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ABSTRACT

Using new employer-employee matched data, this paper investigates the impact of uncertainty, as measured by idiosyncratic stock market volatility, on individual outcomes. We find that firms provide at best partial insurance to their workers. An increase in firm-level uncertainty is associated with a decline in total compensation, especially in variable pay. In turn, individuals reduce their durable goods consumption in response to these uncertainty shocks. These shocks also lead to greater financial fragility among lower-income earners. We also construct a new county-level uncertainty shock and find that local uncertainty shocks reduce county level durable consumption.

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1. Introduction

Common narratives identify uncertainty as a powerful driver of economic fluctuations. Greater uncertainty can, for instance, increase the real option value of delaying difficult-to-reverse investment and hiring decisions, shaping employment and investment dynamics (Bernanke (1983), Abel and Eberly (1994), and Bloom (2009)). Uncertainty can also increase the demand for precautionary saving and liquidity, affecting economic activity and credit usage (Bertola, Guiso and Pistaferri (2005), and Gourinchas and Parker (2002)). The effects of uncertainty can also operate directly through credit markets: Higher uncertainty or risk can lower collateral values and increase credit spreads in the presence of financial frictions, limiting the supply of credit to entrepreneurs and consumers, again slowing economic activity (Christiano, Motto, and Rostagno (2014)).

The effects of uncertainty are also posited to be especially large around sudden rare events that disrupt economic relationships and induce dramatic changes in economic policy. For example, the heightened uncertainty post-2009, as banks and consumers adapted to a changed economic and regulatory climate, has been blamed for that period's anemic consumption and growth (Pistaferri (2016)). Similarly, these arguments observe that the recent COVID-19 pandemic, characterized by an unprecedented increase in uncertainty over future cash flows and stock market volatility, could have longer run consequences for consumption and economic activity. Thus, research into how uncertainty might affect consumer economic decisions and overall economic activity is of particular importance, especially research that can identify the pass-through of uncertainty from firms to employees.

However, as with narratives, the aggregate evidence is difficult to interpret causally, and the transmission mechanism to households remains poorly understood. There are at least two principal challenges to identifying the effects of uncertainty on individuals' consumption and savings decisions. First, uncertainty is usually measured in the aggregate. Indexes such as the VIX, which are useful when characterizing an economy-wide response to turbulence, do not provide sufficient local variation to identify an individual's response to uncertainty. Second, uncertainty might endogenously co-move with "first moment" shocks (Benhabib, Lu and Wang (2016)). For instance, policy-related uncertainty usually increases after a period of weak economic activity, as governments experiment with new policies. This makes it especially difficult to credibly disentangle the effects of uncertainty on consumption decisions from the first moment negative shocks that drive these decisions. In part because of these challenges, much of the existing literature has focused on firms' investment and the

overall effect on aggregate fluctuations.[1]

To help overcome these challenges, this paper investigates the impact of uncertainty on consumer outcomes using a unique dataset that is updated monthly and covers about 30 percent of the existing labor force in the US. A key advantage of our data is that having detailed firm level employment data allows us to study the impact of firm specific uncertainty shocks on its workers. Another advantage is that we observe key credit outcomes sourced from credit reports for all workers at these firms. Together, this information helps us investigate the pass-through of firms' uncertainty shocks on workers' income and consumption decisions. It also allows us to use the variation in credit attributes and other worker observables to identify heterogeneous responses across workers operating within the same firm, all the while controlling for most first moment shocks that simultaneously affect these firms.

Intuitively, we focus on the time-variation in idiosyncratic firm-level risk rather than market-wide dislocations, and building on recent contributions in the literature, we use the stock returns residuals after taking into account the three Fama-French factors (Gilchrist, Sim, and Zakrajšek, 2014; Alfaro, Bloom and Lin (2019)). Furthermore, we always control for the first moment shock as captured by stock returns in order to disentangle the effect of uncertainty from these other relevant shocks. Our analysis first validates this residuals-based uncertainty measure at the firm level, showing that firms reduce their capital expenditures in response to increased uncertainty. These results are not an artifact of the sample of firms in our dataset. We report the same tests for the universe of public firms available in Compustat, and find estimated coefficients that are indistinguishable across the two samples. We then explore the additional outcomes for our subset of firms. In line with the hypothesis that periods of high uncertainty are associated with higher employment risk, employment declines significantly, as a one standard deviation increase in uncertainty reduces employment by 8.9 percent. Uncertainty shocks also increase tail events: An uncertainty shock increase the probability of experiencing an employment reduction of 13 percent. These effects are driven by a combination of reduction in new hires and an increase in termination rates.

We then explore the impact of firm-level uncertainty on wages. Some previous studies have argued that firms are best able to offer insurance to their workers by absorbing these shocks, which would result in a small or insignificant elasticity of wages to uncertainty. In contrast to this hypothesis,

[1]See, for example, Kellog (2018) and the survey in Bloom (2014); Bertola, Guiso and Pistaferri (2005) is a notable exception that focuses on consumer durable goods.

we find that wages decline significantly in response to uncertainty shocks. The main margin of adjustment is variable pay, i.e. the bonuses and commissions, rather than the base pay. In keeping with the variable pay margin of adjustment, we find that the standard deviation of wages within the firm decreases as well. Finally, we can ask whether the wage cuts are equally distributed across workers. We find that these effects are concentrated among the top earners at the firm. One might be concerned that our results might be affected by workers with a higher risk-bearing capacity who self-select into riskier firms. But our results only exploit within-firm variation and are not easily explained by the selection of workers into firms.

