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Appetite for destruction: the impact of the September 11 attacks on business founding

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It is widely accepted that entrepreneurial creation affects destruction, as new and better organizations, technologies and transactions replace old ones. This phenomenon is labeled creative destruction, but it might more accurately be called destructive creation, given the driving role of creation in the process. We reverse the typical causal ordering, and ask whether destruction may drive creation. We argue that economic systems may get stuck in suboptimal equilibria due to path dependence, and that destruction may sweep away this inertia, and open the way for entrepreneurship. To test this idea, we need an exogenous destructive shock, rather than destruction that is endogenous to the process of economic progress. Our identification strategy relies on the September 11 attacks as an exogenous destructive shock to the economic system centered on New York City. Consistent with our theoretical claim, we find that 15 months after the attacks the rate of business founding close to New York City exceeds the rate before the attacks, even after controlling for the inflow of recovery funds. Furthermore, the increase in the business founding rate after the attacks grows faster closer to Manhattan than it does further away from the epicenter of destruction.

JEL classification: L26, O31, O43.

1. Introduction

The term creative destruction evokes a tension between an innovative future and an inertial *status quo*. In origin and application, the tension inherent in the

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label has been bypassed, and creation has been emphasized over destruction. Schumpeter (1942) himself characterized economic evolution as resulting from new markets, new products, and new methods. Destruction of the old in capitalism, in his view, was a simple necessity to make room for the new. The research that has followed under the creative destruction banner has also given pride of place to innovation. Innovations have been categorized in terms of their destructive implications (Abernathy and Clark, 1985), how firm strategies may moderate their impact (Tripsas, 1997), and it has been argued that the rate of innovation at one time may be determined by expectations regarding innovation (and accompanying destruction) in the future (Aghion and Howitt, 1992). Some even claim that destruction is not necessary at all, that innovation may exist without it (Bhide, 2008). But in all of these works it is innovation that drives the process that (perhaps) leads to destruction. The whole set of ideas, from Schumpeter (1942) to the present, would be more accurately labeled as destructive creation rather than creative destruction.

In this article, we start with destruction. We reverse the typical causal pattern and ask whether and when destruction may produce creation. We consider material and psychological implications of destruction. On both of these dimensions, destruction may produce positive impacts in addition to the more obvious negative ones. In the material realm, the advantage of destruction derives from the disadvantages of the *status quo*. Entrenched interests and sunk costs may inhibit progress, and maintain economic systems in suboptimal arrangements. Destroying these pre-existing arrangements opens the possibility of a systemic improvement. In the psychological realm, destruction has the potential to motivate individuals, to promote social cohesion, and to encourage them to contribute to collective goods.

There is an identification challenge with regard to examining these ideas, because according to the familiar theory of progress, destruction is an endogenous result of innovation. Consider, for example, Caballero and Hammour's (1996: 805) definition of creative destruction as at the process where economic structure adapts "to innovations in products, techniques, modes of organization, and to the evolving competitiveness of world markets. Production units that embody new techniques must be constantly created, while outdated units must be destroyed." From this perspective, destruction is "good by association" to innovation. Our argument is that destruction may sometimes be good in its own right. To show this, it is necessary to separate the effects of destruction from the benefits of creation with which they are often associated. What we need to test our ideas is an exogenous destructive shock, rather than destruction that is endogenous to the process of economic progress.

To this end, we analyze a natural experiment created by the September 11 attacks on the World Trade Center, which devastated lower Manhattan and caused a major disruption in the extended economic system centered on New York City. Clearly, these attacks were not endogenous to the evolution of the New York economy. As the slack-jawed response to the attacks from near and far indicates, they were as close to an exogenous shock as can been found in the social world. Our identification strategy

has precedent in the work of Davis and Weinstein (2002, 2008) who used the bombing of Japanese cities in World War II as a natural experiment to examine theories on the evolution of cities. In our case, the foundational idea is that the destruction wrought in the attacks, which was not only physical, but organizational, relational, and psychological, sets the stage for entrepreneurial creation, which we operationalize as new business founding. Our claim that destruction may stimulate creation is intended to apply broadly, in the contexts of systems of transactions, production arrangements, and technologies. New business founding is therefore an example of the phenomenon we seek to explain, not the whole of it.

We are also aware that the methodological advantage of the exogenous September 11 attacks comes with a cost in terms of the idiosyncrasy of that event. Specifically, those attacks were intended to produce terror. Other forms of exogenous destruction, for example an earthquake, or even the bombing of a city in the context of a war between states, may be more or less likely to produce fear and despair, more or less likely to influence social cohesion, and may be associated with different expectations with regard to the likelihood of repeat events of the same type in the future. In other words, the psychological influences of destruction may not be the same for a terrorist attack as for other destructive events. We take the idiosyncrasies of terrorism into account when we generate predictions below, and we highlight it as a concern for generalizing from our study. At the same time, the exogenous influences on the psychology of entrepreneurs is a topic that has received scant attention—for example the issue is almost completely absent in the organizational ecology literature on business founding. So, even as we recognize that terrorism's effect on collective psychology is not indicative of all forms of destruction, we also claim a contribution as an early examination of the idea that exogenously-influenced collective psychology may influence industry dynamics.

2. The creative results of material destruction

We propose that destruction may allow creation and systemic improvement by removing technologies, organizations, jobs, and civic infrastructure that is suboptimal, but persists because of inertia or path dependence. The essence of the argument is that inferior systems may persist because particular actors have an interest in the *status quo* and can resist change. If the *status quo* were wiped out, the resistance of these actors would be eliminated, and the system could move closer to optimality. This argument also assumes the existence of transaction costs, because without them the constituents of the system could compensate the resistors by sharing the gains of moving from the inferior equilibrium to a better one.

The antecedent of our argument, that economic systems can get stuck in suboptimal equilibria, is familiar in a number of literatures. David (1985) evokes path dependence to explain the persistence of inferior technologies. Caballero and Hammour (1996) introduce the term "technological sclerosis" to describe the inertia

in economic systems that emerges because of efforts to protect current jobs. Similarly, students of New York City politics identify ossification produced by interest groups and civil service unions as a barrier to progress to a better city (Lowi, 1969; Brecher and Horton, 1993).

