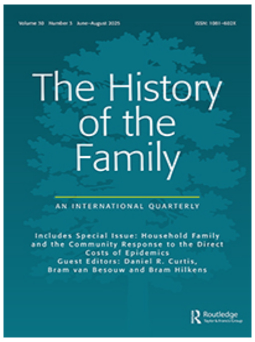

The History of the Family

Routledge Taylor & Francis Group

ISSN: 1081-602X (Print) 1873-5398 (Online) Journal homepage: www.tandfonline.com/journals/rhof20

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To cite this article: Bram Hilkens (2025) Mortality, morcellation, and the market: the impact of epidemic disease mortality on land distribution in a seventeenth-century-Holland village, The History of the Family, 30:3, 413-441, DOI: 10.1080/1081602X.2025.2521526

To link to this article: https://doi.org/10.1080/1081602X.2025.2521526

THE HISTORY OF THE FAMILY
2025, VOL. 30, NO. 3, 413–441
https://doi.org/10.1080/1081602X.2025.2521526

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Mortality, morcellation, and the market: the impact of epidemic disease mortality on land distribution in a seventeenth-century-Holland village

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ABSTRACT
The current article aims to explain the distributional consequences of epidemic mortality by assessing the relationship between post-epidemic land redistribution and land market exchange for one village in early modern central Holland. It argues that plague mortality redistributed land through an increase in smallholders, growing landholding of middling owners, as well as accumulation at the top so that distributional change is not straightforwardly captured by aggregate indices. The user distribution, too, saw increases in smallholding, and more pronounced absorption of land at the top, while middling holdings declined. Land was exchanged chiefly through non-market mechanisms (most notably inheritance and marriage) and ended up mostly in the hands of new owners, rather than accumulation by established owners. The land market, however, did respond to the mortality shock by smoothing out land transactions in an otherwise contracting market. The mortality shock occurred during an already uncertain time—land values fell by 20 percent already in the years before the epidemic struck. The specifics of redistribution are thus explained by the decision to hold, sell, or acquire land, which was partly based on land market conditions, specifically the secular decline in land values in which the epidemic occurred and differing returns to scale per soil type.

ARTICLE HISTORY
Received 2 October 2024
Accepted 13 June 2025

KEYWORDS
Inequality; mortality; land market; rural; epidemics

1. Introduction

In recent years, interest in inequality, epidemics, and the relation between the two has increased. As a stylized fact, it is often taken that epidemic mortality was among the only factors to have structurally caused inequality decline (along with other major disasters and social unrest). Indeed, some authors have claimed the Black Death (1347–1352) to have been a great equalizer through the propensity to destroy human lives while leaving capital intact, effectively raising capital per head of the population (cf. Scheidel, 2017, Ch. 6; Alfani, 2022, pp. 7–16). More specifically, recurring waves of high mortality ensured labor scarcity, increasing wages so that the post-Black Death period is often referred to as the 'Golden Age of Labor'

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/1081602X.2025.2521526

(albeit not uncritically assessed: see Geens, 2023, pp. 23–29 for a recent synthesis). Simultaneously, capital became cheaper through relative abundance, allowing previously propertyless classes to acquire property with newly raised wages (Scheidel, 2017, pp. 297–298). Some authors have even claimed that European expansion and exploitation, and with it the making of a world capitalist system were the direct result of Black Death mortality (Belich, 2022). Additionally, scholars have shown lasting effects on relative factor prices in favor of labor, weakening of extractive institutions such as serfdom, and boosting centralized state formation (Jedwab et al., 2022).

However, the COVID-19 pandemic showed that historians needed to be careful in their generalization of institutional mediation of epidemics (Hilkens et al., 2020) – after all, there is still much we do not know about the socio-economic effects of disease mortality, and the empirical work available does not necessarily lead to scholarly consensus. Firstly, the direct long-term effects of the Black Death were not egalitarian everywhere: Spain's population density had been so low that high mortality shocked productivity to the extent that lands could hardly be worked, pushing up inequality as expressed in the land-wage ratio (Álvarez-Nogal & Prados de la Escosura, 2013; a similar argument for seventeenth-century plague has been made for Italy in: Alfani & Percoco, 2019). Secondly, as seen above, most of the knowledge we have on the egalitarian effects of epidemic mortality comes from the Black Death in Europe, a period with some of the highest mortality rates ever recorded, second only to the Columbian Exchange (Alfani & Murphy, 2017, p. 316). It is often argued that the effects of the second iteration of the Second Plague Pandemic (i.e. the reintroduction of waves of plague mortality in seventeenth-century Europe) were a lot less clear-cut than those of the Black Death and were highly dependent on specific institutional factors (Alfani, 2022, p. 16).

The literature on the redistributive effects of epidemic mortality in seventeenth-century Europe, however, relies almost exclusively on a single case study (also noted by Curtis, 2020, p. 125), which addresses a particular instrument of inheritance, the *fideicommissum*. This institution ensured that wealth patrimonies would be transferred to coming generations by prohibiting heirs from selling certain properties on the market (Alfani, 2010, pp. 67–68). Beyond this case study, it has been suggested that the joint shock of epidemic mortality and destructive warfare in 1630s Augsburg led to a long-term lowering of wealth inequality through destruction of both capital and human lives (Alfani et al., 2022; Scheidel, 2017), but because it is difficult to disentangle the effects of warfare (which tended to encourage the spread of epidemic disease: van Besouw & Curtis, 2022) and epidemic mortality, we cannot gauge the redistributive effects of epidemic mortality clearly. Brea-Martínez and Pujadas-Mora (2019) also allude to short-term inequality decline in the aftermath of plague mortality, but do not elaborate on its potential mechanisms of decline or recovery. van Besouw et al. (2025) find only a slight reshuffling of housing wealth among the top deciles in the Dutch plague-struck city of Leiden. They argue that wealth could only be more equally distributed by epidemic mortality were the shock to disproportionately affect the wealthy, for example by killing many wealthy owners, or by placing severe downward pressure on asset prices.

In short, the literature on epidemic mortality could benefit from additional case studies assessing post-epidemic redistribution of seventeenth-century disease outbreaks. The current article will contribute to the literature in three main ways. Firstly, it presents new evidence on the redistributive effects of epidemic mortality in seventeenth-century Europe, specifically in central Holland, a relatively sparsely understood phenomenon (Curtis, 2016, pp. 140–141). Secondly, it will show how epidemic mortality affected rural property markets, providing insights into how market conditions affected the redistribution of property in a context of high mortality. Thirdly, in addition to the redistributive effect among landowners, it will show redistribution on the user level, as well, which is uncommon in the literature (Curtis, 2020, p. 132; Curtis & van Besouw, 2024, p. 4).

This article argues that the 1655–6 plague epidemic in Holland reshuffled land without significantly affecting aggregate inequality as measured by the Gini coefficient. It redistributed land by increasing the number of landowners at the bottom, but also by adding owners to the top, as well as boosting the holdings of middling landowners. This ultimately 'balanced' the aggregate distribution, where it would have otherwise become more inegalitarian through a combination of land stretching and land concentration. The distribution was affected mostly by transfers outside of the land market, presumably inheritance, (re)marriage, or a combination of both. In fact, the market was affected by the epidemic more than the distribution was affected by the market. Despite falling land values, market turnover rates remained high and stable after the epidemic. Market exchange mostly benefited owners at the bottom and the middle of the distribution, who could make use of the increased market supply of smaller-sized plots. Middling owners took to the market to complement the holdings gained after the epidemic. It is argued that the decision to keep, sell, or increase landholding was influenced by marginal returns to scale.

The article will present the arguments in the following sections: first, it will provide historical context for the case study; second, it will identify mortality regimes within the case study; third, it will assess the changes in land distribution following the epidemic outbreak by matching landowners over time; fourth, it will explain these changes by hand of land market data. The final section will conclude.

2. Land, population, and mortality in Holland

Any study on rural Holland, but particularly a study on landownership responses to mortality shocks should mention that Holland's rural households could not engage in subsistence farming. This is mostly due to extensive peat mining during the late Middle Ages (van Dam, 2001a). Holland's soils, however, had never been very favorable to the cultivation of subsistence crops. Medieval settlers could not attract populations through the promise of fertile lands, and thus lease contracts emerged that provided strong claims to land for the tenants (van der Linden, 1955). Population growth drove land values up during the high Middle Ages already and this in turn created incentives for establishing well-defined property rights (van Bavel, 2001, pp. 20–21). This had obvious effects on the land market in a quantitative sense (through factor market development: van Bavel, 2016), but the socio-political role of land changed along with it. With the increased importance of the market as an allocation system, the social importance of land as a politically oppressive asset in fact dwindled. Instead, individual owners could refute other claims to land through administrative practices inquired by local governments (van Bavel, 2010, pp. 166–167). Without direct elite control of subsistence crops through (for instance) surplus extraction – and thus being heavily reliant on a diversified source of grain imports from the Baltics (van Tielhof, 2002) – subsistence crises in Holland were rare (although the role of grain markets played can be nuanced: Curtis & Dijkman, 2019).

It has been suggested that the relation between wages and population (density) structurally changed during the sixteenth century. This happened throughout Europe but in the Low Countries in particular. Here, higher income could be sustained in the face of population increase because households' productivity improvements (for instance in the form of non-agricultural rural production) were not absorbed by feudal constraints on land (Fochesato, 2018, p. 109). This made wages more rigid in the face of population shocks: productivity increases caused by market-oriented proto-industrial activity outweighed pressure on land as a determinant of wages (van Bavel & van Zanden, 2004). In addition, it should not be forgotten that Holland's economy was chiefly dependent on international demand mediated through urban markets rather than population dynamics or domestic production (Brandon, 2011). Therefore wages in Holland may have been more readily determined by population changes elsewhere, affecting foreign demand for Dutch goods (as is suggested in: Brenner, 2001) than by changes in its population.

