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Philipp Ager Maja U. Pedersen Paul Sharp Xanthi Tsoukli[†]

Abstract

This study provides a comprehensive understanding of the Great Fire's effects on London's economic geography. Our analysis reveals both continuity and change. There was a swift post-fire recovery accompanied by some shift in economic activity towards the City of Westminster by 1690, with markets spreading outside the City, but financial services largely remaining inside. Analysis of London Hearth Tax records further illustrates a significant change in the wealth distribution, with wealthier households returning to fire-impacted areas, reshaping the city's housing and social structure.

Keywords: Great Fire of London, Economic geography, Location of economic activity
JEL codes: N23, N93

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1 Introduction

Major city fires have occurred throughout history, and every schoolchild in the UK learns that "in 1666, London burned to sticks". Studying such events can shed light on how urban areas adapt economically and structurally in response to disasters, influencing patterns of redevelopment and migration. By the 1660s, the City of London was a major cultural, social, and economic centre with an estimated population of 100,000 (Harding, 1990).[1] However, this status was threatened when on Sunday, September 2, 1666, the Great Fire began. It was only extinguished the following Wednesday, after having left 90 percent of homes in the City of London destroyed. A major reconstruction program commenced and was more or less complete a decade later (Reddaway, 1951). But how did economic activity and wealth inequality change in the City of London and surrounding areas in the decades that followed?

Perhaps uniquely for this period of time, we can shed light on this question, having digitised data on London's marketplaces and goldsmiths, the latter being the forerunners of modern banks (Persson and Sharp, 2015). We identified the exact location and period of operation for marketplaces and goldsmiths between 1630-1690. Based on this information, we constructed a reduced-form measure of market and financial access at the parish level to capture local economic activity. These measures are based on a concept of market potential that is used in the trade literature (e.g., Donaldson and Hornbeck, 2016) and aim to encompass the direct and indirect impact of the closings/openings of marketplaces and goldsmiths. Although the parish unit is geographically small, the market potential measure allows us to consider general equilibrium effects, and with these measures at hand, we can evaluate whether the Great Fire substantially altered the centre of economic activity in London. Moreover, we consider the social dimensions of the fire's aftermath through an analysis of the London Hearth Tax records for the years 1666 and 1675, a rare source of historical

[1]The term "City of London" refers specifically to the historic and financial heart of London, an area of approximately one square mile, often simply called "the City". In our context, this is particularly significant as the fire largely destroyed this densely built and economically important area, which was the medieval heart of London. On the other hand, the "metropolis", which we often refer to following modern usage as simply "London" rather than "the City", refers to the broader area of London, encompassing surrounding districts beyond the City of London. The metropolis included outlying areas that were less affected or unaffected by the fire's devastation.

socio-economic data for this period covering the period both before and after the disaster.

Our empirical analysis is based on a difference-in-differences approach, which exploits the timing of the fire and the fact that the fire destroyed buildings in certain parishes while others remained unaffected. While economic activity reemerged in the City of London after the fire, we find evidence that some markets moved westwards towards the neighbouring City of Westminster – then as now the main hub of political power in England, and the location of government and parliament. We also present event-study estimates to capture the dynamic aspects of the fire. Both measures of economic activity show no sign of existing pre-trends, supporting the key identifying assumption in a difference-in-difference approach of common trends in the absence of treatment. After the fire, however, affected parishes experienced a gradual drop in access to markets and financial services compared to non-affected parishes. This gap even widens over time reflecting a longer impact of the fire. These results are robust to including parish linear trends, pre-fire values of the outcome variable interacted by time to flexibly capture potential mean reversion dynamics, and certain geographic characteristics of parishes, such as proximity to rivers interacted by time, that could have affected economic activity in a parish independent of the Great Fire. Quantitatively, an affected parish experienced a relative decline in economic activity measured by access to marketplaces by 2 percentage points by 1690 compared to unaffected parishes. Given that our measure of market access decreased by about 4 percentage points between 1660 and 1690 this effect is economically relevant.

The fire also changed the social structure of the City of London. Using the hearth tax records, we can trace changes in wealth distribution and housing structures within the city. By examining the number of hearths in households before and after the fire, we gain insights into how the disaster influenced the movement of different social classes and reshaped the urban landscape. Our analysis reveals that wealthier households returned to fire-affected areas–the average number of hearths increased, but the Gini coefficient fell. This is possible because the costs of rebuilding were prohibitive for poorer people, especially following new building regulations, and suggests that the fire's impact significantly altered the City's social fabric and residential patterns. Our findings that

the Great Fire substantially changed the social structure of the City is consistent with the work of Field (2008, 2017), who studied the resettlement and reconstruction of London after the Great Fire based on various qualitative and quantitative sources, including the hearth tax records.[2] Although the City of London was quickly rebuilt, our results suggest that low-income groups did not return and contributed to the observed shift in economic activity towards the City of Westminister and other neighbourhoods outside the city walls.

Our work also relates more broadly to studies considering how natural or man-made disasters changed the distribution of economic activity and impacted wealth and income inequality. Glaeser (2022) argues that, for the past 650 years, cities have been quite resilient to physical damage, such as from war, natural disasters, and even plagues. Even large temporary shocks, such as the bombing of cities, leaves the distribution of city sizes unchanged (e.g., Davis and Weinstein, 2002). Closest to our work in this context are other studies of great city fires. These generally find that the destruction altered city structures and often offered new economic opportunities resulting in long-term benefits for city development (e.g., Rosen, 1986; Hornbeck and Keniston, 2017; Siodla, 2015, 2017). Compared to these studies, we provide unique insights into how a major city fire changed economic inequality in a historical context (in the modern context, there is little evidence of how natural disasters affect economic inequality within cities).[3] Although the greater region of London remained resilient to the destruction of the Great Fire, we show that fire caused a relocation of economic activities that likely contributed to the population decline in the City of London and dispersed population from the city centre,[4] in line with studies which show that path

[2]See Bell (1920), Reddaway (1951), and Porter (2011) for historical accounts of the rebuilding of London after the Great Fire of London. For the financial aspects of rebuilding the city after the fire, we refer readers to Coffman et al. (2022). On the financial history of seventeenth century London more general, and the history of goldsmith-bankers in particular, see, for example, Richards (2012), Quinn (1997, 2001), or Sussman (2022); for the period after 1700, see, for example, Temin and Voth (2013). See Smith (1999, 2002), for a detailed description of London's wholesale and retail markets.

[3]There is a large literature on the economic consequences of natural disasters. Hornbeck and Naidu (2014), Long and Siu (2018), or Boustan et al. (2020) find that people moved away from affected areas as a response to the shock, or were less likely to migrate into an affected area (Ager et al., 2020). There is, however, mixed evidence on whether natural disasters significantly affect economic growth (e.g., Cavallo et al., 2013; Imaizumi et al., 2016). In terms of economic inequality, the existing evidence is generally mixed and case-specific (e.g., Keerthiratne and Tol, 2018; Pleninger, 2022; Howell and Elliott, 2018; Wang and Zhao, 2023).