In *The Rise and Decline of Nations* (1982), Mancur Olson begins with the observation that the rate of growth in developed countries has varied greatly in the decades after World War II. His explanation has all the elements of the argument we present above. The defenders of the economic *status quo* in his account are interest groups. The barrier that stops the majority from successfully bargaining with the defenders of the *status quo* is the well-known problem of collective action. And the evidence that destruction can actually be productive is that the post-war growth rates of Japan and Germany are substantially higher than the UK and the United States, which suffered less destruction in the war. The most compelling case for Olson is France, a country that "in less than two centuries . . . has experienced some of the most profound and protracted revolutions in human history, has gone through constitutions almost as though they were periodical literature, and has suffered partial or total occupation four times (5)," yet in 1970 when Olson made his comparison France had "per capita income decidedly above that of Great Britain, about the same as that of Germany, and only a fourth lower than the United States."

Given that our empirical analysis examines business founding, it is important that the suboptimization argument has also been made at the organization level. Fogel *et al.* (2008) argue that "large established firms invest political rent-seeking, manipulating their economies' institutions to lock in the *status quo* and block upstarts. This maintains their dominance at the expense of their economy's growth (2)." They find that countries whose roster of big businesses is more stable exhibit slower economic and productivity growth.

And while many of the above examples identify political institutions as the contexts where inertia happens, the *status quo* may also be enforced within organizations and markets. For example, Barnett (1997) argues that weak competitors may survive because they are part of larger organizations, and therefore shielded by organizational slack. And Oberholzer-Gee and Calanog (2007) demonstrate sub-optimizing in market transactions with evidence that buyers that engage in close, repeat transactions with sellers are more likely to miss useful new products, presumably because they bias their search for solutions to their existing suppliers. As that finding suggests, cognitive satisficing could contribute to the persistence of a wide range of sub-optimal arrangements within organizations and between organizations.

Beunza and Stark (2005) illustrate both the persistence of the *status quo* and the opportunity for change presented by the September 11 attack. They follow a group of arbitragers working in the trading room of an investment bank in the aftermath of the attack. Days after they were driven from their office in the World Financial Center (adjacent to the World Trade Center) by the attack, the group re-established itself in a converted warehouse in New Jersey. The initial organization of the

warehouse reflects the strong shadow of the operation the group had abandoned. Even though the warehouse was a large flat space, they replicated as best they could the three dimensions of their space in the World Financial Center, taping signs in the corners of the warehouse that read "19th Floor, Risk Management," "20th Floor, Equities," and "21st Floor, Fixed Income." The arbitragers arranged their desks as best they could to replicate the spatial relationships from the old set up, with one group, the "agency trading desk" wedging themselves into a table partly occupied by two photocopiers and three fax machines so they could remain together.

In the subsequent months, the group relaxed the strict replication of the earliest days. They nudged their enactment of their occupational identities by adopting a casual jeans-and-boots norm of dress. They experimented with structural decoupling when 24 traders split from the group and rented office space in mid-town Manhattan. They justified the move by citing the necessity of networking and face-to-face contact to confirm the veracity of executives explaining the logic of mergers. When it came time to relocate the whole operation to Manhattan, a number of locations was considered. Ultimately, the group chose to return to exactly where they started, and in March 2002 they were back in the World Financial Center, retaining every trader from the previous September. But they were not an unchanged organization. Based on their updated understanding of the risks they faced, they had created a mirror trading site in New Jersey. Other banks have made permanent re-allocations of staff from Manhattan to other places in the wake of the re-allocation forced by the attacks. Individual workers have made their own decisions. For example, some were prompted by the long exodus on foot from lower Manhattan to take jobs closer to their homes and families, which did not require crossing a bridge to get to work.

In summary we argue that the exogenous destruction of organizations, institutions, physical capital, and reified transactions may actually increase entrepreneurial creation by eliminating inertial, inferior arrangements. This is an important variation on the more familiar arguments that we re-label "destructive creation," which identify the key mechanism as economic progress. In those accounts, destruction happens because the future is so inviting. In ours, creation happens because the anchor of the past is destroyed.

It is worth noting some credible alternatives to our theoretical claim that destruction will bring creation. First, creation is aided by material resources, and if destruction is sufficiently widespread, there may not be enough left over to restart the entrepreneurial process. We consider the impact of resource destruction immediately below. Second is that the impact of destruction is not only material but also psychological. If entrepreneurs are fearful and anxious, they will not be able to take advantage of the opportunity presented by a clean slate. We consider the psychological effects of destruction in the third section below. Third, our argument assumes that inertia sometimes limits economic systems to sub-optimal equilibria. If that is not true, then systems would not need destruction for creation, and the best that

could be hoped for after a destructive event would be a return to the pre-destruction state.

3. Resource implications of material destruction

The creative possibility of destruction can only be expected to emerge in the medium to long term. In the short term, destruction is associated with disruption that should undermine productive efforts of all types. Our specific context for creative destruction, business founding after the September 11 attacks, is a good context to illustrate this. Immediately after the attacks, there were a number of material effects that would be expected to suppress business founding and productive activities of all types. This attack dislocated 18,000 businesses employing around 550,000 people in the vicinity of the WTC (Makinen, 2002). It also caused disruption in communications, transportation, and other vital requirements for smooth functioning of businesses. For example, in an unprecedented event, the New York Stock Exchange was closed after the attack until September 17.

These material disruptions had the immediate effect of reducing resources available for entrepreneurs to start businesses. Businesses are founded when resources such as financing are available in the environment (Stinchcombe, 1965; Aldrich, 1999). For example, Stuart and Sorenson (2003) found that the rate of venture formation increased as resources arising from liquidity events, such as acquisition and initial public offering, increased in the region. In the aftermath of the attack, many resources were directed toward supporting the victims of the attack and rebuilding their lives. Thus, resources that may have flowed to potential entrepreneurs were diverted to other purposes. Moreover, potential entrepreneurs themselves may have been affected by job loss and loss of property, so their personal resources available to found a business may be lessened. This significantly influences the rate of venture formation because a majority of entrepreneurs rely on their personal resources to fund new ventures (Evans and Jovanovic, 1989; Reynolds and White, 1997). Furthermore, the opportunities for new businesses depend on whether there are individuals and healthy businesses available to patronize the new venture (Blau, 1987). The attack reduced the material demand for new businesses as it destroyed many and dislocated people and businesses.

