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WILLIAM PETTY, THE MULTIPLICATION OF MANKIND, AND DEMOGRAPHIC DISCOURSE IN SEVENTEENTH-CENTURY ENGLAND*

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[running head] DEMOGRAPHIC DISCOURSE

Abstract

In the 1650s, after a century of increase, the population of England stopped growing. It was not to increase substantially again before 1750. Over the same interval, and not wholly coincidentally, scholars and theologians were trying to defend the orthodox account of how global population had increased since the Creation and must continue to do so, and the first political arithmeticians were trying to measure and analyse demographic change. This article seeks to throw fresh light on this many-sided discourse by examining William Petty's attempt to write an account of the 'multiplication of mankind', and the reasons why he failed to complete it. It focusses particularly on Petty's part in developing methods of measuring population density which highlighted the potential for future growth, and on the equally important demonstration by John Graunt that high and rising mortality in cities was hindering population growth in reality. As Petty's cousin Robert Southwell pointed out, Graunt's 'rule of mortality' was wholly incompatible with any coherent account of the future multiplication of mankind. At the end of this particular discourse, newly discovered facts about demography triumphed over the presuppositions of divinity.

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'The Multiplication of Mankind' was the title of an unfinished essay by William Petty, circulating in draft among his friends in the 1680s, only parts of which were ever published. He had not invented his title. The phrase was widely used in the seventeenth century, whenever writers on history, divine providence, or the power and wealth of princes and states, wanted to refer to changes in population, whether over the very long run or in their own time; and the sections of Petty's essay which survive show him drawing on all these different strands of contemporary discourse in order to arrive at some conclusions of his own about current demographic circumstances and their implications for the future. As one might expect from Petty, they included some speculative flights of fancy which he admitted were the most 'extravagant' things he had ever written. Yet in an era when there was next to no reliable evidence about population, speculation was essential, and much of it was intellectually productive - even when it led, as in this case, to an essay the author could never finish. The essay merits more attention from students of Petty than it has yet received.

If we want to understand ways of thinking about population in early modern England more generally, moreover, the history of Petty's essay - its genesis, ambition and ultimate failure - is a rewarding place to start. Like much recent work on demographic perceptions in the period,[1] its history brings out the degree to which they were shaped by inherited presuppositions, resilient because they were often reiterated and only occasionally refined or corrected by reflection on demographic events. But Petty's essay also provides a rare case – at the start of systematic demographic investigation in England – when a well-established set of assumptions was successfully challenged by newly discovered and rigorously presented demographic evidence.[2] Since the evidence came from John Graunt, the history of Petty's essay has the additional interest of revealing the two founders of the new discipline of

political arithmetic wholly at odds with one another. As we shall see, by the 1680s talking about population was a more contentious activity than has often been supposed.

In what follows, after a brief account of the essay itself, I want to examine first why the notion of the multiplication of mankind as a continuous process from the Creation to the end of the world had so firm a hold on demographic thinking in the seventeenth century, even after 1650 when the population of England and other European countries had stopped growing; and secondly to show how the failure of all attempts to restart demographic growth by political action compelled contemporaries to confront the impediments to mankind's multiplication, especially the high urban mortality rates identified by Graunt, and to ponder their implications for the English economy. The concluding section of the article sets Petty's unfinished essay firmly in that context, and uses his correspondence with his cousin and fellow member of the Royal Society, Robert Southwell, to throw fresh light on the limitations as much as the ambitions of seventeenth-century demographic discourse.

I

We first hear something of the content of the essay – though not of its title – in a letter from Petty to Southwell in 1681. It enclosed a paper which he had written for a Dublin theologian wanting to answer religious sceptics who thought that the planet would not be big enough to hold all the bodies which must rise from the earth at the Last Judgement and the end of the world. Intrigued by the challenge, Petty had borrowed a method of measuring the growth of population from the Creation to the present from John Graunt's *Natural and political observations* (1662) on the bills of mortality, and he had extrapolated forward from that in order derive the total population of the globe at the point when, he calculated, it would no longer be able to feed itself and the world must end. He estimated that the world in the 1680s was on average even less densely populated than 'our poor Ireland', but within 1400 years it

would be as ‘over-peopled’ as Holland, and the Last Judgement and Apocalypse must occur. Even then, however, the bodies of the total number of people who had ever lived on the planet would comfortably fit onto the surface of a single Irish province, Munster.[3] Religious orthodoxy was secure.

In 1683 Petty added this paper as a postscript to *Another essay in political arithmetick, concerning the growth of the city of London*, which included in its text some ‘extravagant suppositions’ about when not only London but the whole world would be fully peopled (London ‘before the year 1800’ but the world ‘within the next two thousand years’).[4] It seems likely that Petty had originally intended to publish the rest of his thinking about the multiplication of mankind alongside it, as a precursor to *Another essay*, but had had second thoughts.[5] Truncated though it was, *Another essay* was reviewed in Paris, in the *Journal des sçavans*, just as Graunt’s *Natural and political observations* had been. As might be expected, the French reviewer drew particular attention to Petty’s suggestion that London must be much more populous than Paris, the beginning of a long-running dispute about primacy between the two capitals, but he made no reference to Petty’s speculations about the end of the world, nor even to the extravagant prediction – to whose implications we will return later – that London and in consequence England would be fully peopled within little more than a century.[6]

In 1685, two years later, Petty’s correspondence with Southwell tells us more about the rest of a text which both of them now called an essay on ‘the multiplication of mankind’, and which was circulating among their friends, including Samuel Pepys, Peter Pett and William Penn.[7] Southwell himself had fundamental objections to parts of it, and especially to its initial proposition that ‘the speedy peopling of the Earth’ was ‘greatly to the honor of God and the benefit of all Mankind’, and the speedier the better: he saw no need or Biblical obligation for such haste. According to Petty, however, speed would allow more people to

enjoy more quickly the affluence, comforts and intellectual delights to be found in great towns and cities, where 'the wonders of God's Wisdome would be the sooner discoverd'; and it would benefit England in particular, since the king's dominions covered a large part of the globe and would give him in the end the greatest share of global population. Even closer to home, rents would rise, especially in Ireland, where Petty and Southwell had land. In short, he told Southwell, 'the speedy replenishing' of the earth was not only God's command, but for 'the good of Mankind in generall, for The King of England more than for other Princes, and for yours and my benefit in Ireland'.[8] His case, he thought, was unanswerable.

Nonetheless Petty still held back from publication in print. Southwell's entirely reasonable objections that he could not understand why parts of the earth should not be left thinly peopled, and why mankind should be in such a hurry to rush towards its final destruction, seem not to have troubled him unduly.[9] He was given greater pause when Southwell fiercely objected to the methods he proposed for accelerating multiplication, chiefly by making early marriage compulsory, since he was forced to confess in September 1685 that he had 'not yet concluded by what Lawes or other Meanes' his project to speed up multiplication could be 'put in practise'.[10] Ensuring speedier multiplication turned out to be much easier said than done, as we shall see, and Petty was in any case unable to resist revisiting and tinkering with his papers. Increasingly infirm but intellectually as active and politically as ambitious as ever, he now had little else to do.[11] In November 1685 he told Southwell he was 'thinking of publishing the Essay for Multiplication, and many other matters with it', and raised the possibility that Southwell himself might add notes to such a volume, but still he hesitated.[12]

When *Another essay* was republished in 1686 there was consequently no other essay of substance with it, despite the publisher's efforts, and despite the promise now held out by a new general title for the volume, *An essay concerning the multiplication of mankind, together*

with another essay in political arithmetick. An unchanged text of *Another essay* made up by far the larger part of the volume. It was preceded only by a very brief summary of the contents of 'an Essay intended to precede it', which was here called an essay 'concerning the Value and Encrease of People and Colonies'.[13] Its topics were to have included the size and population of England and Ireland, their occupational structures, 'the Value of People' there, 'How many Men and Women are Prolifick, and how many of each are Married or Unmarried', and 'a conjecture' of how soon the two kingdoms might be 'fully peopled, as also all *America*, and lastly the whole habitable Earth'. Finally, it would have asked 'What spot of the Earth's Globe' was 'fittest for a general and universal Emporium, whereby all the people thereof may best enjoy one another's Labours and Commodities'; and to which 'Prince or State' the speedy peopling of the earth would be most advantageous. The answers to those brief final questions were not difficult to predict, but the promise of the whole prospectus was never realised.