[4]Rough population estimates suggest a decline in inhabitants of the City of London after the fire, but an increase in the population of the greater region of London from 400,000 to 575,000 between 1650 and 1700 (Harding, 1990).

dependence and agglomeration forces also exist within cities (Ahlfeldt et al., 2015; Heblich et al., 2020; Ambrus et al., 2020; Siodla, 2021).[5]

Finally, we also speak to a large body of research on the relationship between market access and economic development (e.g., Redding and Sturm, 2008; Donaldson and Hornbeck, 2016; Juhász, 2018). Most of this literature focuses on how variation in market access induced by a sudden change in trade policy or the construction of new transportation infrastructure affects the location of industry, city growth, or other measures of local economic activities. Compared to these studies, we evaluate how a large temporary shock that is confined within London changed its parishes' market and financial access, and at the same time, we can also learn more about the spatial distribution of economic activity across parishes inside and outside the London Wall before and after the Great Fire of 1666.

The remainder of the present work is organised as follows. The next section provides the historical background. Section 3 describes the datasets employed in the study, including the market and financial service locations and the London Hearth Tax records, which inform our analysis of economic shifts and social structure changes. Section 4 outlines our econometric model, and the results are presented in Section 5. The final section concludes.

2 Historical Background

London's history as a commercial centre goes back to Roman times. The earliest financial document discovered is an IOU between two ex-slaves dated January 8, AD 57.[6] Over the next centuries, London experienced remarkable population growth, to around 200,000 inhabitants by 1600 (Wrigley, 1967). By 1650, the area of London was broadly defined as including the 113 parishes of the City of London (97 of them were located inside the city walls), as well as the parishes of

[5] A by now vast literature provides compelling evidence that temporary shocks can leave a long-lasting mark on the distribution of city sizes, highlighting the role of agglomeration economies in determining the distribution of economic activity (e.g., Redding et al., 2011; Bleakley and Lin, 2012; Hanlon, 2017; Ager et al., 2020). We refer the readers to the surveys by Redding and Rossi-Hansberg (2017), Lin and Rauch (2020), and Hanlon and Heblich (2020) for further references on the evolution of the spatial distribution of economic activity across neighbourhoods, cities, and regions.

[6] The Museum of London Archaeology deciphered this document (see UK's oldest hand-written document).

Middlesex, Surrey, and Westminster (Harding, 1990; Cummins et al., 2016).

Before the outbreak of the Great Fire in 1666, the City of London was densely populated and consisted of buildings in a multitude of styles, some of which dated back three or four hundred years. The streets were narrow and many of the houses and shops were owned by institutions, such as livery companies (guilds) and the City of London Corporation (the local government), that were not willing to rebuild for their tenants. There were exceptions, however, and the houses of the richer classes were of higher quality, some of which are associated with the famous architect Inigo Jones, who was appointed Surveyor-General of the King's Works in 1615. For most properties, however, little or nothing had changed in the basic structures of the medieval house by the time of the fire (Schofield, 1984).[7]

The fire famously began in Pudding Lane on September 2, 1666. England was at the time recovering from the 1665 plague and was at war with the Dutch Republic and France. Due to the nature of its housing, the City of London was extremely vulnerable to fire. Around London Bridge in particular, houses were densely packed and mixed with warehouses stocked with flammable goods. In general, London mostly consisted of densely-packed buildings made of wood and thatch using open hearths, and with a limited water supply and firefighting equipment. In the aftermath of the fire, St Paul's cathedral and 84 parish churches were destroyed, as were 44 out of 51 livery company halls and 13,200 houses (Figure 1). Approximately 100,000 people were left homeless, but the impact of the fire was felt differently due to differences in wealth and social status.[8]

It was quickly decided to rebuild the city, and after some discussion, the Rebuilding of London Act was passed by Parliament on February 8, 1667.[9] Since this placed the city in debt to the sum

[7]One striking feature of pre-modern London was the general level of mortality. Mortality rates were extremely high and typhus or plague outbreaks were relatively frequent. The most severe outbreak recorded was the "Great Plague" of 1665. It killed almost 70,000 people, but turned out to be the last major plague outbreak in London (Sutherland, 1972). It has been speculated that this might have been due to subsequent improvements in housing or by the fire's impact on the rat population. This claim has, however, been disputed, since the plague was more severe outside the destroyed area of the City, and besides, less severe outbreaks continued in England until the twentieth century (Scott and Duncan, 2001). See also Cummins et al. (2016) for more details on the living standards and plague incidences in London between 1560 and 1665.

[8]For more details on the Great Fire of 1666 we refer the readers to Field (2017), who provides a fascinating account of the effects of the fire on individuals and communities in London as well as in the rest of England.

[9]The Corporation of London funded the rebuilding of the City after the fire. We refer the readers to Coffman et al. (2022) for further details on the finances of the rebuilding.

Figure 1: The Great Fire of 1666 in London

NOTE.— This figure shows the extent of the Great Fire of 1666 in London. We digitised this map for our empirical analysis. Source: Schofield (1984, pp. 172-173).

of 300,000 pounds sterling, a subsequent Second Building Act in 1670 was passed to address this issue. A Fire Court was established to resolve disputes between tenants and landlords quickly, ensuring that the new structures that were spreading were legally secure and more safely constructed. It sat from February 1667 until September 1672, which marks the point when the City was more or less reconstructed, although the new St. Paul's Cathedral was not completed until June 1675. The process of reconstruction was aided by nationwide charitable donations. Furthermore, in London's core activity, shipping, the centre of government in Westminster, and in the suburbs, resources were available to secure a rapid rebuilding (see also Field (2011)).

Field (2017) constructed a dataset linking 1,360 Londoners in the 1666 and 1675 Hearth Tax lists and demonstrated that 67 percent of all Londoners, and 87.5 percent of all those burned out,

moved to a different location between 1666 and 1675. He explains that the fire accelerated the gradual movement of Londoners from the City to the suburbs, with a clear pattern: the prosperous moved to the west, and the less prosperous, to the east, although many returned to adjacent or nearby locations.[10] Wealthy gentry and merchants were the most likely to return, whereas unskilled labourers and poor craftsmen were the least likely quite probably because they could not bear the cost of reconstruction. This is something we find support for in our analysis.

Our measures of economic activity within London focus on marketplaces and goldsmiths. On marketplaces, Smith (1999) provides an excellent account. He defines markets as "those institutions which were publicly recognised as places of regular trade in basic commodities: meat and livestock, fish and corn, fruit and vegetables, hay and straw, cloth, coal and animal skins". The markets' characteristics and development were shaped by a range of factors: most importantly market forces, but also political concerns. After the fire, Smith explains that the geographical pattern of London's markets took on an increasingly "centrifugal, though lopsided, appearance", with fewer marketplaces in the east, and more in the western part of London, which is consistent with what we find in our empirical analysis below. The fire facilitated a rationalisation so that markets, from having been relatively evenly spaced within the City of London, increasingly were spaced out across the wider metropolis.

For financial services, we consider "goldsmith-bankers" (Chaffers and Aurifabrorum, 1883), an industry that had evolved into an early form of a banking sector by the mid-seventeenth century. These goldsmiths formed a network through mutual debt dependence and inter-banker clearing and were note issuing, fractional reserve banks. The resilience of this network is reflected by their continued functioning through major events such as the plague of 1665, the fire itself, the Stop of the Exchequer in 1672 (a repudiation of state debt), and a religious panic in 1682. Following the Glorious Revolution of 1688, and reduced anxiety about depositing specie with an unpredictable monarch, a more modern banking system began to emerge with the Bank of England founded in

[10] In fact, there was much "residential persistence" across this period, with neighbours recreating pre-fire neighbourhoods in overlapping or nearby areas. The decision to keep the original street plan aided the rapid recovery in this respect.