These effects of material disruption will not be uniformly distributed across geographic space. Because the attack on the WTC mostly destroyed resources, jobs, and businesses in Manhattan, those regions most intertwined with Manhattan were also directly affected by the attack. Specifically, regions closer to Manhattan will be dependent on Manhattan for their jobs, businesses, and opportunities. And, those regions that are farther away from Manhattan are less interdependent with it (Rosenthal and Strange, 2003). So, the material disruption caused by the WTC attack in terms of destroyed resources, opportunities, and supply of initiatives will cause the largest impact on those regions that are close to Manhattan, and lesser

impact on those farther away. This is akin to the ripple created with the fall of a stone in the still water. The water close to the impact has a higher wave and the wave decreases with distance from the epicenter. Of course, the opportunity we see for creation flowing from destruction should also be greater where destruction is more thorough. In our case that is closer to Manhattan.

Interestingly, regions farther away from Manhattan suffered from two processes on the flip side of the creative destruction dynamic. First, incremental flows of resources to regions farther away were diverted toward Manhattan in the reconstruction process. Additionally, there was no destruction that provided opportunities for creation. Because of the lack of opportunities for creative destruction and the lack of increase in flow of funds to regions farther away from the location of the attack, the business founding in these regions would not be expected to improve post-attack as it would closer to Manhattan. Second, this situation is worsened by the changing interdependence with Manhattan. A natural response to a disaster is to decouple interdependent systems, to minimize the disruption if a disaster should re-occur (Perrow, 1999). Such a decoupling occurred after the WTC attacks (Beunza and Stark, 2005). For example, businesses there may have been more hesitant to build reliance on a supplier from outside the city. Thus, regions farther away from Manhattan may get minimal positive spillovers from the material recovery.

4. The psychological impact of destruction

We see the psychological impacts of destruction as depending on the form of destruction. For example, terrorism, war, accidents, and natural disasters may evoke different levels and types of fear because their victims may draw different conclusions regarding the likelihood that one destructive event will be followed by another. These destructive forms also differ in terms of the locus of agency, the process of blame, and the implications for motivation. We therefore present the arguments below within the scope of a large-scale terrorist attack, which has the distinguishing characteristics of uncertain targets, the risk of repeat events, and identifiable human perpetrators.

The goal of the September 11 attacks was to make all Americans afraid, not just those immediately affected. Because the event was televised and covered in the popular press, people from all places saw the aftermath of the attacks. Such exposure has momentous consequences, creating anxiety, fear, and stress in people even when they did not witness the attack directly and were not in geographically proximal areas (Iyengar *et al.*, 1982). For example, a special report in the *New England Journal of Medicine* described a survey conducted immediately after the attacks, in which respondents throughout the country reported feeling increased stress, even in places as far away as California.

There are theoretical reasons to think that people proximate to the attacks would be most terrorized. For example, Bat-Zion and Levy-Shiff (1993) found that physical

proximity to areas in Israel bombarded by missiles was related to greatest distress and difficulty in daily functioning. Similar results have been shown by Ronen *et al.* (2003), Shore *et al.* (1986), and Wright *et al.* (1990). The localized nature of social networks links people more proximate to the attacks to its victims. Moreover, people closer to the material effects of the attack may feel much more the psychological pain and fear. Consistent with this concept of network-transferred despair, Brockner *et al.* (1987) showed that employees who were associated with laid-off employees felt much more psychological pain than others. In the case of September 11 attack, people close to Manhattan are more likely to know someone harmed by the attack, which increases their emotional involvement and consequently their pain, anxiety, and fear.

The state of prevailing fear and anxiety influences our outcome variable, the rate of business founding, by altering the pool of potential entrepreneurs for the following reasons. First, founding a business requires opportunity recognition and the ability to cognitively process information to identify such opportunities is critical. People feeling threatened or anxious are cognitively preoccupied with the threat and tend to divert their attention and resources away from nonthreatening stimuli (Eysenck, 1997). This cognitive diversion reduces the ability to perceive opportunities for business founding. Second, prior research shows that there is significant difference between entrepreneurs and managers in terms of the locus of control, such that entrepreneurs have a significantly higher internal locus of control (Shane, 2003). Given that they have no control over terrorist attacks, threatened or anxious people already feel that they are in a position of harm or risk and that they do not have control over the situation. Such change in perceived locus of control will deter people from turning into entrepreneurs, as they tend to prefer non-risky options in actions on which they have control (Lerner and Keltner, 2001). Third, people who are in an anxious or fearful state tend to be in prevention mode and prefer to avoid losses (Higgins, 1997). Therefore, they tend to take less risk.

Fear and anxiety will assuage if people emotionally move away from the event (Huddy *et al.*, 2005). One factor that could influence the emotions felt by people is the proximity in time. With the passage of time from the event, the saliency of the attack decreases. The fear and anxiety felt after the attack reduces as people cope with their emotions over time. This reduction in emotional attachment makes the effects of the attack less salient. This reduced saliency then allows people to focus on things other than fear and anxiety.

However, in the case of the September 11 attack, the event was kept alive through many facets of governmental and media discourse. For example, after the September 11 attacks, the government set up a color code to remind the nation of the level of threat and this code has always indicated "elevated" or higher threat levels. Similarly, the media has kept the issue alive by its coverage. Provided proper coping mechanisms, people react to such continuous exposure to stress by becoming desensitized, habituated, and inoculated to the underlying stress conditions (Breznitz, 1983).

