

**SHOCKING CONTRASTS:  
POLITICAL RESPONSES TO EXOGENOUS SUPPLY SHOCKS<sup>1</sup>**

Ron Rogowski  
UCLA  
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Abstract: A sudden, large, and unanticipated change in the supply of a crucial factor of production (land, labor, physical or human capital) unleashes social and political turmoil. Returns to a previously scarce factor fall if it suddenly becomes abundant; returns to a previously abundant one rise if it suddenly becomes scarce. Societies typically adjust to such a shock in any of four ways, each more difficult than the one before it: factor substitution, factor mobility, a factor-saving technology, or coercion. I focus on cases in which societies and governments respond to the same shock in opposite ways. Faced with a sudden shortage of labor, one society may shift to less labor-intensive production, while its neighbor uses coercion to suppress workers. Faced with a sudden loss of access to land, some societies will move to technologies that exploit their newly abundant endowments of human or physical capital, or of labor, while others seek to conquer and colonize adjacent lands. In historical case studies, I show how such factors as soil and climate, previous experience of privation, and technological breakthroughs can determine which course a society takes.

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<sup>1</sup> This is an overview of my forthcoming book of the same title with Cambridge University Press. A longer synopsis, which provides more detail on the case studies, is also available.

We . . . need to become comfortable in thinking about the economic activity of the human race, not merely in terms of gradual movements of technical and economic progress occurring by insensible degrees, but also as shoved on occasion by shocks, many barely noticed, some easily absorbed, and a few with cataclysmic consequences.

Larry Neal, "A Shocking View of Economic History," 2000<sup>2</sup>

I define a supply shock as any sudden increase or decrease in a crucial factor of production (land, labor, human capital, physical capital) that is (a) exogenous, (b) unanticipated, and (c) large. I focus particularly on cases in which the same shock elicits radically different responses across societies, governments, and/or groups within societies. I start from the almost trivially obvious fact that supply shocks change, or threaten to change, relative prices: a factor that is suddenly scarce becomes dearer, a newly abundant one cheaper. Owners of the former gain, owners of the latter lose – if the market is allowed to prevail. Predictably, the losers resist, and the winners embrace, the workings of the market; and how powerfully they resist or promote depends both on the magnitude of their potential gains or losses and on their pre-existing endowments of wealth and power.

One example, familiar to every student of European history, is the Black Death of the fourteenth century (discussed more fully below). Clearly exogenous and totally unanticipated, that outbreak of bubonic plague killed off, in successive waves up to about 1420, some two-thirds of Europe's population, while leaving the supply of land and capital (but not of human capital, which was also decimated) unchanged. The ensuing acute shortage of labor led in western Europe to increased wages, decreased rents of land and capital, decreased economic inequality, and the abandonment of the last vestiges of serfdom. In eastern Europe, by contrast, the same shock led to the enserfment of a formerly free "homesteader" peasantry, coercion that held wages to far less than peasants' marginal product, and far greater economic inequality. Why the difference?

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<sup>2</sup> (Neal 2000, 320)

In the twentieth century, the unforeseen duration and extent of World War I entailed (as Keynes perceived) a drastic curtailment of Europe's supply of land – or, more precisely, of Europe's access to the abundant lands of the New World – and precipitated in Germany, as early as 1917, demands for self-sufficiency in food. When the Great Depression intensified those demands, Germany installed a government openly committed to genocidal conquest and colonization of territory. Despite their similar situation, no other European country did so. Again, why?

In short, in the face of major supply shocks, some societies adapt but others resist, using force either against some subset of their fellow citizens or against neighboring societies. What can explain the difference?

Starting from a simple principle of economy of effort (Zipf 1949), I posit three main modes of peaceful adaptation, in order of increasing cost.

- a) Factor substitution: A society uses less of a newly scarce factor, more of a newly abundant one.
- b) Factor mobility: A newly abundant and therefore devalued factor moves into either
  - a. a new sector, where it is in greater demand, or
  - b. a different locality, where it remains relatively scarce.
- c) Factor-saving technological innovation: A sudden scarcity of a previously abundant factor incentivizes the the invention of a technology, or the wider adoption of pre-existing one, that uses that factor more efficiently (Hicks 1963, 124).

Only when all three of these peaceful avenues are foreclosed does a supply shock normally induce a society, or some group within it, to adopt the costly alternative of coercion.

I first lay out the theoretical perspective in slightly greater detail, resorting where necessary to some barebones economics; and then proceed to consider a handful of historical examples. As will become clear, I offer no single explanatory factor. What determines a society's course – or, more precisely, forecloses some alternatives – may

in one case be soil and climate, in another a technological breakthrough or the exogenous opening of a new trade route or mode of transport. I provide, at most, a framework for analysis.

## HOW SUPPLY SHOCKS CHANGE RELATIVE RETURNS

Start with the simplest possible two-factor economy. It might be a purely agricultural one, whose only factors of production are land (T) and labor (L). It is intuitively obvious, but can be shown formally,<sup>3</sup> that a shock that increases the land-labor ratio T/L, will – barring coercion, or any equally sudden change in technology – raise wages relative to the rent of land and hence make society more equal.<sup>4</sup> Moreover, falling rents entail falling land prices, since no rational buyer will pay more for a unit of land than that unit will return in present value of anticipated future revenue. Only slightly less obviously, such a shock will also raise per capita output, i.e., make society as a whole better off. A positive shock to the land-labor ratio will also, of course, create incentives to substitute land for labor, to the extent possible,<sup>5</sup> in production; and to adopt or invent labor-saving technologies.

The more difficult the adjustment, the likelier is political contestation. A sudden rise in the land-labor ratio will move landowners to resist, and workers to promote, the workings of the market.

These basic implications carry through to modern industrial economies, whose factors are physical capital and labor; to a “knowledge economy” (Iversen and Soskice 2019) that relies on labor and human capital; and to more complex multi-factor economies. As any one factor becomes more abundant (scarce), while the others hold roughly constant, returns to that factor decrease (increase), and returns to the others rise (fall). A salient current example is the abundance of labor occasioned by the “China

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<sup>3</sup> See Appendix A1.

<sup>4</sup> This is trivially evident if we take the ratio of rents to wages,  $r/w$ , as the measure of inequality; but it can readily be shown that as  $r/w$  rises, so does the Gini index or the share of total income accruing to the top earners.

<sup>5</sup> I.e., to the extent that substitution is elastic. See further discussion below.

shock:" developed-country wages have fallen and returns to human capital (the "skills premium") and physical capital (e.g., stock market valuations) have risen.

### **WHO ADJUSTS TO A SUPPLY SHOCK AND WHO RESISTS IT: THREE DETERMINING FACTORS**

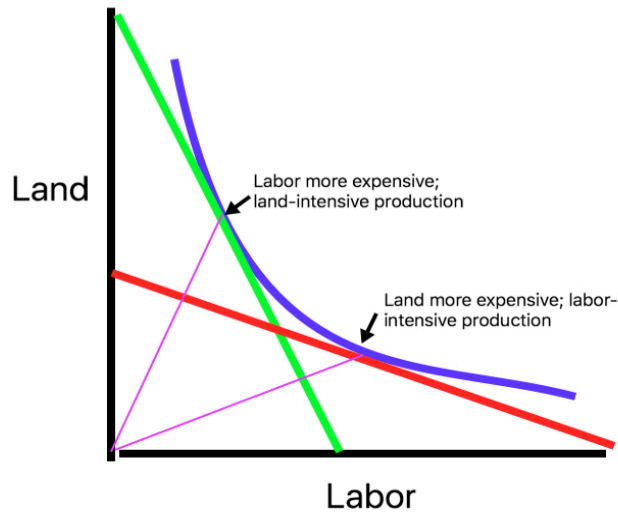
Resistance is costly. Rational actors will bear those costs only to the extent that they promise a commensurate reward or the avoidance of some yet greater loss. Why does the same supply shock threaten radical alteration of returns to factors in some situations but much less change in others? Consider in greater detail the three modes of adaptation: elasticity of substitution; factor mobility (among sectors or regions); and availability of a factor-saving technology. I continue to focus on the illustrative agrarian model, where the only factors of production are land and labor.

Factor substitution. As labor becomes more expensive relative to land, landowners will seek to substitute land for labor in production – i.e., to move along the isoquant (Figure 1). The extent to which they can do so is captured by the elasticity of substitution, which is really a measure of the isoquant's curvature: if it were maximally curved, forming an L-shaped right angle – a Leontieff production function – its elasticity would be zero. No matter how great the increase in the relative price of labor (the steepness of the price line), the proportion of the factors used in production (the slope of the ray from the origin to the point of tangency) would not change. If it were not curved at all, i.e., a straight line, its elasticity would be infinite, and the factors would be perfect substitutes for each other.<sup>6</sup>

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<sup>6</sup> As I have known even very clever graduate students to forget, the standard Cobb-Douglas production function has, by design and for convenience, a constant elasticity of substitution of one.

**FIGURE 1**  
**Factor Substitution in an Agrarian Economy**



Elasticity of substitution matters politically because, where producers can easily substitute one factor for another – where substitution is highly elastic – they can adjust with relative ease to sudden changes in relative factor prices. They face a milder threat and hence are likelier to accept the verdict of the market. Where substitution is inelastic, an unexpected change in the relative price of factors will far likelier provoke political resistance. Owners of the factor that is losing value, and producers who use intensively the factor whose price is rising, have augmented incentives to employ political action, collusion, regulation, or coercion to obstruct the working of markets; while owners of the newly scarce factor, and producers who use the newly abundant factor intensively, will often combine to oppose such obstruction, forcefully if necessary. Such conflicts can easily morph into challenges to existing institutions of governance, Institutional conflict often focuses on a widening or narrowing of the effective franchise, or what some have called the “selectorate” (Bueno de Mesquita et al. 2003).

Factor mobility. Where substitution is inelastic, owners of a factor threatened with declining returns can sometimes put that factor to a different use – i.e., move it a different sector. Redundant agricultural labor may move – if we now relax the

assumption of a purely agrarian economy -- into manufacturing or services.

Alternatively, owners can sometimes move an imperiled asset to an environment where it still commands a higher return (Bates and Lien 1985) (Boix 2003). The most obvious examples are *labor* and *human capital*, which (depending on transport costs and linguistic and political barriers) can emigrate. Physical capital can also move, or even be designed to move;<sup>7</sup> and, while land cannot be exported, its products can. By the same token, in a region or sector where one factor is suddenly in short supply, owners of the complementary factors may seek to import more of it: encouraging immigration, stimulating foreign investment, seeking access to more land.

Technological or institutional remedies. As Hicks wrote almost a century ago, “A change in the relative prices of the factors of production is itself a spur to invention, and to invention of a particular kind—directed to economizing the use of a factor which has become relatively expensive” (Hicks, 1963 (2nd edition), p. 124).<sup>8</sup> A shock that radically curtails the supply of labor incentivizes the invention or adoption of labor-saving technologies; one that decimates human capital inspires – as we’ll see in the case of the printing press – technologies that are less skill-intensive. But invention is difficult and expensive; it’s usually resorted to only if neither factor substitution nor factor mobility is feasible. And even then, a technological “fix” often either does not emerge or is blocked from widespread adoption by entrenched interests or obdurate governments (Juma 2019). In Appendix A2 I address the factors that make innovation more, or less, likely and try to explain why even a highly advantageous new technology, adopted in some societies, is ignored or delayed in others.<sup>9</sup>

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<sup>7</sup> Oliver Williamson cites the example of mobile homes, which were particularly attractive to workers in sectors subject to regional cycles of boom and bust.

<sup>8</sup> Robert Allen explains the English origins of the industrial revolution through two simple facts: in England, “labor was expensive and coal was cheap” (Allen 2009, 2). The steam engine was invented in response to the shortage of labor.

<sup>9</sup> This approach regards technology, including most institutions, as endogenous. In Appendix A3 I consider the claims of technological determinism, including particularly the impact of military technology. While, as we shall see in the case of the printing press, an endogenous innovation can so overshoot as to create a glut of the factor whose shortage summoned it into being, it is extraordinarily rare that a wholly exogenous innovation becomes determinative.

Where no such technological remedy succeeds – and where, additionally, existing technology makes factor substitution inelastic, and factors are largely immobile among sectors and regions, intense political, social, and institutional conflict is almost certain to arise.

I now consider some illustrative historical cases in which the same shock elicited a largely peaceful adjustment in some societies but a violent or coercive response in others. I'll cover two in some detail, three others more cursorily. The (yet) longer version of this paper, available separately, offers more extensive coverage.

### **CASE 1: THE BLACK DEATH OF THE FOURTEENTH CENTURY AS AN EXOGENOUS LOSS OF LABOR**

By the dawn of the Fourteenth Century, Europe's population had risen from its medieval nadir of perhaps 25 million in the time of Charlemagne to between 70 and 100 million (Herlihy 1997) (Russell 1976, 36) (Fischer 1996, 44). The Great Famine of 1315-22 and, even more, the Black Death of 1347-52 and its subsequent recurrences had by 1420 reduced Europe's population to at most 35 million (Herlihy 1997, 17).<sup>10</sup> Since the region's endowments of land, physical capital, and specie barely changed, the capital-labor and land-labor ratios roughly tripled, and the same money was soon chasing two-thirds fewer goods.<sup>11</sup>

Standard economic models, as outlined above, predict the outcome with some precision: wages should rise (in real terms, probably by at least 40 percent), rents on land and capital would fall (probably by about half, again in purchasing power), per-capita output (and thus the average standard of living) would increase, and nominal

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<sup>10</sup> Benedictow suggests, on the basis of an exhaustive survey of the available (if inevitably fragmentary) evidence, that the first wave of the Black Death (1347-1353) likely killed some 60 percent of Europe's population, rather than the one-third conventionally estimated: 50 million, he conjectures, out of a total population of (again, by his estimate) 80 million. The subsequent waves merely prevented population from rebounding until sometime between 1420 and 1450. (Benedictow 2004, chap. 33)

<sup>11</sup> One form of physical capital does appear to have dwindled: livestock. Cattle, sheep, and pigs proved to be also susceptible to the plague, and their high mortality temporarily reduced the meat and wool supply—also, doubtless, further incentivizing the shift to meat, wool, and dairy production described below.



prices would roughly triple. Land-intensive foodstuffs would cheapen relative to more labor-intensive ones (manufactures, construction, hand-copied literature). Inequality, which had reached extremes in thirteenth-century Western Europe, would decline drastically: the rental-wage ratio would likely fall to less than a third of its former level, leading to political and social equalization.<sup>12</sup>

Western Europe. This, at any rate, is what would be expected to happen in an economy subject to market pressures, i.e., one in which neither elite collusion nor governmental action impeded adjustment.<sup>13</sup> The available data suggest that change in much of Western Europe was even more radical than the standard models would suggest. Between the 1320s and the 1380s, Gregory Clark's standard time-series (Clark 2005, 1324) shows, the purchasing power of English craftsmen's daily real wages rose by 55 percent (from an index of 41.3 to one of 63.9), while helpers' (i.e., unskilled laborers') real wages rose by over 90 percent (respective indices of 32.5 and 62.4). At their post-plague peak in England, between 1440 and 1460, craftsmen's real wages had increased by 90 percent over their pre-plague nadir; helpers' wages, by an astonishing 145 percent.<sup>14</sup>

These increases in real terms were accompanied by skyrocketing nominal prices – an inflation not experienced since the later Roman Empire's debasement of its currency (Jones 1953). By 1360, nominal prices in Florence, for example, had increased by about 70 percent; and, by the early 1400s, had doubled (Pamuk 2007, 295).

Rates of return on land in England, which had peaked at around 12 percent annually in the thirteenth century, fell after the Black Death to 5-6 percent (Clark 2007,

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<sup>12</sup> If, in a standard Cobb-Douglas setup, where T is land, L is labor, and A is total factor productivity,  $Y = AT^\alpha L^{1-\alpha}$  and  $\alpha$  approximates one-third (see below, p. 59n), a tripling of the land-labor ratio would imply about a 45 percent increase ( $3^{1/3}=1.44$ ) in per-capita output. Wages would rise by the same amount, and the rent of land would go to  $(1/3)^{2/3}$  of its former level, or about half. The rental-wage ratio, being linear in the labor-land ratio, declines by the same amount as L/T, or to one-third of its former level.

<sup>13</sup> A recent comparative study finds that these effects have been typical, at least in Western Europe and North America, of all high death-rate pandemics since the Black Death: wages have risen and the return to capital has fallen. The effect typically persists for some forty years. (Jordà, Singh, and Taylor 2020)

<sup>14</sup> Pamuk's estimates are somewhat lower: wages of skilled construction workers in London increased between 1350 and 1450 by about 45 percent, while those of unskilled workers roughly doubled. The general pattern throughout western Europe, and indeed as far away as Cairo, was a doubling of unskilled workers' wages; in Florence, however, they appear to have almost quadrupled (Pamuk 2007, 298–99).

168–69). The rent of capital followed suit. In England, interest rates between 1150 and 1350 had hovered between 9.5 and 11 percent; they fell to 7 percent between 1350 and 1400 and, by the late 1400s, to 4.5 percent (Epstein 2000, 61). Similarly, “Rates of interest fell by 50 percent in France and the Low Countries in the century from 1370 to 1470” (Fischer 1996, 55), and the trend seems to have been replicated throughout western Europe (Pamuk 2007, 308) (Epstein 2000, fig. 3.1).

Inequality of course declined: in the Low Countries, the share of the top 5 percent fell from about half of all income before the plague to about a third afterward (Alfani 2017a, 340); and the share accruing to the top decile in Italy dropped from about two-thirds to less than half (Alfani 2017b).<sup>15</sup>

Landowners naturally resisted these changes, attempting both by legal enactment and collusion to restrain wages. In England, a royal Ordinance of Laborers in 1349 forbade workers to demand, or employers to pay, more than pre-plague wages. This being widely ignored,<sup>16</sup> Parliament proceeded in 1351 to enact the more detailed Statute of Laborers (<https://sourcebooks.fordham.edu/seth/statute-labourers.asp>): no employer was to pay wages higher than had prevailed in 1346 (“the twentieth year of our reign”), and specific maxima were laid down for likely times of labor shortage (haying and harvesting).<sup>17</sup> These strictures found little more success; and efforts to enforce them contributed to the Peasants’ Revolt of 1381 (Hilton 1977), which was ultimately suppressed but may have frightened elites into abandoning most of their resistance. Similar efforts to resist market forces, in France, Provence, Aragon, Castile, the Low Countries, and Italian city-states, failed similarly, almost without exception

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<sup>15</sup> In early work, Herlihy, followed by some other students of the period, contended that inequality actually increased in some Italian cities, as surviving patricians took over the property and businesses of the deceased. Alfani shows that this belief rested on errors of measurement; indeed, the property of the deceased was likelier to be acquired by newly well-off workers (Alfani 2017a, 331).

<sup>16</sup> As was admitted eloquently in the preamble to the Statute: “the said servants having no regard to the said ordinance, but to their ease and singular covetise [covetousness], do withdraw themselves to serve great men and other, unless they have livery and wages to the double or treble of that they were wont to take . . .”

<sup>17</sup> e.g., “that none pay in the time of sarcling [hoeing] or hay-making but a penny the day; and a mower of meadows for the acre five pence, or by the day five pence; and reapers of corn in the first week of August two pence, and the second three pence, and so till the end of August . . .”

(Cohn 2007).<sup>18</sup> Legal and social leveling ensued: by the early 1400s, serfdom – the strongest political expression of Medieval inequality<sup>19</sup> – was dead, or at least a dead letter, virtually everywhere in Western Europe.<sup>20</sup>

That outcome owed less to landlord weakness than to landlord adaptation: they found that they could move with relative ease from labor- to land-intensive production. They reduced the acreage devoted to grain and flax (for linen) and increased pasturage for the production of meat, milk, butter, cheese, and wool – all demanding less labor (Pamuk 2007, 294). For tasks other than tillage, they substituted animal power (and capital-intensive wind and water power) for human labor.<sup>21</sup>

These adjustments were not a matter of choice, but a prerequisite of economic survival. An instructive example is the marked decline, after the Black Death, of the Benedictine abbey of Bury St. Edmunds. While landowners all around the abbey switched to land-intensive farming, the monks “insisted on producing wheat in the old fashion,” with “disastrous” results. By the end of the fifteenth century, the abbey had lost most of its endowment and almost all of its political power (Gottfried 1982) (Gottfried 1983, 150).

The knock-on effects of these changes, at least in the judgment of many historians, were even more far-reaching:

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<sup>18</sup> The West European region in which such efforts came closest to success was apparently Catalonia, where repeated conflicts and rebellions were finally resolved with surrender to peasant demands in 1486. (Aston and Philpin 1985, 35–36)

<sup>19</sup> Serfs, in Moon’s concise definition, “were legally bound to a plot of land and to the person of the landowner, were subject to his or her administrative and judicial authority, and . . . passed their servile status on to their children” (Moon 1999, 66). Serfs, however, unlike slaves, were not chattel and could not (albeit with some exceptions) be sold separately from the land to which they were bound.

<sup>20</sup> (Fischer 1996, 48–49), aptly summarizing a line of work from Postan onwards.

<sup>21</sup> On this array of changes, and on many of those described in the next paragraphs, see chiefly (Herlihy 1997, chap. 2) and (North and Thomas 1973, chap. 7). Windmills were known in Europe as early as the twelfth century but were improved in design in the late fourteenth and first came into wide use in the fifteenth century. Similarly, water-powered sawmills had been invented in the early thirteenth century but were widely adopted only after the Black Death (Benedictow 2004, 390). Water power was also crucial in the new technology of paper production (see below, section on print revolution).