The current article presents a case study of the redistributive effects of plague mortality in seventeenth-century Holland. It focuses on the *ambacht* (village) of Hazerswoude, located several kilometers from Leiden which at the time was the most important city in Holland after Amsterdam. Its inhabitants are highly dependent on diversified peat farming, and Hazerswoude is known as a 'prototypical peat village' (van Tielhof & van Dam, 2006, p. 54). The median household chiefly subsisted on a combination of peat mining, cattle farming, and wage labor (Fruin, 1866, pp. 305–306),[1] exploiting long, narrow strips of land, the very end of which could be used to extract and dry peat, and the plot directly connected to the farm could facilitate the grazing of cows (van Tielhof & van Dam, 2006, p. 35). Of course, the village occupational structure was more diversified than that, especially as the economy transformed in service of rapid growth (de Vries, 1974). The 1674 *familiegeld* record makes mention of a variety of shopkeepers (16), shoemakers (7), bakers (6), tailors (5), and more. Yet, of 256 heads of households mentioned in the register, over two-thirds (173) were mentioned as farmers or peat farmers (author's classification based on: van Kessel, 1993). Thus, even if households were dependent on the market for subsistence (as opposed to home production of subsistence goods), land was still an important part of producing subsistence income, as well as supplementing above-subsistence incomes.

As can be seen from Table 1, the population of Hazerswoude grew exponentially during the sixteenth century, multiplying fivefold in roughly 100 years. This was not uncommon for

Table 1. Population developments and total land in *morgen* for Hazerswoude.

	Total land (in km^2)	Population	Hearths	Poor households[a]	Population density (/km^2)
1494	27.2	504[b]	80[c]	25 (31.3%)	21.0
1514	27.8	600[d]	111		21.6
1623	34.2[e]	2,992	689	135 (19.6%)	87.5
1652	34.1	3,663[f]			107.4

[a]Mentioned in the Enqueste (1494) as '*die niet of zeer luttel gelden off contribueren*' (Fruin, 1877) and in the *hoofdgeld* register from 1623 (transcription: van der Helm 1998) as 'small in wealth holding' ('*cleijn van vermogen*') or 'propertyless' ('*onvermogent*'). [b] Rough estimation based on assessment in the Informacie from 1514 (Fruin 1866) that the population has increased since 1494. Based on inhabited hearths, which in 1494 was 72 percent of those in 1514. Population is assumed to have increased proportionally. [c] The Enqueste mentioned that there were ca. 100 hearths, of which only 80 were inhabited. [d] The total population figure was based on the report number of *communicanten*, i.e. those who have partaken in Holy Communion. In line with van der Woude (1972, pp. 89–92), I have taken this to mean that 2/3 of the total population was accounted for, thus simply divided the reported figure by 2/3 to obtain a total population estimate. [e] Total size derived from the 1628 *morgenboek* (OAR 4331 g). [f] Very rough estimate based on Paping (2014), who estimated net rural population growth 1600–1650 to have been 28.4 percent (from 257,000 to 330,000), despite plague mortality (notably 1624–5, 1635–6). Assuming this growth was linear, we can estimate the total population of the Dutch countryside in 1625 at 293,000, which is not too far off from de Vries's (1974) estimate (273,354). Net population growth 1625–1650 would then be estimated at 12.4 percent and so population growth in Hazerswoude 1623–1652 was taken to be 12.4 percent as well.

Sources: Fruin (1866), Fruin (1877), van der Helm (1998), OAR 4331g, 4332-4334.

the Rijnland peat area – the entire population of the Rijnland peat area multiplied by about 5.9 (de Vries, 1974, p. 86). In combination with broader economic prosperity, population density significantly increased pressure on land, and land values rose substantially until 1650 (Kuys & Schoenmakers, 1981). Yet, the share of poor households (i.e. households with little to no wealth) decreased by over ten percent. Peat lands could be very lucrative, even in small quantities, particularly with the increase in land productivity through the 'baggerbeugel' (a long stick equipped with a wired net that enabled scraping peat through the water), allowing for extensive exploitation of peatlands known as 'slagturven' (Ibelings, 1996). 'Slagturven' (peat dredging) is deemed to have had disastrous effects on the land, as it could irreparably be damaged, reducing yields in the long run ('t Riet, 2005). However, given that peat mining was high in land productivity, absolute proletarianization was slow to occur in the peatlands of central Holland. This dampened the inegalitarian effects of increased population density (van Tielhof, 2005), as even small plots of land could be lucrative as long as long demand for peat (mostly driven by population growth and urban proto-industry) remained high (Cornelisse, 2008; Ryckbosch & Saelens, 2023).

It should be mentioned that, even if the case of Hazerswoude is not exceptional in early modern Holland, the results presented in this article need not be wholly representative of other localities in Europe. Being a classic peat village, the share of land held in leasehold was relatively low and urban investors were generally rarer than elsewhere. This could be explained by the fact that peat strips were small, labor-intensive plots, and land productivity did not scale as well as plots that facilitate dairy farming (as will be discussed below). However, both the prevalence of leaseholds and burgher landowners varied highly in late medieval and early modern central Holland. In total, approximately 38 percent of the land was held in leasehold in central Holland, but local variation was large, ranging between 0 and 73.7 percent (van Dissel, 1897). Variation in burgher landownership was almost equally large, ranging between 3 and 51 percent, averaging at 25 percent (van Bavel, 2009, p. 195). Hazerswoude fell in the lower regions of leasehold prevalence (21.6 percent in 1652) and in the lowest regions of urban landownership (3.5–5 percent in 1652). Instead, local smallholding prevailed, as was common in peat villages (van Bavel, 2002, p. 15), and 82.9 percent of the total land was held by Hazerswoude residents in 1652. We should be careful, however, not to exaggerate these differences, especially since the local variance in urban landownership and leasehold were high, to begin with. Thus, even if Hazerswoude is not the archetype village to measure the entirety of Europe by, it is not necessarily less representative than other single localities.

It is in this context of population growth and rural development that Holland experienced several waves of epidemic mortality as part of the Second Plague Pandemic in the seventeenth century (Noordegraaf & Valk, 1988). When looking at different localities in Holland, we can get a grip on the frequency, magnitude and spread of mortality in the seventeenth century. Due to lack of consistent population figures, mortality was estimated in terms of mortality deviation based on backward burial trends, that is, the relative magnitude with which a given number of burials for a year differs from 'normal' number of burials in five years prior. The trend was calculated by taking the sum of the burials of the five years prior to the estimate (Alfani, 2013, pp. 418–419; Curtis, 2016; Del Panta & Bacci, 1977; van Besouw & Curtis, 2022, pp. 8–11). This allows us to reasonably accurately assess the magnitude of mortality shocks without reliable serial population estimates.

For the mortality figures regarding the case study, the current article will use adult mortality and its deviation rate, rather than total mortality, for two reasons mainly. Firstly, children are often unsystematically recorded in death records, being recorded only for select years within the period, only being recorded from a certain point onward, or being under-recorded in certain or all years (van Besouw & Curtis, 2022, p. 7). In the Hazerswoude series, children seem to have been recorded for all years for which we also have reliable adult mortality coverage (i.e. all years 1622–1699 bar 1625 and 1651). Another reason for focusing on adult mortality is that child mortality is largely irrelevant to redistribution. Children who perished in the plague epidemic would likely not have left land for redistributing, unless their parents had died sooner, at which point the household's probate would have likely already been in the hands of other family members (De Haan & Hoppenbrouwers, 1998) or the orphan chamber (Schnitzeler, 2022). Thus, children's deaths during the epidemic could only have been of importance when adults had perished as well, hence adult mortality is the appropriate measure here.

As seen in Figure 1, Hazerswoude suffered several mortality shocks over seventeenth century, peaking in 1635–6, 1655–6, 1664–5 (all concurring with plague years in Holland: Curtis, 2016; Noordegraaf & Valk, 1988; van Besouw & Curtis, 2022, pp. 16–17), 1669–70 (likely malaria or cholera: van Oosten, 2016, p. 719), 1673 (possibly a prelude to the 1676 malaria outbreak: Curtis, 2016, p. 146; van Besouw & Curtis, 2022, p. 16), and 1679–81 (malaria, or other intestinal infectious diseases: Curtis pp. 146–147), decreasing in absolute, albeit perhaps not relative magnitude. The 1655–6 plague epidemic was severe, but highly localized, mostly affecting select localities of Holland and Utrecht (Curtis, 2016,

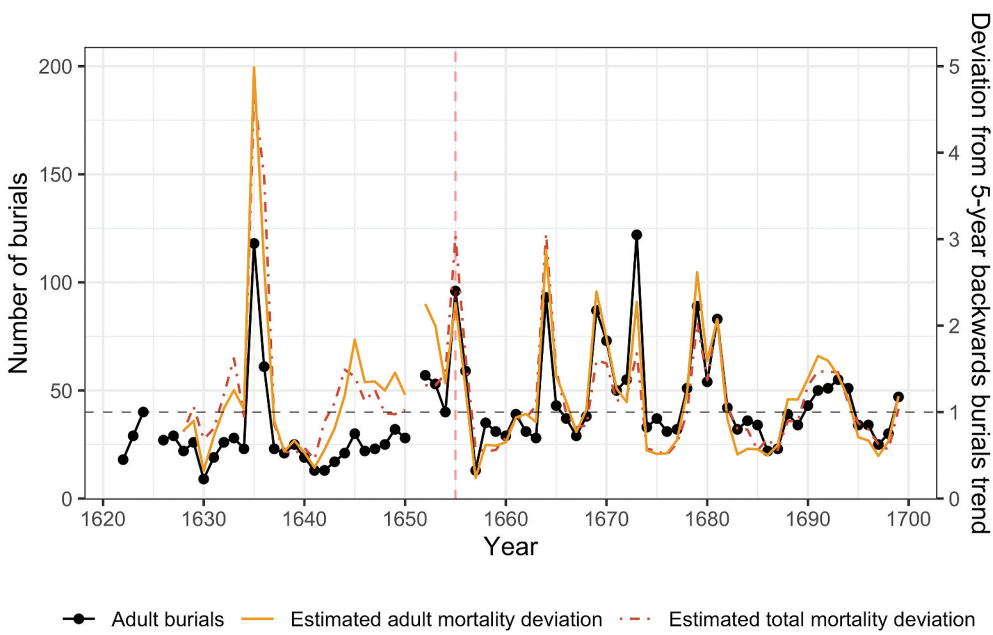

Figure 1. Adult mortality (as proxied by burials) against adult mortality deviation and total mortality deviation in Hazerswoude, 1622–1699. The number of burials in 1625 and 1651 were so low as to be deemed unreliable and have thus been removed. The dashed red vertical line indicates the 1655–6 plague epidemic, the topic of this article. The dashed black horizontal line is the line of 'normal' mortality, where mortality deviation is 1. A mortality deviation of 2 implies a doubling of mortality, while 0.5 implies halving of normal mortality. Data: Curtis (2016).

p. 149). Because of the localized nature of the mortality shock and the fact that the overwhelming share of land was held by village residents, Hazerswoude is deemed a suitable 'testing ground' for the redistributive effects of epidemic mortality in seventeenth-century Holland.