It seems clear that in Petty's mind the 'Multiplication of Mankind' was now less about the good of mankind than about the good of England and its dominions, and it had probably always been so. In August 1687, four months before his death, he was promising yet another paper, even more 'extravagant' than its predecessors, on 'doubling the people' of the British Isles, and how that would more than double the capital value of the land and make James II the greatest monarch in Christendom, 'without wars or bloodshed'. 'Being by my age near heaven', he found such exercises 'Labours of pleasure, of which ratiocination is the greatest and most Angelicall'.[14] Unable to give them up, he left the 1686 *Essay* as the final inadequate summary in print of his view of mankind's future multiplication. It was reprinted in 1699 in a posthumous edition of Petty's *Several essays in political arithmetick*, which was itself reprinted in 1711, 1751, and 1755;[15] and that was the form in which it came to the

attention of later political arithmeticians, some of the pioneers of demography, including Süssmilch and Malthus, and the editors of the great French *Encyclopédie*.[16]

II

Incomplete and insubstantial as they might appear, Petty's speculations and conjectures about the multiplication of mankind nevertheless made a distinctive contribution to thinking about population, in Europe as well as England, and it is important to set them in their contexts, in Petty's own thought and that of his contemporaries, in order to appreciate what was original and provocative about them.

Although the essays on multiplication were largely works of the early 1680s, they reflected many of the questions which had interested Petty much earlier. In 1647, like many of his contemporaries, he was already marvelling at the wealth of Holland, where a dense population was 'set on work, barren grounds made fruitfull' and 'one man or horse' able to do 'as much as three'; and he may well have borrowed the point about productivity from a fellow member of the Hartlib circle, Gabriel Plattes, who had noted in 1639 that when people grew 'too numerous for their maintenance', God gave them understanding of how 'to improve the earth' and double their numbers by using new techniques and labour-saving devices such as horses and oxen had once been. [17] Since 1647, moreover, Petty's experience in Ireland as surveyor and then landowner had given him another comparative benchmark, to be used, as William Temple and others later used it, in counterpoint with that of Holland.[18] Ireland's 'want of people', the 'greatest and most fundamental defect' of a kingdom whose territory could maintain five times as many people as it did, became a constant refrain in his writing;[19] and the contrast with Holland helped to frame his view of the political economy of England, lying somewhere between the two and consequently by no means fully peopled itself. In 1665 Petty constructed the first ever set of national accounts which showed that

labour contributed more to the national wealth of England than land and trade put together, that the 'value of the people' was £69 per head, and that it was desirable that there should be more of them provided they were fully employed. *Political arithmetick*, Petty's most famous work, written in the early 1670s, was intended to underline the point and to show how the population and wealth of the England and its dominions could easily grow so as to rival those of France.[20]

What was new in the 1680s, however, was Petty's incorporation of these immediate and local concerns into a history of the population of the world from the Creation to the Last Judgement, a sacred history underwritten by Scripture and endorsed by ecclesiastical authority. He was pushed in that direction partly by accusations of atheism following his publication of atomic theories in one of his essays in 1674, and he needed to set out his orthodox credentials.[21] But he was also attracted to sacred history because it brought a moral dimension to a case for population growth which initially appealed to him on grounds of national interest and political economy. There could be no doubt that God's command to Adam and Eve and then to the descendants of Noah after the Flood to 'be fruitful and multiply and replenish the earth' continued to apply.[22] It had made *multiplicatio*, the multiplication of mankind, a subject of inquiry and debate for centuries, and there had been isolated attempts earlier to calculate the total population of the world, the trajectory of its growth since the Flood, and the total numbers who had ever lived.[23] By the middle of the seventeenth century, however, the whole topic had become controversial because of the need to defend Scripture, and especially the orthodox date of Creation (c. 4000 BC), against heterodox opinions being newly publicised: that the world was much older than usually supposed, perhaps even eternal, that there were men before Adam, and that cities and civilisations in the distant past had been much more populous than those in the present. In reaction, there was a whole genre of apologetics defending orthodoxy, and Petty found

himself able to combine demography with divinity, and engage with some enthusiasm in a controversy where he appeared, for once, to be on the orthodox side.[24]

In England Graunt's *Natural and political observations* had led the way in showing what political arithmetic could do, defending the usual date of Creation by demonstrating how one couple, Adam and Eve, 'doubling themselves every 64 years' could easily have produced as populous a world as that of 1662. The measurement of growth by 'progressive doubling', as Petty termed it, had mathematical flaws, but it was as influential among political arithmeticians and demographers as Graunt's famous demonstration that there was a small surplus of males over females in the population, and hence that the multiplication of mankind would not be assisted by polygamy, as some of his contemporaries were arguing.[25] In the same year Edward Stillingfleet's Origines sacrae deliberately avoided arithmetic but mounted a 'rational' defence of the orthodox case on theological grounds;[26] and a few years later the great lawyer Matthew Hale employed every kind of evidence for the same purpose in his *Primitive origination of mankind* , citing Graunt as an authority for his assertion that the number of people 'doth and must necessarily increase in the world' across the centuries, and using subsidy returns to demonstrate the 'Multiplication of People' in England since the accession of Elizabeth. The book had a great influence on Petty, and on Hale's friend Southwell, who was no mean authority on Biblical events like the Flood himself. [27]

Many similar publications followed, especially works of 'natural theology' which aimed to reconcile the findings of the new historical and natural sciences with established religion. In 1692, for example, the first set of Boyle lectures, by Richard Bentley, cited Graunt, Petty, Stillingfleet and Hale when it condemned the 'atheistic' notion that there might be 'infinite generations' of mankind without either a beginning or an end.[28] For these authors the multiplication of mankind over the centuries might have been slow and steady, as Stillingfleet suggested, or, as Hale thought, a history of rapid spurts of growth, sometimes

leading to an 'excessive multiplication of Mankind' and needing to be 'corrected' by famines and plagues before growth could resume;[29] but the trend over the centuries was ever upward. As Professor McCormick has pointed out, the doubling methodology invented by Graunt and Petty and adopted by later political arithmeticians had the effect of making population 'not just a number, but a dynamic entity'; and the natural theologians gave its movement a direction and purpose.[30] If the population of England was not growing in the later seventeenth century, they might have said, it ought to have been, and growth would assuredly soon resume.

There were in addition other modes of discourse about population, not all of them pointing in the same direction. The most authoritative and potentially most controversial came initially from Aristotle, who had warned that there might be too many people as well as too few for an ideally good government: a great city was not to be confused with a populous one, since too large a multitude could not be orderly.[31] It is not surprising that in the later thirteenth and early fourteenth centuries, when European population reached its highest point before the Black Death, scholastic writers were discussing the optimum size of a population with Aristotle in mind, and suggesting that the multitude was now too large to be supported.[32] The argument surfaced again in England in the early seventeenth century when half a century of demographic growth produced complaints of a 'superfluous augmentation of mankind' and fears of 'seditions and troubles' as a consequence.[33] By then, however, the Aristotelian point had been overshadowed, though not wholly obliterated, by two new varieties of demographic discourse, each of them powerful elements in Petty's thinking and each pointing to the benefits of growth.

The first came from writers on reason of state who thought large numbers of subjects and citizens vital to the power and wealth of kingdoms and cities, provided that, as Giovanni Botero insisted in 1590, proper attention was paid to the need to match the potentially infinite

reproductive capacity of men and women with the finite economic productivity of a territory.[34] In effect, Botero made discussion of population inseparable from discussion of economics as well as power, and the Dutch example drove the point home by demonstrating that in a trading nation population might break through some of the limits set by finite natural resources at home. Surveying current debates about 'the means to make countries populous' in 1622, Gerald Malynes was able to suggest that population growth might sometimes be self-sustaining because a great 'concourse of people' caused 'the greater consumption of all things', and that attracted further commerce and more people in a virtuous cycle.[35] A discourse about population was becoming a discourse about political economy. The second, equally powerful aspect to early modern thinking about population was its colonial dimension. Just as the Romans were well known to have syphoned off surplus population into colonies, so from the 1570s there seemed obvious opportunities for England to do the same, first in Ireland and then in North America. From Richard Hakluyt in the 1580s to the advocates of emigration to Virginia in the 1620s and Jamaica in the 1650s, the threat or reality of England being 'too populous' and full of 'supernumerary people' was a powerful propaganda tool.[36] For those worried about economic problems at home and attracted by opportunities overseas a discourse about population easily became part of a discourse about the benefits of empire.[37]

In the 1650s, however, after a century of growth, the population had stopped increasing after a century of growth, and that changed everything. The shift seems not to have been appreciated until 1669 when a parliamentary debate on falling rents, rising labour costs and the decay of trade identified 'want of people' as a root cause, but once the point was made complaints that England was 'now very much underpeopled' became legion.[38] Emigration to the colonies, which seems to have peaked between the 1630s and 1660s, was no longer a safety valve for the metropolitan population but a perceived threat to it, and other

causes of depopulation were not difficult to identify once they were looked for: rising mortality, due to civil and foreign wars, the great plague of 1665 and other 'sicknesses and distempers' particularly in cities; and a decline in fertility, sometimes attributed to family limitation but more often, and probably correctly, to a decline in the proportion of people marrying.[39] Since the population was not to rise substantially again until the 1740s, the 1650s marked a watershed in the country's demographic history in the early modern period, and it was one which had momentous consequences for the country's social and economic history.[40] It also had intellectual consequences. It is ironic, though scarcely wholly accidental, that the period in which the multiplication of mankind was most closely studied because it needed defending as a doctrine was also the period when it was least visible and most needed in reality, not only in England but elsewhere in western Europe. There were multiple reasons for paying it close attention.