1. Because the care of animals, and in particular dairying, was traditionally a female preserve, **women achieved greater economic independence**.<sup>22</sup> They became major sources of credit in the rural economy and/or borrowed more freely to establish other enterprises (Dermineur 2018). They married later in life (on average four years later), or sometimes not at all, lowering the fertility rate and keeping wages high – an effect that can be traced most clearly in England (Voigtländer and Voth 2013).
2. The greater availability of meat and dairy products afforded, especially to the poor, a more **protein-rich diet**, increasing median height and (likely) average intelligence, since protein is crucial for brain development (Chertoff 2015).<sup>23</sup>
3. Increased wealth likely meant **increased trade**. As wages rose and the cost of rents and food fell, commoners' budgets incorporated a greater variety and quality of goods, raising demand for imported luxuries and hence for cheaper and more extensive ocean transport (Pamuk 2007, 295), with downstream innovations discussed below.
4. As labor became more valuable, so did the **measurement of time** worked. As one historian has noted, "The first new technology of the plague years was time-keeping – mechanical clocks and hourglasses." (Lienhard, John 1988). Cf. (Landes 1983).
5. The sharp decline in interest rates, coupled with the rise in wages, led to "a **massive substitution of capital for labor**" (Epstein 2000, 61) in manufacturing

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<sup>22</sup> Employment opportunities for women may have extended more widely, including into urban occupations (Pamuk 2007, 307 and 310)

<sup>23</sup> Our knowledge of post-Black Death dietary changes rests at this point on narrative accounts and fragmentary estate records. The analysis of stable isotopes in skeletal remains, which can date dietary change with amazing precision (Cheung et al. 2019), has barely begun. Analyzing skeletal remains from a dig at Petrikirche in Berlin, however, Mariana Zechini found "statistically significant differences between the pre- and post-plague populations . . . Both sexes showed an increased consumption of terrestrial protein following the Black Death, which means they were supplementing their diet with more animal meat." (Zechini 2017, 58) Other studies of European skeletal remains, however, have found no equally clear evidence of such a dietary change; nor, crucially, has anyone yet sought to establish whether places east of the Elbe underwent a change similar to the one that Zechini found in Berlin (private communication from Prof. Gundula Müldner, University of Reading, May 24, 2021). I am grateful to Karin Best for pointing me to this entire line of research.

- throughout the Western European economies – depending, again, on the elasticity of substitution under prevailing technologies in various sectors.
6. A remarkable array of **labor-saving technological and organizational innovations** emerged “that would not have been there with plentiful cheap labor” (Benedictow 2004, 390).
  7. The demand for exotic goods opened opportunities for huge profits from long-distance trade, while high wages encouraged the invention of less labor-intensive means of shipping. Beginning around 1450, the Portuguese devised faster and more capacious ships (the caravel and the carrack, respectively) that could travel farther with smaller crews (Herlihy 1997, 50) (Smith 1993, chap. 2).<sup>24</sup> Coupled with improved methods of navigation (the compass, better maps), these opened not only wider European and African trade but the **voyages of discovery**, above all da Gama’s opening of a direct ocean route to the spices and silks of Asia (Blaydes and Paik 2019).
  8. The demand for less labor-intensive technology extended also to the realm of combat, contributing to the **military revolution** (Pamuk 2007, 311) (Parker 1996). It is only after 1350, for example, that gunpowder, cannons, and (after 1400) firearms begin to be used extensively in warfare (Herlihy 1997, 51).
  9. Most clearly in England, the erosion of hierarchy (or so it is argued) contributed to major **linguistic change**. The efforts of the newly prosperous masses to emulate not only the dress but the accents of their “betters” may have produced the Great Vowel Shift (Benson, L. D. 2000) that differentiates modern from early English (and makes present-day English spelling the nightmare that George Bernard Shaw is supposed to have parodied<sup>25</sup>).

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<sup>24</sup> Curtin argued that “The European ‘maritime revolution’ of the fifteenth and sixteenth centuries was not so much a revolution in ship design as the discovery of the world wind system.” (Curtin 1984, 136) This seems, however, to have remained a minority judgment.

<sup>25</sup> How, Shaw supposedly asked, should the word “ghoti” be pronounced? As “fish,” he answered: gh as in laugh, o as in women, ti as in nation. Alas, the almost universal attribution to Shaw appears to be erroneous (Zimmer 2010).

To understate the case, the consequences of yielding to the market in the wake of the Black Death were radical and extensive. They revolutionized Western European societies, changed their diet, clothing, language, literacy, and military technology; and, if Herlihy is right, set these nascent states on a route to wealth, power, and colonial conquest. It is the moment at which the “great divergence” attained critical mass.

Eastern Europe and western Russia.<sup>26</sup> In the century before the Black Death, as Western Europe’s population outgrew the ability of the land (given current technology) to sustain it, many peasants effectively “homesteaded” in thinly populated Eastern Europe.<sup>27</sup> The process was led mostly by “locators” (*Lokatoren*), either agents of landlords, or independent entrepreneurs who had themselves acquired tracts of land, who recruited peasants to settle as tenants on the eastern expanses (Rosenberg 1943, 11). The settlers were offered generous terms, including fixed rents (usually in money, sometimes in grain), rather than the labor dues or sharecropping that had prevailed in western Europe, and even rent-free early years of tenancy. Above all, they were free of the traditional obligations of feudalism that, in pre-plague Western Europe, were almost universal.<sup>28</sup>

When the Black Death created acute shortages of labor throughout Europe, the eastern settlers, like peasants in the West, sought more favorable terms (Hagen 2002, 34–35). Landowners would not, and likely could not, grant them. Indeed, the general inflation diminished the purchasing power of the fixed monetary rents that the landowners received (Rosenberg 1944, 231). As fairly recent arrivals, the settlers would have found it easy to exit: to move back to the higher wages that were coming to prevail in western Europe. Increasingly, starting in Prussia as early as 1427 (Rosenberg 1944, 231), the landowners forbade them to leave, “binding” them to the soil

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<sup>26</sup> The canonical, if somewhat overstated, treatment is (Blum 1957). An excellent overview of the then-prevailing scholarly consensus is Brenner’s introductory essay in (Aston and Philpin 1985, chap. 1).

<sup>27</sup> (Scott and Melton 2015, 8–9) provides an excellent and concise overview of the process.

<sup>28</sup> Since most of the settlers came from German-speaking regions, the terms that were used to describe the evolving relationships of tenancy are mostly (and sometimes confusingly) German. Helpful efforts to disentangle the terms are to be found in (Rasmussen 2010, n. 1) and (Kaak 1991, 432–35).

(*Schollenbindung*).<sup>29</sup> Fixed rentals yielded fairly quickly to labor dues (*Frondienst*), an obligation to work one or more (usually more) days a week on the owner's land (the demesne or, in German, the *Gut*). Over time, the required labor rose to as many as five days per family per week (Scott and Melton 2015, 10–11),<sup>30</sup> and the demesne incorporated increasing parts of what had been peasant property.<sup>31</sup> *Schollenbindung* advanced to *Gutsherrschaft*, the obligation (which soon became hereditary: *Erbuntertänigkeit*) to work on the owner's land (Kaak 1991). In the most extreme cases, the system turned into one of *Leibeigenschaft*, literally "ownership of the body," a serfdom almost indistinguishable from slavery.

Successful resistance to market pressures meant that few if any of the revolutionary Western European consequences ensued. Literacy remained low, no labor-saving innovations arose, women were not empowered, no voyages of discovery sallied forth, and seaborne trade was confined to the intra-European export of grain and import of manufactures and luxury goods.

Historians – most notably Domar, Williams, Brenner, and Natkhov -- have long attempted to explain the stark divergence of outcomes in Western and Eastern Europe as the product of military necessity, external threat, grain exports, or peasant organizational weakness (Domar 1970) (Williams 1944) (Aston and Philpin 1985) (Matranga and Natkhov 2019). I suggest a simpler explanation: East European landowners did not adapt to less labor-intensive production because they could not. Neither climate nor soil quality suited their expanses for the kind of wool, meat, and dairy production that came to predominate in England and much of Western Europe.<sup>32</sup>

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<sup>29</sup> Efforts to leave were blocked by coercion or terror. In Russia, peasants continued to enjoy unlimited mobility until the late 1450s, when a single monastery was granted the right to prevent its tenants from leaving, and to recover any who fled. By the 1550s, exit was possible only with payment of an increasingly heavy fee; chapter 11 of the law code (*Ulozhenie*) of 1649 completed the enserfment of the Russian peasantry (Hellie 1971, chap. 4) (Hellie 1992, 77). In eastern Europe, too, landowners "tightened the screws" most rapidly after 1500 (Scott and Melton 2015, 10ff.)

<sup>30</sup> In the lands east of the Elbe, the stronghold of the Prussian second serfdom, this process commenced in the late 1400s and reached its apogee only in the sixteenth century. (Hagen 2002, chap. 1)

<sup>31</sup> In the fifteenth century, the demesne normally occupied about a fifth of the total land of the estate; by the late sixteenth century, two-fifths (Kaak 1991, 436)

<sup>32</sup> This is not to suggest that East Elbia had no animal husbandry or was totally unsuitable for it. Peasants clearly grazed pigs on forest land, and there was some wool and dairy production (Hagen 2002, chap. 1).

If, indeed, substitution was highly inelastic, landowners faced a simple choice: raise wages and accept their losses; watch the peasants exit and abandon production for want of labor; or compel the peasants to remain and to accept compensation that was less than their marginal product. That the owners unanimously chose the third option cannot surprise us, since it also had the effect of sustaining land values, otherwise sure to plummet even more than in the West.

A first test of this hypothesis, of course, asks whether soil quality or climate obstructed any effort in the East to move from labor- to more land-intensive production.<sup>33</sup> Fortunately Beck and Sieber have compiled a comprehensive Old World data set that, based on soil and climate alone, gauges the suitability, on a continuous scale from total non-suitability (0) to complete suitability (1), of each unit of approximately 5 x 5 km for one of four kinds of food production:<sup>34</sup> agriculture, pastoralism, hunting and gathering, or “sedentary animal husbandry” (Beck and Sieber 2010).<sup>35</sup> A resultant map of the western Eurasian continent’s suitability for animal husbandry (Figure 2) suggests a pronounced and precipitous change between Eastern and Western Europe:<sup>36</sup> almost everything west of the present-day Polish border and the Carpathian mountains is at least moderately suited to animal husbandry, while

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The output seems however to have been almost entirely for local use. Blum similarly notes the relative unimportance of animal husbandry in the Russian rural economy in this period (Blum 1971, 166).

<sup>33</sup> A pioneering effort to use soil and climate to predict economic and political outcomes was (Easterly 2007). There the ratio, in any given area, of land suitable for wheat to land suitable for sugar cane proved to have a strong statistical association with present-day equality; i.e., wheat was conducive to equality, sugar cane to inequality.

<sup>34</sup> The categories are not mutually exclusive. Some regions are well-suited to two or more kinds of food production.

<sup>35</sup> As they put it, “Suitability of animal husbandry is very low at minimum temperatures below -15°C., whereas it follows a unimodal function with a peak at ca. 5°C above that. Gleysols, planosols, andosols, cambisols and luvisols were among the soil types associated with high suitability for animal husbandry in the model.”

<sup>36</sup> The authors note in their supplementary on-line commentary that one of the sharpest changes in soil and climate, and one of the few in which a change in suitability coincides with a political boundary, is “the western borders of [present-day] Poland,” i.e., today the Oder and Neisse rivers (File S2 Details and interpretation of some patterns. Found at: doi:10.1371/journal.pone.0010416.s003). The leading twentieth-century historian of *Gutsherrschaft*, Heinrich Kaak, has similarly noted the sharp geographical division between areas of free and servile labor and has sought to demarcate it (Kaak 1991, 432).

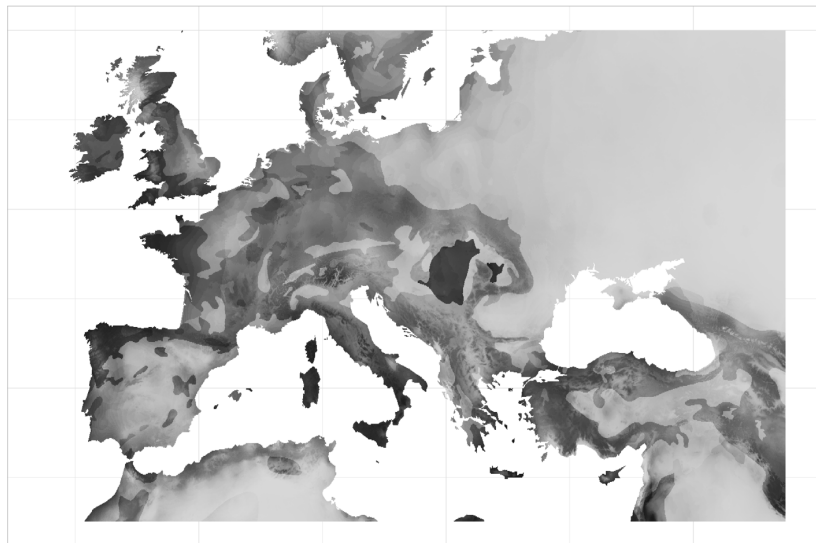


everything east of that line is completely unsuited. As it happens, almost all of the areas characterized by the “second serfdom” lay east of this line.

**FIGURE 2**

**Areas Suited by Climate and Soil for Sedentary Animal Husbandry**

(darker = more suited; lightest = least suited)



Leading historians, moreover, have noted the tight link between grain-growing, and hence the region’s particular suitability for the cultivation of grain, and serfdom:

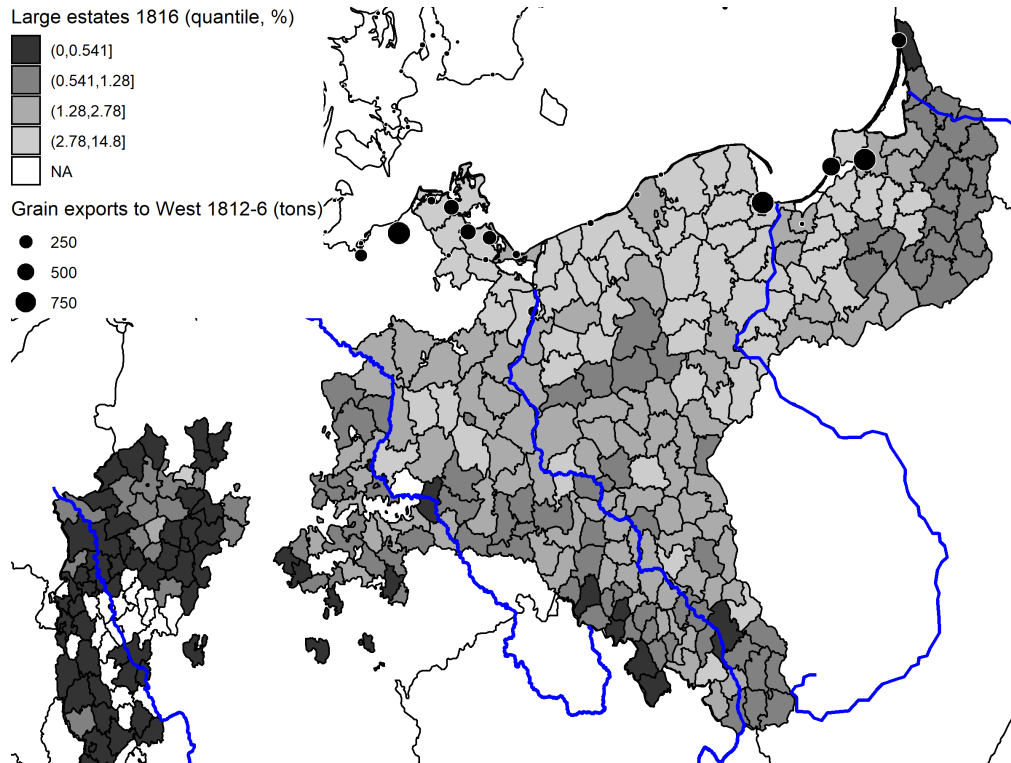
The area of *Gutsherrschaft* is the region in which grain production formed the focus of the agrarian economy. . . . The share of *specialized crops on the one hand, and of pastoral economy on the other, was relatively slight here* [my emphasis]. Binding to the soil [*Schollenbindung*] and an economy based on labor dues [*Fronwirtschaft*] could hardly have formed such a close tie to any other branch of agriculture as it did to grain production in the extensive, relatively thinly populated regions of East-Central and Eastern Europe. . . . (Kaak 1991, 435)

The association between suitability for animal husbandry and serfdom is perhaps clearest in Prussia. Figure 3 depicts a frequently invoked proxy for historical serfdom: the share of large estates (of more than 300 *Morgen*, i.e., some 77 hectares or 190 acres) in the total number of farms in each Prussian county at the time of the

census of 1816, only nine years after the formal abolition of serfdom.<sup>37</sup> The census-takers apparently regarded that acreage, as have subsequent scholars (Cinnirella and Hornung 2016) (Raster 2019), as the minimum estate size that would have employed servile labor.

FIGURE 3

Large Estates in Prussia as Proxy for Servile Labor



Source: (Raster 2019, 92). Reproduced by kind permission of Tom Raster. The blue lines depict rivers; the Elbe is the second from the right.

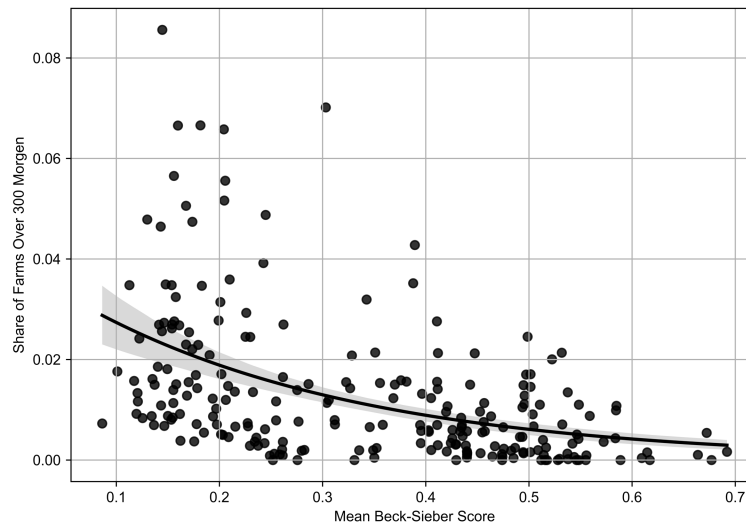
If we regress, for each of the 272 Prussian counties for which data are available, (a) the share of total farms that were larger than 300 *Morgen*<sup>38</sup> on (b) the mean Beck-Sieber score of all the 5 x 5 km rasters whose centroids fell within the given

<sup>37</sup> Census data are from IPEHD, <https://www.ifo.de/en/ipehd>. (Becker et al. 2014)

<sup>38</sup> Unfortunately the census provides us with no data on the exact size of each farm; they are classified simply as “15 *Morgen* or less;” “15-300 *Morgen*,” and “greater than 300 *Morgen*.” Hence, we cannot accurately assess the share of a given county’s area that was included in these large estates.

county, we obtain the fitted curve of the scatterplot in Figure 4<sup>39</sup> and the estimated coefficients in Table 1.<sup>40</sup>

**FIGURE 4**  
**Prussian Counties, 1816**  
**Large Farms as Share of Total Farms vs. Mean Beck-Sieber Score**  
(standard logistic estimation)



In the fuller analysis presented in the longer version of this paper, I take into account such obvious confounders as the county’s geographical area and its adjacency to a major grain shipping port (Figure 3 indicates the location and export volume of those ports). The association of large estates with low Beck-Sieber scores remains substantively strong and precisely estimated; one way of expressing it is to say that a two s.d. increase in a county’s mean Beck-Sieber score (from one s.d. below to one s.d. above its mean) roughly halves its predicted share of large estates, from .015 to .007.

<sup>39</sup> The shaded area indicates the 95 percent confidence interval, calculated by bootstrapping with 500 iterations.

<sup>40</sup> Because the dependent variable is left- and right-censored – the share of large farms must lie between zero and one – I employ quasi-binomial logistic regression rather than ordinary least squares (OLS). Results are robust to the alternative specification, but (as might be expected) OLS produces predicted shares of less than zero in counties with high Beck-Sieber scores. For statistical advice, and without totally absolving him of blame, I am grateful to Caleb Ziolkowski, a 2021 UCLA Ph.D.

**TABLE 1**  
**Prussian Counties, 1816**  
**Large Farms as Share of Total Farms vs. Beck-Sieber Score**

QUASI-BINOMIAL LOGIT REGRESSION TABLE:  
Generalized Linear Model Regression Results

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Dep. Variable:          PERCENTOV300    No. Observations:          237
Model:                  GLM             Df Residuals:              235
Model Family:          Binomial        Df Model:                  1
Link Function:         logit           Scale:                     0.011526
Method:                IRLS           Log-Likelihood:            -13.067
Date:                  Sun, 08 Nov 2020   Deviance:                  2.3742
Time:                  17:38:42        Pearson chi2:              2.71
No. Iterations:        10
Covariance Type:      nonrobust
=====

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	coef	std err	z	P> z	[0.025	0.975]
Intercept	-3.2150	0.136	-23.593	0.000	-3.482	-2.948
MEAN_BS	-3.6924	0.459	-8.042	0.000	-4.592	-2.793

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Conclusion. As wages rose and land rents fell in the wake of the Black Death, Western European landowners could moderate their losses by switching from labor- to land-intensive cultivation. Had Eastern European landowners been able to do the same, or so I conjecture, all of Europe would likely have experienced the radical changes and the wave of labor-saving innovations that transformed the West, initiated its sustained economic growth and outward expansion, and set in on the path to more participatory governance (Gingerich and Vogler 2021). In the circumstances of the fifteenth and sixteenth centuries, there was no possibility that landowners could adjust in any of the other ways outlined earlier: they could not move their land into some non-agrarian form of production, export it in the short run to an area where land was in shorter supply, or – lacking a time machine – introduce some radically labor-saving technology.

