Discrimination and Segregation in the Real Estate Market: Evidence from Terrorist Attacks and Mosques*

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June 2021

Abstract
I evaluate the impact of Islamic terrorist attacks, taken as exogenous shocks which may change individual perceptions towards Middle Easterners and Muslims, on the real-estate market. Using detailed property-level transactions data, I find that US property prices immediately near mosques fell by 5% in the two years following 9/11. I find little evidence of changes in the number of transactions, but an increase of up to 30% in the fraction of Middle Eastern and North African households locating near mosques, indicating increased ethnic and religious segregation from 9/11. Additional evidence indicates that price decreases across areas appear related to prejudice rather than changes in perceived risk.

* I thank Martha Bailey, Patrick Bayer, John Bound, Charlie Brown, Steve Lehrer, Mike Mueller-Smith, Rosina Rodriguez Olivera, Jeff Smith, and seminar participants at the University of Michigan and the RWI Essen for helpful discussions and feedback. I also thank Ihsan Bagby for access to survey data on mosques and Kiu Nasseri for access to the Middle Eastern Surname List.
Identifying willingness to pay to interact or avoid interacting with other racial, ethnic or religious groups is central to the economics of discrimination and segregation. In the real estate market, how household location decisions are causally affected by the group composition of a neighborhood is of particular importance, given that neighborhood effects are an important determinant of outcomes like education and inequality (Durlauf, 2004; Chetty et al., 2020). The largest impediment to studying discrimination is that households sort endogenously into locations with different and often unobservable amenities which correlate with group membership. This sorting suggests the use of exogenous variation to identify the causal impact of the group composition of a neighborhood on household willingness to pay (WTP). But, exogenous events that plausibly affect group perceptions or residential segregation are rare and difficult to identify, resulting in few causal estimates.¹

In this paper, I evaluate the impact of the September 11 2001 attacks (9/11), taken as an event which influenced perceptions towards Muslim households and those from the Middle East and North Africa (MENA), on real estate market discrimination and residential segregation near mosques. The shock provides key variation, since general benefits and costs of living near a mosque, along with property and neighborhood characteristics, are plausibly held constant. Discrimination theory and hedonic pricing models predict that a negative shock to perceptions which affects WTP may lead real estate prices to fall in areas near mosques, using mosques as proxies for interacting with Muslims and nearby concentrations of Muslim households. Moreover, the shock may also affect quantity transacted and, through sorting responses, neighborhood composition.

Using detailed property-level transactions data covering most of the US, I provide evi-

¹The rarity of exogenous variation has been recognized as one of the main challenges in the literature (Charles and Guryan, 2011). Another approach is estimating sorting models using instrumental variable techniques (Bayer et al., 2004).
dence on the impact of 9/11 using a Difference-in-Differences (DID) strategy. I identify changes in market outcomes attributable to the shock by comparing properties in the immediate vicinity of mosques to similar properties slightly farther away but in the same neighborhood. Using geographical coordinates for each property combined with geo-coding the location of mosques allows me to focus on narrow areas, exploiting hyperlocal within-neighborhood variation to credibly isolate the impact of the shock (Ang, 2020). Using ethnic name analysis of buyers and sellers, I also investigate whether MENA households were more likely to locate near mosques as a result of the attacks. While a large fraction of MENA households in the US are not Muslim, terrorist attacks typically impact perceptions towards broad groups perceived as sharing a geographical or religious background with the perpetrators (Allen and Nielsen, 2002; Singh, 2002; Abu Ras and Abu Bader, 2009; Ven, 2012; Zogby, 2001).

I find that 9/11 had important impacts on the real estate market near mosques. Prices within 0.2 miles of mosques decreased by 5% in the two years after 9/11. Decreases were concentrated immediately around mosques and mostly reverted back to their pre-9/11 level after 18-24 months. I find little impact on the quantity of properties sold, but a large increase of 30% in MENA households locating in these areas. Increased segregation has longer-run implications and suggests that households with a smaller than average decrease in WTP for properties near mosques moved in these areas as a result of the shock. Similarly, there may be baseline selection of households locating near mosques so that they are less reactive to these shocks. These two elements suggest that the analysis likely recovers a lower bound on the decrease in mean WTP, particularly for non-MENA non-Muslim households.