By estimating population size before the epidemic of 1655–6, we can conclude that mortality must have been at least between 10.4–12.7 percent.[2] It is important to note that these are lower bound estimates, as recorded burials tend to underestimate actual mortality, sometimes covering under 40 percent of total mortality (Curtis, 2016, p. 141). However, the total mortality estimates presented here are comparable to estimates for cities in Holland and Utrecht, which averaged around 10 percent (Rommes, 2015, p. 61), hence it is assumed that the Hazerswoude burial records reasonably reflected mortality. A mortality shock of around 10 percent can be interpreted as having been relatively mild in the greater scheme of the seventeenth-century plague epidemic, compared to 18–19 percent mortality in Spain, 20–25 percent in Southern Germany, and over 30 percent in Italy. It should be noted, however, that those estimates are extremes (in fact, they are the highest in seventeenth-century Europe: Alfani, 2013, pp. 410–411)—10 percent absolute mortality for a single plague epidemic was not uncommon in early modern Europe, not to mention that it meant a huge shock to the population still. After all, disease was the first and foremost cause of mortality in the Northern Low Countries, and its effects on distribution remain understudied as of now (Curtis, 2020). In any case, in terms of severity, Hazerswoude is comparable to Alfani's study on seventeenth-century Northern Italy, where mortality was estimated at 7.7 percent in a population of 2,555 (Alfani 2010, Appendix).

3. Sources and methodology

Having identified the 1655–6 mortality shock and its relative magnitude in European epidemic history, we turn to the sources for assessing the land distribution and market activity. Both are unique in their detail, recurrence, and survival. Firstly, it makes use of the *morgenboeken* (OAR 4331g, 4332-4334), land registers kept on the village level administering every land user and their plots, usually including from whom the plot was leased if it was not held in self-use.[3] The registers were kept by water boards for raising their revenues, known as *morgengeld*, and used to cover the annual costs for water management, including dike maintenance (van Dam, 2001b). This land tax was levied proportional to the individual's landholding. In Rijnland, it was customary for the land user, rather than the landowner, to cover property taxes (van Amstel-Horák, 2001).[4] Unfortunately for historical researchers, the *morgenboeken* did not register the propertyless, but since it is common in the literature to exclude the propertyless (sometimes by design) and thus report wealth inequality among property owners, this need not be an obstacle for comparative research (e.g. Alfani, 2015; Alfani & Ammannati, 2017).

It is important to note, however, that the *morgenboeken* do not state total landholding of each village inhabitant. Rather, it shows the distribution of all village land among its owners. This has to do with the way *morgengeld* was levied: the water boards gathered taxes on the total land on village level, again, exactly proportional to the share of land the village had relative to the total surface area under the Rijnland water boards' jurisdiction. Villages protested this measure, however, since the soil quality was not equal across places, so the total land within a village could differ strongly from the amount of land that was actually in use. On a centralized level, this issue had been resolved through the practice of 'folding' *morgens*, meaning that 'broken' lands (i.e. plots that were of such poor quality to be practically without economic benefit) were 'folded' into the other lands. This ensured that the village administration only had to levy taxes based on the amount of 'useful' land (van Amstel-Horák, 1985; 1994; 2001).

Thus, the plot sizes registered in the *morgenboeken* do not reflect the true landholding of households, but rather what is known as 'fiscal *morgens*', that is, total land use per household adjusted for economically unviable land (van Tielhof & van Dam, 2006, pp. -108–111). Yet, house plots (excluding those in the village core: van Amstel-Horák, 2001, p. 244) were often registered in the books. This meant that, strictly speaking, land yields were not considered when levying this land tax, which implied that lands with higher land productivity were subject to a lower tax burden relative to lands with lower productivity, particularly house plots. It thus seems that these taxes worked to the advantage of capitalist tenant dairy farmers specifically, as their tax burden was lowest relative to their yields, while also having some of the burden lightened through taxes paid by households whose property produced nothing at all. The water boards seemed to be more worried about taxing (somewhat) equally across villages, than about taxing equally within villages, even if there was a progressive element to *morgengeld* taxation.

An issue with the specific land registers under investigation for the current article is the non-trivial, non-random underreporting of owners for certain leased plots. In these cases, a plot was registered without mentioning the name of an owner. Instead, only an indication of leasehold was mentioned ('*bruijcker*' or '*bruijckt*', i.e. 'user' or 'uses', or '*br*.' for short). The lack of ownership mentions was a non-issue for the village administration, as they simply needed to be able to track land to a taxpayer, which was likely to be the land user. But for our purposes, this means that several landowners are not included in the register. As will be seen below, these plots accounted for 8.5 and 6.8 percent of total land in Hazerswoude in 1652 and 1656, respectively. This means that we may both over- and underestimate inequality as measured by the Gini coefficient, depending on whom these lands were owned. It is assumed here that the missing landowners would *underestimate* aggregate inequality, since these lands were likely owned by wealthy owners, e.g. nobility or city-dwelling investors. This does not imply, however, that all these owners could be found at the top of the distribution, particularly for absentee owners. They may well have held a small plot of land in Hazerswoude as part of a broader property portfolio, placing them in the 'poorer' half of landowners, while in fact belonging to the upper deciles of wealth-holders in Holland. Land inequality among owners could thus be underestimated in two ways: firstly, by underestimating the total landholding of wealthy owners, and secondly, by underreporting of small owners (even if *de facto* wealthy). The former is a lesser issue, as the plots where owners were unidentifiable were removed from the equation, thus the total amount of land would also expand with their wealth – hence, the increase in inequality would be limited. The latter would lead to 'land stretching' (i.e. dividing almost the same amount of land over more people), but this, too, is deemed to be limited, as it is assumed that these small owners were not plentiful.[5] Ultimately, the absence of these owners is deemed unfortunate, but surmountable, as the trends observed in this article seem to hold regardless of selective non-response.[6]

The second main source utilized in this article is the *schepenbankprotocollen* (GAR 143.1.01.26-31), local aldermen registers containing all formal land exchanges. The *schepenbank* was a jurisdictive institution specific to the Low Countries which became widespread in the twelfth century, responsible for all civil and voluntary jurisdiction, including the registry of formal property transactions (Zuijderduijn, 2009, pp. 184–186). Although preindustrial economies could have many informalized parts (Dermineur, 2019), *schepenbankprotocollen* are deemed to include virtually all land sales, if only for the reason that they officialized transactions and thus the claims to the land. Additionally, the *schepenbank* was easily accessible to all layers of society and secured both lenders and creditors in the market Zuijderduijn (2009, pp. 202–203). A concern may be that exchanges were split between *schepenbanken* and notaries, which played a large role in mediating capital and real estate markets in preindustrial France (Dermineur, 2018; Hoffman et al., 2019), but this was not the case in early modern Holland, where registration of property transactions was mandatory by ordinance from at least 1612 onward (but likely already since 1529: Zuijderduijn, 2008, pp. 5–7). In Hazerswoude, in fact, a decree was signed as early as the late fifteenth century, stating that both residential and urban landowners would only sell land in front of the *schepenbank* (Zuijderduijn, 2009, p. 207). Sometimes, however, transactions were registered in later years when they had been done by notaries a while before. In this case, this was mentioned in the deed, and transactions were thus placed in the year of initial exchange. The implication for this article is that some transactions in the later years are potentially omitted (since we trace transactions serially between 1651 and1660), but these are expected to be few, if any at all, since there were only three (3) of such transactions over ten years (accounting for 0.4 percent of all land exchanges).

The *schepenprotocollen* have been used for research in economic history, mostly for reconstructing macro-economic conjunctures (Dambruyne, 1988; Soly, 1974; Zuijderduijn, 2008) and markets for land and capital (Hanus, 2009; Van Onacker, 2013). Thus far, they have not been used for reconstructing real estate prices over time. For this article, all land sales between 1651 and 1660 were collected (677 in total). Using these deeds, a price index was created based on a hedonic price model. The model was made based on the available information in the registers, estimating base land values controlling for location, soil type, any structures present on the plot, and whether the plot had an additional charge attached, such as *erfpacht*, by use of dummy variables. The dependent variable is price per *morgen* of land. Furthermore, prices per *morgen* were regressed on total plot size, because it is assumed that land had differing returns to scale, and marginal returns of productive plots decreased at different paces, as we shall see in the results section of this article. An issue with the hedonic price regression for this article is that the information on these plots is not equal between in the summaries of these acts from which the data was gathered, such that certain plots with little information (e.g. lacking soil type, location, price, size, etc.) were seen as the 'base' to which the price regression relates.[7] However, enough plots remain for the trend of the results to be reliable still. 495 plots contained both a price and a size, and because these were the conditions on which the dependent variable was based, this sample was used in the regression (see Appendix).

