



Contents lists available at ScienceDirect

Journal of Development Economics

journal homepage: www.elsevier.com/locate/jdeveco

Jewish communities and city growth in preindustrial Europe

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ARTICLE INFO

Keywords:

Long-run growth
 Urbanization
 Market access
 Jewish communities
 Toleration
 Religion
 Little divergence

ABSTRACT

We study whether cities with Jewish communities grew faster than cities without Jewish communities in Europe between 1400 and 1850. We match data on city populations from Bairoch (1988) with data on the presence of a Jewish community from Roth and Wigoder (2007). Our difference-in-differences results indicate that cities with Jewish communities grew about 30% faster than comparable cities without Jewish communities. To establish causality, we create time-varying instrumental variables which rely only on the spatially extended network of Jewish communities in order to predict Jewish presence in a given city. We provide evidence that the advantage of cities with Jewish communities stemmed in part from Jewish emancipation and their ability to exploit increases in market access after 1600.

1. Introduction

Numerous scholars have speculated on the role played by economically productive minority groups, such as Protestants, Jews, and Quakers, in driving economic growth (Weber, 1922, 1968; Sombart, 1911; Braudel, 1979; McCabe et al., 2005). Recent research has established that Jews in Europe had high levels of human capital from medieval times onwards (Botticini and Eckstein, 2012) and played a crucial economic role in pre-World War II Eastern Europe (Acemoglu et al., 2011b). Nevertheless, despite the important role Jews played in the European economy from the middle ages to the modern period, there has been little research exploring whether there was a systematic link between Jewish communities and economic growth. This question is important to address given our poor understanding of the links between religious tolerance, the creation of market institutions, and the onset of modern economic growth.

This paper offers insight into these questions by evaluating the role played by Jewish communities in urban development in Europe. We combine data from the *Encyclopedia Judaica* (Roth and Wigoder, 2007) and Bairoch (1988) to create a dataset of European cities with Jewish populations and urban growth between 1400 and 1850. After matching Jewish communities with Bairoch (1988) cities, we show that the presence of a Jewish community in a premodern European city was associated with 30% faster population growth than for comparable cities without a Jewish community.

Despite the strong reasons for thinking that the presence of Jews could be a driver of urban development, it is also highly plausible that Jewish presence might be correlated with factors that affect growth

through other channels. Our second contribution is to establish a causal relationship linking Jewish presence to faster city growth. We do this by explicitly modeling the spatial network of Jewish communities over time using tools drawn from the market access literature (e.g., Donaldson and Hornbeck, 2016). We construct detailed measures of historical travel cost between cities and then use these to create a time-varying index of 'Jewish network access' for each city in our data. We then use this index to create instruments for Jewish presence by recalculating the Jewish network access variable for each city j while excluding all cities within a certain distance of j . The resulting instrumental variables predict the presence of a Jewish community in j using only the extended network of communities, which are less likely to have characteristics correlated with those of j . As a further robustness check, in some specifications we predict Jewish presence in city j using only expulsions of Jewish communities from nearby cities that were more than a given distance away. Our IV analysis confirms that Jewish communities had a positive causal effect on city growth.

Third, we explore the timing and channels through which Jewish presence impacted urban development. Using flexible regressions we find that the beneficial effects of Jewish presence on city growth emerges during the 17th century. Our difference-in-differences estimates suggest that in the period 1750–1850, cities with Jewish communities grew between 30% and 50% faster than cities without Jews.

Turning to the mechanisms responsible for this relationship, we identify two channels that appear to explain why cities with Jewish communities experienced more rapid growth after 1600. The first channel is institutional: cities that emancipated their Jewish commu-

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Received 27 February 2016; Received in revised form 4 September 2016; Accepted 9 September 2016

Available online xxx

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nities grew significantly faster than those that did not. The second channel is based on the rise of more integrated markets in the period prior to the Industrial Revolution. We show that while all cities in Europe experienced significant increases in market access between 1400 and 1850, cities with Jewish communities differentially benefited from this increase. In other words, while all cities experienced comparable increases in market access on the extensive margin, cities with Jewish communities were better able to take advantage of the intensive margin and translate greater market density into growth. To our knowledge, ours is the first paper to calculate market access measures for European cities in the premodern period and relate it to the onset of the Great Divergence.

Our findings have significant implications for our understanding of the drivers of economic growth in Europe in the period leading up to the Industrial Revolution. This period saw some parts of Europe begin to achieve higher levels of urbanization and incomes, a process economic historians label the Little Divergence (Allen, 2001; Fouquet and Broadberry, 2015). This divergence was in part driven by greater trade, commercialization and market integration—Smithian economic growth. To explain this Smithian growth, previous research has argued that institutional and technological factors, notably constraints on the executive (De Long and Shleifer, 1997; Acemoglu et al., 2005), the printing press (Dittmar, 2011), and the introduction of the potato (Nunn and Qian, 2011) played major roles. Other research has pointed to the importance of warfare and disease in leading to higher rates of urbanization (Rosenthal and Wong, 2011; Voigtländer and Voth, 2013; Dincecco and Onorato, 2015).

We highlight another factor that helps explain differences in city growth across Europe after 1600: the willingness or ability of a city to accommodate religious minorities. In so doing we contribute to a literature on the role ethnic and religious minorities play in economic development and on the conditions that support toleration for minority groups. Hornung (2014) quantifies the importance of the Huguenots for Prussian development. Other research examines the prominent role played by the Copts in the premodern Egyptian economy (Saleh, 2013). Relatedly, Arbath and Gokmen (2015) study the role played by Armenians in the Ottoman empire and modern Turkey. Jha (2013) and Diaz-Cayeros and Jha (2014) demonstrate how economic complementarities between minority and majority groups in India and Mexico, respectively, promoted peaceful coexistence.

The economic importance of Jews in the European economy from the early middle ages onwards means that the role of Jewish merchants, traders, and financiers has been extensively studied by historians. The most ambitious and wide-ranging studies include Sombart (1911) and Baron (1975) and are qualitative in character. Recently, building on the classic work of Kuznets (1960), several scholars have been putting together detailed data on Jewish economic attainment in eastern Europe in the early 20th century (Abramitzky and Halaburda, 2014; Spitzer, 2015). In this paper we bring a more macro-level approach to the issue of the economic role played by Jews in premodern Europe.

A second literature that we contribute to is that on human capital and economic development. The link between human capital growth and modern economic growth is fairly robust, at least for the period after 1850 (Mankiw et al., 1992; Galor, 2011).¹ The comparatively high levels of human capital among Jews in medieval and early modern

¹ An older literature on British industrialization downplayed the role of human capital as measured by literacy (see Mitch, 1999). But human capital played a crucial role in enabling Prussia to catch up to Britain in the late 19th century (Becker et al., 2011) and in the economic development of the United States in the twentieth century (Katz and Goldin, 2008). Moreover recent accounts of the Industrial Revolution in Britain now emphasize the importance of other dimensions of human capital beyond literacy in explaining Britain's initial economic advantage in industrializing (Kelly et al., 2014). For theoretical foundations for why human capital became important for growth after 1850, see Galor and Weil (2000).

Europe is also well established. However, since Jews were usually small minorities relative to the size of Christian communities, it is less evident whether or not their high human capital could contribute to overall city growth. The argument that elite human capital may be particularly important for transmitting knowledge and ideas has been made recently in several papers (e.g., Gennaioli et al., 2013). To the extent that we think that the channel we identify linking Jewish presence to city growth is based on their comparatively high level of human capital, our analysis is consistent with their arguments.

Finally, our historical setting naturally leads us to ask whether cultural or religious factors play an important role in explaining the relationship between Jewish communities and urban growth. In this respect we contribute to the growing literatures on the economics of religion and culture. Our study is closest to Cantoni (2015) who studies the consequence of adopting Protestantism in Germany for city growth. He finds no effect of adopting Protestantism on city growth in the early modern period. Our analysis is also related to Becker and Woessmann (2009) who do find an effect of Protestantism in Prussia for human capital accumulation in the 19th century. Our findings also build on a specific literature that looks at the role played by Jews in European economic history.² Botticini and Eckstein (2012) document the human capital advantage that Jews possessed from the medieval period onwards. They argue that it was this comparative advantage in occupations that required literacy or numeracy that led to their specialization as merchants, traders, and moneylenders. In particular, Pascali (2016) examines the presence of Jewish communities in medieval Italy and shows that financial institutions and knowledge persisted over centuries. Because the growth premium associated with the presence of a Jewish community only emerged after 1600, we argue that the high level of human capital among Jews did not have a broader effect on economic growth during the middle ages when restrictions curbed Jewish economic activity and long-distance trade remained limited and confined to a few commodities. If there was a positive interaction between Jewish human capital and city growth, it only emerged once open access institutions enabled Jews to participate more freely in the European economy (North et al., 2009).

The structure of the rest of the paper is as follows. Section 2 outlines our hypothesis, provides the necessary historical background for our analysis, and describes our data. In Section 3 we present our main results and show that they are robust. In Section 4 we describe our instrumental variables approach and report results on the causal impact of Jewish presence. In Section 5 we investigate both the timing of the Jewish city growth advantage and the possible channels through which this advantage emerged. We conclude in Section 6 by discussing the implications our results present for our understanding of the origins of modern economic growth in Europe.

2. Historical background, hypotheses, and data

2.1. Historical background

By the middle ages, Jewish communities flourished across most of Europe. In some instances such as in Spain and Italy these communities dated to Roman times. Elsewhere they were the product of more recent settlement. Jews had settled in Germany in the 9th and 10th centuries and in England from the 11th century onwards. They played an important role in trade in this period and, over time, became increasingly involved in moneylending and banking (see Chazan, 2006). By 1100, virtually all major cities in Europe had a Jewish community.

Europe's Jews faced increasing amounts of discrimination (Anderson, Johnson and Koyama, 2016) from 1200 onwards. Laws

² See, in addition to cited work, earlier more qualitative studies in economic history by Roth (1961), Baron (1975), and Kahan (1986).

restricting settlement were the primary determinants of whether a city had Jews living in it or not (Goldscheider and Zuckerman, 1984). As a result, there was a large amount of local variation in Jewish presence. During the pre-industrial period, England after 1655 was the only European country where Jews were free to settle where they wished. Everywhere else, Jewish settlement rights were conditional and varied unpredictably at a local level. There was a flourishing Jewish community in Fürth in Bavaria but ‘in neighboring Nuremberg a Jew could appear only in daytime and only in the company of a local inhabitant’ (Katz, 1974, p. 12). Even in the Netherlands, often characterized as a uniquely religiously-tolerant state, Jews were excluded from Utrecht, Gouda, and Deventer. The French monarchy in the 17th century permitted Jewish settlement in the regions it conquered from the Holy Roman Empire and allowed Sephardic communities to settle in Bordeaux and Rouen but Jews were not permitted to settle in Paris (Attali, 2010, p. 285).

2.2. Hypotheses

There are several reasons to think that Jewish communities could have had a positive effect on urban development in premodern Europe. We categorize these hypotheses as follows: (1) a human capital mechanism; (2) a cultural transmission mechanism; (3) a religious freedom and toleration mechanism; and (4) a market integration mechanism.