These impacts reflect a discriminatory response to the extent that they represent changes

\[ \text{Changes in perceptions of MENA households towards other MENA or Muslim households may be smaller from a stereotyping or Bayesian updating standpoint if these households have more exposure to these groups. Alternatively, their relative WTP for properties in areas away from mosques may decrease if attacks increase hostility against these households in those areas.} \]
in property valuation due to proximity to certain groups, rather than property or area characteristics. Changing valuation could reflect statistical discrimination from changes in the perceived risk of living near mosques or an increase in prejudice. Abadie and Dermisi (2008) report that 9/11 led to increased vacancy rates of landmark buildings in Chicago, suggesting a reaction to risk in the commercial market. In contrast, Redfearn (2005) finds little price change in residential markets surrounding high risk targets after 9/11, suggesting little reaction to risk for residential housing. Looking at heterogeneity across states, I find little relationship between the magnitude of the price decrease near mosques following 9/11 and an ex-post risk measure of attack in the state. Rather, decreases were particularly large and mostly concentrated to states with smaller Muslim populations and characteristics linked to prejudice against Muslims, namely higher increases in hate crimes following 9/11. Moreover, price decreases were mostly concentrated to mosques which later reported more strongly that American society is hostile to Islam, overall suggesting a response rooted in prejudice and negative stereotypes. This interpretation is consistent with previous work on terrorism increasing bias, prejudice, hate crimes, and police profiling (Swahn et al, 2003; Lauderdale, 2006; Das et al., 2009; Shayo and Zussman, 2011; Hanes and Machin, 2014; Levin, 2017; Ivandic et al., 2019; Zorlu and Frijters, 2019; Lehrer and Lepage, 2020).

3 Terrorism is a long-standing policy issue, but there exists little evidence on the extent to which attacks affect perceptions and behavior in ways which influence economic markets. Attacks also decrease assimilation of Muslim immigrants (Gould and Klor, 2014; Saleem and Ramasubramanian, 2019; Zorlu and Frijters, 2019), which my results indicate could partially result from increased residential segregation. I contribute to the literature on the

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dynamics of discrimination and segregation by presenting new causal evidence with several improvements over previous work, regarding both identification and data.\footnote{Gautier et al. (2009) and Ratcliffe and von Hinke Kessler Scholder (2015) study the impact of terrorism on the real-estate market using aggregate neighborhood data from two European cities. In contrast, I provide the first comprehensive analysis of the impact of 9/11 on the US real estate market. Leveraging variation from a national shock plausibly exogenous to local conditions and detailed transaction-level data covering the country allows me to estimate the impact of terrorism on the real estate market more precisely and extensively.} Further, it allows me to provide novel evidence on the cause of discrimination by exploiting heterogeneity in the impact of 9/11 across areas and mosque characteristics.

The rest of the paper is organized as follows. Section 1 presents the data and discusses the use of terrorist attacks and mosques. Section 2 outlines the empirical strategy, Section 3 presents the results, and Section 4 concludes. All appendix tables and figures mentioned in the text are included in the Online Appendix.

1 Transactions Data, Mosques, and Terrorist Attacks

I use detailed data on real estate transactions covering the US between 1998 and 2016, including information on the sale of residential and commercial properties. For each sale, I observe the price and date, property characteristics, and detailed geographical information.

\footnote{See Cutler et al. (1999, 2008a, 2008b), Bayer et al. (2004), Sethi and Somanathan (2004), Bajari and Kahn (2005), Bayer and McMillan (2005), and Card et al. (2008) on sorting and segregation. Exogenous variation has been used to identify WTP for neighborhood characteristics and amenities in other contexts (e.g. Linden and Rockoff, 2008; Currie et al., 2015; Dealy et al., 2017; Brooks et al., 2018).}

\footnote{Nowak and Sayago-Gomez (2018) study price differentials for properties with an Arab neighbor in a single US county following 9/11. Using mosques instead provides key advantages: they are likely more salient, less likely to be missclassified, and allow me to study segregation. Peralta and Tangvatcharapong (2020) report that mosque openings around Detroit do not affect nearby property values. In contrast, I study an exogenous event and show that restricting to a city or state severely diminishes external validity.}
Prices were adjusted to 2010 constant dollars and transactions with a price of 0 or in the top/bottom 1% of remaining transactions were excluded.

