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RESEARCH

Selection pressure and institutional adaptation: An evolutionary comparison of the 1340 and 1348 epidemics in Florence, Italy

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Abstract
Evolutionary economics is a powerful lens for understanding the heterogeneous, complex, and bidirectional relationship between economic development and disease spreading. This paper supports the relevance of this approach by investigating the well-documented socioeconomic consequences of two successive 14th-century plague outbreaks in Florence, Italy. By analyzing the institutional responses to both the 1340 epidemic and the 1348 Black Death, we demonstrate that mortality alone did not determine post-plague trajectories. Instead, the 1340 outbreak eroded incumbent authorities' legitimacy and fostered fiscal experimentation, briefly empowering reform-minded coalitions, while the 1348 Black Death enabled surviving oligarchic factions to reconsolidate power and implement rent-extractive policies that stifled economic and demographic recovery. Because both shocks occurred within the same political and socioeconomic context, our single-case comparison preserves contextual consistency and highlights the granular mechanisms that produced sharply divergent outcomes, providing a deep evolutionary perspective. Drawing on the co-evolutionary circuit of selection, adaptation, and feedback, we demonstrate that institutional selection pressures were decisive in shaping sharply divergent economic paths, thereby providing a unified mechanistic account for pandemic heterogeneity. Finally, we draw policy lessons by emphasizing how adaptive governance, transparent accountability, and elites renewal may prevent regressive lock-ins in the face of health shocks.

Keywords Economic development · Outbreak effects · Institutional change · Path dependence · Black Death · Fiscal and administrative routines

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1 Introduction

The relationship between economic development and the spread and impact of diseases is complex and bidirectional (Birchenall 2007; Spencer et al. 2020). Scholars document significant heterogeneity in pandemic outcomes (favorable, adverse, or marginal) depending on the timing, location, institutional context, and theoretical approach (Callegari and Feder 2022a; Jedwab et al. 2022). Mainstream economic models typically treat pandemics as exogenous short-term shocks to supply and demand (Bloom et al. 2022; Costa Jr et al. 2021), suggesting few negative or negligible long-term effects. Conversely, historical research emphasizes how institutional and political changes mediate long-run consequences (Alfani 2022; Beach et al. 2022), suggesting significant and potentially positive long-term outcomes. Yet no framework fully integrates these mechanisms or explains why similar health shocks yield such varied trajectories across time and space.

Evolutionary economics can fill this gap by viewing pandemics as selective tools on socioeconomic and institutional systems (Callegari and Feder 2022b). From this perspective, the impact of a health shock is neither uniform nor predetermined but depends on existing institutional configurations and the adaptive responses they enable or constrain (Nelson 2008). Such interactions can redirect an economy's evolutionary path, potentially triggering transitions to new regimes or locking systems into detrimental equilibria (Fiaschi and Fioroni 2019). An evolutionary theory of pandemics would thus offer a unified account of why and how health crises produce divergent long-term effects.

However, supporting an evolutionary theory of the economic development–pandemic nexus is challenging given the sporadic nature of such events. Comparing multiple cases is necessary to identify recurrent patterns, but it has three important drawbacks:

(i) Significant contextual differences between periods or regions make it hard to isolate specific pandemic effects;
(ii) Aggregating many episodes risks losing the granularity essential to evolutionary analysis; and
(iii) The complex and bidirectional relationship between economic development and health dynamics is difficult to observe in comparative settings.

To address these issues, we propose a complementary strategy: a single-case study of a territory affected by temporally close epidemics, thereby preserving contextual consistency while retaining fine-grained detail. Ideally, the chosen case should involve a relatively stable institutional and socioeconomic context but exhibit contrasting long-term outcomes across the outbreaks. This allows us to focus on the granular mechanisms that explain the divergence in effects, without those mechanisms being under- or over-sized by broader contextual differences. Moreover, analyzing several shocks within the same historical setting provides a unique

opportunity to trace the complex and bidirectional relationship between economic development and health dynamics over time. It enables us to observe not only how pandemics impact institutions and socioeconomic outcomes, but also how the economic and political structures in place before each outbreak shaped the severity of the shock and the nature of the response.

To achieve this, we selected mid-14th-century Florence for three primary reasons. First, Florence experienced a severe plague in 1340 followed by the Black Death in 1348, offering a rare opportunity to compare two temporally close outbreaks within the same institutional context, but with opposite outcomes (Day Jr. 2002; Falsini 1971). Second, its unparalleled archival sources allow us to trace political, fiscal, and social transformations in fine detail (Goldthwaite 2009; Tognetti 2017). Third, the timing and severity of these outbreaks do not obscure the effects of the pandemics themselves, but rather illustrate how slight differences in initial conditions can lead to sharply divergent long-term trajectories.

Therefore, the core contribution of this paper lies in both the use of the evolutionary economic framework and in the novelty of the empirical strategy. We draw on evolutionary tools to offer a unified account of why and how health crises produce divergent long-term effects. Indeed, by framing pandemics as selection pressures acting on fiscal and administrative routines, and by tracing the mechanisms of variation, selection, lock-in, and feedback in the case of Florence, we move beyond generic accounts of institutional mediation and identify the specific, granular mechanisms that produced the sharply divergent outcomes of 1340 and 1348.

Specifically, this paper primarily compares the long-run socioeconomic effects of two outbreaks in Florence, focusing on how institutional and political change mediated its impact on growth, inequality, and resilience. Drawing on archival evidence and framed by an evolutionary perspective, we trace the mechanisms through which Florentine elites adapted, and in some cases ossified, their fiscal and administrative routines in response to the health shocks. In doing so, we shed new light on the complex and bidirectional relationship between disease spreading and economic development.

By examining both the Black Death of 1348 and the earlier epidemic shock of 1340 through an evolutionary lens, we see how successive waves of plague first eroded the legitimacy of entrenched oligarchic families, prompting the rise of reform-minded coalitions, and then enabled surviving elites to entrench extractive routines. This dynamic interplay of mutation and selection in Florence's fiscal and administrative systems offers fresh insights into the dual role of economic development in shaping, and being reshaped by, disease spreading. In moving beyond a purely descriptive account of Florence's experience, this paper illuminates how pandemics can trigger institutional innovation or lock in entrenched power structures, with consequences that reverberate across generations.

Following the intuition of Guidi (1977), this paper reorganizes all previous contributions to the topic by connecting pandemic shocks and political development in a unique framework. We show how pandemics can delegitimize authorities, prompting authoritarian moves and facilitating political change, as well as the consolidation of new routines. In 1340, an epidemic contributed to 3 years of severe political instability, finally leading to a short-lived popular government, which implemented

innovative and virtuous policies with positive economic and social effects. However, the Black Death outbreak in 1348 hit the low and middle strata particularly hard, creating the opportunity for the oligarchic elites to re-seize power and usher in a new extractive regime whose policy exacerbated the adverse effects of the pandemic.

This paper concludes that only a combined analysis of political, social, and economic factors can effectively explain the long-term effects of the pandemic. We observe that the selection pressures generated by the outbreaks mediate the long-term impact on political change. While selection may lead to the emergence of constructive variation, it might also lead to reactionary lock-ins. The historical case of Florence illustrates that the long-term consequences of pandemics are not determined solely by mortality rates or the magnitude of the health shock, but by the institutional responses they trigger, a principle confirmed by recent studies on contemporary pandemics such as COVID-19 (Bonaccorsi et al. 2023; Delli Gatti et al. 2023). From an evolutionary perspective, pandemics function as selection pressures that test the adaptability and resilience of socioeconomic systems. Finally, the contrasting outcomes of the 1340 and 1348 epidemics in Florence underscore the significant impact of institutional flexibility, elite turnover, and the political framing of policy responses on a territory's development trajectory.

The remainder of the paper proceeds as follows. Section 2 describes Florentine history until the end of the Black Death. Section 3 presents the direct and indirect consequences of this outbreak in Florence. Section 4 develops our evolutionary framework and proposes some scholarly and policy implications. Finally, Sect. 5 concludes.