1. *The human capital mechanism:* Botticini and Eckstein (2012) document that Jews in medieval Europe had higher levels of human capital than did Christians. In the ancient world, Jews were mostly farmers whose religious activities centered on the Temple in Jerusalem. Botticini and Eckstein argue that Jews specialized in trade and commerce during late antiquity and in the early middle ages because of a shift in religious doctrine following the destruction of the Temple in AD 70 that saw the rise of Rabbinical Judaism with its emphasis on mandatory male literacy. As a result of this religious change, individuals facing a high opportunity cost to becoming literate had a strong incentive to convert to either Christianity or Islam. The minority who remained Jewish eventually came to specialize in long-distance trade, the wine industry, medicine, and in providing financial services and moneylending (Botticini and Eckstein, 2012, p. 194).

Jews did have higher than usual human capital attainment throughout the medieval and early modern period.³ Simon Kuznets established that this remained the case in the late 19th century (Kuznets, 1960). Acemoglu et al. (2011b) show that this held true in Eastern Europe before the Holocaust.⁴ If Jewish minorities had higher human capital than their Christian neighbors for religious reasons and if human capital is important for economic development then we should expect cities with Jewish communities to be more successful economically.

2. *The cultural transmission mechanism:* A growing literature emphasizes the importance of cultural values in shaping economic outcomes.⁵ This literature builds on the argument of Max Weber (1930) who claimed that Calvinism played a role in building a spirit of capitalism. The evidence for this hypothesis is decidedly mixed (see Becker et al., 2016). However, the idea that cultural traits can play an

³ Higher average levels of Jewish literacy and scientific knowledge are reflected in the extent to which Christian society depended on Jewish doctors, merchants and moneylenders (Roth, 1953; Parkes, 1976; Israel, 1985; Kahan, 1986; Hunderet, 1987; Cohen, 1994; Shatzmiller, 1994; Hsia and Lehmann, 1995; Stacey, 1995; Lehmann, 1995; Mundill, 2002).

⁴ Abramitzky and Halaburda (2014) find that Jews were not more educated than urban-non Jews. In other words, the literacy advantage of Jews in pre-World War II Poland was a simple composition effect. Nevertheless, this begs the question: why were Jews concentrated in urban sectors.

⁵ Contributions include Greif (2006), Guiso et al. (2006), Doepke and Zilibotti (2008), and Tabellini (2008). See Alesina and Giuliano (2015) for a recent survey of the connection between culture and institutions.

important role in spurring economic growth needs to be taken seriously. McCloskey (2010, 2016), for one, has argued that it was central to the onset of modern economic growth.

While Weber did not emphasize Jewish values in particular, this idea was developed by the controversial historical economist Werner Sombart. Sombart highlighted the role Jewish traders played in inventing credit instruments in the middle ages and their role as financiers in the early modern period.⁶ Sombart’s work is problematic; not least because he later became a National Socialist and more recent work indicates that he both exaggerated the role Jewish traders played in creating credit instruments and downplayed the heterogeneity within Jewish communities. Subsequent scholars have also found a number of factual errors in his work. Nevertheless, *Die Juden und das Wirtschaftsleben* (Sombart, 1911) develops a number of insights that are important for our analysis.⁷ In particular, Sombart saw Jews as embodying a commercial ethos that made them exceptionally successful in market society. Sombart claimed that these values—what he called ‘the capitalist point of view’—spread to the rest of the population during the 18th and 19th centuries. According to this view, the presence of Jews may be correlated with economic growth because individuals in these cities were more likely to develop market-oriented cultural values.

3. *The religious freedom and toleration mechanism:* Religious freedom is an important characteristic of modern liberal democracies. Religion was tightly controlled in premodern Europe and everywhere Jewish communities faced strict restrictions and regulations on what activities they could and could not engage in. However, whether or not a city was willing to accept a Jewish community at all contains information about its level of tolerance or open-mindedness. After all, expulsions and pogroms were common, as recent research has confirmed (Voigtländer and Voth, 2012; Anderson et al., 2016). In this case, the presence of a Jewish community itself might be a signal that a city is tolerant and hence a marker for overall religious liberalism. If this is the case, Jewish communities will be correlated with economic growth without necessarily being directly responsible for growth itself.

4. *The market integration mechanism:* The early modern period, 1500–1800, is seen as a prelude to the onset of sustained economic growth. For this reason, market integration in this period has been widely studied as a potential driver of urbanization and subsequent economic growth. Within this literature, numerous economists use the law of one price and other measures of price dispersion as tests of the level of market integration (e.g. Bateman, 2011). The consensus of this literature is that grain markets became increasingly well integrated from the late 17th century onwards.⁸

Europe’s Jewish communities were a tiny portion of the continent’s population; but they were disproportionately involved in trade and commerce, in no small part because they had cultural, linguistic, and religious links across the continent. In Amsterdam, Portuguese Jews were heavily involved in the Atlantic trade, particularly in sugar, tobacco, and diamonds (Bloom, 1936). In Poland, they were involved in river trade with Russia, the Ottoman Empire and the Baltic. In Germany, Jews were prominent in cattle trading (see Bell, 2008). Sephardic Jewish communities, in particular, became associated with international trade and with the evolution of a ‘cross-cultural merchant network’ (Trivellato, 2004, p. 37). And cities like Livorno, settled by

⁶ Weber commented on a resemblance between Jewish cultural values and Protestantism values but he downplayed this, arguing that the role of Jewish communities was limited to ‘pariah capitalism’, a phenomenon he termed ‘speculative’ in contrast to the Puritan ‘bourgeois organization of labor’ (Weber, 1930, p. 245).

⁷ See Davis (1997) for a balanced assessment of Sombart’s hypothesis. The English translation of the work by Mordecai Epstein edited and shortened the passages in Sombart’s work, which stressed racial factors (see Davis, 1997).

⁸ Bateman (2011) argued that levels of market integration were stationary between the medieval period and the onset of the industrial revolution. However, by expanding the sample of cities considered, Chiosi et al. (2013) show that northwestern Europe had significantly more integrated markets by 1750.

Sephardic Jews, became centers of international trade during the early modern period. For this reason, there are strong reasons to suspect that one channel through which the presence of a Jewish community might benefit a city economically would be via access to trade networks. We test this hypothesis by constructing measures of market access based on the recent work of [Donaldson and Hornbeck \(2016\)](#). We are the first to adapt this approach for premodern European cities in order to estimate an independent measure of market potential and expansion in the years leading up to the Industrial Revolution. We will show that cities with Jewish communities benefited substantially more from greater market access than comparable cities without Jewish populations.

2.3. Data

The measure of economic development we employ is the population of a city. This is a widely-used metric in the literature on economic development in the preindustrial period (e.g. see, [De Long and Shleifer, 1997](#); [Dittmar, 2011](#); [Nunn and Qian, 2011](#); [Bosker et al., 2013](#); [Dincecco and Onorato, 2015](#); [Jebwab et al., 2015](#)). Given that the European economy was Malthusian in the preindustrial period, urban population data are an important source of disaggregated information concerning technological change and productivity in both commerce and agriculture ([de Vries, 1976](#); [Ashraf and Galor, 2011](#)). Cities were centers of productive activity but they were also disease-ridden and unhealthy—urban death rates almost always exceeded rural death rates. As such, preindustrial cities rarely grew via natural increase. To expand they had to attract migrants from the countryside by offering higher wages and greater economic opportunities. As their ability to do so was constrained by the productivity of their surrounding agricultural land, increases in productive capacity were reflected in the growth of city populations. City growth in the preindustrial period also reflected commercial success with many cities, such as Genoa, Venice, Antwerp, Amsterdam, and London being, first and foremost, centers of trade ([Braudel, 1979](#)).

We combine two main datasets for our analysis. We collect data on the presence of Jewish communities at the city-year level from the *Encyclopedia Judaica* ([Roth and Wigoder, 2007](#)). These are the same data as used by [Anderson et al. \(2016\)](#) except we have expanded the time period covered by fifty years so that the data cover from 1400 to 1850. There are 1069 cities that had a Jewish community at some point in these data. The majority of entries in the *Encyclopedia Judaica* contain an exact date at which a community was allowed into a city. Other entries provide an estimate of the century or decade in which a community is first known to have been established.⁹ [Fig. 1](#) shows the locations of these cities as open circles.

We combine the data on Jewish presence with those on city populations from [Bairoch \(1988\)](#) (henceforth, ‘the Bairoch cities’). This dataset contains all cities with populations greater than 1000 between 800 and 1850. The total number of cities in the dataset is 1797. We use 1792 of these, as 5 cities in northern Norway, Finland, and the far Western Atlantic cannot be matched to the GIS data that we employ to create our geographical controls.¹⁰ [Fig. 1](#) shows the location of the cities in the Bairoch dataset as solid black points.

To match cities in the Bairoch dataset to cities with Jewish communities we create a list of all cities in the Bairoch dataset within 15 km of a Jewish city and then check each of the matched Bairoch-Jewish city pairs by hand. We end up with two samples. The first, which we call the main sample, consists only of Bairoch cities that we could perfectly match to the Jewish community data. The second, which we call the extended sample, includes all Bairoch cities where we

assume that if the city was not matched with a Jewish community, then there was no community present.

For our analysis we focus on the period between 1400 and 1850.¹¹ The main dataset constitutes a 7 period panel with observations in 1400, 1500, 1600, 1700, 1750, 1800, and 1850. Our main variable of interest in both samples is ‘Jewish Community’, which is an indicator variable equal to 1 if there was ever a Jewish community in the city during the previous time period. Descriptive statistics for both samples are provided in Tables 6.3 and 6.4 in Appendix 6.

In Appendix 6 we also provide information on how Jewish presence in European cities evolved over time. [Figure 6.8](#) shows that in the 14th century about 80% of cities in Europe had Jewish communities. In the extended sample the respective number is about 40%. The nadir of Jewish presence was reached in the 16th century when only about 40% of cities in the main sample had communities. This number then gradually increases until it reaches 60% in 1850. In terms of sample sizes, in the main sample, the fewest number of cities overall is 286 in 1400 and the highest number of cities is 482 in 1850. The extended sample goes from a minimum of 572 cities in 1400 to 1695 cities in 1850.¹²

3. The relationship between Jewish communities and city growth: main results

We begin by exploring the relationship between the presence of a Jewish community and city population over the entire period of study by estimating the following difference-in-differences specification:

$$\text{Log Population}_{i,t} = \beta \text{Jewish Community}_{i,t} + \sum_{t=1500}^{1850} \mathbf{X}_{i,t} \mu_t + \delta_i + \eta_t + \varepsilon_{i,t}. \quad (1)$$

The dependent variable is the log of the population of city i in year t . Of principle interest is the indicator variable $\text{Jewish Community}_{i,t}$, which takes a value of one if there was a Jewish community in city i during the previous time period and a zero otherwise. \mathbf{X} is a vector of controls that measure local geography (cereal suitability, proximity to rivers, proximity to coast) and local infrastructure (presence of university and distance to a medieval road).¹³ We allow the effect of these controls on city size to vary over time by interacting them with year fixed effects. We also include time fixed effects, η_t , in all regressions to control for time-varying shocks common to all cities as well as city fixed effects, δ_i , to control for time-invariant unobservables unique to each city.

