Spillovers that Pay Dividends: The Indirect Impact of Federal Disaster Loans on Firm Entry

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Abstract

Disasters increase affected firms' credit demand. I examine bank lending, firm entry, and recovery following rare flood shocks. After flooding, banks reallocate loan supply toward established incumbents, away from new firms. This reduces region-wide firm entry, entrant job creation, and wages, highlighting young firms' disproportionate contribution to growth. Low-interest federal loans to disaster-hit incumbents indirectly offset entrants' credit constraints. This increases firm entry without hurting firm performance, and sustains wages. Consequently, tax revenues compensate for upfront federal spending on business recovery loans. Positive spillovers onto firm entry demonstrate a novel, substantial channel through which government spending supports post-disaster recovery.

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... when communities experience trauma, such as a war or natural disaster, rarely do they return precisely to their former way of life. More often, people adapt, debate, innovate, and try new approaches as they reconstruct their lives.

— "Living With Hurricanes: Katrina and Beyond,"
An exhibit in the Presbytère Museum in New Orleans, Louisiana

1 Introduction

The optimal use of public funds is of central concern in economics. This is perhaps most salient in the case of disaster relief spending, which is only projected to grow given climate change risks.[1] The focus of this paper is the Small Business Administration's ("SBA") disaster loan program, which provides low-interest recovery loans to businesses facing un-/under-insured damages due to federally declared disasters.

The U.S. has spent over 16 trillion USD on disaster loans to firms between 1990 and 2020.[2] Though they are only directly given to incumbent businesses, federal disaster loans expand regional credit supply and may have second-order impacts on firm entry, which is highly sensitive to access to financing and a key driver of reallocation.[3] While firm entry drives productivity in healthy economies, it is not obvious whether post-disaster entrants would benefit local economies or instead cause misallocation and become a drag on economic recovery. This paper sheds a new light on the positive spillovers of federal loans to disaster-affected firms on new firm entry, which in turn props up region-wide job creation, firm performance, and wages. In the long-run, tax revenues from firms and workers more than compensate for the government's upfront cost of providing the loans, demonstrating a novel, substantial channel through which government spending supports post-disaster recovery.

There are three forces at play: the effect of the disaster, the lending behavior of banks, and the role of federal loans. Disasters are a negative shock to firm capital

[1] Climate change magnifies disaster risks, threatening welfare and growth (Mora et al., 2018).

[2] This is calculated from SBA disaster loan data obtained through a FOIA request.

[3] Greater access to financing increases entry (Holtz-Eakin et al., 1994) but credit constraints shrink it (Aghion et al., 2007). Entrants drive job creation, factor reallocation (Decker et al., 2014).

and cash flow, increasing affected firms' demand for credit.[4] After a disaster, banks may also face liquidity/capital constraints and/or become more risk averse.[5] As such, banks may change their business-as-usual lending approach and prioritize the credit needs of incumbents while reducing credit supply to new firms, which typically have no/a short track-record on their credit worthiness and lower capacity to post collateral relative to established firms.[6] Such a propagation of credit shocks from even localized disasters may reduce firm entry in broader regions.

Federal recovery loans, which have lower interest rates than bank loans, help business survival,[7] but their impact on the quantity and quality of entrants is ex-ante ambiguous. If federal loans fall short of (exceed) incumbents' total credit needs, this would sustain (offset) post-disaster entrants' disadvantage in accessing bank loans.[8] Entrants may outperform their counterparts in disaster-hit regions without federal aid, reflecting an unintended but efficiency-improving role of federal aid. But entrants may also underperform, implying a distortionary role of federal spending.[9]

To test these hypotheses, I exploit county-level variation in exposure to exogenous flooding and compare lending and firm dynamics in flooded counties that did/did not receive a presidential declaration—a key precondition for federal disaster loan availability.[10] In an ideal experiment, we would flip two coins to assign two treatments: the first, to assign equally severe flooding to half of all counties, and the second, to avail cheap business recovery loans in only half of the flooded counties. In reality, I can only observe realized floods and the subset that were federally declared. Flooding is plausibly exogenous, particularly with its timing. But disaster

[4]See Brown et al. (2021); Benincasa et al. (2024).

[5]Banks may face increased defaults (Aguilar-Gomez et al., 2024), liquidity/capital constraints (Berg & Schrader, 2012; Cortés & Strahan, 2017; Collier & Babich, 2019).

[6]See Berger and Udell (1998); Collier et al. (2020)

[7]Prior work shows that SBA disaster loans increase business survival, and even crowd in more private loans toward SBA borrowers (see Gallagher et al. (2023); Collier et al. (2024)).

[8]Federal loans may also sustain unproductive/zombie firms that would have been 'cleansed' in the absence of disaster aid (see Foster et al. (2016)). This would would reduce firm entry.

[9]Chava et al. (2023) show an association between lower entry costs and higher loan defaults.

[10]SBA recovery loans to firms may occasionally be availed after non-declared disasters. Such cases have limited sectoral and spatial scope, and are likely rare in my sample period. See Sec. 2.

declaration is not randomly assigned: declared floods are typically more severe than non-declared ones (e.g., they may cause more firm exits), which matters for how we interpret post-disaster firm entry patterns.

I use a difference-in-differences strategy relying on the assumption that, in the absence of a relatively rare flooding event, firm entries *net of exits* would have followed similar trends in flooded regions that do/do not have broad access to SBA disaster loans. I compare regions with declared and non-declared floods against a common control with no flooding. To ensure that flooding is rare and to avoid confounding from locational fundamentals,[11] I only consider counties that experienced flooding in, at most, 1 out of 7 consecutive years between 1994-2014. The Spatial Hazard Events and Losses Database for the US provides information on floods and declaration status. The Community Reinvestment Act captures banks' small business lending: following seminal work on the congruence between firm size and age (Berger & Udell, 1998), I use loan size as a proxy for firm size, and thus, for firm age.[12] I observe firm entry and outcomes from the Business Dynamics Statistics and County Business Patterns datasets.

I find that flooding worsens entrants' credit constraints, but that federal disaster loans offset this. After non-declared floods, banks' total business lending increases by a statistically insignificant ≈18%. The share of the smallest-sized business loans drops by about 7 percentage points (p.p.) while that of the largest sized loans increases by 11 p.p. ($p<0.05$). Hence, banks' post-disaster credit supply disproportionately goes toward larger firms, which are likely to take out larger-sized loans, rather than smaller ones, which are likely to take out smaller-sized loans. This does not appear to be driven by differential loan demand across smaller and larger firms.[13]

[11] The population composition and supply of entrepreneurial talent of regions with frequent flooding (e.g., ultra-urban and/or coastal regions) may confound the indirect impact of SBA disaster loans on firm entry. My analyses control for pre-disaster population size, age and race composition.

[12] This is due to the relative dearth broadly accessible data on borrowing by firm age.

[13] To study demand, I examine applications for business-related loans secured by home equity collateral in the Home Mortgage Disclosure Act data per Doerr (2021). See Section 7.

Assuming a congruence between firm age and size,[14] these results suggest that the youngest firms, which are likely also small, face credit constraints. But, after declared floods, I find no economically or statistically significant change in banks' total lending nor in their loan supply allocation across smaller and larger firms. By implication, federal loans indirectly expand entrants' access to bank credit after flooding.

These changes in post-disaster bank lending are consequential: after non-declared floods, there are 2-3 fewer entrants, including net of exits, per 10,000 county residents for up to 2 years after flooding. Average payrolls of businesses (of any age) also decline by 25% and worker wages decline by a statistically insignificant 3% in the years following the flood, reflecting that reduced firm entry is associated with declining firm revenues.[15] Federal loans indirectly mitigate these outcomes. Declared-flood counties see 3 more firm entries per 10,000 residents *net* of firm exits in the year following the flood, and see increased entries with some offsetting exits in the subsequent 3 years. Entrant job creation, business payrolls, and worker wages evolve to comparable, if not higher, levels relative to the non-flooded control, suggesting that SBA loans do not (indirectly) result in excess entries of low-quality firms but rather boost business churn and dynamism via the firm entry margin. Since non-declared floods are often less severe than declared ones, and may still induce local level assistance, my findings of persistent negative impacts after non-declared floods are likely an underestimate of the disparate recoveries we may, under ideal experimental conditions, find across a declared and non-declared flood of identical size.[16]

Following Hendren and Sprung-Keyser (2020), I calculate the marginal value of public funds (MVPF) of federal spending on disaster loans. The MVPF measures the Willingness to Pay of beneficiaries per each dollar of net government cost. I start with a simple hypothetical in which two identical counties are hit by a flood

[14]This is consistent with seminal models of firm life-cycle financing (Berger & Udell, 1998).

[15]This is consistent with prior findings that young firms, not small firms or established firms, drive job creation and creative destruction in market economies (Haltiwanger et al., 2013).

[16]Further, Section 7 shows that the aforementioned results generally hold across a narrower set of declared and non-declared disasters of comparable property damages.

of the same size but only one receives access to low-interest SBA business recovery loans while only banks provide recovery credit in the counterfactual (non-declared flood) county. Per my reduced-form results, the declared flood county then sees higher firm entries as well as increased firm and worker earnings that will generate additional tax revenues for the government in the 4 years following the flood. These increased tax revenues ultimately entirely compensate for the government's upfront expenditure on disaster loans, even accounting for the subsidy cost of the high default rates on federal disaster loans and the governments' opportunity costs. The WTP of beneficiaries is also high and positive, making for an infinite MVPF of federal disaster loan spending. This suggests that SBA business disaster loan program pays for itself in the long-run, in part due to its positive spillovers on young firm activity.

A key consideration in interpreting the findings of this paper is that SBA loans in declared disaster regions *always* coincide with other federal programs, notably the Individuals and Households Assistance program, which provides cash transfers to disaster-affected households. Cash transfers are expected to increase local consumption, potentially also contributing to more business formation. In line with this, I find that post-disaster firm entries are likely concentrated in nontradable sectors that rely on local demand.[17] While we cannot completely rule out the contribution of such cash assistance programs to young firm dynamics, Section 7.1 presents more evidence on the channels through which they may or may not contribute to bank lending outcomes and entry dynamics. Overall, my results are consistent with the presence of positive spillovers of SBA business loans on new firm entries via (indirect) bank liquidity channels. Moreover, while my MVPF calculation does not directly account for government spending on cash transfers, those upfront costs would plausibly be (at least partially) recouped via tax revenues as well. Thus, even when accounting for federal cash aid programs, the bang-for-buck on government spending on disaster relief likely remains high relative to a counterfactual with no federal declaration.

[17]This is consistent with the literature on Keynesian supply shocks (see Guerrieri et al. (2022); Auerbach and Gorodnichenko (2012))–after negative supply shocks, like disasters, government spending can prop up demand via the firm entry margin.

Related Literature: This paper contributes to several strands of literature, primarily that on the impact of federal disaster assistance on business dynamics and broader regional recovery. Existing work on the impact of SBA loans primarily focuses on their direct impact on incumbent business outcomes, and presents mixed evidence regarding spillovers onto business formation. Gallagher et al. (2023) show causal evidence that SBA disaster loans support business survival in tornado-hit census blocks but find no evidence of spillovers onto local establishment entries. Contemporaneous work by Collier et al. (2024) shows that, beyond increasing borrower businesses' survival, SBA recovery loans are also associated with a marginally significant increase in entries of retail-oriented businesses in the same census tract as the SBA borrower retail establishment, particularly when the borrower business has at least 3 employees. My paper presents new evidence consistent with the presence of large and persistent spillovers of disaster loans onto firm entry—including net of firm exits—and how the spillovers, in turn, support region-wide recovery. Further, this study complements the aforementioned papers by establishing bank credit as a novel, indirect channel through which SBA loans can affect entry dynamics at a wider (county-level) geographic scale beyond the immediate vicinity of SBA borrowers.

More broadly, with the exception of Gallagher et al. (2023), prior studies on the impact of federal disaster spending focus only on large, federally-declared disasters (Roth Tran & Wilson, 2023; Deryugina, 2017) and provide limited evidence on the spillovers and unintended effects. By comparing recovery after declared and non-declared disasters, this paper identifies a novel, indirect channel through which federal spending supports recovery in disaster-hit regions at no net cost—a boost to job creation, economic dynamism, and wage recovery via the firm entry margin.

This study also contributes to the literature on bank lending and disaster recovery. Berg and Schrader (2012) show that lender-borrower relations help established clients instead of new customers access limited credit following earthquakes in Ecuador, but they do not directly study collateral-secured lending, nor the impacts on the real economy. Other existing work on post-disaster bank credit has primar-

ily studied the role of the local vs multimarket nature of banks (Cortés & Strahan, 2017; Gallagher & Hartley, 2022; Ivanov et al., 2022) or their market power (Duqi et al., 2021), but exclusively focuses on large, declared disasters and provides limited evidence on business loans (compared to household loans). My paper shows that, in the absence of federal declaration after a disaster, bank lending behavior to firms of different ages may worsen new entrants' credit constraints, hurting regional recovery.

Lastly, this paper enhances the study of the welfare impacts of government spending on businesses. Existing MVPF estimates in the seminal paper by Hendren and Sprung-Keyser (2020) and the subsequent literature[18] give limited insight on the bang-for-buck of government loans to firms. In contrast with prior work on the welfare-reducing aspects of government subsidies for business creation/expansion in first-best, non-disaster settings (see Slattery (2022); Hurst and Pugsley (2011)), my paper suggests a welfare improving role of federal business loans in a second-best, post-disaster setting due to their positive spillovers onto firm entry.

