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Abstract

The paper aims to analyze the effects of plague on the long-term development of Italian cities, with particular attention to the 1629-30 epidemic. By using a new dataset on plague mortality rates in 49 cities covering the period 1575-1700 ca., an economic geography model verifying the existence of multiple equilibria is estimated. It is found that cities severely affected by the 1629-30 plague were permanently displaced to a lower growth path. It is also found that plague caused a long-lasting damage to the size of Italian urban populations and to urbanization rates. These findings support the hypothesis that seventeenth-century plagues played a fundamental role in triggering the process of relative decline of the Italian economies.

JEL classification: N300, N330, N930, D310

Keywords: Plague, Italian cities, Urban development, Urban demography, Multiple equilibria, Early modern period, Mortality crises, Urbanization, Italy.

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1. Introduction

How did pre-industrial economies react to extreme mortality crises like those caused by severe epidemics of plague? Were health shocks of this kind able to shape long-term development patterns? While past research focused on a very limited number of exceptionally severe shocks, like the Black Death (for example, Álvarez Nogal and Prados de la Escosura 2013; Clark 2007; Voigtländer and Voth, 2013), this paper analyzes the consequences of what was by far the worst mortality crisis affecting Italy during the Early Modern period: the 1629-30 plague. For this later shock much more data is available than for the Black Death, allowing us to study its impact on the development pattern of a large sample of Italian cities.

The consequences for the Italian economies of the 1629-30 plague are a long-debated issue. Some literature has argued in favor of a positive impact of the contraction in population as this would have implied a reduction in labour supply and hence an increase in wage with a consequent increase in living standards and long-term growth (Malanima 2002; Malanima and Capasso, 2007). Recently, however, a re-evaluation of its demographic characteristics has led scholars to formulate the hypothesis that this plague was the source of the relative decline of seventeenth-century Italy (Alfani 2013a). In this paper we take a different approach, arguing that plague caused a productivity shock, worsening the trajectory of development of Italian cities. In this way, we add to previous studies empirical evidence on the hypothesis of the lasting negative effect of the plague.

Specifically, after assembling a new database of mortality rates in a sample of cities covering the three worst plagues affecting Italy in the early modern period (1575-77, 1629-30, and 1656-57), we estimate a model of population growth allowing for different regimes of growth. We find that cities affected by the 1629-30 plague sustained a persistent, long-term effect (i.e., up to 1800) on the pattern of population growth. We also find that in northern Italian regions, the plague caused a lasting decline in both size of urban population and urbanization rates. These suggestive findings are interpreted as evidence of the hypothesis that plague waves may potentially be considered determinants of the decline of economic regions or whole countries.

2. Plague waves in Early Modern Italy: an overview

During the first two centuries of the Early Modern period, Europe was still badly affected by plague. In the sixteenth century, frequent plague waves of varying intensity repeatedly struck all corners of the continent, focusing however on cities and highly urbanized areas. In the seventeenth century, endemic plague progressively disappeared from Western Europe. For example in England, the last epidemic to strike London dates to 1665-66 (ending with the famous Great Fire), although isolated cases are recorded in the city until at least 1679 (Slack 1985, 68-9). In the Low Countries, the last plague affecting Amsterdam occurred in 1663-64 (Van Bath 1965; Rommes 2015; Curtis 2016). In France, the last plague wave began a few years later, in 1668, spreading to the northern parts of the country (Biraben 1975). In central Europe plague lingered longer, until at least 1679, the date of the so-called 'Great Plague' of Vienna.[1]

It has recently been suggested that during the seventeenth century southern Europe, and especially Italy, was affected by plague much more severely than the northern part of the continent. This would be on account of higher mortality rates in the cities, and more importantly, of a greater capacity of plague to affect rural areas as well as cities. In its turn, the damage done to the rural areas would also curb the potential for recovery of the cities, by destroying the demographic surplus traditionally produced in the countryside which, in normal conditions, was continuously transferred to the cities (Alfani 2013a). This characteristic of seventeenth century Italian plagues would differentiate them both from those affecting Europe in the same century, and from those affecting Italy in the sixteenth century (Alfani 2010a).

On the whole, sixteenth century Italy was affected relatively lightly by plague (Alfani 2013b). Even the worst epidemic, in 1575-77, was mostly restricted to cities and spread to a much more limited part of the Peninsula than the great seventeenth-century plague waves. This is also the first plague that can be studied systematically, due to the presence of particularly abundant documentation as well as of a considerable amount of specific research. During the seventeenth century, one interesting characteristic of Italian plagues is

[1] A recent overview of seventeenth-century European plagues, including a discussion of the factors which could have led to the disappearance of endemic plague from the continent, is provided by Alfani (2013b).

that they never overlapped – in fact, we cannot mention any single community in the whole of the Peninsula affected more than once by a plague epidemic throughout the century[2]. Moreover, in that period the number of plague waves affecting Italy is limited to two main ones, in 1629-30 and 1656-57, and a regional plague affecting only Sicily in 1624 (Alfani 2010a; 2013a; Del Panta 1980). Figure 1 details the territorial coverage of the four plague waves mentioned. During the seventeenth century the cities included in the figure were affected by the plague exactly once, and could in addition have been affected by the 1575-77 wave. This is important for our study as a possible confounding factor considered by our analysis is the interaction between the two waves.

[2] The situation was very different in northern Europe, where, for example, London was affected by four serious plague epidemics during the seventeenth century and Amsterdam by six (Alfani 2013a).

Figure 1: Territorial coverage of the main Italian plagues of the Early Modern period

A brief description of each of the three plague waves relevant to this article is necessary.

1575-77: although this was the most severe plague affecting Italy during the sixteenth century, its territorial coverage was limited compared to the later plague waves. It entered the Peninsula from central Europe and the first Italian city to be affected was Trento, where the disease was present from September 1574. During the spring of 1575 the plague started to spread to much of Veneto, affecting all of the main cities of the Venetian Republic such as Venice, Padua, Verona and Vicenza. Later it infected a large part of Lombardy and Emilia but failed to cover the whole of the North and to spread to central and southern Italy, even though the epidemic lasted until 1577 and lingered still longer in certain areas (the last city affected, Genoa, was struck in 1579). In the same period, Sicily in southern Italy was also infected, but this was probably an independent plague epidemic which seemingly had reached the island onboard a pirate ship returning from northern Africa (Alfani 2013b, 89-93; Del Panta 1980). The 1575-77 plague wave showed a markedly urban character as most rural communities were spared, including those placed in the territories of infected cities (Alfani 2010a; 2013b, 92-3).

1629-30: this was the most serious seventeenth-century plague wave in the whole of Europe, originating probably in northern France in 1623 and later spreading to England, the Low Countries, Germany, France, and Switzerland (Duncan and Scott 2001; Eckert 1996; Alfani 2013a). By 1628-29, northern Italy was besieged as all the territories just beyond the Alps were infected. The wartime conditions meant that any preventive measures put in place by the wary Italian states were ineffective: in October 1629, French and Spanish troops crossed the Alps to the West and North respectively, to participate in the War of the Mantuan Succession (1627-31). Winter temporarily arrested the spread of the disease, but when spring 1630 came, the plague advanced quickly, covering all of the North save for Liguria and parts of Friuli and Piedmont (Alfani 2013a; Del Panta 1980). All major cities in the area were affected, as well as most rural communities. According to a recent estimate, excluding Liguria a northern Italian city had just a 5% probability of being spared, while a rural community had a slightly higher chance, 7% (Alfani 2013a). What is more, mortality

rates during this epidemic were particularly high, so that it can be estimated that overall 30-35 per cent of the northern Italian population died, amounting to about two million victims (Alfani 2013a). In 1630-31 the epidemic affected also Tuscany in central Italy, although much less severely. From Lombardy, then under Spanish rule, plague spread by sea to Catalonia.

The 1629-30 plague wave is certainly the most deadly of the early modern period and changed the structure and development pattern of many Italian cities. Barbot and Percoco (2013) first made an attempt to study the effect of the plague on the composition of neighborhoods and on spatial segregation in Milan through the analysis of housing rental contracts and found that the relavance of social interactions in the city began in the aftermath of the health shock.