We report our estimates of β in [Table 1](#). Regressions (1)–(3) show the results of estimating our baseline specification for the main sample and Columns (4)–(6) show results using the extended sample. All specifications suggest that between 1400 and 1850 cities with Jewish communities grew faster than cities without Jews. In our preferred difference-in-differences specification in Column (3), which uses the main sample and includes all controls, the estimated effect of a Jewish community on the growth in the level of city population is 35%. This estimate about doubles in Columns (4) and (5), which use the extended sample. Encouragingly, however, once city fixed effects are included in Column (6), the estimated growth advantage of cities with Jewish

¹¹ We exclude the period before 1400 for three reasons. First, there were relatively few cities with populations over 1000 before 1400. Second, almost all cities had a Jewish community before 1400 and this severely restricts our ability to create a reasonable control group. Third, the Black Death significantly disrupted the urban network with, on average, cities losing 40% of their populations.

¹² Neither sample ever has all of the possible Bairoch cities (1792) because some cities drop out of the sample over time.

¹³ Data on cereal suitability are from the Food and Agriculture Organization (FAO)'s Global Agro-Ecological Zones (GAEZ) database ([Fischer et al., 2002](#)). We assume rain-fed agriculture and medium input intensity and extract average suitability for a circle with 50km radius drawn around the city. Data on rivers and seas come from [Nussli \(2012\)](#). Data on universities are from [Bosker et al. \(2013\)](#). Data on medieval trade routes are from [Shepherd \(1923\)](#).

⁹ Note that we focus on Jewish communities and do not have data on the presence of converted Jews in Spain or Portugal.

¹⁰ The dropped cities are: Bergen, Trondheim, Ponta-Delgada, Falun, and Gaevle.

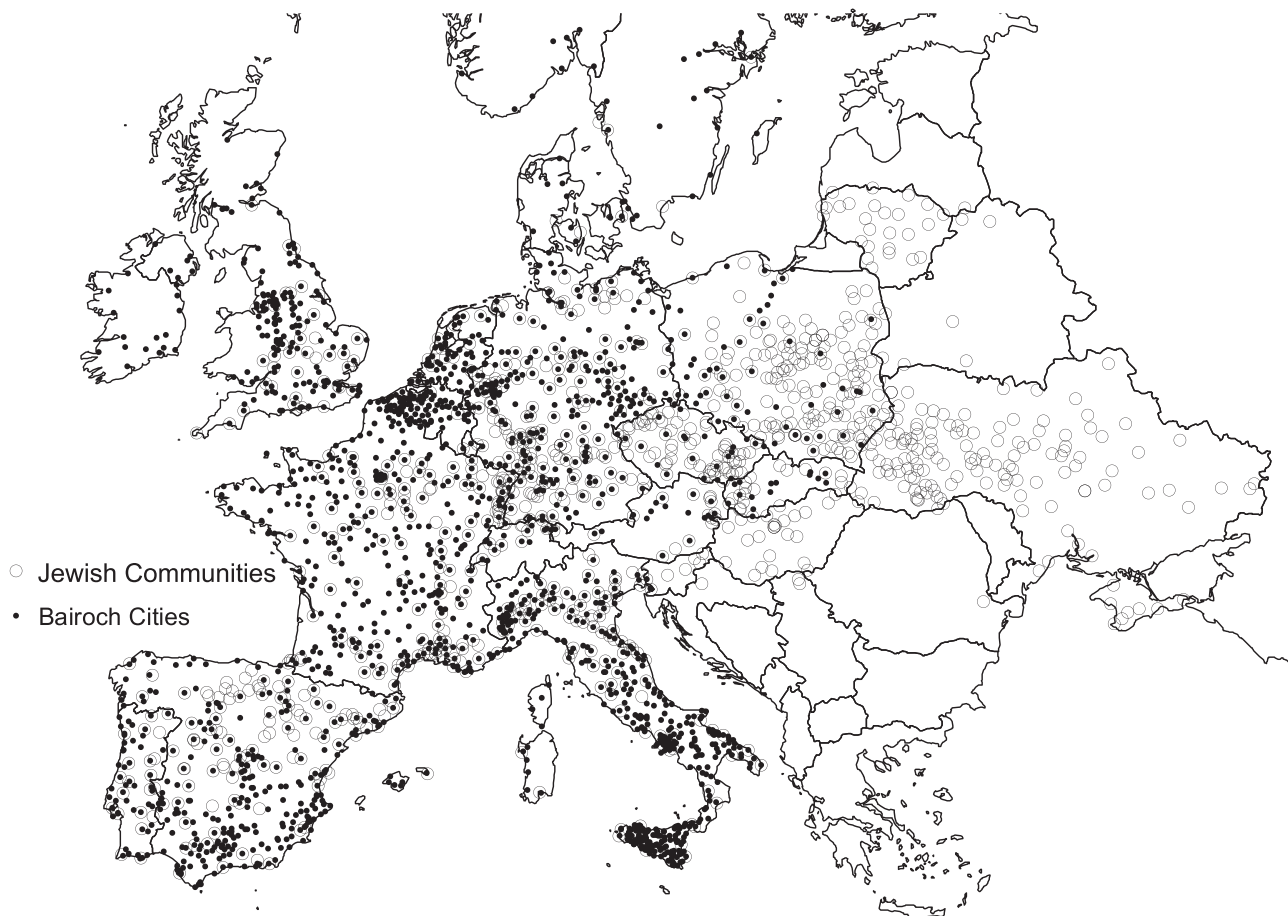


Fig. 1. Matching the Bairoch cities with Jewish communities. Location of the cities in the Bairoch dataset are solid black dots. Locations of Jewish communities are shown as circles. See text for sources.

Table 1
Jewish communities and city population, 1400–1850.

| | Main sample | | | Extended sample | | |
|---|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Dependent variable: log city population | | | | | | |
| Jewish community | 0.175 ^{***} (0.0399) | 0.273 ^{***} (0.0379) | 0.350 ^{***} (0.0455) | 0.625 ^{***} (0.0307) | 0.641 ^{***} (0.0305) | 0.302 ^{***} (0.0430) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls×year FE | No | Yes | Yes | No | Yes | Yes |
| City FE | No | No | Yes | No | No | Yes |
| N | 2898 | 2898 | 2898 | 8440 | 8440 | 8440 |
| R-sq | 0.0888 | 0.212 | 0.471 | 0.156 | 0.222 | 0.445 |

Notes: Columns (1)–(3) use our main sample where we assume cities for which we have no recorded Jewish presence are missing values. Columns (4)–(6) use our extended sample in which we assume no record of a Jewish community means there was not one. All specifications include year fixed effects. Specifications (3) and (6) include city fixed effects. Controls include cereal suitability, medieval university dummy, distance to nearest sea, distance to nearest river, and distance to nearest medieval trade route. Robust standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$.

*** $p < 0.01$.

communities using the extended sample is virtually identical to that found using the main sample.

The estimates reported in Table 1 are unbiased if the error term in Eq. (1) is uncorrelated with the Jewish community presence. As our data are non-experimental we cannot guarantee that this is the case. To address this, we now introduce an identification strategy that uses instrumental variables to establish a causal relationship between

Jewish communities and city growth.

4. Access to the network of Jewish communities: IV analysis

Several factors could affect Jewish settlement. If Jews were free to migrate where they pleased we might expect them to move to fast growing cities. However, Jewish settlement was typically tightly con-

trolled. Jews were often permitted in certain cities by rulers because they ‘anticipated Jewish contribution to the economy’ (Chazan, 2010, p. 102).¹⁴ This could result in Jews moving to areas that were expected to grow rapidly in the future but it could also result in Jews settling disproportionately in unprosperous or unpromising regions where their presence was intended to boost the coffers of local rulers. This was definitely the case, for example, in Germany after the Thirty Years War (1618–1648) (Israel, 1983, pp. 19–22).¹⁵

Other factors that influenced Jewish settlement were exclusions and expulsions. Jews were often perceived as competitors by merchants and, thus, if a city had a powerful enough mercantile class they were sometimes able to exclude Jews from settling. This was the case in Turin until 1424 and Florence until 1437 (Roth, 1950).¹⁶ Jews were also subject to frequent expulsions from cities and regions. These could occur at the national level, as in the infamous expulsions from England in 1290, Spain in 1492 and Portugal in 1497 or at a local level. These local expulsions and persecutions were often driven by economic downturns and shocks (see Anderson et al., 2016).

If Jews were invited to settle in declining cities and expelled or excluded from prosperous ones, this factor would be a source of downwards bias in our OLS estimates. On the other hand, if Jews could decide to selectively migrate to cities that were more prosperous, then this could be a source of upwards bias. There is actually little historical evidence for such positive selection—the bulk of the qualitative literature simply suggests that Jewish traders and merchants sought to establish communities in as many cities as possible for purposes of trade. Furthermore, as Jews became more involved in moneylending in the middle ages, this gave them a further incentive to geographically expand as much as possible in order to smooth local shocks (see Botticini, 1997).

To assuage concerns about selection we need a source of variation in Jewish presence which is plausibly unrelated to unobservables driving a city’s growth. We generate such a source of variation by explicitly modeling the network of Jewish communities over time in Europe using tools drawn from the market access literature (e.g., Donaldson and Hornbeck, 2016). We are also inspired by how historians describe Jewish communities spreading across Europe in the medieval period along historical trade routes (Chazan, 2006; Bell, 2008). Our instrumental variables strategy relies on three assumptions:

1. A Jewish community is more likely to be established close to another Jewish community (e.g., because of trade networks, financial relationships, cultural linkages, or other spatial externalities).
2. ‘Close’ is defined as the least cost travel path.
3. Unobservable characteristics of the cities in which the communities are located become less correlated the further they are from each other.

¹⁴ Chazan notes: ‘the objective was to entice new Jewish settlers ... Early sources tell us of the invitation extended by the Duke of Flanders to Jews to settle in his domain, of the establishment of a Jewish community in London by William the Conqueror, newly installed as king of England’ (Chazan, 2010, p. 6). This was also the case in Spain during the Reconquista.

¹⁵ Israel carefully documents the revival and expansion of many German Jewish communities during this period, concluding that ‘the terrible upheavals of the Thirty Years’ War mostly worked in favor of German and all Central European Jewry, appreciably enhanced the Jewish role in German life, and prepared the ground for the “Age of the Court Jew”—the late seventeenth and early eighteenth century—the high-water mark of Jewish influence on Central European commerce and finance’ (Israel, 1983, p. 30).

¹⁶ For instance: ‘it was either small or middle-sized communes (which had to call on outside financiers) or strong governments (concerned with public order) who turned first and from choice to the Jews. In the plutocratic towns, on the other hand, coalitions of local interests opposed to their admission were able to delay it’ (Poliakov, 1977, 1965, p. 58). Foa writes: ‘Not all Italian cities accepted or solicited settlement by Jews. Cities in which Christian bankers were numerous and organized in guilds were generally hostile to Jews, in whom the former saw dangerous competition’ (Foa, 2000, p. 111).