Writing in 1758, Joseph Massie complained that Petty and political arithmeticians who followed him had taken it for granted that the population of England would continue to increase, without noticing 'the great Depopulation that there was in their own Times'.[41] There was some justice in the charge. Like their contemporaries they were encumbered by assumptions about multiplication which led them to suppose that population growth was the natural state of affairs, and would sooner or later resume its course. In the circumstances what is remarkable is the evidence they were able to assemble in an effort to sustain their assumptions. They succeeded in measuring the total population, if not its trend over time, with reasonable accuracy. More important than that, they invented a comparative measure of the degree to which population was - or was not - pressing against resources (and thus leaving room for further growth), the vital question which Botero had identified and which scholars in other European countries, facing the same problems of stagnant population, were grappling with at much the same time.

III

As with so much else in the history of demography, John Graunt had begun it all.[42] In 1662 before anyone had any impression that population growth had stopped, he had used a variety of sources, including statistics of baptisms and burials and taxation records, to calculate that the population of England was about 6,400,000 - probably a million too many but a better estimate than any other up to that time. There was some disagreement among political arithmeticians about the trend afterwards, with Petty using data from the hearth tax and a census of communicants to arrive at a total of around 7,400,000 in 1683, Gregory King employing similar sources to produce a more reliable figure of 5.5 million in 1695, and Charles Davenant often citing 7 or 8 million.[43] Since the latter were the numbers most often used in printed handbooks in the early eighteenth century, there was room for argument about whether the population had grown since 1660, but if so, it had not grown by very much.[44]

When it came to measuring how large a population England could sustain, Graunt was again a pioneer, calculating an average density of population in England and Wales in terms of acres per head for the first time, although he left it to others to judge whether that was too dense or not dense enough. Assuming the acreage of England and Wales to be 25 million acres (in fact much too small) and the population 6 million (a little too large) he arrived at 'about four acres for every head'.[45] Since he thought the result should be judged by how far it satisfied the 'Rules of Plantation' and 'Husbandry', he may have taken the idea of the calculation from the English colonies in Ireland with their fixed 'plantation acres', either in Ulster after 1609 or in the Cromwellian settlement of the 1650s, which he would have heard all about from Petty who had measured Ireland accurately for the purpose.[46] Although Graunt left the verdict to others, however, it seems clear from what he said about the number of

beggars and lack of work for them in England that he shared the common opinion in the 1650s that England was already too full of people, and therefore thought an average of 4 acres per person the minimum tolerable.[47] He must have known that Petty disagreed, since he was declaring in 1662 that it was 'a false opinion that our Countrey is full peopled', and arguing that if the land was improved 'to the utmost of known Husbandry' it could support 12 million people, and twice as many as that if there were 'extraordinary' levels of industriousness in agriculture, industry and commerce like those found in contemporary Holland and China. England could easily manage with two acres per head, and at a stretch with only one.[48]

Petty thought the potential for growth still greater in Ireland, of course, claiming in the early 1670s that there were above 10 acres of 'good land' to every head there, compared with four in England and France, and 'scarce one' in Holland,[49] and he used similar numbers when advising William Penn in 1682 that Pennsylvania might best be planted with settlers at a density of 7 acres per person, the average of England and Ireland.[50] By 1687 he had revised his figures in the light of new information about acreage. Ireland with 1.3 million people had almost 14 acres per head, while England with 36 million acres and 6 million people had 6 acres, double the 3 acres he now thought necessary for 'sufficient peopling'.[51] That England and Wales were far from fully peopled was the general conclusion of political arithmeticians in the 1690s, when King and Davenant calculated that the country had about 7 acres for each of its 5.5 million people, and could easily sustain double its population (11 million at 3.5 acres per head), since there was 'hardly any sort of ground which numbers of men will not render fertile'. If there were only two acres per head, however, they thought famine would be almost inevitable.[52]

It is easy to be critical of these measurements of what has been called the 'population gap' between reality and potential.[53] The fact that their authors scarcely adjusted their

conclusions when they had more accurate figures for population or acreage suggests that the political arithmeticians were starting with presuppositions about the size of the gap to be filled (roughly another 100 per cent), and using the apparent certainty of number as persuasive rhetoric for their case.[54] They also knew, however, that they were dealing with rough averages and round figures, and that land was much more fertile in some parts of a country than others. By 1680, Petty had a manuscript analysis based on the hearth tax which tabulated with some accuracy the relative density of population in different English counties.[55] He knew Ireland even better, and he was not writing in total ignorance of its potential when he estimated that that kingdom could easily support around 4 million people, which was roughly the total it was to reach in the later eighteenth century, before the rapid further growth leading to the great Irish famine of the 1840s.[56] He was not far off target either in his prediction in *Another essay* that by 1800 the population of England and Wales might be nearly 10 million.[57]

Petty perhaps had a more realistic sense of proportion than he has often been given credit for, and certainly a better one than some of his contemporaries. In 1681, for example, John Houghton, the great advocate of improvement in all its guises, used the now fashionable jargon to argue that four acres would suffice for a family of four, and that England could support another six million people on waste land alone: 'This! 'This! 'tis inclosure will make our yokes easy, our burdens light'. (Later on he admitted to Pepys that people might well think him insane when he compared acres per head in France and England in this way.[58]) Petty's friend, Peter Pett, was equally bullish in 1688, propounding a stadial theory of agrarian progress which had sustained population growth over the centuries, advancing from pasture to tillage, and now, finally, to 'gardening'. Horticulture, Pett predicted, would allow one acre to 'maintain twenty persons', whereas now twenty acres maintained only five.[59]

The taste for such calculations was infectious once they had begun, and not only in England. As Davenant remarked, it was becoming the policy of 'all wise states' to obtain a 'full complement of inhabitants', 'as many as the land will nourish', and that required measurement.[60] Probably the first attempt at it outside England, and certainly the most thorough, was undertaken by Marshal Vauban in France in the 1690s. Based on a partial census which suggested a total French population of 19 million, and on a local investigation of how many people a 'square league' of land would support, it led him to conclude that France could easily sustain four or perhaps even six million more.[61] It is possible that Vauban had heard something about the work of English political arithmeticians from French scholars debating the relative sizes of their capital cities with Petty, in much the same way that his own findings seem to have been talked about in London, but he was also working within an independent French tradition of quantitative investigation which dated back to Bodin.[62] By the time the Prussian demographer Johann Peter Süssmilch came to search for measurements of population density across Europe in the 1740s, he was able to draw not only on the writings of English political arithmeticians, including Petty's Essay, and on Vauban's exercise, which he took as a model, but on similar works by later authors in the Netherlands and Germany. [63] He concluded that Europe as a whole could support on average 200 people per square mile, equivalent to a little over 3 acres per head. The figure differed scarcely at all from the tolerable densities finally arrived at by Petty, King and Davenant. According to Süssmilch, Europe could therefore sustain 550 million people as opposed to the 130 million he thought it held in the middle of the eighteenth century.[64]

Here was the population gap whose measurement was intended to give some certainty and sense of proportion to anxieties about under-population across western Europe from the 1680s to the 1770s. The precise calculation, seductive though its numbers no doubt were, was less important than its confirmation that there was ample room for further growth. In effect

political arithmeticians had devised a tool which could be interpreted to show that the multiplication of mankind had not yet run its predestined course, and must therefore soon resume. That was certainly its importance for Süssmilch himself, since the voluminous evidence he assembled for it contributed to the conspicuous shift of emphasis between the two editions of his *Divine order*, published in 1741 and 1761-2. Starting with an interest solely in the regularities of demographic behaviour which showed divine providence at work, he moved to the conviction, which he shared with German Cameralist writers, that demographic realities could be manipulated by statesmen, whose essential duty was to ensure 'the peopling of the state' by every possible means.[65] Petty had reached that same conclusion long before.