I merged information on 275 mosques for which I can pinpoint an exact address at the time of 9/11 from Bagby (2012). The mosque survey provides information on founding and moving dates as well as mosque characteristics and views of their religious leader. Appendix 3.1 shows the geographical distribution of all US mosques in 2016 (approximately 2,000) overlapped with the subset of mosques in my sample, showing good representative coverage of US mosques. Using a sample of mosques rather than all mosques likely has little impact on the analysis, and sample selection likely underestimates the true impact of interest for several reasons. Since properties near mosques account for a small fraction of all properties, misclassification arises from including properties in the comparison group that are near mosques not in the sample, underestimating the impact of 9/11 on market outcomes near mosques. Regarding representativeness, mosques were randomly selected to be surveyed, but restricting the sample to mosques which did not move between 2000 and 2010 to guarantee that I observe their address on 9/11 also underestimates the impact of interest if these mosques are particularly well established and accepted by their community, consistent with Figure 2. Lastly, Appendix 3.6 shows little evidence of changes in moving and founding of mosques immediately following 9/11, but if 9/11 caused some mosques to close, then my analysis likely recovers a lower bound on discriminatory responses by focusing on the sample of surviving, plausibly less affected mosques.

To focus on more comparable areas, I restrict the sample to properties sold within 1 mile of a mosque, although Appendix 2.5 shows that results are similar when relaxing this restriction. The final sample consists of over 1 million transactions near 275 mosques across
41 states and Washington D.C.\textsuperscript{[6]}

The quarterly log price of transactions within 0.2, 0.2-0.4 and 0.4-1 mile of a mosque is shown in Panel A of Figure 1. Prices across the three categories evolve similarly, supporting the common trends assumption of the DID design. As made clearer below, the largest sustained discrepancy appears to be a lower price within 0.2 miles of mosques in the 18 to 24 months following 9/11, consistent with the paper’s main finding.

Using mosques provides clear advantages over alternative proxies. First, since Muslim or MENA households account for a very small fraction of the US population (around 2%), using aggregate measures like the fraction of MENA households within a neighborhood leaves little meaningful variation across much of the country. Second, aggregating prices introduces imprecision since households are not randomly distributed within neighborhoods. In contrast, comparing transactions in the immediate vicinity of a mosque to transactions in the same neighborhood, but farther away, allows for precise, narrow treatment and comparison groups. Mosques provide a salient proxy, since they are intrinsically associated with Muslims and generally easily identifiable\textsuperscript{[7]} In many cases, they may be more easily identifiable than the ethnic or religious composition of the neighborhood. Their presence clearly signals to a potential household that there likely is a Muslim community nearby, some of which attend the mosque. Mosques can therefore also be seen as indicators of interaction with households who frequent them, even if they live farther away.

The transaction records contain the names of sellers and buyers. I classify buyers and sellers using the comprehensive Middle Eastern Surname List (MESL) developed and tested in Nasseri (2007). The list includes names associated with over 20 countries and regions of

\textsuperscript{[6]}Excluded states have no transaction near a mosque (AK, HI, MT and WY) or report the transaction recording date, which can differ substantially from the transaction date (CT, MA, ME, NH, RI).

\textsuperscript{[7]}A Google Street View inspection suggests that mosques are typically easy to discern from their architecture or a sign, as shown with facade pictures of 12 randomly-selected mosques in Appendix 4.
the Middle East and North Africa, excluding Israel. Identifying households from the same region as organizations associated with 9/11 is useful, because attacks may affect perceptions towards them in particular and because their own perceptions may not be affected to the same extent. There is potential for misclassification, particularly if the name association is viewed as a proxy for the household being Muslim, since, although MENA households are more likely to be Muslim than the average US household (Abu Ras and Abu Bader, 2009), a large fraction are not Muslim and a large fraction of Muslims are not of MENA origin. Nevertheless, as mentioned before, existing work suggests that these distinctions are likely of limited importance for purposes of discrimination, because 9/11 impacted perceptions towards broad groups stereotypically associated with either the religion or the region of the perpetrators.

Islamic terrorist attacks like 9/11 have been some of the most marking moments in recent history. There is little doubt as to their salience (Mellon, 2014) or association with organizations from the Middle East, who often claim responsibility for the attacks. Attacks have been associated with extensive media coverage criticized for painting Muslims in a negative stereotypical light (Norris et al., 2004; Papacharissi and de Fatima Oliveira, 2008; Gadarian, 2010; Powell, 2011; Ivandic et al., 2019; Kearns et al. 2019) and survey evidence suggests that the public generally has little knowledge of Islam (Pew Research Center, 2010).

The analysis focuses on 9/11 given that its importance is unrivaled and death toll 60 times higher than the next deadliest Islamic attack in US history. It provides the most salient shock for identification, although I investigate other major domestic Islamic attacks.

Bagby (2012) reports that African-Americans are the largest group of mosque attendees in the US, followed by South-Asians and then by Arabs and MENA. Together, these three groups account for nearly 90% of followers, while Caucasians and Hispanics account for around 2%.