The most computational challenging task in constructing the IV’s is to create a measure of the cost of travel between cities with Jewish communities. To do this we begin by creating maps of Roman roads, medieval trade routes, major rivers, and seas (details are contained in Appendix 6). Estimates from Bairoch et al. (1990) allow us to assign the cost of transporting goods by each of these routes (portage is assumed to be used when there is no better alternative). We then divide Europe into 5 km×5 km grids and assign the lowest travel cost to each grid. We apply Dijkstra’s algorithm to determine the lowest cost of travel between all 3,211,264 city pairs (van Etten, 2012). Using the travel cost measures, we then create an index measuring the ‘Jewish network access’ for each city. For city j this index is defined as:

$$NA_{jt} = \sum_{i \neq j} \text{Jewish Community}_{it} \tau_{ji}^{-\sigma}, \quad (2)$$

where $\text{Jewish Community}_{it}$ is an indicator variable for city i taking a value of 1 if a Jewish community is located in it in time period t , τ_{ji} is the cost of travel between cities j and i , and σ is a trade elasticity.¹⁷ See Appendix 6 for more details on the construction of this index.

Jewish network access itself is, of course, correlated with the unobservable characteristics of the city for which it is calculated. To overcome this we adopt two strategies to create valid instruments out of the network access measures. Our first set of instruments, which we call the ‘Jewish network IV’, are defined as:

$$Z_{jt} = NA_{jt}|_{>D} \quad (3)$$

where D is the linear distance of city i from city j . In doing this we predict the presence of a Jewish community in city j based only on the network of Jewish communities that are more than D kilometers away. Since it is likely that any unobserved variables correlated with both the growth of city j and Jewish presence in city j will be uncorrelated with Jewish presence in city i that is more than \hat{D} kilometers away, this is a potentially valid instrument.

Our second instrument is constructed the same as the Jewish network IV except, instead of weighting the network access measure by $\text{Jewish Community}_{it}$, we weight by Expulsion_{it} which is an indicator variable equal to 1 if there was an expulsion of a Jewish community in city i in time t .¹⁸ The identifying assumption for this last instrument is that expulsions of Jews that happen more than \hat{D} kilometers away are uncorrelated with other factors driving growth in city j . The relevance of the instrument comes from the exogenous ‘push’ of expelled Jews towards city j combined with the ‘pull’ of city j being on a relatively short least cost travel path to the city from which the Jews are expelled. We call this second set of instruments the ‘Expulsion IV’.

We expect there to be a trade-off between the relevance of both sets of instruments and their validity as D increases. As such we create the instruments using values for D of 0, 50, 100, 250, and 500 km. In Table 2 we report the second stage results of running these regressions using the main sample.

Panel A contains results using the Jewish Network IV. Panel B

¹⁷ The appropriate σ depends on context. For modern and developed economies, researchers tend to estimate higher values. For example, Eaton and Kortum (2002) use 8.28 for OECD trade flows in 1995. Donaldson and Hornbeck (2016) estimate an average $\sigma = 8.22$ for trade flows in the U.S. in the second half of the 19th century. By contrast, Donaldson (2016) estimates $\sigma = 3.8$ for colonial India. Storeygard (2016) estimates the elasticity of city economic activity with respect to transport costs across Africa and arrives at values consistently less than 1 (their preferred estimate is 0.28). Kopsidis and Wolf (2012) assume $\sigma = 1$ for their study of Prussian trade during the Industrial Revolution. This is also the value assumed by many earlier studies of ‘market potential’ or ‘market access’ (Harris, 1954). Since our study covers relatively underdeveloped markets in Europe between 1400 and 1850, we follow Storeygard (2016) and Kopsidis and Wolf (2012) by setting $\sigma = 1$ which is lower than what is preferred for studies of more developed economies, but higher than what it is estimated for underdeveloped regions in Africa today.

¹⁸ The number of expulsions by century is: 1400=135, 1500=177, 1600=95, 1700=17, 1750=7, 1800=5, 1850=2.

Table 2
Jewish communities and city population, 2nd stage IV analysis, 1400–1850.

| | Dependent variable: log city population | | | | |
|--------------------|---|----------------------|----------------------|----------------------|----------------|
| | Panel A: Jewish network IV | | | | |
| | (1) All cities | (2) >50 km | (3) >100 km | (4) >250 km | (5) >500 km |
| Jewish community | 0.467 ^{***} | 0.467 ^{***} | 0.491 ^{***} | 0.522 ^{***} | 0.348 |
| | (0.0615) | (0.0643) | (0.0695) | (0.100) | (0.367) |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| Controls×year FE | Yes | Yes | Yes | Yes | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes |
| N | 2889 | 2889 | 2889 | 2889 | 2889 |
| First stage F-stat | 677.05 | 676.60 | 540.73 | 179.84 | 11.84 |
| | Panel B: Expulsion IV | | | | |
| | (1) All cities | (2) >50 km | (3) >100 km | (4) >250 km | (5) >500 km |
| Jewish community | 0.125 | 0.381 ^{**} | 0.864 ^{***} | 2.777 ^{***} | -0.755 |
| | (0.165) | (0.172) | (0.255) | (0.918) | (0.503) |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| Controls×year FE | Yes | Yes | Yes | Yes | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes |
| N | 2889 | 2889 | 2889 | 2889 | 2889 |
| First stage F-stat | 51.78 | 48.36 | 28.40 | 9.51 | 11.17 |

Notes: The table reports the 2nd stage IV estimates using the main sample. Panel A reports results using the Jewish Network IV. Column 1 uses the whole entire Jewish Network Access measure. Columns 2–5 use the Network Access Measure excluding cities within a 50, 100, 250, and 500 km radius of the city respectively. Panel B reports results using Jewish Network weighted by expulsions as an IV rather than simply Jewish presence. All regressions include controls interacted with year as well as year and city fixed effects. Robust standard errors are reported in parentheses. * $p < 0.10$.

^{***} $p < 0.01$.

^{**} $p < 0.05$.

contains results using the Expulsion IV. In Panel A, the coefficient estimates using the Jewish Network IV and setting D between 0 km and 250 km are remarkably stable and suggest that the population of cities with Jewish communities grew between 47% and 52% faster than cities without Jewish communities between 1400 and 1850.¹⁹

The coefficient estimates based on the Expulsion IV tell a similar story (Table 2, Panel B). In Column (1), where D is set to 0 km, the coefficient estimate is 0.125 and statistically insignificant. This is consistent with the fact that many of the expulsions we use for identification were national expulsions and, as such, one would expect the instrument to predict no Jewish presence for nearby cities (which were also subject to the expulsion decree) but positive Jewish presence for cities further away. Consistent with this interpretation, as D increases, the coefficients become larger and more statistically significant until D is set to greater than 500 km when the coefficient estimates again become insignificant. One point of concern is that the coefficient estimates in Columns (3) and (4) in Panel B are large relative to the difference-in-differences estimates in Table 1 and the estimates in Panel A using the Jewish network instrument. One possible explanation for this is that the Expulsion IV is identifying the impact of a Jewish community using much less information in the later periods of the sample when the number of expulsions declines precipitously. For example, there are only 7 expulsions between 1700 and 1750, 5 between 1750 and 1800, and 2 between 1800 and 1850. Furthermore, as we will show in Table 4, most of the gains associated

¹⁹ Unsurprisingly, when cities more than 500km away are excluded in the construction of the instrument, it loses relevance and the coefficient estimate shrinks and becomes statistically insignificant.

with the presence of a Jewish community in a city accrue after 1600. Given these concerns, and considering the trade-offs involved between relevance and validity, we will use the more conservative specifications which set $D=100$ km for both the Jewish Network IV and the Expulsion IV in the robustness and mechanisms regressions we perform below.

Given the coefficient estimates for the 100 km IV's of 0.491 and 0.864 in Table 2 it is natural to ask whether the magnitude of these effects is plausible? Dittmar (2011) finds that between 1500 and 1600, European cities where printing presses were established in the 1400s grew 60% faster than otherwise similar cities. Nunn and Qian (2011) find that a one percent increase in potato suitability increased city size by 0.5% implying that an area which was twice as good for growing potatoes would have a 50% boost to population size. Given these findings in other papers, our difference-in-differences estimates reported in Table 1 of about 30% seem plausible.

One interpretation of the difference between our OLS and IV estimates is that there is downwards bias in our OLS estimates. This might be driven by selection (whereby Jews were permitted, or forced, to settle in cities that were declining economically) or attenuation bias. Alternatively, the IV estimates may overstate the impact of Jewish communities if they are systematically correlated with other drivers of growth. One obvious candidate is access to greater markets through either being embedded in a better transport network (lower τ in Eq. (2)) or being located closer to other large cities. In this case, our IV regressions would be identifying the effect of being well situated in the network of cities overall, which may have benefited Jewish communities which engaged in commerce or banking activities, but also could be independently correlated with city size. This is a natural concern considering that our measures of Jewish network access are very similar to traditional measures of market access which simply weight by the population of nearby cities rather than an indicator variable for either Jewish presence or expulsions (Harris, 1954). Indeed, as we will see in the next section, when we control for market access in our regressions, the coefficients in the difference-in-differences and Jewish network IV regressions decline significantly and are stable at about 25% while the Expulsion IV coefficient declines to about 67%.

4.1. Robustness

In Table 3 we check the robustness of our main results. For each robustness check we report the coefficient on the Jewish community variable using the main sample, the extended sample, and using both our Jewish network IV and the Expulsion IV with $D = 100$ km. All specifications include our standard controls interacted with year fixed effects as well as year and city fixed effects unless otherwise noted.

In Columns (1)–(5) we interact our year fixed effects with additional time invariant controls that could influence city growth. Nunn and Qian (2011) find that areas with high suitability for the potato experienced more rapid urban growth after 1700 as a result of the Columbian exchange. With this in mind, in Column (1) of Table 3 we control for the interaction between potato suitability and year fixed effects. It is also possible that cities near the Atlantic coast may have grown more quickly (Acemoglu et al., 2005). Thus, in Column (2), we include the interaction of an indicator variable=1 if a city is within 10 km of the Atlantic coast with year fixed effects. In Column (3) we control for market access. This reduces the size of the coefficient estimates, particularly for the IV's, which are constructed in a very similar manner to market access. Recent research has established that levels of anti-Semitism in Europe varied at a local level (Voigtländer and Voth, 2012). As this might affect how Jews interacted with Christian populations, we explicitly control for expulsions and pogroms against Jewish communities using data from Anderson et al. (2016) in Column (4). The Black Death was a major shock to urban development in late medieval Europe that also was strongly correlated with Jewish persecution (Voigtländer and Voth, 2012; Finley and Koyama, 2015). To control for this shock we use imputed city-level Black Death

