(0.017)	(0.010)	(0.033)
Pct. Chg. Min. Wage (t–1)	–0.010	–0.013	–0.011	–0.008	–0.006	–0.023	–0.011	0.028*	0.047*
	(0.012)	(0.009)	(0.009)	(0.020)	(0.011)	(0.017)	(0.022)	(0.016)	(0.023)
Pct. Chg. Min. Wage (t+1)	0.006	0.005	0.004	–0.005	–0.016	0.013	–0.018	–0.000	–0.027
	(0.011)	(0.011)	(0.012)	(0.021)	(0.013)	(0.018)	(0.014)	(0.014)	(0.030)
Bartik Emp. Growth	–0.160	0.118	–0.240	–0.208	0.757***	–0.696**	0.217	0.064	–0.049
	(0.147)	(0.109)	(0.215)	(0.316)	(0.149)	(0.303)	(0.148)	(0.144)	(0.308)
Memo:									
Two-year Min. Wage Effect†	–0.015	–0.015	–0.022	–0.015	–0.002	–0.010	–0.002	0.046	0.050
P-value	[0.380]	[0.391]	[0.241]	[0.625]	[0.721]	[0.096]	[0.905]	[0.013]	[0.226]
Total Min. Wage Effect‡	–0.009	–0.011	–0.019	–0.020	–0.018	–0.028	–0.010	0.046	0.023
P-value	[0.671]	[0.662]	[0.476]	[0.534]	[0.378]	[0.434]	[0.574]	[0.048]	[0.669]
Observations	401	401	401	401	401	401	401	401	401

Notes: The estimates in Panel A are based on the baseline equation $\Delta x^k_{i,t} = \alpha_i + \lambda_l \times \nu_t + \sum_{j=-1}^{1} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$, where the dependent variable is inflation for the category noted at the top of each column, and l denotes a census region. The annual data cover 1998–2014. Core PCE excludes food and energy consumption. Estimates include location (CPI MSA) fixed effects as well as region × year fixed effects. The percent change in the minimum wage when a CPI MSA spans different states is calculated based on the average (population-weighted) minimum wage in each location and year as discussed in the text. MSA employment growth is instrumented using a Bartik instrument. The estimates in Panel B are based on Bai's (2009) estimator: $\Delta x^k_{i,t} = \lambda_i' F_t + \sum_{j=-J_1}^{J_2} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$, using four common factors. †Cumulative effect of the minimum wage change measured over two years (sum of contemporaneous and lagged effects); ‡Total effect of the minimum wage change including any anticipatory effect (sum of contemporaneous, lagged, and lead effects). Standard errors clustered by CPI MSA are in parentheses: * p<0.10, ** p<0.05, *** p<0.01.

TABLE A.2: Minimum Wage Changes and Consumption. Further Robustness Analysis

	(1) Total PCE	(2) Core PCE	(3) Dur.	(4) Nondur.	(5) Serv.	(6) Food at Home	(7) Food Away
	PANEL A: REGION × YEAR FIXED EFFECTS AND CPI-MSA FIXED EFFECTS						
Pct. Chg. Min. Wage (t)	0.026**	0.018*	0.022	0.030**	0.022**	0.024	0.086***
	(0.009)	(0.010)	(0.033)	(0.012)	(0.009)	(0.014)	(0.009)
Pct. Chg. Min. Wage (t–1)	–0.000	–0.002	–0.021	0.002	0.003	0.025	–0.001
	(0.017)	(0.017)	(0.033)	(0.022)	(0.013)	(0.023)	(0.030)
Pct. Chg. Min. Wage (t+1)	0.031*	0.033*	0.108**	0.027	0.014	0.041	0.034
	(0.018)	(0.018)	(0.046)	(0.018)	(0.015)	(0.025)	(0.029)
Bartik Emp. Growth	0.127	0.089	2.300***	0.293	–0.369	0.668	–0.740*
	(0.338)	(0.362)	(0.684)	(0.525)	(0.326)	(0.436)	(0.386)
Memo:							
Two-year Min. Wage Effect†	0.025	0.017	0.001	0.032	0.025	0.050	0.084
P-value	[0.295]	[0.517]	[0.986]	[0.257]	[0.194]	[0.121]	[0.019]
Total Min. Wage Effect‡	0.057	0.050	0.109	0.059	0.039	0.090	0.118
P-value	[0.079]	[0.141]	[0.200]	[0.055]	[0.162]	[0.025]	[0.015]
Adjusted R^2	0.889	0.864	0.847	0.875	0.882	0.642	0.782
	PANEL B: COMMON FACTORS MODEL. BAI (2009)						
Pct. Chg. Min. Wage (t)	0.005	–0.003	0.020	0.015	0.010	0.006	0.087***
	(0.010)	(0.012)	(0.035)	(0.014)	(0.012)	(0.015)	(0.017)
Pct. Chg. Min. Wage (t–1)	–0.020	–0.015	0.015	–0.007	–0.005	0.013	–0.017
	(0.014)	(0.013)	(0.029)	(0.021)	(0.011)	(0.017)	(0.023)
Pct. Chg. Min. Wage (t+1)	–0.002	–0.009	0.048*	0.001	–0.018*	0.009	0.009
	(0.010)	(0.012)	(0.028)	(0.021)	(0.009)	(0.025)	(0.023)
Bartik Emp. Growth	–0.202	–0.079	1.459***	0.589	0.002	0.309	1.811***
	(0.346)	(0.265)	(0.478)	(0.352)	(0.281)	(0.289)	(0.499)
Memo:							
Two-year Min. Wage Effect†	–0.015	–0.018	0.035	0.009	0.006	0.019	0.070
P-value	[0.455]	[0.395]	[0.430]	[0.653]	[0.789]	[0.360]	[0.036]
Total Min. Wage Effect‡	–0.016	–0.027	0.083	0.010	–0.013	0.028	0.079
P-value	[0.534]	[0.354]	[0.155]	[0.761]	[0.606]	[0.239]	[0.138]
Observations	405	405	405	405	405	405	405