1656-57: if in 1630 Spain had been infected by sea from Italy, about 25 years later the contrary happened. Plague had been afflicting Andalusia, the Balearic archipelago and the rest of the Spanish Mediterranean since 1647[3] (Perez Moreda 1988). In 1652 it reached Sardinia, ravaging the island for some years. Only in 1656 did it manage to cross to mainland Italy, infecting Naples and later spreading to the rest of the South, with the exception of Sicily and parts of Calabria and Apulia. To the North, the disease reached Rome a couple of months after infecting Naples and also spread to most of central Italy, sparing however the Granduchy of Tuscany, which had been struck by the previous wave (Fusco 2007; Del Panta 1980). It also spread by sea to Liguria, affecting precisely the areas that had been spared by the 1629-30 epidemic (Alfani 2013a). The available estimates of overall mortality in the Kingdom of Naples are in the 30-43 per cent range (Fusco 2009), corresponding to 0.87-1.25 million victims (Alfani 2013a).

3. Database

This article makes use of a new database of plague mortality rates for the whole of Italy in the period from 1575 to 1700, thus covering all the major plague waves mentioned in the earlier section. The final and complete version of the database is used here for the first time

[3] Ending in 1654, this was the worst plague to strike Iberia during the seventeenth century.

and includes information about 49 Italian cities, including all the main ones. This is by far the largest and most complete collection of plague mortality rates existing for Early Modern Italy. Earlier studies of the impact of plague in the same period analyzed increases in burials (for ex. Alfani 2013a), but for our purposes mortality rates (i.e. the share of a population dying during a specific event) are more suitable. They present the additional advantage of being available also for the sixteenth century, while in most instances data on burials is not available before the *Rituale Romanum* of 1613 which compelled all Catholic parishes to keep the so-called "Books of burials".

The information we use comes from a combination of sources, including state sources, chronicles, and micro-demographic reconstructions. For reasons of space, it is impossible to list here all the original material and the publications of reference. Moreover multiple estimates are available for many cities. All existing estimates have been collected and compared; for the purpose of this article, only the most reliable have been retained. Precedence has been given to estimates resulting (in this order, when applicable): 1. from micro-demographic reconstructions; 2. from information about both the pre-plague population and the number of plague victims; 3. from detailed local studies produced by historical demographers or social-economic historians; 4. from documentation produced by health boards or by other city- or state-level authorities; 5. from chronicles. Additional information present in the database includes the geographic position of each city, the State to which it belonged, its institutional status, and the size of its population at different points in time.

Figure 1 details the geographic position of all cities included in the database, and also provides information about which ones were affected by each plague wave. Table 1 charters descriptive statistics about local mortality rates during the three main plague waves.

Table 1. Urban mortality rates during the Early Modern plagues

Plague wave	N. of cities	Median mortality (per thousand)	Mean mortality (per thousand)	Standard deviation (per thousand)	Max mortality (per thousand)	Min mortality (per thousand)
1575-77 (without South*)	11	220	242	110	444 (Brescia)	79 (Vicenza)
1629-30	32	380	359	177	722*** (Mantua)	15 (Pistoia)
1629-30 (without Tuscany**)	26	400	388	165	722*** (Mantua)	80 (Ivrea)
1656-57	16	476	414	197	783 (Bari)	51 (Melfi)

Notes: * The only southern Italian city included in the database which was affected by plague in the period is Palermo (40 per thousand mortality rate). It has not been included in the table as probably the Sicilian epidemic was totally independent from the one affecting the North.
** For reasons not entirely clear yet, Tuscany was affected in an exceptionally light way by this plague wave. See Alfani 2013a for a discussion.
*** The very high mortality rate experienced by Mantua incorporates the victims of the siege suffered by the city during the plague. Excluding Mantua, the maximum mortality would be that experienced by Verona (615 per thousand).

The data presented in table 1 clearly shows a marked difference in mean and median urban mortality rates between the 1575-77 and both the 1629-30 and 1656-57 plague waves. This difference has already been described in recent publications, which also pointed out that an even more significant difference is to be found in overall mortality across large areas, given the inability of the 1575-77 epidemic to spread pervasively to the rural areas (Alfani 2010a). The urban mortality rates of the 1629-30 and 1656-57 plagues are exceptional also when compared to contemporary plagues in other parts of Europe. For example, in the Low Countries, even the 1664 plague epidemic, the worst affecting Amsterdam during the seventeenth century, killed no more than 120-160 per thousand of the urban population (Van Bath 1965). Higher plague mortality rates were experienced by other Dutch cities, like Leiden in 1635 (265 per thousand although a high estimate has it at 360 per thousand: Rommes 2015, 61), but nowhere in northern Europe were mortality rates in the 400-500 per thousand range to be found. Even in the worst cases, mortality was well below the median

values characterizing the Italian plague waves. Of course, there was much variability across the Peninsula: the fairly high standard deviations of mortality found for all three plague waves are consistent with what we know from the general literature on plague. This reflects a number of factors such as the varying ability of health institutions to manage the epidemic, the different period of the year when the disease reached each city, and so on (Del Panta 2007; Fusco 2007; Alfani and Cohn 2007;Alfani 2013a).

4. The economic consequences of the last Italian plagues: open questions

Plague has recently started to recover a popularity which it had long lost, especially among economic historians. The Black Death pandemic of the fourteenth century has been singled out as a possible factor favoring Europe over the main Asian economies, particularly India and China. According to Pamuk (2007), the Black Death was a powerful exogenous shock capable of leading to a long-lasting increase in wages throughout Europe and triggering institutional innovation, and consequently would lie at the root of the so-called "Great Divergence" between Western Europe and Asia. The positive impact of the Black Death on European institutions and economic structures had earlier been underlined by scholars like Herlihy (1997) and Epstein (2000). The latter described the Black Death as an agent of "creative destruction" capable of moving the European economies to a higher growth path. Recently, Voigtländer and Voth (2013) showed, by means of a two-sector Malthusian model, how the demographic shock caused by the Black Death could have triggered a transition to a new steady state characterized by higher per-capita income. Crucial to this was not only the massive size of the population loss caused by the Black Death, but also the way in which it favoured, indirectly and in association with other factors like the frequent wars, the establishment in Europe of a demographic regime characterized by particularly high mortality. The latter point had also been made by Clark, who underlined the positive impact on European living standards of the new mortality regime shaped by the Black Death and the subsequent plague waves (Clark 2007, 99-102). Related to this, Malanima (2012) focused on the way in which the Black Death altered the functional distribution of income, favouring labour (albeit some words of caution on this matter come from Cohn, 2007). Recent studies about pre- and post-plague concentration of wealth confirmed the

positive distributive consequences of the Black Death, which triggered a phase of significant decline in economic inequality (Alfani 2015; Alfani and Ammannati 2016).[4]

If the Black Death has attracted a significant amount of recent research, the same is not true for the subsequent plague waves. Scholars have generally tended to consider late Medieval and Early Modern plagues as a kind of prolongation of the Black Death, with the capacity to ensuring the long-lasting impact of the initial shock but seemingly not deserving of any individual attention. Another general and quite widespread implication is that late Medieval and Early Modern plagues were, like the Black Death, ultimately beneficial to the economies, as they allowed for an increase in per-capita resources and higher wages – although we now know that in specific settings, like Spain or Egypt, *even the Black Death* had negative, and not positive, consequences in the long run (Álvarez Nogal and Prados de la Escosura 2013; Borsch 2015; Alfani and Murphy 2017). Finally, late Medieval and Early Modern plague has long been considered a kind of "great equalizer", striking now one area of Europe now another, but in the medium to long run affecting similarly all corners of the continent; this implication also seems to come from a bold generalization based on the research conducted on the Black Death.

A recent comparative study of plague across seventeenth century Europe has argued that in that period, the disease affected the continent very unevenly. Italy in particular was struck very badly, with the loss of 30-35 per cent of the total population in the North and 30-43 per cent in the South (Kingdom of Naples), while in northwestern Europe plague intensity can be estimated to be in the 8-10 per cent range in England, in the 11-14 per cent range in France, and in the 15-25 per cent range in the Dutch Republic (Alfani 2013a, 4, but also see the recent synthesis in Alfani and Murphy 2017). The damage done by the Italian plagues was also very concentrated in time (one wave per area, see earlier sections) while elsewhere in Europe it amounted to the combined effect of many plague waves striking repeatedly the same area throughout the century. It has been argued that seventeenth-century plague had a displacement effect on the Italian economies, moving them not to a higher long-term growth path, as is generally believed was the case for the Black Death, but to a lower one (Alfani 2013a, 16-20). This view contrasts with earlier literature on the economic impact of

[4] About the distributive impact of 1629-30 plague, see Alfani 2010c.

plague in Italy. Malanima, in particular, argued that even the seventeenth-century epidemics were beneficial in the medium-long term, as they improved the standards of living of the survivors (Malanima 2002, 345; Malanima and Capasso 2007).