We first investigate the impact of uncertainty shocks on job losses. We find that a one standard deviation increase in uncertainty is associated with 1 percent increase in involuntary job losses. This is equivalent to an 18 percentage point increase in the probability of job loss, from the baseline of 5.5 percent. Our main results center on the pass-through of uncertainty shocks from firms to the wages of individual employees. Consistent with the previous evidence, we confirm that firms only imperfectly insure their workers. In fact, a one standard deviation increase in uncertainty leads to a reduction in wages of about 2.4 percent. Furthermore, these effects are economically meaningful, as the probability of experiencing a reduction in income of at least ten percent is significantly higher when uncertainty is higher. This effect is indeed driven by a reduction in workers' variable pay. To isolate the effect of uncertainty, all specifications include time, firm and individual fixed effects. In addition, to absorb non-parametrically all time-varying local economic shocks, we also include county by time fixed effects in the most conservative specification. In this way, we are comparing the outcomes for two individuals living in the same area at the same time, earning similar wages in the previous year, but exposed to different uncertainty shocks.

Having established the impact of uncertainty shocks on workers income, we turn to the effects on their consumption. Although we do not have a comprehensive measure of consumption, we can capture two key dimensions of durable consumption, which should be in principle the ones most affected; these are car and home purchases. We find that higher uncertainty reduces the propensity to purchase a car by about 1 percent and the likelihood of becoming a first-time home-buyer by 0.15 percent. These point estimates hint that a significant fraction of the reduction in economic activity during periods of turmoil can be attributed to higher uncertainty. Individuals who face a higher employment risk might also alter their saving and borrowing decisions, which could ultimately

increase their financial fragility. We find that this is indeed the case, as individuals are significantly more likely to slow their mortgage repayments, which is consistent with individuals trying to build a buffer in their finances. Finally, another indicator of the toll that uncertainty spikes can exact on individuals is a higher likelihood of default and a concomitant decline in the individual's credit score.

Our empirical tests also point to significant adjustment heterogeneity across consumers. Standard models observe that high income workers likely have bigger buffer stocks of wealth or easier access to external sources of finance that limit the effects of uncertainty pass-through onto their consumption plans. On the other hand, because of their greater exposure to incentive compensation plans, the compensation of high earners might be more strongly tied to business fluctuations, and so this group could become more affected in periods of distress. We find that while the reduction in income as well as the reduction in car purchases are significantly larger among the top earners, the higher financial fragility, captured by the higher likelihood of default and credit score declines, is more widespread among lower income individuals. This is consistent with the view that higher income earners might have more discretionary consumption that they can contract in response to higher uncertainty, but the shocks are more likely to put in jeopardy the left tail of the income distribution as these might not have the resources to cope with the shocks.

We then explore the effects of uncertainty on county-level durable consumption. We first construct a new measure of local uncertainty—uncertainty specific to counties. This measure is derived from the excess returns of public firms and is constructed to filter out aggregate first moment shocks through a factor model. Sectoral uncertainty at the 4-digit NAICS level can be computed using these adjusted stock returns. The industry uncertainty measures are then mapped into the county-level measures by weighting the county's relative exposure to each industry. We then use this new measure of local uncertainty to investigate whether and how uncertainty affects county-level durable consumption measured by using data from FRBNY Consumer Credit Panel/Equifax (CCP). We find that one standard deviation increase in county level uncertainty is associated with a 10 percent reduction in car purchases and a 12 percent reduction in first home purchases in the county.

Both the micro–firm and consumer–and county level results show that volatility in financial markets can have real adverse consequences, even among populations that do not directly own financial assets. This evidence also suggests that when there are adverse short term shocks, government aid to firms that require these firms to continue to pay workers and limit retrenchments could be effective

in maintaining consumption and aggregate economic activity. The rest of the paper is organized as follows. Section 2 discusses related literature while Section 3 describes the data used in this study. Section 4 presents the main results as well as the heterogeneity analysis, while Section 5 concludes.

2. Related Literature

This paper is related to existing literatures in both macroeconomics and finance. In macroeconomics, Bernanke (1983), Titman (1985) and Abel and Eberly (1994) helped develop the idea that the real-option value of waiting to enter into difficult-to-abrogate contracts is higher during periods of increased economic uncertainty.[2] Building on this basic idea, more elaborate models investigate the role of uncertainty in economic fluctuations. In a seminal paper, Bloom (2009) shows that higher uncertainty causes firms to temporarily pause their investment and hiring, also resulting in lower productivity because of lower reallocation across firms. Bloom, Bond and Van Reenen (2007) show that higher uncertainty reduces the responsiveness of investment to demand shocks as the increase in real option makes firms more cautious when investing. Gilchrist, Sim, and Zakrajšek (2014) and Alfaro, Bloom and Lin (2018) show that this is even more true in the presence of financial frictions, as ex-ante financially constrained firms cut their investment more than unconstrained firms. Finally, Bloom et al. (2018) estimates that uncertainty shocks can generate declines in gross domestic product of around 2.5 percent. We complement this literature by using microeconometric evidence that highlights how households' reactions to uncertainty shocks might partly explain the drop in aggregate demand.