Since the number of weekly and monthly observations is limited, the smallest unit of time possible for reliable price index estimates was annual. The lack of prices and sizes for certain plots additionally means that the turnover rates presented in this article should be considered lower bound estimates. As can be seen in the Appendix, underestimation of the turnover rate is approximately consistent with average coverage of plots with sizes being 80.3 percent, ranging between 60.2 percent (in the high season of 1659) and 100 percent (in the low season of 1652). Simultaneously, because of the land registers' tendency to 'fold' *morgens* (see above), turnover rates as percentages of total land would be slightly *overestimated*, since the total surface area of the sum of plot sizes relates to only covers economically viable land, while the plot sizes from the land transactions (when mentioned) do cover all land. However, since 'broken' lands were not often sold in high volumes, this overestimation is considered to be negligible, so the underestimation of turnover through lacking information on plot sizes is deemed the more important source limitation. Turnover as expressed in total property sales is assumed to always cover 100 percent, because of the reasons mentioned above.

Having elaborated the sources used for creating this novel dataset, we can turn to the results, first regarding changes in the land distribution, and subsequently, the land market conditions in which the epidemic occurred.

4. Land distribution

How did the 1655–6 mortality spike affect the distribution of landownership? First, it must be noted that the distributional changes of interest here are those between 1656 and 1660—not between 1652 and 1656. This is the case for two reasons mainly. Firstly, the administration of land transfer in the *morgenboeken* did not always perfectly align with reality, specifically in cases of non-market transfer, since these were not as well-documented as market exchanges. In times with high turnover of land within-family, it would be easier for administrators to simply note the landholding of the deceased, as they would be able to trace the taxable individuals through the names of the previous holder anyway (van Amstel-Horák, 2001, p. 262). Secondly, the land was not primarily exchanged during the epidemic outbreak, but afterward. This can be seen by the relatively low market turnover rate in the spring of 1656, compared to the peak in turnover in the spring of 1657 (Figure 2). Additionally, turnover was higher and more consistent after 1656 than it was before. Thus, when land was exchanged in the wake of the mortality shock, it was mostly done between 1656 and 1660, rather than in 1655–6.

Observing the land distribution between 1652–60 (Table 2) shows remarkable stability on the aggregate level. The Gini coefficient fluctuated between 0.546 and 0.554—a relatively insignificant change in aggregate inequality. However, behind the Gini coefficients, changes in the distribution did take place. Between 1652 and 60, the number of landowners increased from 625 to 712 (+13.9 percent), the largest increase in which can be seen at the bottom of the distribution – of the 87 'additional' owners, 75 held less than 5 *morgen* of land. A notable rise is shown in top and middling holders, as well. There were ten more landowners in the category 10–15 *morgen* (+17.9 percent) and five more owners owning over 20 *morgen* (+22.7 percent). Only the category between 15 - 20 *morgen* shrank both absolutely and relatively.

Table 3 shows landholding decomposed by quintiles (including the average size of land held in *morgen* per quintile), as well as the share of land held by the top 10, top 5, and top 1 percent. Largely, the distribution of land over quintiles remained unchanged – fluctuations across all population shares remained within a single percentage point. The largest change is relative shares can be seen in the top quintile (Q5) where the share of total landholding increased by 0.5 percentage points. The top percentile share decreased by 0.4 percentage points, implying that increases in landholding mostly took place in the sub-top of the distribution. These changes in the sub-top are the likely reason that the Gini coefficient rose slightly between 1652 and 1660. These relative changes, however, are not dramatic, and thus the common measures indicate that there was no increase in aggregate disparities in landholding. In short, landowning changed *absolutely* at almost all levels of landholding, but did not change *relatively*. This means that the changes in the ownership distribution 'balanced' one another, preventing straightforwardly interpretable redistribution.

The user distribution, on the other hand, became distinctly more unequal. Tables 4 and 5 show the same measures for land users as Tables 2 and 3 show for landowners. This includes land held in self-use, i.e. land that was not leased but owner-occupied. Here, too, the number of landholders increased, albeit less dramatic than in the distribution among landowners (+7.9 percent). For users, the expansion of the distribution concentrated largely in the bottom, as well. However, for the user distribution, the bottom (below 5 *morgen*) expanded relatively, as well, by almost 5.0 percentage points. Top land users (over 20 *morgen* in use) increased both relatively and absolutely, by 0.8 percentage points. The share of land held in leasehold, however, declined from 21.6 percent of total land to 15.4 percent of total land.

Decomposition of the user distribution in quintiles shows that the distribution among users changed more than the distribution among owners. The top quintile, decile, and vigintile all increased their share of total landholding, in decreasing relative magnitude – the top 20 percent share increased by 2.3 percentage points, while the top 10 and top 5 percent shares increased by 1.4 and 0.7 percentage points, respectively. As with the

Table 2. Land distribution 1652–1660 in number of owners per category of holding size and Gini coefficients.

	Number of landowners		
Landholding in morgen	1652	1656	1660
<1	131 (21.0%)	136 (21.2%)	150 (21.1%)
1–5	241 (38.6%)	259 (40.3%)	297 (41.7%)
5–10	142 (22.7%)	130 (20.2%)	143 (20.1%)
10–15	56 (9.0%)	64 (10.0%)	66 (9.3%)
15–20	33 (5.3%)	34 (5.3%)	29 (4.1%)
>20	22 (3.5%)	20 (3.1%)	27 (3.8%)
Total	625 (100%)	643 (100%)	712 (100%)
Percentage landholding unknown	8.5	6.8	1.0
Gini among landowners	0.549	0.546	0.554

Sources: OAR 4331g, 4332-4334.

Table 3. Land distribution as share per quintile, mean holding size in *morgen* per quintile, and top shares of landholding.

	1652 (%)	Mean	1656 (%)	Mean	1660 (%)	Mean
Q1	1.1	0.3	1.2	0.4	1.0	0.3
Q2	6.2	1.8	6.3	1.8	6.0	1.7
Q3	12.9	3.8	12.7	3.6	12.7	3.6
Q4	23.5	6.9	23.7	6.8	23.4	6.6
Q5	56.4	16.6	56.2	16.1	56.9	16.2
Top 1%	7.0		6.3		6.6	
Top 5%	23.4		22.7		23.3	
Top 10%	37.0		36.4		37.2	

Sources: OAR 4331g, 4332-4334.

Table 4. Land distribution in number of users per category of land held in use (including self-use).

	Number of land users		
Landholding in morgen	1652	1656	1660
<1	131 (20.4%)	140 (21.2%)	151 (21.8%)
1–5	242 (37.6%)	267 (40.4%)	285 (41.1%)
5–10	149 (23.2%)	126 (19.1%)	129 (18.6%)
10–15	52 (8.1%)	61 (9.2%)	65 (9.4%)
15–20	38 (5.9%)	35 (5.3%)	25 (3.6%)
>20	31 (4.8%)	32 (4.8%)	39 (5.6%)
Total	643 (100%)	661 (100%)	694 (100%)
Gini among users	0.549	0.558	0.568
Total land held in leasehold (%)	21.6	18.8	15.4

Sources: OAR 4331g, 4332-4334.

Table 5. Land distribution of users (including self-use) as share per quintile, including top 1, 5, and 10 % shares.

	1652 (%)	Mean	1656 (%)	Mean	1660 (%)	Mean
Q1	1.1	0.3	1.2	0.4	1.0	0.3
Q2	6.2	1.9	5.9	1.8	5.7	1.7
Q3	12.8	4.0	12.0	3.6	11.8	3.5
Q4	23.6	7.3	23.1	6.9	22.9	6.7
Q5	56.4	17.6	57.7	17.3	58.7	17.2
Top 1%	5.8		5.9		5.5	
Top 5%	22.8		23.2		23.5	
Top 10%	36.8		37.4		38.2	

Sources: OAR 4331g, 4332-4334.

owner distribution, the top percentile share decreased by 0.4 percentage points. The increase in top shares happened at the expense of all quintiles below, but most so for Q3, where the share of total land decreased by a full percentage point, and least so for Q1, whose share of landholding only decreased by 0.1 percentage point. In contrast to the owner distribution, the changes in the user distribution did affect the Gini coefficient significantly. The Gini increased by almost 0.02 points between 1652 and 1660—comparable to the change observed in seventeenth-century Northern Italy (Alfani, 2010).

Additionally, the total share of land held in leasehold – already low because of the strong presence of peasant smallholding (van Bavel, 2009, p. 176) – decreased by 6.2 percent, which may be the direct result of tenants dying while demand for land tenure decreased due to declining returns on land (de Vries & van der Woude, 1997, pp. -533–535).[8] This effect on tenure could have been twofold then. On one hand, landlords' income declined by land lying bare. On the other hand, landlords whose tenants survived received a relatively high return on their land. Landlords were of course unlikely to lower rents conform to the market, especially in context of the long-term lease contracts which typified the region (and which often approximated full rights of ownership: van Bavel, 2008, p. 33), thus they continued to receive rents above market value. This may have increased inequality among landlords, but mostly between landlords and surviving tenants, as the cost of rent relative to returns on land increased significantly.

Admittedly, this has more to do with land market conditions than with plague mortality, but it may be so that mortality sharpened the decline in demand for access to land and, as such, likely deepened the gap between landlords and tenants.

Why was the distribution ultimately balanced across the mortality shock for landowners – and why did it become more unequal on aggregate among land users? And to what extent was this related to the mortality shock in 1655–6? In order to uncover changes behind land shares and Gini coefficients, owners were matched across the three land registers and across the land transaction data. An attempt has also been made to match the burial data with the land transactions and the *morgenboeken*, but this yielded a very low matching rate – only 17 out of 160 adult burials in 1655–6 (10.6 percent) could be found in both the *morgenboeken* and the *schepenregisters*. Most were still recorded as landowners in 1660 despite having perished during the epidemic. Whether this was the result of lagged administration or names simply not being updated to heirs (as was sometimes the case: van Amstel-Horák, 2001, p. 262), remains unknown. Either way, no meaningful analysis could be obtained from a sample this small. The low matching rate, however, need not be surprising. Beyond regular issues with denomination across (premodern) sources, names could also get lost as women inherited land, which would be added to the joint household portfolio registered under the husband's name. To gauge whether the changes were related to the epidemic, then, attempts were made to quantify the share of land that was exchanged outside of the market, i.e. through inheritance or (re)marriage, before and after the epidemic.