In this paper we contend the hypothesis that the plague was beneficial for the Italian economies, and specifically for the urban economies, on the basis of a very intuitive argument. Let us assume that we can evaluate the living standards in an economy on the basis of observed remuneration , that is it is possible to describe the economy solely on the basis of its labour market, as in figure 2.

Figure 2: The effect of the plague on labor supply

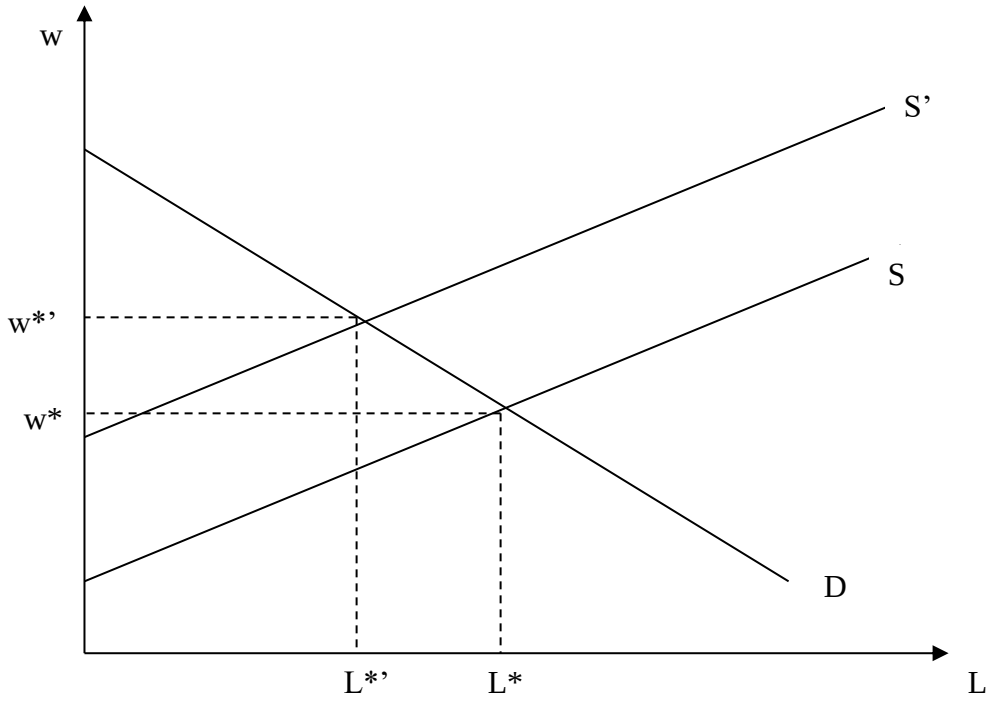
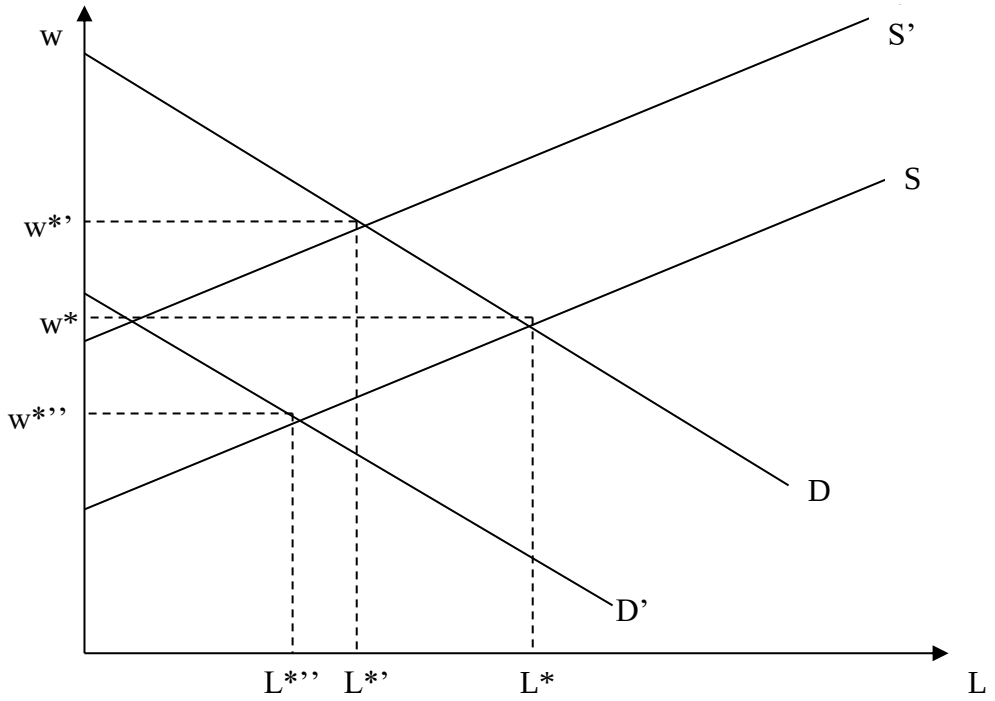


Figure 3: The combined effect of the plague on labor supply and productivity



The basic argument proposed by Malanima and Capasso (2007) is that the plague is a shock in the labour supply which, as a result of mortality, contracts from S to S', increasing the wage of survivors from w* to w*'. This line of reasoning, however, relies on the assumption that there is no change in productivity. To see the relevance of this assumption, let us consider figure 3 in which a shock in labour productivity shifts labour demand from D to D'. In this case, there is no reason to assume *ex ante* that the plague has a positive impact on wages, since its net impact will depend on the size of the labour supply shock relative to the productivity shock.

But why should the plague have had an impact on labour productivity? The reasons for this hypothesis are manifold and rely on the extensive and lasting demographic and economic effects of extreme health shocks. Possibly the most important factor is the damage done by the plague to the stock of human capital existing in northern Italy. As recently argued by Alfani (2013a), mortality rates in the order of 300-500 per thousand indicated that the disease was no longer a "plague of the poor" as had been the case for earlier epidemics since at least the fifteenth century, but had become a universal killer (see Alfani 2013b,

Alfani and Cohn 2007 and Cohn 2010 for an overview of the way in which the characteristics of the disease changed from the Middle Ages to the Early Modern period). This determined a shortage of skilled work available for the sophisticated manufactories which were the backbone of the northern Italian urban economies of the early seventeenth century. Already at the time of the 1575-77 plague, urban governments had some trouble in recovering the lost human capital, namely by means of measures favouring the immigration of skilled workers - even against the will of the local guilds, like in Venice (Preto 1978, 117-18; Alfani 2013b, 107-9). This could be done, however, since other important Italian manufacturing cities were spared and the existing human capital could be re-distributed over a larger area. What is more, the fact that rural areas were generally not affected by this plague wave ensured that unskilled labour was abundant and ready to move in to fill the gaps opened in the cities. This resulted in a widening gap differential in the wages paid to skilled and unskilled labour (Pullan 1964, 416-17). However, the great plague of 1629-30 had very different consequences, due to the fact that 1. it affected *all* the major manufacturing cities of central-northern Italy; 2. it affected rural areas as badly as the cities. Therefore, the skilled workers they needed were not lured to one given city, as all the cities offered the same incentive, and even the traditional, steady immigration of unskilled labour from rural areas was interrupted, for a time at least.

In his classic study of the consequences of plague on the Venetian labour market, Pullan holds that the 1629-30 epidemic "had created labour shortages crippling to industry" (Pullan 1964, 422). Studies related to other cities suggest that the same was happening elsewhere, for example in Cremona (Andreozzi 2010; Mocarelli 2008), while the available data on urban productions (especially textiles) show that the plague was able to displace the production trend to a decidedly lower path (Alfani 2013a, 18-19). Some studies suggest that larger cities, and in particular capital cities, might have been a little quicker to recover but this was to the detriment of the smaller cities, from which they lured away not only the surviving skilled workers but also members of the merchant elite. Seemingly, this was the case of Milan whose recovery hindered that of places like Como, Cremona and Bergamo (Moioli 1999, 49; D'Amico 2001, 700).