Some of the impact of 9/11 could be tied to the War in Afghanistan that followed. It is unlikely to account for a large share of the impact given that there is no observed impact of the 2003 War in Iraq and that foreign wars are likely less salient than domestic civilian casualties.
2 Empirical Strategy

The challenge in estimating household WTP over neighborhood characteristics arises from not observing characteristics of a property or area that are correlated with the characteristic of interest. Regardless of discrimination, properties near mosques sell for a different price because of differences in the areas in which they are located, and proximity to a mosque could affect value independent of discrimination. Appendix 2.1 shows that properties in census tracts with mosques sell for lower prices and that these tracts are younger, more likely to be non-white and foreign-born, slightly less educated, and lower income. These differences motivate the use of 9/11 as a shock to household WTP uncorrelated with local markets.

I first consider an event study specification, providing quarterly evidence of the impact of 9/11 on real estate prices near mosques. I use a time window of two years around the shock to minimize the risk of unobserved changes acting as confounders (Parmeter and Pope, 2013). I consider the following equation for the log price of property $i$ with distance to a mosque $d$ sold at time $t$

$$
\log(P_{idt}) = \gamma_0 + \sum_{k=-8}^{-2} \beta_k D_d \ast 1(Q_t = k) + \sum_{k=0}^{8} \beta_k D_d \ast 1(Q_t = k) + \epsilon_{idt} \tag{1}
$$

where the price is a function of distance to a mosque ($D_d$). $D_d$ is interacted with indicator variables for each quarter ($Q_t$), with quarter -1 omitted. Quarter 0 corresponds to the quarter of 9/11, and $1(Q_t = k)$ takes the value 1 if the transaction took place in quarter $k$ and 0 otherwise. The coefficients of interest are the interaction terms, representing the price
differential for properties near mosques each quarter.

Which distance to include in the treatment group can be understood as a trade off between bias and variance. I consider precise areas within neighborhoods to minimize bias. I include properties within 0.2 mile of a mosque in the treatment group, corresponding to one or two housing blocks from the mosque, which seems reasonable given considerations of salience. As shown below, increases in MENA buyers following 9/11 were also concentrated within 0.2 mile of mosques, suggesting that it is an appropriate radius to capture impacted areas. It is consistent with previous work considering radii between 0.1 and 0.3 and up to 0.5 (Linden and Rockoff, 2008; Currie et al., 2015; Dealy et al., 2017; Brooks et al., 2018; Ang, 2020). Lastly, I show below that price decreases are concentrated within 0.2 mile of mosques and close to 0 beyond.

I then turn to a DID specification for the log price of property $i$ in census block $b$ with distance to a mosque $d$ sold at time $t$. The term $Post_t$ denotes the period following 9/11 and is interacted with the distance indicator. I consider time windows of 1 or 2 years around the attack, such that $Post_t$ takes the value 0 (1) in the 1-2 years before (after) the shock. This yields the following specification

$$\log(P_{idbt}) = \beta_0 + \beta_1 Post_t + \beta_2 D_d + \beta_3 Post_t * D_d + \beta_4 X_i + \alpha_t + \delta_b + \epsilon_{idbt}$$  \hspace{1cm} (2)$$

where $X_i$ is a set of property characteristics, $\alpha_t$ is a collection of year and month-of-the-year fixed effects, and $\delta_b$ corresponds to census block or tract fixed effects. $\beta_3$ is the coefficient of interest, representing the differential price change for properties near mosques following 9/11. A similar specification can be used to study the impact of 9/11 on the quantity of properties sold or the fraction of properties bought and sold by MENA households.

Standard errors are clustered at the census tract level to allow for arbitrary correlation of
errors within neighborhoods, although the results are robust to clustering at levels ranging from census block to state, including at the mosque level.

Estimates from equation (2) correspond to market capitalization rates. Kuminoff and Pope (2014) show that these rates provide an unbiased estimate of WTP if the exogenous shock is uncorrelated with housing and neighborhood characteristics, which appears particularly plausible for 9/11. Further, properties near mosques represent a small fraction of the market, so the impact of 9/11 should be localized with little effect on the broader market.

3 Results

Panel B of Figure 1 presents event-study estimates from equation (1). The estimated price differential between properties within 0.2 mile of a mosque and other properties is mostly flat around 0 in the two years preceding 9/11. Consistent with a causal impact of 9/11, it falls sharply in the quarter of the attack and remains below 0 for approximately two years after. The estimated price decrease is 5-10%, although individual coefficients are generally not statistically significant.