Landowners in the East, if this view is correct, faced a stark choice when labor supply contracted so drastically: abandon production and lose all that they had invested; or bar their tenants from leaving, collude with other landowners and local rulers to mobilize coercion and maintain solidarity, and force peasants to accept lower

wages and significantly increased obligations to labor on the lord's demesne. It is the tragedy of the East, and the key to its long delay in modernization, that the owners almost inevitably chose the latter path.

**EXAMPLE 2: EXOGENOUS LOSS OF LAND: BLOCKADE, HUNGER, AND THE  
NAZI PURSUIT OF LEBENSRAUM**

Keynes, in *The Economic Consequences of the Peace*, analyzed Europe's plight after World War I as an exogenous loss of land – or, more precisely, of access to the lands of the New World.

The [pre-1914] prosperity of Europe was based on the fact that, owing to the large exportable surplus of foodstuffs in America, she was able to purchase food at a cheap rate measured in terms of the labor required to produce her own exports . . . The war had so shaken this system as to endanger the life of Europe altogether. . . its organization was destroyed, its transport system ruptured, and its food supplies terribly impaired. (Keynes 1920, 23 and 25–26)

Beginning in the 1870s, Europe had effectively annexed the lands of the New World: the “imperialism of free trade” (Gallagher and Robinson 1953) guaranteed that their produce flowed to Europe as smoothly as if Europe, the Americas, and Oceania had been part of the same state. Russia (see below) was almost as important a supplier. The Great War, whose severity almost no one had anticipated, had interrupted commerce, sunk much of the Atlantic cargo fleet, unsettled exchange rates previously fixed to gold, and torn apart Europe's prewar high degree of internal commerce and specialization (Landes 2003, 360–61). The Bolshevik Revolution, precipitated by the War, had additionally removed Russia as a source of supply. These changes, at a minimum, drastically increased the costs of foodstuffs<sup>41</sup> and raw materials; and, at worst, threatened hunger and starvation.

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<sup>41</sup> Despite the stock phrase about the “farm depression of the early 1920s,” in fact world prices of agricultural products remained considerably higher than they had been in the pre-war period. The average price of wheat on U.S. markets between 1909 and 1913, for example, had been 89 cents per bushel; at the close of the war (1918-1919) its price per bushel was 208 cents, a year later 222 cents, 2.5 times its prewar price. At its lowest point in the 1924 farm recession, wheat still remained just above its average prewar price, at 96 cents per bushel; but by August 1924, it had recovered to 117 cents per

Most of Europe adjusted peacefully, albeit often with suffering and intense domestic turmoil, by means of what Adam Tooze dubbed the “export powerhouse” strategy of intersectoral mobility: deploying newly abundant human capital<sup>42</sup> into such emerging and export-oriented high-tech sectors as optics, radio, and electric appliances;<sup>43</sup> and using the earnings to meet the higher prices of imported foodstuffs (Tooze 2008, chap. 1). No other route was readily available. Europe could not easily move to more capital-intensive agriculture; nor, before genetic engineering, was a more productive agricultural technology available.

The “powerhouse” strategy was highly successful, not least in Germany, until it wasn’t: the 1929 Crash and the Smoot-Hawley tariff demolished its underpinnings. Only Germany, and at first only a minority of Germans, turned to the costly, genocidal, and ultimately doomed strategy of external conquest: of conquering, “clearing,” and settling enough land to make Germany self-sufficient in food and resources. Why did only Germany seek *Lebensraum*, which segment of Germans initially embraced that goal, and why did they do so?

The answer, I think, lies in two simple facts: Because of the British blockade, Germany was the only European country<sup>44</sup> to have suffered mass starvation in World War I; and, within Germany, the Nazi vision of *Lebensraum*

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bushel. Cotton prices, after a sharp dip in 1921, rose steadily, peaking at 2.5 times their prewar level in late 1923 and remaining at twice their prewar level in 1924 (United States Federal Reserve Board 1915, no. October 1924, pp. 790–791). Note that, because the U.S. remained on the gold standard, real prices increased at least as much as nominal ones; indeed, for gold-scarce Europe, the real prices were likely higher.

<sup>42</sup> Trench warfare had treated low-skill labor as cannon fodder – both Germany and France experienced fatalities of 13 percent of males between the ages of 15 and 49 (Winter 2001, 5692) – but largely spared skilled labor as essential to wartime industry. For the case of Germany, see (Feldman 1992, 69 and 243) and (Sichler and Tiburtius 1925, sec. Appendix 8). The “wage compression” of the 1920s likely demonstrates the new abundance of human capital and relative scarcity of low-skill labor.

<sup>43</sup> Probably because of the relative abundance of human capital, the interwar period experienced significant technological breakthroughs, which continued even into the Great Depression (Frieden 2006, chap. 7).

<sup>44</sup> Parts of the Ottoman Empire, especially Lebanon and Syria, suffered as many as a million deaths as a result of the Anglo-French blockade (Broadberry and Harrison 2005, 125).

expanded its support most among the regions and age cohorts that had suffered the highest increase in starvation-induced mortality.

The Blockade and its toll. Even before the war, and despite high tariffs that had been cynically promoted as assuring self-sufficiency in wartime (Gerschenkron 1966, chap. 1), Germany had imported fully a third of its foodstuffs – more than any other country – and half of its livestock feed (Vincent 1985, 124) (Wehler 1987, 58), as well as huge quantities of nitrate fertilizer.<sup>45</sup> The British blockade, which began in earnest in late 1915, interdicted almost all of these imports; and the lack of fertilizer, as well as of manpower and horses (both conscripted into combat), caused domestic production to recede rapidly as well. Between 1916 and 1917, imports of grain fell 85 percent; of vegetable fats and oils, 81 percent; of meat, 69 percent; of butter, 56 percent; of livestock, 34 percent (Broadberry and Harrison 2005, 58).<sup>46</sup> Domestically, the production of livestock fell by 40 percent, of grain and potatoes by 35 percent.<sup>47</sup> By 1918, agricultural production overall had fallen by between 40 and 50 percent (Broadberry and Harrison 2005, 46) (Wehler 1987, 58).

Despite drastic government intervention, including the use of POWs and of slave labor from the occupied territories, much land went fallow and yields on the rest dropped precipitously (Wehler 1987, 58 and 279). By late 1916, the official rations provided only 1000 calories<sup>48</sup> per day per person, at best 60 percent of the necessary daily intake of even a sedentary worker. The available foods, prominent among them potatoes and root vegetables, were deficient in fats and vitamins.<sup>49</sup> A flourishing black market allowed the better-off to survive, but the great majority became seriously

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<sup>45</sup> Before the war, 24 percent of Chilean nitrate exports went to Germany (Chancerel 2015, 14).

<sup>46</sup> Percentages are calculated from the tonnage (or, in the case of livestock, head) reported in Broadberry and Harrison, Table 2.13. Presumably imports of butter and livestock fell less because they could in part be imported from neutral sources on the Continent.

<sup>47</sup> See also the more detailed statistics for Westphalia in (Roerkohl 1991, 346).

<sup>48</sup> More properly, and almost universally in Continental usage, kilocalories. I hew here to the American usage, which denotes kcal as “calories.”

<sup>49</sup> The shortage of fats impeded also the production of soap, with dire consequences for personal hygiene.

malnourished (Wehler 1987, 61). Region also mattered: rationing was administered equitably and compassionately in some areas, inefficiently or corruptly in others.

In late 1916 and early 1917, notorious as the “hunger winter” or the “rutabaga winter” (*Steckrübenwinter*),<sup>50</sup> starvation became widespread. Death, as in most famines, came mostly from diseases that attacked those weakened by hunger (tuberculosis, dysentery, influenza) or that resulted from specific dietary deficits (scurvy, rickets). Starvation led especially to increased deaths from tuberculosis; they increased between 1914 and 1918 by almost 60 percent nationally<sup>51</sup> and more than doubled in five German cities.<sup>52</sup>

The overall civilian death toll was considerable, especially in the blockade’s worst year, 1917. The losses were greatest among children, those over seventy years of age, and – for all ages between fifteen and sixty – women (Table 2). The especially striking gender difference among the cohort between fifteen and thirty years of age, where female mortality rose over four times as much as that among civilian males, may well have arisen from mothers’ forgoing their own nourishment to keep their children alive (Vincent 1985, 137). What nonetheless leaps off the page is the increase in mortality among children of both sexes between the ages of five and fifteen.<sup>53</sup>

At the end of 1918, the *Reichsgesundheitsamt* estimated that at least 763,000 deaths could be attributed to wartime malnutrition (Reichsgesundheitsamt 1919, 15). Since the blockade continued until the signing of the Versailles Treaty in June of 1919, probably at least 800,000 Germans died as a result of the blockade, and an

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<sup>50</sup> The potato crop failed. Rutabagas became a major source of nourishment.

<sup>51</sup> 1914: 92,896; 1919: 147,406. (Internationale Vergleiche 1922, 9\*). Among 266 German cities of population 15,000 or more, tuberculosis deaths increased by 63.3 percent, from 34,091 to 55,663 (Reichsgesundheitsamt 1921, 56\*). Tuberculosis was understood, then as now, to be closely linked to malnutrition (Sinha et al. 2019).

<sup>52</sup> Essen, Rostock, Krefeld, Halle, and Mülheim an der Ruhr.

<sup>53</sup> The *Reichsgesundheitsamt* estimated the increase in this age bracket between 1913 and 1917 to have been even higher, around 55 percent (Reichsgesundheitsamt 1919, 17)



equal or greater number will likely have survived with lasting effects from malnutrition-induced rickets, scurvy, or tuberculosis.<sup>54</sup>

**Table 2**  
**Mortality 1917 vs. 1913,**  
**Ages 1 and Higher<sup>55</sup>**

**Males**

Age	Deaths 1913	Deaths 1917 <sup>56</sup>	Percent Change
1-5	41124	40732	-1.0
5-15	17929	26535	+48.0
15-30	36268	40065	+10.5
30-60	110652	128663	+16.3
60-70	65028	83805	+28.9
70 and over	93001	124947	+34.4
total	364002	444747	+22.2

**Females**

Age	Deaths 1913	Deaths 1917	Percent Change
1-5	38645	38607	-0.1
5-15	18290	26304	+43.8
15-30	34060	48802	+43.3
30-60	93279	121442	+30.2
60-70	64646	79770	+23.4
70 and over	114556	153304	+33.8
total	363476	468229	+28.8

Source: (Statistisches Reichsamt 1916, 31) (Statistisches Reichsamt 1921, 33)<sup>57</sup>

<sup>54</sup> We have only fragmentary evidence (e.g., from a few urban school systems) on the incidence of rickets-induced bone deformations, and almost none on continuing tuberculosis infections. Tuberculosis, astonishingly, was not regarded by most state health authorities as a “communicable disease.”

<sup>55</sup> Deaths among infants under one year of age actually fell by 49 percent (from 277,196 in 1913 to 141,244 in 1917), but that was because in that *annus horribilis* births fell by just over 50 percent (1913: 1,894,593; 1917: 939,938. (Statistisches Reichsamt 1916, 24 and 31) (Statistisches Reichsamt 1921, 26 and 33). Infants and children under five years of age received extra rations.

<sup>56</sup> Includes only civilian deaths.

<sup>57</sup> Population statistics in the Imperial period always appeared with a considerable lag, exacerbated by the war; and the volume for a particular year was always published in the succeeding year. Thus the volume that appeared in 1921 was labeled *Statistisches Jahrbuch 1920* and reported statistics for 1917.

The fantasy of *Lebensraum* and its centrality to Nazi doctrine. The experience of blockade and wartime deprivation broadened the appeal of autarky – or, at least, of self-sufficiency in food – and the territorial expansion that supposedly would guarantee it (Vincent 1985, 150). General Ludendorff, after the peace of Brest-Litovsk, joined others in advocating the transformation of “whole Russian provinces . . . into settlement colonies for German peasants and war veterans.”

Even in Weimar’s “golden years” (1924-1929), when under Stresemann’s leadership Germany pursued the “export powerhouse” strategy with considerable success, Hitler had made clear (in *Mein Kampf*, published in 1925 and 1926) that Germany’s aim must be self-sufficiency.<sup>58</sup> And unlike earlier advocates, Hitler left no doubt about where *Lebensraum* should be sought: to Germany’s east, in Poland and Russia (Hitler 2016, chap. II: 14).<sup>59</sup> In his “second book” (drafted in 1928), which for economic reasons remained unpublished but was hardly a secret – indeed, substantial passages simply repeated Hitler’s stump speeches (Tooze 2008, 6) – Hitler stated with utter frankness how *Lebensraum* was to be achieved: the Slavic inhabitants of the regions that Germany was to seize and settle would either be confined to reservations or expelled.

The racial (*völkisch*) state . . . must reach the decision, either to cordon off (*abzukapseln*) these racially alien elements . . . or simply to remove them without further ado and to transfer the territory and soil that are thereby freed up to its own racial comrades (*Volksgenossen*)." (Hitler 1961, 81)

Implied clearly by the parallel he frequently drew with the European conquest and settlement of North America (Snyder 2015, 14–18) was what would happen if “removal”

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<sup>58</sup> The only “healthy relationship” between a people and its territory is one that “secures a people’s sustenance [*Ernährung*] on its own soil and territory.” Anything less “will lead, sooner or later, to the detriment, if not to the annihilation, of such a people.” (Hitler 2016, II: 728)

<sup>59</sup> „The National Socialist movement must attempt to eliminate the misalignment between our population and our territory, . . . [which is] the source of our sustenance . . .” “We shall halt the eternal Germanic drive toward the South and the West of Europe and cast our view toward the land in the East.” “The future goal of our foreign policy” must be “an Eastern policy” that seeks “the acquisition of the necessary arable [*Scholle*] for our German people.” (Hitler 2016, II: 732, 742, 757)

did not suffice: the great majority of these areas' native inhabitants would be annihilated.

Widely ignored or ridiculed during Weimar's prosperous years, these views surged into popularity with the economic collapse of 1929-1930, when in many cases hunger reappeared. In the parliamentary elections of September 1930, occasioned by the collapse of Stresemann's Weimar Coalition (Socialists, Liberals, and Catholics), Hitler's National Socialists (NSDAP) suddenly emerged as the second-largest party (after only the Socialists) in the Reichstag: from the risible 2.6 percent of the vote that they had garnered in 1928, the Nazis entered the new parliament with 18 percent of the vote and almost 19 percent of the seats (Falter 1986, 41–45). Another parliamentary dissolution in July of 1932 made the NSDAP, with 37 percent of the popular vote, Germany's largest party.

Starvation and Nazi support. We have of course no individual-level data on Nazi voting support; hence scholars have deployed techniques of ecological inference to ascertain the bounded likelihood that a given group (industrial workers, the unemployed, Catholics) could have voted in favor of the NSDAP.<sup>60</sup> Wartime mortality statistics, unfortunately, were reported at the level of pre-1919 provinces and states, which bore little relation to the administrative or electoral units that the Weimar Republic employed. Fortunately, the boundaries of Germany's major cities experienced far fewer changes;<sup>61</sup> and for all thirty-two largest cities (population of 100,000 or more), plus some smaller ones (population 15,000 to 100,000),<sup>62</sup> we have from an early

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<sup>60</sup> The pioneering effort in this regard, which has stood the test of time surprisingly well, was Falter's 1991 book, *Hitlers Wähler*, revised and expanded edition (Falter 2020). The major subsequent effort has been (King et al. 2008).

<sup>61</sup> The most important exception was the creation, in 1920, of "Greater Berlin" (*Groß-Berlin*), through the annexation of six formerly independent towns and other surrounding territory. That almost doubled Berlin's population and more than doubled its territory. [https://de.wikipedia.org/wiki/Gro%C3%9F-Berlin#Das\\_Gro%C3%9F-Berlin-Gesetz](https://de.wikipedia.org/wiki/Gro%C3%9F-Berlin#Das_Gro%C3%9F-Berlin-Gesetz). Results reported here exclude Berlin but include several of the largest cities that were incorporated into Greater Berlin (e.g., Lichtenberg and Kreuzberg) and that continued to be reported separately in voting data. A second instance was the creation of the new city of Wuppertal through the merger of two former cities, Barmen and Elberfeld, and a few smaller towns. I treat Wuppertal simply as a merger of Barmen and Elberfeld.

<sup>62</sup> In each state, cities with populations of less than 100,000 were grouped by size category (50,000-100,000, 30,000-50,000, and 15,000-30,000), with mortality reported only as a sum for all cities in the

postwar report on the blockade's effect (Reichsgesundheitsamt 1921) far more exact numbers of annual mortality between 1914 and 1918, including specific causes of death.

The cause most closely associated with malnutrition was tuberculosis. The test that I undertake therefore examines whether (a) the increase in Nazi votes in the given city between the party's low point in the 1928 election and its "breakthrough" in 1930 bears any relation to (b) the city's increase in civilian deaths due to tuberculosis between 1914 and 1918. More precisely, I regress (NSDAP vote share 1930 / NSDAP vote share 1928) on (civilian TB mortality 1918 / civilian TB mortality 1914).<sup>63</sup> I take the ratio of 1930 to 1928 votes as the left-hand-side variable as a way of controlling for the "bedrock" propensity of a city to support the NSDAP.<sup>64</sup> On the right-hand side, I use as the numerator 1918 rather than 1917 TB deaths because (a) mortality from tuberculosis was seldom immediate and (b) TB deaths in most cities appear to have peaked in 1918. Data are available for twenty-eight of the largest cities (population > 100,000), six of the specifically named smaller cities,<sup>65</sup> and eleven groups of two or more smaller cities

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given category in that state. Only where only a single city fell into the given category was that city named. Working with research assistants and using city populations as reported in the 1905 census ([https://de.wikipedia.org/wiki/Liste\\_der\\_St%C3%A4dte\\_im\\_Deutschen\\_Kaiserreich](https://de.wikipedia.org/wiki/Liste_der_St%C3%A4dte_im_Deutschen_Kaiserreich)), on which the 1921 report claimed also to be based, I was able to ascertain which cities in each state fell into the categories 30,000 – 50,000 and 50,000 – 100,000 and to match their collective mortality figures with subsequent voting and membership data. Population data for cities in the smallest category (15,000 – 30,000) were not readily available. The full list of cities appears as Appendix Table A1.

<sup>63</sup> The mortality figures used here are those beginning on p. 40\* of (Reichsgesundheitsamt 1921) under the rubric "Die Ursachen der Sterbefälle bei der Zivilbevölkerung in 266 deutschen Orten . . .," col. 21, „Tuberkulose, zusammen“ [i.e., combining male and female deaths].

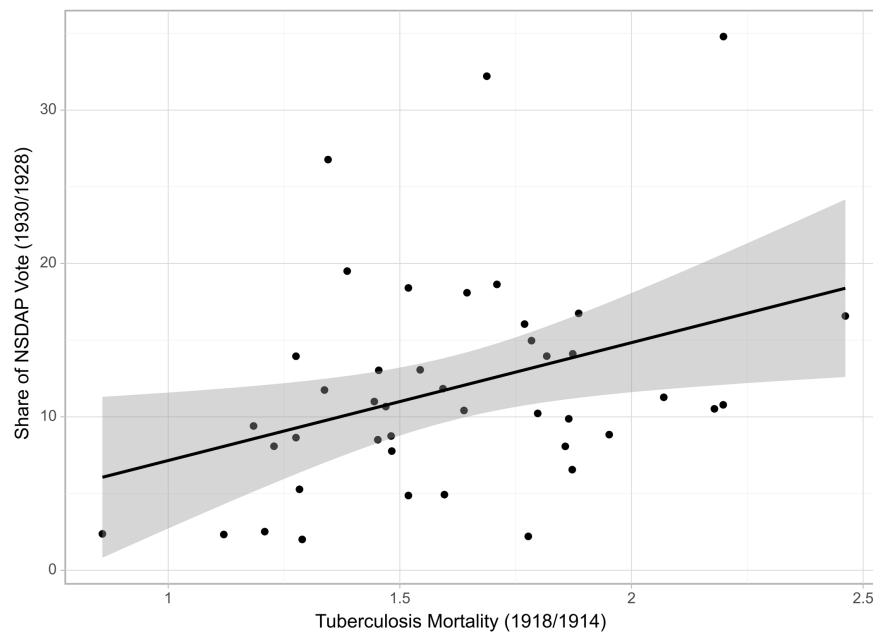
<sup>64</sup> Controls for religion and class (percentage of a city's population classified as Catholic or *Arbeiter*) proved unavailing and, because of missing data for one or both variables in the *Sterblichkeit* source, considerably reduced the number of observations. Concerns could also arise about the use of ratios in a regression (Kronmal 1993). Results here are robust to using a recommended correction, namely inserting on the right-hand side as separate variables the numerator and denominator of the ratio. I am grateful to Bill Clark for alerting me to this possibility, and to Nicolaj Thor for pointing me to the Kronmal article.