Structure of paper: Section 2 provides background on federal disaster loans. Section 3 offers a conceptual framework for hypothesis development, and Section 4 describes my data sources and estimation strategy. Section 5 presents the results. Section 6 estimates the MVPF on federal loans using a hypothetical set-up. Sections 7 and 8 present robustness checks and a discussion. Section 9 concludes.

2 Institutional Background: Federal Disaster Loans

Federal disaster loans are low-interest recovery loans to under-/uninsured businesses affected by federally declared disasters, primarily those which receive a presidential disaster declaration ("PDD"). A PDD is a special place-based designation that is requested by local governments and declared by the U.S. president, ultimately unlocking SBA disaster loans and several forms of disaster assistance, including Public

[18]See the Policy Impacts Website for an up-to-date repository of existing MVPF estimates.

Assistance grants for large (re)construction projects (e.g., infrastructure reconstruction, debris removal), Household Assistance programs to give cash grants to affected households, Hazard Mitigation projects. SBA loan programs are always available as long as the President declares the household cash grant program. Declared floods are associated with about 9 percent higher property damage than those which do not receive a PDD (see Appendix Table A.1). Non-declared disasters still receive other forms of local government assistance (e.g., at the state level).

While the federal government also provides cash grants to businesses in agriculture/fishery sectors, the SBA disaster loans are the primary source of federal disaster assistance available to the majority of businesses.[19] Indeed, survey evidence on the post-disaster recovery of small businesses finds that, after severe hurricane events, 52% of affected businesses sought federal assistance, and of these, 71% sought SBA disaster loans (FRB, 2018).[20] Any business in a region with a declared disaster is eligible to apply for an SBA disaster loan of up to 2 million USD to cover various types of un-/under-insured losses. A key consideration for loan approval is credit score (see also (Collier et al., 2024)). Approved disaster loans can be used to repair physical damage to business assets or the owner's personal property, or to cover working capital during recovery period (Economic Injury Disaster Loans, "EIDL"). Appendix Figure A.1 presents summary statistics on the total and average approved amounts of SBA disaster loans to businesses specifically for flood-related events—the focus of this study—between 1990-2016. For the majority of this period, the average SBA disaster loan to businesses ranges between 50-100 thousand USD.[21]

SBA loans typically carry lower interest rates than loans from private lenders. The maximum interest rate on SBA disaster loans is capped at 4 percent interest

[19]The direct cash grants program has much smaller in spending and scope as it is only applicable to businesses in the farming/agriculture, livestock, and fishery sectors.

[20]More broadly, SBA loans and credit lines and bank loans are the two most important sources of recovery credit for disaster-affected businesses—45% of affected firms reported that they applied for SBA loans or lines of credit, and 53% sought bank loans. Note that these numbers need not add up to 100 percent because firms may seek credit from various sources.

[21]Approved disaster loan data were obtained through a FOIA request from the SBA.

rate for businesses which have no reasonable alternative source of credit, and at 8% for those which do have access to other credit such as bank loans (Lindsay & Getter, 2023). In comparison, the effective interest rate that small businesses paid for bank loans in 2019 is 10.5% (GoldmanSachs, 2023). This interest rate differential implies a significant appeal of SBA loans relative to bank loans for disaster-affected firms.

Being a capped low-interest government loan program in a post-crisis setting, the SBA disaster loan program has a higher credit subsidy rate—i.e., the program's non-administrative cost divided by the amount dispersed[22]—compared to other SBA loan guarantee programs. This is because defaults are substantially more common among post-disaster borrowers: in the 2020 fiscal year, the default rate among *all* disaster loan borrowers, which includes both businesses and households, was 10.35% compared to 4.75% in regular non-disaster SBA loan programs (Lindsay & Getter, 2023). Additionally, unlike other SBA loan programs, SBA disaster loans also do not have fees for borrowers. Understanding the direct and indirect roles and efficiency implications of this disaster loan program with such high subsidy rates is important.

Note that, for the majority of the sample period in my study, PDDs were the only trigger for SBA loan availability. While various rule changes have enabled the SBA to independently declare disasters and avail recovery loans during the sample period, the conditions for these SBA declarations are highly limited in scope (e.g., of sector or disaster type) and are thus not likely to affect my analyses.[23] Its ability to avail physical disaster loans as long as certain minimum thresholds of damage were met (from 1999 on) may matter more, and such cases may affect my results by attenuating the estimated magnitude of the effect of non-PDD disasters (which I term as "non-declared" disasters) on bank lending and firm dynamics.

[22]In 2020FY, the subsidy rate on disaster loans was 13.62% (i.e., SBA provided ≈$7.34 in disaster loans per each dollar appropriated for disaster loan credit subsidies (Lindsay & Getter, 2023).

[23]Since 2007, SBA has been able to independently avail EIDL loans even in the absence of a PDD but only to farming businesses or only after specific disasters like droughts or low-water level. See (FederalRegister, 2002, 2006)

3 Conceptual Framework

Consider a standard model of firm dynamics (see Hopenhayn (1992)) in which reallocation is a function of two elements: idiosyncratic shocks in the business environment (e.g., productivity conditions), and firms' responses to the shocks in their environment. Firms expand (i.e., create jobs, open new establishments) in response to positive shocks, and contract or exit (i.e., destroy jobs, close existing establishments) in response to negative shocks. In a healthy market economy, an up-or-out dynamic results in *net* exit/downsizing of less productive firms, driving aggregate productivity growth. Wages paid by a firm are reflective of its performance.

Firms need financing to start up and expand:[24] assume also a life-cycle financing model of firms whereby firm age and firm size increase together, as does the amount of information observable about the firm to external lenders (see Berger and Udell (1998)). Under these assumptions, Berger and Udell (1998) establish that over their life-cycle, new firms often start out as small, unknown entities to external lenders and thus use personal assets/savings. It is only after they enter and accumulate a track record about their credit worthiness that they obtain loans from external lenders like banks. Beyond their informational opacity, new firms may also be at a disadvantage compared to older ones for getting external loans because they are expected to under-insure against negative shocks (Rampini et al., 2014).

Firms also need financing to weather negative shocks–like unexpected disasters–that can hurt their assets, capital, and/or cash flow. Indeed, Brown et al. (2021) and Benincasa et al. (2024) show that firms increase their credit demand after severe weather events. Yet, banks may also suffer various negative impacts after disasters (see (Collier & Babich, 2019; Cortés & Strahan, 2017).[25] In the post-earthquake Ecuadorian context, liquidity constrained banks reduced credit supply to new ap-

[24] Young firm activity shrinks due to barriers to financing access (Aghion et al. (2007); Doerr (2021)) but rises following positive shocks to income and wealth (Holtz-Eakin et al., 1994; Bellon et al., 2021), income fall-backs (Barrios et al., 2022), and self-insurance (Hombert et al., 2020).

[25] Additionally, banks may also face increased deposit withdrawals (Brei et al., 2019) and defaults (Aguilar-Gomez et al., 2024) after disasters.

plicants but met the credit needs of repeat clients (Berg & Schrader, 2012). These factors may also increase banks demand for collateral, particularly for new borrowers like entrant firms. Collier et al. (2020) find that larger firms were more likely than smaller ones to receive all the credit that they requested, in part because of their capacity to post collateral. I hypothesize that young firms' or (aspiring) entrants' relative disadvantage in accessing bank credit compared to incumbent businesses would increase after a disaster.

It is not obvious how the expansion in regional credit supply may affect post-disaster firm entry. If federal loans simply make disaster-affected borrowers whole again, firm entry rates would simply recover to the pre-disaster status quo. Second, if federal and bank recovery loans still fall short to cover incumbents' credit needs, financing constraints may still restrict new firm entry. Firm entry may also drop if federal loans distort a potential 'cleansing' role of disasters. Decker et al. (2020) show that the post-1980s declining responsiveness of businesses to the shocks in their environments has reduced reallocation and productivity growth rates. Here, cheap federal loans may significantly strengthen the survival of established incumbents, even less productive ones that would have exited in the absence of that federal assistance, making it harder for new firms to enter and compete. Third, if federal loans expand regional liquidity supply so much so that they effectively free up additional bank credit to new entrants, firm entry would increase.

The impact on expanded access to credit on the quality of entrants is ex-ante ambiguous as well. On one hand, entrants in declared flood regions may outperform their counterparts in non-declared flood regions, suggesting that federal disaster assistance is associated with a material improvement in the quality of entrants, or even relative to those in the non-flooded control. These entrants may even outperform their counterparts in non-flooded regions, similar to how broad-based rebuilding after the Great Boston Fire of 1872 spurred urban growth (Hornbeck & Keniston, 2017). This would imply that the disaster along with federal assistance knocked the region out of an inefficient equilibrium such as a pent-up supply of credit-constrained but

high-quality entrepreneurs.

On the other hand, entrants in declared flood regions may also underperform. Chava et al. (2023) find that lower entry costs are associated with higher rates of lower quality entrepreneurs who default on loans years after entry, particularly in states enacting business-friendly subsidies and taxes. And firms born in downturns also start and remain small over their entire lifecycle (Moreira, 2016). Expanded credit supply after disasters may thus increase low-performing entrants with low growth potential, distorting efficiency goals. Lastly, it is also possible that entrants may perform comparably–instead of better or worse–to their counterparts in non-flooded regions. Bellon et al. (2021) find that personal wealth windfalls are associated with an increase in firm entries but do not systematically increase the survival rate of those businesses.

Given that disasters and federal cash grants represent negative and positive shocks to household income/wealth, respectively, post-disaster firm entry outcomes are expected to drive sectoral differences in entry dynamics. In particular, federal cash assistance may increase consumption (Roth Tran & Wilson, 2023; Gallagher et al., 2023). These factors predict that firm entry outcomes would mirror the negative and positive shocks to demand after non-declared and declared disasters, respectively.[26] Conversely, the impact on tradable sectors that cater to non-local demand (e.g., manufacturing) is expected to be much smaller.

[26]Standard models of firm dynamics predict that such an increase in local demand may be entirely absorbed by entrants. See Karahan et al. (2019); Decker et al. (2020); Hopenhayn et al. (2022).

4 Data and Econometric Strategy

4.1 Data

4.1.1 Flood events and disaster declaration status

Flood events and presidential disaster declarations– The Spatial Hazard Events and Losses Database for the US (SHELDUS) provides annualized information on human and financial losses associated with various hazard events and perils (like crop and property damage) starting from 1960. I use county-level aggregated SHELDUS data related to flood hazards for the period 1990-2016 from the Version 21.0 SHELDUS database released in February 2023. For many disasters, this dataset also provides measures of disaster damages by drawing on various data sources.[27]

Data were first downloaded from the SHELDUS website at the county-year level of aggregation for water-related adverse weather hazards that SHELDUS reports, namely, floods, severe storms/thunder storms, hurricanes/ tropical storms, hail, tornadoes, winter weather, and winds (winds being a highly similar hazard category to hurricanes). Two sets of downloads were carried out, first to identify the universe of these SHELDUS-reported hazard events, and then to identify the subset of these events which received presidential disaster declarations. Both downloads included measures of disaster intensity such as the number of records for each hazard in each affected county, property and crop damage estimates (adjusted to 2020 prices), the duration of hazard days, and counts of injuries and fatalities. These data were both subsequently re-aggregated to the yearly level and merged onto a combined panel of the business data to be able to identify counties which received disaster events and/or presidential declarations.

[27] E.g., FEMA, the National Oceanic and Atmospheric Administration.

4.1.2 Lending

I use data on bank lending to businesses from various sources. I use data on small business loans availed by the Community Reinvestment Act (CRA), which was enacted to encourage banks to meet the credit needs of the communities in which they operate. These CRA data cover both secured and unsecured small business loans and provide, for each county, the numbers and dollar amounts of small business that banks originated by loan size—below 100k USD, 100k-250k USD and 250k-1 million USD—from 1996 onward.

I assume that firm age is increasing in firm size (per Berger and Udell (1998)) and that the loan sizes are also increasing in firm age. I define the sub-$100,000 loan category as likely associated with the youngest firms and the $250,000-1million category, with the most established/oldest businesses among all businesses taking out sub-1million dollar loans. The subject of this study, young firms, are what contribute the most to net job creation in the US–not small firms (Haltiwanger et al., 2013). Yet, given that young firms often start out small, and that prior work on post-disaster credit has identified similar credit seeking behavior among young and large firms that is distinct from small firms Collier et al. (2020), my mapping between firm age and loan size is plausible.

Second, I use the Loan Applications Register (LAR) data from the Home Mortgage Disclosure Act (HMDA) to identify business-related loans secured by home-equity collateral following the approach in previous work on lending to young firms (see Doerr (2021)). These data are openly accessible from HMDA, which covers a substantial proportion of home mortgage applications and outcomes, loan amounts, as well as applicant demographic characteristics like race, gender, and ethnicity. Banks have to report the race, ethnicity, and gender of applicants who are not natural persons but companies as 'Not applicable' (Avery et al., 2007). I leverage this feature and restrict the loan data to bank-originated loans whose 'purpose' is mortgage refinancing in order to identify home equity loans associated with small businesses. This

approach is consistent with the framework discussed in Section 3 about how entrants are likely to rely on personal assets and collateral for financing in their early stages (Berger & Udell, 1998).