Table 3

Jewish communities and city population, robustness, 1400–1850.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|-----------------------------|----------------------|------------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|-----------------------|----------------------|------------------------|
| | <i>Potato</i> | <i>Atlantic cities</i> | <i>Market access</i> | <i>Persecutions</i> | <i>BD mortality</i> | <i>Years Jewish</i> | <i>Zero pop = 500</i> | <i>Solow spec.</i> | <i>1200-Sample</i> | <i>Cluster country</i> |
| $\beta_{OLSMain}$ | 0.347*** (0.0450) | 0.341*** (0.0464) | 0.275*** (0.0455) | 0.383*** (0.0512) | 0.353*** (0.0457) | 0.405*** (0.0507) | 0.368*** (0.0460) | 0.0866*** (0.0182) | 0.356*** (0.0486) | 0.350** (0.124) |
| $\beta_{OLSExtended}$ | 0.301*** (0.0426) | 0.292*** (0.0431) | 0.237*** (0.0418) | 0.370*** (0.0509) | 0.311*** (0.0432) | 0.356*** (0.0476) | 0.320*** (0.0432) | 0.155*** (0.0151) | 0.306*** (0.0447) | 0.302** (0.109) |
| $\beta_{IV100\text{ km}}$ | 0.578*** (0.0858) | 0.456*** (0.0696) | 0.242*** (0.0865) | 0.586*** (0.0943) | 0.529*** (0.0782) | 0.586*** (0.0828) | 0.562*** (0.0773) | 0.371*** (0.0594) | 0.540*** (0.0644) | 0.491** (0.216) |
| $\beta_{IVExp100\text{ k}}$ | 0.993*** (0.365) | 0.839*** (0.233) | 0.672** (0.296) | 1.675** (0.784) | 0.989*** (0.325) | 0.977*** (0.297) | 0.632** (0.329) | 0.429*** (0.0876) | 0.252 (0.214) | 0.864** (0.394) |
| N_{Main} | 2898 | 2898 | 2898 | 2898 | 2898 | 2898 | 3507 | 2647 | 3282 | 2898 |
| $N_{Extended}$ | 8440 | 8440 | 8440 | 8440 | 8440 | 8440 | 12544 | 7101 | 9080 | 8440 |

| | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) |
|-----------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | <i>Cities 1400</i> | <i>Cities 1500</i> | <i>Cities 1600</i> | <i>Cities 1700</i> | <i>Drop UK</i> | <i>Drop NLD</i> | <i>Drop France</i> | <i>Drop Germany</i> | <i>Drop Italy</i> | <i>Drop Spain</i> |
| $\beta_{OLSMain}$ | 0.353** (0.0538) | 0.355** (0.0493) | 0.356** (0.0481) | 0.363** (0.0470) | 0.228** (0.0438) | 0.355*** (0.0464) | 0.399** (0.0536) | 0.426** (0.0521) | 0.337*** (0.0509) | 0.307** (0.0437) |
| $\beta_{OLSExtended}$ | 0.307*** (0.0505) | 0.307*** (0.0465) | 0.314*** (0.0454) | 0.313*** (0.0443) | 0.188*** (0.0383) | 0.299*** (0.0435) | 0.344*** (0.0502) | 0.351*** (0.0499) | 0.307*** (0.0490) | 0.272*** (0.0425) |
| $\beta_{IV100\text{ km}}$ | 0.439*** (0.0801) | 0.459*** (0.0678) | 0.495*** (0.0686) | 0.495*** (0.0692) | 0.196*** (0.0836) | 0.542*** (0.0802) | 0.627*** (0.0725) | 0.540*** (0.0656) | 0.432*** (0.0843) | 0.485*** (0.0777) |
| $\beta_{IVExp100\text{ k}}$ | 1.078*** (0.366) | 0.912*** (0.259) | 0.957*** (0.280) | 0.959*** (0.284) | 0.570*** (0.239) | 1.061*** (0.318) | 1.023*** (0.274) | 0.694*** (0.199) | 0.878*** (0.272) | 1.112** (0.436) |
| N_{Main} | 1953 | 2349 | 2564 | 2694 | 2652 | 2835 | 2349 | 2199 | 2428 | 2527 |
| $N_{Extended}$ | 3850 | 5002 | 6272 | 7201 | 7636 | 8128 | 6960 | 7111 | 6641 | 7239 |

Notes: Every numbered column is a different robustness check. We report four specifications for each robustness check: (i) OLS estimates using the main sample, (ii) OLS estimates using the extended sample, (iii) IV estimates using the 100 km Jewish Network instrument, (iv) IV estimates using the 100 km expulsions instrument. All regressions include year and city fixed effects as well as standard controls interacted with year fixed effects. Robust standard errors in parentheses.

* $p < 0.10$.** $p < 0.05$.*** $p < 0.01$.

mortality data from [Jedwab et al. \(2015\)](#) interacted with year fixed effects.²⁰ Our main results are robust to the inclusion of all of these variables with coefficients retaining their size and significance.

In Columns (6)–(10) we experiment with different ways of defining our specification and main variables. Our primary variable of interest is a binary variable for Jewish presence. However, in many cases Jewish communities either arrive or disappear in the middle of one of our time periods. Rather than code these cities as 1, in Column (6) we redefine our treatment variable to be the proportion of years in the previous period that a Jewish community was in the city.²¹ This does not have a significant effect on our estimates.

The *Encyclopedia Judaica* is less likely to include an entry for smaller cities and if these cities are not yet above the 1000 person threshold required for inclusion into the Bairoch dataset, then this may be a potential source of bias. In Column (7) we assume that any city not yet over the 1000 inhabitant threshold actually has a population of 500. When we do this, the coefficients are largely unaffected.

In Column (8) we abandon our standard difference-in-differences specification, which uses the log level of population as the dependent variable, in favor of a ‘Solow’ type of specification in which we use the population growth rate as the dependent variable and include the lag of the log level of population of the city as a control.²² In Column (9) we run our regressions using a longer sample which extends from 1200 to 1850. This causes the Expulsion IV coefficient to shrink in size and become statistically insignificant. This is likely due to the fact that very

few cities did not have Jewish communities before 1400 and, also, there were relatively few expulsions on which to identify.²³ In Column (10) we control for spatial correlation by clustering our standard errors at the modern-country level. As expected, this reduces the statistical significance of the coefficients, but does not substantively change any of the results.

Our baseline analysis uses an unbalanced panel in which many cities are entering and exiting over the 450 year period we study. In Columns (11)–(14) we restrict our sample to only cities that existed in 1400, 1500, 1600, or 1700 respectively. Both the OLS and the IV estimates are stable across these samples.

In Columns (15)–(20) we systematically drop the cities of the largest modern countries from our sample. One concern with our result that the emergence of the Jewish city growth premium only emerges after 1600 may be that it is driven by the precocious growth in Britain in the early years of the Industrial Revolution. In Column (15) we drop cities in the UK and our coefficients are stable. Given the active participation of Jews in banking in Italy and their economic prominence in Germany we are encouraged that dropping these countries does not change any results ([Pascali, 2016](#)). Similarly, given the large-scale Iberian expulsions of Jewish communities at the end of the 15th century, we are reassured that dropping Spanish cities from the sample also has little effect on our results.

²⁰ The data are created using an inverse distance weighted spatial interpolation based on 256 cities for which mortality rates are known, as reported in [Christakos et al. \(2005\)](#).

²¹ These coefficient estimates are multiplied by 100.

²² In order to avoid Nickell bias, we also drop the city fixed effects from these regressions ([Nickell, 1981](#)).

²³ There were 10 expulsions in 12th century and 38 in the 13th century. 76% of cities had Jewish communities in the 12th century and 82% did in the 13th century.

5. The relationship between Jewish communities and city growth: timing and mechanisms

5.1. Flexible estimates

The regressions we report in Tables 1 and 2 suggest that cities with Jewish communities grew faster on average between 1400 and 1850. However, we would like to know if this growth advantage varied over time, as this will help us identify possible explanations for it. We therefore estimate a flexible version of Specification (1) in which we allow the estimated coefficient on Jewish Community β_t to vary by time period.²⁴

In Table 4 we report the effect of a city possessing a Jewish Community in each year of the sample based on our regression results. 1400 is always the omitted year. Column (1) reports OLS estimates using the main sample. These regressions suggest that cities with Jewish communities grew faster at the beginning of the period, but that this advantage declined after the Black Death, and then started increasing in size again in the 18th century. In Columns (2) and (3) we report flexible estimates using our two instrumental variables. Both these sets of regressions suggest that cities with Jewish communities experienced no growth advantage in the 15th and 16th centuries, but after 1600 this changed dramatically. The estimates in Column (2) using the Jewish network IV suggest cities with Jewish communities grew about twice as fast as cities without Jewish residents after 1600. The estimates in Column (3) using the Expulsion IV suggest that this difference was closer to 130–200%. These last estimates are very large and we interpret them with the same caveats we provided above concerning the number of expulsions during the later periods and the potential that the exclusion restriction is violated given that we are not controlling for market access. In Columns (4) and (5) we re-run our IV regressions while controlling for market access. Doing so reduces the size of the coefficients significantly for both specifications. The Jewish Network IV regression now suggests that after 1600, cities with Jewish communities grew between 42% and 79% faster than cities without Jewish presence. The Expulsion IV coefficients are also reduced, but still quite large, suggesting that after 1600, cities with Jewish residents grew two to two and half times faster than cities without Jewish communities.

In Column (7) we report the coefficients from running the flexible specification using the extended sample of all cities in the Bairoch database. This regression tells a clear story. Cities with Jewish residents always possessed a growth premium over cities without Jewish communities of about 20% (though selection is likely to bias this estimate). Beginning in the 17th century, however, this growth premium steadily increases until it reaches about 50% in 1850.

Figs. 2, 3, 4 and 5 plot the coefficients along with their 95% confidence intervals for each year using the results from Columns (1), (4), (5) and (6) of Table 4. Overall, two facts emerge from the flexible regressions. First, before 1600 there is little evidence for a Jewish growth premium. Second, depending on the sample and estimator used, there appears to have been a divergence between the growth rates of Jewish and non-Jewish cities sometime between 1600 and 1700, which persists up until the end of the sample in 1850. These results support historical accounts which view the period between 1300 and 1600 as one of crisis and decline for Europe's Jewish population, whereas the period after 1600 was one of economic and demographic expansion (Braudel and Press, 1949; Israel, 1985).

Importantly, these findings appear inconsistent with a pure human capital story as Jews had higher human capital than Christians throughout the medieval and early modern period. Rather, it suggests

that something else changed around the 17th century that made the human capital and skills of Jews more complementary to economic growth. In the next section we explore some of these mechanisms.

5.2. Mechanisms

Now let us consider some of the mechanisms linking the presence of a Jewish community with more rapid economic growth. We identify five potentially important factors which could explain the Jewish city growth advantage: whether the Jewish community was Sephardic, whether the community had a Jewish-run printing press, whether it was a 'Port Jew' community, whether the Jewish community was emancipated, and whether there was a relationship between the density of markets and the performance of cities with Jewish communities. We run regressions where we interact proxies for each of these mechanisms with our binary Jewish community variable. The results of these regressions are reported in Table 5. In what follows, we discuss each of these potential mechanisms in greater detail and interpret the results of the regressions.

Sephardic communities: A sizable historical literature associates the expansion of Jewish trade and economic activity after 1600 with the Sephardic Jewish communities who migrated from Spain and Portugal after 1492 and settled across Europe in cities such as Amsterdam, Bordeaux, Hamburg, Livorno, and London during the 16th and 17th centuries (see Braudel and Press, 1949).