2 Floorence before the black death

At the beginning of the 12th Century, Florence had 5000 inhabitants and an urban area of a few tens of hectares (Tognetti 2017). Two centuries later, the city had expanded to 600 ha and was home to more than 100,000 inhabitants. This exponential demographic growth was accompanied by economic growth unparalleled in Europe. Its secret lay in developing the trading and banking sectors, which provided Florence's manufacturing industry with the capital, knowledge, and skills to produce high-quality products sold internationally (Tognetti 2001). At the start of the fourteenth century, this particular economic structure made Florence the fourth European metropolis, after Milan, Paris, and Venice (Tognetti 2017). Unlike these metropolises, but like most Tuscan cities, Florence did not feature large communities of foreign businessmen (Tognetti 1995). The key banking and financial sectors developed based on tight familial bonds, guaranteeing privacy and trade secrecy. These valuable and sought-after financial skills, combined with a strong Guelph political position, transformed Florence into the bank of the Catholic Church and its European supporters.

The symbol of Florentine financial and monetary supremacy is the florin; first minted in 1252, it soon became the leading European currency (Tognetti 2015). In the Late Middle Ages, two monetary systems developed in Florence: the gold florin, used by merchants, bankers, wealthy craftsmen, and international traders;

and the silver coin, an instrument of local trade used by wage earners and small craftsmen. Starting from the 1320 s, Florence's manufacturing activities greatly expanded, especially the textile sector, which grew in both quality and employability, and led the city to become one of the most important European industrial hubs. The Florentine economy continued to grow in the first 30 years of the fourteenth century. However, the situation was reversed during the so-called "decade of disaster" (1339–1348), which culminated in the Black Death of 1348 and saw the collapse of both private and public finances (Brucker 2015). Historians apply the label "decade of disaster" because multiple, interacting adverse events occurred in rapid succession:

(i) Two famines (autumn 1339 and spring 1340), followed by further food shocks;
(ii) Severe financial setbacks driven by interconnected business failures;
(iii) The weakening of the alliance with the Avignon papacy and the start of the Hundred Years' War which both led to significant financial losses for the Florentine bankers;
(iv) The excessive military expenditures required to extend Florentine control over Tuscany;
(v) The alterations in the gold/silver ratio and the corresponding monetary instability; and
(vi) An epidemic in 1340 that, together with the other stresses, produced systemic political and fiscal strain well before the Black Death of 1348 (Becker 1959).

Florence in the fourteenth century had an idiosyncratic socioeconomic structure whose contours must be sketched before identifying the key conflicts driving the historical developments. The top of the Florentine social hierarchy was occupied by the noble families, the *Magnati*, and the families forming the most profitable and prestigious guilds, the *Arti Maggiori*. Initially, these two groups were clearly distinct: the first drew their wealth from feudal land ownership and privileges, and the second from commercial and financial activities. However, marriages and business partnerships blurred the line over time. While the distinction between nobility and commoners still mattered, the significant economic and political interests shared by the *Magnati* and the *Arti Maggiori* members led to a de-facto oligarchy co-enacted by these two dominant groups. The members of the other guilds, the *Arti Medie* and *Minori,* identified a second social group, mostly connected with manufacturing interests, spanning several social strata, from the affluent large-scale manufacturer to modest small shop owners. This social group was usually associated with the so-called "new men", families who migrated to Florence decades earlier and succeeded in establishing various commercial and manufacturing activities, and gaining entry to the guild system. The third group comprised non-associated workers and merchants engaged in trades deemed too menial to merit official guild incorporation or political rights. Finally, a vast underclass of seasonal laborers, prostitutes, refugees, and beggars, mostly dependent on the Church and communal alms, completed the picture.

The social classes largely reflected the economic dynamics of the city. For the purposes of our analysis, a central line of conflict ran between the manufacturing

interests, including new, innovative trades, primarily represented by the *Arti Medie* and *Minori*, on the one side, and the financial interests, comprising *Magnati* and *Arti Maggiori*, on the other. The former had a vested interest in the continuous growth of urban production and consumption. The latter, instead, primarily sought to maintain their political control over both urban and rural areas in order to secure a predictable extraction of economic surplus. Economic development, while welcome, was often subordinated to maintaining political control. These different aims are illustrated below by the succession of Florentine governments. Poor laborers and those at the margins of economic life were formally excluded from political life. However, they could still make their voices heard through rioting and the organized support of popular champions from the *Arti*. Their role will be significant all the way to, and including, the *Ciompi* revolt.

In what follows, we therefore focus on three elements of this configuration that are central for our analysis:

(i) Which groups gained or lost access to executive and representative offices,
(ii) How fiscal and military commitments constrained policy choices, and
(iii) How conflicts over taxation and labor regulation evolved between urban and rural actors.

These are the dimensions along which the two epidemic shocks of 1340 and 1348, and the *Ciompi* revolt of 1378, will later be interpreted in our evolutionary framework.

In 1293, a set of laws called the Ordinances of Justice came into force. These laws aimed to contain and punish the misdeeds of the *Magnati*, exclude them from any public office, and allow only guild members to participate in political life. However, only 2 years later, in 1295, the Ordinances were amended, signaling the oligarchic compact unifying the upper classes, in order to allow the *Magnati* to regain indirect access to the municipal government, while excluding de facto the members of the *Arti Medie* and *Minori*. This exclusion was reinforced by the establishment and subsequent reform of electoral practice, which greatly reinforced the political power of the *Arti Maggiori* by extending their control over the selection of electable officers (Guidi 1972). The resulting government was widely perceived as inefficient, grossly corrupt, and ultimately responsible for the military defeats and the economic crisis affecting the city. It is enough to say that financial mismanagement led the public debt to increase tenfold from 1303 to 1338 (Barducci 1979). The situation was further aggravated by a famine that plagued the city and the surrounding countryside between the fall of 1339 and the spring of 1340. The famine drew a large number of peasant refugees into the crowded, unsanitary urban slums, seeking alms from the many religious charities operating in the city.

This dire situation was made untenable by a dramatic epidemic outbreak in late 1340, which, according to contemporary sources, in only a few months killed around 15,000 citizens and an unknown number of refugees (Carmichael 2014; Guidi 1977;

Henderson 1988).[1] The epidemic was the final straw for the political order in the city. Governmental inertia during the disaster moved two noble families to attempt a coup d'état later in the same year. While the citizens managed to thwart this attempt to restore aristocratic rule to the city, the crisis shook the already flagging government, convincing the oligarchic bloc that an authoritarian turn was required to avoid losing control of the situation. Consequently, the government invited a French nobleman to temporarily take control and restore order in the city: Gualtieri di Brienne, Duke of Athens, was nominated City Protector in 1342 and put in charge of the city defense. Only a few days later, Gualtieri declared himself Lord of the city, dissolving the republican government.

In order to gain popular support, Gualtieri passed a number of reforms re-establishing the Ordinances of Justice and enabling some of the poor workers, such as the wool workers, to create their own guilds, and, therefore, gain access to political life. The new government also attempted to reintroduce guild taxation, following the example of the previous Lord of Florence, Charles (Becker 1960). The nobles and the wealthy were mollified through tax reductions, judicial dispensations, and immunities (Becker and Brucker 1956). The emergency conditions brought by the plague weakened institutional inertia, enabling new institutional variations to come to the fore. Despite these efforts, the short-lived Gualtieri government failed to provide a solution to either the economic and financial crisis facing the city or the famine affecting the countryside, leading to its downfall in 1343. A new government of the *Arti Maggiori* took over, promptly banning the new guilds created by Gualtieri and eliminating the Ordinances of Justice, the only popular reforms of the previous regime. Nothing substantial was done, instead, to address the crises affecting the city, leading after a few months to civil protests resulting in a new government, now including a significant presence of the *Arti Medie* and *Minori*, including many "new men", coming from outside the great families that had ruled Florence so far (Becker and Brucker 1956), including some member of the yet quite obscure Medici family (Brucker 1957). While the *Arti Maggiori* also participated in the new government, the majority was held by the coalition between the *Arti Medie* and *Minori*, who together initiated several reforms aimed at addressing the multiple crises facing the city. The *Arti Maggiori* were heavily indebted to Avignon, and it was only by compromising with the "new men" of the *Arti Medie* and *Minori* that they could resist the pressures of the Church for the immediate repayment of this debt and limit the ability of the Papacy to interfere in Florentine domestic matters, thereby reducing the sphere of supervision and legal authority of the Inquisition (Becker 1959).