While the use of both of the CRA and HMDA datasets expands our understanding about post-disaster loan dynamics, there are important differences between these data sources. The HMDA data cover both applications for and approved loans but only for home-equity secured loans, while the CRA data cover only approved loans but for both secured and unsecured types. According to Doerr (2021), secured business-related loans reported in HMDA are, on average, larger than the average small business loan such as that reported in the CRA data, but loan amounts across the two datasets are generally highly and positively correlated. Note also that home equity value is likely to suffer from disasters.[28] Consistent with this, a survey of hurricane-affected firms finds that home equity-secured business loans were among the *least* common recovery lending source these businesses applied for (only 5% application rate) compared to business loans from banks, which were the *most common* channel businesses sought (53% application rate) (FRB, 2018). Thus, post-disaster loan applications for home-equity secured loans in HMDA should be interpreted as an under-estimate of total (secured and unsecured) loan demand by businesses.

4.1.3 Entry, exit, and firm outcomes

I use the Business Dynamics Statistics (BDS) data from the US Census Bureau to capture firm entry and outcomes. The BDS tracks business churn over time, providing annual measures of establishment openings and closings, firm startups and shutdowns, and job creation and destruction by industrial sector, 3-digit and 4-digit NAICS, state, MSA, and county. These measures are also available by firm and establishment size and age. The BDS captures firms that have at least one paid employee and pay taxes. To complement the extensive margin analyses of entry and

[28] See Cen (2021)

exit and understand firm outcomes, I draw on a key intensive margin outcome of young firms captured in the BDS, job creation.[29]

I use the Census Bureau's County Business Patterns data to observe average payrolls. The CBP is another publicly available Census data source that reports various elements of county-level business cycles, such as establishment counts, payrolls, and employment for most NAICS industries except for crop/farming sectors, government/public employees, and a few other sectors. I use the mid-March employment and annual payroll figures reported in the CBP data to calculate average payrolls, both as payroll per establishment and payroll per employee.

4.1.4 Controls

Lastly, I obtain data on population size and the composition by different age and race groups from the Surveillance Epidemiology and End Results (SEER) population database. I use these data to control for pre-disaster county population size, share of population aged between 20-64, and the share of Black and Hispanic residents.

4.2 Econometric Strategy

I use the below a distributed lag model, which cumulates the gama coefficients for a treatment over the 3 periods prior to and 4 periods after the disaster.

$$Y_{ct} = \sum_{j=-3, j\neq -1}^{4} \gamma_j D_{c,t+j} + \beta X_{ct} + \alpha_c + \theta_t + \varepsilon_{ct} \tag{1}$$

Y_{ct} represents outcomes like firm entry in county c year t. X_{ct} represents control variables related to county population characteristics. α_c are individual county fixed effects. γ_t are year fixed effects. ϵ_{ct} is the error term. Errors are clustered by county.

The treatment, represented by the binary dummy, D, represents a declared or non-declared flood event j years ago in county c in year t. In each case, the sample

[29] Young firms create the vast majority of net new jobs (see Haltiwanger et al. (2013)).

is limited to regions which experienced at most 1 year with flooding but no flood declaration or those with declared flood in the overall event study window of 7 years. This helps to ensure that repeated flooding across years within the event study window (especially if there is additional heterogeneity on whether those multiple events are declared or not) does not systematically affect my results.

4.3 Samples

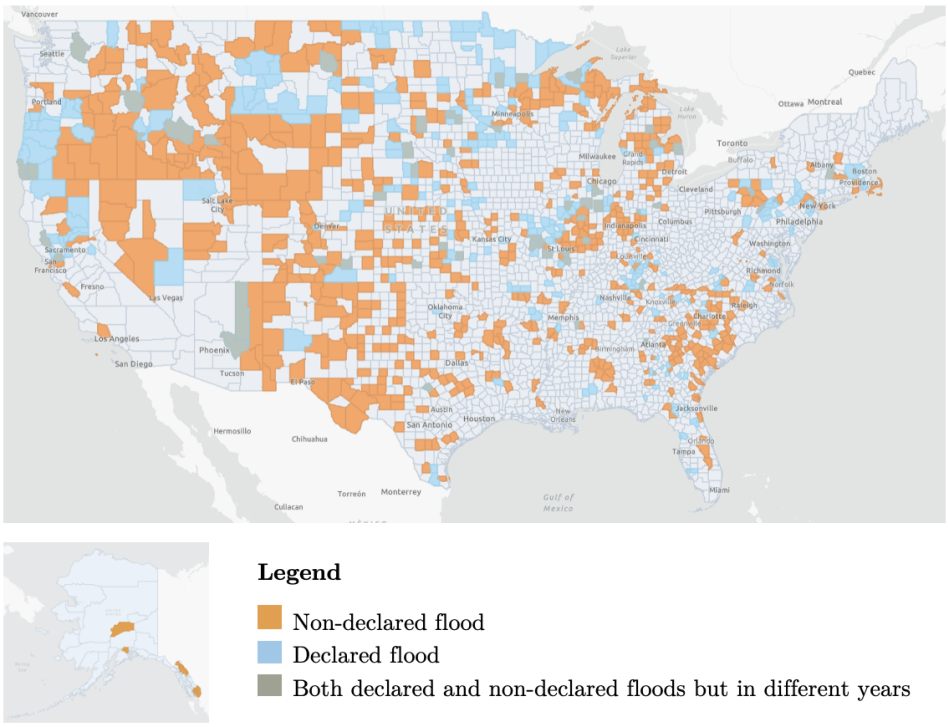
Combining the data from the different sources discussed in Section 4 and dropping counties which are missing any years of business-related data gives me a strongly balanced county-year panel for the period 1990-2016 with 84,213 observations. In this panel, about 32 percent of counties have experienced flooding in some year.

Consistent with my distributed lag estimation (see Equation 1), which considers the three periods prior to a flood and the 4 years after it, I identify flooded counties around a 7-year event window between 1994-2014. Regions which receive frequent disasters may have characteristics—such as such as population size and composition, urbanization, wealth, amenities, coastal location—that influence their business dynamics, their likelihood of requesting and receiving federal disaster assistance once a disaster occurs. Additionally, there may be selection in the types of individuals who settle in highly flood prone areas or those who leave after disasters. These factors could, in turn, invalidate the parallel trends assumption for my difference-in-differences strategy. Thus, allowing flooded regions to receive *at most* one flood in a 7-year window helps to isolate the impact of a relatively rare and unanticipated flood that may come as a real shock to finances and regional dynamics. The requirement that flooded regions experience no other flood in the 3 years prior to that particular event and in the 4 years following it holds for 43 percent of the starting panel.

I construct one common control group and two treated groups based on the following sample restrictions. The common control group consists of counties with no flood event 3 years before and 4 years after any given year. The sample of regions

with a non-declared flood treatment consists of counties that experienced one year with a flood but no federal disaster declaration in a 7-year event window. Conversely, the sample of regions with a declared flood treatment consists of counties which had exactly one year with a presidentially-declared flood in a 7-year window, and no non-declared flood in that 7-year window. Additionally, I exclude regions which may have experienced a storm or hurricane-related declaration from all three subsamples. The reason for excluding these is that storms and hurricanes are related to flooding and may affect similar places, but those that are associated with federal disaster declarations tend to be much larger than flood events and may have more lasting effects on regional finances and firm dynamics that do not die out in 4 years.

Figure 1: Counties that experienced flooding in any year between 1994-2014



Source: SHELDUS

Figure 1 shows the spatial distribution of regions which received declared and non-declared flood treatments in any year across the 1994-2014 period. The flooded regions included in my subsamples are generally spread out throughout the US instead of being merely concentrated in only some regions, like coastal regions in the

South Eastern part of the U.S., which receive frequent flooding due to rising sea levels and storms. This demonstrates the one-flood-in-7-years restriction in constructing the subsamples of flooded regions is somewhat effective to exclude coastal regions with high disaster exposure due to climate change. It is also notable from this map that, while there is a relatively higher number of counties with non-declared flooding, the locations of counties with declared and non-declared flooding are not mutually exclusive: they are often located near one another in contiguous counties. There are also a small group of counties in my sample that experienced both declared and non-declared flooding but in different 7-year windows.

Table 1 below shows summary statistics and mean differences across the declared flood, non-declared flood and no flood (control) samples from the year 2004 for key dependent and independent variables. The year 2004 is chosen as a reference because, among counties in the treated (flooded) groups, the median year of non-declared floods was 2005 and that of declared floods was 2006. Thus, 2004 serves as a common pre-period for the treated samples against the non-flooded control, which inherently has no pre-event period.

Note here that this table gives summary statistics on levels, while my difference-in-differences strategy with county and time fixed effects that was discussed in Section 4.2 compares differences in trends across the different flooded and control groups over time. As such, statistically significant mean differences across the subsamples will be absorbed by the county and time fixed effects in my regression analyses so long as they are time- and space-invariant. Statistically significant pre-trends across treated and control groups in my distributed lag results (in Section 5) would be more concerning for my identification rather than level differences in Table 1.

Overall, the control and two treated samples appear fairly comparable in terms of young firm activity and business lending. There are a few statistically significant mean differences (see last 3 columns), particularly related to population composition. Notably, counties with declared floods have a 9% and 7% lower share of Black

and Hispanic residents compared to the non-flooded control and non-declared flood regions, respectively ($p < 0.01$). These differences are in levels and can be absorbed by the county fixed effects in my regressions. Still, I include controls in my regression analyses as interactions between flood treatment status and whether the county had above-median population size, share of age 20-64 residents, and share of minority residents in the decennial census year preceding the year of the flood treatment.

Table 1: Snapshot of key outcome and explanatory variables from 2004

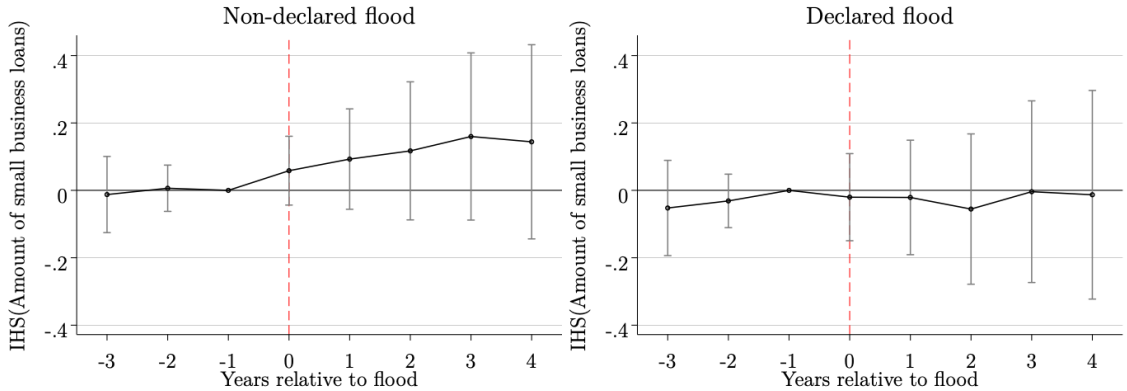
	Summary Statistics						**Pairwise t-tests**					
	Declared		Non-declared		Control		Declared-Non-declared		Declared-Control		Non-declared-Control	
Variable	N/Clusters	Mean/(SE)	N/Clusters	Mean/(SE)	N/Clusters	Mean/(SE)	N/Clusters	Mean difference	N/Clusters	Mean difference	N/Clusters	Mean difference
New firm entries p.c.	97	0.00162	309	0.00154	684	0.00149	406	0.00007	781	0.00013	993	0.00005
	97	(0.00008)	309	(0.00005)	684	(0.00004)	406		781		993	
Incumbent (non-entrant) firms p.c.	97	0.02042	309	0.01981	684	0.02024	406	0.00061	781	0.00017	993	-0.00044
	97	(0.00066)	309	(0.00037)	684	(0.00030)	406		781		993	
Net new firm entries p.c.	97	0.00032	309	0.00023	684	0.00020	406	0.00009	781	0.00012	993	0.00003
	97	(0.00008)	309	(0.00004)	684	(0.00003)	406		781		993	
Entrants' job creation (pop. weighted)	97	0.00757	309	0.00705	684	0.00632	406	0.00051	781	0.00125	993	0.00074*
	97	(0.00129)	309	(0.00037)	684	(0.00020)	406		781		993	
Average payroll (in 1000 USD)	97	25.65060	309	26.17791	683	25.15429	406	-0.52731	780	0.49631	992	1.02362**
	97	(0.52034)	309	(0.39881)	683	(0.25319)	406		780		992	
Payroll per establishment (in 1000s)	97	296.76814	309	296.37039	685	276.81548	406	0.39775	782	19.95267	994	19.55491
	97	(15.22846)	309	(9.57881)	685	(7.40699)	406		782		994	
County population (in 1000s)	97	54.52952	309	71.52217	685	45.13414	406	-16.99265	782	9.39537	994	26.38802**
	97	(12.96084)	309	(11.45112)	685	(6.02372)	406		782		994	
% Black & Hispanic residents	97	0.07507	309	0.16780	685	0.14733	406	-0.09273***	782	-0.07226***	994	0.02046
	97	(0.01126)	309	(0.01081)	685	(0.00672)	406		782		994	
% county residents aged 20-64	97	0.56474	309	0.57105	685	0.56650	406	-0.00631	782	-0.00176	994	0.00455*
	97	(0.00341)	309	(0.00209)	685	(0.00147)	406		782		994	
Total HMDA business loans (in 1000 USD)	97	1.91e+03	309	2.46e+03	685	1.57e+03	406	-5.51e+02	782	338.36000	994	889.12765
	97	(750.32961)	309	(595.99922)	685	(434.98793)	406		782		994	
Total small business loans (in 1000 USD)	97	5.50e+04	309	6.80e+04	685	4.33e+04	406	-1.30e+04	782	1.17e+04	994	2.47e+04*
	97	(1.46e+04)	309	(1.07e+04)	685	(6.66e+03)	406		782		994	
% business loans sub-$100,000	97	0.43274	309	0.46971	685	0.47830	406	-0.03698*	782	-0.04556**	994	-0.00859
	97	(0.01702)	309	(0.01191)	685	(0.00822)	406		782		994	
% business loans b/n $250,000-1m	97	0.38396	309	0.35003	685	0.34773	406	0.03393*	782	0.03623**	994	0.00230
	97	(0.01538)	309	(0.01068)	685	(0.00766)	406		782		994	
F-test of joint significance (F-stat)								3.52432***		3.32011***		1.10044
F-test, number of observations								406		779		991
F-test, number of clusters								406		779		991