For example, Ziv and Israeli (1973) found that the anxiety levels of Israeli children exposed to frequent shelling were no different than those of children who were not exposed, the explanation being that the former group became habituated to the threat. Similarly in the September 11 case, when provided with proper coping mechanisms, people would also become habituated and inoculated to the threat signals arising from continuous exposure from media and governmental discourse, which will lead to alleviation of fear and anxiety over time.

Such alleviation of fear is likely to be faster in locations closer to Manhattan because people close to the attack were provided with social mechanisms for coping with the distress arising from the attack. For example, the environment in and near Manhattan had many memorial sites, where people could leave messages venting their emotional feelings. Further, there were many groups which arrived in Manhattan to provide psychiatric and psychological help after the event, further enhancing access and resources for psychological recovery. Moreover, those proximate to the epicenter of the attacks had more opportunities to share their feelings and experiences with other victims which promotes catharsis and support (Austin and Godleski, 1999) and produces social cohesion and positive norms (Muller and Barash-Kishon, 1998). This is less likely to happen farther away from the epicenter, where people have not directly experienced hardship, and therefore are not drawn together to overcome it. These people were not provided with legitimate means of coping with their emotional distress, as they were not seen as direct victims of the attack. Such lack of coping mechanisms could keep these people anxious and afraid for a long time.

Further, people farther from the attacks may be hindered longer by fear and anxiety because of a tendency to overestimate the likelihood of more attacks. Yechiam *et al.* (2005) showed that tourists tended to overestimate the likelihood of terrorist attacks, while Israelis with proximate experience to terrorism made more accurate estimates. There can be little doubt that citizens proximate to Manhattan were prompted to be more analytical about the likelihood of another attack after September 11, as they were more exposed to active debates about appropriate security measures and because they were forced to make constant decisions about the implications of terrorism for their own safety. Farther away, there was less reason to thoroughly analyze the likelihood of attack. Yechiam *et al.*'s (2005) results suggest that in such "low analysis" circumstances, the general tendency to overestimate the likelihood of rare events is more prevalent.

5. Combining the material and psychological effects to predict founding rates

Because the effects of material disruption and psychological effects are present simultaneously, our prediction for founding rates must consider both simultaneously.

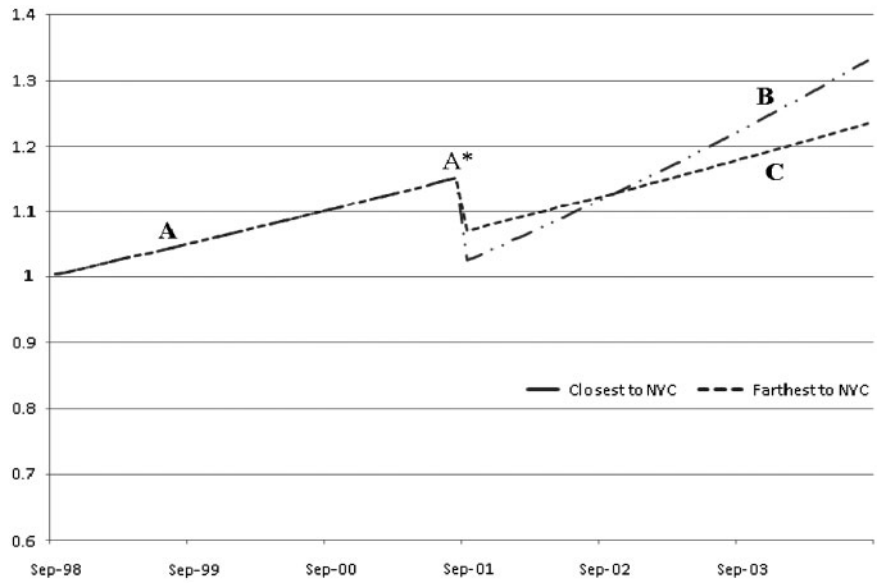

Figure 1 Predicted effects of WTC destruction on business founding.

Fortunately, both the material and psychological arguments suggest similar temporal and spatial patterns of founding rates. Both lines of argument suggest that foundings will decrease after the attacks, and that the decrease will be greatest close to Manhattan. Both arguments also suggest a post-attack recovery that is quicker close to Manhattan and eventually reaches a level of business founding higher than pre-attack level. Figure 1 illustrates the pattern our arguments predict. Calendar time is on the *x*-axis and the multiplier rate of the founding rate on the *y*-axis. The effect of the attack is shown to be most negative in the area immediately around Manhattan, but also rebounds faster there due to creative destruction. Note that a scope condition for the predicted pattern in Figure 1 is that it applies to places that are within the economic gravity of Manhattan. There is probably some distance from the attacks that is beyond both the psychological and material impacts. We will not consider how far that is in this article, but our empirical analysis of New York and contiguous states includes places that are obviously interdependent with Manhattan.

Evidence of destruction-led creation appears in three ways in Figure 1. First, the territory close to Manhattan (most subject to destruction) could experience a steeper positive trajectory of post-attack business founding (the slope of line segment B is steeper than that of line segment C). This comparison is closest to Olson's (1982) comparison between France and Great Britain. Second, the business founding rate close to Manhattan could eventually exceed its point at the time of attacks (line

segment B eventually exceeds A*). This indicates that the entrepreneurial system in the area most subject to attack exceeded its pre-attack level. Third would be to compare at the rates of growth in the founding rate pre- and post-attack, specifically whether line segment B had a greater slope than line segment A. This comparison requires a tenuous assumption, namely that the pre-attack growth rate would have continued on its trajectory into the future.

Just as importantly, it is fully possible that the actual results might vary from Figure 1 in ways that disconfirm our arguments. Most obviously, if foundings did not decrease immediately after September 11, or did not subsequently reach their pre-attack levels, it would indicate that our argument was fundamentally wrong. Also, if the post-attack growth in the founding rate was greater farther from Manhattan, it would indicate that recovery processes were impeded where the destruction was greater, again counter to our claim that exogenous destruction clears the path of entrepreneurial progress. Either of these patterns could occur, for example, if the destruction wrought by the attack caused a permanent decrease in economic activity, as might be predicted by multiple-equilibria theories of the location of economic activity (Davis and Weinstein, 2008).