If we decompose once more by categories of landholding, we can grasp which categories gained and lost most, on average. Table 6 shows the average change in *morgen* for all established owners per category of landholding, divided by whether they gained or lost land. The category of landholding refers to their current holding, i.e. the year of the last *morgenboek*. It shows that, of the owners that gained land between 1652–6, most gained in the 1–5 *morgen* category – their landholding increased by over 270 percent on average. After the epidemic, however, most gains were made in the categories between 5 and 10 *morgen* of landholding. On average, landowners between 5–10 *morgen* more than doubled their landholding, while owners between 10–15 *morgen* more than tripled it. Except for owners between 15 and 20 *morgen*, all owners that gained land gained more after the epidemic than they did before. Particularly middling holders had been strengthened, which balanced the distribution which would have otherwise become more unequal due to gains at the top and an increase of smallholders at the bottom.

5. The land market and distributional change

Mortality can redistribute property in two major ways: through property markets and non-market transfers like inheritance and/or (re)marriage. Early modern Holland is known for a strong system of partible inheritance, leaving the concrete division of property in the hands of surviving children post-mortem (De Haan & Hoppenbrouwers, 1998, pp. 344–346). With the death of a propertied individual, property was usually left to the surviving spouse, if there was one. Children would usually be second in line. Instead, in cases the children did not inherit property, they often received cash bequests. In case there was no surviving spouse, and the property was to be divided among children equally, it would often be economically favorable not to morcellate the property but instead have one of the siblings

Table 6. Distribution of owners per category of landholding, distinguished by their position relative to the previous land register, compared between 1652–6 and 1656–60. It also reports average changes in landholding for established owners (i.e. owners that were present in the previous distribution).

	New owners	Gaining owners	Losing owners	Stable owners	Total	Average gain	Average loss	Average change[a]
Before epidemic (1652–1656)								
<1	21 (15.4%)	9 (6.6%)	19 (14.0%)	87 (64.0%)	136 (100%)	+0.1 (+76.1%)	−1.7 (−71.1%)	−0.3 (−5.6%)
1–5	49 (18.9%)	44 (17.0%)	42 (16.2%)	124 (47.9%)	259 (100%)	+1.1 (+271%)	−1.9 (−26.1%)	−0.1 (+51.6%)
5–10	15 (11.5%)	33 (25.4%)	29 (22.3%)	53 (40.8%)	130 (100%)	+1.7 (+80.7%)	−1.4 (−14.2%)	+0.1 (+19.6%)
10–15	9 (14.1%)	23 (35.9%)	15 (23.4%)	17 (26.6%)	64 (100%)	+2.3 (+30.3%)	−1.9 (−11.9%)	+0.4 (+9.4%)
15–20	0 (0.0%)	12 (35.3%)	10 (29.4%)	12 (35.3%)	34 (100%)	+4.0 (+66.8%)	−4.2 (−15.5%)	+0.2 (+19.0%)
>20	0 (0.0%)	7 (35.0%)	9 (45.0%)	4 (20.0%)	20 (100%)	+3.2 (+15.8%)	−4.0 (−8.1%)	−0.7 (+1.9%)
Total	94 (100%)	128 (100%)	124 (100%)	297 (100%)	643 (100%)	+2.1 (90.2%)	−2.5 (−24.5%)	−0.1 (+16.0%)
Of established owners	NA	23.3	22.6	54.1	85.4			
Of total owners	14.6	19.9	19.3	46.2	100.0			
After epidemic (1656–1660)								
	New owners	Gaining owners	Losing owners	Stable owners	Total	Average gain	Average loss	Average change [a]
<1	44 (28.9%)	7 (4.7%)	25 (16.8%)	74 (49.7%)	149 (100%)	+0.2 (+124%)	−3.4 (−69.8%)	−0.8 (−9.6%)
1–5	112 (37.7%)	38 (12.8%)	45 (15.2%)	102 (34.3%)	297 (100%)	+1.4 (+206%)	−2.4 (−36.5%)	−0.3 (+33.4%)
5–10	34 (23.8%)	36 (25.2%)	40 (28.0%)	33 (23.1%)	143 (100%)	+2.4 (+337%)	−3.3 (−21.0%)	−0.4 (+104%)
10–15	13 (19.7%)	28 (42.4%)	8 (12.1%)	17 (25.8%)	66 (100%)	+4.0 (+411%)	−1.4 (−9.2%)	+1.9 (+216%)
15–20	6 (20.7%)	8 (27.6%)	6 (20.7%)	9 (31.0%)	29 (100%)	+3.6 (+32.4%)	−0.7 (−4.1%)	+1.1 (+10.2%)
>20	7 (25.9%)	13 (48.1%)	5 (18.5%)	2 (7.4%)	27 (100%)	+8.4 (+120%)	−8.0 (−20.8%)	+3.5 (+72.5%)
Total	215 (100%)	129 (100%)	129 (100%)	237 (100%)	712 (100%)	+3.3 (+205%)	−3.2 (−26.9%)	+0.8 (+70.9%)
Of established owners	NA	26.1	26.1	47.9	69.5			
Of total owners	30.5	18.1	18.1	33.2	100.0			

[a]Average percentage changes in gains and losses were calculated as the mean of all percentage changes per category. Therefore, the total average change in *morgen* could be negative, while the average change in percentage would be positive.
Sources: OAR 4331g, 4332-4334.

compensate the others. The household would then still enjoy the returns to scale without having siblings forego their rightful shares of the probate. When a widow had underaged children, the widow was legally bound to report the inherited belongings to the orphan chamber, which would then appoint a legal guardian and would manage the probate until the children had reached the age of 25, or when they married (Schmidt, 2010, pp. 19–20).

When two children from different households inherited (relatively) small plots, they could conjoin them in wedlock as a strategy to counteract issues of morcellation. Sometimes children did so to support their surviving parent – which they could not have done if the property was subdivided – even if they were not the direct heirs of the property (Schmidt, 2007, p. 273). If children's property holdings were contingent on marriage, and would conjoin properties of adequate size in order to start a household, this principle would incentivize early marriage among surviving children in times of heightened mortality. Beyond inheritance, then, (re)marriage was a (heretofore under-appreciated) means of redistribution in systems of partible inheritance (cf. Curtis & van Besouw, 2024, pp. 25–26).

Epidemic mortality could thus affect land market demand by increasing liquidity and lowering market access of previously propertyless (or even previously non-existent) households. Table 7 gives the absolute rate of turnover as a share of total land between 1652–6 and 1656–60, respectively. It shows that absolute turnover was much higher between 1656 and 1660 than it was between 1652 and 6 (34.7 percent against 15.8 percent, respectively). Turnover due to accumulation by established owners (i.e. owners that could be matched between books) was 6.2 percent in 1656, while it was 9.8 percent in 1660—a modest increase. Turnover due to entry of new owners (i.e. landowners who gained land but could *not* be matched between books) was 9.6 percent in 1656 and grew to 25.0 percent in 1660. Put differently, a quarter of all land fell into the hands of previously landless owners between 1656 and 1660. On average, 50.7 percent of turnover could be traced back to market exchange between 1652 and 1656, while only 18.6 percent could be matched to market transactions between 1656 and 1660. Thus, turnover was higher after the epidemic than it was before – both for exchanges in the market and outside the market – but the

Table 7. Turnover of land (as percentage of all land in Hazerswoude) between 1652–6 and between 1656–60.

	1652–6	1656–60
Absolute turnover (%)[a]	15.8	34.7
Due to accumulation of established owners (%)	6.2	9.8
Due to entry of new owners (%)	9.6	25.0
Average annual turnover (%)	4.0	8.7
Average annual market turnover (%)	2.0	2.4
Average annual non-market turnover (%)[b]	2.0	6.3
Average annual share of turnover outside of the market (%)[c]	49.3	72.4
Average annual share of turnover within the market (%)[d]	50.7	27.6

[a]Absolute turnover was calculated by dividing the sum of *positive* changes in landholding by total landholding. *Morgenboeken* were usually signed off in late December, so that transactions in the year itself counts for the turnover rate, but not the year of the previous *morgenboek*. Only positive differences were taken as to avoid double counting (Curtis & van Besouw, 2024, pp. 17–18). Market turnover, however, does include double transactions, for instance when a plot is immediately sold to a third party, or when someone both sells and purchases land in a single year. These cases are relatively rare, so that the overlap in market and non-market turnover should be minimized.

[b]Average annual non-market turnover was calculated by subtracting annual market turnover (as calculated from the *schepenregisters*) from the average annual turnover rate.

[c]The share of average annual turnover that was achieved outside of the market was calculated by multiplying the total change in landholding by the difference between total turnover and market turnover and dividing this by the average turnover in surface area.

[d]Average annual share of turnover within the market was calculated by subtracting the average annual share of turnover achieved outside of the market from 100.

Sources: OAR 4331g, 4332-4334.