5 Results

5.1 First Stage

Disasters are a shock to firm capital and cash flow, thereby increasing firms' demand for recovery lending. I use the Community Reinvestment Act data to examine how this factors into the total loans originated by banks and the variation by firm size. Figure 2 shows that in the absence of a presidential disaster declaration, banks in flooded regions increase their small business lending by a statistically insignificant 18 percent relative to the non-flooded control (left panel). Yet when federal assistance is available (right panel), there is no evidence of economically significant change in bank lending amounts. The difference in the magnitude of the coefficients suggests that federal disaster loans supplement the loan supply of banks.

Figure 2: Total amount of originated small business loans by banks



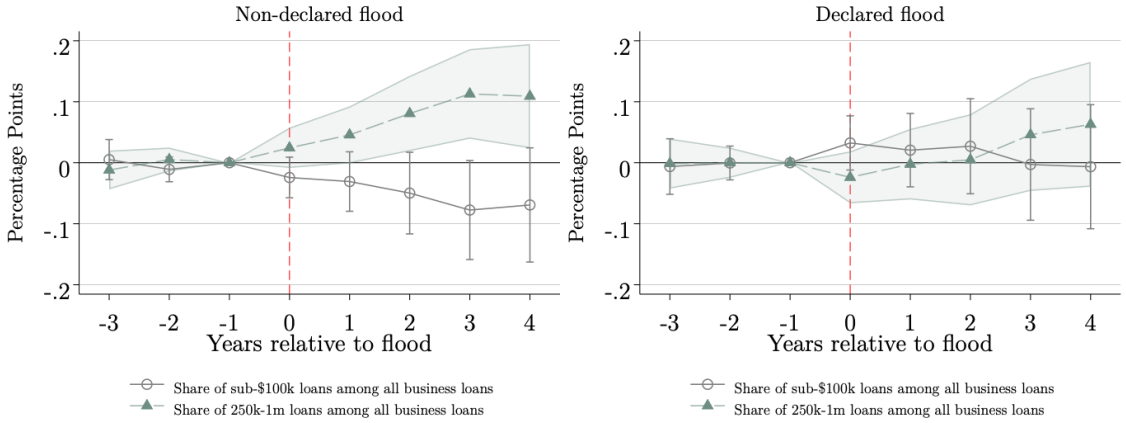
Obs.: 8944, Counties: 1210, (1996 - 2014). Obs.: 10402, Counties: 1352, (1996 - 2014).

Sources: SHELDUS, CRA, SEER

The aggregate changes in post-disaster bank lending mask significant heterogeneity among smaller and larger firms in terms of their access to financing. To study this, I compare amounts of loans originated by banks under two different loan size categories: loans below $100k, and those between $250k and $1 million. In the absence of a presidential declaration, smaller firms are more likely to face credit con-

straints. As the left panel of Figure 3 shows, after a non-declared flood, the share of loan dollars that went into sub-$100k loans for smaller firms, which are more likely than larger ones to take out smaller sized loans, declines by about 7 p.p. 3-4 years later. Conversely, the share of loan dollars going into $250k-1 million loans for larger firms, which are more likely to take out larger-sized loans, increases by 11 p.p., which is about a third of the share in the baseline control (see Table 1). As discussed in Section 3, the life-cycle model of firm financing in Berger and Udell (1998) assumes a positive and monotonic association between firm age, firm size, and information. Thus, since young firms often start out small, these results can be interpreted as reflecting that bank loan supply is primarily taken up by established firms following non-declared flood shocks, leaving the youngest firms credit constrained.

Figure 3: Share of originated small business loans by loan size



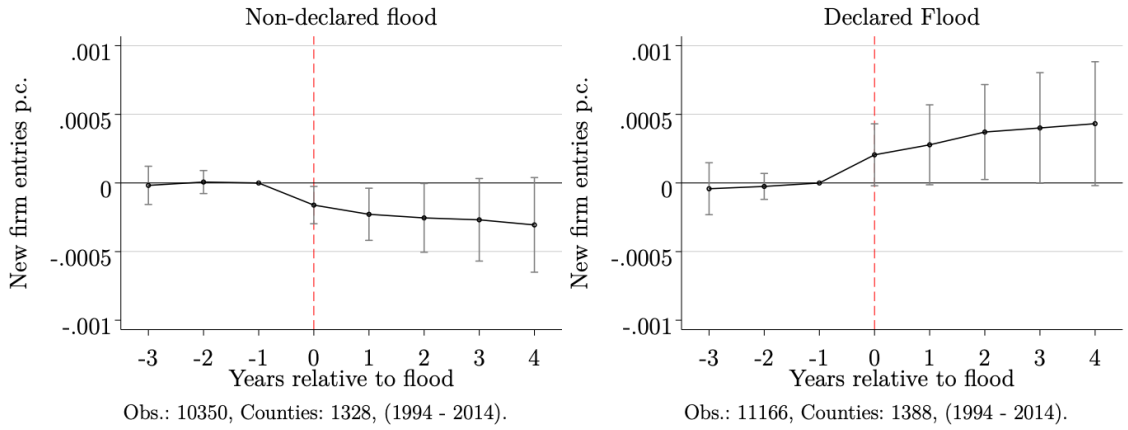
Sources: SHELDUS, CRA, SEER

On the contrary, when federal disaster assistance is available, there are no apparent changes in the share of loan dollars that go to smaller and larger firms (see right panel of Figure 3). This result may not be surprising given that SBA disaster loans may be more preferable compared to bank loans because of their lower interest rates (see Lindsay and Getter (2023); Duqi et al. (2021)). As such, broad-based access to SBA disaster loans to incumbents appears to free up bank credit supply to entrants that may have otherwise been taken up by established (older) firms.

5.2 Main Effects on Firm Entry

The main results on net firm starts are captured in Figure 4. The y-axis represents new employer firm entrants weighted by the county's population. Relative to baseline trends in the common control group with no flooding, non-declared floods (left panel) are associated with a negative impact on firm entries. In particular, these regions see about 2-3 fewer firms per 10,000 county residents for up to 2 years after the flood. Conversely, counties with declared flooding see 4 new firms per 10,000 county residents in the post-flood period.[30] These findings suggest highly persistent and divergent patterns in firm entry across flooded regions with and without a PDD.

Figure 4: Firm entries (weighted by county population)



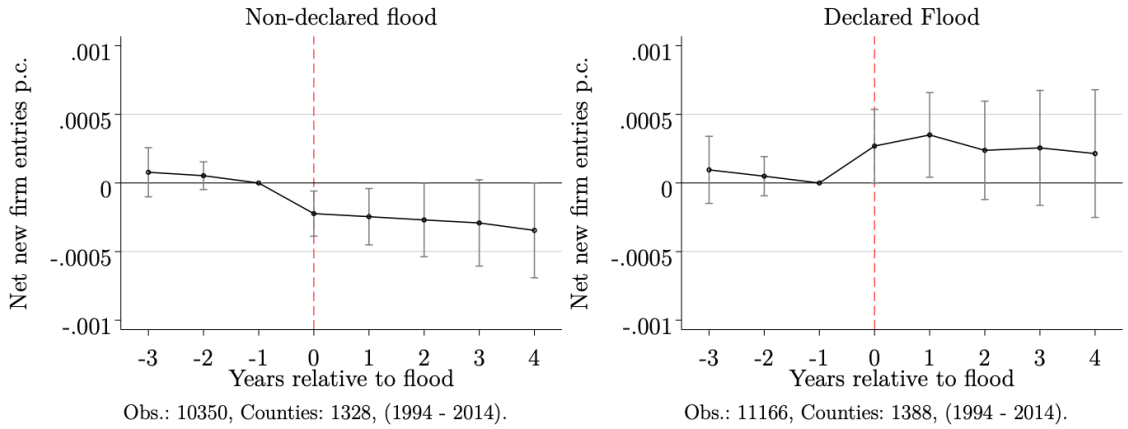
Sources: SHELDUS, BDS, SEER

Flooded counties also see divergent patterns in *net* firm entries, i.e., firm entries minus firm exits. The left panel of Figure 5 shows that, for every 10,000 county residents, there is a net exit of 2-3 firms after non-declared floods. But, when federal disaster loans are available (right panel), there are 3 excess entrants net of firm deaths in the year following the flood compared to the non-flooded control. Hence, the divergent trends in firm entry in Figure 4 are not merely the result of severity differences between declared and non-declared floods that affect firm exit rates.

[30] Appendix Figure A.2 shows no evidence of statistically significant change in population, but regions with federally declared floods see about a 4 percent increase 4 years after a flood.

Instead, firm deaths are largely similar across the non-declared and declared flood regions in the immediate year after the disaster but see a pronounced increase after 2 years out only after a declared flood (see also Appendix Figure A.3 for a stand-alone result on firm exits). This suggests that federal disaster loans indirectly accelerate business churn, primarily through the firm entry margin.

Figure 5: Firm entries net of exits (weighted by county population)



Sources: SHELDUS, BDS, SEER

5.3 Heterogeneity Across Sectors

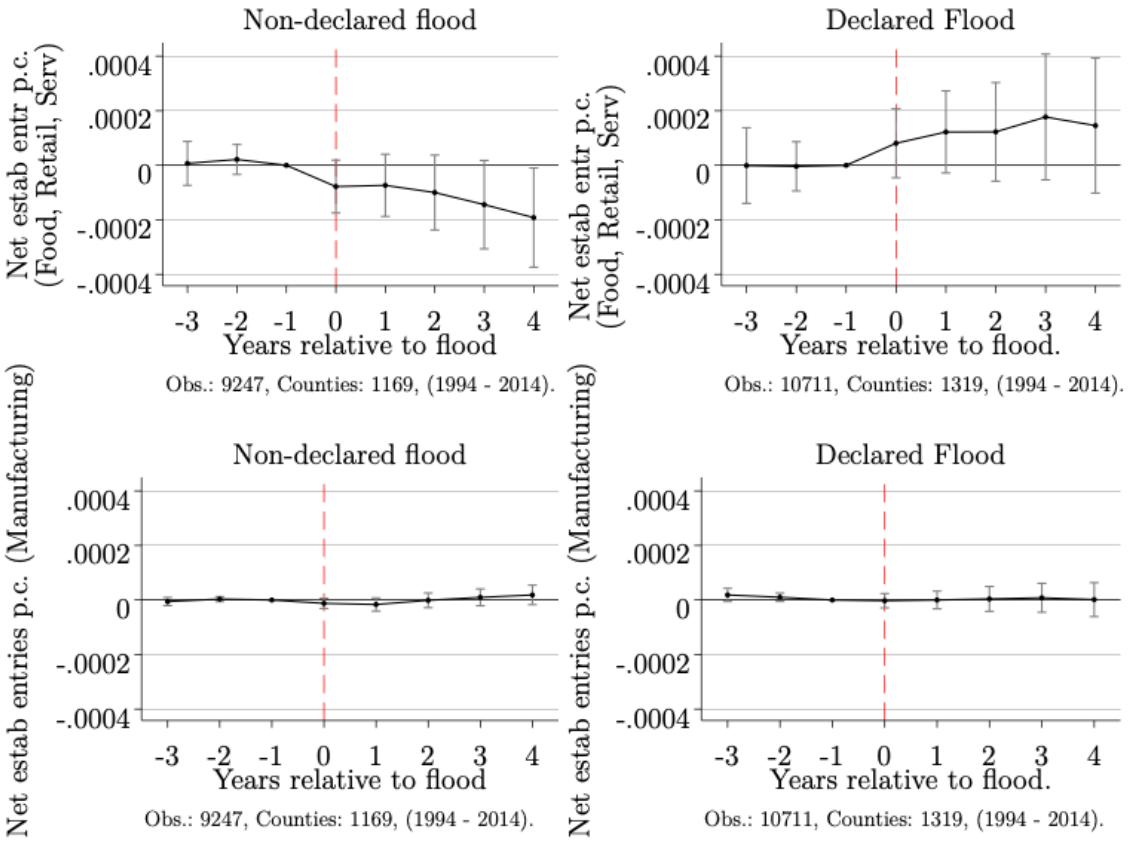
Disasters and federal cash assistance to households (which always coincide with SBA disaster loans) are shocks to local demand and are likely to affect sectors that are sensitive to local consumption. While data on firm age distributions for each industry are not publicly available in the BDS or CBP, I use data on net establishment entries—establishment births net of establishment exits among firms of *any* age—from the BDS to infer entry-exit dynamics in various sectors.[31]