Panel A of Table 1 shows DID estimates from equation (2), pooling quarters surrounding the attack into one pre and post period and testing joint statistical significance. The first column shows that properties within 0.2 mile and 0.2 to 1 mile generally sell for a similar price and that 9/11 did not affect overall prices when including time and location fixed effects. Column (2) adds the interaction term of interest, showing that properties within 0.2 mile of mosques were sold for nearly 6% less following 9/11. Column (3) adds an indicator for whether a property was sold between 0.2 and 0.4 mile of a mosque and interacts it with $Post_t$, showing that the impact is concentrated to properties in a 0.2 mile radius around
mosques. Column (4) includes individual property characteristics which have a minor impact on the estimates. Columns (5) and (6) restrict to residential and non-residential properties. The price decrease appears larger for non-residential properties, although there are few observations. Column (7) restricts the comparison group to a 0.4 mile radius around mosques, with limited impact on the estimates. Across columns, the interaction term is statistically significant at the 5 or 10% level, except for non-residential properties.

Panel B of Table 1 presents results with the log number of monthly transactions per census block as the outcome. It provides little evidence that 9/11 differentially affected the quantity of properties sold near mosques, suggesting no more than a 1% statistically non-significant change.

A natural consideration is whether other events or periods are associated with a similar impact on prices as 9/11. I conduct placebo tests from a series of rolling time window regressions. For each quarter excluding the first and last two years of my sample, I estimate equation (2) defining the placebo \( Post_t \) as the two years following the given quarter and comparing to the two years before. The results shown in Appendix 3.2 show that the quarter of 9/11 and the one that followed are associated with the two largest differential price decreases. The only three statistically significant price decreases at the 5% level correspond to these two quarters and the second quarter following 9/11. The impact of 9/11 was unique in its magnitude and statistical significance, supporting a causal interpretation. Appendix 2.2 also provides additional placebo tests investigating the impact of 9/11 on prices near Christian churches as well as of deadliest mass-shootings with no link to Islamic terrorism on prices near mosques and Christian churches, indicating that results from Table 1 relate

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10 Excluding properties between 0.2-0.4 mile yields similar results, suggesting little spillover between areas.
11 Holding the sample constant to properties with non-missing housing characteristics has little impact on estimates from columns 1-3 in Tables 1 and 2, as expected given the use of 9/11 as an exogenous shock.
12 The results are similar whether tax-exempt properties, including religious buildings, are included or not.
specifically to mosques and Islamic terrorist attacks.

Panels a-e of Figure 2 present heterogeneity analyses based on mosque characteristics. Price differentials are mostly concentrated to mosques in the bottom or top 25% of attendance. Large mosques may be particularly salient, while smaller mosques tend to be in states with lower Muslim population and higher prejudice, characteristics associated with larger price decreases as discussed below. Little apparent relationship between the price decrease and the MENA share of attendees indicates changing perceptions towards Muslims and mosques in general.\textsuperscript{13} Price decreases appear smaller around mosques established at their location for more than 10 years before 9/11, suggesting integration and acceptance by the community. Interestingly, decreases are almost exclusively concentrated around mosques who reported more strongly that American society was hostile to Islam in 2011. This relationship does not appear driven by these mosques being more conservative, because price decreases are no greater around mosques whose representatives reported more strongly that America is an immoral society, as shown in Appendix 3.4. Decreases were also slightly larger around mosques which reported increased Muslim youth radicalism in the area.\textsuperscript{14} The impact of 9/11 may have been stronger in these areas, or these perceptions may themselves have resulted from 9/11. In any case, these correlations suggest a link between price decreases and prejudice corroborated by the next subsection.

Recent work shows that linear regressions with period and group fixed effects recover weighted sums of the average treatment effect in each group and period, with some weights potentially being negative. Under treatment heterogeneity, these negative weights can cause the coefficient of interest to be negative even when all average treatment effects are positive. Following de Chaisemartin and D’Haultfoeuille (2020), less than 5% of weights in

\textsuperscript{13}Similarly, there is little difference in price differentials based on the fraction of African-Americans.

\textsuperscript{14}The response rate for these questions is around 98%.
my setting are negative, and a substantial amount of heterogeneity in the average treatment effect (minimum standard deviation of 6% in price differentials) would be needed to yield a coefficient of the opposite sign than the average treatment on the treated. Still, characterizing heterogeneity based on mosque and state characteristics is precisely the goal of the previous paragraph and the next subsection, highlighting that the average price decrease can be misleading since it hides substantial heterogeneity.