IV

It was one thing to diagnose the disease of under-population, however, and quite another to find a practicable cure. That was one of the problems which prevented Petty ever finishing the 'Multiplication of Mankind' and publishing it as the tract for the times he must originally have envisaged. There was not yet any general dispute in principle about the political capacity of governments to influence demographic outcomes.[66] Provided the action taken could be thought consistent with the prescriptions of divine providence, as when it favoured multiplication, it was usually approved by commentators, especially when there were precedents for it.[67] The solutions advocated for low fertility, the complaint most often voiced in print, were therefore familiar ones. In England projectors looked back again, as they had done in the 1530s, to the tax and other incentives used in classical times to encourage marriage and childbearing. They had been introduced in France by Colbert in 1666, in response to a seemingly stagnant population, and removed in 1683 having had no discernible impact.[68] They were soon being recommended in England by writers who thought the

population had fallen below 'what the extent of our territory and fertility of our soil' would allow,[69] but their only achievement was a temporary tax on bachelors and childless widowers imposed in 1695 which had no demographic consequence and collapsed within a decade.[70] More radical proposals, such as reform of the marriage laws to make divorce easier or even legitimise bigamy, however, got nowhere, and only evoked popular satire, as in a *Women's complaint against tobacco, or an excellent help to multiplication*, which wanted to stop men smoking because it was 'an enemy to ... procreation' and threatened the 'dissolution of mankind'.[71]

Never reluctant to contemplate radical solutions himself, Petty was greatly interested in polygamy as an aid to multiplication, but perhaps out of deference to English sensibilities, he kept the topic for private papers relating to the American colonies and, on one occasion, to the Irish.[72] If it had been advocated in any version of the 'Multiplication of Mankind', Southwell would surely have mentioned it. The proposals which were there, and to which Southwell reacted with horror, were radical enough. They probably included the suggestions in two of his other papers, that marriage should be made compulsory for boys at 18 and girls at 16, that there should be taxes on childless women, and maternity hospitals for unmarried mothers, and that bastards and orphans should be 'servants to the publicq for 25 yeares' and might be sold to parents willing to adopt them.[73] Southwell's opposition was unqualified. Putting 'a Girle at 16 and a Ladd at 18 to gett Children, before they know how to maintain them, or have served out halfe their Apprentiseshipps' would only result in 'more Children than honest labour can maintaine', all of them supported by the state, and subject to a 'vassalage' which left parents no other right to their children 'than the Earth hath to its Plants'. No one could possibly consent to such laws or 'Constitution' in England's political 'Climate'.[74] Since Petty knew perfectly well that people were marrying late because they were afraid of being unable 'to maintaine the Children they shall begett', he must himself

have suspected that there was unlikely to be any speedy improvement in fertility by means of unenforceable legislation.[75]

On the face of it political action might have been more likely and more likely to be effective in managing migration, by reducing emigration to the colonies and encouraging immigration. There was no prospect of a ban on emigration to the plantations which some projectors talked about, however, because they had to be populated if they were to be defended. It is striking that successive Boards of Trade and Plantations paid much more attention to the populations of the American colonies, to the extent of regularly counting heads, than ever they did to the populations of England and Ireland.[76] More was done to encourage immigration, but the devices adopted were always controversial, like the short-lived Declarations of Indulgence of 1672 and 1687, one of whose aims was allegedly to 'make these kingdoms more populous', and a Naturalisation Act, finally passed in 1709 in the face of popular xenophobia which had to be repealed in 1711. It was discredited for good when what ought to have been its greatest success story – the reception of 13,000 'poor Palatines', refugees from the Rhineland - became a costly fiasco.[77] Defoe had a well-publicised project to settle up to 10,000 of them in 'little colonies' on 4,000 acres of the New Forest, multiplying population and productivity, and adding to the wealth of the nation in the manner Petty would have endorsed, but the refugees had no resources of their own and none of the necessary skills, and it never got off the ground.[78]

Proposals for stimulating fertility and immigration having failed, only high mortality remained as an acknowledged cause of depopulation which might perhaps be remedied. It proved to be the easiest to recognise and measure, and impossible to control. Graunt's explicit ambition in his work on the London bills of mortality was to identify regularities in demographic events, so that he could arrive at 'clear knowledge', 'some Truths, and not commonly-believed Opinions'; and his greatest achievement was to demonstrate that

mortality from plague and other epidemic diseases was getting worse over time.[79] He observed that 'before the year 1600' there had been more births than deaths in London, and that the balance since then had been moving rapidly in the other direction, with the important consequence that London was now becoming ever more dependent on immigration from the countryside for its continuing growth. In one of his most striking hypotheses, Graunt asked his readers to consider 'whether a City, as it becomes more *populous*, doth not, for that very cause, become more *unhealthful*'.[80] This regularity, 'the law of urban natural decrease' as Jan de Vries has termed it, was deservedly another of Graunt's discoveries much admired by later demographers.[81] One of its components was a high infant mortality rate which Graunt had calculated for the first time, and modern research amply confirms that metropolitan mortality was increasing across the seventeenth century, not solely because of plague but owing to other diseases and infections, including smallpox.[82]

Perhaps because he saw this 'urban penalty' as one of the regularities in his data, and therefore as a 'natural' as opposed to 'political' observation, Graunt seems to have assumed that little could be done about it; and that led him once again to part company with Petty. In the case of plague, he had come to doubt whether the common practice of isolating those infected in an effort to reduce contagion was worth the 'vast inconveniences' it caused since the disease appeared to be carried in the air and not from person to person. In 1662 he had compared earlier epidemics of the disease in London with one another, observed that the worst had been in 1625, and deduced a relationship between the weekly number of deaths and total mortality which turned out to match experience in the great plague of 1665. After 1662 he also collected further data on earlier European epidemics, including those raging in the 1650s in towns across Europe from Cracow to Geneva, which led him to suppose, quite rightly, that this was a single disease 'perambulating' from place to place, but he seems not to have concluded that information of this kind might be used to stop it in its tracks. [83]

Petty by contrast was determined to find a solution for a disease which he reckoned in 1665 cost the national economy nearly £70 for every death, money which would have been better spent on preventive measures. Though no less interested than Graunt in regularities in plague time, and often insistent when it suited him that nature must have its course and 'would not be ill governed', he had multiple proposals for 'lessening the Plagues of London'. They included much more rigorous use of pesthouses and household quarantine, precisely the mechanisms which Graunt doubted were worth the costs involved.[84] Yet by 1683, ten years after Graunt's death, Petty was himself compelled to acknowledge that mortality in London continued to rise even without recent plague epidemics; and he had to factor that into his calculation of the city's future growth in *Another essay*.[85]

The result elicited Southwell's most acute objection to Petty's whole model. Having read first Graunt and now Petty's text, Southwell understood that the speedy multiplication of mankind must probably mean 'the multiplication of other Cittys' like London; and he deduced that the more urban residents there were, whether concentrated in one town or spread between several, 'the more will the Rule of Mortality increase'. The 'future Throngs' of people Petty was predicting would 'somewhat impayre' the progress of multiplication itself, he tartly remarked. [86] The point was all the sharper because Petty was fully aware of its importance. It had prompted the most original paragraphs in *Another essay*, and it raised questions which had as much to do with the peculiar character of England's economy at the end of the seventeenth century as with the multiplication of mankind.

V

In *Another essay* Petty had shown that on present trends, London must cease to grow in or around 1800. It would then contain 5 million people out of a national total of nearly 10

million, and he concluded that country would no longer be able to feed city. Since Graunt had established that there was already a contrast between a death rate of 1 in 30 of the population in London as against 1 in 50 in the country, Petty also calculated that the population of England would have begun to decline, with a loss to the nation of £1.4 million a year at £70 per head (the value of the missing people).[87] The question then arose of whether there was any alternative, and in order to clarify that issue, he put forward two hypothetical scenarios, 'two extravagant contrary suppositions'. One was a London close to its maximum of 5 million people, able to employ and feed them, expand its economy, and advance useful learning. It would enjoy all the Natural and Spontaneous Benefits and Advantages that Men find by Living in great more than in small Societies', including a rising standard of living, but average expectation of life would be low. The alternative was the opposite, a London reduced in size to 100,000, deprived of the advantages economic growth, but with much lighter mortality. Neither of these 'Imaginary states' was wholly practicable, Petty admitted. They were extreme cases. But the choice between them should guide government policy in moving 'by degrees' towards one or the other; and he provided criteria, 'Touch-stones', to help decide which political avenue was, for the moment at least, better 'for the Publick Good'.[88] His own preference could not have been clearer.