1694 (Neal and Quinn, 2001). The business of goldsmith-bankers started then to decline in the eighteenth century (Quinn, 1997).

So far, there is no rigorous quantitative evidence on how goldsmiths responded to the Great Fire. The only exception to our knowledge is a case study by Mitchell (1994), who considers the case of one particular goldsmith-banker, Thomas Fowle, who conducted his trade from the Black Lion at Temple Bar, Fleet Street at the time. He was fortunate enough to see the Great Fire stop just yards from his door, due to a fortuitous change in the direction of the wind. His trade expanded rapidly subsequently, which might have been due to the competitive advantage enjoyed by the goldsmiths of Fleet Street and the Strand, given that those in Lombard Street and Cheapside were burned out. Our empirical analysis complements the historical narrative by providing quantitative evidence on whether and how the Great Fire changed the locations of goldsmith-bankers and marketplaces within the parishes of London.

3 Data

We use information on the economic activity of marketplaces and goldsmith-bankers in London, covering the decades 1630-1690. We rely on two sources of data to create two measures of access of a parish to these two services; *London Goldsmiths* and *market places*. The analysis we conduct is at the parish level every ten years.[11] A parish referred to a geographical unit within the city, governed by its own local church. These parishes were central to community life and served as the basic units of both ecclesiastical and civil administration, including the administration of poor relief. Our sample includes a total of 222 parishes that are further divided into 99 parishes that were affected by the fire and 123 that remained unaffected. Given that the fire led to some redrawing of parish boundaries, in our analysis we keep the parish borders constant throughout the entire period. As explained below, by construction all our outcomes of interest do not depend much on

[11] Although we have yearly data for both markets and goldsmiths, the variation each year is not significant. Therefore, our analysis is conducted in decade intervals. This means that the number of markets or goldsmiths that we use in each decade represents the number of services that were active in a given year. For example, the year 1660 takes into account the active markets and goldsmiths in the year 1660.

the actual parishes at a given point in time and hence our results are not sensitive to changes in parish borders.

To quantify financial activity in the City of London, we construct a panel dataset that traces the activity of *goldsmith-bankers* using the list of *London Goldsmiths*, as reported by Heal (1972), who lists individual goldsmiths, jewellers, bankers, and pawnbrokers, as well as their locations. In particular, the information includes the family and first name of the individual, his occupation, the address, the year of opening and closure, as well as the name(s) of partners (if applicable).[12] The address rarely consists of both the street name and the number, but in most cases, the street name and the parish name are provided. Goldsmiths that were located in London, without mentioning the parish they were working in, are excluded from our sample.[13] For every goldsmith-banker we geo-reference the location to obtain the coordinates, using the information given about the location. Thereafter, we assign them to the relevant parish used in our analysis.

After geo-referencing the locations of the goldsmiths, we construct a measure that we call *Access Index (Goldsmiths)*, where we calculate the average distance of working goldsmith-bankers from the centre point of each parish for a given year.[14] This measure follows the concept of market potential as outlined by Harris (1954). We normalise the access index such that it can only take values between zero and one. Higher values of *Access Index (Goldsmiths)* reflect better access to financial services for a parish. In order to quantify the economic activity of open marketplaces in each parish, we construct a similar access index, *Access Index (Markets)*, using the location of London's marketplaces. The information is taken from Smith (1999) and includes the name of each market, along with the year of establishment and closure. For each of the marketplaces, it is possible to find the exact location, since their name indicates the street they were located on. Once we have the coordinates of each market place, we once again assign them to the relevant parish and compute our access index.

[12] Sometimes the individual is reported to have several occupations.

[13] The goldsmiths excluded because of missing information about the parish are about 15% of all goldsmiths in our data.

[14] The average distance is calculated as the mean of the distances of each goldsmith from the central point (centroid) of a given parish. The parishes included and their borders are held constant throughout time.

More precisely, we use GIS to calculate the average distance from the centroid of each of our included parishes to the geographical point of the services (market or goldsmith). This highlights the advantage of using this index, as we include services that can be accessed from a parish, not only those that are located in the parish. This gives a more realistic understanding of the availability of services in the parish. The average distance of the access index is as follows:

$$Distance_{it} = \frac{\sum_{j=1}^{n} \sqrt{(X_j - X_{Ci})^2 - (Y_j - Y_{Ci})^2}}{n} [Year_{it} = t] \,, \tag{1}$$

where $Centroid_i = (X_{Ci}, Y_{Ci})$ for parish i is the location of the central point of a parish as used in GIS, and $EconomicActivity_j = (X_j, Y_j)$ is the point of geographical location for j markets or goldsmiths as used in GIS. We take the inverse of this measure and normalise it so it takes a value between 0 and 1 (the highest possible access to markets or goldsmith):

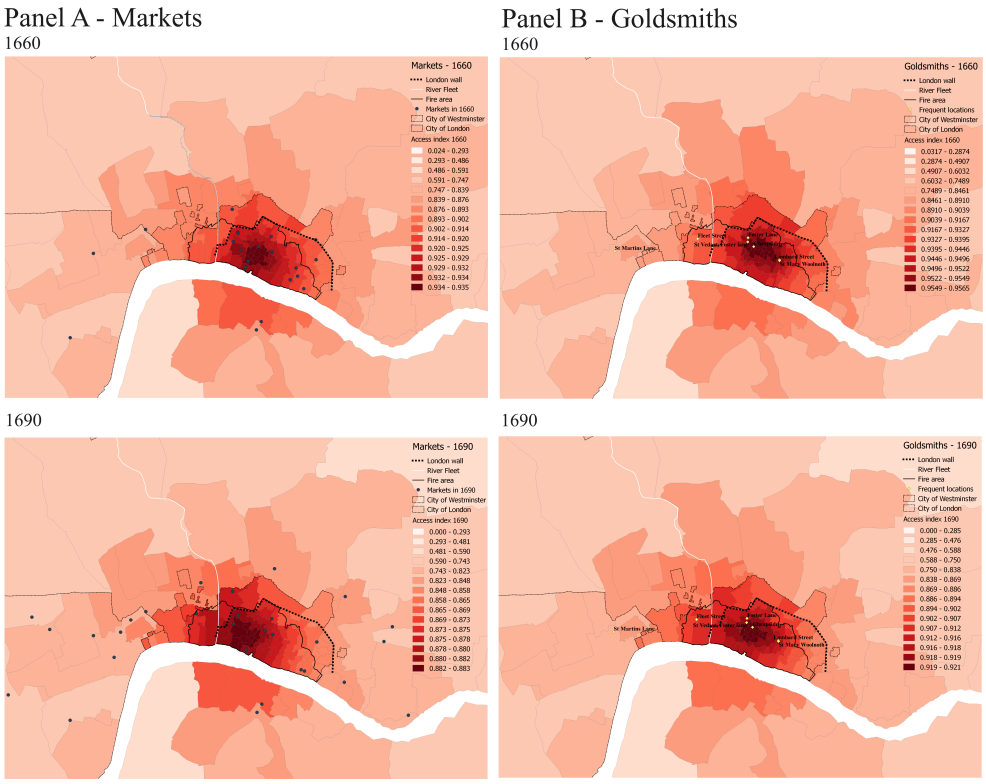
$$Access\ Index_{it} = 1 - \frac{Distance_{it}}{max(Distance_{it})} \,. \tag{2}$$

We use *Access Index* as a proxy for economic activity within London, as it accounts for the direct and indirect market access (i.e., market places and goldsmith-bankers located outside the parish) of any parish in our sample in a given year. For example, goldsmiths located in a particular parish probably also impact on activities in surrounding parishes. When using our index, the latter is taken into consideration. A simpler measure of economic activity, such as the number of marketplaces or goldsmiths per parish in a given year, would be zero for a large number of parishes and would not take the "full market potential" of each parish into account.