6. Research methods

6.1 Sample, dependent variables, and analytic technique

To examine the above arguments we rely on annual data of new business foundings in each of the counties of New York, New Jersey, Connecticut, and Pennsylvania, as the economic gravity of New York City includes the neighboring states of New Jersey, Connecticut, and Pennsylvania. To avoid questions about the necessity to replace businesses that were directly destroyed by the attacks we present models with and without Manhattan, and they are substantively the same.

We collected annual data on the number of foundings in each county of these states for each of 19 industrial sectors for the years 1998–2004. Each observation in our data represents the number of businesses founded in a sector in a county in a year. Because each annual observation covers period from April of 1 year to March of the next, our data cover 3 years before (April 1998–March 2001), one that spans the attack (April 2001–March 2002) and two that follow it (April 2002–March 2004). Detailed descriptions of operationalization and data sources of our variables appear in Table 1.

Founding tallies are counts of events over a discrete period of a year. Poisson regression is potentially suitable to analyze these measures (Hausman *et al.*, 1984):

$$\Pr(Yi = yi) = \frac{\exp(-\lambda i)\lambda i^{Yi}}{Yi!}$$

Table 1 Summary description of variables

Variable	Description	Source of data
1. Annual county-sector foundings	No. of establishment in each county-sector from April to next March	US Census Bureau's Statistics on US Businesses
2. Sector failures	No. of business failures in the county in specific sector in prior period	US Census Bureau
3. Sector density	No. of firms in specific sector in each county in the prior period	Census Bureau's County Business Patterns
4. Sector employment	No. of people employed by the sector in the county in prior period	US Census Bureau
5. Sector average pay	Average amount of pay for employees in the sector in the county prior period	US Census Bureau
6. Sector capital intensity	Fixed assets/Sales	Internal Revenue Service; Computed
7. Post-event capital intensity	Sum of fixed assets/Sales of each sector weighted by number of foundings in that sector in the county	Internal Revenue Service; Computed
8. Labor force	Total labor available in each county	US Department of Labor
9. Density	No. of firms in each county in the prior period	Census Bureau's County Business Patterns
10. Unemployment	Percentage of unemployed people in each county	US Department of Labor
11. Federal aid	Amount of money given by federal government to the county in the prior period	Federal Assistance Award Data System, US Census Bureau
12. Per capital income	Per capital income of county in the last period	US Census Bureau
13. No. of cities/towns	No. of cities and towns in the county	Statistical Abstract of NY
14. Area	Area is square miles	Statistical Abstract
15. Manhattan neighbors	Neighboring counties of Manhattan = 1; others = 0	Computed
16. Capital county	Coded as one if county is capital	Computed
17. Bank density	No. of bank branches in the county	Federal Reserve Bank
18. Bank deposits	Average bank deposit/population	Federal Reserve Bank
19. IPO funds	Amount of IPO money raised by firms in the county in the last period	S.D.C. database
20. VC funds	Amount of venture capital funds in the county in the last period	VentureX of S.D.C.
21. Percentage republican	Percentage of votes for republican presidential candidate (Intrapolated)	NY State Election Board
22. Education	% of people educated at least at Bachelors level	US Department of Education
23. Suicide rate	Percentage of suicides in county in prior period	State Agencies
24.Recession	March, 2001 to November, 2001 = 1; other periods = 0	National Bureau of Economic Research
25. Distance to Manhattan	Distance between population centriods of each county	US Census Bureau; Computed
26. Time	Linear clock	Computed
27. Post–event	If time> September, 2001 then post-event = 1; else 0;	Computed
28. Post-event clock	0 for observations before October 2001; is a linear clock starting with 1 from October 2001.	Computed

where λ_i represents the mean and the variance of the event count and Y_i is the count of new venture formations in county-sector "i". Poisson regression estimates λ_i as a function of $\beta_j X_{ij}$, where X is the data vector for the j variables and β is the associated vector of regression coefficients:

$$\lambda_i = \exp\left(\sum \beta_j X_{ij}\right)$$

Poisson regression models rely on an assumption that the conditional mean is equal to variance, which does not hold in our data. Therefore, we used negative binomial regression to account for over-dispersion (Cameron and Trivedi, 1990). Another issue with these analyses is that there are multiple observations for each county and sector. To account for unobserved heterogeneity, we employ two sets of fixed-effects, one for counties and one for sectors. Given that the standard packages estimate only conditional fixed-effect models (Hausman *et al.*, 1984), we include an indicator variable for each county and each sector in the regression equation to capture the real fixed-effects of each county.[1]

6.2 *Independent variables*

To test the arguments regarding the temporal and spatial pattern of business founding as affected by the attack, we used an indicator variable, post-event, as well as the distance of the focal country from Manhattan. We interact these variables and a post-event time clock which is zero for April 2001–March 2002 observations, and increases by one in each subsequent year.

6.3 *Control variables*

Several factors that are beyond the theoretical scope of this article may influence the rate of formation of new businesses in a geographic location. We made a particular effort to control for these influences so that our post-event clock and distance variables would represent the impact of the attacks, and not other correlates of the business founding rate. The long list of controls include macro economic variables, sector-county-level measures to capture the industry structure in each place, traditional measures of population dynamics, and a host of variables to capture the financial, organizational, and human capital resources in each county. We also controlled for political leanings in each county, and the flow of Federal grants. We included an annual measure of the average capital intensity of business foundings

[1]The advantage of conditional fixed-effect models is that they estimate the coefficients even for time-invariant variables. As a robustness test, we also present results with conditional negative binomial models. Additional robustness analysis using the log of the count variable as a dependent variable employing ordinary least squares regression with fixed-effects for counties yielded similar results.

in each, to check whether the pattern of foundings in terms of requisite capital changed after the attack. More detailed descriptions of all of these variables appear in Table 1.

Since the correlations among many of our controls (sector density, total county density, bank density, labor force, federal aid, and per capita income) were high, we orthogonalized these variables using a modified Gramm-Schmidt procedure (Golub and Van Loan, 1989) implemented in Stata. This procedure removes high correlations between the specified variables without affecting correlation of these variables with other variables in the data. The descriptive statistics of the original variables and simple correlations among the transformed variables for the data are available from the authors.