Table 8. Established accumulating owners found in the *schepenregisters* per category, shares of difference in landholding purchased through the market (as opposed to gained outside the market). N.B.: share of buyers purchasing full difference in market contains buyers who purchase more than 100 percent of the difference through the market. This is because these owners likely sold land, too, in favor of larger holdings. Their *gains* are then fully dependent on market purchase (see Appendix).

	n (% of accumulating landowners within category)	Average size purchased in *morgen*	Average share of difference purchased in market	Share of buyers purchasing full difference in market
1652–6				
<1	18 (60.0%)	0.5	95.3	88.9
1–5	43 (46.2%)	2.0	78.7	53.5
5–10	21 (43.8%)	1.7	69.2	52.4
10–15	16 (50.0%)	4.4	71.9	31.2
15–20	4 (33.3%)	3.1	61.1	0.0
>20	1 (14.3%)	2.5	7.7	0.0
1656–60				
<1	15 (30.0%)	0.8	86.7	73.3
1–5	50 (33.3%)	2.3	87.9	68.0
5–10	23 (32.9%)	3.2	63.7	39.1
10–15	14 (34.1%)	2.4	59.3	35.7
15–20	4 (28.6%)	4.0	62.8	0.0
>20	2 (14.3%)	1.6	5.7	0.0

Sources: OAR 4331g, 4332-4334.

increase in turnover was much larger for new owners than it was for established owners. Non-market turnover was also much higher than market turnover.

The market was used as a tool for exchanging land mostly by households at the lower end of the distribution. Table 8 shows differences between accumulating landowners before and after the epidemic by landholding category. It shows that, on average, accumulating landowners below 5 *morgen* tended to purchase larger shares of their land gains on the market than accumulating landowners above 5 *morgen*. Landowners below a single *morgen* also tended to purchase their entire landholding on the market more often than large landowners. Especially owners in the largest category tended to obtain only small shares of their gains through the market.

The epidemic did not affect the market at every category of landholding equally, if at all. It did not significantly affect market behavior of landowners over 15 *morgen*—their occurrence was still rare, and their purchase as a share of landholding was roughly equal. The categories below were affected in different ways. The category below a single *morgen* still purchased large shares of their landholding when they gained through the market, but the relative occurrence of accumulating owners below a single *morgen* reduced from 60 to 30 percent of all accumulating owners. This implies that accumulating owners below 1 *morgen* gained through non-market mechanisms more often than before the epidemic. Accumulating owners between 1 and 5 *morgen* were also found in the market less frequently relative to before the epidemic, but they tended to purchase larger shares on the market than before (+9.2 percentage points on average) and more often acquired their full gains in landholding through the market.

Accumulating owners between 5 and 10 *morgen* were less frequently found in the market, as was the case for the two lowest categories of landholding. They tended to purchase slightly lower shares of their differences in landholding (a difference of −5.9 percentage points on average) than before the epidemic and less frequently purchased the full difference through the market (−13.3 percentage points). This implies that the gains in this category were driven by non-market exchange more than before the epidemic. The same is true for the 10–15 *morgen* category: their relative occurrence declined (−15.9 percentage points), as did the average share of land gains achieved through the market (−12.6 percentage points). However, they acquired their full difference through the market slightly more often (+4.5 percentage points). This suggests that this category purchased smaller plots more often than before, as can be judged from the smaller average size purchased on the market.

What does the above imply for the effects of epidemic mortality on the distribution of land? The changes in the categories between 5–15 *morgen* are of particular interest, since these categories showed the largest gains in landholding after the epidemic (Table 6). The fact that their occurrence was less frequent, and their share of landholding purchased through the market was lower suggests that the effect of non-market transfer on distributional change was strong. In fact, it suggests that the 'balancing' of the distribution was largely driven by non-market mechanisms, rather than through the market. Middling holders tended to obtain at least some land through inheritance or (re)marriage and subsequently complemented their landholding with plots purchased on the market. Bottom owners (below 5 *morgen*) also gained more outside of the market after the epidemic relative to before, although they were more likely to purchase larger parts (or their entire landholding) than before the epidemic.

Thus: the largest part of distributional change happened outside of the market. The market, however, affected the distribution in two main ways. Firstly, from the supply side by increasing the market supply of smaller plots, particularly those below a single *morgen*. This was not necessarily provided by heirs, which might have to do with the fact that heirs moved into inherited holdings. They sold their old smallholdings in favor of bigger, inherited holdings. Alternatively, people were now able to market smaller plots because of increased liquidity at the bottom through (non-land) inheritance – when the surviving spouse would inherit property, children often obtain cash (Schmidt, 2010, p. 17). Secondly, the market was affected through the demand side by increased activity of new owners of middle and top holdings. They supplemented their newly acquired landholding (through marriage or inheritance) by taking to the market. Thus, the mortality shock and the resulting inheritance did not only increase land supply, but it also increased land demand as agents who were previously not active in the market now entered the market because of (i) increased liquidity and (ii) increased borrowing capacity (by putting up inherited or conjoined lands as collateral). As shall be argued below, demand was also partly driven by rationalized marginal returns.

6. Market conditions and marginal returns

If the aggregate changes in the land distribution were contingent on the decision to bring the land to market, we can ask what informed the decision to do so. To explain why the distribution changed differently at different levels of landholding, we turn to the market conditions for an explanation. Here we must distinguish two matters. Firstly, the market context in which the plague epidemic took place, and secondly, the effect of the epidemic outbreak on the land market. As we shall see, the epidemic occurred in the context of falling land values (for the first time in a century: Hilkens, in press), but it did not ascertain a lasting negative price effect. Additionally, we see that returns to scale differed per soil type, and these differences may have affected changes in the land distribution.

6.1. Turnover and prices

The land market was affected by the epidemic more than post-epidemic redistribution was mediated by it. Figure 2 shows turnover rates as the percentage of total surface area

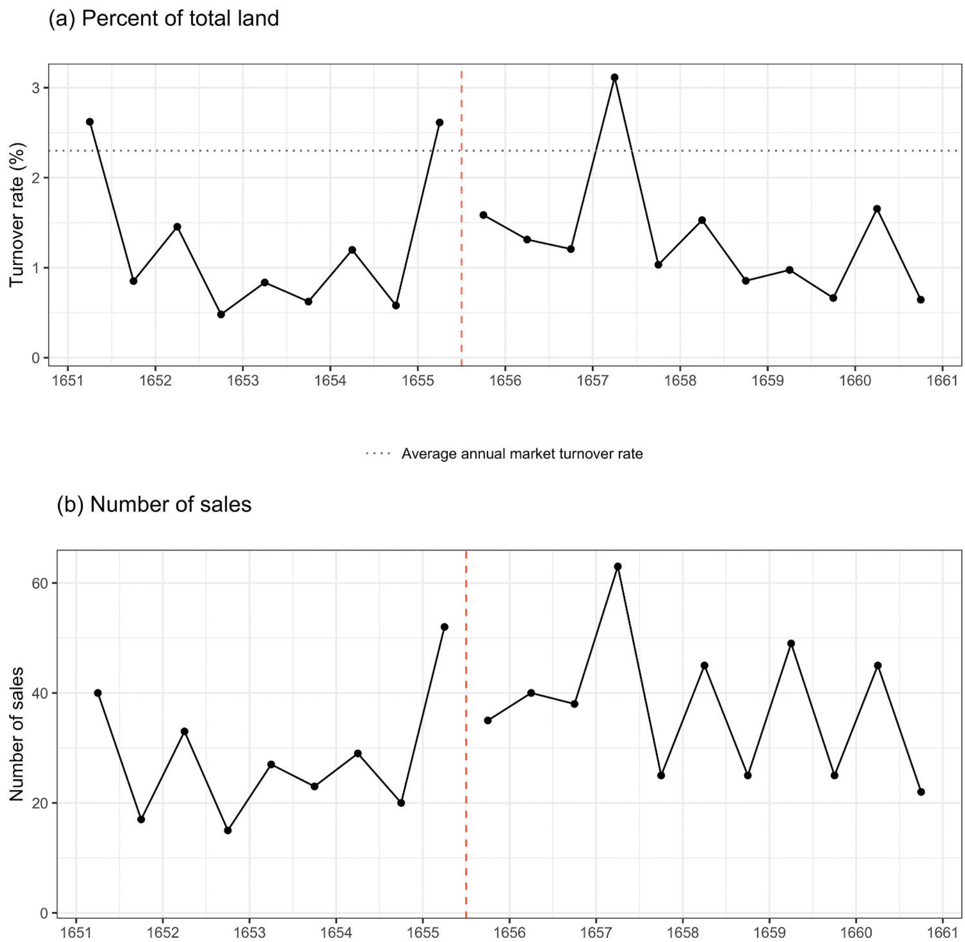

Figure 2. Annual turnover as (a) share of total land and (b) as total number of sales, 1651–1660. N.B.: the turnover rates as percentage of total land, as presented in panel (a) are lower bound estimates, since not all plot sales included plot sizes. The high season of 1659 had particularly poor coverage (only slightly above 60 percent of plot sales included plot sizes, see appendix), which explains why the peak in spring turnover in that year was only small. Sources: GAR 143.1.01.26-31.

sold, and as a total number of sales. The average annual turnover rate for Hazerswoude between 1651–1660 was 2.3 percent, which was on the higher end compared to other localities in preindustrial Europe: it was higher than all localities discussed in van Bavel (2008, p. 41), save for Germany at the late eighteenth century, which had a turnover rate of 2.6 percent and an average for copyhold land in England Middlesex, which is guesstimated at 5 percent. It was also decidedly higher than the sixteenth-century Campine area, which had a rather inactive land market with an annual turnover between 0.7 and 0.9 percent (Van Onacker, 2013).

Land transactions followed a seasonal pattern, with a clear high season in the first six months of the year peaking in May or June and a low season in the fall, usually with a modest peak in December (see Appendix). Before the onset of the plague epidemic in September of 1655, turnover was highest in the high season of 1651, as land values reached their zenith in a long process of rural development (de Vries & van der Woude, 1997, pp. 531–535), and in the spring of 1655, right before epidemic mortality struck. Early cases of plague could have instigated a rush to the land market, perhaps to create buffers for the upcoming period of economic insecurity, or to prevent post-mortem conflict over property division, but since mortality only started taking off from August onward, this is deemed unlikely (see Appendix on seasonal mortality). Rather, it is argued that the peak in turnover in the spring of 1655 was the result of restoring the market cycle after the declining land values and low turnover of the preceding years. More striking is the fact that turnover clearly smoothed out over the epidemic period (Figure 2). The spring season of 1656 was particularly inactive – turnover in terms of sales was higher in the fall, due to sales of many small plots. Turnover took off again in May 1657, reaching the highest turnover of the decade. This suggests that investment in rural property was cautious in the time of heightened mortality, only recovering (and compensating for the years of low investment) after the plague epidemic was surely over. After 1657, seasonal turnover (as numbers of sales) was more stable than before the epidemic, although the trend in turnover as a share of total land mass declined. This indicated declining average plot sizes per transaction.