Figure 2 displays our measures of *Market Access*, where the parishes shaded darkest on the map have the highest market access. From a visual inspection, there appears to be a shift in economic activity westwards towards Westminster. Summary statistics are presented in Table 1.

In Figure 3, we plot the evolution of the number of goldsmiths and marketplaces in parishes affected by the fire and unaffected parishes for the years 1630 to 1700, while Figure 4 displays these numbers by location (City of London, Westminster, and others).

Figure 2: Access Indexes in 1660 and 1690



NOTE.— This figure shows the market access of every parish in the sample for the years 1660 (before the Great Fire) and 1690 (after the Great Fire). Panel A shows the index for marketplaces and Panel B for goldsmith-bankers. A darker shaded area reflects that a parish had greater access to marketplaces or financial services.

In addition to our two measures of economic activity, we also make use of the London Hearth Tax assessments to investigate the impact of the fire on wealth and social status.[15] As explained by Field (2017), the hearth tax was a property tax collected based on the number of hearths a household possessed and can roughly be thought of as a measure of wealth and social standing. The tax was collected from 1662 to 1689 and in our analysis we make use of the records from 1666 which were created a short time before the outbreak of the fire, and those from 1675. The records list, among other things, the number of hearths the household possessed and the address of the household.[16] The records include all London households who were required to pay the tax

[15]The original Hearth Tax Assessments are kept at the National Archives for the years 1666 (E179/252/32) and 1675 (E179/252/23). We downloaded the former from London Hearth Tax: City of London and Middlesex, 1666 (2011); see British History Online. The 1675 data were kindly provided by Jacob F. Field.

[16]In many cases the listed address is a parish or a ward, hence not giving the exact location of the household.

Table 1: Summary Statistics for Markets and Goldsmiths

	Total					Fire area within					Fire area without				
	Mean	St.Dev	Median	Min	Max	Mean	St.Dev	Median	Min	Max	Mean	St.Dev	Median	Min	Max
Panel A - Full sample															
Parish area (km)	1.370	3.208	0.030	0.001	17.924	0.018	0.022	0.011	0.003	0.143	2.419	3.976	0.510	0.001	17.924
Min distance river (km)	1.036	1.264	0.536	0.052	6.782	0.431	0.203	0.407	0.052	1.021	1.506	1.518	0.897	0.129	6.782
Panel B - 1660															
Access index (markets)	0.781	0.226	0.898	0.024	0.935	0.925	0.009	0.928	0.897	0.935	0.669	0.249	0.771	0.024	0.919
Access index (goldsmiths)	0.791	0.235	0.911	0.032	0.957	0.945	0.012	0.948	0.909	0.957	0.673	0.257	0.783	0.032	0.937
Number of markets	0.113	0.344	0.000	0.000	2	0.155	0.391	0.000	0.000	2	0.080	0.301	0.000	0.000	2
Number of goldsmiths	0.694	2.888	0.000	0.000	37	1.134	4.155	0.000	0.000	37	0.352	1.109	0.000	0.000	9
Panel C - 1690															
Access index (markets)	0.750	0.212	0.862	0.000	0.883	0.876	0.007	0.877	0.850	0.883	0.652	0.240	0.768	0.000	0.877
Access index (goldsmiths)	0.771	0.226	0.890	0.000	0.921	0.912	0.009	0.915	0.876	0.921	0.662	0.252	0.766	0.000	0.909
Number of markets	0.131	0.421	0.000	0.000	4	0.103	0.338	0.000	0.000	2	0.152	0.476	0.000	0.000	4
Number of goldsmiths	1.667	6.203	0.000	0.000	76	2.278	8.407	0.000	0.000	76	1.192	3.652	0.000	0.000	33
Share fire parishes	0.437	0.497	0.000	0.000	1										
Parishes	222					99					123				

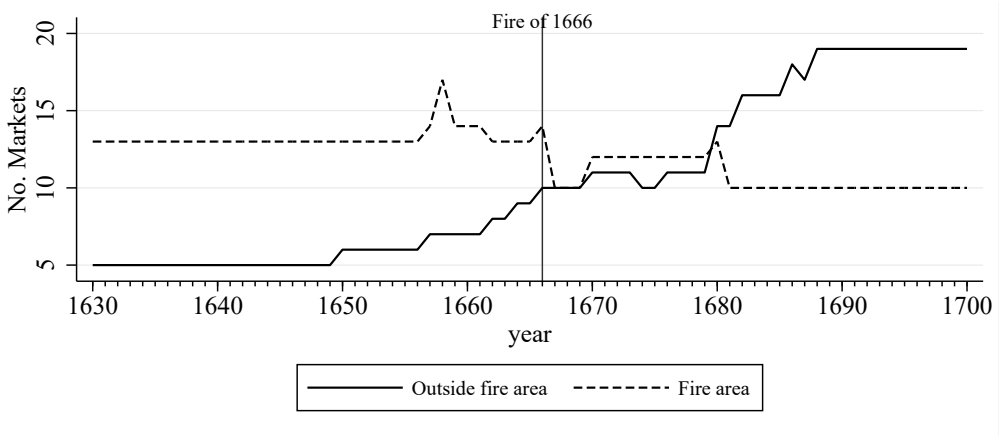
NOTE.— This table shows summary statistics of the markets and goldsmiths. Panel A shows statistics for the entire sample, while Panels B-C shows the results for the two decades 1660 and 1690 respectively. The first five columns refer to all parishes, the next five refer to parishes affected by the fire and the last five columns refer to parishes not affected by the fire.

(i.e., the very poor were exempt from paying the tax).