Israel (2005, p. 11) argues that the Sephardic diaspora created 'a new phenomenon ... a new type of Jewish commercial system' that was based not on local markets, or on trade in agricultural products but on the transportation of luxury goods over long distances. Similarly, Trivellato (2009) argues that the Sephardic diaspora was remarkable for its 'geographical breadth' and 'stability' and that '[o]ther branches of the Jewish diaspora could not count on the same geographical dispersion or interconnectedness' (Trivellato, 2009, p. 149).²⁵ They formed a network of interconnected merchants tied together 'on the basis of implicit contracts with blood-kin and in-law'. Sephardic merchants formed long-lasting partnerships and employed long distance agency relationships relying on both formal courts and on reputation-based mechanisms of the kind that Greif (1992, 2006) studied in the context of the Geniza records. Community organizations strove to uphold the collective reputation of local merchants, excommunicating members found guilty of trading in counterfeit coins or goods or acting in such a way that would "discredit the commerce of the Jewish nation" (Trivellato, 2009, p. 166).

Sephardic merchants were involved in a variety of mercantile activities. The Sephardic or Portuguese community in Amsterdam was heavily involved in the silk trade (until it was closed to them in the 1650s), in sugar, and in the trade with both the Levant and with the Portuguese colonies in the Americas and in Asia (see Bloom, 1936). They were a significant presence in the colonial trade between the British West Indies and England from the 1650s onwards (Fortune, 1984). Sephardic Jews came to play a similarly important role elsewhere in Europe, in the Venetian economy, for example, where they imported Spanish wool and Spanish American dyestuff for the Italian textiles industry (Fusaro, 2015, p. 261). Livorno, in particular, grew in importance as an entrepôt for trade with the Levant; it was the fastest growing port in Italy in the 17th century (Trivellato, 2009, p. 71).

We create a time-varying indicator variable equal to one if a Jewish

²⁴ The regression specification we use is: $\text{Log Population}_{i,t} = \sum_{t=1500}^{1850} \beta_t \text{Jewish Community}_{i,t} + \sum_{t=1500}^{1850} \mathbf{X}_{i,t} \boldsymbol{\mu}_t + \delta_i + \eta_t + \varepsilon_{i,t}$ where all variables are defined as in (1).

²⁵ There was a widespread perception in Amsterdam and in other cities such as Hamburg that the Sephardic Jews were significantly more prosperous and entrepreneurial than were Ashkenazi Jews. For example, Bloom writes: 'Unlike their Sephardic brethren the Ashkenazic Jews, because of different background and tradition, were not concerned with secular matters but were deeply engrossed in the study of the Talmud.' He notes that though 'the Ashkenazic community by dint of sober industry and thrift had acquired a certain degree of prosperity ... It is self evident that, as compared with the Sephardim, the Ashkenazic group was poor indeed' (Bloom, 1936).

Table 4
Jewish communities and city population: flexible regressions.

| | Dependent variable: log city population | | | | | |
|---------------------------|---|---------------------------------|---------------------------------|---------------------------------|--------------------------------|---------------------------------|
| | Main sample | | | | | Extended sample |
| | (1) <i>OLS</i> | (2) <i>IV100k</i> | (3) <i>IVExp_100k</i> | (4) <i>IV100k</i> | (5) <i>IVExp_100k</i> | (6) <i>OLS</i> |
| Jewish community×1500 | 0.382 ^{***} (0.074) | 0.080 (0.308) | −0.973 (1.147) | 0.129 (0.302) | −0.773 (1.017) | 0.194 ^{***} (0.052) |
| Jewish community×1600 | 0.190 ^{***} (0.056) | 0.064 (0.208) | 0.356 (0.308) | −0.052 (0.216) | 0.256 (0.338) | 0.174 ^{***} (0.049) |
| Jewish community×1700 | 0.189 ^{***} (0.059) | 0.999 ^{***} (0.342) | 1.878 ^{**} (0.663) | 0.788 ^{**} (0.356) | 1.668 ^{**} (0.662) | 0.311 ^{***} (0.063) |
| Jewish community×1750 | 0.202 ^{***} (0.054) | 0.599 ^{***} (0.222) | 1.287 ^{***} (0.488) | 0.422 [*] (0.236) | 1.088 ^{**} (0.530) | 0.279 ^{***} (0.058) |
| Jewish community×1800 | 0.317 ^{***} (0.061) | 0.991 ^{***} (0.231) | 1.794 ^{***} (0.613) | 0.746 ^{***} (0.251) | 1.545 ^{**} (0.619) | 0.358 ^{***} (0.063) |
| Jewish community×1850 | 0.553 ^{***} (0.072) | 1.236 ^{***} (0.205) | 2.079 ^{***} (0.792) | 0.730 ^{***} (0.261) | 1.686 ^{**} (0.856) | 0.506 ^{***} (0.067) |
| Control for market access | No | No | No | Yes | Yes | No |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls×year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes | Yes |
| <i>N</i> | 2898 | 2889 | 2889 | 2889 | 2889 | 8440 |

Notes: This table presents results from specifications in which we allow the effect of a Jewish community on city growth to vary over time. Coefficients reported are the sum of the direct effect of a Jewish community and the indirect effect in year *t*. Column 1 uses OLS on the main sample. Columns 2 and 3 present results using the Jewish Network IV and the Expulsion IV respectively. Column 4 uses OLS on the extended sample. All regressions include year and city effects as well as standard controls interacted with year fixed effects.

* *p* < 0.10.
** *p* < 0.05.
*** *p* < 0.01.

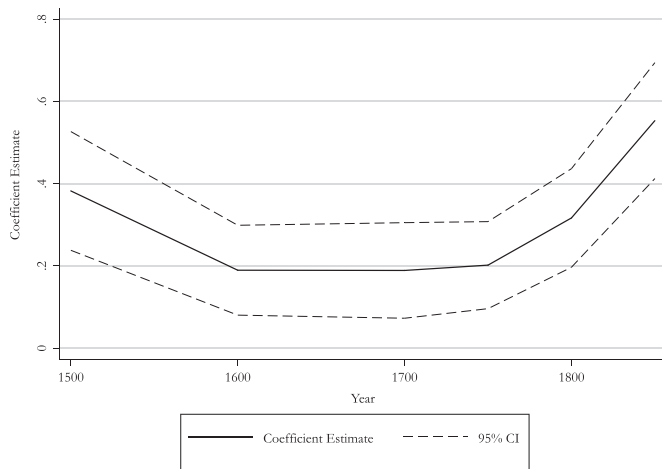


Fig. 2. Flexible estimates using OLS and the main sample.

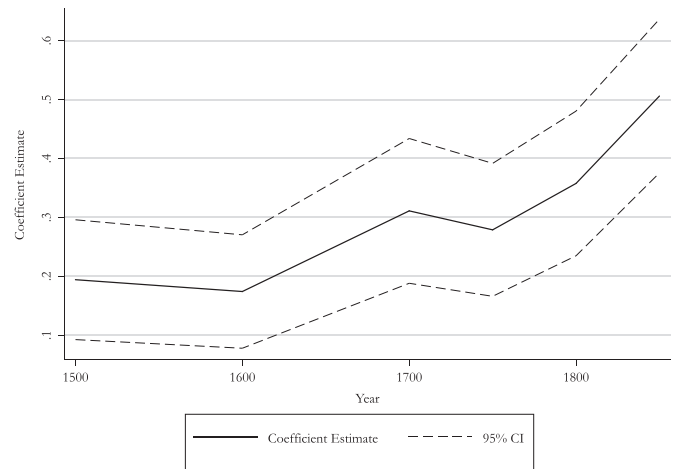


Fig. 3. Flexible estimates using OLS and the extended sample.

community was known to be Sephardic based on the information contained in Beinart (1992) and checked with Roth and Wigoder (2007). We report the results of running these regressions in Table 5, Columns (1) and (2).²⁶ In Column (1) the difference-in-differences estimate suggests that Sephardic cities grew 48% more quickly than non-Sephardic cities (which could be either Jewish and non-Sephardic or have no Jewish presence whatsoever). The IV estimate in Column (2) suggests a 38% growth premium.

Cities with Sephardic communities were undoubtedly prosperous in the period before the Industrial Revolution. But the presence of Sephardic communities is not sufficient to explain the timing of the

²⁶ For our regressions on Sephardic Community and Port City we report only the coefficient on the direct effect of Sephardic or Port on city growth since these variables are perfectly collinear with their interaction with Jewish Community (all cities with Sephardic Jewish communities or cities with Port Jew cities, by definition, also had Jewish communities). As explained in the text, this is not the case with Hebrew Press.

Jewish city growth premium we identify. In fact, if one restricts the sample to just the periods 1750–1850, the effect of being a Sephardic city becomes large and *negative*. This is shown in Appendix Table A2. This is consistent with the historical literature, as the heyday of the Sephardic Jewish trading networks were the 17th and 18th centuries; they faded into relative insignificance following the Industrial Revolution and the break-up of the Spanish Empire in the Americas.

Hebrew Printing Press: To explore evidence of cultural mechanisms linking the presence of a Jewish community to economic growth, we collected data on the existence of Jewish printing presses based on information contained in Beinart (1992) and Gilbert (1992). The historical literature suggests that the existence of a Hebrew printing press was a measure of cultural interaction between Jews and Christians (see Burnett, 1998). A Hebrew printing press either meant there was a Jewish community in the city that had the status and freedom to print their own religious literature or it signaled the

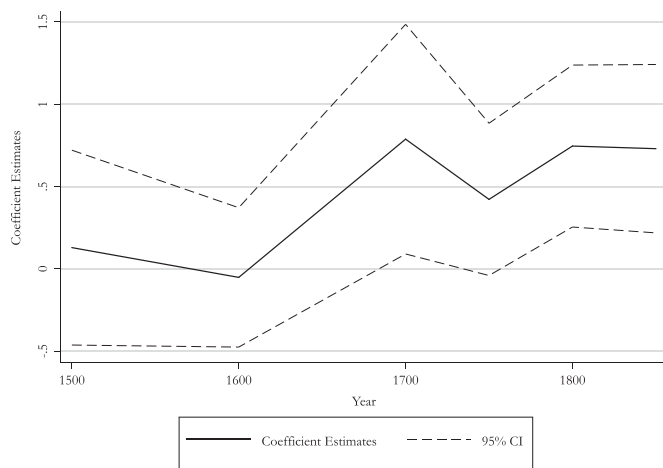


Fig. 4. Flexible estimates using Jewish network IV.