Mass destruction of human capital can determine, per se, a serious productivity shock. However, in the historical context of early seventeenth century Italy, it came to be associated with other factors detrimental to productivity. The 1629-30 plague affected the economies of the Peninsula at the worst possible moment, that is when their manufactories were dealing with increasing competition from northern European competitors. As already mentioned, this event was very unlike the Black Death as it affected specific areas of the continent much more severely than others (many of which were entirely spared); this is why it could have had a general displacement effect (Alfani 2013a). From the specific point of view of the cities, the plague favoured two processes detrimental to the urban economies: the transfer of capital from the manufactories to investment in land, which seemed to offer better opportunities and safer revenues; and the transfer of part of the production from the cities to rural areas, where they were also able to escape the rigidities of the guild system. We will discuss these developments later. What needs to be pointed out now, is that both processes tended to reduce the availability of capital for the urban manufactories - the other factor which could have caused a serious negative shock to productivity.

Having clarified some of the reasons why plague could have proved detrimental to the economy, this article will now contribute to the ongoing debate about the actual consequences of severe epidemics, by providing a novel empirical test of whether plague was able to displace the Italian urban economies, and whether displacement led to a higher or a lower growth path. The focus will be placed especially on the 1629-30 epidemic, the worst to affect the richer part of the Italian Peninsula. Changes in city size will be used as an indicator of economic growth (or decline) over the long run, as is common procedure in the on historical urban economics literature (Bosker et al., 2008; Percoco, 2013a; 2013b). It should be mentioned that in this paper we cannot directly identify the effect of the plague on labour productivity. However, we offer evidence through a reduced-form model highlighting the (causal) effect of the plague on long run urban development.

5. Methodology

In previous sections we set out our hypothesis that the plague of 1630 had significant and persistent effects on relative city size growth. In this section, we present our methodological approach by building on the seminal paper by Davis and Weinstein (2002), further applied by Brakman et al. (2004) who based their analysis on a new economic geography framework in which if a shock is small, then the economy recovers to the initial stable equilibrium. If the shock is large enough, then the economy converges to a new equilibrium.

Let us consider a process of relative city size growth in the form:

(1) $$s_{it} = \Omega_i + \varepsilon_{it}$$

And

(2) $$\varepsilon_{it+1} = \rho\varepsilon_{it} + \upsilon_{it+1}$$

Where s_{it} is relative size of city i at time t, i.e. it is the ratio between city population and total Italian population. Ω_i is a long run equilibrium around which city size oscillates given an error structure given by equation (2) and an iid error term υ_{it+1}. Parameter in equation (2) satisfies the condition $0 \le \rho \le 1$.

By combining equations (1) and (2) and by considering differences, we have the following equation:

(3) $$g_{it+1} = (\rho - 1)\upsilon_{it} + \left[\upsilon_{it+1} + \rho(\rho - 1)\varepsilon_{it}\right]$$

Where $g_{it+1} = s_{it+1} - s_{it}$. In equation (3), if $\rho = 1$, then g_{it+1} follows a random walk as it reduces to $g_{it+1} = \upsilon_{it+1}$; while if $0 < \rho < 1$, then a shock has a persistent effect of the growth rate of relative city size.

It is difficult to identify a shock υ_{it+1}, hence we make the assumption that $\upsilon_{it+1} = g_{it}$, that is our specification to be estimated is:

(4) $$g_{i1650–1700} = \alpha + \beta g_{i1600–1650} + controls_i + \varepsilon_i$$

Where the dependent variable is the growth rate in relative size of city *i* between 1650 and 1700, whereas $g_{i1600\text{-}1650}$ is the growth between 1600 and 1650, in a period comprising the effect of the 1630 plague. In equation (4) we also include control variables, such as if city *i* is a capital city or not and dummies for geographical macro-areas (North, Center and South).

The parameter of our interest is β which is equal to $\rho - 1$ in equation (3). Hence, if $\beta = 0$ the growth rate over the period 1650-1700 follows a random walk as $\rho = 1$ (other things being equal, that is after controlling for other factors); if $\beta = -1$, then the shock over the period 1600-1650 is completely undone in the period 1650-1700. Finally, if $-1 < \beta < 0$ the shock has a permanent effect on city growth. It should be noted that having an estimated parameter equal to $-1 < \beta < 0$ does not imply that cities affected by the plague will not recover population, but rather that it will require a considerable amount of time to recover from the shock in terms of relative city size. In particular, an estimated $-1 < \beta < 0$ implies $0 < \rho < 1$ so that the economy recovers from the shock only to a certain extent in each period.

In order to identify the shock imposed by the plague in 1630, we need to estimate equation (4) by means of an instrumental variable procedure. This is because $g_{i1600\text{-}1650}$ is a noisy proxy for the shock imposed by the 1630 plague.

To this end, we propose the use of the logarithm of mortality rate for the plague in 1630 as an instrument to identify parameter β. The instrument, in our case, is meant to eliminate the measurement error from $g_{i1600\text{-}1650}$ since this is a noisy measure of the shock induced by the plague.

For the aims of this article, we focused on the cities for which acceptable estimates of the population size at 50-year intervals since at least 1600 were available or could be produced. The resulting sample consists of 35 cities across the Italian Peninsula.

Finally, it should be noted that regression (4) is estimated in differences, so that city-specific time invariant fixed effects are ruled out. The use of control variables serves in our case to control for remaining eventual heterogeneity across regions.

6. Results

The methodology presented in the previous section postulates the estimation of a system of equations estimated via the Instrumental Variable estimator.

Table 2 documents estimates of several specifications of the first stage regression in which the dependent variable is the cumulative growth rate of relative city size. Our instrument to predict exogenously such growth rate is the mortality rate in the cities caused by the 1630 plague. Importantly enough, our variable of interest is always significant across specifications with a point estimate of the elasticity of about -0.03. Furthermore, in model 2 and 3 we control also for the status of capital city (with a moderately significant and positive coefficient) and for the geographical macro-area in which the city is located. In model 3 we control also for the plague in 1575 (as a dummy variable) and find no significant effect. Further to be noted is the fact that the coefficient for the South is not significantly different from zero, indicating that the South did not experience differential negative growth across the period. This is consistent with our hypotheses, as the area was not affected by the 1630 plague.

Table 2: First stage regressions (Dependent variable is relative city size growth 1600-1650)

	(1) Growth 1600-1650	(2) Growth 1600-1650	(3) Growth 1600-1650
Log mortality rate of 1630 plague	-0.035***	-0.023***	-0.025***
	(-5.480)	(-3.036)	(-2.967)
Capital city		0.172*	0.186*
		(1.745)	(1.760)
Center		-0.185**	-0.119
		(-2.090)	(-0.931)
South		-0.001	0.012
		(-0.00815)	(0.143)
Plague 1575			-0.118
			(-1.086)
Constant	0.066*	0.092	0.086
	(1.765)	(1.167)	(1.026)
Observations	35	35	35
R-squared	0.338	0.454	0.479

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In table 3 we report estimates of second stage regressions. Model 1 reports a coefficient associated to cumulative growth over the period 1600-1650 equal to -0.868, indicating, according to the model presented in the previous section, that the plague of 1630 had a permanent effect as the estimated coefficient is negative. The coefficient maintains its sign and significance also in models 2 and 3, although with smaller magnitude. Interestingly, when our dependent variable is cumulative growth over the periods 1650-1750 and 1650-1800 (models 4 and 5), the effect of the shock sustained over the period 1600-1650 loses significance. The same is true for the effect of the plague of 1575 which was found significant in model 3. What is more, in model 3, when we introduced the dummy for the 1575 plague, the magnitude and significance of the effect of the 1630 shock decreased substantially, indicating a potential interaction between the two events. Note however that the coefficient related to all demographic shocks stays negative throughout the models. Interestingly, the coefficients associated to South are always negative (although not always

significant), indicating a negative differential growth across the period not dependent on the 1630 plague (but possibly due to the 1656-57 plague).