Our measure of uncertainty is similar to the measure used in Gilchrist, Sim, and Zakrajšek (2014) and is based on the realized volatility of abnormal returns of individual firms (i.e. firm return after we take out the loading on the Fama-French four factors). Equity market based measures are a useful proxy for uncertainty, and one key advantage of our empirical setting is the linking of an employer specific equity market based uncertainty measure to the financial and consumption decisions of individual employees.[3]

In particular, labor market risk is posited to be a key channel through which employer specific uncertainty might affect the financial decisions of employees. The underlying logic behind this channel

[2] Also see Caplin and Leahy (2010) for a related survey.
[3] Baker, Bloom, and Davis (2016), and Baker et al. (2019) study policy uncertainty risks.

is that in the presence of financial frictions, an increase in idiosyncratic uncertainty — the variance of productivity shocks to firm capital—increases credit spreads for firms (Christiano, Motto, and Rostagno (2014)). And increased credit spreads can in turn reduce investment and employment, exposing workers to greater employment and wage risk. In turn, workers engage in greater precautionary behavior, reducing spending and increasing credit lines in order to target greater financial flexibility (Aydin (2015), Gourinchas and Parker (2002), Hahm and Steigerwald (1999)). Ben-David et al. (2018) also document the heterogeneity in uncertainty perception across households and find higher individual level uncertainty is associated with higher precautionary behavior. Our empirical setting, with its matched firm-employee data, allows relatively direct tests of this labor market risk channel on consumer decisions.[4]

Recent studies focused on the role of firms in insuring workers against risk include Guiso, Pistaferri and Schivardi (2005), which shows that firms absorb temporary fluctuations fully but insure workers against permanent shocks only partially. More recently, Low, Meghir and Pistaferri (2010) show that increases in employment risk have large effects on output and welfare. Friedrich, Laun, Meghir and Pistaferri (2019) uses Swedish data to show that firm-specific permanent productivity shocks transmit to individual wages of high-skilled workers; while firm-specific temporary shocks tend to affect the low-skilled. Fagereng, Guiso and Pistaferri (2018) uses Norwegian data to study the importance of uninsurable wage risk for individuals' portfolio allocations, while Berk and Walden (2013) investigate the interaction between firms' access to capital markets and the insurance they provide to workers. Ellul, Pagano and Schivardi (2017) highlights the substitutability of unemployment insurance offered by government and firms for family firms.[5]

Finally, most closely related to our work is the recent and complementary work of Alfaro and Park (2019), which analyzes how employers' uncertainty shocks affect workers' consumption behavior using debit and credit card transaction data. We exploit credit report data augmented with detailed data on wages to trace the direct impact of firms' uncertainty shocks on households debt repayment and default probabilities, as well as, on wage composition. In addition, we focus on the distributional

[4]There is of course a large literature on individuals' precautionary responses to income risk, see among others Zeldes (1989), Deaton (1991), Carroll (1997), Carroll and Samwick (1997), Banks, Blundell, and Brugiavini (2001), Gourinchas and Parker (2002); and Attanasio, Banks, Meghir, and Weber (1999). In this tradition, Bertola, Guiso and Pistaferri (2005) uses Italian data to understand how consumers adjust durable goods consumption in response to microeconomic uncertainty, and Eberly (1994) focuses on car purchases, while microeconomic studies focused on investment include Guiso and Parigi (1999) and recent work by Stein and Stone (2014).

[5]See Guiso and Pistaferri (2020) and Pagano (2019) for a review of this recent literature.

impacts of uncertainty shocks among workers within each firm.

We contribute to this literature by showing the consequences of this, at best, partial insurance provided by the firms on workers' decisions and financial health. Our evidence on the heterogeneous effects of uncertainty shocks also informs the debate on consumption inequality and housing wealth accumulation across households, and how these trends might be more pronounced after major uncertainty shocks.

3. Data

The lack of employee-employer linked data is one major challenge to studying the pass-through of uncertainty shocks from firms to households. We use proprietary data provided by one of the main credit bureaus, which allows us to construct the key outcome variables. One side of this data has been used in numerous household finance studies and provides information on households' balance sheets, specifically, monthly history of all the borrowers' loans, including auto loans, mortgages, and credit cards (revolving). The data has granular information about the main features of these loans, such as date opened, account type, credit limits, monthly scheduled payment, balance, and performance history. Our proprietary version is unique because our data are not confined to households' balance sheet information, but include employment information about the borrowers. Specifically, more than ten thousand employers in the U.S., covering about thirty percent of the US labor force, employ the credit bureau's services for employment and income verification services. We use anonymous employment and income information provided by employers for this study.[6]

Overall, we believe our data provide us with a unique opportunity to shed light on whether uncertainty also directly affects households' consumption pass-through of uncertainty shocks. Given the fact that our measure of uncertainty shocks is based on volatility of the stock prices, we only focus on public firms. Our data covers a total of 323 firms for the period of the third quarter of 2010 to the third quarter of 2018. There are also 374,283 individuals who worked at these firms during this time and are covered with our data.[7]

[6]See Kalda (2019) for a more detailed discussion on the representativeness of the employment and income data.
[7]Full summary statistics are available upon requests.

4. Results

4.1. Firm-Level Evidence

To validate our empirical methodology, we begin our analysis by investigating the effect of uncertainty at the firm level. We estimate the following specification:

$$y_{it} = \beta \cdot Uncertainty_{i\,t_{1-4}} + \delta \cdot Avg\,Returns_{i\,t_{1-4}} + X'_{it}\alpha + \gamma_i + \eta_t + \varepsilon_{it} \tag{1}$$

where y_{izt} are outcome variables measured at the firm-month level measures such as capital expenditures, employment and wages. The coefficient of interest β measures the effect of changes in uncertainty, which has been computed as an average over the previous four quarters. To make sure we are controlling for the first moment shock, we always include the average returns over the previous four quarters. Depending on the specification, we also control for additional time-varying firms' characteristics X_{it}. All specifications control for firm and time fixed effects, *e.g.*, γ_i and η_t, so that we can interpret β as measuring the effect of changes in uncertainty on the dependent variables. In order to facilitate the interpretation of the results, we standardize the uncertainty and average return measures. Therefore one can think of the estimated coefficients as the impact of one standard deviation change in the uncertainty measure.