At the time of the new government's formation, the Florentine Republic was deeply in debt and could not honor its commitments or even pay its officials. Furthermore, many great Florentine companies were declaring bankruptcy, and Florence's control over the surrounding Tuscanian lands was quickly eroding, with numerous subject cities such as Arezzo, Pistoia, and Volterra declaring independence from their Florentine overlords (Becker 1962). The newly elected representatives restored

[1] Since all this information was only reported by Villani, who has personally experienced this outbreak, the impact of this pandemic may have been overestimated.

the Ordinances of Justice to their original form by reducing the numerous exceptions and preferential treatments granted to the *Magnati* (Fubini 2012). Then, they addressed the ongoing financial crisis by developing a systematic tax-collection structure, balancing the distribution of communal levies, and strictly enforcing the law for all social classes (Becker 1960). The significantly improved efficiency of the communal fisc led to an almost immediate increase in tax revenues. The new government also proceeded to demobilize the costly mercenary forces, accepting territorial losses rather than engaging in a military contest that Florence could not support at the time. Finally, the government consolidated all outstanding loans under a single public debt, the *Monte*, paying a standardized and relatively low-interest rate, compared with the previously standing ad hoc arrangements. The policy lowered total interest payments to a third and, combined with improved revenues and reduced outlays, finally put Florence on the path to financial recovery. The number of voluntary financiers, shareholders, and speculators in Florentine public securities was hugely extended, even abroad (Barducci 1979). This mechanism benefited the upper classes, but members of the *Arti Medie* and *Minori* also benefited from the new system of public funding.

Fiscal recovery, enforcement of the rule of law, and political liberalization greatly contributed to the renewal of the city's economic activities. The government further supported the growth of urban manufacturing through monetary and labor policies aimed at guaranteeing both high effective demand and a relatively cheap labor supply. These policies guaranteed a steady increase in direct and indirect tax revenues, business profits, and population growth from 1343 to 1348. The new government also reformed the administration of the countryside under Florentine control. Previous oligarchic mismanagement had led to a situation in which the countryside essentially did not contribute any resources to the public budget, as all rents were absorbed by the nobles and landlords, with the Republican administration being reduced to almost complete ineffectiveness by underfunding, corruption, and widespread violence. The new government completely overhauled the provincial administration, instituting an effective bureaucracy, which extended the application of Florentine law throughout most of the surrounding countryside. As a result, the Florentine countryside was transformed into one of the most significant sources of revenue for the city and the control of local nobles over tax revenue was effectively eliminated (Becker 1962; Mandich 1988).

The pivot of the fiscal, military, and administrative reorganization in Florence was the reform of the urban districts in 1343 (Stella 1993). Even if the prerogatives and functions of each administrative unit remained almost unchanged, the new urban organization profoundly changed political representation, as the election system for government offices was tied to the urban districts. Between 1343 and 1348, elections proceeded in good order, resulting in the *Arti Maggiori* securing only a third of the available electoral positions, many of them being filled instead by "new men" with no previous governmental experience (Becker 1962; Brucker 2015; Rutenburg 1971). The new political power obtained by the *Arti Medie* and *Minori* resulted in many reforms, such as the increased pecuniary limits for unappealable sentences and the diminished application of the anti-monopoly legislation, which was particularly damaging for the *Arti Medie and Minori*'s interests (Becker 1959; Franceschi

1993). While the vast reforms brought by the new government were, by and large, successful in restoring a modicum of prosperity to most citizens, oligarchic resistance grew as emergency conditions receded. The liberalization process started to reverse already in 1346. Indeed, the citizenship requirements for political participation became stricter, favoring the *Arti Maggiori* and the *Magnati*. Further restrictions against Ghibellines families were passed in 1347, again favoring the *Arti Maggiori* and *Magnati*, who were practically entirely Guelphs. This was a consequence of the fact that, by 1346, the *Arti Maggiori*'s precarious financial position was on the mend, and their tolerance for a mixed government was waning. In late 1347, the *Magnati* reacquired the privilege of purchasing absolution from court rulings at lower prices, a practice common before 1343.

Starting from the fall of 1346, a new series of calamities struck the countryside surrounding the city, with flooding, famine, and small-scale epidemics killing thousands of people. To escape these calamities, tens of thousands of poor farmers took refuge within the city walls, where the government organized large-scale distributions of bread (Henderson 1988). Contemporary sources cite the number of 94,000 people being fed in this way (Rodolico 1902), accounting for around four-fifths of the total population of the city at that time, which could be estimated to be around 120,000, possibly the highest population achieved by Florence until then (Bosker et al. 2008; Day Jr. 2002; Herlihy 1978). Lower estimates put the total population in 1347 between 80,000 and 100,000 (Benedictow 2021; de la Roncière 1976; Fiumi 1950), but these estimates do not take into account the movements of refugees (Day Jr. 2002). On the eve of the Black Death, the city was packed full of poor, weakened, and sickly refugees, crowded together in the city slums during the night and in the public plazas during the day, queuing to receive the daily bread, while the commercial activities, bolstered by the coalition government, kept expanding, increasing the inflows and outflows of people and goods. Given how conducive these conditions were to rapid and widespread contagion, the Black Death of 1348 proved especially devastating for Florence.

By late 1347, the Black Death had reached Pisa, prompting the Florentine authorities to organize a 3-day procession to appeal to God for the city to be spared (Hatty 1992). Citizens were ordered to clean up streets and private homes, farmers and butchers to keep animals out of the city, prostitutes were expelled, a 500-lire fine was imposed on travelers from Genoa and Pisa, and vendors of used goods were forbidden to sell the possessions of the infected (Carmichael 2014). However, the overcrowded city still required regular grain shipping from Pisa, ensuring an easy avenue for the disease to enter the city (Benedictow 2021). The bacterium found its way inside a panicked Florence during the first months of 1348 (Del Panta 1995; Henderson 1988). The Black Death struck the Florentines with unprecedented vehemence and intensity (Falsini 1971). All private and public activities came to an abrupt halt. Only doctors, priests, and gravediggers moved from house to house in the now deserted streets. Even essential public services, such as the policing of the city, were interrupted. The government reacted by creating a dedicated magistracy with unprecedented emergency powers (Carmichael 2014) to contain the spread of the disease by promoting public hygiene, mandating restrictions on entry to the city from infected areas, and quarantining heavily affected districts (Henderson 1992).

These measures were unable to stop the contagion, leading to the collapse of coordinated efforts in the face of ever-present death.

Governmental failure was accompanied by medical failures, as doctors consistently misdiagnosed the means of contagion, focusing on “foul vapors” and underplaying the role of direct contact with the infected and their possessions (Podd 2011). The Florentines were quicker to catch on to the connection and promptly fled contact with the infected, leaving many of them to die alone, breaking strongly established traditions (di Coppo Stefani 1903). Many of the poorest became impromptu undertakers, taking corpses to the cemetery in the family’s stead, and receiving very high salaries for their willingness to expose themselves to infection. The rich owners of countryside manors fled the city, while the surviving poor, trapped within the city walls, often pillaged the now-empty houses of the wealthy (Podd 2011). Desolation and death left a sense of fear and helplessness in contemporaries, who longed for a change (Villani et al. 1857; Cohn 1991). The Black Death abated in the last months of 1348, with most wealthy families being back in a bleak Florence by early 1349 (Hatty 1992).