Table 3: Second stage regressions (Dependent variable is relative city size growth; IV estimates)

	(1) Growth 1650-1700	(2) Growth 1650-1700	(3) Growth 1650-1700	(4) Growth 1650-1750	(5) Growth 1650-1800
Growth 1600-1650	-0.868***	-0.571***	-0.480**	-0.149	-0.037
	(-4.837)	(-2.720)	(-2.474)	(-0.552)	(-0.0874)
Capital city		0.115*	0.111*	-0.009	-0.011
		(1.700)	(1.900)	(-0.120)	(-0.0972)
Center		0.115	0.198**	0.267**	0.296*
		(1.518)	(2.437)	(2.269)	(1.860)
South		-0.166***	-0.143**	-0.061	-0.040
		(-3.024)	(-2.240)	(-0.715)	(-0.351)
Plague 1575			-0.117*	-0.098	-0.143
			(-1.717)	(-1.049)	(-1.311)
Constant	-0.001	-0.089*	-0.103**	-0.157**	-0.215**
	(-0.0396)	(-1.951)	(-2.183)	(-2.441)	(-2.318)
Observations	35	35	35	35	35
R-squared	0.396	0.628	0.667	0.375	0.254

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

To give a more concrete interpretation of results, it would be useful to consider the case of Milan, where the mortality rate was 46.2% of the total population. Given an estimate of the population in 1628 of 130,000 and estimated parameters in table 2 (model 3) and 3 (model 3), the city would have recovered from the shock only after about two centuries, other things being equal (that is after controlling for other growth factors approximated by the controls in our regression). This example is also useful to clarify the meaning of "permanent effect": the recovery from the plague occurred only in the long run and in a

given period the relative size of a given city affected by the shock would have been larger had the plague not hit.

As a robustness check, in table 4 we have excluded cities in the South, because the process of decline began there well before the cities in the Centre-North. Moreover, we have divided our sample into two groups: one comprising only the cities of the Republic of Venice and one comprising all other cities, in order to account for interaction between the plague effects and the War of Candia (1645-1669), during which Venice fought against the Turks. Note that all cities belonging to the Republic of Venice were also affected by the 1575 plague. Models (1) and (2) report estimates of the model in which the dependent variable is calculated over the period 1650-1750. In this case, point estimates become significant and lay in the interval (-1, 0) across the two groups. In model (3) we have excluded cities belonging to the Sabaudian State because of the civil war raging from 1638 to 1642. Also in this case, point estimate is significant and equal to –0.2. Models (4)-(6) consider the same groups as models (1)-(3) but the time period is extended to 1650-1800. In this case, results are qualitatively confirmed, although with slightly lower coefficients for the first two groups but larger for the third one.

Table 4: The combined effect of the plague in the Republic of Venice versus other cities (IV estimates; second stage; only cities in the Center-North)

	(1) Growth 1650-1750 – Republic of Venice	(2) Growth 1650-1750 – Other cities	(3) Growth 1650-1750 – Other cities, excluding Savoy	(4) Growth 1650-1800 – Republic of Venice	(5) Growth 1650-1800 – Other cities	(6) Growth 1650-1800 – Other cities, excluding Savoy
Growth 1600-1650	-0.275**	-0.303**	-0.201**	-0.227**	-0.286***	-0.241***
	(-2.425)	(-2.331)	(2.541)	(2.254)	(-3.103)	(-4.333)
Capital city	0.012	0.039	0.012	-0.232	0.018	0.025
	(0.841)	(0.264)	(-0.137)	(-0.593)	(0.442)	(0.353)
Center		0.002			0.004	
		(0.211)			(0.240)	
Constant	-0.122	-0.030	-0.153	-0.170	-0.037	-0.050
	(-0.329)	(-0.303)	(-0.214)	(-0.514)	(-0.318)	(-0.550)
Observations	12	19	17	12	19	17
R-squared	0.236	0.215	0.219	0.216	0.224	0.212

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Finally, small sample is admittedly a problem in our econometric analysis. By using simulation results, McFadden (1999) argues that a rule of thumb for accepting with a considerable amount of confidence results from IV estimates is that the difference between the number of observations and the number of instruments should be larger than 40. In our case, it is 34 in the general case, below the threshold but not significantly below. Furthermore, McFadden (1999) demonstrates that IV is considerably more efficient than OLS even for samples much smaller than ours. This is why we believe that the advantages and novelty of our estimates outweight the cost of some possible imprecision in the estimates.

Besides the small sample properties of the IV estimator, our results seem to be robust across specifications, especially if we consider two important factors:

a) The War of Candia (in which the Republic of Venice invested huge resources: Pezzolo 2006) can be considered a potential confounding factor of the 1630 plague, however it took place mostly after the demographic shock. In other words, as the sources of mortality rates we use in the first stage are mainly *Parish books of burials* for the plague year and censuses slightly preceding the crisis, our data do not account for war deaths, hence the effect of the plague is statistically identified. A similar argument can be made for the Sabaudian civil war.
b) Furthermore, the War of Candia was fought not on the mainland of the Republic of Venice, but in the Aegean area.

As in table 4 we present models that also account for those confounding factors and as point estimates lay in the interval of interest, we can conclude that the demographic shock caused by the plague had a persisting effect on relative city size. In the next section we provide some evidence of persisting effects on the overall size of the urban population of northern Italy as well as on urbanization rates.

7. Consequences of the 1629-30 plague: urban population, urbanization rates and real wages in northern Italy and Tuscany

In the previous section, we demonstrated that the 1629-30 plague altered the relative growth paths followed by Italian cities. That analysis needs to be completed taking into account the absolute impact of the epidemic, in terms of overall urban population and urbanization rates. To this end, we made use of the database published by Malanima (2005), which, although less precise and detailed at the local level compared to the one we used until now, provides the advantage of covering the whole of Italy. A limitation of this database is that it includes only one estimate per city per century (at 1500, 1600, and so on), however we were able to calculate the size of the urban populations (cities >5,000 inhabitants) of Piedmont, Lombardy and Veneto at 1600 and 1700. These three regions roughly correspond to the three main states of seventeenth-century northern Italy, respectively, the Sabaudian State (limited to its "Italian" part), the State of Milan (under

Spanish rule) and the Republic of Venice[5]. We also calculated the size of the urban population for the other northern regions (Liguria, Emilia-Romagna), for the whole of the North, and for Tuscany which is the only region of central Italy affected by the 1629-30 plague. Our findings are summarized in table 5.

Table 5. Urban population in northern Italy and Tuscany (1,000 of people; cities>5,000 inhabitants)

	Piedmont	Lombardy	Veneto	Liguria	Emilia-Romagna	North	Tuscany
1600	126	345	324	75	250	1120	169
1700	153	285	295	71	243	1047	173
Change (%)	21.4	-17.4	-9.0	-5,3	-2,8	-6.5	2,4

Notes: Piedmont includes the Aosta Valley and Veneto includes Friuli-Venezia Giulia

In northern Italy as a whole, by 1700 the urban population was still 6.5% smaller than in 1600. This was mostly due to the 1629-30 plague, although the 1656-57 plague, which affected Liguria, also played a role. Of all the northern Italian regions, only in Piedmont did the urban population increase, from 126,000 to 153,000 people (+21,4%)[6]. This seems to reflect the fact that Piedmont/Sabaudian State was the area least affected by the plague. The same can be said for Tuscany, where the epidemic was markedly less severe compared to the northern regions (both in terms of probability of contagion and of local mortality: also see Alfani 2013a, 418-9). The opposite is true for the Republic of Venice (ruling over eastern Lombardy as well as Veneto), consistently with the available literature suggesting that in this area, the 1629-30 plague killed around 40% of the overall population (Dalla Zuanna et al. 2004, 35).