Panel A of Table 1 explores the effect on variables recorded in Compustat on capital expenditures. This table has two objectives: showing that uncertainty alters firms' behavior and that our sample of firms is representative of other public firms. We also compare the effect of uncertainty shocks on capital expenditure of firms in Compustat with the sub-sample of firms covered by our data. Columns (1) and (2) include firm and year fixed effects while Columns (3) and (4) include firm and industry by year fixed effects. In this way, we can absorb any shock that might affect one particular industry more than others, *e.g.*, commodity shocks. We also control for other firm characteristics, such as the size as measured by firm total sale, leverage, cash holding, and EBITDA. We find the effects of uncertainty to be statistically and economically significant, with a one standard deviation increase in uncertainty reducing capital expenditure by about 0.8 percent. What is also comforting is that the effects are extremely similar across sub-samples. Similar results have been found in the literature (see, for instance, Alfaro, Bloom and Lin, 2018).

Having confirmed that our sample of firms is reacting to uncertainty shocks similarly to other public firms, we take advantage of our dataset to explore the effect of uncertainty shocks on a number of other dimensions. Panel B of Table 1 focuses on employment. Column 1 shows that a one standard deviation increase in uncertainty reduces employment by 9 percent. We also decompose this result between new hires (Column 2) and termination of existing workers (Column 3). We find that the reduction in new hires and the increase in terminations contribute almost equally to the decline in employment. Finally, we are also interested in understanding whether the uncertainty shocks we capture are mainly causing small fluctuations or could instead be responsible for larger changes in hiring. In order to do so, we investigate whether changes in uncertainty increase the probability of a decline in employment greater than ten percent in Column 5. We find that a one standard deviation increase in uncertainty increases the probability of large swings in employment by 13 percent.

Panel C complements the previous evidence by investigating whether uncertainty also directly affects wages. Column 1 shows that uncertainty shocks lead to a reduction in the average wage. The effect is also economically significant as a one standard deviation increase leads to a decline of 6.4 percent. We further investigate this effect by decomposing it into base pay and bonuses to understand the main margin of adjustment. Bonuses and commissions are likely to be easier to adjust in response to changes in economic conditions. Column 2 provides evidence consistent with this hypotheses. We find that uncertainty shocks result in a significant increase in the fraction of wages classified as base pay over total pay, *e.g.*, there is a reduction in the bonuses. Column 3 also shows that uncertainty leads to a reduction in the dispersion of wages within a firm as measured by the standard deviation of wages. Columns 4-6 show the impact of uncertainty shocks on different percentiles of wages within the firm. This result suggests that wages in the top decile of the income distribution within the firm suffer the largest reduction in income as a result of uncertainty shocks. Intuitively, since the mechanism for the reduction in wages is working through cuts in bonuses and commissions, these changes are more likely to affect high-earners than minimum wage workers, compressing the wage distribution within a firm. Collectively, this evidence shows that firms are highly sensitive to changes in uncertainty, helping to validate our approach. We next examine the pass-through of these shocks onto individual employees.

4.2. Effects on Individual Income

In principle, firms might at least partially insure their workers, which would then mitigate any adverse effect that uncertainty might have on individuals' consumption and savings decisions. Furthermore, workers are likely to self-select into occupations subject to different levels of uncertainty, which would then predict that those workers subject to uncertainty shocks are also the ones most able to cope with them. We take advantage of our individual-level data to investigate whether this is the case.

In Table 2 we estimate a similar specification to the previous one but at the individual-quarter level. To capture potential heterogeneity, we control for lagged income in the previous year, house price growth and the unemployment rate in the county. Furthermore, we include firm, quarter and, importantly, individual fixed effects. To the extent that latent risk preferences are time invariant, individual-level fixed effects help us address the self-selection issue. However, potential adverse effects on the individuals' income could be the result of broader negative economic shocks that increase both the general level of uncertainty as well as impacting individuals' income. To control for such a possibility, the most conservative specifications in the table also include county by quarter fixed effects. In other words, we are comparing the effect of changes in uncertainty on individuals residing in the same regions at the same time, holding fixed the same level of past income, taking into account the time-invariant characteristics at the individual level.

We start by analyzing the impact of uncertainty shocks on the probability of job losses. Panel A of Table 2 shows that a one standard deviation increase in our measure of uncertainty is associated with 0.5 percent increase in the probability of voluntary job loss and 1 percent increase in the probability of an involuntary job loss. The involuntary job loss result is consistent with the previous finding that firms reduce employment as a result of uncertainty shocks. The increase in voluntary job losses is also consistent with the idea that more "uncertain" firms are less appealing to workers.

In Panel B of Table 2 we restrict the sample to those who stayed with the firm. Column 1 shows that a one standard deviation increase in uncertainty leads to a reduction in log wages of 2.4 percent. Column 2 complements this finding by showing that uncertainty shocks also leads to a 1.5 percent higher probability that an individual experiences a decline in income of at least 10 percent. That is, even after controlling for "first moment" shocks, higher uncertainty appears to have a large independent negative effect on worker outcomes. Columns 3 and 4 decompose this effect and show that while we do not find a reduction in the base pay, the fraction of base pay over total compensation

significantly increases: Bonuses and commissions are the principal adjustment margin. These effects do not seem to be affected by local heterogeneity, in fact, as we compare the coefficients from the first four columns to the other four, we do not find significant differences. This is probably also a feature of the way we constructed our uncertainty measure as a residual after taking into account systematic risk. In sum, uncertainty shocks appear to impact individuals' income and the next section examines how household's respond to these uncertainty induced income shocks.