Although marketed land supply increased, prices were not significantly affected by the epidemic. The land price index (Figure 3) shows a steady decline in land prices between 1652 and 1656. Yearly price indices destabilized in the years following the mortality crisis, although both the price increase of 1657 and 1659 are statistically insignificant (see Appendix). Base prices per *morgen* plummeted by over 50 percent across the period, the year effect of 1660 in fact being statistically significant. Therefore, the current article will focus mostly on the overall downward trend of prices, rather than the potential interruptions of that trend in 1657 and 1659. Judging from the indices produced here, the mortality shock of 1655–6 had no lasting effect on land prices. It is possible, however, that land values declined temporarily as a result of the epidemic—Francke and Korevaar (2021, p. 2) find that housing prices in seventeenth-century Amsterdam declined by 13 percent on average in the first six months after a plague outbreak. Since the current article presents yearly indices, this price effect cannot be captured.

Although the rising index in 1657 is statistically insignificant, it is still interesting that the turnover rate increased with rising land prices in the aftermath of epidemic mortality. One explanation for this would be that the market had become illiquid, that is, it was

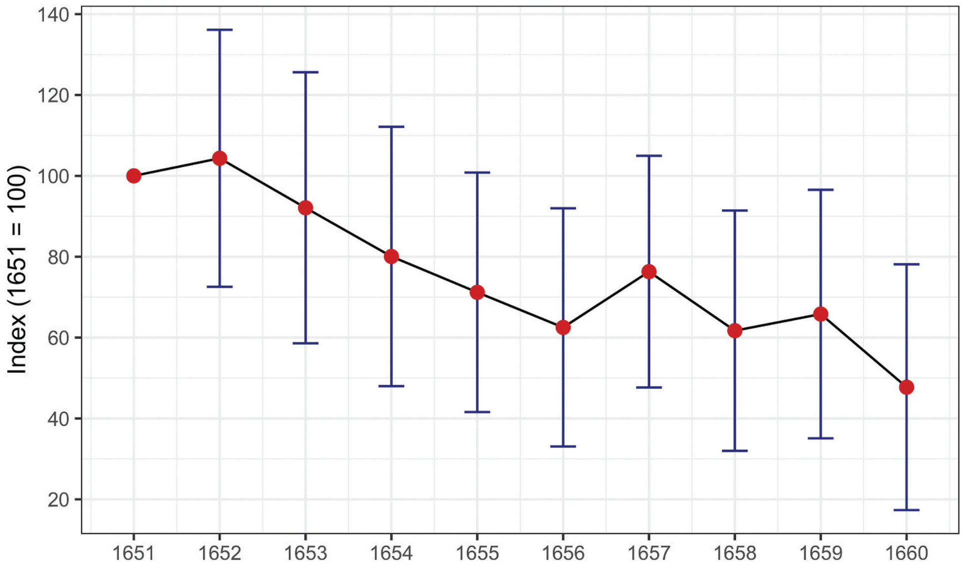

Figure 3. Land price index Hazerswoude, 1651–1660 with 95% confidence interval. Sources: GAR 143.1.01.26-31. Full regression table: see appendix.

difficult to sell land except for at a loss, and so landowners held on to it (cf. pre-industrial Brabant and Flanders: De Vijlder, 2018). It is likely, then, that with the freeing up of previously unattainable land due to the epidemic, demand rose as well. Owners likely still sold at a loss, but new owners were willing to pay a higher price now land and cash were available. It could also be the case that demand for land rose as investors had waited out the social turmoil that ensued during the phase of high mortality, as was the case in seventeenth-century Amsterdam (Francke & Korevaar, 2021). More likely, however, seems to be the interpretation that demand for land increased as the number of landowners increased. Inheritance did not satisfy the demand for land in the short term, but instead created it, as argued above.

As suggested by Francke and Korevaar (2021, pp. 9–10), the price effect of the mortality shock (insofar it can be observed in the current article) was thus mostly one based on perceived risk and uncertainty caused by the epidemic, rather than mortality-induced land supply – it thus reflected *demand* rather than supply. Demand for land decreased during the epidemic and picked up again after the epidemic had ended. For Hazerswoude, we can reasonably support this argument. Investors, either wealthy (who likely purchased capital-intensive grasslands) or previously propertyless (who likely purchased house plots), waited until the epidemic outbreak was over before taking to the market. Still, potential buyers had plenty reason to be pessimistic about land returns – and they would be right to, given the incoming agricultural price crisis of the 1660s. Ultimately, for our purposes (testing the effect of mortality on distribution) it suffices to say that this redistribution happened in the context of plummeting prices, a trend which continued deep into the seventeenth century.

6.2. Returns to scale

Land market mechanisms might help explain changes in the post-epidemic land distribution. It is somewhat counterintuitive that residential smallholding would increase as land values declined and morcellation became riskier and more burdensome than before. Yet, most heirs did not sell the land that had been bestowed upon them, either because they could not or did not want to sell. Thus, the rise in smallholders would have been proportional to heirs not engaging in the land market. To deepen this argument, we can look at the value of (relatively) small plots in relation to the groups of holding sizes in which the number of landowners grew. Growth in the number of owners below five *morgen* was most significant and, as can be seen in Figure 4, marginal land values decreased but stabilized above a certain threshold. Thus, smaller plots were relatively more valuable than mid-sized plots. Therefore, landownership could have been relatively more valuable to previously landless households than to mid-range owners, for which these small plots (especially in combination with a strongly reduced labor force) were not particularly attractive. Hence, the decision to hold on to small plots may have been influenced by the fact that it was relatively more beneficial to have a small plot when one had no land at all, than to increase one's large- or middle-sized holding with a small parcel. This disincentivized smallholders from selling their plots, however small, and disincentivized investors from obtaining them. Hence, we see signs of a slightly different land market than the post-Black Death land market as suggested by Scheidel (2017, p. 305) and Alfani (2022, p. 11), even if the poorer strata could obtain property. Where post-Black Death land abundance and labor scarcity created a 'buyers' market' through favorable land market conditions, the bottom of the distribution in seventeenth-century Hazerswoude could obtain property because of the high share of

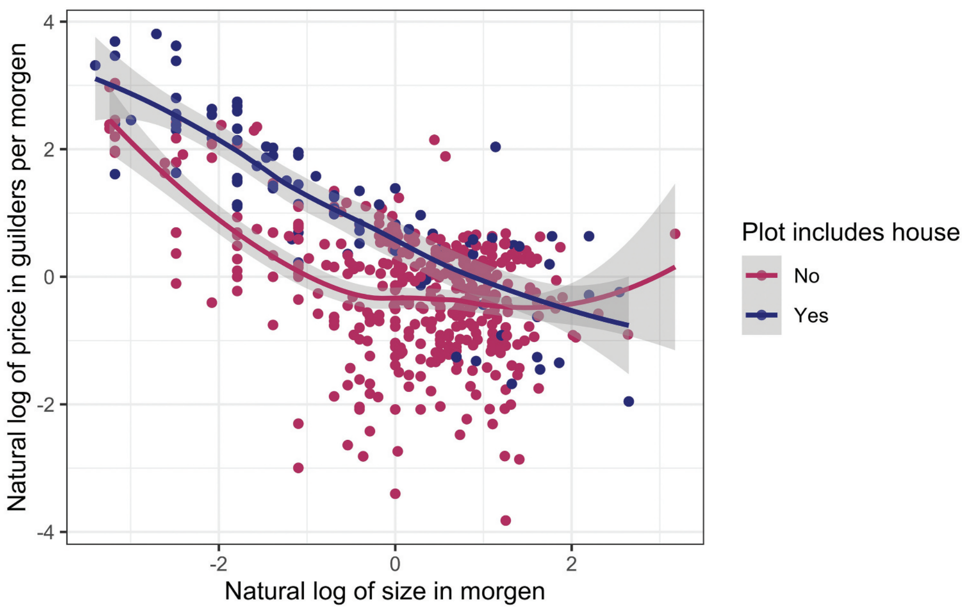

Figure 4. The relation of price per morgen and total plot size in morgen for all priced plots 1651–1660. Sources: GAR 143.1.01.26-31.

propertyless households pre-epidemic, who did not have to rely on access to land for their subsistence, but instead already earned a living through wage labor (van Bavel & van Zanden, 2004; van Bavel, 2005; 2007).

With falling base land prices, differing returns to scale per soil type became important in the decision to take land to or from the market. First, a note on soil types is presented in this article.[9] Most plots sold mention '*erf*' as their soil type, referring to a small plot of land, often but not always sold together with a house. These lands were also registered in the *morgenboeken*, even if they do not at first sight, seem economically productive. However, small-scale economic activity was not uncommon in early modern Holland (de Vries, 1974), as micro plots close to the household could be used for gardening and holding a small number of animals (as they were in eighteenth-century Groningen: Paping, 1995). The effect of '*erven*' and houses on price per *morgen* was large: a 51 and 42 percent increase respectively. Houses and house plots are also responsible for the strong downward effect of total plot size on prices per *morgen* (see Figure 4). This means that house plots raised the base value of the plot, but marginal values decreased rapidly as the values of these plots were mostly pushed up by the houses they held on there.

The most commonly sold productive soil type (i.e. non-housing plot) was, unsurprisingly, peat land. The records distinguish between '*veenland*' and '*slagturfland*'. Although there is no direct translation available, we can differentiate between land suitable for peat *digging* (associated with household production) or *mining* (associated with scale enlargement: van Dam, 2001a, p. 35), and peat *dredging* (which increased land productivity, but was more harmful to the soil: Ibelings, 1996). Both *veenland* and *slagturfland* lowered price per *morgen* per increased unit of land by about 54 percent relative to unspecified land, likely because they were not as lucrative as grasslands, even if their land productivity was likely higher. It was also the most common soil type in Hazerswoude.