Table 2 investigates the impact of 9/11 on the fraction of MENA households near mosques. Panel A presents results for buyers. Column 1 shows that MENA households are 32% more likely to locate within 0.2 mile of mosques in general. Column 2 adds the interaction term of interest, also restricting the sample to a one-year window around 9/11, and showing that the fraction of MENA buyers disproportionately increased by roughly 30-40% in the year following 9/11 for properties within 0.2 mile of a mosque compared to 0.2-1 mile. Column (3) adds an indicator for transactions within 0.2 and 0.4 mile of mosques and interacts it with the indicator for the period following 9/11, showing a concentrated impact within 0.2 mile of mosques. Column (4) adds property characteristics which have limited impact on the coefficient of interest. Columns (5) and (6) show that the increase appears concentrated to residential properties. Column (7) restricts the comparison group to within 0.4 mile of mosques, which has little impact on the results. Estimates are statistically significant at the 5 or 10% level except for non-residential properties. Panel B presents results for sellers. Estimated differentials are small and statistically non-significant, suggesting that impacts are primarily buyer-driven. Combining changes for buyers and sellers suggests a net increase of up to 30% in the fraction of MENA households.

15The fraction of MENA buyers remained approximately 13% higher in the second year following 9/11 before decreasing to its pre-9/11 level, but the effect is not precisely estimated.
16Appendix 3.3 presents results using 0.1 mile bins, which decreases precision, but indicates that both price decreases and fraction of MENA buyer increases appear concentrated within 0.2 mile.
Appendix 2.6 also shows that the number of MENA buyers - not just the proportion - increased near mosques. Combined with little change in overall quantity sold, it suggests that changes in composition were driven both by an increase in MENA buyers and decrease in non-MENA buyers.

This sorting is consistent with increased ethnic and religious segregation around mosques caused by 9/11. It provides a potential mechanism through which terrorism decreases assimilation of Muslim immigrants, as found in previous work, and has longer run implications for these neighborhoods (Anderson, 2011; Ludwig et al., 2013; Chetty et al., 2016; Chyn, 2018; Aliprantis et al., 2019). Sorting also informs the interpretation of price differentials. The pattern is consistent with a subset of households locating near mosques following the attack, for example because their WTP for these properties was not affected to the same extent as other households. The estimated price decrease likely constitutes a lower bound on the average decrease in WTP for non-MENA households. Nevertheless, the proportion of MENA buyers near mosques remains relatively small at around 7%, suggesting that these areas, although disproportionately non-white, are fairly diverse. They are also likely more religiously than ethnically segregated, given that MENA individuals account for a minority of mosque followers (mean 33%, median 17%) and 1% of the population.

Taken together, the evidence indicates a substantial real estate price decrease near mosques in the 18 to 24 months following 9/11 as well as an increase in residential sorting. In the longer run, attacks do not substantially affect prices, but changes in neighborhood composition remain. Appendix 1 presents a simple housing search model which jointly rationalizes these findings and highlights that it is sufficient to observe the equilibrium sale price rather than listing and offer prices to identify changes in WTP. My estimates of 5% price decreases are larger than previous estimates of 1.5% and 3% using neighborhood-level
data or Arab neighbors as the treatment. This is expected given more precise measurement, transaction-level data, and mosques as a proxy for interacting with MENA or Muslim households. Further, by restricting the analysis to a city or county, previous work has been unable to investigate the substantial heterogeneity in discriminatory responses across areas that I document next.

### 3.1 Interpretation as Discrimination

The exogenous nature of 9/11 supports interpreting the change in WTP to live near mosques as a discriminatory response, given that factors beyond perceptions of Muslims and mosques are held constant, with crime and policing as a potential exception discussed below. The source of this response is also of importance, because it influences potential policies.

There are two main candidate explanations. First, statistical discrimination from changes in risk, objective or perceived. Following 9/11, households may have perceived Muslim and MENA households as well as areas near mosques to be more dangerous. This could arise because of perceived risk of subsequent terrorism. For example, Di Tella and Schargrodsky (2004) document increased police presence in high terrorism risk areas, while Lehrer and Lepage (2020) document increased frisking and use of force against Arabs in New York City precincts with higher concentrations of mosques following terrorist threats.\[17\] Perceived risk of terrorism is at odds with Redfearn (2005) finding no evidence of price decreases following 9/11 in areas surrounding high risk targets, while I document a decrease near mosques. It is also inconsistent with Panel f of Figure 2 showing no greater price decreases in states