With the benefit of hindsight it is possible to see that Petty had identified what was special about the economy of England in the later seventeenth-century. It had reached the paradoxical position of wealthy preindustrial states which, in Adam Smith's terminology, had acquired a 'full complement of riches' but were moving towards a 'stationary state'. They were condemned by low fertility and high mortality never to reach what Davenant had called a 'full complement of inhabitants' and were therefore unable to grow further.[89] It was a paradox often debated in the middle of the eighteenth century;[90] but the prospect was wholly novel to Petty's generation. For Petty himself there was a further paradox. The picture he

painted of London in 1800 was something close to his vision of utopia on earth. It would be full of all the 'Arts of Delight and Ornament', precisely because it would be 'a general and universal Emporium' where the people of the world might 'best enjoy one another's Labours and Commodities', and full also of 'Philosophers and admirers of God's works' - just before the Last Judgement occurred. Given all that, as Southwell sensibly pointed out, it seemed 'a very unnatural design' for people to be advised 'to seek their own dissolution' as speedily as Petty was proposing.[91]

Leaving eschatology, the science of the last things, on one side, however, it is also reasonable to ask why Petty and his contemporaries did not accept the realities of their situation in what Tony Wrigley christened an advanced organic economy, and count their blessings.[92] There was a lot to be said after all for a country with a population rising only very slowly, growing in wealth more rapidly and enjoying the benefits of high wages and rising incomes per head.[93] Increasing productivity *per capita* was at the root of England's economic growth in the later seventeenth century. Without a massive increase in labour productivity in agriculture such as Gabriel Plattes and other agrarian improvers in 1640s and 1650s had imagined, there could not have been the major shift in England's occupational structure towards industries and services which had occurred by the middle of the eighteenth century. Neither could there have been any increase in productivity in manufacturing without the improvement in skills of artisans advocated by John Streater in the 1650s, and by John Cary in his Bristol workhouse for the poor in the 1690s.[94]

Petty would certainly have agreed with John Evelyn in 1674 that a 'multitude of men' did not in itself enrich a country: only 'their address and industry' could do that.[95] The need for 'industriousness', which had been stressed in the context of population discourse from Hakluyt onwards,[96] was one of the lessons reinforced by the contrast between Ireland and Holland, and absorbed by Petty as much as anyone else. In the Irish case Petty wanted more

immigrants from England in order to make the Irish more industrious, and capable of stimulating an increase in productivity and a rise in population along with it, and he was not alone in thinking that some kind economic stimulus must generally come before population growth. Matthew Hale, for example, who had anticipated Cary in some of his proposals for employing the poor, argued that the provision of two acres of hemp and flax in every parish would set 'multitudes' to work, and once that had begun, population and productivity would 'continually increase in a kind of Geometrical Progression', and the necessary multiplication of mankind naturally follow. [97] But Petty and the majority of his contemporaries were predisposed to assume that population growth and economic growth, populousness and prosperity, must always go hand in hand. When they did not, they were left to indulge in wishful thinking that the tide must soon turn, and there was precious little evidence of that before 1750.

VI

Until then the myth of the multiplication of mankind and the uses which political arithmeticians had made of it nonetheless continued to influence natural theologians.[98] They sometimes appealed to social reformers and projectors who also drew on Petty for inspiration, like Laurence Braddon whose scheme for the poor in 1717 involved a series of collegiate cities, each planted on 10,000 acres of waste, with two or three people per acre, and housing a total population of 1.5 million. It promised to 'double the wealth and strength of Great Britain', and at the same time accord with the requirements of 'sacred history'.[99] Yet neither Braddon nor the natural theologians drew attention to Petty's extravagant paragraphs with their two scenarios in *Another essay*. Petty's originality as a political arithmetician and political economist continued to be recognised on both sides of the Channel, but *Another*

essay was only occasionally referred to, [100] and the stark dichotomy it presented was virtually forgotten.[101]

By the 1760s the myth itself, like Petty's model of it, had lost much of its appeal, as the style and context of demographic debate in England changed. One forceful challenge to it came from Adam Ferguson, writing with all the secular confidence of the Scottish Enlightenment about the *History of civil society* in 1767. He thought most of the devices invented by 'statesmen' to increase population in the past had been counterproductive, serving only to 'frustrate the expectations of mankind, or to mislead their attention.' Wherever a people had been 'fortunate in their political establishments, and successful in the pursuits of industry' their population was 'likely to grow in proportion'. Yet even this 'increase of mankind which attends the accumulation of wealth' had its limits, set by the productive capacity of a country and the ever rising economic expectations of its citizens. Once the first was exhausted or the second disappointed, then 'population is checked, or begins to decline'.[102] That prediction of a likely stationary state was one verdict on Petty's political projects for population growth and on the circumstances which frustrated them.

A second came from those who were beginning to see the multiplication of mankind as a threat rather than a blessing, like James Steuart who warned in the same year of the need for political intervention to prevent a 'rapid multiplication' beyond the ability of England to provide 'nourishment and employment' for it.[103] That was the prospect analysed by Malthus at the end of the century with much greater acumen than Steuart could manage, and in circumstances which gave it immediate relevance. Malthus had read *Another essay*, though he refers to it only in the second edition of his *Essay on the principle of population*, and then only to dispute Petty's method of 'progressive doubling' and note that London's population in 1800 was far smaller than Petty had predicted. More relevant to the demographic circumstances of Petty's own time, however, were the comments Malthus made about

mortality, and his suggestion that in England and France the positive check to population growth presented by 'great and ravaging epidemics' in the seventeenth century had been replaced in the eighteenth by the new positive check represented by 'the silent, though certain, destruction of life in large towns and manufactories', which would 'always remain less healthy than country situations and country employments'.[104] Graunt and Petty would have understood the point. It is a reminder of the importance of the high mortality regime which persisted immediately after the end of plague in England, and it prompts a closer look at the role which Southwell's 'rule of mortality' played in Petty's model of the multiplication of mankind, and at their correspondence which offers a rare opportunity to observe demographic discourse in operation.

In their exchange of letters in September and October 1685, Southwell had many criticisms, some of them based on pushing Petty's assumptions as far as they would go. He foresaw that in Petty's prospective future, where military power would still mean manpower, and every state be rivalling the next for the larger population, the end result could only be 'either Laws or Bloodshed' to reduce surplus numbers. So much for arguments from reason of state. As for sacred history and natural theology, Southwell could cite Scripture to suit his purpose as well as the next man and remind Petty that there were stories like that of the pharaoh who ordered the drowning of the Hebrew children 'on account of Multiplication': they had 'multiplied ... and the land was filled with them'. Multiplication had its drawbacks, and if successful, Petty's whole project could only be 'ruinous' for mankind.[105]

In response to much of this Petty gave the classic evasive reply that it was far too early to tell. When Southwell pointed out that 'Mankind must by your method become at last as thick as grasse – not 3 acres to a man but 3 men to an acre and what not!', Petty's answer was that in a thousand years there would be three acres per head, which was 'sufficient peopling', and that would be the time to consider objections to 'a Surplus of men in the

world'. For the moment it was important only to know that there was plenty of space for further multiplication.[106] He might also have pointed out that Southwell had misunderstood his purpose, which was not to prescribe or predict end-points, but to set out hypotheses which served two functions. One was to clarify minds by showing 'the way to that Knowledge I aim at',[107] in this case knowledge of how far the population of England could grow with economic benefit and without damage to the public good. The second was to suggest a direction of travel rather than a precise agenda for policy-makers. When Petty found no clear answer to what 'Lawes or other Meanes' might be acceptable to enforce compulsory early marriage, he could well have added that private behaviour and public policy could change in the future as they had in the past. There was no doubt about what was needed.

What Petty could not do, however, was deny the importance of Southwell's increasing rule of mortality. It could not be minimised in the way that Matthew Hale and some of the natural theologians had explained earlier great epidemics, as merely temporary checks before population increased once more.[108] There was no immediate prospect of this rule of mortality ever declining in urban societies. It must increase further, and sooner rather than later bring England's demographic growth to a halt. It had to be incorporated into Petty's model, and it made it incoherent. Rising mortality was incompatible with ongoing multiplication, and given Petty's assumptions, it would have left England full of people in 1800 and presumably enjoying all the delights of the last days of the world, nearly two thousand years before the more barren parts of the globe, like America, caught up.[109] It made a nonsense of an ordered chronology of sacred history, and it made the utopian promise of London's great emporium of wealth and wisdom, to which Petty attached such importance, appear nonsensical too.