Sectors which are highly sensitive to local demand experience larger impacts in establishment entry-exit dynamics compared to the manufacturing sector, the demand for whose products/services is not restricted to local consumers. The top two

[31]See Appendix Figure A.6 for results based on population-weighted firm counts by sector.

panels of Figure 6 show the population-weighted counts of establishment entries net of establishment exits in non-tradable sectors, namely the food and accommodation, retail, and professional services sectors.[32] The bottom two panels show net establishment entries in the manufacturing sector.[33]

Figure 6: Population-weighted establishment entries net of exits in non-tradable (top panels) and tradable sectors (bottom panels)



Sources: SHELDUS, BDS, SEER

The top panels of Figure 6 show that there is a net exit of 2 establishments

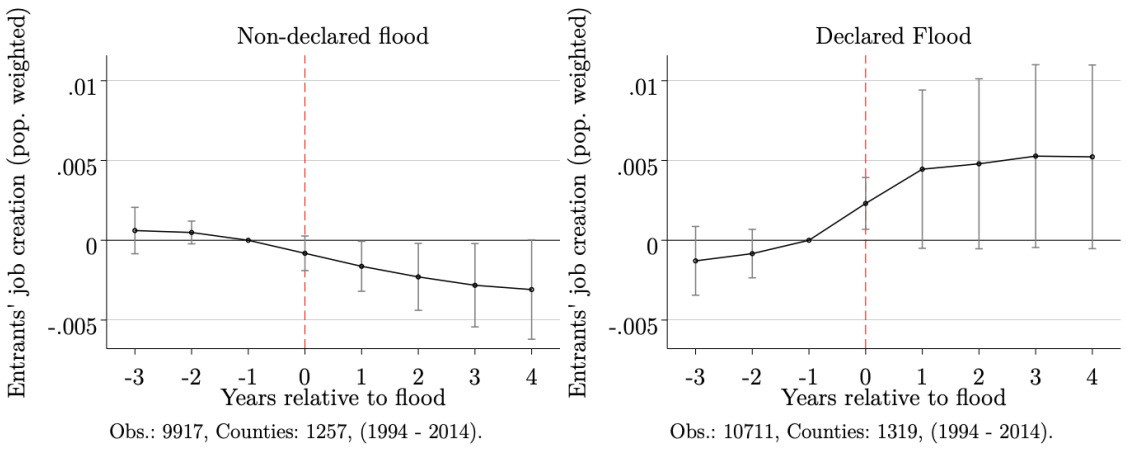
[32]For precision, these are: "Accommodation and Food Services" (NAICS code 72), "Retail Trade" (NAICS code 44-45) and "Professional, scientific, and technical services" (NAICS code 54) sectors.

[33]Distinct from other non-tradables, the construction sector likely experiences a boost in demand after both declared and non-declared disasters due to rebuilding needs. Thus, I study it separately from other non-tradable sectors. Appendix Figure A.4 shows that the sector sees 2 net new construction establishments in the year after a declared flood.

per 10,000 county residents 4 years after a non-declared flood. Federal assistance offsets such a drop and is rather associated with an increasing trend in a net entry of establishments. But after federally declared floods, there is a similarly-sized but opposite effect–an excess entry of 2 establishments per 10,000 country residents 4 years later. In comparison, the manufacturing sector generally sees similar patterns of net establishment entries but the effect sizes are much smaller that what is observed in non-tradable sectors (bottom panels). This is consistent with prior finding that federal disaster loans increase survival of non-manufacturing businesses relying on local demand Gallagher et al. (2023); Collier et al. (2024).

5.4 Firm Performance and Aggregate Outcomes

Figure 7: Entrant cohorts' job creation (weighted by county population)



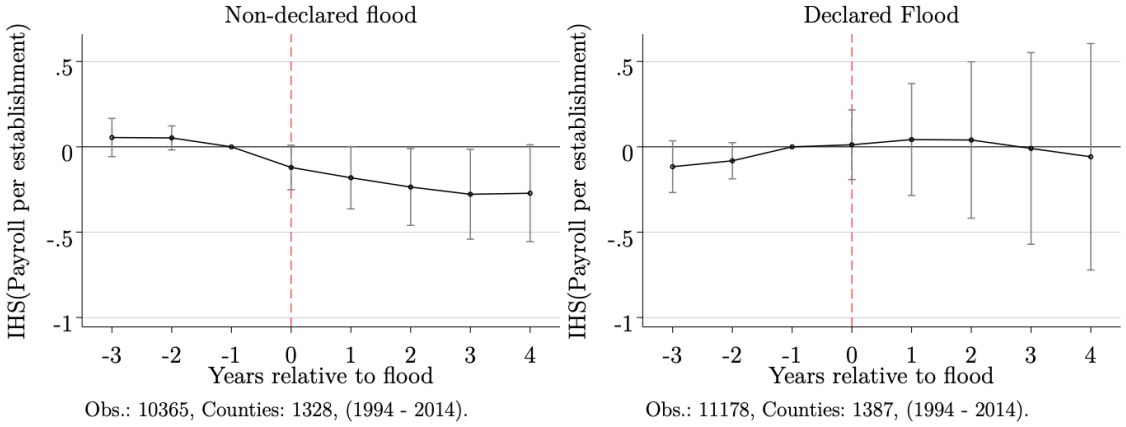
Sources: SHELDUS, BDS, SEER

I find that the job creation outcomes of cohorts of entrants follow divergent patterns across regions with non-declared and declared flooding. The left panel of Figure 7 shows that, after flood shocks, job creation by cohorts of firm entrants drops by 20-30 per 10,000 county residents relative to the control group with no flooding. But, when federal aid is available after flooding, it not only offsets the drop in entrants' job creation that may have otherwise occurred but also appears

to set entrant job creation on a comparable, if not higher, trend compared to the non-flooded control: relative to this non-flooded common control, entrants create 50 more jobs per 10,000 county residents in the third year after the declared flood.

Further, in Appendix Figure A.5, I show that the post-disaster *average* job creation of entrants evolves largely similarly, with no statistically significant change from the non-flooded baseline, across declared and non-declared flood regions, with relatively higher coefficient magnitudes after declared disasters. This suggests that entrant quality does not necessarily decline in either of these contexts and that, the increase in firm deaths 2 years after federally declared disasters (see Figure A.3) reflects increased entry-exit dynamism rather than a distortionary role of federal aid.

Figure 8: Payroll per business establishment (businesses of any age)



Sources: SHELDUS, CBP, SEER

Unlike flooded counties with broad access to SBA loans, counties with non-declared flooding see a decline in overall business performance, suggesting that declining young firm activity is associated with declining firm revenues (from which employee payrolls are sourced). As the left panel of Figure 8 shows that the average payroll across business establishments of all ages in flooded regions drops by about 25 percent 3-4 years after a non-declared flood.[34] This result is not merely driven by compositional factors like declining employment at those establishments because, as

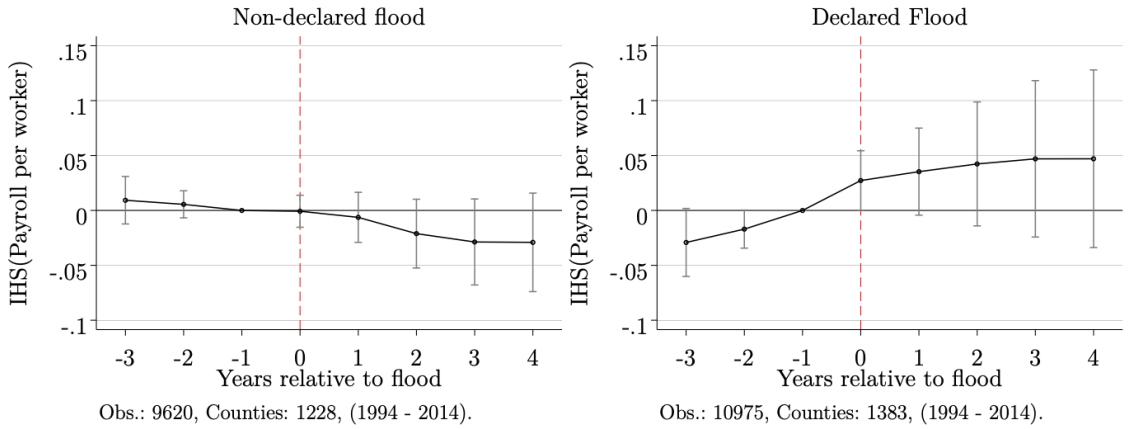
[34]Data on payrolls by each firm age group are not available in the BDS and CBP.

Figure 9 below shows, average worker wages also decline in those regions. As such, it is an important finding about the importance of young firm activity for aggregate outcomes, including in post-disaster settings. If young firm activity did not matter for aggregate outcomes, then the previously shown results of a decline in loan access to smaller and younger firms (Figure 3) as well as declining firm entries (Figure 4) would, mechanically, suggest that those non-declared flood counties should see higher average payroll per establishment due to relatively higher survival among more established (larger and/or older) businesses in those counties. Yet, the fact that Figure 8 shows the opposite–a decline in average establishment payrolls and, by extension, revenues–demonstrates that the decline in young firm activity in those non-declared flood counties is associated with declining business dynamism region-wide, which is consistent with previous findings that young firm activity is a central driver of job creation, productivity growth, and creative destruction (Decker et al., 2014). This also lends further credence to my interpretation of loan size and firm size as proxies for firm age–if the first stage result in Figure 3 was merely capturing firm size but not age, it would be highly implausible that the decline in small firm activity would singularly drive the decline in average business revenues documented in Figure 8 because young, not small, firms are what drive business dynamism (Haltiwanger et al., 2013).

The right panel of Figure 8 suggests that there is no evidence of a statistically or economically significant change in the average payroll paid by establishments in declared flood counties compared to the non-flooded control. This suggests that the positive spillovers of federal disaster loans onto the firm entry margin sustains broader regional firm performance.

More broadly, I find that increased firm entry after federally declared disasters is associated with higher regional wages, one key indicator of disaster recovery. While the coefficients are estimated imprecisely, Figure 9 shows clear and diverging patterns in how payroll-per-worker evolves after non-declared (left) and declared (right) floods which do not and do have access to SBA disaster loans. Compared to the non-flooded

Figure 9: Payroll per worker (i.e., wages)



Sources: SHELDUS, CBP, SEER

control, the average employee compensation is about 4 percent lower four years after a non-declared flood. However, when federal aid is available, worker payrolls are higher by about 5 percent in the same 4-year window. Hence, the positive spillovers of federal disaster loans on young firm activity sustain worker wages that would have declined in a counterfactual in which firm entry shrinks due to financing constraints. These findings regarding average wages also further confirm that the results on average payroll per establishment in Figure 8 are not merely driven by the reduction of employees per establishment.

6 Marginal Value of Public Funds

Following Hendren and Sprung-Keyser (2020), I calculate the marginal value of public funds (MVPF) of SBA disaster loans using the below equation:

$$\text{MVPF} = \frac{\text{Willingness to Pay (WTP) of beneficiaries}}{\text{Net cost to government}} \tag{2}$$

The detailed calculation is presented in Table A.2 in the Appendix but I give a short summary here. I estimate the amounts shown in Equation 2 under a simple hypo-

thetical set-up that is close to the ideal experiment described in the Introduction and use the estimates from my reduced form analyses. Suppose there are two identical counties, County A and County B, that each house 10,000 residents. For simplicity, I take values from the control group means in from Table 1 to set certain uniform characteristics for both counties. Thus, I assume that each county has 200 (incumbent) firms, with their average annual revenue being $1.84 million.[35] The average payroll is $25,000. The average tax rate faced by workers is 13.6%, for firms, it is 20%, and banks face a 21% corporate tax rate.[36]

Imagine that both counties are hit by a flood of the same size but that only County B gets a disaster declaration. All 200 pre-disaster businesses in each county seek loans to weather the negative shock, but the federal declaration makes all the businesses in County B eligible to apply for low-interest disaster loans. Since surveys of hurricane-affected firms find that 52% of them sought federal assistance, mainly SBA disaster loans (FRB, 2018), assume that half of the 200 incumbents in County B (i.e., 100 firms) apply for a federal disaster loan. To be more conservative, assume that these incumbents get the highest SBA interest rate for businesses that have other sources of credit, 8% (Lindsay & Getter, 2023), which is still lower than the bank interest rate of 10.5% (GoldmanSachs, 2023). Defaults are more likely after disasters: assume that the default rate on SBA disaster loans of 10.35% but that for bank loans is lower, at 3%.[37] In line with the grouping of loan sizes used in my analyses, incumbents borrow 250k while entrants in County B borrow 100k at the higher bank rate. The earning premium for owning a small, young business as relative to wage work is 36%, i.e., 9,000 compared to the 25,000 average wage.[38]

[35] I assume a conservative 15% share of employee payrolls from total business revenues (see Quanne (2023)). Payroll per worker was $276,000 in 2004 in the control group (Table 1).