Peatland can be best contrasted with '*weiland*' (grassland). Grassland was by far the most lucrative soil type, as it facilitated dairy farming and ox fattening. On average, an increase in units of land went hand in hand with an increase of 49 percent in price per *morgen* (Table 9). This is unsurprising for three main reasons. Firstly, dairy was one of Holland's main export products, and both beef and dairy prices sky-rocketed particularly between 1625 and 1650 (Bieleman, 2008, p. 47). Secondly, given the high demand for its products, grasslands were relatively scarce in the Holland peat area. Thirdly, because cattle need abundant space for grazing, grasslands tend to scale well. In fact, grasslands are the only soil type in the dataset that shows an upward effect of plot size on price per *morgen* in the higher regions of plot sizes (see Figure 5).

The decision to hold or sell inherited land was thus not only conditional on size, but also on soil types. Linking the above to Figure 5, it is likely that the smaller plots were either house plots or peat soils. These were either not often brought to the market, as heirs could (or already did) use these assets. When they were brought to the market, they could be purchased by formerly propertyless households, increasing the number of smallholders in the distribution. Larger landowners likely held more grasslands, as these provided the highest returns to scale. They were able to absorb part of the land supply that was expanded through the epidemic, such that the number of large owners (>20 *morgen*) increased, but not to the extent that aggregate distribution became more unequal. Thus, the land market steered redistribution

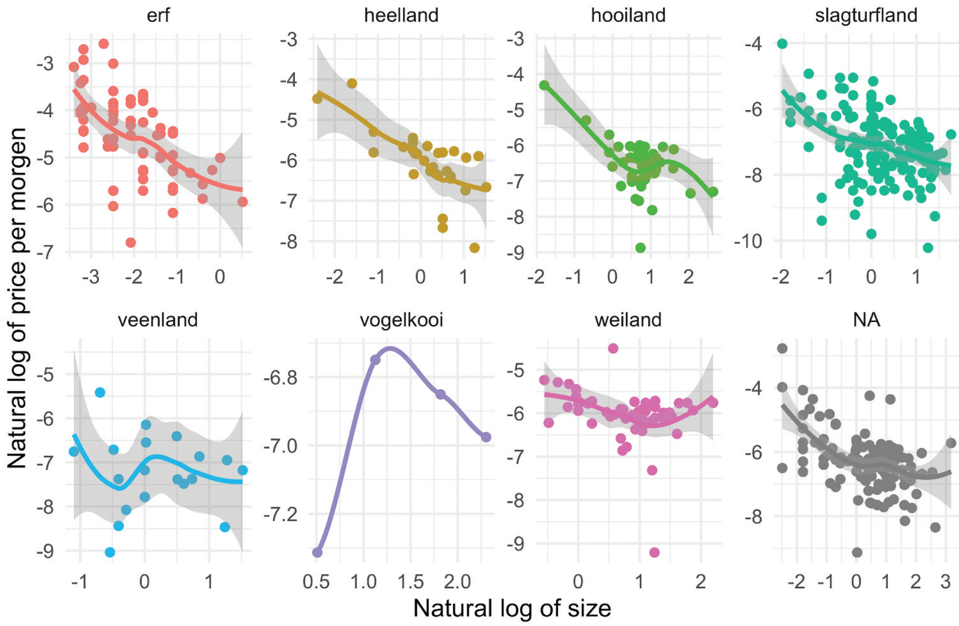

Figure 5. The relation of price per *morgen* and total plot size per soil type. Sources: GAR 143.1.01.26-31.

Table 9. Hedonic price regression results, coefficients per soil types, 1651–1660. See Appendix for full regression results.

Dependent variable:	Ln(price per *morgen*)		
Soil type	Coefficient	St. dev.	p-value
Erf	0.54	0.16	0.001***
Slagturfland	−0.54	0.10	0.000***
Veenland	−0.55	0.18	0.003***
Weiland	0.49	0.12	0.000***
Location FE	Yes		
Year FE	Yes		
Structures FE	Yes		
Ln(size)	Yes		

Sources: GAR 143.1.01.26-31.

by incentivizing smallholding for plots with quickly declining marginal returns (housing and peat) and incentivizing accumulation for plots with increasing marginal returns (grasslands).

7. Conclusion

What role did land market conditions play in the distributive outcomes of the 1655–6 plague epidemic? In line with Alfani (2022, p. 16), this article concludes that 'the way in which severe epidemics affect inequality depends strictly upon the initial conditions and the institutional framework at the onset of the crisis.' The effects of mortality shocks on wealth distributions, then, are not universal, nor are they specific to institutional frameworks or agro-systems only – they are also dependent on economic factors in time, in this case, the land and lease market, which partly dictated the possibilities and preferences mediating the outcome of the mortality crisis. Alfani (2022, p. 18) mentions that plague could have complex effects on local economic inequality that are not easily captured by synthetic measures like the Gini coefficient, and this article concurs. Changes in the number of smallholders and the boost in middling ownership, for instance, were only captured through decomposition of the data and matching owners over time. This means that these local studies may significantly broaden our perspective on the economic effects of mortality shocks in the past, far beyond aggregate distributional measures.

The main findings, then, are as follows. Firstly, epidemic mortality affected the land distribution immediately by morcellation as a result of strong partible inheritance combined with high pressure on land and a large share of propertyless households. On the other end of the distribution, large holders could absorb some of the property that became available through epidemic mortality. This happened on both the owner and the user level. Thus, as in Northern Italy in 1629–30 (Alfani, 2010), epidemic mortality was unable to redistribute property more equally on the aggregate – but it was also unable to redistribute property more unequally. A more unequal aggregate distribution was prevented by strong partible inheritance and marriage among middling owners. Secondly, whether the immediate redistributive effect persisted was contingent on market conditions. Whether inherited plots were sold or not depended on one's initial landholding and the type of property that had been bestowed upon them. Not all households could benefit from adding a medium-sized plot for cattle grazing to their lands, while not all households could sell a small peat plot in times of declining land values. Marginal returns played a role in the decision to either hold on to the inherited property or to deliver it to the market. Falling land values in the context of a large share of propertyless households suggests that this market had become illiquid (land was difficult to sell with profit), which was only partially and temporarily relieved with the increase of both land supply and demand post-epidemic.

Whether the new distribution was favorable or not in terms of inequality should be considered in terms of the development of demographic and economic conditions in the long run. The 1655–6 mortality shock (and likely the smaller waves in the 1660s until the early 1680s, too) flushed a large part of the local population with small parcels of a depreciating asset, paving the way for cheap land concentration and increased proletarianization in the late seventeenth century, especially as the rural economy tended toward crisis from the 1660s (de Vries & van der Woude, 1997, pp. 673–680) until deep into the eighteenth century (van der Woude, 1988; van Zanden, 1987, pp. 597–601). Particularly highly morcellated peat regions are deemed to have suffered from these unfavorable economic conditions (van Tielhof & van Dam, 2006, pp. 222–226). Thus, rather than mortality having been a contributor to long-term economic decline (as it was in the cities of Italy: Alfani & Percoco, 2019), mortality waves in Holland after 1650 happened in a context of secular economic stagnation and decline, affecting the long-term economic consequences of post-epidemic redistribution negatively.

Notes

1. The *Informacie*, a document compiled in 1514 as issued by the Habsburgian emperor in order to reform taxation (Fruin 1866), mentions that Hazerswoude generated half its income through peat and cattle farming, and half '*mitten handen*' ('with their hands', i.e. wage labor).
2. Mortality estimates were created using a lower bound population (2,992, as in 1623) and an upper bound population (3,663, based on Paping, 2014). The former is a lower bound estimate, as we can assume that the population had continued to grow in the period of economic prosperity, and the latter can be deemed an upper bound estimate given that peat areas had seen the largest relative population growth between 1514–1623 of all places in Holland, and it can thus be assumed that the largest population growth had already taken place.
3. The official legal entity for these villages is called an *ambacht* and most closely corresponds to a lordship as seen in the Southern Netherlands.
4. The name *morgenboeken* refers to the unit in which land was measured, the *Rijnlandse morgen*, one of which approximately corresponds to 0.85 hectares.
5. Seven (7) could be identified in 1660, amounting to 1.0 percent of all owners.
6. For additional source criticism, please consult the supplementary materials.
7. Summary transcripts of the land transactions can be found on the website of the municipal archive in Alphen aan den Rijn: https://gemeentearchief.alphenaandenrijn.nl/collectie/?mivast=105&mizig=210&miadt=105&miaet=1&micode=143.1.01&minr=761465&miview=inv2. The original documents can still be consulted physically at the archive itself (Gemeentearchief Alphen aan den Rijn, inv. 143.1.01.16–53).
8. As we lack lease prices for the period after 1650, however, this is hard to say with certainty. However, declining land values would also suggest declining rents, even if the decline is smaller (Francke & Korevaar, 2021, p. 6).
9. The text of this article will only distinguish between three soil types ('*erf*', peatland, and grassland), since these were the most important. For additional treatment of soil types and their effect on base land values, consult the Appendix.

Acknowledgments

The author would like to thank two anonymous reviewers for their very useful comments on the structure and argument of this article. Additional thanks to Daniel Curtis and Bram van Besouw for sharing the mortality data, and for helpful comments along the way. Final thanks go to Anton Svensson for his comments and insights regarding some early results. This research was supported by the NWO Vidi project *Positively Shocking! The Redistributive Impact of Mass Mortality through Epidemic Diseases and Violent Conflict in Early Modern Northwest Europe* (016. Vidi.185.046).

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the Nederlandse Organisatie voor Wetenschappelijk Onderzoek [016. Vidi.185.046].

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