As he hastened to rearrange his papers for posterity in 1686 and 1687, he was still pondering how to square the circle. He was searching again for some means to ensure the marriage of all fertile women in order to increase 'the peopling of the nation for strength or

Trade' and thus provide 'the best remedy against the enormous growth of London': increasing rural fertility would presumably overtake rising metropolitan mortality. He was also gathering together suggestions for better quarantine and other precautions for London's health, and in a final burst of wishful thinking on the grand scale, he noted that in 1685 the numbers of burials and baptisms in London were equal: he had misread one of the bills of mortality.[110] He had no means of knowing that by the 1750s fertility would indeed be improving at last, largely through a fall in ages at marriage, and that urban mortality would also be improving, because of changes in the virulence of diseases and the extent of exposure to them; and it would have greatly surprised him to know that neither development owed anything at all to deliberate political action.[111]

For all his life-long confidence in the efficacy of social and economic engineering, especially when he provided the blue-prints himself, Petty had totally failed to find any certain remedy. In consequence, he never finished his essay on the multiplication of mankind, which he may well now have regretted ever starting, and it is telling that he made no effort to preserve it (if any coherent draft had ever existed) in this final tidying of his papers.[112] Instead, ever the political economist, he turned to listing, for the benefit of James II, a variety of demographic and economic projects to enhance the power of the nation in the shorter term, not least through the growth of its possessions overseas.[113] In effect, when it came to a choice between them, the observable fact of the rule of mortality had trumped the myth of the multiplication of mankind, and driven it to the back of Petty's mind, if not yet off the intellectual stage altogether. In the end demography defeated divinity.

In more ways than one, therefore, John Graunt's observation that the population of London could only grow by ever increasing migration from the countryside deserves a central place in the history of population and how it has been thought about since the seventeenth century. Unlike so many of the demographic projections and speculations of the political

arithmeticians, it was based on painstaking research, the 'many Observations' Graunt thought necessary for a generalisation or 'Theoreme', which 'like Oaks and other Trees fit for durable Building' must be 'of many years growth'.[114] It was confirmed by later experience. It shaped all future discussion of urban demography. And it identified one of the things - perhaps even the most important thing - that made the demography and therefore the economy of England in the later seventeenth century so different from anything that had gone before.[115] For Petty, however, Graunt's observation had proved to be a two-edged sword. It inspired the most original, if now largely forgotten, paragraphs of *Another essay*, those two extravagant scenarios of an England in the very near future which might be urban and civilised or healthy and primitive; and yet it also prevented his ever finishing a coherent account of the multiplication of mankind, the myth which had inspired him to measure the distance between present and future levels of population in the first place.

Petty deserves some credit for recognising its significance, given the damage it did to his model, but any account of his dialogue with his cousin must allow Southwell - armed with the rule of mortality he had learnt from Graunt - to have the last word. Tactful and diplomatic as ever, he might not have wanted it. His own farewell to the subject came in a letter to Petty from his new house at King's Weston near Bristol, reporting that 'whatever enemy you think me to *Multiplication*, I have this day planted above 40 faire Trees, and I hope they will produce their like, and soe on *in Secula Seculorum*'.[116] It would be good to think that some of them, like John Graunt's 'theorems', might still survive.

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* This article gives fuller consideration to a theme introduced in my *'Plenty of people'. Perceptions of population in early modern England* (Stenton Lecture 2010, University of Reading, 2011), and I am grateful for comments from two anonymous referees which helped me to refine its development here.

All pre-1800 works were published in London unless otherwise stated.

[1] See for example Ted McCormick, 'Political arithmetic and sacred history: population thought in the English Enlightenment, 1660-1750', *Journal of British Studies*, 52 (2013), pp. 829-57.

[2] For another example, also involving Graunt, see Margaret Pelling 'Far too many women? John Graunt, the sex ratio, and the cultural determination of number in seventeenth-century England', *Historical Journal*, 59 (2016), pp. 695-719.

[3] Marquess of Lansdowne, ed., *The Petty-Southwell correspondence, 1676-1687* (London, 1928) [hereafter *Correspondence*], pp. 92-3. For Graunt's calculation see his *Natural and political observations*, in C. H. Hull, ed., *The economic writings of Sir William Petty, together with the Observations upon the Bills of Mortality* (2 vols., Cambridge, 1899), [hereafter *Economic writings*], II, pp. 387-8.

[4] Ibid., II, pp. 456, 470, 477-8.

[5] Ibid., II, pp. 450-3; Sabine Reungoat, *William Petty: observateur des Îles Britannique* (Paris, 2004), pp. 251-2.

[6] *Le journal des sçavans*, 15 Mar. 1683, pp. 64-5. On the dispute about the populations of Paris and London, see Jacques Dupâquier, 'Londres où Paris? Un grand débat dans le petit monde des arithméticiens politiques (1662-1759)', *Population*, 53 (1998), pp. 311-25.

[7] *Correspondence*, pp. 147, 153, 155, 166, 176. In Petty's lists of his essays, written in 1685 and 1686, he refers first to 'Growth of the People and Multiplication of Mankind', and then to 'Upon the Multiplication of Mankind' with a separate entry for 'An Essay upon the Growth of London': Marquess of Lansdowne, ed., *The Petty papers* (2 vols., London 1927), [hereafter *PP*] II, pp. 263, 266.

[8] *Correspondence*, pp. 153-5, 166.

[9] For Petty's views on the end of the world, see *Correspondence*, p. 154; *Economic writings*, II, p. 464; Rhodri Lewis, *William Petty on the order of nature: an unpublished manuscript treatise* (Tempe, AR, 2012), p. 134; and for contemporary argument on the topic, Jed Z. Buchwald and Mordechai Feingold, *Newton and the origin of civilization* (Princeton, NJ, 2013), pp. 134-5, 174-8.

[10] *Correspondence*, pp. 145, 167.

[11] Frances Harris, 'Introduction', *The Petty papers* (British Library, Catalogue of Additions to the Manuscripts, 2000), pp. xviii-xix.

[12] *Correspondence*, p. 176.

[13] *Economic writings*, II, pp. 454-5, 642. The contents listed here included some of the topics discussed in a paper of 1686: *PP*, I, pp. 193-8.

[14] *Correspondence*, pp. 283-4; *PP*, II, pp. 55-7; British Library, Additional MS 72866, fos. 53r, 138-43.

[15] *Economic writings*, II, p. 649; Reungoat, *Petty*, p. 323.

[16] Below, at notes xx, xx, xx.

[17] William Petty, *The advice of W.P. to Mr. Samuel Hartlib* (London, 1647), p. 23; Ted McCormick, 'Population: modes of demographic thought', in Philip J. Stern and Carl Wennerlind, eds., *Mercantilism reimagined. Political economy in early modern Britain and its empire* (Oxford, 2014), p. 33; Paul Slack, *From reformation to improvement* (Oxford, 1999), pp. 80-1.

[18] William Temple, *Observations upon the United Provinces of the Netherlands*, ed. Sir George Clark (Oxford, 1972), pp. 109-10. For an excellent account of Ireland's influence on Petty's thinking, see Adam Fox, 'Sir William Petty, Ireland, and the making of a political economist, 1653-87', *Economic History Review*, 62 (2009), pp. 388-404.

[19] *Economic writings*, I, pp. 46, 223.

[20] Ibid., I, pp. 108-10, 284.

[21] Ted McCormick, *William Petty and the ambitions of political arithmetic* (Oxford, 2009), pp. 224-5. Southwell may have heard of Petty's interest in 'multiplication' at this time: Lewis, *Petty*, pp. ix-x, 68-9.

[22] Genesis 1.28, 9.1; Peter Biller, *The measure of multitude. Population in medieval thought* (Oxford, 2000), p. 113. For later comment, see, for example, William Perkins, *A cloud of faithfull witnesses* (1607), pp. 131-2; George Hakewill, *An apologie of the power and providence of God in the government of the world* (Oxford, 1627), pp. 35-6.

[23] Biller, *Measure of multitude*, pp. 244-6; McCormick, 'Political arithmetic', p. 840; Marie-Elizabeth Ducreux, 'Les premiers essais d'évaluation de la population mondiale et l'idée de la dépopulation au XVIIe siècle', *Annales de Démographie Historique* (1977), pp. 421-38, at p. 428 ; Giovanni Battista Riccioli, *Geographiae et Hydrographiae Reformatae Libri XII* (Bologna, 1661), Appendix, pp. 630-4.