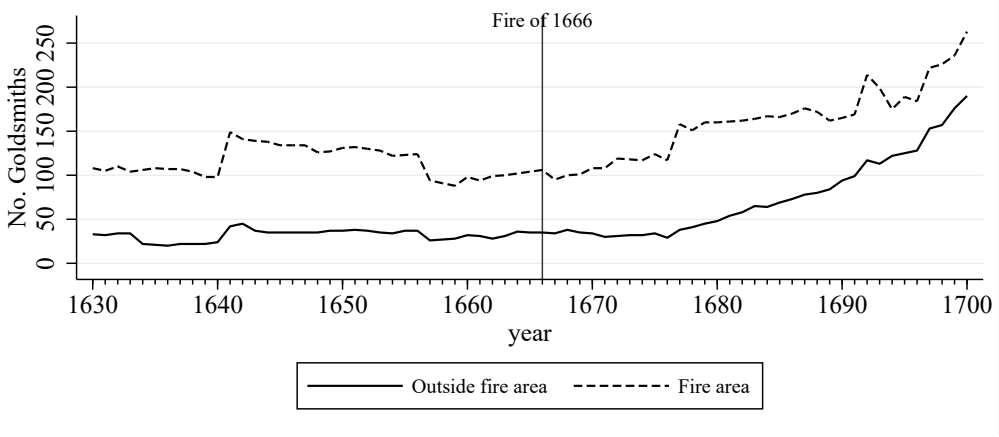
In a similar manner to our approach for markets and goldsmiths, we locate each household by geo-referencing their location to obtain the coordinates and then we assign them to the parish in which they are located, based on the parishes used in our analysis.[17] With this information, we can aggregate the data at the parish level, measuring the average number of hearths per household in each parish before and after the fire. Additionally, to measure the degree of inequality, we compute the Gini coefficient using the distribution of the number of hearths across households within each parish. When aggregating the data at the parish level, we obtained a sample of 73 parishes (with 52 parishes affected by the fire and 21 unaffected parishes) for which we have information from both before and after the fire. Finally, we assign each household to one of four social groups,

[17] We once again keep parishes and borders constant, and all outcomes are computed based on the geo-references locations and hence do not depend much on changes in parishes associated with the fire.

Figure 3: Number of Goldsmiths and Markets over Time Based on Fire



(A) Markets



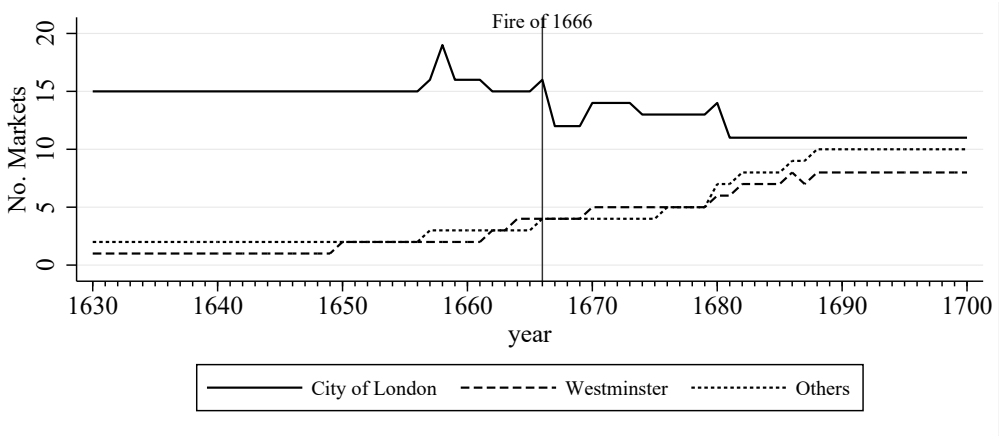
(B) Goldsmiths

NOTE.— This figure shows the evolution of the number of goldsmiths (Panel A) and markets (Panel B) for parishes that were affected by the fire or not.

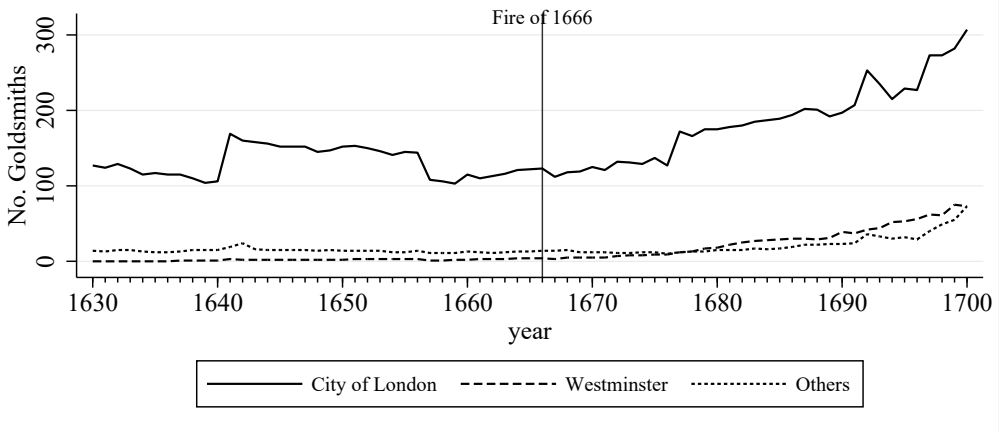
based on the number of hearths according to the following classification: 1 hearth, labouring poor, husbandmen, poor craftsmen; 2-3 hearths, craftsmen, tradesmen and wealthy yeomen; 4-7 hearths, Wealthy craftsmen and tradesmen, merchants and poorer yeomen; 8 or more hearths, gentry and above.[18] This classification is used in our analysis at the household level to assess the effects of the fire on the distribution of wealth. In Table 2 we present summary statistics for the hearth tax data both at the parish and individual level.

[18]This follows the system used by FamilySearch.

Figure 4: Number of Goldsmiths and Markets over Time Based on Location



(A) Markets



(B) Goldsmiths

NOTE.— This figure shows the evolution of the number of goldsmiths (Panel A) and markets (Panel B) for different locations in London (City, Westminster and others).

4 Empirical Strategy

We use a difference-in-differences approach to investigate the impact of the Great Fire of 1666 on economic activity within London. The sample spans the decades 1630 to 1690. Identification comes from changes in the access of marketplaces or goldsmith-bankers across parishes that were differentially affected by the fire. We use the following specification to estimate our baseline results:

$$Access\ Index_{it} = \beta Fire_i \times Post1666_t + \Gamma X_{it} + c_i + \theta_t + \varepsilon_{it}\ , \tag{3}$$

Table 2: Summary Statistics for London Hearth Tax Records

		Total					Fire area within					Fire area without				
		Mean	St.Dev	Median	Min	Max	Mean	St.Dev	Median	Min	Max	Mean	St.Dev	Median	Min	Max
Panel A - 1666																
Parish level	Average no hearths	4.694	1.154	4.855	2.041	9.162	4.742	0.933	4.865	2.041	6.471	4.574	1.598	84.217	2.241	9.162
	Gini coefficient	0.338	0.057	0.328	0.194	0.451	0.323	0.054	0.310	0.194	0.438	0.375	0.049	0.371	0.280	0.451
Individual level	Number of hearths	4.085	3.933	3.000	0.000	193.000	4.304	3.289	4.000	0.000	86.000	3.937	4.309	3.000	0.000	193.000
	Social Status	2.412	0.934	2.000	1.000	4.000	2.489	0.926	3.000	1.000	4.000	2.358	0.936	2.000	1.000	4.000
No. parishes				73					52					21		
No. individuals				38037					15374					22663		
Panel B - 1675																
Parish level	Average no hearths	5.978	1.372	6.141	2.674	9.000	6.263	1.100	6.306	3.375	9.000	5.273	1.720	4.796	2.674	8.816
	Gini coefficient	0.246	0.059	0.240	0.000	0.398	0.226	0.035	0.221	0.168	0.312	0.295	0.077	0.310	0.000	0.398
Individual level	Number of hearths	5.194	3.657	4.000	1.000	135.000	5.819	3.169	5.000	1.000	40.000	4.844	3.861	4.000	1.000	135.000
	Social Status	2.769	0.863	3.000	1.000	4.000	3.016	0.707	3.000	1.000	4.000	2.630	0.911	3.000	1.000	4.000
No. parishes				73					52					21		
No. individuals				26097					9379					16718		

NOTE.— This table shows summary statistics of the London Hearth Tax records. Panel A shows statistics for 1666 and Panel B for 1675. The first five columns refer to all parishes, the next five refer to parishes affected by the fire and the last five columns refer to parishes not affected by the fire.

where $Access\ Index_{it}$ denotes the outcome of interest, i.e. the *Access Index* for marketplaces or goldsmiths in parish i at year t. $Fire_i$ is an indicator variable that equals one for parishes affected by the Great Fire of 1666, while $Post1666_t$ is an indicator variable that equals one for the decades after the Great Fire occurred. We further include a set of parish-specific controls, X_i, which differs by specification. Our baseline includes the initial access index interacted with decade-fixed effects. In some specifications, we also control for the nearest distance to the Thames or Fleet River or a river dummy both of which we fully interact with decade-fixed effects.