Due to the lack of records from such chaotic times, the total number of victims cannot be determined conclusively. However, we know that the Florentine population in 1350 ranged between 32,000 and 42,000 (Day Jr. 2002); the Black Death killed between three-quarters and two-fifths of the population, depending on the estimate used (Benedictow 2021; Day Jr. 2002; Falsini 1971). Among the victims, we can count the popular coalition government. The chaotic environment created by the plague weakened social and political customs, while simultaneously making the successful reforms of the previous few years insignificant in the face of the appalling death toll. The *Arti Maggiori* used the chaos to their advantage, guaranteeing that the majority of political seats were assigned to the members of these seven guilds. In August 1348, the emergency magistracy, four-fifths of whom were from the *Arti Maggiori*, reduced the number of guilds from 21 to 14, eliminating seven *Arti Minori* from political life, justifying the decision with the huge casualties suffered by the city. Furthermore, electoral nominees were modified to greatly favor the *Arti Maggiori* and virtually ensured their control over the key *Gonfaloniere di Giustizia* office (Becker and Brucker 1956; Guidi 1977). The *Arti Medie* and *Minori*, much more severely affected by the Black Death, failed to mount any opposition to this squeeze by the oligarchy. The numerous vacancies brought by this outbreak were then filled through elections held in 1349 using the new rules, which ensured a clear dominion by the *Arti Maggiori* over most political positions, and ushered in a new political phase in Florence. The conditions for a regressive lock-in stifling renewal were now in place.

3 Florence after the black death

In early September 1348, the outbreak disappeared as quickly as it began, and a very different city rose from the ashes (Villani et al. 1857; Cohn 2002). The survivors from the lower classes found themselves in possession of some of the wealth previously accumulated at the top through charitable bequests from wealthy victims and

the looting of empty houses left behind by wiped-out or fleeing households (Podd 2011; Renouard 1948). The quality and quantity of their consumption grew considerably, despite the significant increases in price caused by the much-reduced supply of labor and harvest from the fields, often abandoned and neglected during the Black Death. Indeed, compared with other stricken cities, food prices were relatively lower in Florence, probably due to the very high mortality rate, which led to a collapse in food demand (Benedictow 2021). The low labor supply, the redistribution of wealth, and the increased prices enabled the surviving workers to negotiate successfully for significantly higher salaries, thereby increasing their purchasing power (Tognetti 1995) and the range of products consumed (Franceschi 2012, 2016). Florence was notable for the remarkably rapid increase in wages and relatively slow increase in the prices of goods (Goldthwaite 1975).

Even the survivors from the higher classes had some advantages in the post-Black Death period, as capital was now concentrated in fewer hands (Renouard 2020). Moreover, the deaths and bankruptcies that followed led to the extinguishment of many debts. One of the guilds most negatively affected was the guild of doctors and apothecaries, decimated by this health shock and often unpaid for the medical services they rendered (Ciasca 1927). An office was set up to collect outstanding guild credits from the survivors, but with only modest success. Manufacturing activities suffered from a lack of skilled workers and worsening financial conditions due to the higher labor costs. The government reacted to this profit upset with policies aimed at putting a ceiling on wages and controlling prices. The Black Death did not negatively affect all productive sectors (Falsini 1971). Undertakers became enormously wealthy, leading to laws regulating the prices of their services (Carmichael 2014) and the demand for builders and artists boomed (Cohn 2012; Rota and Weisdorf 2020; van Zanden 2009). Indeed, the pandemic promoted the survivors' desire to be remembered by posterity and commemorate their deceased ones. However, the overall economy struggled to recover, as evidenced by frequent nonpayment by entrepreneurs to the government for their leases. To get through these difficult times, the government reduced the rates on outstanding public leases, in contravention of a norm promulgated during the outbreak. Lingering emergency conditions continued to facilitate both processes of generation and selection of institutional variation.

Order in the city was re-established only in 1349, as signaled by the resumption of official documentation. Administrative, legal, and policing activities carried out by the government resumed over time, as the numerous vacancies were slowly filled with new personnel. The sharp drop in both trade and the municipality's tax collection capacity led to a significant contraction in tax revenues, significantly worsening the already precarious situation of the Florentine public debt. Since many public officers had low and irregular salaries, which only modestly increased after the outbreak (Caferro 2013), the new officers primarily came from the wealthier strata, reinforcing their power at the administrative level. The new government resorted to heavy-handed policies to fix the financial crisis, such as confiscating the assets of those who died without either a will or heirs up to the eighth degree of kinship (Falsini 1971). The extremely high mortality rate led to a significant number of cases being ascertained by a municipal bureaucracy on the brink of collapse, resulting in many mistakes, followed by litigation promoted by the legitimate heirs, who,

in most cases, eventually managed to come into their inheritance. Some relief for the public finances came from the fact that the Black Death and its chaotic aftermath prevented ordinary interest payments, while complex hereditary arrangements, made more difficult by the authorities' meddling, prevented the payments of arrears (Barducci 1979). In 1349, it was decided that creditors not yet fully repaid could ask for direct reimbursement, which led to massive crowds and even riots in front of the municipal offices. This murky situation induced creditors to corrupt the *Monte* officers in order to receive their due (Barducci 1979). The members of the *Arti Medie* and *Minori* were the most affected by the penalties imposed by the ensuing investigation. However, some of the *Arti Maggiori* had to pay fines, and even the *Gonfaloniere di Giustizia* was implicated. While the coalition government reflected a relatively large political majority, the post-Black Death oligarchic government was imposed as a *fait accompli* on a city shocked by tragedy. To remain in power, forceful methods were required, thus creating path-dependent pressures towards regressive, even violent policies.

The financial crisis brought about by the Black Death led the new government to increase taxation for over a decade (Barducci 1979; Falsini 1971). Particularly significant were the increases in indirect taxes on wine, grain, meat, doors, salt, and bread. The heterogeneity of the affected goods followed the changes in consumption among the lower classes that occurred in those years. While primarily motivated by the need to provide for the high and increasing public expenditures, taxation was also used to moderate higher quality consumption among urban workers. The taxes were accompanied by specific sumptuary and labor laws aimed primarily against rural workers, perhaps the most repressive of their kind among those enacted in post-Black Death Europe, that were regularly re-enacted and extended every three years for the following three decades (Cohn 2007). By imposing heavy fines on farmers attempting to leave the lands near the city, and an increasing tax burden on the peasants working more distant land, the authorities managed to stabilize the rural population and their wages. To counter the high urban wages, the government inaugurated new policies to favor immigration. Although the ensuing immigration gave new life to the labor market and the economic growth of Florence, the immigrants were not granted political rights, thus preventing a return to the political scene of the *Arti Medie and Minori* and their "new men". Despite significantly higher wages, Florentine urban workers' conditions improved less than in other territories (Alfani and Murphy 2017; Goldthwaite 1975). The limited support base for the oligarchic government again forced it to prioritize maintaining political equilibria by creating divisions among the lower classes through careful management of political rights.

The countryside shouldered even more unfair taxation than the city. Elements such as the status, age, gender, or physical condition of the heads of the family had little influence on the tax burden, which was instead affected by geographical features such as altitude (Cohn 1996). The families that were the poorest, most numerous, and furthest from Florence paid the highest rates. Rural taxes increased for decades, up to fourfold the original amount (Epstein 1993). Tax policy reflected purely urban interests, reflecting the lack of political weight of the peasants and countryside aristocrats in the Florentine Republic (Cohn 1995). High rural taxation also served as an incentive to promote immigration into the city. However, many peasants

elected instead to emigrate abroad, or to engage in rebellions, often led by the local *Magnati* who refused to pay taxes to the city. As a result of these heavy-handed, extractive policies, the rural population kept declining, reaching a minimum in 1375, making food more expensive over time. Less productive land for cereals was repurposed for different types of cultivation, such as olive groves and vineyards, that were increasingly in demand by the population (Tognetti 1995). Some land left entirely fallow reverted to forest, keeping the cost of firewood low. The farmers living closer to the city could not resort to armed rebellion; those who refused to migrate into the city and join the urban poor mostly became sharecroppers (Brown 1989). Indeed, the post-Black Death context favored sharecropping (*mezzadria*), a system that greatly limited the autonomy of the land tenant in favor of the landowner, thereby stabilizing the extractive regime. Although sharecropping was an efficient response to the new constraints, as well as the lower labor supply and the novel demand for crop mix, its consolidation served as a structural anchor for the pandemic-induced regressive lock-in. Indeed, sharecropping stifled broad-based economic recovery by suppressing rural demand and institutionalizing a rigid socioeconomic structure that reinforced long-term inequality for generations.