[24] The best account of the controversy is McCormick, 'Political arithmetic', passim. See also William Poole, *The world makers. Scientists of the Restoration and the search for the origins of the earth* (Oxford, 2010), pp. 27-44.

[25] *Economic writings*, II, pp. 329, 374, 388; Pelling 'Far too many women?', passim. On the mathematics of the 'doubling' methodology, see Jean-Marc Rohrbasser, 'William Petty (1623-1687) et le calcul du doublement de la population', *Population*, 54 (4-5) (1999), pp. 693-706.

[26] Edward Stillingfleet, *Origines sacrae, or a rational account of the grounds of Christian faith* (1662), p. 556.

[27] Matthew Hale, *The primitive origination of mankind, considered and examined according to the light of nature* (1677), pp. 205-7, 237; William Poole, 'Sir Robert Southwell's dialogue on Thomas Burnet's theory of the earth', *Seventeenth Century*, 23 (2008), pp. 72-104.

[28] McCormick, 'Political arithmetic', p. 846; Richard Bentley, *The folly and unreasonableness of atheism* (1693), 'Structure of Human Bodies', p. 21.

[29] Hale, *Primitive origination*, pp. 212, 219; Buchwald and Feingold, *Newton*, pp. 179-80.

[30] McCormick, 'Political arithmetic', p. 841.

[31] *Aristotles politiques*, trans. John Dickenson (1598), p. 356.

[32] Biller, *Measure of multitude*, pp. 128-32, 243, 358-61 .

[33] For example, William Harrison, *The description of England*, ed. Georges Edelen (Ithaca, NY, 1968), p. 182; *Francis Bacon. A Critical Edition of the Major Works*, ed. Brian Vickers (Oxford, 1996), p. 368.

[34] Giovanni Botero, *Della ragione di stato* (Rome, 1590), pp. 226-41; Botero, *A treatise concerning the causes of the magnificencie and greatness of cities*, trans. Robert Peterson (1606), pp. 91-4.

[35] Gerard Malynes, *Consuetudo vel lex mercatoria* (1622), p. 235.

[36] Richard Hakluyt, *Discourse of western planting*, ed. David B.Quinn and Alison M. Quinn (Hakluyt Society, Extra Series, no. 45, 1993), pp. 28, 32; Patrick Copland, *Virginia's God be thanked* (1622), p. 30; Abigail L. Swingen, *Competing visions of empire. Labor, slavery and the origins of the British Atlantic empire* (New Haven, Conn., 2015), p. 54.

[37] David Armitage, *The ideological origins of the British Empire* (Cambridge, 2000), pp. 74-81. On the colonial theme in English political argument, see also Nessa Cronin, 'Writing the "New Geography": cartographic discourse and colonial governmentality in William Petty's *The political anatomy of Ireland* (1672)', *Historical Geography*, 42 (2014), pp. 58-71.

[38] J. Thirsk and J. P. Cooper, eds., *Seventeenth-Century Economic Documents* (Oxford, 1972), pp. 68, 77, 80, 85; Slack, *'Plenty of people'*, p. 9.

[39] E. A. Wrigley and R.S. Schofield, *The population history of England, 1541-1871: a reconstruction* (2nd edn., Cambridge, 1989), pp. 220-1, 224; E.A. Wrigley, R.S.Davies,

J.E.Oeppen, and R.S. Schofield, eds., *English population history from family reconstitution, 1580-1837* (Cambridge, 1997), p. 195.

[40] Andrew Hinde, *England's population. A history since the Domesday survey* (London, 2005), pp. 180-1; Julian Hoppit, *Britain's political economies. Parliament and economic life, 1660-1800* (Cambridge, 2017), pp. 8-9; Paul Slack, *The invention of improvement: information and material progress in seventeenth-century England* (Oxford 2015), pp. 12-14, 154-61; below, p. xx.

[41] Joseph Massie, *A plan for the establishment of charity-houses* (1758), pp. 91-3.

[42] On Graunt's methodology, see Philip Kreager, 'New light on Graunt', *Population Studies*, 42 (1988), pp. 129-40; A.M Endres, 'The functions of numerical data in the writings of Graunt, Petty and Davenant', *History of Political Economy*, 17 (1985), pp. 245-64.

[43] *Economic writings*, II, pp. 369-72, 460; Gregory King, 'Natural and political observations and conclusions upon the state and condition of England, 1696', in Peter Laslett, ed., *The earliest classics* (Farnborough, 1973), p. 36; Charles Davenant, *The political and commercial works*, ed. Sir Charles Whitworth (5 vols., 1771), I, pp. 19, 62, 197, II, p. 221.

[44] See the arguments in David V. Glass *Numbering the people. The eighteenth-century population controversy* (Farnborough, 1973), pp. 11-89.

[45] *Economic writings*, II, pp. 371-2.The actual acreage (37.3 million) was measured with approximate accuracy by Edmond Halley only in 1685. Graunt appears to have deduced acreage (accurately enough) from an area of 39,000 square miles which was much too low.

[46] William J. Smyth, *Map-making, landscapes and memory. A geography of colonial and early modern Ireland, c. 1530-1750* (Cork, 2006), pp. 55, 83, 172.

[47] *Economic writings*, II, pp. 353-4.

[48] Ibid., I, p. 21; *PP*, I, p. 208, 'Observations of England' (which used population and acreage figures close to Graunt's). There has been much speculation about Petty's influence on Graunt's *Observations*, e.g. D.V.Glass, 'John Graunt and his natural and political observations', *Notes and Records of the Royal Society*, 19 (1964), pp. 78-89; Reungoat, *Petty*, pp. 33-42. The calculation of density per acre is a case where they must have talked about the methodology, while disagreeing about their conclusions; and it supports the view that Graunt indubitably had a mind of his own. See Pelling, 'Far too many women?', passim, and below pp. xx-x.

[49] *Economic writings*, I, p. 217. In 1675 Southwell reported similar figures to the Royal Society: Thomas Birch, *The History of the Royal Society of London* (4 vols., 1756-7), III, pp. 196-7.

[50] Mary M. and Richard S. Dunn, eds., *The papers of William Penn* (5 vols., Philadelphia, PA, 1981-7), II, pp. 279-80.

[51] Fox, 'Petty', p. 393.

[52] Gregory King, 'Natural and political observations', pp. 36-8, 41-2; Davenant, *Works*, II, pp. 221-2.

[53] James C. Riley, *Population thought in the age of the demographic revolution* (Durham NC., 1985), pp. 47-51.

[54] On the epistemological claims of political arithmetic, see Mary Poovey, *A history of the modern fact* (Chicago, 1998), pp. 120-43, and on Davenant in particular, William P. Deringer, 'Finding the money: public accounting, political arithmetic, and probability in the 1690s', *Journal of British Studies*, 52 (2013), pp. 638-68.

[55] Paul Slack, 'Measuring the national wealth in seventeenth-century England', *Economic History Review*, 57 (2004), pp. 607-35, at pp. 630-2.

[56] Fox, 'Petty', p. 397. The Irish population had reached 5 million by 1801 and about 7 million by 1821: Roderick Floud and Deirdre McCloskey, *The economic history of Britain since 1700* (2nd edn., Cambridge, 1994), p. 93.

[57] *Economic writings*, II, p. 464. In 1801 it was 8.7 million.

[58] John Houghton, *A collection for the improvement of husbandry and trade*, ed. Richard Bradley (4 vols, 1727-8), IV, pp. 10-17; J. R. Tanner, ed., *Private correspondence and miscellaneous papers of Samuel Pepys, 1679-1703* (2 vols, London, 1926), II, pp. 263-5.

[59] Peter Pett, *The happy future state of England* (1688), p. 100.

[60] Davenant, *Works*, II, pp. 221-2.

[61] Andrea A. Rusnock, *Vital accounts : quantifying health and population in eighteenth-century England and France* (Cambridge, 2002), pp. 188-90; Sébastien Le Prestre de Vauban, *A project for a royal tythe, or general tax* (1708), pp. 128, 132-3, 142.

[62] Norbert Meusnier, 'Vauban: arithmétique politique, ragot et autre *cochonnerie*' in Thierry Martin, *Arithmétique politique dans la France du XVIIIe siècle* (Paris, 2003), pp. 92, 124-5; Reungoat, *William Petty*, p. 273. Vauban, *Project*, pp. 130-1, 165, lists questions similar to Petty's. For earlier discussion of censuses in France, see Jean Bodin, *Six books of the commonwealth*, transl. M.J.Tooley (Oxford, 1955), pp. 221-2 ; Nicolas Barnaud, *Le miroir des françois* (n. p., 1581), pp. 460-4.