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\[17\] Increases in policing affect the value of living in these areas, but they do not provide an alternative explanation for price decreases near mosques. Increased anti-terrorism policing is vastly preventive and associated with decreased crime, with the exception of hate crimes, which should increase WTP to live in these areas and act as a mitigating factor to the discriminatory response, particularly for non-MENA non-Muslim households.
with higher ex-post risk based on being targeted by at least two attacks/threats since 9/11 (CA, NY, IL, NJ, DC, FL).\(^{18}\) In fact, most of the price decrease in those states is driven by Florida, which differs starkly from other high risk states on prejudice-related measures considered below. Lastly, Panel g shows substantially larger price decreases in states with below-median Muslim population, suggesting a negative link between price decreases and propensity to interact with Muslims.\(^{19}\)

Another source of statistical discrimination comes from risks related to retaliation and hostility against mosques or MENA and Muslim households. Yet, the majority of households are non-MENA, non-Muslim, and do not frequent mosques. They face little reasonable risk from such hostility, so the documented price decrease appears much too large to ascribe to such reaction. Moreover, such a reaction is itself caused by expected prejudice in these areas, and it seems unlikely that prejudice would increase risk in these areas without directly affecting the WTP of households to live there. Accordingly, if risk does play a role, it is likely symptomatic of prejudice.

In fact, it is apparent from previous work that terrorism generates prejudice (Swahn et al., 2003; Lauderdale, 2006; Das et al., 2009; Shayo and Zussman, 2011; Levin, 2017; Ivandic et al., 2019; Zorlu and Frijters, 2019). The question is whether prejudice is systematically associated with price decreases near mosques. Panel h of Figure 2 shows that decreases were particularly large and mostly concentrated to states with higher increases in hate crimes against Arabs or Muslims following 9/11.\(^{20}\) Nearly 75% of states with above-median increases

\(^{18}\)Results are similar for attacks and threats per capita or for the number of mosques per capita. A list of terrorist plots is available at https://en.wikipedia.org/wiki/List_of_unsuccessful_terrorist_plots_in_the_United_States_post-9/11.

\(^{19}\)This result suggests that price decreases were unlikely to be driven by increased attendance and traffic around mosques. Abu Ras and Abu Bader (2009) also report only a modest increase in religious attendance of Arab-Americans following 9/11.

\(^{20}\)Data on hate crimes is from the FBI Uniform Crime Reporting. Alternatively, using more detailed data on per-Muslim-capita hate crimes against Muslims between 2012 and 2017, available at
in hate crimes are located in the South or Midwest and nearly 80% leaned Republican in 2000. Panel i shows that price decreases were larger in states with higher prejudice against African-Americans as measured in Stephens-Davidowitz (2014), which is likely correlated with prejudice against other minority groups and time persistent. The Pew Research Center reports that less favorable opinions of Islam are higher among Republicans, older people and the less educated. Consistent with these associations, Panels j-l display higher price decreases in states with higher shares of Republican voting in the 2000 federal election, a higher median age in 2000, and a higher share of the population with less than a college education in 2000. Appendix 3.4 suggests that this heterogeneity is exacerbated when looking at the county level, and that price decreases were larger in counties with lower population density. The results indicate a consistent mapping between the magnitude of price decreases and prejudice in the area, both immediately following 9/11 and in the years after.

An increase in police profiling and hate crimes near mosques is not incompatible with the increase in MENA households locating there. These households may also have faced increased discrimination in other neighborhoods, the price decrease near mosques may have been sufficient to compensate some of them, and their WTP may have increased if these areas provided various forms of community support. As such, these results also suggest that price decreases were not primarily driven by a response to perceived risk of living near mosques, but rather decreased WTP of non-MENA households due to prejudice.

Taken together, the evidence is consistent with 9/11 leading to price decreases and increased household sorting, in large part through increased prejudice against MENA or Muslim households. These impacts could reflect a preference shock, although the response suggests a stronger reaction in areas with fewer Muslims and more negative views of minorities, in https://www.newamerica.org/in-depth/anti-muslim-activity/, also indicates higher price decreases in states that later have more hate crimes.
line with a model of discrimination from biased beliefs like Lepage (2021). Households in states with little knowledge and interaction with Muslim or MENA households may have updated their views particularly strongly after 9/11, leading to larger negative perceptions in these areas. This idea is consistent with a 2016 report from the Pew Research Center and Saleem et al. (2016), who find that individuals with more knowledge of Islam and contact with Muslims are less likely to hold negative perceptions of the group.

4 Conclusion

This paper uses 9/11 as an exogenous shock to perceptions of MENA and Muslim households to provide rare causal evidence of discrimination and segregation in the real estate market.