[36] See York (2023), Watson (2022), and Watson (2022) as references for the tax rates faced by workers, firms, and banks, respectively.

[37] Lindsay and Getter (2023)—rates of default for disaster-related SBA loans (which is 10.35%) are higher than for regular SBA loans (4%). I attribute this 4$ regular SBA default rate as the post-disaster default rate that banks may face.

[38] Levine and Rubinstein (2017) find that owners of incorporated businesses earn 36% more per hour. I cannot identify incorporation status of firms in the BDS. But because the BDS only captures employer firms (and not self-employed individuals, who are likely to earn less than wage workers),

Since the MVPF considers long-term net costs and WTP involved with a policy, I consider the outcomes estimated 4 years after the disaster events. My results suggest that four years after the flood, there would be 7 more firm entrants in County B compared to County A (difference between coefficient estimates of -3 and 4 per 10,000 residents in Figure 4). Worker payrolls would be 8% higher in County B relative to County A. Average firm revenues would stay the same as the pre-disaster level in County B but they would drop by 25% in County A.

The net costs of government spending on SBA recovery loans for County B compared to the counterfactual in Count A is calculated as the difference between the cost (including opportunity costs) of the total SBA disaster loan dollars on one hand and, on the other, the loan paybacks and additional tax revenues in County B. In particular, the opportunity cost of SBA disaster loans consists of two items: the interest income that the government could have earned if it had invested those funds,[39] and the corporate taxes the government would have collected from banks if County B's incumbent businesses had borrowed from banks instead of the SBA like their counterparts in County A. The income/tax revenue we would deduct comes from the loan paybacks and interest income (net of defaults) and additional tax revenues from the earnings of businesses and workers as well as the earning premia enjoyed by the 7 new entrants in County B. Ultimately, this latter set of revenues and taxes more than fully compensates for the upfront costs of providing the loans, making for a *negative* net cost of about 13 million for the government.

Further, the WTP of beneficiaries (the numerator) is positive, meaning that the federal disaster loan program is an infinite MVPF policy that *more than* pays for itself. Relative to the counterfactual in County A, the WTP of beneficiaries in County B is calculated by deducting the costs faced—i.e., the 7 new entrants' loan payback obligations (principal + interest)—from the additional post-tax revenues or cost savings of businesses, workers, and entrants in County B. In particular, the

I use this 36% figure for my analyses.

[39]In particular, I assume a relatively safe Treasury Bond investment with a 5% return.

latter consists of the post-tax amounts of sustained worker wages and firm revenues in County B that would have dropped in the County A counterfactual, the 100 incumbent firms' savings on their lower interest payments to the SBA (compared to their bank loan outside option), as well as the post-tax earnings of the 7 entrants on the $9,000 earnings premium they enjoy compared to the wage-work outside option. The numerator comes out to about 93 million dollars, which, when divided by the no net cost denominator calculated above, results an MVPF of about -7. This suggests an infinite WTP of beneficiaries for federal disaster loans to businesses. In other words, while the SBA disaster loan program only directly lends to incumbent businesses, it recoups all of its initial upfront costs (and opportunity costs) due to its positive spillovers on the firm entry margin, which props up economic recovery.

These findings highlight a previously-underexplored yet remarkable benefit of federal disaster assistance to local disaster recovery. This hypothetical exercise demonstrates a particular benefits of young firm activity for economic dynamism and regional recovery after disasters. Many programs that invest in young children have infinite MVPFs, and among programs targeting adults, those with spillovers onto children have been found to have particularly high bang-for-buck (Hendren & Sprung-Keyser, 2020). In a similar vein, this paper demonstrates a distinct benefit of direct government spending on older firms that has positive spillovers onto the most important margin of firm dynamics–the entry margin.

7 Robustness

Loan demand vs loan supply: One alternative explanation for the disparate patterns in shares of smaller and larger-sized bank loans after non-declared floods (left panel of Figure 3) may be disparities in loan demand, namely declining loan demand among younger firms and increased demand among more established ones.

However, my analyses using loan application data find no evidence of pro-

nounced disparities in loan demand between newer and older firms. I study this using HMDA data, which allow me to observe both applications for and approved loans unlike the CRA data, which only capture approved loans. Figure A.8 depicts the percent changes in total business-related home equity loan applications of different loan sizes. The left panel shows no evidence of a statistically significant deviation in applications for the different–i.e., smaller vs larger–loan categories after non-declared floods compared to the no-disaster control. Applications for home-equity secured business loans under the sub-$100k category decline by a statistically insignificant 20% 4 years after non-declared floods, but this coefficient is highly similar to that for larger sized loans between $250k-1 million. This suggests that loan demand after non-declared floods for both large and small loan size groups remains largely comparable. After declared floods, demand for larger-sized loans more than doubles ($p<0.01$), consistent with expanding business activity in those regions.

As explained in Section 4.1.2, the loan applications observed in HMDA data are likely to be an under-estimate of the total (secured and unsecured) loan demand by firms because disasters depreciate home equity collateral,[40] which is the main focus of HMDA data. There is little reason to expect that demand unsecured loans would decrease when the results in Figure A.8 suggest there is no statistically significant decrease in the demand for loans secured by home equity across any loan size. Further, these robustness results are consistent with prior findings that young firms and large firms are both highly likely to apply for credit after disasters, but that larger firms are more likely to receive all the credit that they requested (see Collier et al. (2020)). Thus, the decline in bank lending to younger businesses shown in Figure 3 is not driven by declining loan demand from younger firms.

Differences in severity between declared and non-declared disasters Despite the fact that I study net outcomes (e.g., net firm entries), concerns related to my comparison of declared and non-declared disasters—declared disasters are, on average, more destructive than non-declared ones, and may superficially appear to

[40] Cen (2021) shows that flooding reduces property values.

be followed by increased firm entry due to an Ashenfelter's dip phenomenon. As an additional measure to quell such concerns, I provide evidence on a narrower comparison between disasters that were associated with similar levels of damage using the thresholds for damage per county resident that FEMA uses to evaluate whether its larger rebuilding programs are warranted after a disaster event. These thresholds primarily fall between $2.50 and $3.60 in the publicly available records.[41] Thus, I re-estimate the main results related to firm entry restricting my sample to flooded regions which suffered a slightly wider range of damages, $2-$4 dollars per county resident. The results are presented in Appendix Figures A.9 and A.10, and are largely consistent with the main results shown in the paper.

In addition to these robustness results, the fact I find strong and persistent negative impacts observed after non-declared floods in my main results establishes a lowerbound estimate of the true negative impacts that may be associated with highly destructive hazards in the absence of federal disaster assistance.

7.1 Other Potential Channels: The role of federal household assistance programs

For declared disasters, SBA disaster loans are always available as long as the federal Individuals and Households Assistance program has been declared. This cash transfer program has been shown to substantially aid household recovery after natural disasters (Gallagher & Hartley, 2022). While its coexistence with the SBA loan program makes the task of isolating the roles of the two programs virtually impossible, it is unlikely that it is the *primary* explanation behind key first-stage result of this paper (see Figure 3)–the large disparities in (aspiring) entrants' access to bank loans in non-declared and declared regions. Prior work shows that, following major hurricanes in the Caribbean, banks face deposit withdrawals and subsequently reduce lending (Brei et al., 2019). In my setting, disasters may decrease regional bank

[41] See https://www.fema.gov/assistance/public/tools-resources/per-capita-impact-indicator

deposits while federal cash assistance helps offset those declines, or, if it acts as a large windfall, it may even increase deposits beyond the baseline level.[42] To test this alternative hypothesis, I examine how bank deposits evolve following declared and non-declared floods using data from the Federal Deposit Insurance Corporation.[43] Figure A.7 in the Appendix shows that there is no evidence of statistically or economically significant difference in bank deposits across declared and non-declared flood regions. This is consistent with SBA loans being the central driver for the main bank credit channel I document in explaining disparate patterns of entrants' access to private loans (particularly for unsecured private loans) and young firm activity across declared and non-declared disaster regions.

One channel through which cash assistance may expand entrants' access to (secured) bank credit after declared disasters is by enabling repair of disaster damages to housing collateral. This channel is particularly relevant for young firm financing because one of the most common methods through which young firms obtain external credit in their early life is to use their home equity as collateral.[44] In line with the predictions of dynamic risk management theory that more financially constrained firms may be less likely to insure (Rampini et al., 2014), banks may increase demand for collateral for younger and smaller borrowers following disasters. Thus, federal cash transfers may expand (aspiring) entrants' access to collateral-secured credit by enabling them to repair damage to housing value that may have otherwise declined.

Appendix Figure A.11, which is based on both loan application and decisions in the HMDA data, suggests that bank requirements for collateral increases after disasters, particularly for smaller loan sizes. The left panel of Figure A.11 shows that the share of approved business-related home equity loans in the sub-$100k category increases by more than 10 percentage points after both declared and non-

[42]The discovery of oil and natural gas shale discoveries has been documented to increase bank deposit/liquidity inflows and loan supply (Gilje et al., 2016). Thus, in this context, if households have no pre-disaster financial constraints, federal cash transfers may act as a windfall and contribute to much higher bank deposits and lending.

[43]https://www7.fdic.gov/sod/dynaDownload.asp?barItem=6

[44]See Berger and Udell (1998); Doerr (2021).

declared floods ($p<0.05$)–the increase happens gradually (after 2 years or so) after non-declared disasters but more immediately for declared disasters, consistent with the interpretation that federal cash assistance may enable quicker home repair. Approval rates for larger loan categories ($250k-1m) increase by a much higher 30 p.p. after non-declared floods but evolve similarly to trends in the non-flooded control, and at lower magnitudes compared to approval rates for smaller loan size categories, after declared floods. Overall, these results suggest a positive role of cash transfers by the federal government to disaster-damaged households in further enabling young firm activity after declared disasters by enabling flood-damage repair.

Note however that, as discussed in Section 4, business-related loan sizes in HMDA data are, on average, higher than those in small business loans (captured by CRA data), and that HMDA loans are one of the *least* common recovery loan sources sought out by disaster affected businesses while bank business loans in CRA data are the most common source of recovery credit sought out by disaster-affected businesses. So it is possible that relative to the categorizations in the CRA data, the sub-$100k versus $250k-1million loan size categories in the HMDA may be less meaningful/reliable as a proxy for entrants versus incumbents, respectively (e.g., these may also be capturing disaster-unaffected incumbents, or larger and/or growth oriented young firms). Thus, care should be taken in interpreting what these findings from HMDA data tell us about the relative importance of federal cash assistance programs and SBA loans.[45]

[45]Based on surveys, (Collier et al., 2023) document that most businesses borrowed through informal channels, such as from their family and friends, and prefer not to take on debt burden from formal loans (i.e., from SBA or private lenders like banks). It is also possible that federal cash transfers may contribute to increased young firm activity by expanding the sources of informal credit for disaster-affected firms that do not wish to take out bank or SBA loans.

8 Discussion

My findings demonstrate previously underexplored insight that post-disaster government spending helps recovery by boosting economic dynamism via the firm entry margin, which has been shown as a significant multiplier of local shocks (Walsh, 2023). Perhaps not all, or any, of the entrants in declared flood regions becomes a high-growth firm in the long term, and a majority of them likely fail even more quickly than the 50% exit rate of small businesses in non-disaster setting.[46] Yet, the benefits to regional job creation and firm revenues that I document are consistent with the crucial and lasting contribution of each (even short-lived) young firm to broader job creation and reallocation (Decker et al., 2014), innovation (Doerr, 2021), economic experimentation (Stern, 2005; Kerr et al., 2014), and regional growth (Glaeser et al., 2015). Related to this, my finding of declining aggregate business revenues (as proxied by average establishment payrolls) after non-declared floods can reasonably quell concerns about my interpretation of the bank loan size results (see Figure 3) as reflecting loan access by not just firm size but also firm age: if it were merely small firms (not young firms) that faced lower bank credit access following disasters, increased exits among small firms, which would have mechanically driven up county-wide average revenues (assuming a congruence between business size and payroll size), but not necessarily decreased region-wide business performance because young, not small, firms are what drive economic dynamism (Haltiwanger et al., 2013).

Note that since disasters that are not presidentially declared still receive local disaster aid, potentially including some access to SBA disaster loans, the large differences in regional recovery that I identify between non-declared and declared disaster regions are likely a lower bound of the negative impacts of disasters. Additionally, while the dataset I use to identify declared and non-declared disasters (SHELDUS) has been shown to miss some disasters or underreport damages associated with disasters Gallagher (2014, 2023), the fact that I find strongly negative effects on firm entry

[46] Only about half of small businesses survive past 5 years (SBA, 2019)

after non-declared disasters suggests that the imperfections of the dataset have not entirely curtailed our ability to learn about the destruction of non-declared disasters.