<sup>65</sup> TB mortality data are lacking for two of the specifically named smaller cities, Rüstingen and Schwerin. I exclude Bremerhaven, one of the smaller named cities that did report data (and the only one of its size in the city-state of Bremen), as an extreme outlier. Probably because the blockade halted much of its activity, its mortality from tuberculosis declined (as happened in only one other case), indeed fell more sharply than anywhere else: deaths in 1918 were 84 percent of those in 1914. At the same time, its vote for the NSDAP in 1930 was 26 times what it had been in 1928, the fourth highest ratio among all our observations.

(population 30,000-50,000 or 50,000-100,000). Taking these as our data points, we obtain the results reported in Figure 5 and Table 3.

**Figure 5**

**Increase in NSDAP Vote Share 1928-1930 Plotted Against  
Increase in Civilian Mortality from Tuberculosis 1914-1918,  
German Cities of Population > 30,000**



Despite the obvious noisiness of the data (adjusted  $R^2 = .11$ ), we can be reasonably confident ( $p = .02$ ) of a positive relationship between wartime tuberculosis mortality – our proxy for starvation – and growth in the Nazi vote between 1928 and 1930. As with other studies of Weimar electoral data, this association holds only at the regional level and may not reflect individual experience.

**Table 3**

**Increase in NSDAP Vote Share 1928-1930 Regressed on  
Increase in Civilian Mortality from Tuberculosis 1914-1918,  
German Cities of Population > 30,000<sup>66</sup>**

BIVARIATE REGRESSION TABLE FOR TOTAL TB MORTALITY AND CITIES OVER 100000 PLUS SMALLER CITIES PLUS GROUPED:

OLS Regression Results						
Dep. Variable:	change_votes	R-squared:	0.134			
Model:	OLS	Adj. R-squared:	0.113			
Method:	Least Squares	F-statistic:	6.497			
Date:	Tue, 16 Aug 2022	Prob (F-statistic):	0.0145			
Time:	22:58:29	Log-Likelihood:	-145.56			
No. Observations:	44	AIC:	295.1			
Df Residuals:	42	BIC:	298.7			
Df Model:	1					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
Intercept	-1.0839	5.119	-0.212	0.833	-11.415	9.247
total_tb	7.9501	3.119	2.549	0.015	1.656	14.244
Omnibus:	16.273	Durbin-Watson:	2.320			
Prob(Omnibus):	0.000	Jarque-Bera (JB):	18.890			
Skew:	1.334	Prob(JB):	7.91e-05			
Kurtosis:	4.784	Cond. No.	11.2			

To see whether the “war babies” who had suffered the greatest wartime mortality were especially drawn to the Nazis, we must turn to membership data. Of those who joined the Party (over 90 percent male) between its “re-founding” in 1925 and September 1930 (when the election results drew a flood of opportunists), the median age was twenty-eight (Falter 2020, 124). By contrast, among the general population of males over the age of twenty (the pool from which members would most readily be recruited), the median age – likely owing to wartime losses – was between forty-five and fifty (Statistisches Reichsamt 1930, 15). Fully 56 percent of the new joiners came from what Falter defines as *Kriegskinder*, “war babies:” those born between 1900 and 1915. In the German population as a whole, roughly 40 percent had been born in that interval (Falter 2020, 133 and 292). The general impression that the

<sup>66</sup> The association is robust to the exclusion of the three obvious outliers in Figure 7. These turn out to be Breslau, Mühlheim an der Ruhr, and the Hessian grouped cities with population between 50,000 and 100,000. Removing those, we obtain an estimated coefficient of 5.03 and a t-score of 1.95 (p = .06).

card-carrying Nazis were a “young” party (Vincent 1985, 166) is thus confirmed; and it is at least suggestive that this was precisely the cohort that had suffered the greatest increase in mortality during the blockade.

Adam Tooze, considering the surprising extent of German acquiescence to the ethnic cleansing when it began on the Eastern Front in 1941, has concluded that

[Hitler’s] genocidal plan commanded such wide-ranging support because it concerned a practical issue, the importance of which, following Germany’s experience in World War I, was obvious to all: the need to secure the food supply of the German population, if necessary at the expense of the population of the Soviet Union (Tooze 2008, 166).

That was almost as true, I contend, in 1930 as in 1941.

### **EXAMPLE 3: WHEN THE ENDOGENOUS BECOMES EXOGENOUS: THE PRINTING PRESS AS A FIFTEENTH-CENTURY MULTIPLIER OF HUMAN CAPITAL**

The Black Death, by decimating the *scriptoria* that produced hand-copied literature and raising its price, created strong incentives to devise a less labor-intensive technology for book production. In this sense, the innovations of Johannes Gutenberg (and likely of several less-known predecessors) were endogenous. Like other revolutionary technological breakthroughs (the railroad, the steamship, the cotton gin), however, it so greatly overshot the original need that it became itself a seemingly exogenous shock to supply – in this case, the supply of human capital.

The printing press expanded the supply of human capital both directly, by rendering the skills of scribes and ancillary professions superfluous; and indirectly, by (a) lowering the costs of literacy and making available a greater wealth of reading matter, and (b) making material available in the vernacular, the language that all but a thin elite spoke. No longer was a command of Latin the prerequisite to the acquisition of literacy, or of new knowledge and skills.

Like all positive supply shocks, this one at first threatened earlier owners of the newly abundant factor of production. Unlike other such shocks, a sudden increase in society’s supply of human capital can, after even a few years, raise returns to *all* human

capital – and, indeed, to other factors of production. Far more than other factors of production, human capital is characterized by large positive externalities: the social return on human capital appears to be from two to three times as large as the individual return (Acemoglu and Angrist 2000, 11).<sup>67</sup> To put it another way, “the rate of return on human capital of a worker is increasing in the human capital stock of the workforce” (Acemoglu 1996, 780).

In the fifteenth and early sixteenth centuries, Europe faced substantial short-term incentives to restrain or even reverse the sudden and unanticipated surge in human capital – not least, because those who already had human capital were politically powerful in both church and state. If, however, at least some regions of Europe could leap over those early impediments, even the previous owners of human capital would soon find it to their advantage to allow a yet greater expansion of supply. To a first approximation, and admitting many exceptions, northern and northwestern Europe surmounted that hurdle and accelerated – not only through increased printing but through a rapid expansion of educational institutions – the growth of human capital. Much of southern and central Europe, by way of contrast, restricted printing and otherwise restrained the expansion of human capital.

In the roughly half-century after the invention of printing, however, opposition was often fierce almost everywhere. Not only the scribes and manuscript workshops, but the whole elite of clerics, university graduates, and Latinate scholars found their skills to be suddenly less valuable. Many others could now do what, before the advent of printing, only they could provide. They were obviously tempted to use their political influence to retard or restrict the new “divine art” of mass-producing literature and literacy – as, indeed, the Ottoman Empire, having drawn its lessons from the European experience, subsequently did, forbidding all printing in Arabic script until the early

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<sup>67</sup> Acemoglu offers a convincing theoretical explanation for this result: where search costs are high but investment in human capital is increasing, potential employers will overinvest in physical capital in anticipation of attracting future workers with more human capital. Hence even the workers with less human capital will wind up with more physical capital per unit of labor, hence higher productivity. (Acemoglu 1996)



eighteenth century (Coşgel, Miceli, and Rubin 2012).<sup>68</sup> While the new technology spread too widely and with too much speed to allow such a total prohibition in fifteenth and sixteenth century Europe, printing could be severely restricted and censored. That indeed was the outcome in much of southern Europe, with the result that literacy spread there far more slowly. In northern and northwestern Europe by way of contrast, and particularly in the Netherlands, printing and literacy expanded swiftly and censorship remained light. The long-term consequences were profound: printing contributed centrally to, and plausibly caused, the Protestant Reformation (Rubin 2014); the Reformation in turn expanded schooling and insured the further growth of “thin upper tail” human capital; and near-universal literacy and extensive education spurred economic growth.

Why, then, intensified resistance in southern Europe and enthusiastic acceptance in much of northern Europe? In this case, I contend, the explanation lies neither in factor substitution nor in exit to another jurisdiction, but in *factor mobility*: northern Europe developed whole new sectors that would employ the newly plentiful holders of human capital, and indeed would encourage a yet greater expansion of supply, while southern Europe did not.

Before the Black Death, a hand-copied book cost between a sixth and a third of a typical worker’s annual earnings.<sup>69</sup> By 1400, the decimation of the *scriptoria* and the rising demand from a newly prosperous readership had roughly tripled that cost (Overtly 2008, 4–5). The invention of printing reduced the price of a typical book by at least two-thirds (J. Dittmar 2011, 1133), and demand proved to be enormous: over twelve million books were printed between 1450 and 1500 (the so-called *incunabula*); between 1500 and 1550, just under 80 million (Buringh and Van Zanden 2009, 417). By way of

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<sup>68</sup> The Ottoman rulers allowed printing in Roman, Armenian, and Hebrew characters – which only a small and unthreatening minority of their subjects could read.

<sup>69</sup> Overtly finds the average price of a book in the Hereford Cathedral Library (one of the few to have recorded valuations) to have been 97 pence in 1300 (Overtly 2008, 5), although values ranged from 24 to 360 pence. The Statute of Laborers of 1351 stated the pre-Black Death wage of an agricultural worker to have been between 1 and 2 pence per day; hence a 100-pence book would have amounted to between 50 and 100 days of labor, out of an annual total (excluding Sundays) of roughly 300 working days.

contrast, in all of the relatively prosperous thirteenth century, fewer than three million books had been hand-copied; and over the whole period from the sixth through the twelfth century, fewer than 1.5 million (Buringh and Van Zanden 2009, 416).

Literacy also exploded. In 1450, according to the most generous estimates, between 10 and 15 percent of Western Europe's adult population could read and write (Barbier 2017, 21) (Buringh and Van Zanden 2009, 434). Cheaper books extended access to the less wealthy and enticed those still illiterate to learn to read, especially as books became available in the vernacular. Practical works – on arithmetic, bookkeeping, business, law, and administration<sup>70</sup> – found an extensive popular market. Elite readers rushed to stock their burgeoning libraries with the new, astonishingly cheap versions.<sup>71</sup>

The traditional scribes were not amused. One of them, the “dyspeptic Benedictine” Filippo de Strata, complained to the Doge of Venice, no less, that the printers were

utterly uncouth types of people who have driven reputable [scribes] from their homes . . . , bemoaning the damage which results from the printers' cunning. They shamelessly print, at a negligible price, . . . while a true [scribe] dies of hunger<sup>72</sup>

(<https://www.historyofinformation.com/detail.php?entryid=4741> )

The leaders of the Church, having at first welcomed the new technology, grew unsettled when vernacular translations of the Bible began to appear. With the outbreak of the Reformation in 1517, their unease turned to alarm.<sup>73</sup> It was no longer possible to outlaw printing altogether – even by 1500, 240 European cities had at least one printing

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<sup>70</sup> (J. Dittmar and Seabold 2020, esp. 8-9) show the pervasiveness and popularity of business-related books; and they find that the frequency with which such books were printed in a given city relates strongly to its subsequent population growth.

<sup>71</sup> The acknowledged champion in this endeavor was Hernando Colón (1488-1539), son of Christopher Columbus. As a wealthy and peripatetic official of the Habsburg Empire, he purchased books in cities all over Europe and ordered hundreds sent to him from cities he did not visit. He amassed a library of over 15,000 works, including not only books but such ephemera as pamphlets (Pettegree 2010, 87–88) (J. Dittmar and Seabold 2020, 15 and 60).

<sup>72</sup> The literal term here is “writer,” but in contemporary usage that meant scribe, not author.

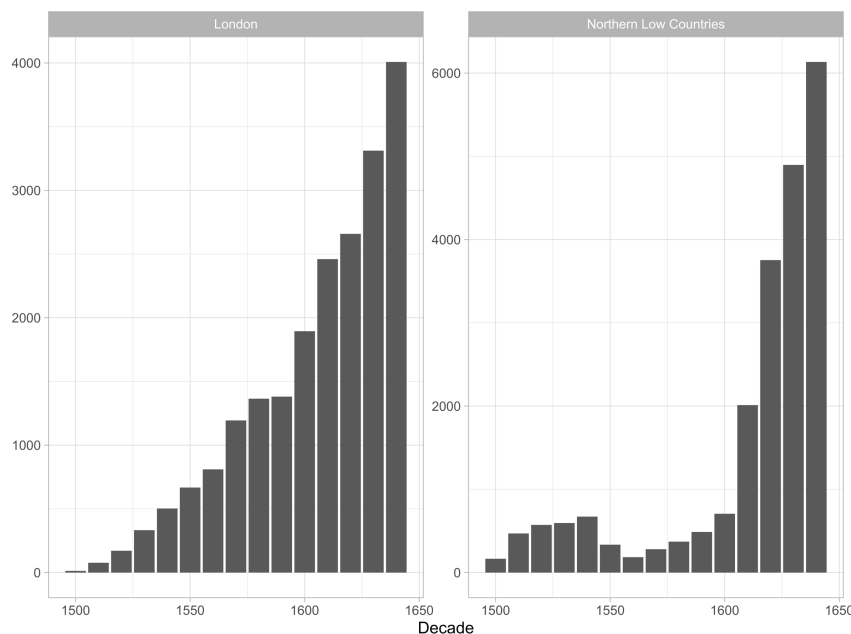
<sup>73</sup> It did not help that Luther called the printing press “das höchste Geschenk, durch welches Gott die Sache des Evangeliums vorantreibt,” “the greatest gift by which God advances the cause of the Gospel.”

press (Sasaki 2017, 1013) – but increasingly Draconian censorship could be, and was, imposed throughout Catholic Europe. Protestants also censored, but their touch was decentralized and lighter; only the most scandalous books were suppressed (Creasman 2012, 5 and 135). By the end of the Thirty Years War in 1648, Europe was clearly divided into a (mostly) Protestant North and a Catholic South.

Predictably, the center of European publishing began to move. Growth was most rapid in the Protestant (northern) parts of the Low Countries and London. The Universal Short Titles Catalog (USTC) allows one to generate timelines of decadal production of distinct titles (Figures 6 and 7). In the half-century between 1600 and 1650, production in London more than doubled (from fewer than 200 titles to 400 annually<sup>74</sup>) and in the Northern Low Countries more than sextupled (from fewer than 100 to over 600 annually).

**FIGURE 6**

**Number of Titles Printed Each Decade  
In Protestant Region or City, 1500-1650<sup>75</sup>**

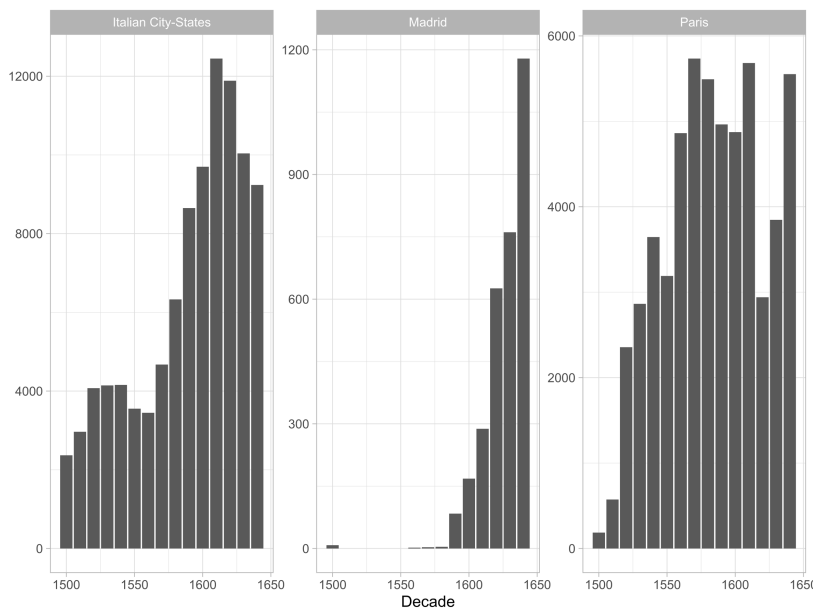


<sup>74</sup> I impute to each year an average over each decade: i.e., each year had one-tenth of the decadal total.

<sup>75</sup> Note that vertical axes, in this and following figure, vary.

**FIGURE 7**

**Number of Titles Printed Each Decade  
In Catholic Region or City, 1500-1650**



By contrast, the issuance of new titles fell sharply in the Italian City-States (including Venice, one of Europe’s early centers of printing<sup>76</sup>). After peaking at over 1200 volumes annually between 1610 and 1620, production there had fallen by 1650 by 25 percent. Production in Paris stagnated at about 500 volumes annually, albeit with sharp fluctuations.<sup>77</sup> In Madrid, production grew rapidly from an initially risible level but by the 1640s amounted to only 120 titles annually. The overall pattern seems clear: rapid growth in the Netherlands and London, stagnation in Paris, decline in Italy; and, in Madrid, growth only to a level that was dwarfed by that of other major cities.<sup>78</sup> Martin,

<sup>76</sup> In the last five years of the fifteenth century Venice had printed the second highest number of titles of all European cities (Barbier 2017, 179).

<sup>77</sup> After increasing in the late 1640s, printing in Paris fell rapidly again in the 1660s, as Colbert imposed strict censorship and limited the number of print shops to thirty (from an initial total of seventy-nine). The result, as Soll notes concisely, was that “Colbert’s state regulation succeeded in strangling the once great Parisian book industry.” (Soll 2009, 130–31) Moreover, of the volumes from this period that have survived in the holdings of the *Bibliothèque nationale*, a steadily rising share (after 1680, over 40 percent) are on religious topics, as against roughly 15 percent in arts and sciences (Martin 1984, 1065)

<sup>78</sup> All results are from USTC, accessed September 6, 2022, by Jacob Morrier.

in his magisterial overview of European printing in the seventeenth century, notes the “singular contrast” between the “relative vacuum” in Spain or the “stagnation” in Italy, and “what one can observe to the north and the east of France,” i.e., in the Low Countries and Germany. (Martin 1984, 28).

Reading shifted even more rapidly than printing. By the first half of the seventeenth century, the Protestant Netherlands had become the undisputed center of European readership, consuming a then astonishing 140 books annually per thousand, or one book for every seven, persons; England came second, purchasing 80 annually per thousand; and Germany, despite the plunder and bloodshed of the Thirty Years War (1618-1648), stood third, at 54 per thousand souls annually. Italy had fallen to fifth place in book consumption: 42 volumes annually per thousand inhabitants. Among Catholic states, France was the signal exception: 52 volumes annually per thousand of population, or one for every twentieth person (Buringh and Van Zanden 2009, 421). Northern Europe welcomed both the growth of human capital and the Reformation; southern and southeastern Europe remained largely Catholic and did not.

The reason for the divergence lay – or so I conjecture – in two kinds of *factor mobility*. The sudden cheapening of human capital incentivized the creation in northern Europe – but only there – of whole new sectors that could use it productively: **state bureaucracy** and **long-range commerce**. The former was likely the more important of the two and was unique to northern Europe. Bureaucratic absolutism, indeed, may have arisen in northern Europe in this period precisely because human capital had suddenly become so abundant – and because ambitious rulers saw how that capital could be used to build the strong states that their survival required.

*State bureaucracy*. In southern, or “Latin,” Europe, states arose early – in France and Spain, as early as the thirteenth century – from the rubble of the Carolingian Empire and its welter of small principalities. Notoriously, however, these early states suffered, despite their outward pomp, from serious weaknesses. Desperate for money to fight their frequent wars, they had often resorted to the sale of offices and had even (for payment of a yet higher price) permitted those offices to become hereditary.

Moreover, in their rush to enlarge their domains, these rulers often incorporated new territories only by granting them substantial administrative and legal autonomy. The rulers neither fully controlled their “proprietary” bureaucracies nor imposed anything resembling uniform law and administration throughout their nominal domains.

The nascent states of northern Europe, and particularly of Germany, emerged by contrast only later, beginning in the last decade of the fifteenth century (Ertman 1997, 243).<sup>79</sup> Out of the literally hundreds of small principalities there swiftly emerged some two dozen increasingly sovereign states (Ertman 1997, 237). Their ambitious rulers were intent on avoiding what they saw as the mistakes of the Latin monarchies, and they faced heavy external threats, not least from each other. Each ruler, if he wanted to survive, sought unwaveringly to create a strong and independent state, staffed by bureaucrats (*Beamten*) who would be both highly skilled and loyal only to him.<sup>80</sup>

The opportunity that these emerging rulers saw lay precisely in the sudden abundance of human capital. The most important reason for the sudden emergence of these strong, non-proprietary bureaucracies was that

. . . the administrative and legal skills which government officials possessed [and required] were no longer the rare commodities they had been in the thirteenth and fourteenth centuries, and hence could not be used to extort concessions from their rulers. (Ertman 1997, 244)

Supply quickly expanded even further to meet the growing demand. In the Protestant universities, but only in them, enrollments in theology fell, to be supplanted by the study of law and the other secular subjects that would fit graduates for temporal and administrative offices<sup>81</sup> -- to which, by all evidence, they increasingly turned.

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<sup>79</sup> The first, according to Ertman (*loc. cit.*), were the Austrian domains of Maximilian I (reforms carried out 1493-97), Saxony (1499), and Bavaria (1501). Maximilian’s reforms emulated in many respects ones that the Netherlands had pioneered.