To rein in the rural *Magnati*, who were engaging in rebellions and banditry in the mountain areas, the new government reversed the policy of retrenchment favored by the previous administration immediately after the Black Death was over (Caferro 2008). The first military campaigns aimed to re-establish Florentine dominion over the surrounding countryside, which, after the Black Death, was considered a key source of revenue and labor, now scarce (Becker 1966). The first campaign, launched to subjugate the mountainous areas of the countryside, eventually spilled into a series of conflicts with Milan for control over the contested area and its population (Caferro 2013). The armies heavily pillaged and harassed the countryside, worsening the damaging impact of the extractive Florentine policies. While these campaigns were quite expensive and ultimately ineffective in imposing the Florentine policies over the mountainous border areas, they succeeded in enforcing serfdom over the areas surrounding the city, ensuring the relatively low food prices considered necessary to lower the inflated workers' wages. Furthermore, the military requirements of an aggressive stance towards the rural areas provided the Florentine government with a stable reserve of troops to cow potential internal unrest, thus securing the regressive lock-in initiated with the Black Death.

In general, foreign and domestic policy, while not always successful, was conducted in a way consistent with the oligarchic interests of the government, which could be articulated as follows: to ensure elite domination over all relevant political and administrative offices in order to secure the revenue required to pay interest on public debt instruments through extractive policies. Of course, the *Arti Maggiori* and their allies received most of these payments. Undoubtedly, the *Arti Maggiori* exploited the post-Black Death situation to guarantee that the majority of political seats would have been assigned to the members from these seven guilds, leaving the residual seats to the other 14 guilds. This new state of affairs regenerated an unfair and speculative financial and fiscal system, which greatly advanced their interests (Barducci 1979). The entrepreneurial, commercial, and financial elites composing the *Arti Maggiori* managed to take advantage of the crisis generated by the Black

Death by capturing the executive and legislative power and centralizing political power into their guilds. However, we must not assume that the families of the *Arti Maggiori* were the same as in the period preceding the Black Death, as this outbreak affected the elites unevenly, determining which actors took part in the oligarchic turn of this period (Ciappelli 1991). Once in power, the *Arti Maggiori* were able to gain support from the most affluent members of the other social groups (Ciappelli 1991), also through strategic marriage policies (Padgett 2010). In 1350, the number of guilds was brought back to 21, expanding the number of eligible candidates for office and allowing new political subjects to join the oligarchic government (Franceschi 1993; Tognetti 2017). However, these new positions were mostly honorary in nature, and did not imply any significant loss of control of the *Arti Maggiori*. Furthermore, those honored by these positions tended to identify themselves with the rich and powerful (Brucker 1957). Thus, the *Arti* Maggiori managed to quickly replenish their losses after the plague, while most of the "new men" power base, strongly linked to specific personalities and conditions, was mostly destroyed. With the repayment of the lingering debts owed to Avignon by the Florentine banking families, the relationship between the *Arti Maggiori* and the Church improved. Nevertheless, the oligarchic government did not restore power to the Inquisitorial office (Becker 1959) and later abolished all existing laws against usury, as religious meddling in the city affairs, and especially its banking sector, was against the oligarchs' interests, no matter how devout they professed to be.

The governmental efforts aimed at re-establishing a steep social hierarchy and preventing the economic gains of the workers from solidifying, and perhaps becoming political gains too, were effective. In the decades following the outbreak, a strong trend towards inequality and limited social mobility emerged and became established in Florentine society, contrary to other Italian cities (Alfani and Ammannati 2017; Stella 1993). The increased taxation prevented common people from further improving their living conditions. The oligarchs avoided most taxation, being instead apparently forced to lend to the *Monte*, receiving very high interest payments for their trouble, thus increasing their wealth in the medium term. The complex but very profitable method of financing Florence's increasingly high public debt through loans and public debt provided the *Arti Maggiori* with relatively safe and highly remunerative investment vehicles for those with capital to invest (Herlihy and Klapisch-Zuber 1978). To avoid wealth dispersion due to future epidemics, the wealthy changed their testamentary customs, ensuring that, no matter what, the inheritance would remain in the family (Cohn 2012), thus closing another possible redistribution avenue. The *Statutum Biadi* of 1355, which governed the new relations within the guilds and between them and the government, further solidified the *Arti Maggiori*'s grip on the political and legislative power (Becker and Brucker 1956; Franceschi 1993; de la Roncière 1982). Despite attempts to reduce wages to ensure competitive production costs, the new local and international consumer preferences emerging after the Black Death ensured the terminal decline of the Florentine wool production directed to the mass market in favor of higher quality production using fewer, more skilled workers (Franceschi 1993; Tognetti 2001). The decline of the pre-pandemic textile sector, which before the pandemic almost monopolized the low-skilled labor market in Florence, and the highly unequal policies of the post-Black Death

oligarchic government reduced the well-being of the workers, who failed to achieve any sort of significant political rights (Brown 1989), contributing to the build-up of social tensions (Tognetti 2001).

While internal tensions were mounting, the foreign policy continued to pursue an ambitious expansionist project aimed at securing tribute and taxation from the surrounding regional powers (Muir 1981). After the campaigns in the countryside and the following conflicts with Milan, an aggressive campaign was launched to subjugate Pisa, with the aim to annex the surrounding plains and transform them into a Florentine breadbasket, in order to lower the higher food prices brought by the Black Death. In 1375, the government, betraying its long-standing Guelph position, attacked the Papal States, leading to 3 years of inconclusive fighting that greatly worsened Florentine public finances. The last serious rural resistance to Florentine expansionism submitted to taxation by the 1380 s. By the fifteenth century, Florence achieved full regional hegemony (Epstein 1991). These expansionist policies, combined with the astounding decision to triplicate the interest rates paid on the *Monte*, to an unheard of 12 percent, despite no lack of willing lenders, led to a fourfold expansion of the public debt between 1348 and 1378, prompting a corresponding increase in the burden of taxation, which fell especially heavily on the newly conquered lands, farmers, and workers. Taxes were often collected through brokers, who paid in advance, recovered their due from the general population later, and received interest payments in the meantime (Caferro 2008). The farmers living in the mountains managed to partially avoid the severe taxation, due to their ability to physically resist tax officers, and suffered less than those living in the plains (van Bavel 2022). The increased taxation, combined with the unpopular and largely unsuccessful war against the Pope, which led to the city's excommunication, finally tipped the scales against the government, prompting the beginning of a short-lived popular revolt in 1378.

The *Ciompi* Revolt of 1378 put the new regime to the test. It began with the submission of three petitions to the government coming from a disparate coalition of citizens, consisting of the *Magnati* unhappy with the outcome of the recent war with the Papal States, guildsmen from the *Arti Medie* and *Minori* and common workers, all asking for the abolition of proscription, popular access to minor political positions and an end to some of the more unfair taxes (Lantschner 2014). These issues were championed by the current *Gonfaloniere*, who also attempted to reinstate the currently severely limited *Ordinamenti di Giustizia* against the *Magnati*. Although some requests were accepted, the situation remained tense and eventually led to violence, with the wool workers, who began to be called the *Ciompi* by their political enemies, occupying government buildings and declaring a popular government. The new administration launched a number of significant reforms, focused primarily on dismantling the absolute control held by the *Arti Maggiori* and the *Magnati* over the key political positions. The radical nature of the reforms and the rising tensions within the city convinced the *Arti Minori* to abandon their support of the workers, forcing the new government to stand down. In its place, a new *Arti Maggiori* coalition government was created, with the *Arti Medie* and *Minori* gaining a minority position. The new government quickly reversed all the reforms passed by the *Ciompi* government, and re-established the oligarchic dominion: in a few years, the

Arti Medie and *Minori* returned to the minor political roles that they had held before the revolt.