4.3. Consumption and Financial Health

An increase in work place uncertainty can affect households' consumption and financial decision making through its direct impact on income, as higher firm-level uncertainty is associated with a higher risk of an individual losing her job and an increase in the riskiness of her income. Therefore, an increase in firms' uncertainty can have a first order effect on aggregate demand. Evidence on the effects of uncertainty on consumer demand is thus key to both evaluating theories that emphasize the importance of uncertainty in aggregate fluctuations and developing policies to contain the aggregate consequence of uncertainty. To wit, increases in the stock market volatility do not affect merely the relatively small fraction of the population that is directly exposed to the stock market through their portfolio holdings. Instead, these uncertainty shocks can trickle down to individuals through their employers, amplifying the potential aggregate effects of firm-level uncertainty. For instance, individuals might postpone important decisions and large purchases, such as buying a car or becoming a homeowner.

Table 3 investigates this hypothesis. Specifically, since we expect durable consumption to be the most affected by changes in volatility, we use two measures of durable consumption computed using the credit report data, i.e. the probability of purchasing a car and the probability of becoming a first-time homeowner (Mian, Rao, and Sufi (2013)) Column 1 shows that a one standard deviation increase in firm uncertainty reduces the probability of buying a car by 0.9 percent. This effect holds after controlling for local heterogeneity and is conditional on the individual having a car or not already. Column 2 confirms this adverse effect on consumption by showing that the probability to become a homeowner also significantly declines. We find that a one standard deviation increase in uncertainty leads to a reduction of 0.15 percent in this probability.

An increase in uncertainty, and the resulting loss of income, can also worsen an individual's

financial health. For instance, households are likely to have more difficulty in repaying their liabilities if their income declines suddenly and sharply. Consistent with this prediction, column 3 shows that a one standard deviation increase in uncertainty suggests a 0.26 percent increase in the probability that an individual becomes delinquent. Column 4 provides consistent evidence showing that the credit score of these individuals affected by uncertainty increases are also adversely impacted. Negative loan performance and decline in creditworthiness are not the only dimensions where we see an effect. Column 5 provides evidence that individuals are also less likely to pay down their mortgages in response to these uncertainty shocks. Finally, Column 6 shows that revolving utilization captured by total credit card balance over credit limits, keeping the credit limit fixed, significantly increases in times of uncertainty. This suggests that individuals tend to rely more prominently on their lines of credit during periods of turmoil. Taken together, this evidence shows that individuals cut their consumption, and their financial fragility increases when uncertainty spikes. The results in columns 7-12 are very similar when we control for county-time fixed effects in the regressions.

4.4. Heterogeneity

Consumers have different risk-bearing capacities. We do not observe savings, but higher income individuals likely have a greater buffer stock of resources to smooth uncertainty induced fluctuations in income. These agents also generally have access to cheaper sources of external financing. Thus, income and credit scores could affect how consumers respond to these shocks. At the same time, the results of Table 1 suggest that uncertainty shocks disproportionately impact individuals with higher income.

Table 4 thus estimates our baseline regression but interacts the uncertainty shock with a dummy identifying individuals whose income in the past year is above the median income in our sample. The results in Columns 1 to 4 show that indeed high income people have higher exposure to uncertainty shocks. For example, the result in Column 1 shows that as a result of a one standard deviation increase in uncertainty, the income of people in the bottom half of income distribution is reduced by 5 percent. However, the same number is 12 percent for the people with income above the median wage in our sample. Columns 5 to 10 analyze the impact of uncertainty shocks on durable purchases of households and their financial decisions. This analysis suggest that uncertainty shocks affect high income people and low income people's durable purchases and financial decisions similarly. This

striking contrast between the income result and the consumption result suggests that high income people also have more financial resources to insure themselves against income shocks; even for an uncertainty induced income shock more than twice as large, higher income individuals adjust their consumption similarly to that of the lower-income sample.

4.5. County Level Durable Consumption

The previous sections show that firm uncertainty affects individual consumption, but it is possible that these individual level effects can be cancelled out at a more aggregate level. This section thus uses aggregated county-level data to explore the possible effects of uncertainty on consumption.

As mentioned previously, aggregate indexes are likely to endogenously co-vary with aggregate first-moment shocks that also drive credit decisions. Therefore, to help identify how uncertainty might influence consumption decisions, we develop a time-varying county-level measure of economic uncertainty that is constructed to be free of aggregate credit market and other first moment shocks—henceforth referred to as local uncertainty. Put simply, the measure captures the local labor market's exposure to industry-level idiosyncratic demand or technological uncertainty shocks employing the county exposure to fluctuations in the firms' stock prices.

To construct the local-uncertainty measure, for each public firm, we first remove the systematic component in daily excess returns by regressing the daily excess stock returns on a three factor model. We use the standard factors such as the returns of the SP 500 index, the book to market ratio, and the relative market capitalization. Thus, by construction, the residuals from these regressions are unlikely to include aggregate first moment shocks. These residuals instead contain firm-level idiosyncratic demand or technological shocks which constitute the main source of variation for our analysis.