<sup>80</sup> The “laicization” of the governmental elite had begun in some areas as early as the thirteenth century and had accelerated in the wake of the Black Death (Gottfried 1983, 145–46); bureaucratic absolutism, however, emerged only in the course of the sixteenth century (Anderson 1979, 15).

<sup>81</sup> Before the Reformation, in the universities that later became Protestant, as well as those that remained Catholic, approximately 10 percent of students majored in theology. By 1600, theology enrolled in

Moreover, new universities continued to be founded – between the Black Death and 1600, some twenty-eight in all, including such renowned institutions as Tübingen, Uppsala, Edinburgh, and Leiden – “producing a steady stream of graduates trained in Roman and canon law suitable for positions in government service.”<sup>82</sup> (Ertman 1997, 244)

*Long-range commerce.* While southern Europe, and particularly Italy, had long been Europe’s entrepôt for the lucrative Silk Road trade in Asian spices and fabrics, the last decade of the fifteenth century also, fortuitously, began Italy’s precipitous decline, to be supplanted briefly by Portugal and soon thereafter by the Netherlands and England. Vasco da Gama’s opening of a sea route to Asia in 1498 drastically reduced profits from the arduous overland journey through central Asia to the Red Sea and the Mediterranean, which had been the backbone of Italy’s long-range commerce (Neal and Cameron 2016, 126). That, coupled with Columbus’s voyages to the Americas in the 1490s, began a rapid shift of Europe’s long-range commerce to Atlantic seaports, which soon concentrated on the flourishing harbors of the Netherlands -- first Bruges, then Antwerp, and finally Amsterdam – and the secondary ones of London and Hamburg (Neal and Cameron 2016, 132). From these, trade radiated out in all directions, but it remained most intense in northern Europe.

Long-distance trade, as the Italians had already learned, demanded an extensive array of skills: double-entry bookkeeping, a variety of languages (still including Latin as the European *lingua franca*), banking, the writing of binding contracts, knowledge of foreign markets and mores. Here, in short, any excess of human capital could find employment, likely even more lucrative (if riskier) than in rulers’ expanding bureaucracies.

Taken together, these new and expanding sectors could absorb all of the sudden abundance of human capital and demand yet more – from schools, apprenticeships, and

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Protestant universities fewer than 2 percent of students, but in Catholic universities (despite an initial dip to about 5 percent) still about 9 percent. (Cantoni, Dittmar, and Yuchtman 2018, 2072)

<sup>82</sup> For a comprehensive list, see

[https://en.wikipedia.org/wiki/List\\_of\\_oldest\\_universities\\_in\\_continuous\\_operation#Founded\\_as\\_universities\\_before\\_1500](https://en.wikipedia.org/wiki/List_of_oldest_universities_in_continuous_operation#Founded_as_universities_before_1500).

universities. These new sectors supported, benefited from, and furthered the Reformation; and it was in the Protestant universities that students increasingly devoted themselves to precisely the subjects that the new sectors required. Hence, far from resisting either printing or the explosion of human capital, Protestant northern Europe embraced both. First Amsterdam, and later London, became Europe's great centers of publishing and commerce.

The exogenous shock of printing was welcomed where the burgeoning factor of human capital proved itself to be mobile to new sectors of employment; it was resisted and suppressed, to the region's long-term detriment, where human capital – largely for exogenous reasons – revealed itself to be immobile.

#### **EXAMPLE 4: RAILWAYS AND REVOLUTION: THE NINETEENTH-CENTURY RUSSIAN POPULATION EXPLOSION**

If the Black Death, over a period of some seventy years, reduced Europe's population to a third of its former level, an obvious counterpoise are the last decades of Czarist Russia: in just over seventy years, between 1850 and 1914, its population roughly tripled.<sup>83</sup> No less an observer than John Maynard Keynes, in *Economic Consequences of the Peace*, linked that rapid growth to important political consequences:

. . . the extraordinary occurrences of the past two years [1917-19] in Russia, . . . may owe more to the deep influences of expanding numbers than to Lenin or to Nicholas; and the disruptive powers of excessive national fecundity may have played a greater part . . . than either the power of ideas or the errors of autocracy. (Keynes 1920, 14–15)

Because most of us know how babies are made, it offends common sense to regard rapid population growth as exogenous; yet in this case, no less than in contemporaneous India, it was. Russia's "national fecundity" had always been "excessive," the average woman bearing over her lifetime seven

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<sup>83</sup> Poll tax data show a total male population of 18.3 million in 1850 and 53.3 million in 1914-17 (Moon 1999, 21), equivalent to an annual growth rate of 1.7 percent. Falkus, more conservatively, estimates a total population of 74.1 million in 1860 and 170.1 million in 1913, implying a growth rate of 1.3 percent annually (Malcolm E. Falkus 1972, 17).



to nine children (Moon 1999, 23–24). That did not change after 1850. What did change was that famine, the most horrible of the Rev. Dr. Malthus’s “positive checks” to population growth, almost ceased. They did so for the same exogenous reason that famines receded in contemporaneous colonial India (Burgess and Donaldson 2012): the construction of an extensive railway network, erected almost entirely for the military purpose<sup>84</sup> of being able, in event of war or rebellion, to deploy troops rapidly.<sup>85</sup>

Famines, in Russia as in most places and ages, were chiefly local. Indeed, even during famines, Russia continued to export large quantities of grain. As Westwood has noted succinctly, “. . . a bad harvest in one province could rarely be compensated by grain shipments from a more fortunate region; hence the frequency in Russia of localized but deadly famines” (Westwood 1964, 26). And the obstacle was clear: “Russia’s endemic transport problems,” which made it “difficult and expensive to move food to areas where crops had failed.” (Moon 1999, 28). Consequently, Moon conjectured two decades ago, local famines abated in Russia after about 1857 because the growing railroad network facilitated interregional transportation of food (Moon 1999, 34).

Beyond simply relieving local shortages, the railroads in Russia, hardly less than in the Americas, opened *new lands* to cultivation: they both brought settlers in and conveyed their produce out (Moon 1999, 58). In all, the area under cultivation expanded in the last half of the nineteenth century by at least 12 percent [(Gatrell 1994, 88) in (Eklof, Bushnell, and Zakharova 1994, chap. 5)]. The railroads also facilitated industrialization, not least by permitting seasonal migration (Burds 1998): during rural “down times,” when farm labor might otherwise be idle, the peasant could claim an internal passport, move temporarily to the city, and take a job in industry, without

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<sup>84</sup> “Although railroad construction stimulated economic growth, strategic considerations were initially more important to railroad building than profitability. Close links were early established between railroading and the military.” (Reichman 1987, 18–19) Cf. (Ames 1947, 64).

<sup>85</sup> The earliest line of any significance, that from Warsaw to Vienna, which extended in Russia to the Austro-Hungarian frontier, opened in 1848. Almost its first use was to convey troops to crush that year’s Hungarian uprising (Westwood 1964, 25)

compromising his family's claim to village land.<sup>86</sup> The availability of cheap labor, coupled with a government policy that favored industrialization, induced foreign capital to flood in.

The net result was that the population explosion, rather than diminishing living standards, raised them significantly: the K/L ratio rose, the T/L declined only slightly, and total factor productivity – not least in agriculture, where mechanization proceeded rapidly – rose. Perhaps the strongest evidence of rising living standards is anthropometric: between the 1850s and the years just before World War I, the average height of conscripts to the Russian army rose by about 3 cm., from 165 to 168 cm. (Mironov 2012, 119).<sup>87</sup> The increase seems to have been especially pronounced among peasants (Mironov 2012, 122). Per capita national income, according to the best estimates, rose throughout the period by about 1.6 percent annually; during the period of most rapid advance, the 1890s, by 3.4 percent per year (Gregory 1994, 24). Real wages also rose, more in agriculture than in industry;<sup>88</sup> and urban and rural wages converged.<sup>89</sup>

The railroads also brought gains from trade, in two senses: greater interregional specialization, and radically improved access to world markets, where demand was burgeoning.<sup>90</sup> Exports of wheat roughly quintupled between 1860 and

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<sup>86</sup> The issuance of internal passports shot up, from 1.2 million annually in the 1860s to 8.8 million annually between 1906 and 1910, and of course was highest in the areas closest to industrial centers (Burds 1998, 21–22).

<sup>87</sup> There is some left-censoring in the data, which may therefore understate the change. In the 1850s, the minimum height for recruits was 155.6 cm.; beginning in 1876, the minimum was lowered to 153.4 cm. Values below that (i.e., for rejected recruits) were not recorded. The situation is even slightly more complicated, as required minimum chest sizes were also changed (Markevich and Zhuravskaya 2018, 1110)

<sup>88</sup> Real wages in agriculture increased by 50 percent in the decade after the 1861 emancipation of the serfs and, by the first decade of the twentieth century, had almost doubled (Mironov 2012, 319).

<sup>89</sup> One important study, albeit confined to the St. Petersburg *gubernia*, demonstrates the convergence precisely and in detail: (Borodkin, Granville, and Leonard 2008).

<sup>90</sup> Wheat prices in Amsterdam rose between 1850 and 1900 by over 85 percent, from .624 grams to 1.17 grams of silver per liter. Even by 1880, they had risen by over 60 percent (1880 price = 1.017 grams per liter). Allen-Unger Commodity Price Dataset, International Institute of Social History, <http://webstore.iisg.nl/hpw/allen-unger-commodities/Wheat/>, tab "Amsterdam." Accessed 1 June 2020.

1912 (from about 50 million to 250 million *poodi*<sup>91</sup> annually), accounting for between a quarter and a third of total world exports (M. E. Falkus 1966, 416–17).

As Crisp put it succinctly in her magisterial study of the pre-1914 Russian economy, “the effect of the railways was truly revolutionary” and, even more than the abolition of serfdom, demarcated a new age in Russian economic development (Crisp 1976, 17).

The two Russias. All of this is more or less common knowledge. What is less frequently noted is that the exogenously determined laying of track divided Russia into regions with, and without, good access to the new railways. The well-connected areas enjoyed opportunities for seasonal migration, produce prices close to those on world markets, higher literacy, and rapid newspaper delivery. The “cut off” areas had none of these advantages. They had notably slower wage growth (Mironov 2012, 324). Rural areas were especially disadvantaged: their peasants could not easily engage in seasonal migration, they remained less literate, and even their postal service was poor. Perhaps most problematic of all: high transportation costs meant that their produce sold for less, and the price at the farmstead was inevitably lower, the more distant the nearest rail connection. The isolated areas were thus especially vulnerable to fluctuations in the world grain price.

At the same time, the cut off areas were hotbeds of political interest and peasant organization. Literacy in such areas was often low, but the arrival of a newspaper was followed immediately by the gathering of a crowd, who listened attentively as one of their literate fellows read the news aloud; and, as one peasant later wrote, after each such reading, the community would “passionately discuss what was read, usually divided into two parties, the Progressives and the Black Hundreds” (Burds 1998, 176–77). In contrast, the well-connected regions should have remained on average more prosperous, better able to withstand temporary price shocks, and more mobile and individualistic; and, with less experience of communal reading and response,

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<sup>91</sup> In standard U.S. agricultural measure, this translates to an increase from about 35 million bushels in 1860 to 130 million in 1913. One *pood*  $\cong$  36 lb., so that two *poodi* (72 lbs.) are equivalent to 1.2 bushels (one bushel of wheat = 60 lbs.).

will have had less fully developed “forms of horizontal political organization” (Burds 1998, 179).

For later Imperial Russia, we have over-time data on track density (kilometers of track per square kilometer of area),<sup>92</sup> which continued to expand in those years, and on peasant unrest; and time-invariant data on soil quality and previous serfdom, all at the *uyezd* level.<sup>93</sup> We also have monthly wheat prices as reported at Amsterdam for wheat from Odessa.<sup>94</sup> Wheat prices are available only for the years from 1885 through 1901, and the unrest data also terminate in 1901, so the analysis is confined to that timespan. Pioneering research has also shown that peasant unrest in post-emancipation Russia correlated positively with soil quality and extent of previous serfdom (Finkel, Gehlbach, and Kofanov 2017), so those must enter as control variables in any statistical test.<sup>95</sup>

Given these data, we estimate an equation of the form

$$U_{ij} = f(G_i, RR_{ij}, G_i * RR_{ij}, \mathbb{X}_j),$$

where  $U_{ij}$  represents the likelihood of at least one unrest event in *uyezd*  $j$  at time  $i$ ,  $G_i$  is the Odessa wheat price at time  $i$ ,  $RR_{ij}$  is the track density in *uyezd*  $j$  at time  $i$ ,  $G_i * RR_{ij}$  is the interaction of wheat price and track density, and  $\mathbb{X}_j$  is a vector of *uyezd*-specific time-invariant control variables, including soil quality, intensity of previous serfdom (Finkel, Gehlbach, and Kofanov 2017) (Dower et al. 2018), and the percentage of total

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<sup>92</sup> I employ log-transformed track density to compensate for the extreme skew of the data.

<sup>93</sup> Track density is from geocoded version of a railway map included in vol. 4 of the National Atlas of Russia, History and Culture (Natsional’nyi atlas Rossii). See: <https://национальныйатлас.рф/cd4/129/129.html>. List of unrest events was compiled by Brendan McElroy (to whom deep thanks are due) from vols. 7 and 8 of the series *The Peasant Movement in Russia*, respectively: A. S. Nifontov and B. V. Zlatoustovskii, eds., *Krest’ianskoe dvizhenie v Rossii v 1881–1889 gg.: Sbornik dokumentov* (Moscow: Izdatel’stvo sotsial’no-ekonomicheskoi literatury, 1960) and A. V. Shapkarin, B. V. Zlatoustovskii and N. I. Pishvanova, eds., *Krest’ianskoe dvizhenie v Rossii v 1890–1900 gg.: Sbornik dokumentov* (Moscow: Izdatel’stvo sotsial’no-ekonomicheskoi literatury, 1959). Share of population that were serfs before 1861 and soil quality are from (Castañeda Dower et al. 2017).

<sup>94</sup> The few missing monthly prices were imputed from other series, based on their average covariation with the Amsterdam / Odessa prices.

<sup>95</sup> The better the soil, the greater the stakes; the greater the extent of previous serfdom, the likelier were grievance and resentment.

peasant arable<sup>96</sup> sown to wheat in 1881.<sup>97</sup> We<sup>98</sup> do so using a standard logit model (given that 92 percent of district-years have no unrest events) that employs a three-knot cubic spline to account for time trends.<sup>99</sup> We also interact the three-knot spline with fixed effects for each of the thirteen main regions noted standardly by Kopsidis *et al.* (Kopsidis, Bruisch, and Bromley 2015).<sup>100</sup> This allows time to have a unique – and highly flexible – effect in each region. We thus account for any dynamic relationship between region and time, as well as any unobserved variables that change with time. Further, the regional fixed effects allow for varying baselines of unrest at the level of the region. The results of that procedure appear as Table 4.

It appears that, in any given *uyezd* in any given year, the likelihood of peasant unrest was significantly lower the better was its railway connection; and that, where railway connection was good, but not otherwise, unrest tended to increase with the price of wheat. Moving from the first to the third quartile of log-transformed railway density is associated with a statistically significant *decrease* in predicted probability of unrest by about 3.2 percentage points, i.e., from the baseline of 8.0

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<sup>96</sup> More specifically, the share of peasant allotments, i.e., the lands received by village communities under the terms of the emancipation settlement.

<sup>97</sup> The area sown to wheat in any given year will vary with anticipated grain prices. I take 1881 as the base year to avoid this possible source of endogeneity. The 1881 data are from (Central Statistical Committee 1901) and were supplied by Brendan McElroy.

<sup>98</sup> The following analysis incorporates the findings of joint research with Caleb Ziolkowski (Princeton) and Brendan McElroy (Michigan), with expert and unflagging research assistance from Can Yesildire (Harvard undergraduate). Our analysis will be presented in much more extensive form in a joint paper, on which we are now working.

<sup>99</sup> Cubic splines are piecewise cubic functions that interpolate data and guarantee smoothness at the points chosen for the knots—including the boundary points. A three-knot spline is a flexible function, allowing for a time trend that "bends" up to three times. There are effectively five degrees of freedom, making it roughly equivalent to a four-degree polynomial term. But, unlike a polynomial term, the cubic spline spreads out the knots in a more even manner, making it much more flexible than a polynomial term (Hastie and Tibshirani 2017). Further, splines, unlike polynomial terms, avoid overfitting the data (including at the extremes ends of the range of the data).

<sup>100</sup> Baltic region (Estland, Livland, Kurland), Lake region (St Petersburg, Pskov, Novgorod, Olonets), Far North (Arkhangel'sk, Vologda), Urals (Viatka, Perm'), Central Industrial region (Kostroma, Vladimir, Iaroslavl', Tver', Moscow, Kaluga, Nizhnii Novgorod), Bielorrussia (Smolensk, Mogilev, Minsk, Vitebsk), Lithuania (Kovno, Vil'na, Grodno), Southwest region (Volyn', Kiev, Podol'ia), Malorossiiia (Chernigov, Poltava, Khar'kov), Novorossiiia/Southern Steppe region (Bessarabia, Kherson, Taurida, Ekaterinoslav, Don Cossacks Oblast'), Central Agricultural region (Orel, Tula, Riazan', Tambov, Voronezh, Kursk), Middle Volga (Kazan', Simbirsk, Penza, Saratov) and Lower Volga (Astrakhan', Samara, Ufa, Orenburg). The present analysis treats the Baltic as the baseline region.

percent to 4.8 percent, about a 40 percent decrease from the baseline probability of unrest. On the other hand, the price of wheat has no general association with unrest, but rather is linked to increased unrest only in regions with better transport (see estimated coefficient on interaction term, density x wheat price). in a *uyezd* with good railway connections (in the third quartile of log-transformed track density), high wheat prices were associated with a somewhat *higher* probability of unrest (an increase of 1.0 percent) than in districts whose railway connections were in the first quartile (a decrease of 0.6 percent). The estimated difference---1.6 percentage points--- while substantively small, attains conventional levels of statistical significance. I conclude from this, at least tentatively, that in well-connected (and, presumably, more prosperous) regions, rebellion was a “luxury good,” while in the cut off regions, unrest was likelier associated with deprivation.

**Table 4**  
**Logistic Regression of Peasant Unrest Over Time**  
**On Uyezd-level Railroad Density, Percentage of Former Serfs,**  
**Percentage of Area Planted to Wheat, and Soil Quality;**  
**And on Monthly Odessa Wheat Prices<sup>101</sup>**

	Logistic Model
(Intercept)	-14.483 *** (1.828)
Wheat Percent	0.072 (0.069)
Wheat Price	0.074 (0.058)
Log Railroad Density	-0.529 *** (0.100)
Serf Percentage	0.115 * (0.067)
Good Soil	-0.038 (0.079)
Log Population	0.985 *** (0.115)
Wheat Percent x Wheat Price	-0.011 (0.048)
Wheat Percent x Log Railroad Density	0.189 * (0.098)
Wheat Price x Log Railroad Density	0.302 *** (0.101)
Wheat Percent x Wheat Price x Log Railroad Density	-0.089 (0.102)
N	8194
logLik	-2033.973
AIC	4191.946

\*\*\* p < 0.01; \*\* p < 0.05; \* p < 0.1.

As regards the control variables: unrest was indeed somewhat associated with the extent of prior serfdom, as Finkel *et al.* found; but, in our more articulated model, good soil is basically unrelated to the probability of unrest. It seems likeliest that,

<sup>101</sup> Model includes regional fixed effects; see text.

given the strong correlation between soil quality and area sown to wheat (rye, as every farm child knows, can be grown on poorer soil), this is merely a symptom of collinearity: “area sown to wheat” (wheat percent) correlates with “good soil” at  $r = .46$ ) and hence likely picks up most of the effect of soil quality.

The crucial finding here is that, controlling for other factors, the best connected – and presumably economically most advanced – parts of Russia were less likely to rebel; it was peasants in the isolated regions, economically left behind, who were more likely to do so. Fully in accord with conventional wisdom, however, peasants in those more isolated areas grew more content, or at the very least no more discontent, when grain prices were high; much against conventional wisdom, peasants in the prosperous areas grew *more* rebellious when wheat commanded a higher price.

Conclusion. Late Imperial Russia’s population explosion was likely a result of its growing railway network, laid exogenously chiefly for military reasons. The railways, and their associated opening of new lands and attraction for foreign capital, allowed the rapidly growing population to achieve rising wages and living standards; but they also divided Russia into well-connected and isolated regions. Fragmentary evidence suggests that, controlling for other factors, the isolated regions were likelier to experience peasant unrest and to do so especially when grain prices fell.

#### **EXAMPLE 5: FORCED MIGRATION AS AN EXOGENOUS SHOCK TO THE SUPPLY OF HUMAN CAPITAL: THE HUGUENOT FLIGHT FROM FRANCE INTO PROTESTANT GERMANY AFTER 1685**

Among the few historical examples of migration that (a) involved human capital more than low-skill labor and (b) were exogenous and almost entirely unanticipated, was the massive emigration of the Huguenots (Calvinist Protestants) out of France at the end of the seventeenth century, after Louis XIV revoked the toleration supposedly guaranteed by the almost century-old Edict of Nantes.