Parish fixed effects c_i are included in the estimation, which captures all time-invariant characteristics of a parish that could influence local levels of economic activity independent on the fire, such as whether a parish is located outside or inside the city walls. Decade fixed effects θ_t control for shocks that are common to all parishes. The coefficient of interest, β, can be interpreted as the relative change in *Access Index* of parishes affected compared to those non-affected by the fire.

The key identifying assumption of a difference-in-differences approach is common trends in

the absence of treatment. While this assumption is not testable, we can provide support for it by looking at the dynamic patterns of access to marketplaces and financial services across the parishes in our sample. The dynamic difference-in-differences approach relaxes the assumption that the treatment effect is constant over time. In particular, there should be no evidence of pre-trends in the access to marketplaces and financial services between affected and non-affected parishes before the fire broke out in 1666. Potential differences in market access between affected and non-affected parishes should only emerge in the decades after the fire.

Hence, we modify estimating equation (3) and introduce decade-specific effects that are interacted with the fire indicator variable. This flexible difference-in-differences approach is outlined in the following equation:

$$Access\ Index_{it} = \sum_{t=1630}^{1690} \beta_t Fire_i \times Decade_t + \Gamma X_{it} + c_i + \theta_t + \varepsilon_{it} \ , \tag{4}$$

where $Decade_t$ is an indicator for the decades 1630, 1640, 1650, 1670, 1680, and 1690. We choose the decade 1660 as the reference year (i.e., the omitted category in the analysis) since it is the closest to the fire in 1666. Standard errors in all specifications are clustered at the parish level.

We estimate an equation similar to equation (3) using the London Hearth Tax aggregated at the parish level, with the average number of hearths and the Gini coefficient as our outcomes of interest. However, when using the London Hearth Tax, we only have two years, one from before and one from after the fire. Furthermore, we also include district fixed effects interacted with time, to capture characteristics that change over time but are the same within different districts of London.[19] In addition, we also perform a repeated cross-section analysis at the household level where we can compare households affected by the fire to those not affected. Two different specifications are used, depending on the outcome of interest. When using the number of hearths we use Pooled OLS while for the social groups we use an ordered logit model. In both cases, we include fixed effects for year and parish.

[19]Districts are areas bigger than parishes and broadly define different zones of the entire area of London. There is a total of 10 districts in our sample.

5 Results

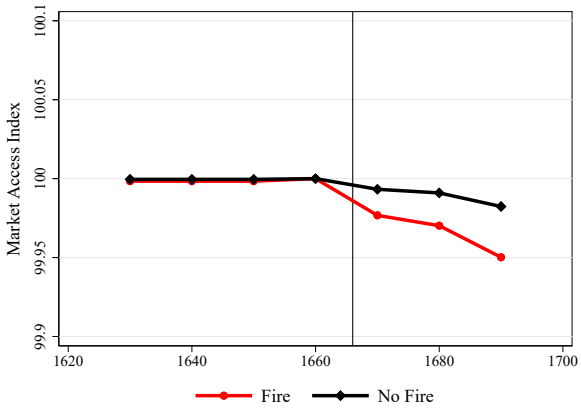
Before we turn our focus to estimating the effects of the Great Fire on our measures of market access, we can already assess in a purely descriptive manner whether the common trends assumption is likely to be not violated for both indices. Figure 5 depicts the evolution of the access index for marketplaces (Panel A) and the access index for goldsmith-bankers (Panel B) for the whole period of interest from 1630 to 1690 by treatment (i.e., whether a parish was affected by the Great Fire of London).

As Figure 5 strikingly illustrates, there are no apparent pre-trends in the periods before the Great Fire, while there is a divergence for both indexes after the fire occurred between parishes that were affected by the fire and those that were not. This pattern in the raw data strengthens our confidence in the validity of our empirical design.

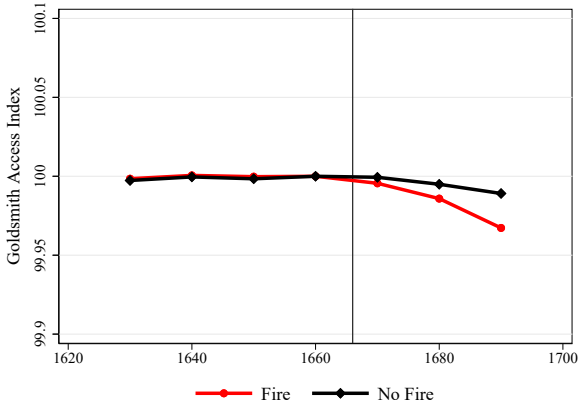
Table 3 reports our difference-in-differences estimates of the effect that the Great Fire had on our measures of economic activity as defined in the previous section. The estimating equation is (3) and the method of estimation is least squares. Columns (1)-(2) report the impact of the fire on the access to marketplaces whereas columns (3)-(4) report the corresponding effects on the access to goldsmith-bankers. All specifications (1)-(4) include decade fixed effects and parish fixed effects, as well as the corresponding initial index (in 1660) fully interacted by decade fixed effects to capture flexibly potential convergence dynamics. We have 1,554 observations for 222 parishes throughout the decades 1630 to 1690. Columns (1)-(2) also always include parish linear time trends to account for parish-specific characteristics in each decade. Columns (2) and (4) include a dummy for whether a parish is located on a river fully interacted by decade-fixed effects as a control to account for the location advantage that might have played a different role in the location of the markets/goldsmiths over time. We also report Conley standard errors with different distance thresholds to take potential spatial correlation into account.

The coefficient β is negative, statistically significant and robust throughout all specifications in columns (1)-(4) for both indexes. After the Great Fire of London in 1666, affected parishes experienced an increase in the distance of economic activities, both in terms of open marketplaces

Figure 5: The Great Fire of London and Access Indexes



(A) Market Access Index



(B) Goldsmith Access Index

NOTE.— This figure shows the evolution of the access indexes normalised to 100 in 1660. The black line represents the unaffected parishes, whereas the red line depicts the parishes that were affected by the Great Fire. The Great Fire is a dummy variable that equals to one for parishes affected by the fire. The vertical red line indicates the year of the Great Fire (1666). Panel A shows the normalised access index for marketplaces. Panel B shows the normalised index for goldsmith-bankers.

and goldsmiths-bankers. In fact, the distance to marketplaces and financial services increased in affected parishes on average by around one percentage point. Our results indicate that there was some relocation of economic activities after the fire. Parishes that were affected by the fire lost, at least to a certain extent, their privileged access to marketplaces and financial services. As Figure 4 has already illustrated, both marketplaces and goldsmiths also spread out towards the periphery after the fire occurred.