7. Results

The results of the fixed-effect negative binomial regressions of monthly foundings in each county excluding Manhattan are presented in models 1 and 2 of Table 2. The results of the model that includes all control variables along with "post-event" variable are presented in model 1. These results show that the rate of foundings within a county increased with prior sector failures, sector density, sector average pay, sector employment, post-attack capital intensity, and time. The rate of foundings within a county-sector increased in the recession period and decreased with increase in unemployment rate and per capita income. The coefficient of the post-event indicator variable is negative and significant (-0.046; $P<0.01$), which indicates that the average rate of founding in post-attack 3-year period within county-sector decreased by 4.5% compared to the pre-attack 3-year period.

Model 2 estimates the temporal and spatial shockwave of the attack by including the two-way interactions of "distance from Manhattan" with "post-event" and "post-event clock." To illustrate the combination of the main and interaction effects of these variables, we graphed the relevant results from model 2 in Figure 2. Time is plotted on the *x*-axis and the multiplier of the *ceteris paribus* rate of business foundings is plotted on the *y*-axis. The graph shows that the immediate effect of the attack was a drop in the level of business founding. As Figure 2 shows, in the four-state analysis, the immediate negative impact of the attacks on business founding is greater closer to Manhattan. With the passage of time after the attack, the founding rate increases faster closer to Manhattan than it does farther away, so much so that it exceeds its pre-attack level after about a year. On the other hand, the rate of founding in counties farther away from Manhattan did not reach pre-attack levels by the end of our observation period.

The pattern demonstrated in Figure 2 is quite similar to that of Figure 1. The results indicate all three possible forms of support for our destruction-lead creation argument. First, the post-attack founding rate close to Manhattan increases faster than that farther away from the destruction, and second, the rate close to Manhattan

Table 2 Multivariate analysis on annual-sector county foundings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sample excludes	NYC observations				NYC Obs. and Obs. spanning September 2001				NYC obs.		None	
Form of distance	Linear								Logged		Linear	
Form of fixed effect	Indicator		Conditional		Indicator		Conditional		Indicator	Conditional	Indicator	
Sector failures	0.968***	0.978***	0.961***	0.971***	1.038***	1.052***	1.019***	1.035***	0.978***	0.969***	0.975***	0.984***
	(0.088)	(0.088)	(0.087)	(0.087)	(0.099)	(0.099)	(0.097)	(0.097)	(0.088)	(0.087)	(0.088)	(0.088)
Sector density	0.070***	0.069***	0.070***	0.069***	0.072***	0.071***	0.071***	0.070***	0.068***	0.070***	0.070***	0.070***
	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.003)	(0.003)
Sector average pay	0.009***	0.009***	0.009***	0.009***	0.012***	0.012***	0.013***	0.013***	0.009***	0.009***	0.009***	0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sector employment	0.002***	0.002***	0.002***	0.002***	0.001***	0.001***	0.001**	0.001**	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Sector capital intensity	0.038	0.045	−0.018	−0.013	0.101	0.114	0.062	0.075	0.044	−0.016	0.044	0.049
	(0.076)	(0.077)	(0.078)	(0.079)	(0.079)	(0.080)	(0.080)	(0.081)	(0.077)	(0.079)	(0.076)	(0.077)
Post-event Cap. Int.	0.036***	0.036***	0.030**	0.030**	0.051***	0.052***	0.047***	0.049***	0.036***	0.030**	0.036***	0.036***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)	(0.014)	(0.015)	(0.015)	(0.013)	(0.013)	(0.013)	(0.013)
Labor force	0.190	−0.049	−0.046**	−0.058***	0.182	−0.089	−0.041*	−0.056**	−0.083	−0.062**	0.228	−0.021
	(0.165)	(0.194)	(0.022)	(0.023)	(0.170)	(0.199)	(0.024)	(0.024)	(0.199)	(0.025)	(0.166)	(0.196)
Density	0.079*	0.070	−0.031**	−0.034**	0.097**	0.089*	−0.009	−0.014	0.041	−0.034**	0.109	0.106
	(0.046)	(0.046)	(0.014)	(0.014)	(0.049)	(0.049)	(0.016)	(0.016)	(0.047)	(0.015)	(0.070)	(0.070)
Unemployment rate	−0.012**	−0.017***	−0.020***	−0.026***	−0.008	−0.012*	−0.014**	−0.019***	−0.018***	−0.028***	−0.012**	−0.017***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Federal aid	0.002	−0.005	0.006	0.002	−0.003	−0.008	−0.000	−0.004	−0.008	0.000	0.007	−0.000
	(0.011)	(0.011)	(0.008)	(0.008)	(0.011)	(0.011)	(0.009)	(0.009)	(0.011)	(0.008)	(0.011)	(0.011)

(continued)