One of the main reasons for the failure of the revolt was that radical change in the policy of the Florentine government found opposition among the *Arti Medie*, who benefited from the fiscal and financial regime established by the oligarchy, and even among the *Arti Minori* as they generally appreciated the repressive stance taken against urban and rural laborers, and the resulting lower wages and cheaper food prices. Furthermore, all guilds had access to minor political positions, from which the laborers were excluded. Disbelieving in the longevity of the new regime, the *Arti Medie* and *Minori* preferred to curry favor among the elites by suppressing the laborers, rather than risking either being punished if the revolt failed, or ending up in a subordinate position to members of the lower classes. Two factors largely explain the *Ciompi* failure. First, previous popular governments were supported by the laborers but run by the *Arti*, thus maintaining the latter's leading role. Second, the revolt did not coincide with any particular external shock, damaging the ruling socio-political institutions. In normal conditions, the revolutionary implications of the *Ciompi* government were unacceptable even for the progressive members of the guild establishment. With the revolt suppressed, the government proceeded with its reforms, this time turning towards the judicial system.

The oligarchic turn also had relevant long-term effects on the new forms of dispute settlement that arose after the Black Death (Cohn 1981; Jansen 2013). Before 1348, disputes were managed by various associations comprising communal government and chaplains of popular and middle-class origin. Their primary function was to report incidents arising in their parishes. After the Black Death, however, the sentences issued by the court based on reports made by the chaplains fell from 60 to 25%, completely disappearing by the beginning of 1400 (Cohn 2013; Zorzi 1990). Moreover, the post-Black Death records cite many cases in which the chaplains were fined for failing to carry out their duties. At the end of the *Ciompi* Revolt in 1382, a new magistracy responsible for public order was instituted: the *Otto di Guardia*. Florence's justice approach changed from an accusatorial system to an inquisitorial one, i.e., from a justice system favoring settlement to one geared toward penalties and sentences. After 1382, electoral mechanisms were tightened for the various government offices, further reinforcing the *Arti Maggiori*'s control (Franceschi 1993). Over the years, the Black Death significantly intensified the oligarchic tightening that, albeit with some slowdowns, culminated with the rise of the Medici in the next century (Brucker 1983; Najemy 2006).

While the government inaugurated by the Black Death largely succeeded in realizing its political program, finding itself uncontested within the city by the end of the fourteenth century, a number of failures were becoming evident. At the beginning of the 1400 s, countryside revolts intensified, and Florence was forced to accede to the requests of the insurgent peasants, who obtained considerable legal and fiscal advantages (Cohn 2000). Starting from 1402, the rural communities hardest hit by either the plague or by war regularly obtained a reduction in their tax burden, in contrast to previous practice (Cohn 2000). However, the rural population remained severely exploited and repressed. Contrary to other Italian and European cities, the population continued to decrease even many decades after the end of the outbreak

(Tognetti 2015). This diaspora affected farmers and businessmen alike, who went to seek their fortune elsewhere, reducing the competence base of Florence and making other cities more competitive. The continuous waves of wars, famines, and plagues that followed did not help to reverse this demographic trend. The exploitative policy followed by the oligarchic government continued to prevent demographic growth after the Black Death, both within and outside the city (Epstein 1993). Florence never regained its demographic pre-eminence, its demographic and socioeconomic growth lagging behind that of all other major Italian states (Epstein 1991). The urban population nadir was reached in 1427, with a two-thirds reduction in the rural population compared with the beginning of the previous century (Curtis 2012). At the same time, economic inequality reached a peak: in 1427, the first percentile of the Florentine families owned one-quarter of the wealth of the city, and one-sixth of the total wealth of Tuscany (Muir 1981). In the meantime, Florentine salaries stagnated (Malanima 2013). This, combined with very weak rural demand due to sharecropping practices,[2] led to a terminal decline in large-scale manufacturing activities and a consequent decline in the living conditions of most of the population (Epstein 1993). The regional socioeconomic decline was further worsened by the protectionist policies imposed by Florence, which, together with excessive capital concentration, stymied the development of manufacturing activities in the entire region, thereby promoting a return to subsistence farming in the countryside (Epstein 1991). Urban manufacturing activities, under significant international pressure, turned instead towards small but autonomous artisan shops oriented to luxury goods, such as silk, for the great international merchants (Padgett and McLean 2011). Even the struggling wool textile sector evolved toward higher-quality goods, forsaking low-income demand, which was, in any case, flagging due to the aforementioned repressive policies. The oligarchic government achieved its intended results, but at the cost of stifling economic growth and re-imposing quasi-feudal conditions over the countryside, contributing to the relative economic decline of the Italian peninsula.

4 Discussion

Before 1340, Florence's commercial vibrancy depended on finely tuned, but poorly resilient, mechanisms of taxation and debt management. However, the first outbreak wave exposed the fragility of these arrangements and triggered a wave of fiscal reforms that streamlined revenue collection and delegitimized previous routines (Becker 1962). From an evolutionary standpoint, this shock acted as a selective pressure that allowed adaptive practices to thrive. As argued by Cordes: "Behaviors, habits, routines, or institutions do not exhibit the constancy of genetic material, but are adapted systematically to selection pressure" (Cordes 2006, p.537). The latter can be understood as contextual conditions that weaken or even overturn institutional inertia, thereby promoting the conditions for institutional change. The weakening

[2] However, the diffusion of this rural agreement had some positive consequences for the peasants (Galassi 1992).

of incumbent elites after 1340 had opened space for new fiscal mechanisms and political actors, fostering a period of institutional renewal. In stark contrast, when the far deadlier Black Death of 1348 struck, surviving oligarchs leveraged the ensuing chaos to consolidate their grip, imposing heavier levies on weakened guilds and rural producers (Curtis 2012; Klein and Ogilvie 2016; Cohn 2002). This re-entrenchment of the ruling oligarchy led to the implementation of extractive policies aimed at protecting elite interests and stifling broader structural adaptation. Using an evolutionary framework, the practices and institutions that emerged after 1340 did not have time to become entrenched routines, whereas those formed during the Black Death did. These divergent outcomes demonstrate that a pandemic's legacy depends less on the magnitude of the shock than on the institutional system's openness to selection, turnover, and renewal.

From an evolutionary perspective, pandemics are powerful selection tools for institutional systems. The first political consequence of large-scale epidemics is government delegitimization, which creates strong selection pressures on existing socioeconomic institutions. There are two main reasons for this. The first derives from the incumbent government's failure to mitigate the mortality and morbidity of the outbreak (Abad and Maurer 2021). The government can be accused of failing to avoid the spread of the infectious disease, creating the conditions for the outbreak, or even having directly or indirectly caused the outbreak through previous governmental actions. Historically, epidemics have often been associated with the ruler's lack of divine favor (Aydemir 2021). Even in modern times, governments are unlikely to avoid blame for an outbreak (Kreps and Kriner 2020). The second reason derives from a deficient political response to the catastrophic socioeconomic effects of the epidemic in the short run (Brodeur et al. 2021; Hatty 1992). The incumbent government is prompted to act quickly and decisively against the outbreak, yet its efforts are unlikely to be very effective. Even a hypothetical prompt and rational action would only prevent a worse tragedy from taking place, a paltry excuse in the face of the suffering and loss faced by the citizens. More realistically, the sudden and mysterious nature of an outbreak usually leaves the government unable to act effectively. Therefore, the outbreak usually delegitimizes the political establishment facing it in the short run, although the severity of the effect will be mediated by the mortality of the outbreak (Bol et al. 2021). While a strong government may survive, any pre-existing tensions will be brought to the fore, leading weaker regimes to falter. Epidemics create the opportunity for new elites to emerge by replacing the previous regime, and, if the new elites are capable and well-organized, more successful practices and institutions can develop (Aydemir 2021; Becker 1962). However, it can also happen that the dominant elite retains power, and the pandemic induces policies that minimize uncertainty but reduce the long-term development potential, leading to a reactionary lock-in outcome (Curtis 2012; Klein and Ogilvie 2016).