Figure 6 shows the dynamic results based on estimating equation (4). Panel A (B) of Figure

Table 3: Standard Difference-in-Differences Results for Market- and Goldsmiths Access Index

	(1)	(2)	(3)	(4)
Dependent Variable:	*Market Access Index*		*Goldsmith Access Index*	
Fire x Post1666	-0.010***	-0.010***	-0.008***	-0.008***
	(0.001)	(0.001)	(0.002)	(0.002)
Year FEs	Yes	Yes	Yes	Yes
Parish FEs	Yes	Yes	Yes	Yes
Initial x Year FEs	Yes	Yes	Yes	Yes
River dummy	No	Yes	No	Yes
Parish linear trend	Yes	Yes	No	No
Conley SE (0.1 km cutoff)	[0.001]***	[0.001]***	[0.001]***	[0.001]***
Conley SE (0.2 km cutoff)	[0.001]***	[0.001]***	[0.001]***	[0.001]***
Conley SE (0.5 km cutoff)	[0.002]***	[0.002]***	[0.002]***	[0.002]***
Conley SE (1 km cutoff)	[0.002]***	[0.002]***	[0.002]***	[0.002]***
R-squared	0.931	0.932	0.600	0.602
Observations	1554	1554	1554	1554

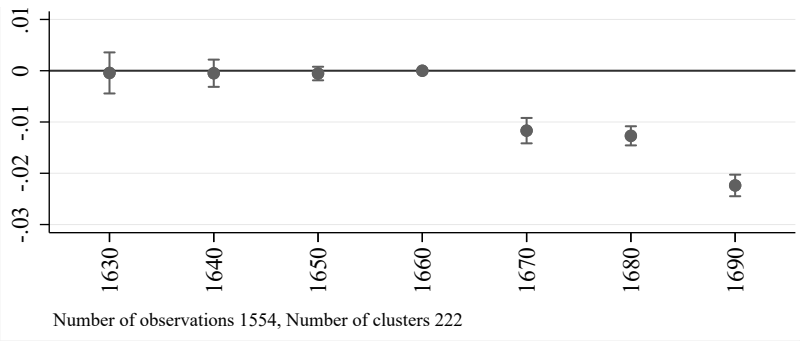
NOTE.— This table shows the results from a simple difference-in-differences regression at the parish level using the fire dummy (=1 for parishes affected by the fire) as the explanatory variable. Columns 1-2 use the market access index as the outcome of interest and columns 3-4 use the goldsmith access index as the outcome of interest. Standard errors in parentheses are clustered at the parish level. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

6 displays the results for the market access index (goldsmith access index) including parish and time fixed effects, controls for the initial index interacted by time and a parish-specific linear time trends for markets. Reassuringly, there are no pre-trends before the fire occurred in both panels. The estimated coefficients of interest in the decades before the fire are always close to zero and never statistically significant, supporting the common trends assumption. The effects in the decades following the fire are always negative and statistically significant.

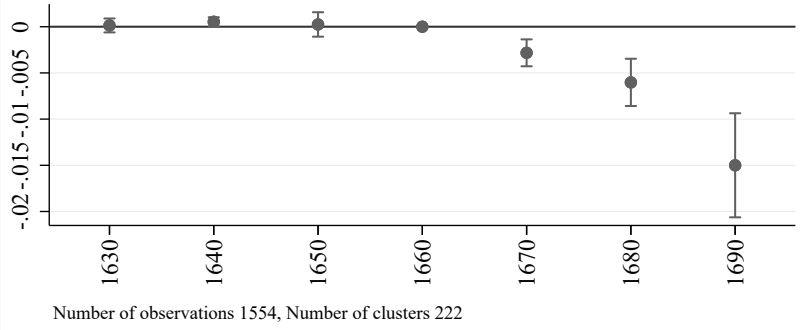
The estimates displayed in Panel A of Figure 6 reveal that affected parishes experienced a *relative* decline in market access compared to non-affected parishes. This negative effect of the fire in terms of access to marketplaces on affected parishes gradually increased (in absolute terms) over time. Specifically, compared to unaffected parishes we observe a relative decrease in access to marketplaces from one to two percentage points between 1670 and 1690 in affected parishes.

We also observe a similar downward trend in Panel B of Figure 6. Access to financial services in affected parishes decreased by around one-third of a percentage point in 1670 to 1.5 percentage points in 1690 relative to unaffected parishes. We report the corresponding point estimates together with their standard errors in Table 4. It is also important to note that even when using different specifications, the decade-specific estimates remain unaffected indicating that our results are robust. Overall, our empirical evidence suggests that towards the end of the sample period goldsmiths and marketplaces either relocated or started new businesses in the City of Westminster or in even more peripheral parishes.[20]

Figure 6: Flexible Difference-in-Differences Results



(A) Markets



(B) Goldsmiths

NOTE.— This figure shows the dynamic estimates for the access to marketplaces and financial services of every parish for the period 1630 to 1690 (the decade 1660 is the omitted reference year). Panel A shows the index for marketplaces and Panel B for goldsmith-bankers. The estimated coefficients display the effect of the fire on market access for every decade together with 95-percent confidence intervals. In both panels, we include fixed effects for decades and parishes and the initial access index interacted by decade fixed effects, while in Panel A we also include a parish linear trend.

[20] Apart from the larger share of markets/goldsmiths moving towards Westminster and western parishes right outside the wall, a smaller share opens in the areas of Ossultone, Tower in the eastern part of London (about 1-1.5% of all new entrances after the fire).

Table 4: Flexible Difference-in-differences results

	(1)	(2)	(3)	(4)
Dependent Variable:	*Market Access Index*		*Goldsmith Access Index*	
Fire x 1630	-0.004	-0.004	0.000	0.000
	(0.004)	(0.004)	(0.000)	(0.000)
Fire x 1640	-0.003	-0.003	0.001**	0.001**
	(0.003)	(0.003)	(0.000)	(0.000)
Fire x 1650	-0.002	-0.002	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Fire x 1670	-0.010***	-0.011***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Fire x 1680	-0.010***	-0.011***	-0.006***	-0.006***
	(0.003)	(0.003)	(0.001)	(0.001)
Fire x 1690	-0.018***	-0.019***	-0.015***	-0.015***
	(0.003)	(0.003)	(0.003)	(0.003)
Year FEs	Yes	Yes	Yes	Yes
Parish FEs	Yes	Yes	Yes	Yes
Initial x Year FEs	Yes	Yes	Yes	Yes
River dummy	No	Yes	No	Yes
Parish linear trend	Yes	Yes	No	No
R-squared	0.937	0.938	0.618	0.619
Observations	1554	1554	1554	1554

NOTE.— This table shows the dynamic estimates for the access to marketplaces and financial services of every parish for the period 1630 to 1690 (the decade 1660 is the omitted reference year). Columns 1-2 show the results for marketplaces and columns 3-4 for goldsmith-bankers. The estimated coefficients display the effect of the fire on market access for every decade. Robust standard errors in parentheses clustered in 222 parishes. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

How did the fire affect the spatial distribution of wealth? Table 5 addresses this question and reports the results for the London Hearth Tax using the average number of hearths and the Gini coefficient. The specifications include fixed effects for year and parish, the corresponding initial values and the district fixed effects are both interacted by year. Columns (2) and (4) also

include the river dummy interacted by year. The results reported in columns (1) and (2) reveal that parishes affected by the fire had more hearths on average after the fire than unaffected parishes. In column (2), affected parishes had on average 1.2 more hearths than the unaffected parishes. These estimates are positive and statistically significant at the 1-percent level. The increase in the average number of hearths is associated with a decline in the Gini coefficient. The estimated coefficients in columns (3) and (4) are negative and highly statistically significant. This finding suggests that affected parishes had a more equal distribution of wealth after the fire compared to unaffected parishes.