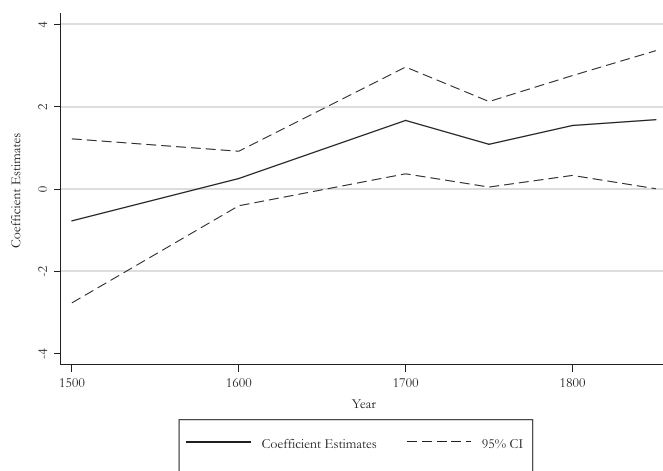


Fig. 5. Flexible estimates using Expulsion IV.

presence of Christian Hebraists who were interested in studying Hebrew literature.²⁷

We create a time varying indicator variable equal to one if a city had a Hebrew Printing press in that year. In Table mechanisms, Columns (3) and (4) we report the effect of a city having a Hebrew Printing press on population growth. The coefficients suggest a growth premium similar to Sephardic cities. This suggests that there might have been a cultural transmission channel and that the benefits of Jewish presence were greatest where they were able to interact with their Christian neighbors. However, two caveats come with these results. First, there were very few cities with Hebrew printing presses and these tended to be large and important cities. Only 4 cities had presses in 1400 (Avignon, Lisbon, Faro, and Rome) and by 1850 this number had only increased to 18.²⁸ Secondly, these cities are not responsible for explaining the acceleration in growth experienced by cities with Jewish communities after 1700. If we restrict the sample to the period 1750–1850, the coefficients on Hebrew Press become negative and statistically insignificant. This suggests that, while the presence of a Hebrew Press may have been important, it does a poor job explaining both the cross-sectional and the time series patterns we identify in our sample.

Port Cities and Port Jews: We also consider the interaction

between the existence of a Jewish community and an indicator variable for whether or not that city is on the coast in order to test whether communities of so-called Port Jews had a greater impact on city growth. Historians refer to ‘port Jews’ to describe those maritime Jewish communities that flourished in early modern cities such as Livorno, Trieste, Amsterdam, and London (Cesarani, 2001, Dubin, 2001, 2006; Sorkin, 2001). These communities tended to offer great religious freedom to Jewish communities. The OLS estimate in Column (5) suggests an effect of Port Jews; however, this disappears under IV estimation. Furthermore, as shown in Appendix Table A2, both these estimates shrink to zero for the period 1700–1850.

Emancipation: A large literature emphasizes the importance of institutions for economic development. In cities in which Jewish presence was part of a set of extractive institutions designed to create and capture rents for a ruling elite, as was the case in much of medieval Europe where toleration for Jews was predicated on their importance as moneylenders, we might expect to find a smaller net impact of Jewish presence on city growth.²⁹ Similarly, we should expect a stronger relationship between Jewish communities and economic growth in cities where they were free to choose their occupation and to interact openly with non-Jews.

From this perspective, the most important institutional change for Jewish communities was Jewish emancipation. Jewish emancipation refers to the elimination of rules restricting Jews’ choice of residence, education, occupation, and economic activity. Particularly in central Europe it was a gradual process that extended from the 1780s to 1870s.

During the medieval and early modern period, Jews faced limitations on the range of economic activities they could engage in. These restrictions segregated Jews from Christians. This was particularly the case where Jews were confined in ghettos, such as those in Italy and Germany from the 15th century onwards. Ghettos permitted Jewish communities to survive amid religious persecution and violence (Kaplan, 2007). But they came at a high cost: they limited the ability of Jews to put their labor to its highest value use; they prevented Jewish businesses from hiring non-Jewish workers; and they prevented or limited Jews from attending universities. More generally, they produced cultural isolation: as ‘[f]ew secular influences pervaded the ghetto, and there was little to disturb its inbred notions and ideas’ (Rudavsky, 1967, p. 95).

Jewish emancipation broke down these barriers. The first countries to grant Jews a measure of economic freedom (if not full political and religious freedom) were the Dutch Republic and England, and to a lesser extent in France. In England after 1654 Jews were free to settle throughout the country. At first their condition was precarious but by the end of the 17th century they were firmly established and settled in several cities across England including Bristol, Liverpool, and later Manchester. Similarly, in the Netherlands, Jews were involved in a wide range of trading and commercial activities and were no longer confined to moneylending as had been the case in the middle ages.

From the late 18th century, under the influence of Enlightenment thought, Jewish communities across Europe were granted economic and civic rights. Christian Wilhelm Dohm’s 1781 work, *Über die bürgerliche Verbesserung der Juden* (*On the Civic Improvement of the Jews*), was of particular significance, beginning a pan-European debate on the condition of the Jews in Europe by advocating emancipation as a means to make the Jews useful to society at large (Hess, 2002).³⁰

The first act of emancipation in a major continental Europe state was passed by Joseph II in 1782. This Edict of Toleration did not grant Jews legal equality with Catholics, but it was seen as an important step in the direction of greater legal rights for religious minorities. Formal

²⁷ Thus there are some cities which acquired Hebrew printing presses but did not have Jewish communities, such as London prior to 1655.

²⁸ In 1850 the cities were: Geneva, Berlin, Luban, Rome, Basel, London, Krakow, Hamburg, Avignon, Strasbourg, Faro, Paris, Venice, Prague, Amsterdam, Lisbon, Antwerp, and Nice.

²⁹ See, for further analysis, Koyama (2010) as well as Baron (1965a,b,1967a,b,1975), Barzel (1992), Foa (2000), and Klein (2006).

³⁰ For a more extended discussion, see Carvalho and Koyama (2016).

Table 5
Jewish communities and city population, mechanisms.

| Dependent variable: log city population | | | | | | | | | | |
|---|----------------------|----------------------|-------------------------------|----------------------|----------------------|---------------------|----------------------|--------------------------------|--------------------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| | OLS | IV100k | OLS | IV100k | OLS | IV100k | IV100k | IV100k | OLS | IV100k |
| Jewish community | 0.311*** (0.0443) | 0.465*** (0.0722) | 0.349*** (0.0457) | 0.498*** (0.0712) | 0.316*** (0.0464) | 0.603*** (0.157) | 0.248*** (0.0407) | 0.440*** (0.0967) | -0.577 [†] (0.299) | -3.523*** (0.655) |
| Sephardic×JewishCommunity | 0.482** (0.205) | 0.375*** (0.136) | | | | | | | | |
| HebrewPress×JewishCommunity | | | -0.114 (0.197) | -0.571** (0.264) | | | | | | |
| Hebrew Press | | | 0.518 [†] (0.274) | 0.776*** (0.264) | | | | | | |
| PortJew×JewishCommunity | | | | | 0.444*** (0.145) | -1.000 (1.321) | | | | |
| Emancipation×JewishCommunity | | | | | | | 0.332*** (0.0788) | 1.078*** (0.394) | | |
| Emancipation | | | | | | | 0.0671 (0.0627) | -0.573 [†] (0.306) | | |
| MarketAccess×JewishCommunity | | | | | | | | | 0.123*** (0.0450) | 0.542*** (0.0971) |
| Market access | | | | | | | | | 2.105*** (0.310) | 2.012*** (0.294) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Controls×year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| City FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 2898 | 2889 | 2898 | 2889 | 2898 | 2889 | 2898 | 2889 | 2898 | 2889 |
| R-sq | 0.477 | | 0.474 | | 0.476 | | 0.485 | | 0.512 | |

This table reports the coefficient on the interaction term for each of our mechanism regressions. Robust standard errors are in parentheses.

[†] $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$.

equality was granted to French Jews in 1791 and this policy was spread into those lands conquered by the Revolutionary and Napoleonic armies (Acemoglu et al., 2010, pp. 111–114). As a result, Jewish communities were emancipated across much of Germany and Italy. However, the defeat of France saw the reimposition of restrictions on Jews across many cities including Bremen, Lübeck, Frankfurt, Hamburg, Hanover and Nassau (Jersch-Wenzel and Meyer, 1997, p. 29). Jews were granted rights in Prussia in 1812 and in Denmark in 1814, but full emancipation for all Jewish communities in Germany only came in 1871 after unification. Similarly, while many Jewish communities in Italy experienced emancipation during the French occupation, they only gained permanent emancipation in the 1840s or 1860s. Emancipation led to religious reform among Jewish communities across much of Germany and to the entry of large numbers of Jews into the institutions of secular education, particularly the universities (Kober, 1954, Pulzer, 1992; Carvalho and Koyama, 2016).

We code a Jewish community as emancipated based on the proportion of years in the previous century that they were emancipated. For example, the Jewish community of Berlin was emancipated in 1812 so they receive a value of 0.76 for the period 1800–1850. Though in practice Jewish emancipation was rarely binary, our results are not sensitive to how we code emancipation. For example, in our baseline analysis we code all Jewish communities in the Habsburg empire as emancipated following the Toleration Edict of 1782 giving them a value of 0.36 for 1800 and 1 for 1850. It is widely acknowledged, however, that the Edict of Toleration did not lead to full Jewish emancipation in the Habsburg empire, which was only achieved in 1867. Therefore, as a robustness exercise we employ an alternative and more restrictive coding that counts the Jewish communities of the Habsburg empire as not emancipated (Appendix Table A1). This does not affect our results.

Columns 7 and 8 in Table 5 report the results of the interaction term between the presence of a Jewish community and whether or not

they were emancipated. We also report the direct effect of Jewish emancipation on city growth. This is because in some parts of Europe such as England after 1655, Jews were free to settle and emancipated throughout the country but for a long time there were few such Jewish communities outside the largest cities such as London. We obtain a large and statistically significant coefficient on the interaction term between Jewish presence and emancipation using both OLS and our IV.

This is consistent with the hypothesis that institutions played a crucial role in determining the contribution that Jewish communities could make to economic growth. Prior to emancipation, Jews were concentrated in either moneylending or trade or else were involved in retailing, peddling, or informal commerce. In the wake of emancipation, Jews began to enter universities and the secular professions such as law. Their economic role expanded and as a consequence the period after 1800 saw a tremendous expansion in the number of Jewish thinkers and scientists.

Market Access: The historical literature points to the importance of Jewish trading and financial networks. But, while economic historians have conducted numerous studies of market integration during the early modern period, with a few exceptions these have focused on the grain trade with little systematic study of other markets due to data limitations. Jewish merchants in medieval and early modern Europe, however, did not play a prominent role in the grain trade but, rather, were involved in the transport of diamonds, sugar, silks, tobacco, and other luxury products in addition to playing a large role in banking and finance. Therefore, rather than looking at grain markets, we explore a more general measure of market integration based on market access.

Studying market access has a long tradition in economic geography and trade with one of the first modern studies done by Harris (1954). The market access approach emphasizes that a region's level of economic development should be positively related to the density of development surrounding it. This harkens back to Marshall's three

centripetal forces that lead to increasing returns and, as a result, urban agglomeration: (1) forward and backwards linkages, (2) thick markets, and (3) knowledge spillovers (Marshall, 1890; Fujita et al., 2001). The concept of market access plays a large role in a growing literature that focuses on the welfare effects of extending transportation networks (see, e.g., Eaton and Kortum, 2002; Donaldson and Hornbeck, 2016; Storeygard, 2016; Donaldson, 2016).