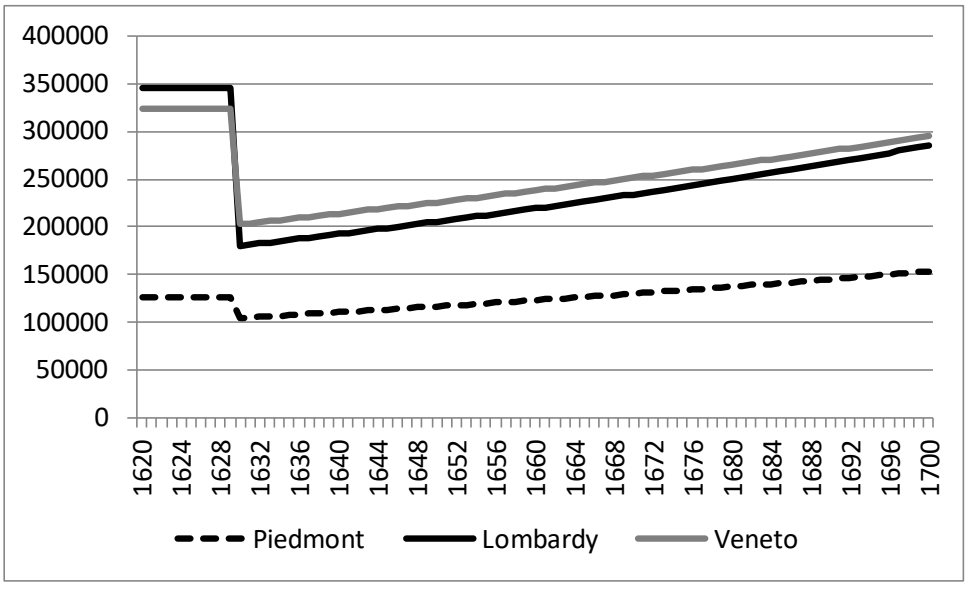
To demonstrate the centrality of the plague in shaping the trend of urban populations at the regional level, we used the database presented in section 3 to estimate average mortality

[5] More precisely, on the eve of the plague (1629) the Sabaudian State did not include eastern Piedmont (the current provinces of Alessandria and Novara) which were part of the State of Milan, and the State of Milan did not include eastern Lombardy (the current provinces of Bergamo, Brescia, and Cremona) which were part of the Republic of Venice.

[6] This is consistent with the increase of the overall Piedmontese population between 1600 and 1700 as reconstructed by Scalone and Del Panta (2008) and Del Panta et al. (2002).

levels in cities of Piedmont, Lombardy, and Veneto. We found that the most affected were the cities in Lombardy (478 per thousand) and Veneto (374 per thousand), while the average urban mortality rate was considerably lower in Piedmont (223 per thousand). Moreover, we used the database published by Alfani (2013a) to estimate the probability that a city of each of these regions was affected by the plague. The resulting point estimate was 1 in both Lombardy and Veneto, and "just" 0.77 in Piedmont. Combining this information and assuming the urban population in 1629 was the same as in 1600, we were able to estimate that the 1629-30 plague caused about 21,600 deaths in cities of Piedmont, about 164,900 in Lombardy, and about 121,200 in Veneto. These estimates allowed us to overcome the limitation of Malanima's database, which does not include mid-century measures of the urban population. We were, in fact, able to estimate the path followed by the urban population of each region, as seen in graph 1 (for simplicity, we assumed exponential growth at a constant rate throughout the period from 1631 to 1700).

Figure 4. Size of the urban population in Piedmont, Lombardy, and Veneto (1620-1700)



The trends shown in figure 4 should be taken as indicative and could be refined taking into account other factors, however no refinement can be expected to alter the crucial finding: the 1629-30 plague had such a huge impact that it basically determined the long-term trend - allowing Piedmont, the least-affected region, to acquire a more favourable position compared to the other parts of northern Italy. Focusing on the three main regions/states, it is clear that the possible confounding factors accounted for in section 6 (the civil war raging in the Sabaudian State in 1638-42, and the War of Candia involving the Republic of Venice in 1645-69) did not alter the fact that, if judged by the recovery that occurred by 1700, the relative position of the urban populations of the areas is inversely proportional to the overall plague mortality: Piedmont, the least affected, improved its relative position while Lombardy, the most affected, was lagging behind. True, Lombardy was also the region most affected by the War of the Mantuan succession, especially in the period from 1629 to 1631, but this event simply cumulates with the plague (which, as seen in section 1, arrived in Italy together with the foreign armies involved in the war), simply making the shock stronger. The effects of war might help to explain why average urban mortality rates were significantly higher in Lombardy compared to another badly plague-ridden region like Veneto.

Although human losses in cities are relevant per se, both demographically and economically as they are indicative of the damage caused by the plague to human capital and to the amount of available skills, it is also important to consider the share of urban population over the total - as urbanization rates are one of the best possible indicators of the level of economic development of a preindustrial society and "urbanisation quite adequately reflects the changes in economic leadership" (Malanima 2009, 250). Unfortunately, we only have estimates of population size per macro-region (Del Panta et al. 1996, 277) so that we could calculate urbanization rates for the whole of the north only. Only for Piedmont and Tuscany are region-specific estimates of urbanization rates available (Breschi and Malanima 2002; Alfani 2015). Moreover, Malanima (2005, 103) provides information for a wider central-northern Italian area that also includes Tuscany. All available information is summarized in table 6.

Table. 6. Urbanization rates in the North and Centre-North of Italy (%, cities >5,000)

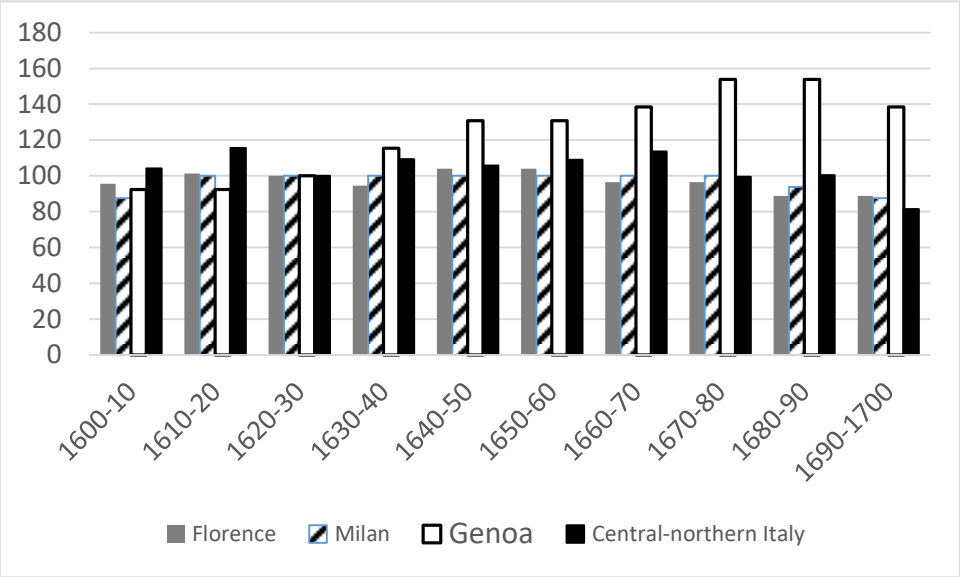
	Piedmont	Tuscany	North	Centre-North
1600	24,5	21,0	20,4	18,4
1700	22,9	19,0	16,1	16,9
Change (%)	-6,5	-11,9	-20,9	-8,2

Notes: for Piedmont, the 1600 figure actually relates to 1612 and the 1700 one to 1734.

Even taking into account 70 years of recovery, by 1700 northern Italian urbanization rates were still 4.3 percentage points below the level of 1600. Even in Piedmont, where by the end of the seventeenth century the size of the urban population had exceeded that of the beginning of the century, the increase did not fully compensate for a shock that affected the city more than the country. Consequently, even in Piedmont we find a lasting decline in urbanization rates. This was not without consequence for the relative position of the Italian economies compared with the most dynamic parts of northern Europe (England, the Netherlands and even France and Spain experienced a large increase in urbanization rates during the seventeenth century: Alfani 2013a, 424). In fact, the information we presented about the lasting impact of the plague on overall urban population confirms its ability to displace growth paths, both at the local and at the regional level, as further discussed in the next section.

Our argument can be further strengthened by showing that while there is clear evidence of the negative consequences of the 1630 plague, there is very little to argue for a *positive* effect. As discussed in section 4, one could make the reasonable hypothesis that this plague, as was the case of the Black Death in most areas of Europe, led to increasing real wages and consequently, better living standards. However, the potential positive consequences of the plague might have been entirely eroded by a negative productivity shock (as seen in Figure 3). Our regression analysis has provided indirect evidence of this, however there is also direct evidence as for Florence, Genoa and Milan we have time-series of real wages of masons covering the entire seventeenth century. This information is summarized in Figure 5, where we also include the most recent estimate of overall urban and rural real wages across central-northern Italy.

Figure 5. Real wages of masons in cities of northern Italy and overall urban and rural real wages in central-northern Italy, 1600-1700 (index based on the average of 1620-30).