This effect can be observed throughout history (Callegari and Feder 2022b; Cohn 2002). However, our analysis highlights an interesting consequence. The government tested by the outbreak will likely provoke an authoritarian response to the widely perceived loss of efficacy and control. This reactionary turn aims to showcase the establishment's strength, cow the critics into submission, and repress potential political adversaries. This reaction took place in both cases described, with one

critical difference. In 1340, the tightening of political power from above failed, leading to a popular reaction in the opposite direction. In 1348, the tightening of political power from above succeeded and stifled any popular reaction. Neither rural nor urban revolts managed to change the new Florentine political reality. This political change significantly affected the development trajectory of the entire Tuscany region for decades to come. The Black Death's negative impact on government legitimacy led to a significant oligarchic shift. This change brought dramatic consequences that can be counted among the indirect impacts of the pandemic. However, the long-term impact of the Black Death was not purely indirect, although the oligarchic government did strongly limit all its direct socioeconomic effects. For example, they fought food prices and workers' wages increases, recreating the now weakened material divide between social classes, thereby re-establishing profitability for these manufacturing sectors struggling with the post-Black Death conditions. All these policy directives were a direct response to the great changes brought by the pandemic. Therefore, we argue that pandemics have both short-term and long-term political consequences, changing their socioeconomic development path.

From an evolutionary perspective, the long-term developmental outcomes of a health shock are not linearly determined by the severity of its demographic or economic impact. Instead, they emerge from the interaction between the pre-existing institutional configuration, the political system's adaptive capacity, and the endogenous selection of policy responses and leadership structures. Building on the evolutionary economics tradition (Nelson and Winter 1982), we frame pandemics as exogenous shocks that test the fitness between institutions and the new socioeconomic environment. Pandemics generate acute stress that reveals institutional fragilities and opens space for policy experimentation. This process follows four core evolutionary mechanisms: variation, selection, lock-in, and feedback. First, the outbreak shock induces selection, as institutions and political actors are judged, implicitly or explicitly, on their ability to respond to the health crisis. Second, in open institutional contexts, this may lead to experimentation and reform, and the emergence of variation in the guise of new political coalitions, fiscal tools, and administrative routines. However, selection is often based on short-term survival rather than long-term developmental fitness, leading in some cases to the consolidation of power-preserving but growth-inhibiting structures. Third, once some practices are institutionalized as successful responses, they tend to be retained, potentially leading to path dependence or even developmental lock-in. Institutions that prove effective at preserving elite interests during a crisis may persist, even if they hinder future innovation or equity. Finally, these responses reshape the socioeconomic landscape, altering distributional dynamics, social cohesion, and investment incentives, thereby influencing future institutional behavior. This feedback loop closes the co-evolutionary circuit between the policy responses to the epidemic shock and the broader economic trajectory. Figure 1 illustrates the proposed mechanisms at work.

This evolutionary pattern seems to mirror contemporary behavioral patterns, where individual and collective decision-making in response to health shocks can produce divergent aggregate outcomes, depending on pre-existing social norms and power asymmetries. More broadly, this framework helps explain the observed heterogeneity of pandemic outcomes across time and space. When institutions

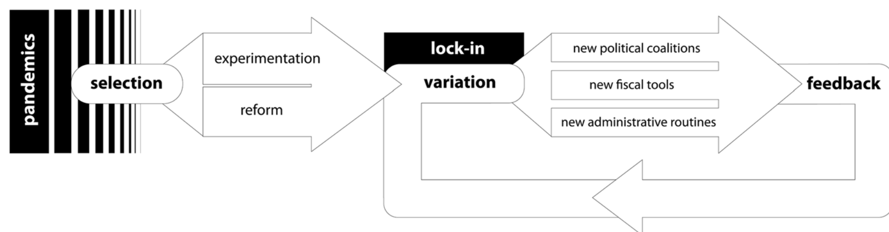

Fig. 1 The co-evolutionary circuit between epidemic shocks and institutional change

are pluralistic, transparent, and accountable, it is more likely that their societies will undergo adaptive change in response to pandemics. In contrast, when institutions are centralized and rigid, power structures tend to select for stabilizing but regressive responses. Therefore, the magnitude and direction of pandemic outcomes depend not only on their biological or economic characteristics but, above all, on their role as a stress test for the institutional order. In this view, pandemics are not only crises of health, but they are also critical moments in the evolutionary history of institutions.

Our contribution also engages critically with the burgeoning field of disaster history (Worster 1979). The central debates in this literature—on vulnerability, resilience, and institutional adaptation to shocks—are highly relevant to our findings (Rohland 2018). While much of disaster-history scholarship frames historical trajectories in Malthusian, Marxist, commercialization, or broader institutional terms (van Bavel et al. 2020), the evolutionary perspective adopted here provides an analytical advance by offering a dynamic framework that integrates these four approaches. Although these established frameworks correctly identify important drivers of historical crises, they often do not explain the mechanisms by which these factors interact dynamically during acute shocks. Our evolutionary account does not simply subsume these perspectives; rather, it treats them as contextual inputs that shape selection processes.

Furthermore, whereas disaster historians stress the significance of institutional preconditions and flexibility in mediating hazard outcomes (Acemoglu and Robinson 2013), our contribution is to provide a unified mechanistic account of observed heterogeneity using evolutionary economics. We conceptualize pandemics not merely as exogenous shocks but as selection pressures acting on existing fiscal and administrative routines. This framing lets us examine the mechanisms of variation, selection, and institutional lock-in that determine long-run trajectories and distinguishes our analysis from broader historical or institutional narratives. By tracing the co-evolutionary circuit, we illuminate the complex, bidirectional relationship between disease spread and economic development; in this sense, our methodology resonates with the view that historical disasters operate as "tests at the extreme margin" for institutional fitness (van Bavel et al. 2020).

Finally, the specific design of our single-case study affords an empirical advantage for assessing the relative importance of preconditions emphasized in the disaster-studies literature (Blaikie et al. 1994; Bankoff et al. 2004). The within-case comparisons allow us to isolate mechanisms that produced divergent outcomes (adaptation versus lock-in). Our evidence indicates, with high granularity, that institutional selection pressures and differential responses by political actors were decisive in driving the divergence, independent of broader pre-existing cultural and socioeconomic differences. This strengthens the role of institutional dynamics as the key evolutionary mechanism shaping long-run socioeconomic paths.

Moreover, this paper contributes to the resolution of a key historical puzzle about the long-run impact of the Black Death in Florence: despite one of the highest mortality rates in Western Europe, Florence's post-plague trajectory more closely resembles that of Eastern and Central Europe, where the Black Death was far less lethal (Benedictow 2010; Clark 2007; Robinson and Acemoglu 2012). Although similar exceptions emerge in some rural areas (Álvarez-Nogal et al. 2020; de la Escosura and Rodríguez-Caballero 2022), rurality does not apply to Florence, one of the greatest European metropolises of the fourteenth century. We solve the puzzle by suggesting that Florence may also have experienced the positive long-term economic and social effects typical of Western Europe, but the authoritarian political turn effectively stifled them, ushering in some effects commonly associated with Eastern and Central Europe instead (Jedwab et al. 2022). Therefore, we highlight the political relevance of the Black Death, a dimension that has received relatively little scholarly attention (Bosker et al. 2008; Falsini 1971). Indeed, by connecting pandemic shocks and political development in a unique framework, we also propose to solve the apparent inconsistency between the size of the event and its apparently limited socioeconomic impact.