Notes: The estimates in Panel A are based on the baseline equation $\Delta x^k_{i,t} = \alpha_i + \lambda_l \times \nu_t + \sum_{j=-1}^{1} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$, where the dependent variable is the percent change in nominal consumption growth for the category noted at the top of each column, and l denotes a census region. The annual data cover 1998–2014. The estimates include location (CPI MSA) fixed effects as well as region × year fixed effects. The percent change in the minimum wage when a CPI MSA spans different states is calculated based on the average (population-weighted) minimum wage in each location and year as discussed in the text. MSA employment growth is instrumented using a Bartik instrument. The estimates in Panel B are based on Bai's (2009) estimator: $\Delta x^k_{i,t} = \lambda_i' F_t + \sum_{j=-1}^{1} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$, using four common factors. †Cumulative effect of the minimum wage change measured over two years (sum of contemporaneous and lagged effects); ‡Total effect of the minimum wage change including any anticipatory effect (sum of contemporaneous, lagged, and lead effects). Standard errors clustered by CPI MSA are in parentheses: * p<0.10, ** p<0.05, *** p<0.01.

CPI Results without Bartik Employment Growth

TABLE A.3: Baseline: Minimum Wage Changes and Inflation. No Control for Economic Conditions

	(1) All	(2) All	(3) Core	(4) Dur	(5) Nondur	(6) Serv	(7) Food at Home	(8) Food Away	(9) HH Furnish
Pct. Chg. Min. Wage (t)	0.009	0.011	0.009	–0.003	0.007	0.011	0.006	0.032***	0.032
	(0.007)	(0.009)	(0.010)	(0.013)	(0.007)	(0.012)	(0.015)	(0.010)	(0.020)
Pct. Chg. Min. Wage (t–1)	0.014	0.017	0.019	0.031*	–0.001	0.014	–0.002	0.016	0.041
	(0.011)	(0.011)	(0.013)	(0.018)	(0.013)	(0.015)	(0.014)	(0.015)	(0.036)
Pct. Chg. Min. Wage (t+1)	0.006	0.007	0.008	0.003	–0.017*	0.016	–0.003	0.002	0.014
	(0.011)	(0.011)	(0.013)	(0.020)	(0.010)	(0.015)	(0.011)	(0.011)	(0.022)
Memo:									
Two-year Min. Wage Effect†	0.023	0.028	0.028	0.028	0.006	0.025	0.004	0.047	0.073
P-value	[0.117]	[0.070]	[0.096]	[0.201]	[0.738]	[0.260]	[0.799]	[0.017]	[0.105]
Total Min. Wage Effect‡	0.029	0.034	0.036	0.031	–0.012	0.040	0.002	0.050	0.086
P-value	[0.136]	[0.086]	[0.096]	[0.280]	[0.611]	[0.146]	[0.938]	[0.046]	[0.091]
Observations	424	424	424	424	424	424	424	424	424
Adjusted R^2	0.642	0.332	0.286	0.448	0.895	0.413	0.663	0.305	0.254

Notes: The estimates are based on the baseline equation $\Delta x^k_{i,t} = \alpha_i + \nu_t + \sum_{j=-1}^{1} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$, where the dependent variable is inflation (price growth) for the CPI category indicated at the top of each column. The annual data cover 1997–2014. The estimates include location (CPI MSA) fixed effects as well as year effects. The percent change in the minimum wage when a CPI MSA spans different states is calculated based on the average (population-weighted) minimum wage in each location and year as discussed in the text. †Cumulative effect of the minimum wage change measured over two years (sum of contemporaneous and lagged effects); ‡Total effect of the minimum wage change including any anticipatory effect (sum of contemporaneous, lagged, and lead effects). Standard errors clustered by CPI MSA are in parentheses: * p<0.10, ** p<0.05, *** p<0.01.