The Edict had been issued on April 13, 1598, by Henry IV, himself a recent convert to Catholicism.<sup>102</sup> The aim was to end over thirty-five years of religious civil war by guaranteeing to the Protestant minority “in perpetuity” freedom of worship in their own territories and estates and equality before the law. Nonetheless, on October 18, 1685, Henry’s grandson Louis XIV, having on more than one occasion reaffirmed that its guarantees were “perpetual,” abruptly and without prior notice revoked the Edict, proclaimed Catholicism the sole legal religion of France, ordered the Protestant churches demolished, forbade Protestant worship, and decreed that the children of Protestants must be raised as Catholics, even if doing so entailed separating them forcibly from their parents<sup>103</sup> (Prestwich 1988, 63–64). Although the Edict’s guarantees had been eroded in recent decades, and intermittent persecution had already occurred, the revocation came as a thunderbolt, certainly to the Huguenots and even to the Sun King’s closest advisors<sup>104</sup> (Hornung 2014, 90).

The Protestants at that point constituted between four and five percent of the French population of between nineteen and twenty million. At least a fifth of them, or 160,000 to 170,000 souls, quickly fled the kingdom, perhaps anticipating correctly that the King would soon prohibit their emigration, punishing further attempts to leave with enslavement or death (Dölemeyer 2006, 26 and 51–52) (Scoville 1952a, 297).

That the Huguenots embodied a significant bloc of human capital is scarcely in doubt. They could, indeed, have served as Exhibit A for Max Weber’s Protestant Ethic, or at least for the Calvinist variant on which Weber focused.<sup>105</sup> They were highly educated, famously diligent, above average in prosperity, and heavily concentrated in the worlds of business, the professions, technologically advanced agriculture, and even

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<sup>102</sup> Raised as a Protestant, Henry had converted to Catholicism only in 1593, after four years on the throne, famously (although unverifiably) explaining, “Paris vaut une messe,” “Paris is worth a mass.”

<sup>103</sup> Such separations are of course unthinkable in our own more enlightened age.

<sup>104</sup> Supposedly major impetus came from the King’s pious former mistress (by then his secret wife) Madame de Maintenon, and prior deliberation was confined largely to the bedroom.

<sup>105</sup> It is also possible, of course, that the Huguenots’ precarious position, demonstrated in a bloody civil war and repeated massacres, could have spurred them to acquire that most mobile of resources, human capital. Cf. (Becker et al. 2020).

the military.<sup>106</sup> Their prowess in textiles and tailoring was especially renowned; they were among Europe's few breeders of silkworms and weavers of silk.<sup>107</sup> The gain to the jurisdictions to which the Huguenots fled – chiefly England, the Netherlands, Switzerland, Scandinavia and the parts of Germany that the Peace of Westphalia had confirmed as Protestant – was significant, indeed often transformative.<sup>108</sup>

Not every Protestant part of Europe, however welcomed the refugees. The widest and most puzzling variation was to be found in Europe's German-speaking lands, not least because these comprised a patchwork of over 300 jurisdictions (principalities, dukedoms, margravates, free cities, archbishoprics, etc.), with governance structures that ranged from absolute or limited monarchies to merchant- or guild-dominated, or sometimes even popularly elected, councils.<sup>109</sup>

That some German jurisdictions failed to welcome the Huguenots is at first sight baffling. Nowhere should their talents have been more welcome than in the area which, scarcely a generation earlier, had lost between a quarter and a third of its population to the Thirty Years War (1618-1648) (Schmidt 2003).<sup>110</sup> That conflict, moreover, had deepened Germany's economic backwardness. Surely there was need of re-population ("*Peuplierung*"); moreover, an influx of high-skill people would alleviate Germany's backwardness and stimulate economic growth.

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<sup>106</sup> As their most important twentieth-century historian has put it, they "dominated many local industries and branches of trade and [were] among the wealthiest and most industrious of France's middle class." (Scoville 1952a, 296). The *intendant* at Nîmes reported that the Protestants there "have a higher standard of living and are more active and more industrious than the Catholics" (Scoville 1953, 429)

<sup>107</sup> "In Germany [the Huguenots] introduced several kinds of textiles; they made ribbons, gloves, laces, woolen and silk stockings, and fine felt hats; they began the manufacture of blown and cast plate glass; they improved tanning and the hardware trades; and they brought additional land under cultivation and extended the margin of intensive farming" (Scoville 1952b, 410).

<sup>108</sup> The leading places of refuge (with the number of immigrants in parentheses) were: the Netherlands (50,000), England (40,000), Germany (38,000; of which some 20,000 went to Brandenburg-Prussia), and Switzerland (20,000). (Deutsche Hugenotten-Gesellschaft e.V. 2021, sec. Weltweite Ausbreitung) (Dölemeyer 2006, 51–52) (Tollin 1886, 240).

<sup>109</sup> A useful categorization, albeit for the early eighteenth century and only for the rural jurisdictions, can be found in (McElroy 2020, 146–57).

<sup>110</sup> The losses differed regionally, lightest in the south and heaviest in the north and northeast. Those of Brandenburg-Prussia were among the most severe. See map in (Franz 1961, 8).

Some jurisdictions, most notably the Electoral Palatinate of the Rhine<sup>111</sup> and the Electorate of Brandenburg-Prussia,<sup>112</sup> actively recruited the Huguenots, offering generous incentives and privileges.<sup>113</sup> In other Protestant territories, however, opposition was fierce (Tollin 1886, 264–68): Württemberg, Mecklenburg, Saxony,<sup>114</sup> and most of the Hanseatic city-states<sup>115</sup> either rejected the refugees outright or made their lives painfully difficult.

Trying to ascertain why Protestant German rulers and cities may have welcomed or shunned these evidently valuable immigrants, I worked with research assistants to assemble a novel dataset of the 60 Protestant cities whose attitudes could readily be ascertained from secondary sources, coding not only the attitude of the city (on a four-point scale, ranging from active recruitment to outright opposition) but also that of its territorial ruler (unless a Free Imperial City or a Hanseatic City), as well as a host of other city and territorial attributes.<sup>116</sup> A simple cross-tab (Table 5) reveals an important difference.

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<sup>111</sup> The mostly Calvinist-ruled Rhine Palatinate (Kurpfalz) had begun even in the sixteenth century (and even more generously after Frederic IV's Edict of Mannheim, 1607) to welcome Huguenots who found France uncongenial. (Braun and Lachenicht 2007, 17–34) (Tollin 1886, 243)

<sup>112</sup> These rulers held the title of "Elector" because of their nominal role in electing the Holy Roman Emperor.

<sup>113</sup> The "Great Elector" of Brandenburg-Prussia, Friedrich Wilhelm, extended the warmest and quickest welcome; and, as Erik Hornung has established in a natural experiment exploiting exogenous variation among Prussia's towns, reaped significant economic benefits (Hornung 2014, 103).

<sup>114</sup> The Electoral Principality of Saxony and the Free Imperial City of Frankfurt went so far as to forbid Calvinists to own land or become citizens (Tollin 1886, 266) (Braun and Lachenicht 2007, 36).

<sup>115</sup> Lübeck opposed their settlement, Hamburg forbade Calvinist preaching (Deutsche Hugenotten-Gesellschaft e.V. 2021, sec. Religiöser Einfluss der Hugenotten in den Aufnahmeländern). Bremen, however, welcomed the Huguenots (Tollin 1886, 267–68).

<sup>116</sup> A full list of the cities, together with their population and the extent of their losses in the Thirty Years War, is included below as Appendix Table A2. For heroic labors in combing the available databases and published sources, I thank particularly Nina Groeneveld, Stephanie Inchaustegui, and Arthur Krön. Jeremiah Dittmar very kindly guided me through his database.

**Table 5**  
**Attitude Toward Huguenot Settlement**  
**Of Cities vs. Attitude of Cities' Territorial Rulers**

		City Attitude				
		Opposed	Mixed Reaction	Welcomed	Actively Recruited	Sum
Ruler Attitude	Mixed Reaction	1	5	0	1	7
	Welcomed	0	7	8	0	15
	Actively Recruited	6	4	12	12	34
	Sum	7	16	20	13	56

Over 60 percent of the territorial rulers (34 of 56) actively recruited the Huguenots; less than a quarter of the city governments (13 of 56) did so. One in every eight of the city governments (7 of 56) outright rejected the refugees; not a single one of the territorial rulers did so. Perhaps most remarkable, of the 34 cities in which rulers were actively recruiting, the municipal governments of 10 (or 30 percent) either hesitated to admit the Huguenots (4 cases) or rejected them (6 cases).

Among the territorial rulers, previous population loss seems to have mattered most. Slightly over half of the cities (31 of 56) had lost over 40 percent of their population. In more than 70 percent of those high-loss cities (22 of 31), the territorial ruler actively recruited Huguenots. Among the cities that had lost 40 percent or less of their inhabitants, fewer than 40 percent of territorial rulers (11 of 28) actively recruited.

Why were the cities less welcoming? Historians seem almost unanimous in regarding the urban craft guilds as the most embittered opponents (Dölemeyer 2006, 91).<sup>117</sup> Guilds formed the foundation of early modern cities' economies, perhaps more so in Germany than elsewhere (Walker 1971, chaps. 2 and 3). Each guild – of bakers,

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<sup>117</sup> A vivid example came from the city of Torgau, one of three Saxon cities that the Electorate's ruler, Friedrich August I, had ordered to accept Huguenots. The Torgau city council protested vehemently against the plan to settle "almost 400 persons, refugee French manufacturers (bey nahe . . . vier hundert Persohnen, refugirten französischen Manufacteurs)," including "bakers, shoemakers, tailors, and similar artisans," and – worst of all – brewers of "so-called French beer (so genandtes französisches Bier)," given that the principal economic activity of Torgau was brewing. (Middell 2007, 55)

hatters, tailors, butchers, etc. – guaranteed the competence of its members and the quality of their work; but each also extracted monopoly rents and resisted technical innovations. The existing artisans and merchants of Germany’s towns and cities would inevitably see in the potential newcomers unwelcome competition – an unanticipated surge of human capital that, particularly if it proved superior to their own, could only devalue their hard-acquired skills and raise the costs of the newly scarce factors of labor and physical capital.<sup>118</sup> At worst, they rightly feared, this “price scissors” could reduce them to penury. Nor, in the face of this adverse supply shock, did the guilds have any of our usual alternatives to coercive resistance. Existing technologies allowed little factor substitution, the artisans’ skills would be in no greater demand in another sector or jurisdiction, and the Huguenots already had the most advanced technology.

Yet the extent of a city’s guild power, at least as measured by Fabian Wahl (Wahl 2016) for thirty-six of our sixty cities, seems to bear no relation to its rejection or acceptance of the Huguenots.<sup>119</sup> While just over half of the cities with little or no guild power welcomed or actively recruited the Huguenots, so did exactly half of those with some, or strong, guild influence. Neither do such other candidates as city size (Walker 1971, 27–28) (de Vries 1981, 82–83), existing upper-tail human capital, or secularized (and demonstrably better) schooling correlate significantly with Huguenot acceptance or rejection (J. E. Dittmar and Meisenzahl 2019).

Only two properties of cities seem to correlate reliably with Huguenot acceptance. The first is obvious: a city where a territorial ruler resided – a *Residenzstadt* – was far likelier to accept the Huguenots. Of the 24 cities known to have been *Residenzstädte*, precisely one opposed the entry of the Huguenots. Of the 30 that were not seats of territorial rulers, 7 were opposed.

More intriguingly, Huguenots found readier acceptance in cities that lay close to a major trade route. Cities that actively recruited the refugees lay on average

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<sup>118</sup> As human capital grew more abundant with the arrival of the Huguenots, in relative terms other factors of production, notably labor and physical capital, grew by definition scarcer and costlier.

<sup>119</sup> Selection bias may have been at work. Rulers may have avoided settling the refugees in cities where guilds would be powerful enough to succeed in rejecting them.

within five kilometers of a major trade route (indeed, no city that recruited them lay more than thirteen kilometers from such a route), while the average distance of a non-recruiting city was twice as great (eleven kilometers).<sup>120</sup> If we dichotomize city attitude into either “actively recruited” vs. “other” and logistically regress that indicator variable on city distance to the nearest trade route (Table 6), we find with reasonable confidence that distance reliably predicts whether the city actively recruited Huguenots or did not: the farther a city lay from a trade route, the less likely it was to engage in active recruitment of the Huguenots.<sup>121</sup> Cities close to trade routes, I conjecture, were likely to be more flourishing and to see enough opportunity to regard the Huguenot infusion of human capital as less threatening, or indeed as an opportunity for further growth.

**Table 6**  
**Logit Regression of “Active Recruitment”**  
**On Distance to Nearest Trade Route**

Logit Regression Results						
=====						
Dep. Variable:	three city att	No. Observations:	56			
Model:	Logit	Df Residuals:	54			
Method:	MLE	Df Model:	1			
Date:	Sat, 16 Jul 2022	Pseudo R-squ.:	0.05696			
Time:	23:07:49	Log-Likelihood:	-27.439			
converged:	True	LL-Null:	-29.096			
Covariance Type:	nonrobust	LLR p-value:	0.06866			
=====						
	coef	std err	z	P> z	[0.025	0.975]
-----						
const	-0.7894	0.422	-1.870	0.061	-1.617	0.038
tr_distance	-0.0682	0.046	-1.474	0.140	-0.159	0.022
=====						

To return to the obvious and fundamental question: why were the rulers, almost without exception, eager to attract the Huguenots, why were so many of the cities nominally under their rule intransigently opposed, and why were rulers prepared to ignore or override that opposition? Clearly the rulers sought repopulation and economic growth, not least because military pressure demanded ever-increasing

<sup>120</sup> Major trade routes are those specified in (Yue, Lee, and Wu 2017); city distances calculated by Brandon Zhao. The relevant table is included as Table 10 in the longer version of this paper.

<sup>121</sup> The variable “three city att” was the code for active recruitment.

revenue (Klingebiel 1990, 70). And perhaps the Huguenots held the answer to economic growth in more than one way.

Here, I think, we see at least one case in which ideas mattered. Up to 1650, the prevailing view of the world took the guild structure of economic activity as given and immutable. A radically different picture had recently been offered by the scholar, jurist, and statesman Veit Ludwig von Seckendorff<sup>122</sup> in his influential volume *Der teutsche Fürstenstaat* (Seckendorff 1711). As originally published in 1655, it had urged German rulers to encourage immigration and grant full religious toleration as spurs to economic growth. The third edition,<sup>123</sup> however, which appeared in 1665, propounded the ideas that soon became common currency, if not dogma, among territorial rulers. Here, Seckendorff condemned the guild system as a major obstacle to economic growth and called explicitly for its abolition (Dölemeyer 2006, 85). The third edition was, as Leopold von Ranke put it, the Great Elector's "most beloved manual of German policy" (*beliebtestes Handbuch der deutschen Politik*). It was also read approvingly by the rulers, or at least by the rulers' closest advisers, in Hessen-Cassel and Brandenburg-Bayreuth – and, very likely, in many other chancelleries (Dölemeyer 2006, 85). It became – admittedly, to exaggerate somewhat – the "Washington consensus" among that era's territorial rulers. To ones who had been persuaded, by this or similar works, or by experience,<sup>124</sup> that the guild system was a millstone around the necks of their economies, and perhaps even a barrier to re-population, the entry of the Huguenots must have seemed a golden opportunity: not only to enlarge their populations and gain valuable new human capital, but to serve as a kind of solvent to undermine, and ultimately to eliminate, the guilds.<sup>125</sup>

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<sup>122</sup> Seckendorff is sometimes regarded as the founder of German economics.

<sup>123</sup> It eventually went through eleven editions, the last in 1737. The demand for it appears to have been considerable.

<sup>124</sup> The Great Elector had observed during his youthful sojourn in the Netherlands that the vibrant Dutch economy was largely unconstrained by guilds.

<sup>125</sup> On the general tendency of rulers to view the granting of "privileges" to the Huguenots as a means of undermining the guild system, see (Dölemeyer 1997, 324–25).

Determined, to the extent they could, to override or circumvent urban opposition to their plans, the rulers saw in the Huguenots not only an influx and multiplier of human capital, but a means to reform their economies fundamentally. The success of the endeavor in Brandenburg-Prussia likely proved to their satisfaction the validity of Seckendorff's radically new ideas. The strongest rulers, as in Brandenburg-Prussia, overcame the opposition and began the breakthrough to rapid economic growth. The weaker or less assertive ones yielded to the opposition, allowed the cities to exclude the Huguenots, and fell behind economically and militarily.

## CONCLUSION

Why, then, do responses to the same shock often differ so radically, across and within regions? Do variables other than the three I have emphasized affect how, or whether, they will adjust? What of institutions, which surely a political scientist ignores at his peril? Or culture and ideas, whose importance even economists nowadays often stress? Are some cultures more open to innovation, hence likelier to conjure up a technological response to a supply shock? What role do leaders – good or bad, wise or foolish – play? And, ultimately, don't ordinary individuals decide – to rebel or to acquiesce, to stay or to leave, to support or to reject some political movement? What is the role of human agency in responding to supply shocks?

My short answer is that, yes, all of these things matter – but, with rare exceptions, only at the margins. In the face of the kinds of extreme and unanticipated shocks discussed here, the other influences prove surprisingly, perhaps even depressingly, malleable. In short, institutions and ideas are largely endogenous; and leaders and ordinary individuals are mostly compelled by circumstances. The possibilities of factor substitution, exit, and technology are almost always determinative.

*Institutions* are “sticky” but endogenous. They may channel or impede reaction to a moderate or foreseeable shock; but an extreme enough exogenous supply shock will alter institutions, albeit often with some delay. The extent, for example, to which existing institutions empowered peasants and landowners, versus workers and urban consumers, powerfully affected how European countries responded to the flood of New World foodstuffs in the later nineteenth century. Yet institutions can be neutered, ignored, or swept aside in the face of a large and unanticipated shock.



*Cultural traits* often have ancient roots and long lives – and, over time, can become markedly suboptimal. People of African ancestry whose ancestors came from regions that were heavily raided for slaves continue to exhibit lower levels of interpersonal trust (Nunn and Wantchekon 2011); populations whose ancestors adopted the plow (which demanded more physical strength, and hence favored males), or who come from regions whose climate and soil favored use of the plow, are characterized even today, it seems, by lower female participation in the labor market and fewer women in leadership roles (Alesina, Giuliano, and Nunn 2013). Yet these norms, too, can change under large shocks. Two World Wars dramatically increased the share of women in the workforce in belligerent nations, regardless of ancestral ties to the plow (Economics Focus: The Plough and the Now 2011).

*Leadership.* In an age in which monarchs mattered, whether the monarch was bright or dim (or, in the worst cases, feeble-minded from inbreeding) strongly affected her or his country's prosperity and security (Ottinger and Voigtländer 2020). Arthur Schlesinger, Jr., the hagiographer of Franklin Roosevelt, was convinced that leaders had played the same critical role in the twentieth century.<sup>126</sup> Under the pressure of extreme supply shocks, however, leadership fades into insignificance. Edward III, usually accounted one of the abler English monarchs, failed utterly to impose wage controls in the wake of the Black Death. The Holy Roman Emperor Charles V lacked neither ability nor energy, yet his best efforts could not constrain the Reformation that the printing press had unleashed. Nor is it easy to imagine that Gustav Stresemann, even had he lived beyond 1929, could have held back the Nazi onslaught unleashed by the 1929 Crash and the Great Depression.<sup>127</sup>

*Ideas.* Famously, Keynes asserted that “the world is ruled by little else” than “the ideas of economists and political philosophers.” (Keynes 1936, 383) Even allowing

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<sup>126</sup> “Would the next two decades have been the same had the automobile that hit him killed Winston Churchill in 1931, and the bullet that missed him killed Franklin Roosevelt in 1933?” (One Year, Two Accidents 2012)

<sup>127</sup> Stresemann died on October 3, 1929, exactly three weeks before the Black Thursday (October 24, 1929) that marked the onset of the Wall Street crash.

for professional hubris, Keynes was at most half-right. Ideas are powerful when they accord with, and account for, experience; and, above all, when they are *systemic* ideas.

*Systemic* ideas are what Lippman called the “pictures in our heads” that tell us how the world works (Lippmann 1922, chap. 1). They describe an interlocking and internally self-consistent mechanism with definite predictions about how changing one aspect will inevitably change others. Classical economics, including Say’s Law, was emphatically such an idea – and one that constrained even labor-dominated governments to respond to the Great Depression with counterproductive policies of austerity.

Only as the Great Depression deepened, belying the classical economists’ assurances that it would quickly resolve, did leaders in several countries – Sweden, the U.S., and not least Nazi Germany – began to experiment with heterodox policies, even before Keynes’s intellectual revolution could take hold (Weir and Skocpol 1985) (Frieden 2006, 202–5). Nor is it an accident that the world was so receptive, precisely in those years, to Keynes’s alternative systemic idea. Similarly, only in the wake of the devastating Thirty Years War and under the pressures of interstate competition did seventeenth-century German rulers prove ready to abandon the received picture of urban life as necessarily dominated by craft guilds and to accept Seckendorff’s radically different systemic idea.

Systemic ideas, then, can be remarkably tenacious. They yield only to contrary experience, and to an equally comprehensive systemic idea that accords better with experience.

*Human agency.* If leaders are usually powerless against major supply shocks, perhaps their subjects – the ordinary people – carry greater weight; and, by virtue of a kind of Aristotelean “wisdom of crowds,” may discern an optimal course of action more clearly and have the massed power to pursue it. Probably the clearest evidence for collective wisdom is the working of markets, even where those markets are weakly developed or morally suspect.

The impersonal forces unleashed by supply shocks, however, just as often impel large segments of the population toward welfare-reducing policies. However much the arrival of the Huguenots might have contributed to the overall prosperity of a seventeenth-century German city, its citizens frequently allowed their short-term self-interest to dominate their prospects of long-term growth and opposed the refugees' entry. Crowds can be, and often are, as pig-headed as leaders.