Lastly, my study motivates further research and has important policy implications. Flooding is the most frequent and costly disaster in the US, with climate change expected to further worsen flood risk.[47] A detailed inquiry into the welfare implications of federal disaster assistance—accounting for how extending social safety nets to high disaster-risk regions may encourage continued settlement and moral hazard—is beyond the scope of this paper, but nevertheless an important topic for future research. But, to the extent that both non-declared and declared flood regions in my analyses rebuilt after disasters (e.g., no drop in population after non-declared disasters in Figure A.2) one policy implication of my result that warrants further research is the expansion of the scope and/or budget for low-interest business recovery after non-declared disasters to enable positive spillovers onto economic dynamism.

9 Conclusion

In this paper, I examine how low-interest federal recovery loans to incumbent firms after flooding indirectly affect firm entry, outcomes, and regional recovery. I document a novel and significant, though unintended, channel through which this federal disaster assistance program supports post-disaster recovery—a boost to economic dynamism and wages via positive spillovers onto firm entry. Compared to a counterfactual in which only banks supply recovery credit, federal loans have an infinite MVPF because tax revenues from firms and workers compensate for initial government spending on loans. Given growing climate change threats, this paper contributes useful and timely insight to both academic and policy audiences: expanding federal loan access for disaster-affected businesses would come at no/little net cost to the government, but could potentially substantially benefit disaster-hit regions.

[47] Between 1990-2021, FEMA has spent 469 billion USD (in 2022 dollars) on disaster relief (CBO, 2022). See also NOAA (2022); Mora et al. (2018); FBIIC (2010).

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A Appendix

Spillovers that Pay Dividends: The Indirect Impact of Federal Disaster Loans on Firm Entry

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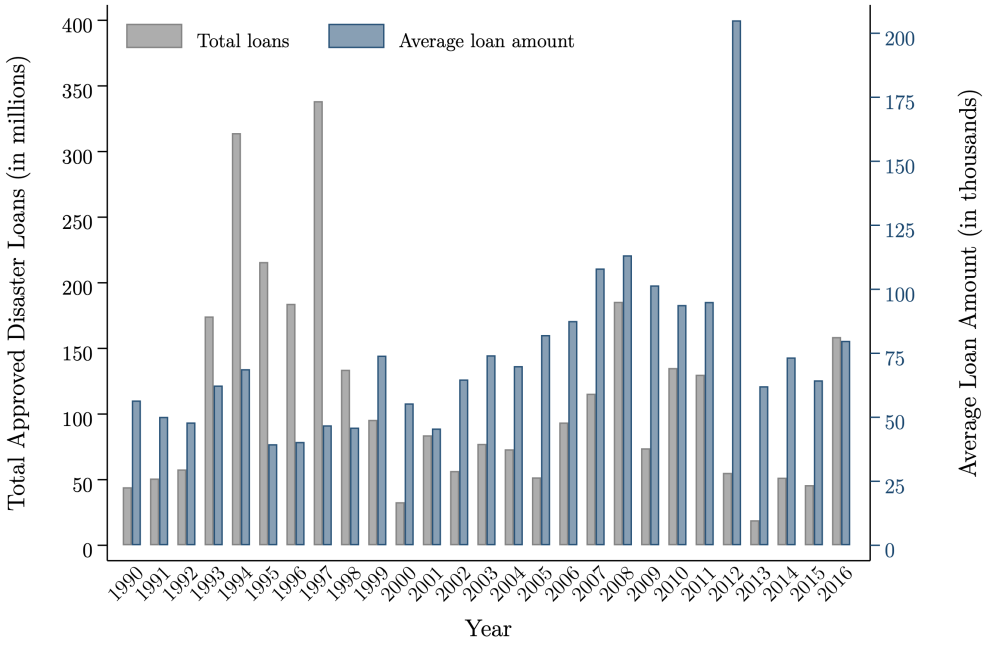
Table A.1: Among regions which have received a flooding event, those which received presidential disaster declarations suffered more severe property damages

	(1) Disaster Declaration Linear	(2) Disaster Declaration Logit
IHS(Property damage per county pop.)	0.086***	0.416***
	(0.005)	(0.008)
IHS(Crop damage per county. pop)	0.008	0.003
	(0.005)	(0.007)
Observations	27647	27721
Adj. R-squared	0.231	
Pseudo R-squared		0.119

Standard errors in parentheses

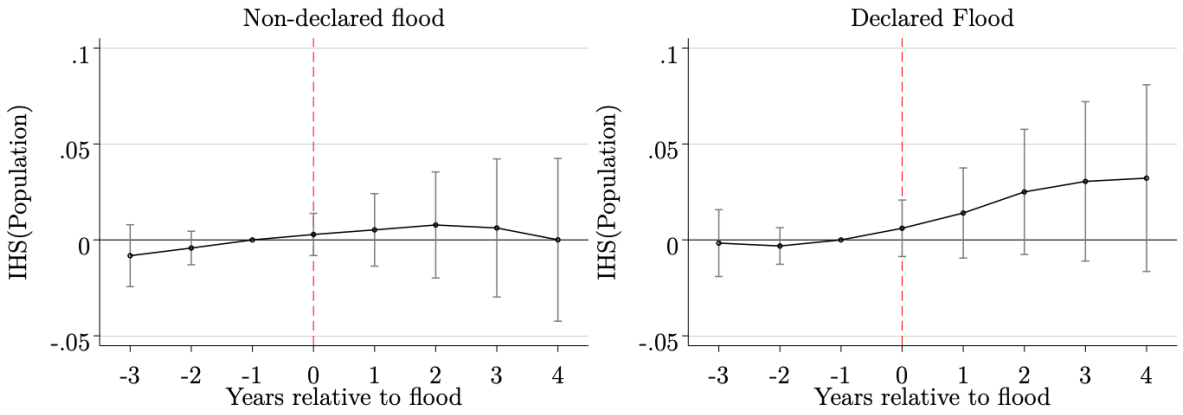
Source: SHELDUS. Sample: counties that experienced flooding between 1990-2016.

Figure A.1: SBA Disaster Loans (1990-2016)



Source: SBA Disaster Loans Data (obtained through FOIA Request)

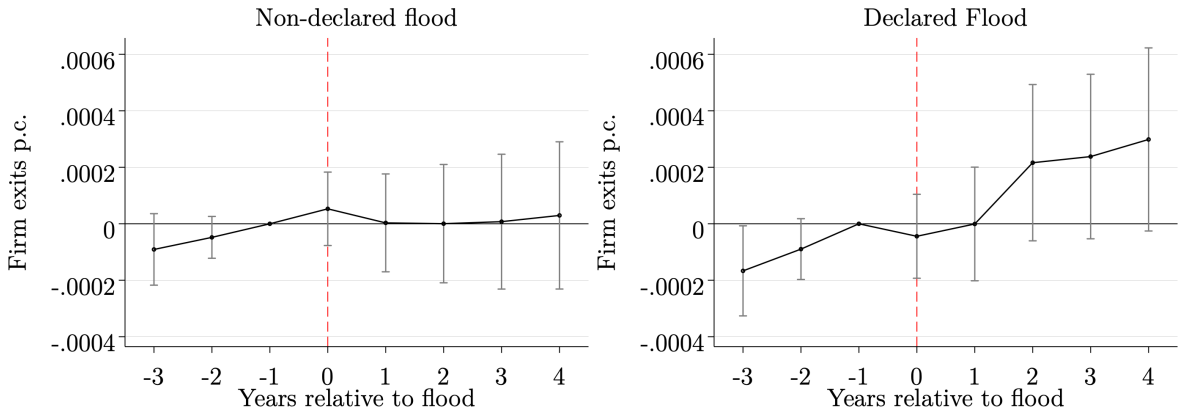
Figure A.2: County population



Obs.: 10373, Counties: 1330, (1994 - 2014).

Obs.: 11186, Counties: 1389, (1994 - 2014).

Figure A.3: Firm exits weighted by county population

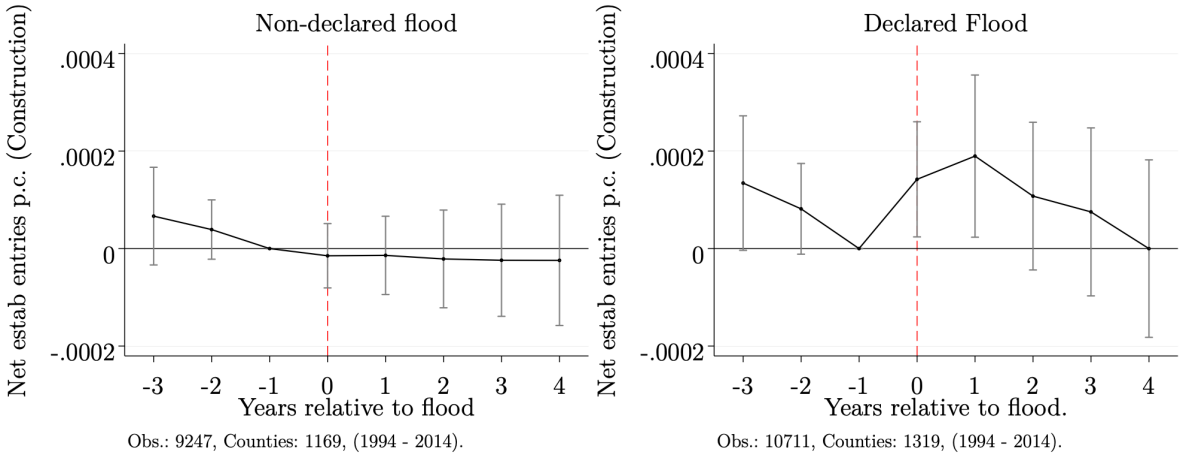


Obs.: 9917, Counties: 1257, (1994 - 2014).

Obs.: 10711, Counties: 1319, (1994 - 2014).

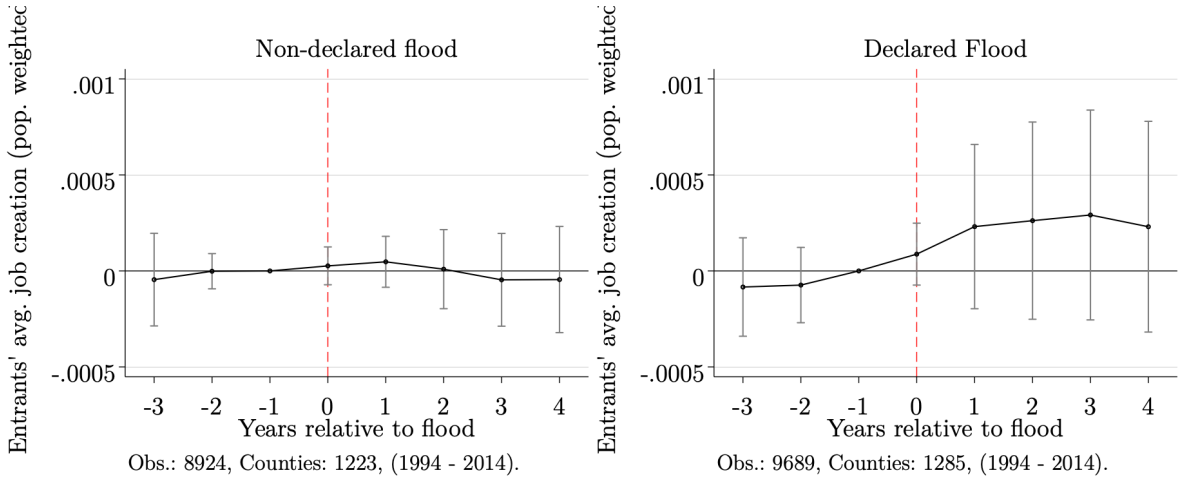
Sources: SHELDUS, BDS, SEER

Figure A.4: Construction sector impacts



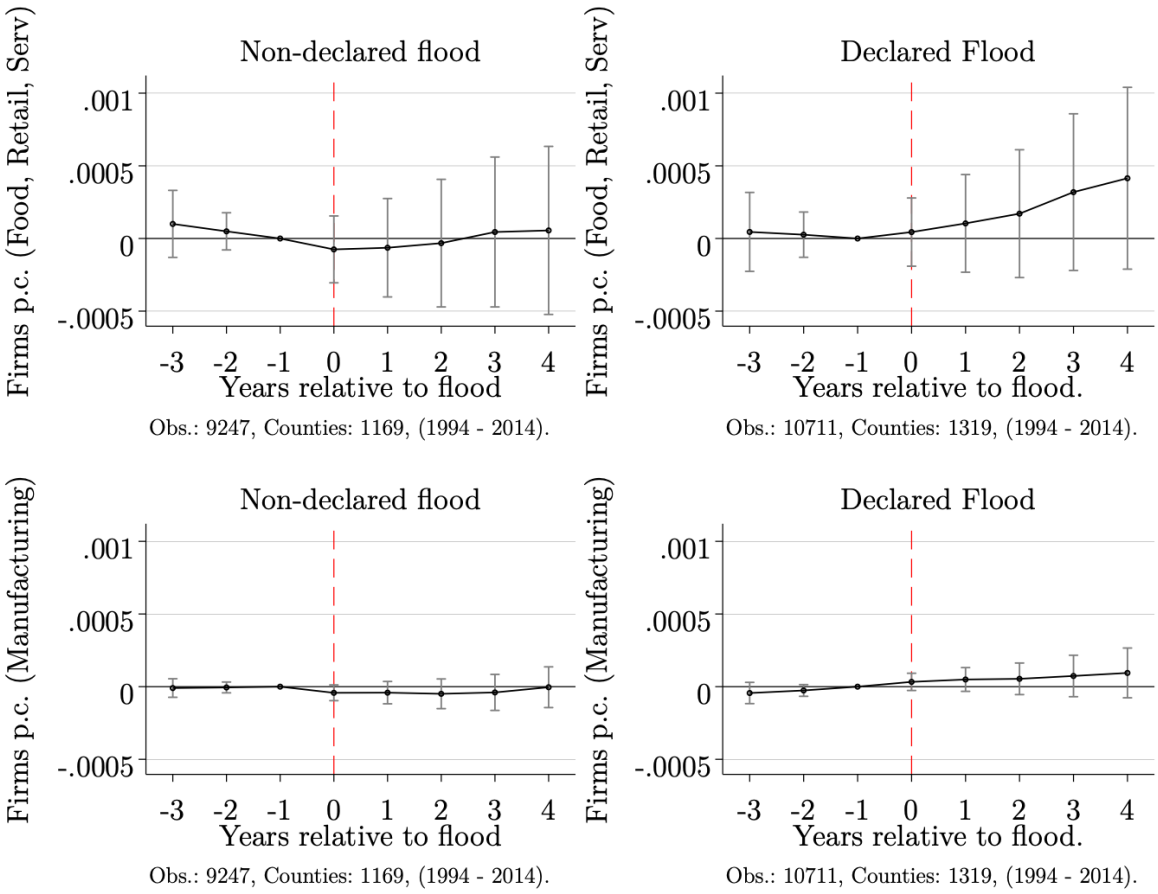
Sources: SHELDUS, BDS, SEER

Figure A.5: Average job creation by entrants



Sources: SHELDUS, BDS, SEER

Figure A.6: Patterns in total firm counts also suggest that the results presented in this paper about firm entry are likely primarily tied to firm dynamics in non-tradable sectors rather than that in the manufacturing sector, which is less sensitive to local demand shocks.