The second step computes the daily industry portfolio residual returns by weighting the daily residual returns of firms by the firm's relative size among firms in the same 4 digit sectoral industrial classification code (NAIC) code—the firm's relative market capitalization. The third step calculates the quarterly sector-specific standard deviation of these daily idiosyncratic returns (see Gilchrist, Sim, and Zakrajšek, 2014 for a similar procedure). This produces a sector-specific index of volatility.

The final step draws upon the quarterly sectoral employment data from the Quarterly Census of Employment and Wages (QCEW), which lists employment in each county by the 4 digit NAIC code. We use the QCEW data to create an employment weighted index of economic volatility by county:

the 4 digit NAIC sector specific index of volatility is weighted by the county's employment share in that sector with a one-year lag. The use of employment shares captures the relative exposure of a county to different industry level uncertainty shocks, sharing the spirit of a Bartik instrument. The use of a one-year lag in the employment share mitigates the potential contemporaneous endogenous response of employment to uncertainty.

Along with this second moment index, we also construct the first moment analog as a control variable: The weighted mean idiosyncratic stock returns at the county level—henceforth referred to as local returns. We standardize both the uncertainty and first moment measures. For the county-level consumption measures, we draw a twenty percent sample from the FRBNY Consumer Credit Panel/Equifax (CCP) data. This is a proprietary consumer credit dataset, similar to credit report data used in previous sections, but is not linked to employers. The sample results in a balanced panel of about 450,000 individuals. It includes comprehensive quarterly information on key dimensions of debt usage for 2002-2015. We then aggregate the data to the county level and look at variables such as number of car purchases and first home purchases, similar to the individual level analysis in previous sections.

Table 5 shows the regression results. In all regressions, we control for the first moment shocks, local house price growth, local unemployment rate and county and state-time fixed effects. This helps to address concerns of local demand as confounding factors. The results are very similar to what we find in the individual level analysis. For example, Column 1 shows that a one standard deviation increase in county level uncertainty is associated with a 10 percent reduction in car purchases in the county, while in Column 2 a one standard deviation increase in uncertainty shock is associated with a 12 percent reduction in first home purchases. These results are consistent with what we found in the individual level analysis and suggest that these uncertainty shocks also matter at a more aggregate level.

5. Conclusion

This paper sheds new light on the economic effects of uncertainty, and more generally, how asset prices might affect the real economy. In contrast to the narrative that only richer households with significant exposure to the stock market are likely to be affected in periods of high volatility, we find

that uncertainty is likely to have wider adverse effects. Specifically, when uncertainty increases, firms tend to take contractionary measures, such as reducing investment and laying-off workers. We find that these policies, in turn, have significant effects on households' consumption and savings decisions. Individuals tend to cut durable consumption, such as car and home purchases, and tend to increase their indebtedness. Higher debt balances coupled with lower wages result in a lower creditworthiness and a higher likelihood to default. We also find similar results at the more aggregate county level, where greater uncertainty is associated with less durable goods purchases.

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Table 1: Firm-level Outcomes

Panel A: Investment

	(1)	(2)	(3)	(4)
Sample	All	WorkNumber	All	WorkNumber
Dep Var	$CapitalExpenditure_t$ / $TotalAssets_{t-1}$			
Uncertainty qtrs 1-4	-0.788***	-0.852***	-0.743***	-0.711***
	(0.137)	(0.233)	(0.091)	(0.135)
Avg. return qtrs 1-4	0.429***	0.0315	0.467***	-0.0233
	(0.0772)	(0.132)	(0.0677)	(0.140)
Firm-Year Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	No
Sector × Year FE	No	No	Yes	Yes
N	104,916	7,405	104,789	7,032
R^2	0.371	0.514	0.386	0.614

Panel B: Employment

	(1)	(2)	(3)	(4)	(5)
Dep Var	% New Hire	% Termination	Empl Change	I(Empl Ch $\geq 10\%$)	I(Empl Ch $\leq -10\%$)
Uncertainty qtrs 1-4	-4.828***	4.330***	-8.896***	-1.715**	13.100***
	(0.860)	(1.112)	(1.442)	(0.748)	(2.508)
Avg. return qtrs 1-4	-1.561*	-0.12	-2.377*	0.093	0.417
	(0.781)	(0.901)	(1.289)	(0.196)	(1.038)
Firm FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
N	5,076	5,076	5,076	5,076	5,076
R^2	0.759	0.772	0.412	0.223	0.401

Panel C: Wages

	(1)	(2)	(3)	(4)	(5)	(6)
Dep Var	Log(Mean Income)	Mean (% Base Pay)	SD (Income)	Log(50^{th} Income)	Log(75^{th} Income)	Log(90^{th} Income)
Uncertainty qtrs 1-4	-0.064***	0.873***	-0.283***	0.014	-0.025*	-0.053***
	(0.015)	(0.248)	(0.023)	(0.017)	(0.014)	(0.011)
Avg. return qtrs 1-4	0.001***	0.054**	0.0001	0.0002	0.0001	-0.0004
	(0.000)	(0.024)	(0.001)	(0.000)	(0.000)	(0.000)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	8,730	8,730	8,730	8,730	8,730	8,730
R^2	0.932	0.899	0.794	0.946	0.936	0.941

Notes: This table reports OLS regressions of firm-level outcomes. The uncertainty measure is a standardized average of the firm's uncertainty over the previous four quarters. Returns is a standardized the average of the previous four quarters. In Panel A, the outcome variable is capital expenditure spending as a percentage of the previous quarter's assets and we control for Tobin's Q, leverage (total debt / total assets), EBITDA (normalized by lagged total assets), cash holdings (normalized by total assets), the log of sales and year fixed effects. Data is obtained from Compustat. In Panels B and C, the outcome variables are the column titles and we control for firm and year fixed effects. In addition, we also control for log of number employees from four quarters prior in Panel B and lagged dependent variable in Columns (1), (4)–(6) in Panel C. Standard errors are double-clustered by firm and year in Panel A and by year-quarter in Panels B and C. Standard errors are reported in parentheses. Asterisks denote significance levels (***=1%, **=5%, *=10%).