Our measure of market access is calculated in a manner very similar to our calculation of Jewish network access in Eq. (2). However, instead of weighting the index by an indicator variable for the presence of a Jewish community, we weight by the populations of all surrounding cities. We calculate market access for city j as $MA_{jt} = \sum_{i \neq j} N_{it} \tau_{ji}^{-\sigma}$, where N_{it} is simply the time-varying measure of city i 's population from the Bairoch dataset.³¹ As in Eq. (2), τ is the cost of taking the least cost path between city j and i and σ is a trade elasticity.³²

There are two ways that market access could differentially impact the growth of cities with Jewish communities. First, density of potential economic activity could be higher in areas surrounding Jewish communities than for other cities. This could occur for reasons having nothing to do with Jewish presence, but nonetheless, cities that happen to have a Jewish community might benefit from it. We say this source of growth stems from Jews benefiting from the extensive margin of market access. Alternatively, there could be something about Jewish communities that makes them, intrinsically, better able to take advantage of market potential, regardless of the level of market access. We say this sort of growth stems from cities with Jewish communities benefiting from the intensive margin of market access.

In Fig. 6 we plot the average value for market access for cities with and without Jewish communities. Two facts are made clear from this figure. First, there is no difference in average market access between cities with Jewish communities and those without for the entire period. If anything, cities without Jewish communities experienced greater market density before 1600. This suggests that a growth advantage on the extensive market access margin cannot explain the Jewish city growth advantage we identify. The second fact evident from Fig. 6 is the increasing value of market access for all cities. This opens the possibility that the Jewish city growth advantage after 1600 may have stemmed from their ability to better take advantage of this growth in market density.

We test this possibility in Columns (9) and (10) of Table 5 by interacting the Jewish Community indicator variable with our measure of market access. Two interesting results emerge from these regressions. First, the direct effect of market access on all cities, regardless of whether they had a Jewish population, was large throughout the sample period. The estimate of about 2 is stable across both the OLS and IV regressions and suggests a one standard deviation increase in market access led to about a 136% increase in population relative to cities with no increase in market access. The second fact made clear by regressions (9) and (10) is that cities with Jewish communities differentially benefited from increases in market access. In other words, cities with Jewish populations benefited from market access on the intensive margin.

To facilitate interpretation of the magnitude of the effects of market access on cities with Jewish communities, we plot the partial derivative with respect to Jewish Community of the estimated equation in Column (9) along with its 95% confidence interval in Fig. 7. We also indicate in Fig. 7 the median value of market access for Jewish communities in 1400, 1600, 1750, and 1850 using vertical lines.³³ According to these estimates, market access in 1400 accounts for

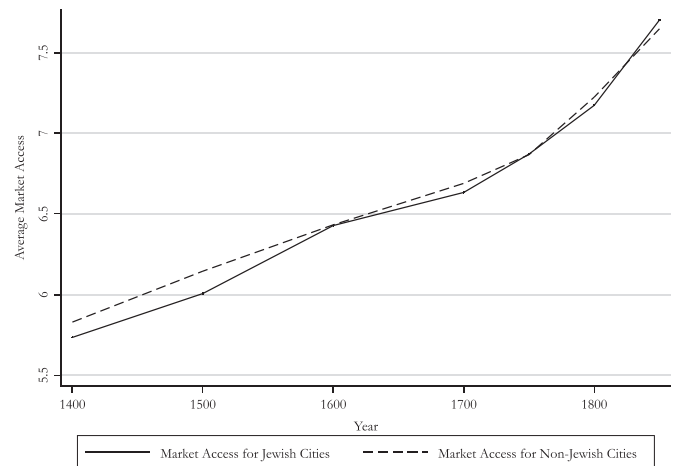


Fig. 6. Average market access for cities with Jewish communities and cities without Jewish communities.

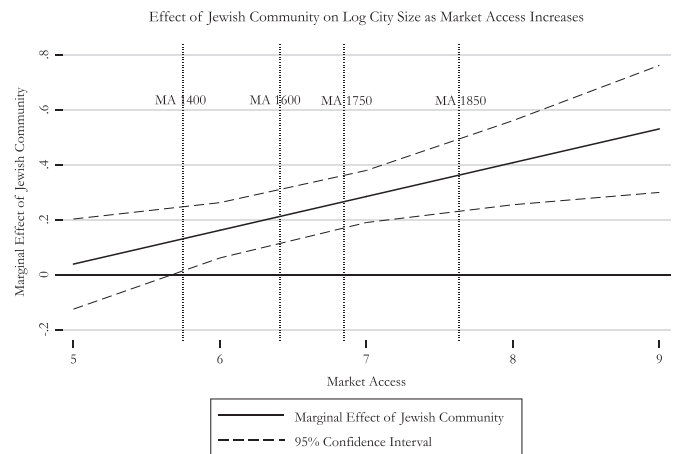


Fig. 7. The effect of a Jewish community on city size as market access increases. The vertical lines indicate the median value of market access for cities with Jewish residents in 1400, 1600, 1750, and 1850 respectively.

between 0 and 20% of the estimated growth advantage of cities with Jewish communities. As market access increases over time, this estimate rises until in 1850 it explains between 20% and 50% of the advantage with a point estimate of just under 40%. Considering that our preferred specifications from Table 4 suggest a growth advantage for cities with Jewish communities in 1850 of between 55% and 75%, these estimates for the role played by market access seem reasonable and important.³⁴

These findings are consistent with the argument made by numerous historians that Jewish trading and finance networks help to knit together the European economy, particularly in the period 1650–1800 (Israel, 1985). Israel, for example, notes that the importance of Jewish merchants and trade lay not in ‘any important innovations’ or in a particularly distinctive capitalistic outlook as Sombart maintained: ‘the techniques of Jews commerce and finance differed not a jot from other commerce and finance’ (Israel, 1985, p. 222). Rather, the

³¹ Consistent with our discussion of the Jewish network variable in Section 4 we set $\sigma = 1$.

³² We use the natural log of market access in our regressions in Table 5.

³³ Median market access is virtually identical to average market access in this sample.

³⁴ We present a similar table illustrating the magnitude of the market access effects using the IV estimates in Column 10 in Appendix 6. The IV results have a similar interpretation as the OLS results.

distinctive and important characteristic of Jewish merchants was their access to a wide network of merchants and financiers.³⁵ Examining the letters of two Sephardic Jewish merchants from Livorno, *Trivellato (2009)* found of the nearly 14,000 letters exchanged, a considerable proportion involved Amsterdam, London, Aleppo, Marseilles, and Lisbon as well as Venice, Genoa, and Florence (*Trivellato, 2009, pp. 195–196*). Our analysis substantiates this qualitative evidence: Jewish merchants had access to a commercial network that extended beyond Europe and allowed them to transport information and resources across long distances.

Both the emancipation and the market access mechanisms are consistent with an increase in the economic importance of European Jewish communities after 1600. Europe's Jews did not play an important role in invention or innovation during the Industrial Revolution. *Bairoch et al. (1999)* observed that during the Industrial Revolution era: 'the share of the Jews contributing to technological innovations is lower than their share in the total population ... not only were there few Jews among the innovators of technology nor were they outstanding in their accomplishments' (*Bairoch et al., 1999, pp. 132–133*).³⁶ But Jewish traders and financiers played an important role in the expansion of markets and trade that ensured that economic growth would diffuse from England to the rest of Europe in the 19th century. This is evident both in the rise of great banking families such as the Rothschild family and in smaller-scale and more representative role played by Jews in the expansion of the retail trade in mid-19th century Germany (see *Ferguson, 1998; Richarz, 1975; Schofer, 1981; van Radden, 2008*).

6. Conclusion

This paper studies the relationship between the presence of a Jewish community in a city and that city's population growth in pre-industrial Europe. We find cities with Jewish communities grew faster in the preindustrial period by between 30% and 50% in our preferred specifications. We develop an IV strategy based on modeling the spatial network of Jewish communities. These IV estimates suggest that the presence of a Jewish community indeed had a causal impact on city growth.

Our analysis of a flexible specification suggests that the Jewish city growth advantage is driven by the post-1600 period. There is no robust evidence for an impact of a Jewish community on city growth in the late middle ages. This is inconsistent with a simple human capital story. Jews had higher human capital than their Christian counterparts throughout the middle ages but this did not result in notably faster economic growth. One reason for this was that, in the middle ages, these skills were exploited by political elites who, for example, often licensed and taxed Jewish moneylending (*Koyama, 2010*). The net effect was that the presence of a Jewish community did not translate into economic growth—at least as measured by city growth—in the medieval period.

This story changed in the post-1600 period. After this date we do find a growth effect associated with the presence of a Jewish community. In investigating potential channels linking the presence of a

³⁵ For instance: 'The key factor which imparted a certain import to the post-1570 Jewish role' Israel writes 'was the simultaneous penetration during the sixteenth century of both Ashkenazi and Sephardi Jews, as well as of the Marranos living in Portugal and the Portuguese empire, into maritime and overland long-distance transit trades linking the Levant to Italy, Poland with the Levant, Poland with Germany, and Portugal and the Portuguese empire with northern Europe ... This entrenched position in so many crucial but distant markets proved a factor of great potency' (*Israel, 1985, pp. 222–223*).

³⁶ *Bairoch et al. (1999)* studied several sources including the *Biographical Dictionary of the History of Technology and The Timetables of Technology*. In the former he was able to identify 57 out of 2160 or 2.6% of inventors with Jewish names and in the latter he could only find 11 (1.2%) certainly Jewish and 40 (4.4%) possibly Jewish inventors. For a discussion of why Jews did not play an important role in the First Industrial Revolution see *Rubinstein (1999)*.

Jewish community to city growth, we find indirect evidence that this effect was associated with Jewish merchant networks and with Jewish emancipation. This result provides support for the accounts of historians who have emphasized the important role played by Jewish traders in 17th and 18th century Europe (such as *Fortune, 1984; Israel, 1985; Trivellato, 2009*). Furthermore, our story is consistent with an institutional account (e.g., *Acemoglu and Robinson, 2012*). In the middle ages, the presence of Jewish communities was part of an institutional arrangement that extracted rents from society and distributed these among members of the ruling elite. The eradication of these rent-seeking arrangements and the liberalization of Jewish economic activity first in the Netherlands and England, and then in the rest of Europe following Jewish Emancipation was of critical importance as it is in those cities that possessed emancipated Jewish communities that we observe the strongest relationship between the presence of Jews and economic growth.

Acknowledgments

We would like to thank Eric Chaney, Philip Hoffman, Larry Iannaccone, Garrett Jones, Remi Jedwab, Réka Juhász, Andrea Matranga, Nathan Nunn, Santiago Perez, Maria Petrova, Claudia Rei, Roberta Romano, Jared Rubin, Mohamed Saleh, Nikolaus Wolf, Thilo Huning, and Melanie Meng Xue for giving us comments. We also benefited from the comments of seminar audience members at Chapman University (2016), American University (2016), Humboldt University, (2016) the Fall 2015 Washington Area Development and Economic History Workshop, the Role of History in Understanding Development Conference, NES (Moscow), the 2015 Social Science History Association Meeting (Baltimore), the IOEA Summer Institute (2016), EHA (Boulder), and the participants at the Johnson & Koyama Book Manuscript Conference sponsored by the Mercatus Center (2016). All remaining mistakes are the fault of the Authors. We gratefully acknowledge the support of the Mercatus Center and Joy Suh at the GMU Data Services Center. We thank Jordan Bazak, Michael Spizindor Watson, Megan Teague, Trey Dudley, Zhilong Ge, and Jessi Troyan for research assistance.

Appendix A. Supplementary data

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.jdeveco.2016.09.002>.

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