CPI Results Using All Available Data

TABLE A.4: Minimum Wage Changes and Inflation. Full Sample

	(1) All	(2) All	(3) Core	(4) Dur	(5) Nondur	(6) Serv	(7) Food at Home	(8) Food Away	(9) HH Furnish
Pct. Chg. Min. Wage (t)	0.015**	0.017**	0.015	0.004	0.016**	0.016	0.011	0.046***	0.043**
	(0.007)	(0.008)	(0.009)	(0.012)	(0.007)	(0.009)	(0.014)	(0.013)	(0.020)
Pct. Chg. Min. Wage (t-1)	0.015	0.019*	0.024*	0.022	–0.008	0.023*	–0.023	0.018	0.035
	(0.010)	(0.010)	(0.012)	(0.015)	(0.010)	(0.014)	(0.014)	(0.014)	(0.034)
Pct. Chg. Min. Wage (t+1)	0.013*	0.015*	0.016*	–0.003	–0.011	0.027***	0.008	0.006	–0.002
	(0.007)	(0.007)	(0.008)	(0.013)	(0.010)	(0.010)	(0.011)	(0.011)	(0.022)
Memo:									
Two-year Min. Wage Effect†	0.030	0.036	0.039	0.026	0.009	0.039	–0.011	0.064	0.078
P-value	[0.028]	[0.013]	[0.016]	[0.167]	[0.522]	[0.045]	[0.490]	[0.008]	[0.080]
Total Min. Wage Effect‡	0.043	0.050	0.056	0.023	–0.002	0.066	-0.003	0.070	0.075
P-value	[0.012]	[0.006]	[0.006]	[0.301]	[0.906]	[0.005]	[0.874]	[0.010]	[0.179]
Observations	767	767	767	767	767	767	767	767	767
Adjusted R^2	0.644	0.584	0.564	0.662	0.867	0.436	0.630	0.299	0.278

Notes: The estimates are based on the baseline equation $\Delta x^k_{i,t} = \alpha_i + \nu_t + \sum_{j=-1}^{1} \beta(j)\Delta w_{i,t-j} + \eta y_{i,t} + e_{i,t}$, where the dependent variable is inflation (top panel) or the percent change in consumption growth (panel B) for the category noted at the top of each column. The annual data cover 1983–2014. Core PCE excludes food and energy consumption. The estimates include location (CPI MSA) fixed effects as well as year effects. The percent change in the minimum wage when a CPI MSA spans different states is calculated based on the average (population-weighted) minimum wage in each location and year as discussed in the text. †Cumulative effect of the minimum wage change measured over two years (sum of contemporaneous and lagged effect); ‡Total effect of the minimum wage change including any anticipatory effect (sum of contemporaneous, lagged effect, and lead effect). Standard errors are in parentheses: * p<0.10, ** p<0.05, *** p<0.01.

Summary Statistics

TABLE A.5: Summary Statistics: CPI Inflation and Its Components

	Total	Less Energy	Core	Dur.	Nondur.	Serv.	Food at Home	Food Away	HH Furnishing
Min	–2.643	–0.716	–1.190	–5.740	–6.754	–1.196	–2.037	–1.715	–5.787
Max	5.845	5.349	5.478	8.279	9.080	8.012	8.545	7.826	7.541
p50	2.564	2.128	2.011	-0.827	3.273	2.732	2.337	2.719	0.105
Mean	2.443	2.155	2.065	-0.769	2.901	2.804	2.540	2.817	0.017
sd	1.238	0.921	0.998	1.666	2.569	1.399	1.944	1.245	2.151

TABLE A.6: Summary Statistics: PCE Growth and Its Components

	Total	Core	Dur.	Nondur.	Serv.	Food at Home	Food Away	Housing
Min	–3.467	–2.456	–13.001	–7.012	–1.200	–3.446	–4.895	–0.893
Max	10.407	10.402	13.199	12.888	10.476	11.315	12.326	10.478
p50	4.515	4.380	4.059	5.018	4.793	4.102	4.484	4.570
Mean	4.505	4.455	3.222	4.584	4.666	3.917	4.497	4.541
sd	2.413	2.231	4.931	3.362	2.093	2.416	2.868	2.242

TABLE A.7: Summary Statistics: Debt Changes and Success Rates

Panel A: Total Debt Change

	All	Subprime	Young	Subprime Young
Min	–10.152	–23.232	–19.414	–26.052
Max	119.995	130.152	118.425	122.804
p50	4.928	3.888	3.314	2.377
Mean	7.033	5.134	4.942	3.263
sd	12.996	14.649	13.686	14.236

Panel B: Auto Debt Change

	All	Subprime	Young	Subprime Young
Min	–12.189	–16.578	–17.839	–21.166
Max	128.594	136.403	128.701	137.017
p50	5.341	4.607	3.822	3.702
Mean	7.824	6.164	6.214	4.917
sd	15.133	15.555	15.607	16.629

Panel C: Success Rate and Change in Subprime Share

	Success Rate				Change
	All	Subprime	Young	Subprime Young	Δ Subprime Share
Min	46.035	31.776	44.125	35.388	–2.853
Max	129.708	105.773	132.898	109.105	2.325
p50	73.490	51.059	70.887	56.440	–0.366
Mean	74.944	53.654	72.726	58.411	–0.347
sd	15.647	12.982	16.221	13.177	0.617

Source: NY Fed Consumer Credit Panel/Equifax.