[63] Johann Peter Süssmilch, *Die göttliche ordnung in den veränderungen des menschlichen geschlechts* (lst edn., Berlin, 1741), pp. 13-16; (2nd edn., Berlin, 1761-2), vol. I, pp. 274-310, 411, vol. II, pp. 232-5.

[64] Ibid., vol II, pp. 177-85.

[65] Julius Nipperdey, 'Johann Peter Süssmilch: From Divine Law to Human Intervention', *Population* (English Edition), 66 (2011), pp. 611-36; Süssmilch, *Göttliche ordnung* (1761-2 edn.), vol. I, pp. 396, 407-8.

[66] In contrast to doubts about the efficacy of commercial regulation from the 1620s onwards: Poovey, *Modern fact*, pp. 66-91.

[67] An exception was occasional opposition to quarantine precautions on the grounds that plague epidemics were works of providence: Paul Slack, *The impact of plague in Tudor and Stuart England* (London,1985), pp. 232-9.

[68] Slack, *'Plenty of People'*, p. 5; L. Chantrel, 'Dépopulation et réforme de la fiscalité en France aux XVI-XVIIe siècles', *Population* (French edition), 49 (1994), pp. 457-80.

[69] William Temple, 'An essay on popular discontents', in Temple, *Miscellanea. The third part* (1701), pp. 72, 76-7.

[70] Colin Brooks, 'Projecting, political arithmetic and the act of 1695', *English Historical Review*, 97 (1982), pp. 31-53.

[71] *The womens complaint against tobacco* (1675), title page, p. 4.

[72] McCormick, *William Petty*, pp. 239-40.

[73] *PP*, II, pp. 50-1, 54-5. There are similar notions in 'Of Doubling the People' (1687): ibid., II, pp. 55-7.

[74] *Correspondence*, p. 145.

[75] *PP*, I, p. 267.

[76] Robert V. Wells, *The population of the British colonies in America before 1776* (Princeton NJ, 1975), pp. 7-13; Charles M. Andrews, *British committees, commissions, and councils of trade and plantations, 1622-1675* (Baltimore, 1908), pp. 69, 118, 129-30.

[77] British Library, Additional MS 32523, fo. 54v; Daniel Statt, *Foreigners and Englishmen. The controversy over immigration and population, 1660-1760* (Newark, DE, 1995), pp. 34-7, 121-65; H. T. Dickinson, 'The poor Palatines and the parties', *English Historical Review*, 82 (1967), pp. 464-85.

[78] [Daniel Defoe], *A brief history of the poor Palatine refugees* (1709), pp. 3, 15; Defoe, *The Review*, V (1708/9), pp. 513-15, VI (1709), pp. 149-71.

[79] *Economic writings*, II, pp. 334, 397.

[80] Ibid., II, pp. 393-4.

[81] Jan de Vries, *European urbanization, 1500-1800* (London, 1984), p. 179. For a stimulating analysis of Graunt's contribution, to which I am greatly indebted, see Richard Smith, 'John Graunt, the law of decline and the origins of urban historical demography', Gresham College Lecture, 29 Nov 2012 (transcript available at https://www.gresham.ac.uk, accessed 7 March 2017).

[82] Margaret Pelling, 'John Graunt, the Hartlib circle and child mortality in mid-seventeenthcentury London', *Continuity and Change*, 33 (2016), pp. 335-59, at p. 341; Gill Newton and Richard Smith, 'Convergence or divergence? Mortality in London, its suburbs and its hinterland between 1550 and 1700', *Annales de démographie historique*, no. 126 (2013), pp. 17-49; Neil Cummins, Morgan Kelly and Cormac Ó Grada, 'Living standards and plague in London, 1560-1665', *Economic History Review*, 69 (2016), pp. 3-34, at pp. 25, 32.

[83] *Economic writings*, II, pp. 320, 366, 404-5.

[84] Ibid., I, p. 109 (the document in the footnote here should be dated 1687 not 1667); Slack, *Invention of improvement*, p. 117; *PP*, I, pp. 26, 38-40.

[85] *Economic writings*, II, pp. 471, 475.

[86] *Correspondence*, p. 146.

[87] *Economic writings*, II, pp. 459-65, 475-6.

[88] Ibid., II, pp. 469-76.

[89] E. A. Wrigley, *Energy and the English industrial revolution* (Cambridge, 2010), pp. 197-8; above, p. x.

[90] See, for example, David Hume, 'Of the populousness of antient nations', in *Essays and treatises on several subjects,* vol. IV (2nd edn., 1753), pp. 216-17.

[91] *Economic writings,* II, pp. 455, 474-5; *Correspondence,* pp. 154, 161-2.

[92] E.A.Wrigley, 'The transition to an advanced organic economy: half a millennium of English agriculture', *Economic History Review*, 59 (2006), pp' 435-80.

[93] Stephen Broadberry, Bruce M.S. Campbell, Alexander Klein, Mark Overton, and Bas van Leeuwen, *British economic growth, 1270-1870* (Cambridge, 2015), pp. 406-10, 415, 426.

[94] Slack, *'Plenty of people'*, p. 11; John Cary, *An account of the proceedings of the corporation of Bristol* (1700), pp. 12-16.

[95] John Evelyn, *Navigation and commerce, their original and progress* (1674), pp. 15-16.

[96] Craig Muldrew, *Food, energy and the creation of industriousness* (Cambridge, 2011), pp. 301-5.

[97] Fox, 'Petty', pp. 397-8; Sarah Lloyd, *Charity and poverty in England, c. 1680-1820* (Manchester, 2009), p. 111.

[98] McCormick, 'Political arithmetic', pp. 848-9.

[99] Lloyd, *Charity and poverty*, pp. 79-93; Laurence Braddon, *The miseries of the poor* (1717), title page, p. iv.

[100] E.g. Thomas Short, *A comparative history of the increase and decrease of mankind in England, and several countries abroad* (1767), p. 20; *Journal oeconomique* (Paris, 1756), p. 189; Denis Diderot and Jean d'Alembert, eds., *Encyclopédie* (17 vols., Paris, 1751-65), I, p. 678, referring to Petty's essay on 'la multiplication du genre humain'..

[101] The only exception was Louis-Joseph Plumard de Dangeul, *Remarks on the advantages and disadvantages of France and of Great-Britain with respect to commerce* (1754), p. 191-2.

[102] Adam Ferguson, *An essay on the history of civil society* (Edinburgh, 1767), pp. 214, 218, 357-8.

[103] James Steuart, *An inquiry into the principles of political oeconomy* (2 vols, 1767), II, pp. 72-5.

[104] Thomas Robert Malthus, *An essay on the principle of population* (2nd edn., London, 1803), pp. 5, 345-6, 597.

[105] *Correspondence*, pp. 144-5; Exodus, I. 7.

[106] Ibid., pp. 144, 148, 150.

[107] *Economic writings*, I, p. 245.

[108] Above, p. xx; William Nicholls, *A conference with a theist* (1698), Part I, p. 69.

[109] *Economic writings*, II, p. 456; *Correspondence*, pp. 161-2.

[110] British Library, Additional MS 72866, 'Analysis populi', fo. 53v, 'Worke for the next parliament', fo. 112; *PP*, I, pp. 37-40, 194.

[111] Hinde, *England's population*, pp. 184-9; Jan de Vries, 'The economic crisis of the seventeenth century after fifty years', *Journal of Interdisciplinary History*, 40 (2009), pp. 151-94, at pp. 160-1. It is ironic that the rule of mortality as Graunt defined it ceased to operate in England in the 1780s and 1790s, just before the date Petty predicted that London's growth must end: E. A. Wrigley, *The path to sustained growth: England's transition from an organic economy to an industrial revolution* (Cambridge, 2016), p. 93.

[112] The fact that no manuscript copies of a 'Multiplication' essay have yet been discovered, in contrast to those of Petty's 'Scale of creation' (Lewis, *Petty*, pp. 83-4), suggests that the 'essay' circulating among his friends in the 1680s may have been little more than a list of scarcely connected propositions.

[113] Above, p. xx.

[114] *Economic writings*, II, p. 398.

[115] The classic account is E. A. Wrigley, 'A simple model of London's importance in changing English society and economy, 1650-1750', *Past and Present*, no. 37 (July 1967), pp. 44-70.

[116] *Correspondence*, p. 175.