Table 2: Individual-Level Income

Panel A: Job Loss

	(1)	(2)	(3)	(4)
Dep Var	Voluntary Job Loss	Involuntary Job Loss	Voluntary Job Loss	Involuntary Job Loss
Uncertainty qtrs 1-4	0.512***	0.966***	0.587***	1.000***
	(0.0640)	(0.0850)	(0.0630)	(0.0790)
Avg. return qtrs 1-4	0.008***	0.009***	-0.011***	-0.019***
	(0.0020)	(0.0020)	(0.0010)	(0.0020)
Log(Income$_{t-4}$)	-1.910***	-3.154***	-1.792***	-2.966***
	(0.022)	(0.031)	(0.022)	(0.030)
House price growth	-6.507***	-11.303***		
	(0.687)	(0.984)		
Unemployment rate	1.464***	2.391***		
	(0.023)	(0.036)		
Individual FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	No	No
County Time FE	No	No	Yes	Yes
N	12,590,173	12,590,173	12,590,173	12,590,173
R^2	0.203	0.23	0.18	0.19

Panel B: Wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep Var	Log (Income)	I($\Delta Income \leq -10\%$)	Log(Base Pay)	% Base Pay	Log (Income)	I($\Delta Income \leq -10\%$)	Log(Base Pay)	% Base Pay
Uncertainty qtrs 1-4	-0.024***	1.524***	-0.001	1.303***	-0.023***	1.441***	-0.001	1.299***
	(0.0020)	(0.2760)	(0.002)	(0.107)	(0.0020)	(0.1830)	(0.002)	(0.081)
Avg. return qtrs 1-4	0.001***	-0.102***	0.002***	0.017***	0.001***	-0.103***	0.002***	0.016***
	(0.0003)	(0.0180)	(0.001)	(0.005)	(0.0003)	(0.0180)	(0.001)	(0.005)
Log(Income$_{t-4}$)	0.059***	38.565***	0.049***	-0.418***	0.057***	38.771***	0.048***	-0.388***
	(0.001)	(0.169)	(0.001)	(0.038)	(0.001)	(0.149)	(0.001)	(0.028)
House price growth	0.024	-0.869	0.024	-0.002				
	(0.025)	(2.088)	(0.030)	(0.837)				
Unemployment rate	-0.0003	0.028	-0.001	0.021				
	(0.0010)	(0.0660)	(0.001)	(0.022)				
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	No	No	No	No
County Time FE	No	No	No	No	Yes	Yes	Yes	Yes
N	12,351,339	12,351,339	12,351,057	12,351,339	12,351,339	12,351,339	12,351,057	12,351,339
R^2	0.951	0.635	0.931	0.836	0.952	0.641	0.932	0.84

Notes: This table reports employee-level year-quarter OLS regressions where the outcome variables are the column titles. The uncertainty measure is a standardized average of the firm's uncertainty over the previous four quarters. Returns is a standardized average of the previous four quarters. Controls include log of income is from the previous four quarters and in columns (1)-(4), county-level house price growth and unemployment rate for the previous quarter. Individual and firm fixed effects are included in all regressions, while time fixed effects are included for columns (1)-(4) and county-time fixed effects are included for columns (5)-(8). Standard errors are double-clustered by firm and county and reported in parentheses, and asterisks denote significance levels (***=1%, **=5%, *=10%). Sample period is 2010–2018.

Table 3: Individual-Level Consumption and Credit

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dep Var	Buying Car	FT Home	Prob DLQ	Risk Score	Paydown Mortgage	Rev Utilization	Buying Car	FT Home	Prob DLQ	Risk Score	Paydown Mortgage	Rev Utilization
Uncertainty qtrs 1-4	-0.903***	-0.134***	0.267***	-0.457**	-0.536***	0.399***	-0.847***	-0.124***	0.243***	-0.353**	-0.471***	0.252***
	(0.139)	(0.021)	(0.088)	(0.190)	(0.092)	(0.078)	(0.103)	(0.023)	(0.087)	(0.151)	(0.089)	(0.077)
Avg. return qtrs 1-4	-0.013	0.001	-0.028*	0.022	0.009	-0.003	-0.014	0.001	-0.024	0.026	0.009	-0.007
	(0.010)	(0.002)	(0.017)	(0.024)	(0.017)	(0.011)	(0.010)	(0.002)	(0.017)	(0.025)	(0.017)	(0.011)
$\log(\text{Income}_{t-1})$	-0.032	0.247***	-0.193***	1.959***	0.132	-0.747***	-0.028	0.234***	-0.177***	1.865***	0.131	-0.669***
	(0.037)	(0.021)	(0.035)	(0.064)	(0.084)	(0.032)	(0.033)	(0.022)	(0.036)	(0.063)	(0.084)	(0.032)
House price growth	-2.400**	0.166	-3.574***	-5.502***	7.829***	-2.640***						
	(1.148)	(0.323)	(0.979)	(1.691)	(1.329)	(0.849)						
Unemployment rate	-0.085***	-0.010*	0.355***	-0.572***	-0.032*	0.120***						
	(0.021)	(0.006)	(0.027)	(0.055)	(0.018)	(0.026)						
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
County Time FE	No	No	No	No	No		Yes	Yes	Yes	Yes	Yes	Yes
N	12,351,339	4,487,075	12,351,339	12,351,339	5,260,253	12,349,365	12,351,339	4,487,075	12,351,339	12,351,339	5,260,253	12,349,365
R^2	0.149	0.132	0.591	0.889	0.139	0.678	0.159	0.147	0.596	0.89	0.153	0.682