Sources: for Florence, Milan, and Genoa, Malanima, *Wages in Italy 1290–1990* pp. 20-21, in www.paolomalanima.it. For central-northern Italy, Malanima 2013, Statistical Appendix.

Notes: we use eleven-years periods because this is the format of the information provided by Malanima, *Wages in Italy 1290–1990.*

This sample of cities is particularly interesting, as it includes one heavily affected by the 1630 plague (Milan: mortality rate of 462 per thousand), one relatively less affected (Florence: 137 per thousand) and one entirely spared (Genoa). Interestingly, of the three, the only one showing signs of an increase in real wages after 1630 is Genoa. The series of overall urban and rural real wages for central-northern Italy is also quite flat from 1600 to 1670, with signs of a decline afterwards (which deepens in the eighteenth century: see Malanima 2013, 178). In the city worst-affected by plague, Milan, if we equal to 100 the average real wages of masons in 1620-30, we get a flat index until 1680, which then declines to 87,5 in 1690-1700. For another city badly affected by the 1630 plague, Venice (mortality rate of 330 per thousand), we have more fragmented information about the real wages of labourers. Also in this case, if we equal to 100 the average for 1620-30, by 1670-

80 it has declined to 85,2.[7] This evidence strongly supports our hypothesis that negative productivity shocks prevented the seventeenth-century plagues from being beneficial to the Italian economies, particularly regarding their urban component.

8. Final discussion

Our regression analysis confirmed the ability of plague to displace economies to lower growth paths - and not always, or not necessarily, to higher ones as has been argued by many earlier works dedicated to the Black Death epidemic. Consequently, our analysis confirms that the economic consequences of severe demographic shocks need to be understood and studied on a case-by-case basis, as the historical context in which they occurred can lead to very different outcomes.

More generally, our analysis offers a novel perspective on the timing and the causes of the relative decline of the central and northern Italian economies compared to other areas of Europe. At the end of the sixteenth century and in the early seventeenth, these economies were still very strong as stated by the most recent overall evaluation of the Italian economic trend during the Early Modern period (Alfani 2013b) and consistently with the revisionist literature which for some decades has been developing the notion of "relative decline" to describe the fortunes of Italy during the seventeenth century (Sella 1997; Lanaro 2006). According to Malanima (2006), the century when Italy as a whole faced its deepest crisis was in fact the eighteenth. This however leaves open the question of when the progressive decline of the northern Italian economies started. Alfani suggested that the turning point is the 1629-30 plague : "The long sixteenth [1494-1628] and short seventeenth [1629-1710] centuries were clearly separated by a fall (a 'catastrophe') in the population and in product, for which the plague was mainly responsible" (Alfani 2013b, 173). Later he demonstrated that plague had a deeply different demographic impact across seventeenth century Europe, and developed an "epidemiological hypothesis" to explain the origin of the relative decline of the most advanced areas of Italy compared to northern Europe (Alfani 2013a). This

[7] Information from Malanima, *Wages in Italy 1290–1990* pp. 18-19, in www.paolomalanima.it.

article provides support for this hypothesis, demonstrating that plague had a permanent negative effect on many key Italian cities, and also had a huge and long-lasting effect on the size of urban populations and on urbanization rates (the latter being indicative of preindustrial economic development). In other words, although it seems plausible that Malanima is right in pointing to the eighteenth century as the period when (in relative terms, and broadly speaking) Italy touched the bottom level, the process leading to such an outcome began in the seventeenth century, and was "caused" by the mortality crises in that period, inasmuch as they displaced the area towards a lower growth path.

The decline of the urban economies and especially of their manufacturing sector - possibly triggered, as we argued, by a negative productivity shock caused by plague - needs to be better placed into perspective, as one fundamental argument put forward by those who introduced the notion of relative decline, notably Sella (1997), is that during the seventeenth century production moved, to a degree at least, from the cities to the rural areas. This meant being able to make use of the abundant labour present in the country in addition to escaping the rigidities of the urban guild system. However, in the medium and long run it also implied a re-focusing of the northern Italian manufacturing sector on the production of semi-finished products (like silk) and of lower-quality products. By the beginning of the seventeenth century, when demographic recovery after the plague was completed, the northern Italian states were unable to also recover the position of centrality in the European economy which they had enjoyed up until the eve of the plague. The decline of their cities, which is reflected in urbanization levels lagging behind those of a century earlier, is clearly an essential explanatory factor of this ultimate failure to keep the same pace as the most dynamic areas of Europe. To put it bluntly, we should not forget that even a relative decline is still a decline.

9. Conclusion

This article has provided an overview of the demographic impact of plague on Italian Early Modern cities, from the 1575-77 epidemic up until the last great seventeenth century plagues. It has introduced the largest-existing database of urban mortality rates in plague years, allowing us, first, to demonstrate the particularly high severity of the last Italian

plagues (in the two final waves, mean mortality rates in cities were in the order of 400 per thousand), and secondly, to analyze their economic impact.

Using the methods of economic geography to study the ability of a mortality crisis to alter the growth path followed by a city, we found evidence that the 1629-30 plague affecting Tuscany and northern Italy was able to displace some of the most dynamic and economically advanced Italian cities, like Milan or Venice, moving them to a lower growth path. We were also able to estimate the huge losses the epidemic caused in urban populations, and showed that it had a lasting effect on urbanization rates throughout the affected areas. Demonstrating that the plague had a permanent negative effect on many key Italian urban economies, the article has provided support to the recently-formulated hypothesis that the origins of the relative economic decline of the northern part of the Peninsula are to be found in particularly unfavorable epidemiological conditions. More generally, the article has provided a useful new perspective on Italian long-term economic trends, including aspects like the falling-back of northern Italy compared to its main European competitors and the final consequences of the progressive "ruralization" of the Italian economies during the seventeenth century.

References

Alfani, G. 2010a. 'Pestilenze e «crisi di sistema» in Italia tra XVI e XVII secolo. Perturbazioni di breve periodo o cause di declino economico?', in S. Cavaciocchi (ed.), *Le interazioni fra economia e ambiente biologico*. Florence: Florence University Press: 223-247.

Alfani, G. 2010b. 'Climate, population and famine in Northern Italy: general tendencies and Malthusian crisis, ca. 1450-1800', *Annales de Démographie Historiqu*e, 2: 23-53.

Alfani, G. 2010c. 'The effects of plague on the distribution of property: Ivrea, Northern Italy 1630', *Population Studies*, 64: 1-15.

Alfani, G. 2013a. 'Plague in seventeenth century Europe and the decline of Italy: and epidemiological hypothesis', *European Review of Economic History*, 17 (4): 408-430

Alfani, G. 2013b. *Calamities and the Economy in Renaissance Italy. The Grand Tour of the Horsemen of the Apocalypse*. Basingstoke: Palgrave.

Alfani, G. 2015. 'Economic inequality in northwestern Italy: A long-term view (fourteenth to eighteenth centuries)', *The Journal of Economic History*, 75(4), 1058-1096.

Alfani, G. Ammannati, F. (2016). 'Long-term trends in economic inequality: the case of the Florentine State, ca. 1300-1800', *Economic History Review* (2016), forthcoming.

Alfani, G. and Cohn, S.K. 2007. 'Nonantola 1630. Anatomia di una pestilenza e meccanismi del contagio', *Popolazione e Storia*, 2/2007: 99-138.

Alfani, G. and Murphy, T. 2017. 'Plague and Lethal Epidemics in the Pre-Industrial World', *Journal of Economic History*, 77(1), forthcoming.

Álvarez Nogal, C. and Prados de la Escosura,L. (2013). 'The Rise and Fall of Spain (1270-1850)', *Economic History Review*, 66(1), 1–37.

Andreozzi, D. 2010, '«Ritratto lacrimevole delle miserie e calamità humane». Crisi di mortalità e standard di vita nel Cremonese del XVII secolo', in S. Cavaciocchi (ed.), *Le interazioni fra economia e ambiente biologico*, Florence University Press, Firenze, 575-84.

Barbot, M. and Percoco, M. 2013. *A Good Neighborhood is not always for Free. Housing Prices and the Rise of Social Interactions in Early Modern Milan (1560-1670)*, working paper

Biraben, J.N. 1975. *Les hommes et la peste en France et dans les pays Européens et Méditerranées.* Paris: Mouton.