In the two years following 9/11, prices immediately near mosques around the US fell by approximately 5%. I find little impact on the number of transactions, but a large increase of up to 30% in the fraction of MENA households locating near mosques. Prices seemed to revert back to their pre-9/11 level in the longer run, but a re-allocation of household remains. These results are consistent with a simple housing search model in which household WTP, primarily of buyers, is negatively affected by the shock.

Evidence on heterogeneity in price decreases across mosque and state characteristics suggests discriminatory responses particularly consistent with prejudice rather than perceived risk. Areas with relatively little interaction with Muslims and higher measures of prejudice seemingly had their perceptions of MENA and Muslim households impacted particularly strongly by the attack, leading to larger decreases in WTP.

This paper shows that salient events to perceptions can meaningfully affect behavior and outcomes of economic markets. These events can have far-reaching consequences by affecting
segregation and integration, potentially further contributing to negative stereotypes. Indeed, hate crimes against Muslims have never reverted back to their pre-9/11 levels and have increased since (Levin and Grisham, 2016).

References


Figure 1: Real Estate Prices and Event Study Evidence of the Impact of 9/11 on Real Estate Prices near Mosques

Prices are in constant 2010 dollars. Coefficients in Panel B represent the estimated quarterly price differential from equation (1) for real estate transactions within 0.2 mile of a mosque compared to between 0.2 and 1 mile. Standard errors are clustered at the census tract level and dashed lines represent pointwise 95% confidence intervals. Data source: Bagby (2012).
Figure 2: Heterogeneity in Price Differentials by Mosque and State Characteristic

- **a** - Mosque: Attendance
- **b** - Mosque: % MENA
- **c** - Mosque: Tenure
- **d** - Mosque: Hostility
- **e** - Mosque: Radicalism
- **f** - State: Attack Risk
- **g** - State: % Muslim
- **h** - State: Hate Crimes
- **i** - State: Prejudice
- **j** - State: % Republican
- **k** - State: % College
- **l** - State: Median Age

Low/Medium/High attendance corresponds to mosques in the first/middle two/last quartile. Hostility/Radicalism corresponds to a rating from 1 (Strongly Disagree) to 5 (Strongly Agree) by the mosque official to whether American society is hostile to Islam/radicalism is increasing among Muslim youth in the area. High risk corresponds to states targeted by two or more terrorist attacks/threats between 9/11 and 2017. Hate Crimes is the percentage increase in hate crimes against Arabs or Muslims over the two years before and after 9/11. Prejudice corresponds to the index against African-Americans from Stephens-Davidowitz (2014). % Republican corresponds to the Republican voting share from the 2000 presidential election. See Table 1 for regression details. Data source: “List of unsuccessful terrorist plots in the United States post-9/11” (n.d.); Federal Election Commission (2001); Meyer (2001); Bauman and Graf (2003); Weeks (2003); Bagby (2012); FBI UCR (1998-2003) and Stephens-Davidowitz (2014).
Table 1: Difference-in-Differences Estimates of the Impact of 9/11 on Real Estate Prices and Quantities Traded near Mosques

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Clustered standard errors at the census tract level are presented in parentheses. Estimates obtained from equation (2) where D20 (D40) are indicator variables for properties sold within 0.2 (0.2-0.4) mile of a mosque. The comparison group is restricted to within 1 mile of a mosque and 0.4 mile in column 7. The analysis is restricted to a two-year time window before and after 9/11 and to mosques which did not move between 9/11 and their reported location in the 2011 data. “Time and Location FE” include year, month-of-year and census block fixed effects. When included, housing characteristics include lot size in square feet, the decade of construction, and the number of units in the lot. “Log Quantity” corresponds to the log of the monthly number of transactions per census block. Data source: Bagby (2012).
Table 2: Difference-in-Differences Estimates of the Impact of 9/11 on the Fraction of Middle Eastern and North African Buyers and Sellers near Mosques

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- **Time and Location FE**: Y Y Y Y Y Y Y
- **Clustered SE (Census Tract)**: Y Y Y Y Y Y Y
- **Housing Characteristics**: N N N Y N N N
- **Residential Only**: N N N N Y N N
- **Commercial Only**: N N N N N Y N
- **Within 0.4M of a Mosque Only**: N N N N N N Y

See Table 1 for information on definitions. Column 1 includes the entire sample period, while columns 2-7 restrict the analysis to a one-year time window around 9/11. Data source: Nasseri (2007); Bagby (2012).