Table 2 Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sample excludes	NYC observations				NYC Obs. and Obs. spanning September 2001				NYC obs.		None	
Form of distance	Linear								Logged		Linear	
Form of fixed effect	Indicator		Conditional		Indicator		Conditional		Indicator	Conditional	Indicator	
Per capita income	−0.064**	−0.058*	−0.080***	−0.080***	−0.041	−0.046	−0.054***	−0.060***	−0.058*	−0.069***	−0.069**	−0.064**
	(0.029)	(0.031)	(0.019)	(0.020)	(0.032)	(0.033)	(0.021)	(0.021)	(0.031)	(0.020)	(0.029)	(0.030)
No. of cities			0.008***	0.008***			0.007***	0.007***		0.007***		
			(0.001)	(0.001)			(0.001)	(0.001)		(0.001)		
Area			0.000	0.000			0.000	0.000		0.000		
			(0.000)	(0.000)			(0.000)	(0.000)		(0.000)		
NYC neighbors			−0.411***	−0.400***			−0.487***	−0.477***		−0.486***		
			(0.097)	(0.097)			(0.106)	(0.106)		(0.117)		
Capital counties			−0.247***	−0.249***			−0.179*	−0.181*		−0.235**		
			(0.092)	(0.091)			(0.102)	(0.102)		(0.092)		
Bank density	0.003	−0.006	0.008	0.004	−0.002	−0.011	−0.003	−0.006	−0.013	0.004	0.021	0.005
	(0.014)	(0.015)	(0.011)	(0.011)	(0.015)	(0.016)	(0.012)	(0.012)	(0.015)	(0.011)	(0.023)	(0.023)
Bank deposits	−0.001	−0.001	−0.001*	−0.001*	−0.001	−0.001	−0.002**	−0.001*	−0.001	−0.002*	−0.001	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
IPO Funds	−0.025	−0.027	−0.032	−0.033	−0.015	−0.026	−0.035	−0.045	−0.021	−0.027	−0.022	−0.024
	(0.028)	(0.028)	(0.031)	(0.031)	(0.043)	(0.044)	(0.046)	(0.046)	(0.028)	(0.031)	(0.028)	(0.028)
VC Funds	−0.010	−0.008	−0.009	−0.006	−0.011	−0.011	−0.025	−0.019	−0.008	−0.006	0.002	0.002
	(0.011)	(0.011)	(0.010)	(0.010)	(0.028)	(0.028)	(0.026)	(0.026)	(0.011)	(0.010)	(0.005)	(0.005)
Republican votes (%)	−0.000	−0.001	0.000	−0.001	−0.000	−0.002	−0.000	−0.002	−0.002	−0.002	−0.000	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Education	0.007	0.003	0.020	0.014	0.011	0.005	0.021	0.014	0.003	0.017	0.006	0.004
	(0.014)	(0.014)	(0.013)	(0.013)	(0.015)	(0.015)	(0.013)	(0.014)	(0.014)	(0.013)	(0.015)	(0.015)

(continued)

Table 2 Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sample excludes	NYC observations				NYC Obs. and Obs. spanning September 2001				NYC obs.		None	
Form of distance	Linear								Logged		Linear	
Form of fixed effect	Indicator		Conditional		Indicator		Conditional		Indicator	Conditional	Indicator	
Suicide	0.133	0.054	0.099	0.093	−0.206	−0.285	−0.319	−0.299	0.100	0.111	0.159	0.083
	(1.167)	(1.165)	(1.129)	(1.127)	(1.361)	(1.360)	(1.323)	(1.322)	(1.165)	(1.129)	(1.165)	(1.164)
Recession	0.130***	0.134***	0.124***	0.125***					0.132***	0.122***	0.132***	0.135***
	(0.015)	(0.018)	(0.015)	(0.019)					(0.018)	(0.019)	(0.015)	(0.018)
Distance to NYC			−0.113***	−0.107***			−0.098***	−0.093***		−0.087**		
			(0.033)	(0.033)			(0.036)	(0.036)		(0.043)		
Time	0.025***	0.019**	0.029***	0.023***	0.018**	0.014	0.020***	0.014*	0.018**	0.019**	0.028***	0.022**
	(0.007)	(0.009)	(0.006)	(0.008)	(0.007)	(0.009)	(0.007)	(0.008)	(0.009)	(0.008)	(0.007)	(0.009)
Post-event	−0.046**	−0.052**	−0.032	−0.035	−0.054**	−0.051	−0.043*	−0.032	−0.073	−0.053	−0.049**	−0.054**
	(0.023)	(0.025)	(0.023)	(0.026)	(0.024)	(0.033)	(0.024)	(0.034)	(0.046)	(0.045)	(0.023)	(0.026)
Dist* post-event		0.010		0.010		−0.003		−0.006	0.008	0.009		0.010
		(0.008)		(0.008)		(0.017)		(0.018)	(0.009)	(0.008)		(0.008)
Post-event clock		0.042***		0.047***		0.033*		0.036*	0.126***	0.139***		0.042***
		(0.015)		(0.015)		(0.019)		(0.019)	(0.030)	(0.029)		(0.015)
Post-event clock* dist		−0.021***		−0.025***		−0.012		−0.012	−0.024***	−0.027***		−0.022***
		(0.005)		(0.005)		(0.010)		(0.011)	(0.005)	(0.005)		(0.005)
Constant	−0.547	−0.105	0.249*	0.320**	−0.789**	−0.281	0.114	0.190	0.064	0.665***	−0.537	−0.085
	(0.336)	(0.391)	(0.144)	(0.145)	(0.352)	(0.405)	(0.153)	(0.155)	(0.413)	(0.228)	(0.331)	(0.384)
Observations	17,898	17,898	17,898	17,898	14,915	14,915	14,915	14,915	17,898	17,898	18,012	18,012
Number of counties	157	157	157	157	157	157	157	157	157	157	158	158

Notes: SEs in parentheses, and state and sector indicator variables are included in all models.

*significant at 10%; **significant at 5%; ***significant at 1%.

NYC: New York City.

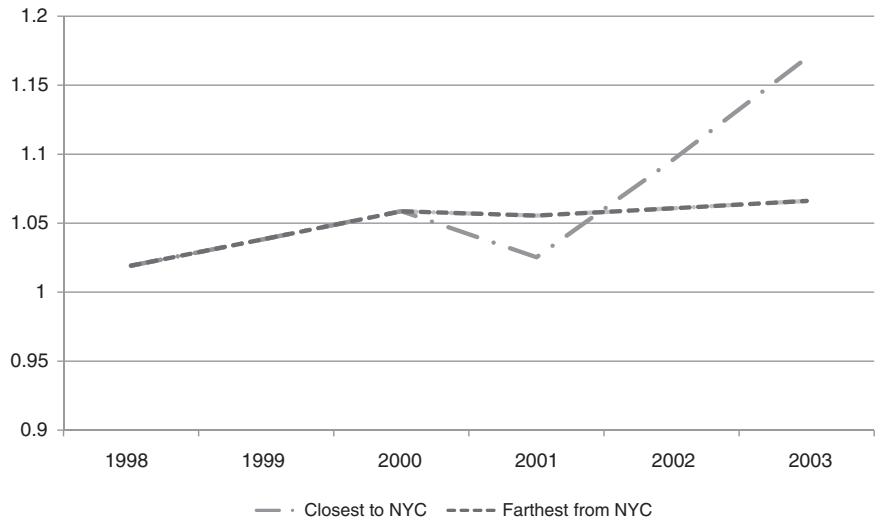

Figure 2 Effects of WTC attack on foundings in counties-sectors of four states.