Borsch, S.J. 2015. ‘Plague, Depopulation and Irrigation Decay in Medieval Egypt’, in *Pandemic Disease in the Medieval world. Rethinking the Black Death*, edited by Monica H. Green, 125–56. Kalamazoo and Bradford: Arc Medieval Press.

Bosker, M., Brakman, S., H. Garretsen, H. de Jong, and M. Schramm. 2008, 'Ports, Plagues and Politics: Explaining Italian City Growth 1300-1861', *European Review of Economic History*, 12: 97-131.

Brakman, S., Garretsen H., Schramm M. 2004., 'The Strategic Bombing of German Cities during World War II and its Impact on City Growth', *Journal of Economic Geography*, 4: 201-218.

Breschi, M. and Malanima, P. 2002. ‘Demografia ed economia in Toscana: il lungo periodo (secoli XIV-XIX)’, in Breschi, M. and Malanima, P. (eds.), *Prezzi, redditi, popolazione in Italia: 600 anni (dal secolo XIV al secolo XX)*, Udine: Forum, 109-142.

Clark, G. 2007. *A Farewell to Alms*. Princeton: Princeton University Press.

Cohn, S. K. 2007. ‘After the Black Death: Labour Legislation and Attitudes towards Labour in Late-Medieval Western Europe’, *Economic History Review*, 60(3): 486–512.

Cohn, S.K. 2010. 'The changing character of plague in Europe, 1348-1800', in S. Cavaciocchi (ed.), *Le interazioni fra economia e ambiente biologico*. Florence: Florence University Press, 33-56.

Curtis, D. R. 2016. ‘Was Plague an Exclusively Urban Phenomenon? Plague Mortality in the Seventeenth-century Low Countries.’ *Journal of Interdisciplinary History*, 47(2): 1-32

Dalla Zuanna, G., Rosina, A. and Rossi, F. 2004. *Il Veneto. Storia della popolazione dalla caduta di Venezia a oggi*. Venice: Marsilio.

D'Amico, S. 2001. 'Rebirth of a City: Immigration and Trade in Milan, 1630-59', *Sixteenth Century Journal*, 32(3): 697-721.

Davis, D.R. and Weinstein, D.E. 2002., 'Bones, Bombs, and Break Points: The Geography of Economic Activity', *American Economic Review*, 92(5): 1269-1289.

Del Panta, L. 1980. *Le epidemie nella storia demografica italiana*. Torino: Loescher.

Del Panta, L. 2007. ‘Per orientarsi nel recente dibattito sull'eziologia della 'peste': alcune indicazioni bibliografiche e un tentativo di riflessione’, *Popolazione e Storia*, 2/2007: 139-149.

Del Panta, L., Reginato, M., Scalone, F. 2002. 'Un tentativo di ricostruzione dell'evoluzione demografica del Piemonte tra XVII e XIX secolo', in L. De Panta, L. Pozzi and R. Rettaroli (eds.), *Dinamiche di popolazione, mobilità e territorio in Italia (secoli XVII-XX)*, Udine: Forum, 15-41.

Del Panta, L., Livi Bacci, M., Pinto, G. and Sonnino, E. 1996. *La popolazione italiana dal Medioevo a oggi*. Bari: Laterza.

Duncan, C. and Scott, S. 2001. *Biology of plagues: evidence from historical populations*. Cambridge: Cambridge University Press.

Eckert, E.A. 1996. *The Structure of Plagues and Pestilences in Early Modern Europe. Central Europe, 1560-1640*. Basel: Karger.

Epstein, S.R. 2000. *Freedom and Growth: The Rise of States and Markets in Europe, 1300–1750*. London: Routledge.

Fusco, I. 2007. *Peste, demografia e fiscalità nel regno di Napoli del XVII secolo*. Milano: Franco Angeli.

Fusco, I. 2009. 'La peste del 1656-58 nel Regno di Napoli: diffusione e mortalità', in G. Alfani, G. Dalla Zuanna and A. Rosina (eds.), *La popolazione all'alba dell'era moderna*, special number of *Popolazione e Storia*, 2/2009: 115-138.

Herlihy, D. 1997. *The Black Death and the Transformation of the West*. Cambridge M.A.: Harvard University Press.

Lanaro, P. 2006. *At the Centre of the Old World. Trade and Manufacturing in Venice and the Venetian Mainland, 1400-1800*. Toronto: Centre for Reformation and Renaissance Studies.

Malanima, P. 2002. *L'economia italiana. Dalla crescita medievale alla crescita contemporanea*. Bologna: Il Mulino.

Malanima, P. 2005. 'Urbanisation and the Italian economy during the last millennium', *European Review of Economic History*, 9: 97-122.

Malanima, P. 2006 'An Age of Decline. Product and Income in Eighteenth Century Italy', *Rivista di Storia Economica*, 22: 91-133.

Malanima, P. 2009. *Pre-Modern European Economy*. Leiden-Boston: Brill.

Malanima, P. 2012, 'The economic consequences of the Black Death', in E. Lo Cascio (ed.), *L'impatto della "Peste Antonina"*. Bari: Edipuglia, 311-328.

Malanima, P. 2013. ‘When did England overtake Italy? Medieval and early modern divergence in prices and wages’, *European Review of Economic History*, 17: 45-70.

Malanima, P. and Capasso, S. 2007. 'Economy and Population in Italy. 1300-1913', *Popolazione e Storia*, 2/2007: 15-40.

McFadden, D. (1999), *Lecture Notes: Instrumental Variables*, University California at Berkeley, mimeo.

Mocarelli, L. 2008. ‘Tra città e campagna: gli assetti organizzativi della manifattura tessile cremonese alla prova della crisi secentesca (1580-1680)’, in R. Canetta, A. Carera, M. Taccolini (eds.), *Temi e questioni di storia economica e sociale in età moderna e contemporanea. Studi in onore di Sergio Zaninelli*. Milan: Vita e Pensiero, 5-43.

Moioli, A. 1999. 'Il mutato ruolo delle corporazioni nella riorganizzazione dell'economia milanese del XVII secolo', in A. Guenzi, P. Massa (eds.), *Corporazioni e gruppi professionali nell'Italia moderna*. Milan: Franco Angeli, pp. 45-78

Pamuk, S. 2007. ‘The Black Death and the origins of the ‘Great Divergence’ across Europe, 1300-1600’, *European Review of Economic History*, 11: 289-317.

Percoco, M. 2012. “Entrepreneurship, Social Capital and Institutions: Evidence from Italy”, *Spatial Economic Analysis*, 7(3): 339-355.

Percoco, M. 2013a. 'Geography, Institutions and Urban Development: Evidence from Italian Cities', *Annals of Regional Science*, 50: 135–152

Percoco, M. 2013b, 'Path dependence, Institutions and the Density of Economic Activities: Evidence from Italian Cities', *Papers in regional science*, forthcoming.

Pezzolo, L. 2006. *Una finanza d'Ancien Régime. La Repubblica di Venezia tra XV e XVIII secolo*. Edizioni Scientifiche Italiane: Napoli.

Pérez Moreda, V. 1988. ‘La peste de 1647-1657 en el Mediterraneo Occidental’, *Bollettino SIDES*, 5: 14-25.

Preto, P. 1978. *Peste e società a Venezia (1576.)* Vicenza: Neri Pozza.

Pullan, B. 1964. ‘Wage-earners and the Venetian economy’, *Economic History Review*, 2nd ser., 16: 407-426.

Rommes, R. 2015. ‘Plague in Northwestern Europe: The Dutch Experience, 1350–1670.’ *Popolazione e Storia*, 16(2): 47–71.

Scalone, F., Del Panta, L. 2008. *The Reconstruction of the population of Northern Italy with a comparison between the demographic evolution of Piedmont, Emilia and England (XVIII-XIX Centuries)*, paper given at European Population Conference, Barcelona, 9-12 July.

Sella, D. 1997. *Italy in the Seventeenth Century*. London: Longman.

Slack, P. 1985. *The impact of plague in Tudor and Stuart England*. London: Routledge.

Van Bath, S. 1965. 'Study of historical demography in the Netherlands', in *Actes de colloque international de démographie historique*. Liege-Paris: Génin, 185-198.

Voigtländer, N. and H.J. Voth 2013. "The Three Horsemen of Riches: Plague, War, and Urbanization in Early Modern Europe." *Review of Economic Studies* 80 (2): 774–811.

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