Our contribution could also be helpful in the economic literature on the long-run effects of the Black Death and pandemics in general (Alfani 2022; Callegari and Feder 2022b). Indeed, the mediator role of the political changes induced by this outbreak could complement the previous explanations of the variety of the long-term impact of the Black Death observed within and outside Europe (Benedictow 2021). A similar argument could also be useful in interpreting the even greater heterogeneity of pandemics' effects in general (Callegari and Feder 2022a). While some outbreaks modify the development path, others lead to an unrelenting decline of the territory over time, and still, others positively induce marginal effects on the socioeconomic trends (Callegari and Feder 2022c; Epstein 2000). These effects emerged sequentially in Florence during the mid-fourteenth century, which became a notable theoretical laboratory for understanding and deepening the socioeconomic impact of pandemics in the long run.

These insights offer several relevant implications for contemporary policymaking, especially in light of COVID-19. First, institutional adaptability is crucial. The starkly contrasting long-term outcomes following the 1340 epidemic (which fostered institutional and fiscal experimentation) versus the 1348 Black Death (which entrenched rigid, extractive routines) underscore that institutional flexibility, not merely the magnitude of the mortality shock, determines post-pandemic trajectories. Governments should then invest in flexible administrative

frameworks, such as adaptive budgeting mechanisms and temporary regulatory tools, that can support rapid and equitable responses to systemic shocks without entrenching special interests. This prioritization of adaptive capacity over rigid protocols is a primary lesson. For instance, during COVID-19, authorities that combined strong public-health measures with flexible, data-driven adjustments to restrictions and compensation schemes were better able to reconcile health protection with economic continuity (Bonaccorsi et al. 2023; Di Porto et al. 2022).

Second, political legitimacy must be safeguarded. In Florence, efforts to suppress dissent and centralize power may have preserved short-term stability, but they ultimately undermined long-term resilience. Contemporary policymakers should prioritize transparent communication, accountability, and public trust during crises. Independent oversight, accessible data, and inclusive decision-making are essential to avoid authoritarian drift and maintain legitimacy. During the COVID-19 pandemic, the combination of model uncertainty, rapidly evolving scientific information, and political contestation often eroded public trust in science and authority (Kreps and Kriner 2020). However, transparent, science-based communication and clear responsibility for decisions have cushioned the legitimacy shock created by stringent measures such as lockdowns and vaccine mandates (Bol et al. 2021).

Third, elite renewal and inclusive governance matter. The 1340 epidemic facilitated the emergence of new coalitions, thereby enabling policy experimentation. In contrast, the continuity of the pre-Black Death oligarchy led to rigid responses that prioritized elite interests over structural adaptation. Modern health shocks can similarly reshape elite competition: evidence from the 1918 influenza and from COVID-19 indicates that epidemics can alter electoral outcomes, cabinet composition, and the credibility of technocratic experts (Abad and Maurer 2021; Brodeur et al. 2021). Thus, crisis governance should include mechanisms for leadership turnover and diverse stakeholder input. Rotating advisory bodies, term limits for emergency powers, and the engagement of civil society in policy discussions can introduce new ideas and prevent institutional capture.

Finally, policymakers should anticipate and guard against long-term institutional "lock-in". The Florentine oligarchy's rent-extractive policies after 1348 created a path-dependent structure that hindered future development. Similarly, contemporary vulnerabilities reflect long-standing institutional choices that shape how societies absorb new shocks. In many countries, the market-oriented reforms that preceded the COVID-19 pandemic, particularly the privatization of welfare services and the weakening of labor market regulations, amplified the pandemic's economic impact and exacerbated existing inequalities (Dosi et al. 2020). Therefore, policy demands stemming from this pandemic call for a systematic shift towards new socioeconomic models (Leach et al. 2021). To prevent temporary crisis measures from calcifying into permanent distortions, emergency measures should include built-in sunset clauses and be subject to rigorous ex-post evaluations. Ensuring that crisis-driven policies do not become permanent distortions is key to preserving economic dynamism.

In sum, the case of the Black Death in Florence reminds us that the true legacy of a pandemic lies in how institutions respond. By designing policies that promote

adaptability, legitimacy, inclusion, and long-term accountability, governments can turn a crisis into an opportunity for institutional evolution rather than regression.

5 Conclusion

This study has shown that an epidemic outbreak is a selection event on existing fiscal and administrative routines. Indeed, the Florentine divergent post-plague socioeconomic trajectories depend not on mortality alone but rather on how political and institutional actors responded to each epidemic. This study has shown that an epidemic outbreak is a selection event on existing fiscal and administrative routines. Indeed, the Florentine divergent post-plague socioeconomic trajectories depend not on mortality alone but rather on how political and institutional actors responded to each epidemic. Our analysis focuses not merely on the Black Death (1348) or the encompassing "decade of disaster", but on the sequence of selection pressure and the resulting institutional adaptation (or failure thereof) it triggered. The 1340 plague and the 1348 Black Death served as two successive institutional stress tests to analyze how institutions mediate the bidirectional relationship between the spread of disease and economic development.

The 1340 plague weakened entrenched oligarchs and spurred fiscal reform, allowing adaptive practices to thrive, whereas the Black Death enabled surviving elites to consolidate power and enact extractive measures that suppressed broader socioeconomic recovery. By conceptualizing pandemics as evolutionary "stress tests" for institutional fitness, our analysis reveals that adaptability and elite behavior are decisive in shaping long-run outcomes. This framework employs the core evolutionary mechanisms of variation, selection, lock-in, and feedback to explain the divergence in effects to underscoring the need for frameworks that integrate institutional change into economic-health models. For modern policymakers, the lessons are clear: crisis governance should prioritize flexible administrative mechanisms, transparent decision making, and inclusive leadership renewal. Embedding sunset clauses in emergency measures and conducting rigorous ex-post evaluations can prevent temporary responses from calcifying into regressive lock-ins.

This study makes dual contributions to existing literature. First, we support the relevance of evolutionary economics as a powerful lens for understanding the heterogeneous, complex, and bidirectional relationship between economic development and disease spreading. By illustrating how institutional selection pressures shape long-run economic paths, our evolutionary theory offers a unified account of why and how health crises produce divergent long-term effects. Second, concerning the historical literature on pandemics, we contribute to resolving a key historical puzzle: despite having one of the highest mortality rates in Western Europe, Florence's post-plague trajectory more closely resembled that of Eastern and Central Europe. We argue that the potential positive long-term effects, typical of Western Europe, were stifled by the authoritarian political turn that led to extractive policies after 1348, thereby underscoring the political relevance of the Black Death.

Methodologically, this paper offers a novel solution to the challenges inherent in studying pandemic outcomes, such as the difficulty of isolating specific effects, the

loss of granularity, and the challenge of observing the complex bidirectional relationship in comparative settings. To overcome these issues, we adopted a complementary single-case comparison (1340 vs. 1348) within a relatively stable socioeconomic and institutional context. This strategy preserves contextual consistency and retains the fine-grained detail necessary to track how institutional dynamics—specifically the interplay of mutation and selection in Florence's fiscal and administrative systems—produced sharply divergent long-term trajectories.

However, our analysis suffers from at least three limitations. First, one might argue that the Black Death merely coincided with political changes rather than causing them. Even if the timing appears to support our account, we cannot exclude alternative interpretations. Second, although the social and economic framework remains broadly similar, it continued to evolve throughout the period under study. While our single-case approach mitigates this issue compared with large-scale quantitative analyses, we cannot rule out that factors beyond the health shocks also influenced political dynamics and long-term trends. Third, because our conclusions are drawn from Florence in the Late Middle Ages, they may not be directly generalized to other settings. Therefore, our hypothesis that careful analysis of how pandemics affect policy change yields deeper insights into their long-term effects must be tested in further studies. Interpreting pandemics as selective pressures on institutions offers a powerful guide both for understanding historical legacies and for designing resilient responses to future health shocks.

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Data Availability No datasets were generated or analysed during the current study.

Declarations

Competing Interests The authors declare no competing interests.

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