Notes: This table reports employee-level year-quarter OLS regressions where the outcome variable is an indicator for buying a car in columns (1) and (7), an indicator for purchasing a home in columns (2) and (8), probability of delinquency in columns (3) and (9), credit score in columns (4) and (10), an indicator for having paid down mortgage by at least $10,000 in the quarter in columns (5) and (11), and revolving utilization (%) in columns (6) and (12). The uncertainty measure is a standardized average of the firm's uncertainty over the previous four quarters. Returns is a standardized average of the previous four quarters. Controls include log of income is from the previous four quarters, county-level house price growth and unemployment rate for the previous quarter in columns (1)-(5), and an indicator for having a car in columns (1) and (7). Individual and firm fixed effects are included in all regressions, while time fixed effects are included for columns (1)-(6) and county-time fixed effects are included for columns (7)-(12). Standard errors are double-clustered by firm and county and reported in parentheses, and asterisks denote significance levels (***=1%, **=5%, *=10%). Sample period is 2010–2018.

Table 4: Heterogeneity Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep Var	Log (Income)	I($\Delta Income \leq -10\%$)	Log(Base Pay)	% Base Pay	Buying Car	FT Home	Prob DLQ	Risk Score	Paydown Mortgage	Rev Utilization
Uncertainty qtrs 1-4	-0.010***	0.338*	0.009***	1.183***	-0.746***	-0.123***	0.316***	-0.599***	-0.475***	0.274**
	(0.002)	(0.203)	(0.002)	(0.074)	(0.109)	(0.024)	(0.109)	(0.183)	(0.105)	(0.127)
× High income	-0.026***	1.816***	-0.018***	0.231***	-0.223***	-0.005	-0.13	0.443**	0.008	-0.028
	(0.002)	(0.195)	(0.002)	(0.051)	(0.080)	(0.033)	(0.114)	(0.202)	(0.118)	(0.140)
Avg. return qtrs 1-4	0.001**	-0.060***	0.001***	0.011*	-0.030**	0.001	-0.007	0.024	-0.002	-0.027
	(0.000)	(0.021)	(0.001)	(0.006)	(0.013)	(0.003)	(0.024)	(0.033)	(0.016)	(0.020)
× High income	0.001	-0.085**	0.001	0.011	0.031*	-0.002	-0.034	0.005	0.02	0.024
	(0.000)	(0.033)	(0.001)	(0.009)	(0.018)	(0.003)	(0.027)	(0.039)	(0.026)	(0.027)
N	12,351,339	12,351,339	12,351,057	12,351,339	12,351,339	4,487,075	12,351,339	12,351,339	5,260,253	6,862,625
R^2	0.952	0.642	0.932	0.84	0.159	0.147	0.596	0.89	0.153	0.727

Notes: This table reports employee-level year-quarter OLS regressions where the outcome variables are the column titles. The uncertainty measure is a standardized average of the firm's uncertainty over the previous four quarters which is also interacted with an indicator for the employee with high income above the median in the past year. Returns is a standardized average of the previous four quarters which is also interacted with an indicator for the employee having a high income. Controls include log of income is from the previous four quarters, county-level house price growth and unemployment rate for the previous quarter, and an indicator for having a car and its interaction with having a high income in column (5). Individual, firm, and county-time fixed effects are included in all regressions. Standard errors are double-clustered by firm and county and reported in parentheses, and asterisks denote significance levels (***=1%, **=5%, *=10%). Sample period is 2010–2018.

Table 5: Uncertainty and County Level Consumption

	(1)	(2)	(3)	(4)
Dep Var	Buying Car	FT Home	HELOC Increase	Paydown Mortgage
Uncertainty qtrs 1-4	-0.10***	-0.12***	-0.17***	-0.18***
	(0.015)	(0.025)	(0.018)	(0.020)
Avg. return qtrs 1-4	0.025**	-0.046***	0.013	0.10***
	(0.010)	(0.016)	(0.012)	(0.013)
House price growth	0.28***	0.19	-0.35***	-0.14
	(0.070)	(0.17)	(0.10)	(0.093)
Unemployment rates	-0.010***	0.011**	-0.018***	-0.030***
	(0.0028)	(0.0047)	(0.0034)	(0.0035)
County FE	Yes	Yes	Yes	Yes
State Time FE	Yes	Yes	Yes	Yes
N	62326	62326	62326	62326
R^2	0.966	0.836	0.951	0.953

Notes: This table reports county-level year-quarter OLS regressions where the outcome variable is log number of car purchases in column (1), log number of first home purchases in column (2), log number of individuals with HELOC increasing more than $3,000 in column (3), and log number of individuals paid down mortgage by at least $10,000 in the quarter in column (4). The uncertainty measure is a standardized industry weighted uncertainty over the previous four quarters. Returns is the standardized industry weighted average returns of the previous four quarters. Controls include county-level house price growth and unemployment rate for the previous quarter. County, and state-time fixed effects are included in all regressions. Regressions are weighted by county population in 2002. Standard errors are reported in parentheses and asterisks denote significance levels (***=1%, **=5%, *=10%). Sample period is 2002–2015.