Table 5: Standard Difference-in-Differences Results Using London Hearth Tax Records

	(1)	(2)	(3)	(4)
Dependent Variable:	*Average number of hearths*		*Gini index no hearths*	
Fire x Post1666	0.979***	1.156***	-0.071***	-0.067***
	(0.297)	(0.328)	(0.012)	(0.013)
Year FEs	Yes	Yes	Yes	Yes
Parish FEs	Yes	Yes	Yes	Yes
District x Year FE	Yes	Yes	Yes	Yes
Initial x Year FEs	Yes	Yes	Yes	Yes
River dummy	No	Yes	No	Yes
Conley SE (0.1 km cutoff)	[(0.221]***	[0.241]***	[0.008]***	[0.008]***
Conley SE (0.2 km cutoff)	[0.242]***	[0.266]***	[0.006]***	[0.006]***
Conley SE (0.5 km cutoff)	[0.098]***	[0.145]***	[0.006]***	[0.006]***
Conley SE (1 km cutoff)	[0.076]***	[0.093]***	[0.005]***	[0.006]***
R-squared	0.714	0.729	0.931	0.933
Observations	146	146	146	146

NOTE.— This table shows the results from a simple difference-in-differences regression at the parish level using the fire dummy (=1 for parishes affected by the fire) as the explanatory variable. Columns 1-2 show the results when using the average number of hearths as the outcome of interest and columns 3-4 use the Gini coefficient considering the distribution of hearths in households within each parish. Standard errors in parentheses are clustered at the parish level. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

Table 6 presents results that can explain the decline in wealth inequality. These are based on the repeated cross-section analysis using the London Hearth Tax records. In columns (1)-(2) we use pooled OLS to estimate the effect of the fire on the total number of hearths in a household

and in columns (3)-(4) we use ordered logit to estimate the effect of the fire on social status. The estimated value in the ordered logit model can be interpreted as the probability of observing a household affected by the fire in the lowest social group. Three cutpoints are also estimated and can be translated into the probabilities for a household of being in one of the other three social groups based on being affected by the fire or not. In columns (1) and (3) fixed effects for year and parishes are included, while in columns (2) and (4) we also include district fixed effects interacted by time.

Similarly to Table 5, there is a positive and statistically significant effect on the number of hearths in households affected by the fire. The estimated coefficients indicate that, on average, affected households had about 1.2 more hearths than households outside the affected parishes. Furthermore, in columns (3)-(4) the positive and significant estimates indicate that it is less likely for a household affected by the fire to be in the lowest social group. For example, the estimate of 0.958 in column (4) means that only about 7% of households affected by the fire would be in the lowest social group as opposed to almost 17% of the unaffected households.[21]

On the other hand, the results indicate that a larger share of households affected by the fire would be in the highest social group (65% as opposed to 42% of the unaffected households). The results resonate with Field (2017) who explains that certain groups would be less likely to move after the fire, because of commercial ties with the zone of residence. Moreover, the new housing constructed after the fire was also bigger and of better quality. Consequently, the low-income groups would be more likely not to return to the City after the fire because housing would be more expensive and economic activity shifted, at least to some extent, to areas outside the City of

[21]The probabilities can be obtained from the estimate and cutpoints of the ordered logit model according to the formulas:

$$Pr(S_j + u_j < \kappa) = 1/(1+e^{S_j-\kappa})$$
$$Pr(S_j + u_j > \kappa) = 1 - 1/(1+e^{S_j-\kappa})$$
$$Pr(\kappa_1 < S_j + u_j < \kappa_2) = 1/(1+e^{S_j-\kappa_2}) - 1/(1+e^{S_j-\kappa_1})$$

where S_j is the estimate (it is equal to 0 for unaffected households) and κ is the cutpoint. u_j is the error term of the ordered loigt model. The lowest social status, group 1, corresponds to the interval $S_j + u_j < Cut\,point1$, group 2 corresponds to the interval $Cut\,point1 < S_j + u_j < Cut\,point2$, group 3 corresponds to the interval $Cut\,point2 < S_j + u_j < Cut\,point3$, and the highest social group, group 4, corresponds to the interval $S_j + u_j > Cut\,point3$.

Table 6: Individual Level Using the London Hearth Tax Records

	(1)	(2)	(3)	(4)
	Pooled OLS		Ordered logit	
Dependent Variable:	*Number of hearths*		*Social status*	
Fire x Post1666	0.936***	1.179***	0.797***	0.958***
	(0.270)	(0.275)	(0.033)	(0.068)
Cutpoint 1			-1.462***	-1.613***
			(0.058)	(0.095)
Cutpoint 2			0.467***	0.316***
			(0.058)	(0.095)
Cutpoint 3			2.653***	2.506***
			(0.059)	(0.096)
Year FEs	Yes	Yes	Yes	Yes
Parish FEs	Yes	Yes	Yes	Yes
District x Year FE	No	Yes	No	Yes
R-squared	0.141	0.144		
Observations	64134	64134	62943	62943

NOTE.— This table shows the results using the London Hearth Tax records. Columns 1-2 show the results of a Pooled OLS at the household level, considering the number of hearths as the outcome of interest. Columns 3-4 show the results of an ordered logit model considering four groups of social classes as the outcome of interest: group 1 is the lowest and group 4 is the highest social group. Standard errors in parentheses are clustered at the parish level. ***, **, and * indicate significance at the 1, 5, and 10 percent level.

London. Moreover, we come to similar conclusions when calculating the share of households in the areas affected by the fire which have four or more hearths. When doing so, we find that the share was 54% of households before the fire and 81% after the fire.

6 Conclusion

The Great Fire of London in 1666 was a devastating event that has been widely discussed among historians but has not yet been extensively studied quantitatively. This paper investigates the impact of the Great Fire of London on economic activity in the parishes of the City of London and its surroundings. Our empirical analysis is based on a novel dataset of the locations of goldsmiths and marketplaces between 1630 and 1690, which allows us to create indices of financial and market access to measure economic activity at the parish level. We also investigate the effects of the fire

on the distribution of wealth using the London Hearth Tax. Although the City of London was quickly rebuilt, our access indices to markets and financial services show that locations outside of the city walls became more attractive after the fire. This was in part driven by a movement of the low- and middle-class to outside the affected areas. A higher average number of hearths and a falling Gini coefficient suggest that the City of London became richer and more equal after the fire. While the temporary destruction of most of central London changed the social structure within the City of London and probably contributed to the shrinking of the city centre's population after the Great Fire, it was also in part responsible for the growing importance of Westminster and other neighbourhoods in the Greater London area during the late seventeenth century.

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