Supply shocks severely constrain human agency. In almost theological terms, such shocks can easily overwhelm free will. Few eastern European landlords declined to enserf their peasants in the wake of the Black Death; few German cities, even if they were devoutly Protestant, welcomed the competition of Huguenot refugees; many Russians in areas cut off from railroad access revolted, despite the growing prosperity and opportunities of Russia as a whole; depressingly few Germans, by the late 1930s, recoiled from the idea of Eastern conquest and ethnic cleansing.

Supply shocks bring opportunity and tragedy. Against their impersonal force, institutions, culture, and leadership avail little, the “wisdom of crowds” even less. Only systemic ideas matter, and then but rarely. Factors and developments beyond our control – soil, climate, trade routes, historical memory – condition, and in most cases determine, our response. We can hope to understand supply shocks, perhaps even to adapt to them; we cannot resist or control them.

## APPENDICES

### A1. “Toy” Cobb-Douglas model of agricultural economy.

In a standard “workhorse” Cobb-Douglas production function, output  $Y$  is given by

$$Y = AT^\alpha L^{1-\alpha},$$

where  $\alpha$  is some fraction greater than 0 and less than 1 and  $A$  (usually denoted “total factor productivity”) is a technology parameter. Absent collusion, monopoly, or coercion – i.e., assuming a competitive economy – each factor commands its marginal product, so that the laborer’s wage and the rent of land are, respectively,

$$w = \text{MPL} = Y_L = (1-\alpha)A(T/L)^\alpha$$

$$r = \text{MPT} = Y_T = \alpha A(T/L)^{\alpha-1} = \alpha A(L/T)^{1-\alpha}$$

Wages, in other words, rise monotonically (holding technology constant), and rents fall, as the land-labor ratio rises. If we take the ratio of rents to wages,  $r/w$ , as an indicator of economic *inequality*,<sup>128</sup> we have

$$r/w = \frac{\alpha}{1-\alpha} (L/T).$$

In words, the more abundant that labor is, or the scarcer land becomes, the more unequal will such an agricultural society be. Indeed, in this extremely simplified Cobb-Douglas setting, the ratio of land rents to wages increases linearly with the labor/land ratio.<sup>129</sup> Finally, if we take per-capita output to be  $Y/L = A(T/L)^\alpha$ , it obviously also increases with the land-labor ratio.

### A2. Why a Factor-Saving Innovation Does, or Does Not, Occur

An unanticipated shortage of some factor, especially if it cannot be met by factor substitution or factor mobility, creates strong demand for a factor-saving

<sup>128</sup> Or  $w/r$  as a measure of equality: see, for example, (O’Rourke and Williamson 1999).

<sup>129</sup> If, as has historically been the case in agriculture (including on the farm in Nebraska on which I grew up),  $\alpha = 1/3$  (the landlord receives a third of the crop, the tenant the other two-thirds), the rent-wage ratio increases at exactly half the rate of the labor-land ratio.

technological innovation.<sup>130</sup> Where labor is scarce, owners of land or capital will pursue some labor-saving technology; where land is scarce, workers and capitalists will welcome some innovation (e.g., a new crop, better machinery, or different property rights) that increases per-hectare output.

Equally, a positive shock to one factor will motivate owners of that factor to seek a technology that uses one or more of the other factors (now in relatively shorter supply) more efficiently. In a predominantly agricultural economy, a sudden influx of labor produces powerful incentives to use land more efficiently, e.g., by introducing a more calorie-producing crop or changing methods of cultivation. Similarly, the “China shock,” by providing industrialized societies with a relative abundance of low-skill labor, has engendered innovations that employ human and physical capital more efficiently, e.g., computers and robotics.

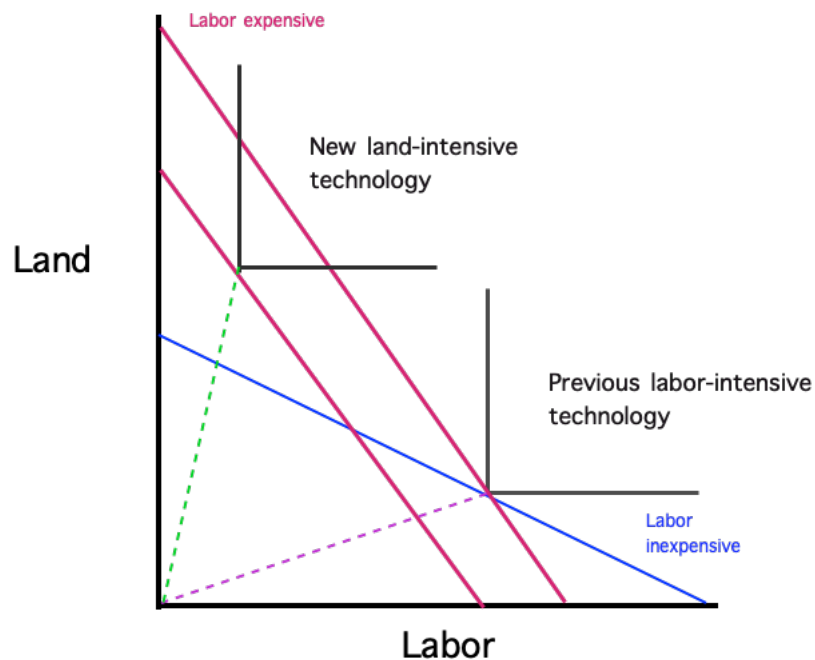
Graphically, a labor-saving innovation would appear as in Figure A1, which also portrays both the old and the new technology as characterized by zero elasticity of substitution (i.e., Leontief isoquants). If a sudden shortage moves labor from being inexpensive (the shallower price line) to being expensive (the steeper price lines) relative to land, the old technology would force producers to pay the higher wages; and, if we assume the conventional equilibrium in which profits of the representative enterprise were already zero, this would mean producing at a loss (or, likelier, simply going out of production). If some new technology that allows land (now cheap relative to labor) to be substituted for labor, and that perhaps is more efficient in its use of both factors, producers will readily shift to the newer technology. In consequence, the ratio of land to labor actually used in production will move from the slope of the lower ray from the origin (the shallower dashed line) to the slope of the higher ray (the steeper dashed line). If, as depicted in Figure A1, the new technology can produce the same output using about a quarter as much labor and three times as much land, and if land is now far cheaper relative to labor, producers who adopt the new technology will obtain

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<sup>130</sup> Following convention in economics, I subsume institutions as a subspecies of technology. Hence this section also covers institutional innovations.

a windfall profit. The benefit will be even greater than might have been achieved from more elastic substitution.

**FIGURE A1**  
**Introduction of a Labor-saving Technology**  
**In Response to an Increase in Wages**



So what determines the likelihood that a technological answer, even where the need seems dire, arises at all? Two obvious determinants, I contend, are (a) the intensity of incentives and (b) the “innovative fertility” of the given pool of potential inventors.

Intensity of incentives. Think, as a potential inventor might, of the likely return (if any) on her investment of effort and ingenuity. At least three factors would have to be weighed: how extreme is the shortage, how big a technological leap (and

hence how great an effort) is required, and how extensive is the potential market?<sup>131</sup> An illuminating example, discussed more fully in the text, is the invention of moveable-type printing around 1450. The supply of new books had been curtailed by the Black Death's decimation of the *scriptoria*, while the demand among the newly wealthy and literate had expanded; hence the shortage was extreme and prices were high.<sup>132</sup> For a sometime goldsmith, blacksmith, and minter of coins like Johannes Gutenberg, already acquainted with a variety of metals, screw presses, and woodcut printing, the technological leap was not large; and the potential market, especially in vernacular languages, was evidently large. Hence the probability that someone like Gutenberg would make the requisite leap was high; but how many Gutenbergs were there?

Innovative fertility. We owe to the Nobel Laureate Michael Kremer the startlingly simple insight that innovative fertility depends on the size of the pool of potential inventors and the ease with which news of an innovation, or of progress toward that innovation, can be transmitted. In the abstract, we assume that each person has the same, very small, probability of coming up with a solution. We assume also that, within some relevant population, whether because of shared language, physical proximity, literacy, or existing information technology, the innovative idea, once arrived at, can be transmitted instantly and universally. Then the likelihood that a technical solution will be found increases monotonically (albeit at a declining rate<sup>133</sup>) with the size of the population linked by those means of communication (Kremer, 1993).<sup>134</sup> It follows that technological innovations become ever likelier to emerge as the

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<sup>131</sup> The potential market must be quite large. Even under the well-developed patent system of the United States between 1940 and 2001, according to the estimates of Nordhaus, innovators captured only between 2 and 3 percent of the social benefit from their inventions. (Nordhaus 2004, 22)

<sup>132</sup> The typical book, just before the advent of printing, probably went for between two and four months of the typical laborer's earnings. Cf. (Overtly 2008, 5)

<sup>133</sup> If  $p$  represents the (very small) probability that any given individual will have a brilliant idea in a given span of time, then the probability that nobody among  $n$  individuals has such an idea is  $(1-p)^n$ ; and therefore the probability that at least one person has such an idea (label that probability  $b$ ) is  $b = 1-(1-p)^n$ .  $1-p$  must be a number less than, albeit very close to, 1; hence, as  $n$  increases, in the limit  $(1-p)^n$  goes to zero, and  $b$  goes to 1. It will probably be intuitively obvious that  $b$  increases with  $n$ , but at a declining rate. Doubters may check the second derivative.

<sup>134</sup> Kremer attributes this insight to Kuznets and Simon; he uses it to develop a more complex and innovative model than is sketched here.

relevant population becomes larger and denser, means of cheap and rapid communication multiply, and linguistic barriers fall.<sup>135</sup> If this is correct, technological solutions to sudden factor shortages will be likelier among large and literate populations that share one or more common languages and swift means of communication.

A second puzzle, however, is why a technological solution that emerges in one region of the world, even if it becomes rapidly known and available, is not adopted everywhere. This is the fundamental puzzle that underlies the “Great Divergence:” why was modern industrial technology, once it had demonstrated its potential in places like Britain and North America, not immediately adopted everywhere? Why did some regions remain desperately poor, or indeed become poorer, even as the industrialized countries became rich?

The answer is to be found in pre-existing factor endowments, as shown by Robert Allen (Allen 2009, 152) – whose analysis, again, is more easily seen if we resort to graphical exposition and isoquants (Figure A2). Suppose a technology, and therefore an isoquant, common to two countries, with the labor-abundant one producing at L, the labor-scarce one at H. The rate at which capital trades for labor is represented by the two sets of price lines, with of course the steeper ones characterizing the labor-scarce economy. Suppose that some new technology allows the same quantity to be produced at point T, which we can usefully regard as the vertex of (as before) a Leontief production function (i.e., one with zero elasticity of substitution), depicted here as the right-angle figure at the upper left. Producers in the labor-scarce economy will adopt that technology at once; but it will have no appeal in the labor-abundant country, which can still produce more cheaply using the old technology. Only when a series of what Allen calls “micro-improvements” (i.e., increases in total factor productivity), in which the new technology maintains the same ratio of capital to labor in production but successively needs less of both, brings costs to a point like X, will producers in the labor-abundant economy find it worthwhile to adopt the innovation. We saw essentially the

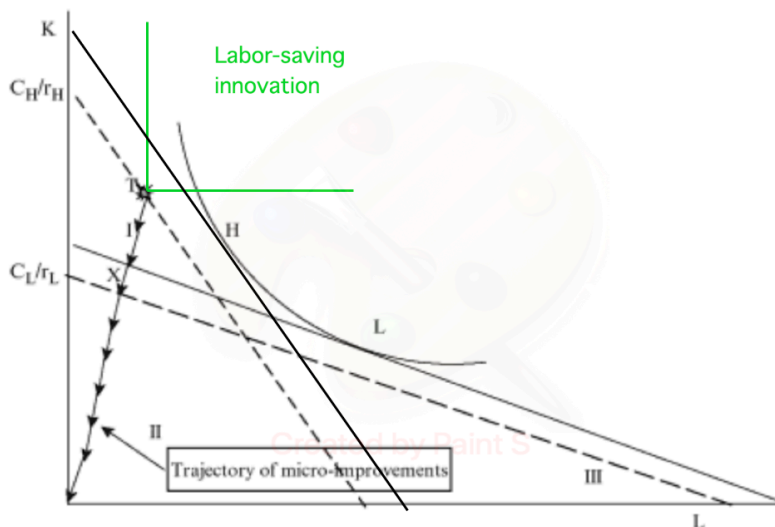
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<sup>135</sup> In the High Middle Ages, Epstein argues, “By exposing a larger proportion of the population to new technology, market integration may also have increased the rate of invention.” (Epstein 2000, 65)



same argument in Figure A1, where the new technology would never have been adopted so long as wages remained low.

**FIGURE A2**  
**Delay of Labor-Abundant Economy**  
**In Adopting Labor-Saving Technology**  
(from Allen 2009)



Institutions as technology. Systems of land tenure have often adapted (but more often failed to adapt) to shocks in supply (North and Thomas 1973). Rome's sudden abundance of slaves, and of Egyptian grain, after the Second Punic War displaced peasant smallholdings in favor of latifundia (Scullard 1970, 19–20);<sup>136</sup> the sudden decline in population that accompanied the fall of the western Roman Empire (coupled, to be sure, with a decline in security) gave rise to the manorial system; and the population surge of the seventeenth century occasioned, at least in the most densely populated parts of Western Europe, the enclosures that ended the manorial system and alone made possible the soil improvements and intensified cropping that constituted the Agricultural Revolution.<sup>137</sup>

<sup>136</sup> It's reasonable to conjecture that the sudden abundance of land, and the consequent relative shortage of labor, human capital, and physical capital, encouraged innovations – in transport, agriculture, and not least combat – that economized on the use of all three.

<sup>137</sup> Controversially, North and Thomas attribute the demographic crises of the fourteenth century, culminating in the Black Death, to a failure of institutional innovation: the population, in their view, had

### A3. Is Technology Determinative? Military Technology as the Leading Example

Even the earliest organized societies (tribes and chiefdoms) sometimes warred against each other; and, indeed, external threats powerfully stimulated greater organization, specialization, and hierarchy. Early warfare created incentives to the introduction of militarily more effective technologies, from bronze and iron to chariots, saddles, and stirrups. As Aristotle may have been the first to note, particular military technologies often correlated with political and social structures: heavy armor went together with kingship and cavalry with oligarchy, whereas “light infantry and naval forces are an entirely democratic element” (*Politics* 1297b and 1321a). Nineteenth- and early twentieth-century historians of ancient Greece, chief among them George Grote and Victor Ehrenberg, turned correlation into causation, arguing that the “hoplite revolution”<sup>138</sup> and Athenian reliance on naval power (Hale 2009, chap. 7) had in essence created Greek democracy.

Later historians and sociologists have boldly extended to many other eras the attribution of major social and political change to “revolutions” in military technology. Gaius Marius’s replacement of Rome’s citizen army with well-drilled professional legions allegedly caused, or was at least necessary for, the rise of Caesarism and Rome’s subsequent transformation from Republic to Empire (Scullard 1970, 58–59). The introduction of the stirrup into western Europe around 750 A.D., by re-establishing after centuries the dominance of heavily armed cavalry over infantry, single-handedly created feudalism (White 1962, chap. 1),<sup>139</sup> while the introduction of firearms, as part of

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simply outgrown the ability of the manorial system to feed it, and chronic malnutrition rendered people more susceptible to plague. For a well-argued dissenting view, which views constricted markets rather than institutions of land tenure as the relevant constraint, see (Epstein 2000, chap. 3).

<sup>138</sup> Hoplites were lightly armed infantry, into which virtually all adult male citizens were conscripted. Formed into phalanxes they proved superior to traditional heavily armed cavalry portrayed in the *Iliad*.

<sup>139</sup> To elaborate White’s intriguing thesis in greater detail: mounted knights, to be effective, required expensive armor and years of training, only possible in an agrarian economy if they were sustained by the revenues of large landed estates. Hence Charles Martel granted his nascent cavalry revenue from, and control over, tracts of land seized from the Church; and his example was quickly emulated by rival rulers. All else – benefice, commendation, vassalage, subinfeudation, ultimately parcelization of sovereignty – supposedly followed as the night the day.

the larger “military revolution” of the sixteenth and seventeenth centuries (Eltis 1995) (Parker 1996), supposedly doomed feudalism and forced the creation of larger armies of professional infantry – whose fiscal burdens in turn gave rise to the modern Westphalian state (Tilly 1990, chap. 3).<sup>140</sup> And, most recently, Ferejohn and Rosenbluth have argued, mass armies – of the French Revolution, the U.S. Civil War and two World Wars – by conscripting and arming virtually all able-bodied adult males, gave rise to modern democracy (Ferejohn and Rosenbluth 2017, chaps. 10 and 11).

Alluring as Ockham’s Razor, or our innate human love of simplicity, makes such monocausal theories, historians have cast doubt on the seeming centrality of military revolutions. Sparta also relied on hoplites but was hardly a democracy; the stirrup had been known for centuries in China and the Near East without giving rise to feudalism; Ming China’s already strong state was unaffected by (and indeed found little use for) firearms (Hoffman 2015); and mass warfare appears to be neither a necessary nor a sufficient condition for democratization: Switzerland and the U.S. in the nineteenth century demonstrate the first point, the USSR in and after World War II the latter one.

It seems likelier that the link between military innovation and regime change is endogenous – that both the military innovations and the social and governmental adaptations respond to some radical change in factor supply. As most historians of the period will now argue, both Athenian democracy and Athenian hoplite armies stemmed from rapidly growing Athenian prosperity, which in turn owed to the sudden opening of new land (via trade with the grain-growing Black Sea regions and Magna Graecia<sup>141</sup>) that allowed overpopulated Athens to specialize in high-quality manufactures.<sup>142</sup> The new

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<sup>140</sup> Hintze, echoing Aristotle, argued at the end of the nineteenth century that powers dependent on large armies (e.g., Germany) necessarily inclined toward authoritarian rule, while ones that could rely on naval power (Britain) or mountain defenses (Switzerland) were likely to develop democratic institutions (Hintze 1906).

<sup>141</sup> Sicily and southern Italy, which in turn (much like nineteenth-century Argentina) grew wealthy on its agricultural exports. Our adjective for extreme luxury, “sybaritic,” derives from the legendary wealth of the Sicilian city of Sybaris in present-day Calabria, Italy.

<sup>142</sup> Scheidel estimates that the per capita GDP of Athens had risen by around 330 B.C. to “four to five times minimum physiological subsistence, similar to fifteenth-century Holland and sixteenth-century England” (Scheidel 2017, 85).

wealth of Athens (and of such similarly situated Greek cities as Corinth) allowed its middle and lower classes to purchase the light armor and spears that formed the essential equipment of the hoplite soldier.<sup>143</sup>

Similarly, feudalism was an inventive adaptation to the depopulation, technological retrogression, and general insecurity that characterized late Roman and post-Roman Europe. The infantry-based legions of Rome would have found but slight use for the stirrup, or for that matter for the heavy armor of the Medieval knight; but in thinly populated and locally autarkic Carolingian Europe, a land-intensive and equestrian technology of combat made perfect sense.<sup>144</sup> It was the growing wealth and population of Europe that made possible the military revolution of the sixteenth and seventeenth centuries, and the mass armies of the late nineteenth and twentieth centuries could be fed and transported only after the industrial revolution and the introduction of the railroad (Onorato, Scheve, and Stasavage 2014)

Military revolutions, in short, usually follow supply shocks; and the alleged consequences of military revolutions – as regards economic equality, political participation, or property rights – are themselves mostly engendered by radical changes in the supply of crucial factors of production. While they will play a role in some of the analyses presented here, they will rarely prove to be determinative.

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<sup>143</sup> Sparta financed its legendarily obedient hoplite soldiers without trade, but by conquering the extensive lands of neighboring Messenia and enslaving its inhabitants.

<sup>144</sup> A useful thought-experiment is to imagine pitting the valiant knights of, for example, the *Song of Roland*, against a Roman legion in its prime, e.g., under Augustus. Even with stirrups and heavy armor, the knights would be unlikely to prevail.

**Table A1**  
**Cities Included in Weimar Voting Analyses**

**Population 100,000 or More<sup>145</sup>**

AACHEN  
ALTONA  
AUGSBURG  
BOCHUM  
BRAUNSCHWEIG  
BREMEN  
BRESLAU  
CHEMNITZ  
DORTMUND  
DUESSELDORF  
ERFURT  
FRANKFURT  
HALLE  
HAMBURG  
HANNOVER  
KARLSRUHE  
KASSEL  
KIEL  
KOELN  
KOENIGSBERG  
KREFELD  
LEIPZIG  
LICHTENBERG  
MAGDEBURG  
MANNHEIM  
MUELHEIM a d. RUHR  
MUENCHEN  
NEUKOELLN  
NUERNBERG  
STETTIN  
STUTTGART  
WUPPERTAL

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<sup>145</sup> Berlin is excluded because of boundary changes; the cities annexed to it in 1920 are included, wherever data are available.