exceeds its pre-attack level soon after the attack. The third possible support for our argument, that the growth rate of the founding rate (the slope of the line relating the founding rate to time) increased post-attack close to Manhattan, is also supported (the growth rate is higher post-attack for counties closer to Manhattan). Overall, these results are striking as to the effect of destruction on entrepreneurship. With business founding as the indicator, and controlling for the flow of recovery funds, entrepreneurial creation is greater after the September 11 attack in counties closer to the destruction than in those farther away. The results are wholly in line with the argument that the World Trade Center attacks seeded entrepreneurial creation.

7.1 Robustness tests

We performed several robustness checks. First, we re-estimated our models employing conditional negative binomial models, where the coefficients for time-invariant variables are estimated. The results of these models are presented in models 3 and 4 of Table 2. The results mirror that of the regressions with indicator variables for counties.

Second, since the observations of September 2001 may be abnormal due to the attack, the results of analysis eliminating the annual observations for April 2001–March 2002 are presented. The results of regressions where we explicitly include the indicator variables are presented in models 5 and 6 of Table 2 and results of conditional fixed effect regressions are presented in models 7 and 8. The results of all these models are similar to those presented earlier.

Third, we introduced the logged form of distance instead of linear form of distance in models 9 and 10 of Table 2. Model 9 is the negative binomial model with indicator variables for each county and model 10 is the conditional fixed effect model. The results of both these models are also similar to earlier models.

Lastly, the results of analyses where we included New York county observations in the sample are presented in Models 11 and 12 of Table 2. The results of these models are again similar to the ones presented earlier for samples without New York county observations.

8. Discussion

Schumpeter (1942) coined that term "creative destruction" to describe the necessity for entrepreneurial advances to destroy existing institutional arrangements which are often sub-optimal, if workable. He had in mind destructive processes endogenous to the economy, but a major exogenous destructive shock presents a rare opportunity to erase the ever-present inertia born of path dependence, and may therefore present social and economic opportunities. After the WTC attacks, for example, an urban planning process for lower Manhattan began (and is ongoing) that seems destined to produce a more livable and vibrant community than the one that pre-dated the attacks, which was popularly seen as severely compromised by an earlier generation's planning mistakes (Foner, 2005). Similarly, the destruction and displacement of economic resources by the attacks presents the opportunity to deploy new resources more effectively because the constraints of previous investments in jobs, organizations and transactions are reduced.

This evidence prompts a rethinking both of the phenomenon of entrepreneurship and of public policies that may promote it. Of course, we think that the destruction-led creation that we document occurs in other contexts. For example, Rosen's (1986) history of great urban fires attributes to them a stimulating effect for the development of important US cities. More recently, the US Secretary of Education Arne Duncan observed that "the best thing that happened to the education system in New Orleans was Hurricane Katrina." Duncan's explanation of the creative effect of the hurricane is in line with our argument, specifically that it swept away an entrenched education system that was itself a disaster. Our evidence and these examples suggest that explaining the incidence of entrepreneurship and economic creation of all forms requires attention to the macro-system of inertia. Terrorist attacks and natural disasters are rare but significant parts of this system and deserve more theoretical and empirical attention. We see two key scope conditions as to which types of exogenous destruction will be followed by creation. Both point to the confidence that investments of entrepreneurial energy and capital will bring future returns. First, enhanced creation will not follow destruction that entrepreneurs expect to repeat. For example, a natural disaster or terrorist act that is seen as a likely indicator of future destruction in the same place will discourage

investment and the creative rebound that we document here. Second, destruction that undermines the institutional foundation of economic activity, including the rule of law, would similarly reduce the willingness of entrepreneurs to invest in new organizations, technologies, and means of exchange.

In the policy realm, the evidence here suggests at the least a new perspective on the public response to disaster. If societies aspired to improvement, rather than recovery, after disasters, they would act differently. To take another contemporary example, consider the response to the current financial crisis. Some commentators and legislators have argued that protecting every job should be a policy goal in this crisis (Koller, 2010). Yet this approach is at odds with empirical evidence that job losses during recessions actually spur subsequent economic growth (Caballero and Hammour, 1996). The right policy approach to protection from and the occurrence of disasters depends on an accurate and comprehensive understanding of the implications of destruction. We do not claim to present a comprehensive theory of destruction in this paper, but we do move toward that goal by highlighting an under-emphasized and positive result, the removal of a sub-optimal *status quo*.

As an effort to combine theories of organizational ecology and entrepreneurship, we see this paper as following on the path set out by John Freeman. In fact, John and his co-authors provided a precedent for our work when they wrote "[T]he winds of creative destruction rarely blow more fiercely than in a newly deregulated environment (Silverman *et al.*, 1997: 31)." As we do, they realized that destruction of the institutional *status quo* sometimes precedes innovation. And of course, the multidimensional effect of inertia was at the heart of John's work (e.g. Hannan and Freeman, 1984, 1989), as it is at the heart of this paper. John also championed an idea that our argument relies on, that individuals and organizations rationally pursuing their own interests could produce collectively irrational results (Freeman, 1999).

In conclusion, we return to the question around which we organized this paper. Is there evidence that external destructive events unhinge path-dependent processes and lead to creative processes? The answer is decisively yes in the area where such an effect might be most expected. Within the economic gravity of lower Manhattan, business founding rebounded after a short post-attack depression and reached levels higher than pre-attack levels. This is an outcome of the combined effects of both the material as well as psychological resilience. On the other hand, a slow recovery was apparent farther away from Manhattan, indicating that psychological response to terrorism may be less positive the less direct the experience. The implication is that research on creative destruction also needs to pay attention to seldom considered non-material aspects.

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