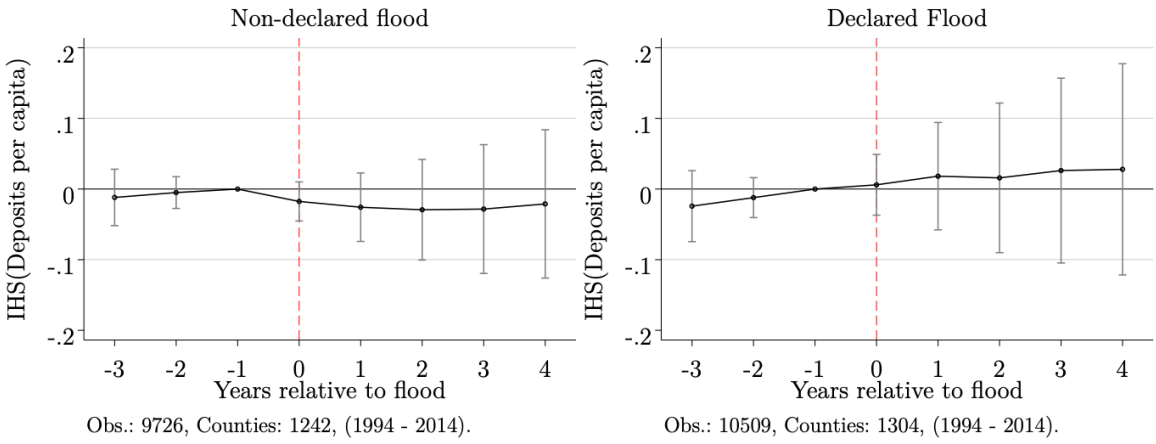


Sources: SHELDUS, BDS, SEER

Table A.2: Calculating the Marginal Value of Public Funds (MVPF) of federal spending on disaster loans
Suppose, two identical counties–A and B–are hit by a similarly-sized flood, but only County B gets a federal declaration. Below is the MVPF of that disaster loan spending in County B relative to the counterfactual in County A.

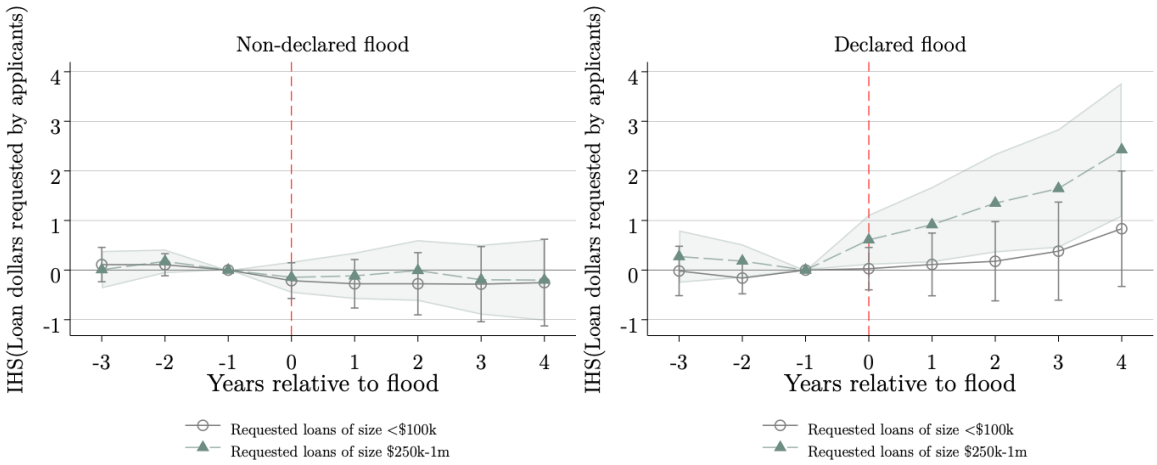
Item	**Calculation**	**Amount**
Willingness to Pay of Beneficiaries		
Post-tax revenues/savings for beneficiaries		
SBA borrowers' interest savings (8% vs 10.5% bank rate)	(1-0.2)*100*(122725.51-90122.24)	2,608,261.81
25% lower firm revenue in County A vs B (20% tax rate)	200*1840000*0.25*(1-0.2)	73,600,000.00
8% higher wages in County B vs A (13.6% tax rate)	10000*25000*0.08*(1-0.136)	17,280,000.00
Earnings premium for entrants (20% tax rate)	7*9000*(1-0.2)	50,400.00
Costs		
Loan and interest payments by entrants	$7*((100000*(1.105)^4) - 100000)$	343,631.44
WTP	**Savings & Revenues - Costs**	**93,195,030.38**
Net Government Cost		
Costs to Government		
Upfront cost of SBA loans ($250k for 100 firms)	100*250000	25,000,000.00
Foregone Treasury Bond interest earnings (5%)	$(25000000*(1.05)^4) - 25000000$	5,387,656.25
Foregone tax revenue from banks (21% tax; 3% default)	$0.21*((250000*(1.105)^4 - 250000) * 100 * 0.97)$	2,499,918.69
Savings / Additional Revenues for Government		
Returned principal from SBA loan borrowers (10% default)	0.9*100*250000	22,500,000.00
Interest payments by borrowers (10% default)	$0.9*100*((250000*(1+0.08)^4) - 250000)$	8,111,001.60
Tax revenue from new entrants on increased earnings	7*9000*0.2	12,600.00
Tax revenue from banks lending to entrants (21% rate)	$7*((100000*(1+0.105)^4) - 100000) * 0.21$	72,162.60
Tax revenue on 25% higher firm revenues in County B vs A	200*1840000*0.25*0.2	18,400,000.00
Tax revenue on 8% higher wages in County B vs A	10000*25000*0.08*0.136	2,720,000.00
Net government cost	**Upfront Costs - Savings & Revenues**	**-18,928,189.26**
Marginal Value of Public Funds	**WTP / Net Government Cost**	**-4.92 $\Longrightarrow \infty$**

Figure A.7: Bank deposits weighted by county population



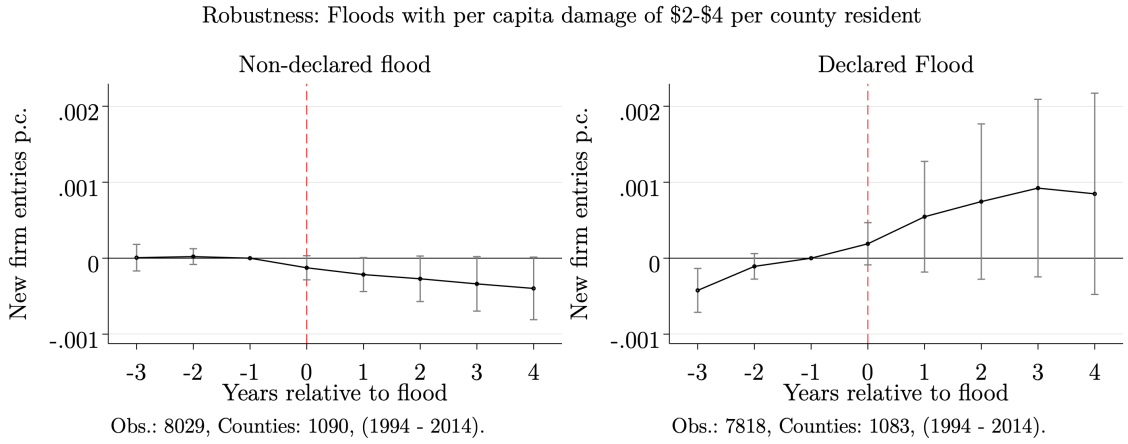
Sources: SHELDUS, FDIC bank deposits data, SEER

Figure A.8: Applications for business-related loans secured by home equity



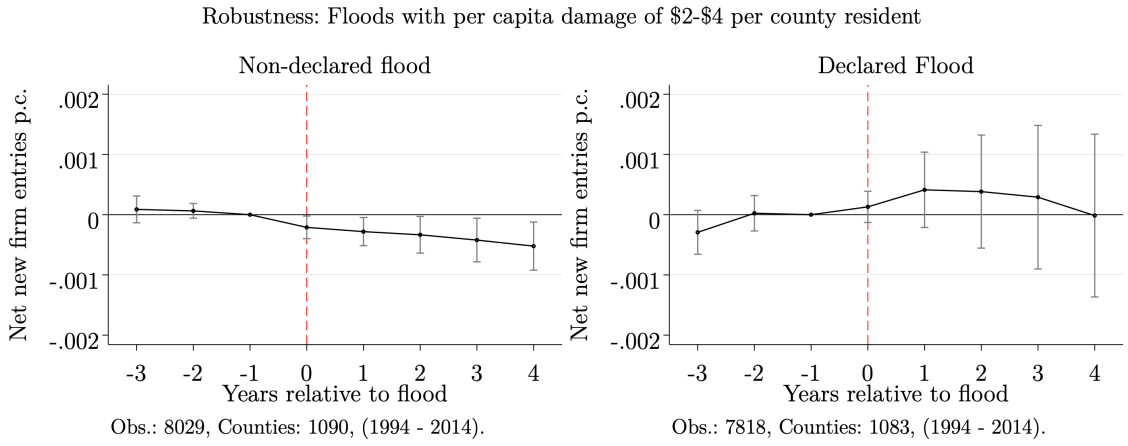
Sources: SHELDUS, HMDA, SEER

Figure A.9: Firm entries following disasters that were associated with floods that caused similar levels of disaster damage (2-4 dollars)



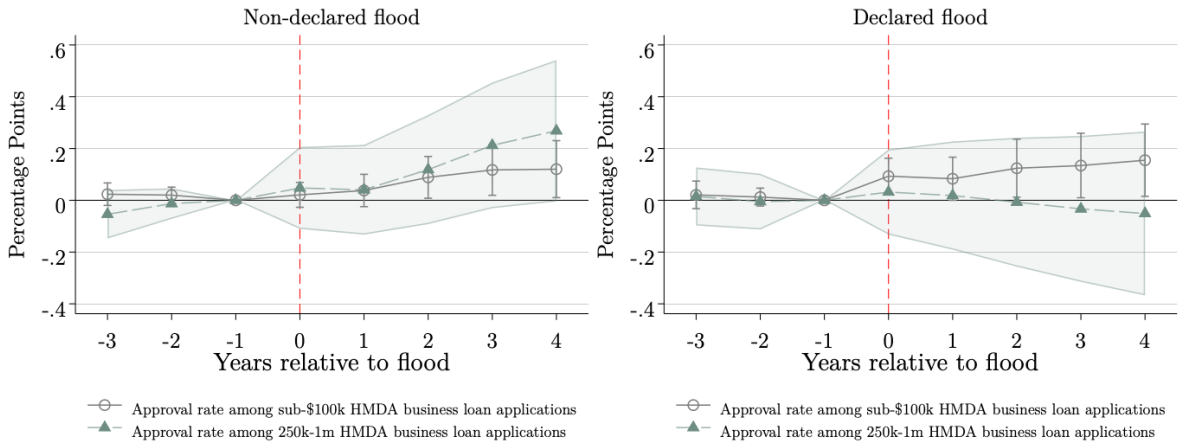
Sources: SHELDUS, BDS, SEER

Figure A.10: Net firm entries following disasters that were associated with floods that caused similar levels of disaster damage (2-4 dollars)



Sources: SHELDUS, BDS, SEER

Figure A.11: Banks' approval rates of housing collateral-secured loans by size of requested loan



Sources: SHELDUS, HMDA, SEER