**Population 50,000 – 100,000 and  
Specifically Named**

DESSAU  
HEIDELBERG  
ROSTOCK  
GIESSEN

**Population 30,000 – 50,000 and  
Specifically Named**

BREMERHAVEN  
WORMS  
SCHWERIN  
RUESTRINGEN

**Grouped Cities Within States**

Prussia 50, 000-100, 000	Spandau, Frankfurt (Oder), Potsdam, Osnabrück, Linden, Harburg, Stettin, Bromberg, Mülheim an der Ruhr, Bonn, Remscheid, München-Gladbach, Koblenz, Oberhausen, Erfurt, Görlitz, Gleiwitz, Liegnitz, Flensburg, Münster, Hagen i. W., Bielefeld, Elbing
-	
Bayern 50, 000-100, 000	Würzburg, Ludwigshafen am Rhein, Fürth, Kaiserslautern
-	
Sachsen 50, 000-100, 000	Plauen, Zwickau
-	
Baden 50, 000-100, 000	Freiburg i. Br., Pforzheim
-	
Hessen 50, 000-100, 000	Mainz, Darmstadt
-	
Prussia 30, 000-50, 000	Cottbus, Landsberg an der Warthe, Guben, Forst, Hildesheim, Gottingen, Lehe, Hanau, Tilsit, Stralsund, Stolp, Trier, Solingen, Rheydt, Malstett-Burbach, Neuß, Halberstadt, Mühlhausen i. Th., Weißenfels, Zeitz, Kattowitz, Ratibor, Oppeln, Schweidnitz, Wandsbek, Neumünster, Recklinghausen, Hamm, Witten a. R., Herne, Graudenz, Thorn, Düren, Nordhausen, Iserlohn, Lüdenscheid, Insterburg
-	
Bayern 30, 000-50, 000	Regensburg, Bamberg
-	
Sachsen 30, 000-50, 000	Zittau, Meißen
-	
Württemberg 30, 000-50, 000	Ulm, Heilbronn, Eßlingen

**Table A2**  
**Population, and Share of Population Lost in Thirty Years War,**  
**Of Seventeenth-Century German Cities<sup>146</sup>**

City	City Size: De Vries Coding	Population Loss During Thirty Years War: No Losses, 1-10%, 10-20%, 20-30%, 30-40%, 40-50%, Over 50%
Hamburg	50 - 99.9k	No Losses
Danzig	50 - 99.9k	No Losses
Berlin	50 - 99.9k	30-40%
Dresden	40 - 49.9k	No Losses
Konigsberg	30 - 39.9k	No Losses
Bremen	20 - 29.9k	No Losses
Lübeck	20 - 29.9k	No Losses
Frankfurt am Main	20 - 29.9k	40-50%
Leipzig	20 - 29.9k	10-20%
Magdeburg	10 - 19.9k	40-50%
Hannover	10 - 19.9k	No Losses
Mannheim	10 - 19.9k	Over 50%
Daubhausen	<10k	40-50%
Hanau	<10k	40-50%
Leonberg	<10k	Over 50%
Maulburg	<10k	20-30%
Todenhäusen	<10k	40-50%
Uckermark	<10k	10-20%
Walldorf	<10k	Over 50%
Halle	<10k	Over 50%
Weimar	<10k	0-25%
Diez	<10k	Over 50%
Hötensleben	<10k	No Losses
Mannheim	<10k	Over 50%
Marburg	<10k	50%
Eilenburg	<10k	10-20%
Meissen	<10k	No Losses
Offenbach	<10k	40-50%
Oschatz	<10k	10-20%
Rohrbach	<10k	30-40%

<sup>146</sup> Source: (de Vries 1981, 82–83)

<b>Heidelberg</b>	<10k	Over 50%
<b>Leipzig</b>	<10k	10-20%
<b>Torgau</b>	<10k	No Losses
<b>Brandenburg</b>	<10k	40-50%
<b>Burg</b>	<10k	40-50%
<b>Bützow</b>	<10k	Over 50%
<b>Calbe</b>	<10k	40-50%
<b>Halberstadt</b>	<10k	n/a
<b>Halle (an der Saale)</b>	<10k	10-20%
<b>Hamel</b>	<10k	10-20%
<b>Mecklenburg</b>	<10k	30-40%
<b>Neustadt</b>	<10k	Over 50%
<b>Prenzlau</b>	<10k	40-50%
<b>Ansbach</b>	<10k	30-40%
<b>Bayreuth</b>	<10k	30-40%
<b>Frankfurt an der Oder</b>	<10k	Over 50%
<b>Quedlinburg</b>	<10k	10-20%
<b>Weferlingen</b>	<10k	10-20%
<b>Wolfenbuettel</b>	<10k	No Losses
<b>Celle</b>	<10k	No Losses
<b>Dornholzhausen</b>	<10k	40-50%
<b>Erlangen</b>	<10k	40-50%
<b>Frankenthal</b>	<10k	Over 50%
<b>Friedrichsdorf</b>	<10k	n/a
<b>Holzappel</b>	<10k	Over 50%
<b>Homburg</b>	<10k	40-50%
<b>Karlsruhe</b>	<10k	40-50%
<b>Kassel</b>	<10k	40-50%
<b>Sieburg</b>	<10k	40-50%
<b>Stettin</b>	<10k	20-30%
<b>Lueneburg</b>	<10k	No Losses
<b>Darmstadt</b>	<10k	Over 50%
<b>Stargard</b>	<10k	Over 50%
<b>Stendal</b>	<10k	Over 50%



## REFERENCES

- “1931: One Year, Two Auto Accidents That Could Have Changed the World.” 2012. *International Churchill Society*.  
<https://winstonchurchill.org/publications/churchill-bulletin/bulletin-047-may-2012/1931-one-year-two-auto-accidents-that-could-have-changed-the-world/>  
(August 15, 2021).
- Acemoglu, Daron. 1996. “A Microfoundation for Social Increasing Returns in Human Capital Accumulation.” *The Quarterly Journal of Economics* 111(3): 779–804.
- Acemoglu, Daron, and Joshua Angrist. 2000. “How Large Are Human-Capital Externalities? Evidence from Compulsory Schooling Laws.” *NBER Macroeconomics Annual* 15: 9–59.
- Alesina, Alberto, Paola Giuliano, and Nathan Nunn. 2013. “On the Origins of Gender Roles: Women and the Plough\*.” *The Quarterly Journal of Economics* 128(2): 469–530.
- Alfani, Guido. 2017a. “The Rich in Historical Perspective: Evidence for Preindustrial Europe (ca. 1300–1800).” *Cliometrica* 11(3): 321–48.
- . 2017b. “The Top Rich in Europe in the Long Run of History (1300 to Present Day).” *VOX: CEPR Policy Portal*. <https://voxeu.org/article/europe-s-rich-1300>  
(April 3, 2020).
- Allen, Robert C. 2009. *The British Industrial Revolution in Global Perspective*. Cambridge ; New York: Cambridge University Press.
- Ames, Edward. 1947. “A Century of Russian Railroad Construction: 1837-1936.” *The American Slavic and East European Review* 6(3/4): 18.
- Anderson, Perry. 1979. *Lineages of the Absolutist State*. London: Verso.
- Aston, T. H., and C. H. E. Philpin. 1985. *The Brenner Debate: Agrarian Class Structure and Economic Development in Pre-Industrial Europe*. Cambridge [Cambridgeshire] ; New York: Cambridge University Press.
- Barbier, Frédéric. 2017. *Gutenberg’s Europe: The Book and the Invention of Western Modernity*. Cambridge, UK ; Malden, MA: Polity Press.
- Bates, Robert H., and Da-Hsiang Donald Lien. 1985. “A Note on Taxation, Development, and Representative Government.” *Politics & Society* 14(1): 53–70.

- Beck, Jan, and Andrea Sieber. 2010. "Is the Spatial Distribution of Mankind's Most Basic Economic Traits Determined by Climate and Soil Alone?" ed. Anna Dornhaus. *PLoS ONE* 5(5): e10416.
- Becker, Sascha O. et al. 2020. "Forced Migration and Human Capital: Evidence from Post-WWII Population Transfers." *American Economic Review* 110(5): 1430–63.
- Becker, Sascha O., Francesco Cinnirella, Erik Hornung, and Ludger Woessmann. 2014. "IPEHD—The Ifo Prussian Economic History Database." *Historical Methods: A Journal of Quantitative and Interdisciplinary History* 47(2): 57–66.
- Benedictow, Ole Jørgen. 2004. *The Black Death, 1346-1353: The Complete History*. Woodbridge, Suffolk, UK ; Rochester, NY: Boydell Press.
- Benson, L. D. 2000. "The Great Vowel Shift." *The Geoffrey Chaucer Page*. <http://sites.fas.harvard.edu/~chaucer/vowels.html> (February 21, 2020).
- Blaydes, Lisa, and Christopher Paik. 2019. "Muslim Trade and City Growth Before the Nineteenth Century: Comparative Urbanization in Europe, the Middle East and Central Asia." *British Journal of Political Science*: 1–24.
- Blum, Jerome. 1957. "The Rise of Serfdom in Eastern Europe." *The American Historical Review* 62(4): 807–36.
- . 1971. *Lord and Peasant in Russia: From the Ninth to the Nineteenth Century*. Princeton, N.J.: Princeton University Press. [http://nrs.harvard.edu/urn-3:hul.ebookbatch.ACLS\\_batch:20170426MIU0110000000000000000667](http://nrs.harvard.edu/urn-3:hul.ebookbatch.ACLS_batch:20170426MIU0110000000000000000667) (February 17, 2020).
- Boix, Carles. 2003. *Democracy and Redistribution*. Cambridge, UK ; New York: Cambridge University Press.
- Borodkin, Leonid, Brigitte Granville, and Carol Scott Leonard. 2008. "The Rural/Urban Wage Gap in the Industrialisation of Russia, 1884-1910." *European Review of Economic History* 12(1): 67–95.
- Braun, Guido, and Susanne Lachenicht, eds. 2007. *Hugenotten und deutsche Territorialstaaten: Immigrationspolitik und Integrationsprozesse = Les Etats allemands et les huguenots: politique d'immigration et processus d'integration*. München: Oldenbourg.
- Bueno de Mesquita, Bruce, Smith, Alastair, Siverson, Randolph M., and Morrow, James D. 2003. *The Logic of Political Survival*. Cambridge, Mass.: MIT Press.
- Burds, Jeffrey. 1998. *Peasant Dreams & Market Politics : Labor Migration and the Russian Village, 1861-1905*. Pittsburgh, Pa.: University of Pittsburgh Press.

- <http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=5868>.
- Buringh, Eltjo, and Jan Luiten Van Zanden. 2009. "Charting the 'Rise of the West': Manuscripts and Printed Books in Europe, a Long-Term Perspective from the Sixth through Eighteenth Centuries." *The Journal of Economic History* 69(2): 409–45.
- Cantoni, Davide, Jeremiah Dittmar, and Noam Yuchtman. 2018. "Religious Competition and Reallocation: The Political Economy of Secularization in the Protestant Reformation\*." *The Quarterly Journal of Economics* 133(4): 2037–96.
- Castañeda Dower, Paul, Evgeny Finkel, Scott Gehlbach, and Steven Nafziger. 2017. "Replication Data for 'Collective Action and Representation in Autocracies: Evidence from Russia's Great Reforms'" ed. *American Political Science Review*. <https://doi.org/10.7910/DVN/X7AMNO>.
- Central Statistical Committee. 1901. *Posevnye ploshchadi prinimaemye Tsentral'nym Statisticheskim Komitetom pri razrabotke urozhaev 1881, 1887 i 1893–1899 gg. po 50 guberniiam Evropeiskoi Rossii*. St. Petersburg: Vremennik TsSK MVD (Central Statistical Committee of the Ministry of Internal Affairs). Statistical Bulletin.
- Chertoff, Mariela. 2015. "Protein Malnutrition and Brain Development." *Brain Disorders & Therapy* 04(03). <https://www.omicsgroup.org/journals/protein-malnutrition-and-brain-development-2168-975X-1000171.php?aid=55936> (February 21, 2020).
- Cheung, Christina et al. 2019. "Stable Isotope and Dental Caries Data Reveal Abrupt Changes in Subsistence Economy in Ancient China in Response to Global Climate Change." *PloS one* 14(7): e0218943-.
- Cinnirella, Francesco, and Erik Hornung. 2016. "Landownership Concentration and the Expansion of Education." *Journal of development economics* 121: 135–52.
- Clark, Gregory. 2005. "The Condition of the Working Class in England, 1209–2004." *Journal of Political Economy* 113(6): 1307–40.
- . 2007. *A Farewell to Alms: A Brief Economic History of the World*. Princeton ; Oxford: Princeton University Press.
- Cohn, Samuel. 2007. "After the Black Death: Labour Legislation and Attitudes towards Labour in Late-Medieval Western Europe." *The Economic History Review* 60(3): 457–85.

- Coşgel, Metin M., Thomas J. Miceli, and Jared Rubin. 2012. "The Political Economy of Mass Printing: Legitimacy and Technological Change in the Ottoman Empire." *Journal of Comparative Economics* 40(3): 357–71.
- Creasman, Allyson F. 2012. *Censorship and Civic Order in Reformation Germany, 1517-1648: "Printed Poison & Evil Talk."* Farnham, Surrey, England: Ashgate Pub.
- Crisp, Olga. 1976. *Studies in the Russian Economy before 1914.* London: Macmillan ; the School of Slavonic and East European Studies, University of London.
- Curtin, Philip D. 1984. *Cross-Cultural Trade in World History.* Cambridge: Cambridge University Press. <https://www.cambridge.org/core/books/crosscultural-trade-in-world-history/0FD4DBE86A2B1593ACC355F9D28D8C15>.
- Dermineur, Elise, ed. 2018. *12 Women and Credit in Pre-Industrial Europe.* Turnhout, Belgium: Brepols Publishers. <https://www.brepolsonline.net/doi/book/10.1484/M.EER-EB.5.111944> (February 21, 2020).
- Deutsche Hugenotten-Gesellschaft e.V. 2021. "Das internationale und das deutsche Refuge." *Deutsche Hugenotten-Gesellschaft e.V.* <https://www.hugenotten.de/hugenotten/refuge.php> (February 2, 2021).
- Dittmar, Jeremiah. 2011. "Information Technology and Economic Change: The Impact of The Printing Press." *The Quarterly Journal of Economics* 126(3): 1133–72.
- Dittmar, Jeremiah E, and Ralf R Meisenzahl. 2019. "Public Goods Institutions, Human Capital, and Growth: Evidence from German History." *The Review of Economic Studies.* <https://academic.oup.com/restud/advance-article/doi/10.1093/restud/rdz002/5306344> (August 17, 2020).
- Dittmar, Jeremiah, and Skipper Seabold. 2020. "New Media and Competition: Printing and Europe's Transformation After Gutenberg." <https://www.jeremiahdittmar.info/research>.
- Dölemeyer, Barbara. 1997. "Die Aufnahmeprivilegien Für Hugenotten Im Europäischen Refuge." In *Das Privileg Im Europäischen Vergleich*, Ius commune. Sonderhefte ; 93, 125, Frankfurt am Main: V. Klostermann.
- . 2006. *Die Hugenotten.* Stuttgart: Kohlhammer.
- Domar, Evsey D. 1970. "The Causes of Slavery or Serfdom: A Hypothesis." *The Journal of Economic History* 30(1): 18–32.

- Dower, Paul Castañeda, Evgeny Finkel, Scott Gehlbach, and Steven Nafziger. 2018. "Collective Action and Representation in Autocracies: Evidence from Russia's Great Reforms." *American Political Science Review* 112(1): 125–47.
- Easterly, William. 2007. "Inequality Does Cause Underdevelopment: Insights from a New Instrument." *Journal of Development Economics* 84(2): 755–76.
- "Economics Focus: The Plough and the Now." 2011. *The Economist*: 74.
- Eklof, B., J. Bushnell, and L.G. Zakharova. 1994. *Russia's Great Reforms, 1855-1881*. Indiana University Press. <https://books.google.com/books?id=g0BhZY1n5SsC>.
- Eltis, David. 1995. *The Military Revolution in Sixteenth-Century Europe*. London ; New York : New York, NY: Tauris Academic Studies ; StMartin's Press distributor.
- Epstein, Stephan R. 2000. *Freedom and Growth: The Rise of States and Markets in Europe, 1300-1750*. London: Routledge.
- Ertman, Thomas. 1997. *Birth of the Leviathan: Building States and Regimes in Medieval and Early Modern Europe*. Cambridge, UK ; New York: Cambridge University Press.
- Falkus, M. E. 1966. "Russia and the International Wheat Trade, 1861-1914." *Economica* 33(132): 416.
- Falkus, Malcolm E. 1972. *The Industrialisation of Russia, 1700-1914*,. London: Macmillan.
- Falter, Jürgen W. 2020. *Hitlers Wähler: die Anhänger der NSDAP 1924-1933*. Überarbeitete und erweiterte Neuauflage. Frankfurt: Campus Verlag.
- Ferejohn, John A., and Frances McCall Rosenbluth. 2017. *Forged through Fire: War, Peace, and the Democratic Bargain*. New York: Liveright Publishing Corporation, a Division of WWNorton & Company.
- Finkel, Evgeny, Scott Gehlbach, and Dmitrii Kofanov. 2017. "(Good) Land and Freedom (for Former Serfs): Determinants of Peasant Unrest in European Russia, March-October 1917." *Slavic Review* 76(3): 710–21.
- Fischer, David Hackett. 1996. *The Great Wave: Price Revolutions and the Rhythm of History*. New York: Oxford University Press.
- Frieden, Jeffrey A. 2006. *Global Capitalism: Its Fall and Rise in the Twentieth Century*. 1st ed. New York: Norton.
- Gatrell, Peter. 1994. "The Meaning of the Great Reforms in Russian Economic History." In *Russia's Great Reforms, 1855-1881*,.

- Gingerich, Daniel W., and Jan P. Vogler. 2021. "Pandemics and Political Development: The Electoral Legacy of the Black Death in Germany." *World Politics* 73(3): 393–440.
- Gottfried, Robert. 1982. *Bury St. Edmunds and the Urban Crisis, 1290-1539*. Princeton, N.J.: Princeton University Press.
- . 1983. *The Black Death: Natural and Human Disaster in Medieval Europe*. New York: The Free Press.
- Gregory, Paul R. 1994. *Before Command: An Economic History of Russia from Emancipation to the First Five-Year Plan*. Princeton, N.J., Baltimore, Md.: Princeton University Press, Project MUSE.
- Hagen, William W. 2002. *Ordinary Prussians: Brandenburg Junkers and Villagers, 1500-1840*. Cambridge, UK ; New York, NY: Cambridge University Press.
- Hale, John R. 2009. *Lords of the Sea: The Epic Story of the Athenian Navy and the Birth of Democracy*. New York: Viking.
- Hastie, T.J., and R.J. Tibshirani. 2017. *Generalized Additive Models*. 1st ed. Routledge. <https://www.taylorfrancis.com/books/9781351445979> (August 7, 2021).
- Hellie, Richard. 1971. *Enserfment and Military Change in Muscovy*. Chicago: University of Chicago Press. [http://nrs.harvard.edu/urn-3:hul.ebookbatch.ACLS\\_batch:MIU010000000000000003602886](http://nrs.harvard.edu/urn-3:hul.ebookbatch.ACLS_batch:MIU010000000000000003602886) (April 11, 2020).
- . 1992. "The Impact of the Southern and Eastern Frontiers of Muscovy on the 'Ulozhenie' (Law Code of 1649) Compared with the Impact of the Western Frontier." *Russian History* 19(1/4): 75–95.
- Herlihy, David. 1997. *The Black Death and the Transformation of the West*. Cambridge, Mass.: Harvard University Press.
- Hicks, John. 1963. *The Theory of Wages*. [2d ed.]. London: Macmillan.
- Hilton, R. H. 1977. *Bond Men Made Free: Medieval Peasant Movements and the English Rising of 1381*. London ; New York: Methuen.
- Hintze, Otto. 1906. *Staatsverfassung und Heeresverfassung. Vortrag gehalten in der Gehe-stiftung zu Dresden am 17. Februar 1906*. Dresden: Zahn & Jaensch. <http://nrs.harvard.edu/urn-3:HUL.FIG:005184019> (March 15, 2020).
- Hoffman, Philip T. 2015. *Why Did Europe Conquer the World?* Princeton: Princeton University Press.

- Hornung, Erik. 2014. "Immigration and the Diffusion of Technology: The Huguenot Diaspora in Prussia." *American Economic Review* 104(1): 84–122.
- Iversen, Torben, and David W. Soskice. 2019. *Democracy and Prosperity: Reinventing Capitalism through a Turbulent Century*. Princeton, New Jersey: Princeton University Press.
- Jones, A. H. M. 1953. "Inflation under the Roman Empire." *The Economic History Review* 5(3): 293–318.
- Jordà, Òscar, Sanjay R. Singh, and Alan M. Taylor. 2020. "Longer-Run Economic Consequences of Pandemics." Washington, D.C. Working Paper NBER 26934. <http://www.nber.org/papers/w26934.ack> (April 19, 2020).
- Juma, Calestous. 2019. *Innovation and Its Enemies: Why People Resist New Technologies*. paper. Oxford and New York: Oxford University Press.
- Kaak, Heinrich. 1991. *Die Gutsherrschaft: theoriegeschichtliche Untersuchungen zum Agrarwesen im ostelbischen Raum*. Berlin ; New York: Walter de Gruyter.
- Keynes, John Maynard. 1920. *The Economic Consequences of the Peace*. New York: Harcourt, Brace, and Howe. <https://oll.libertyfund.org/titles/303>.
- . 1936. *The General Theory of Employment, Interest and Money*. New York: Harcourt, Brace.
- King, Gary, Ori Rosen, Martin Tanner, and Alexander F. Wagner. 2008. "Ordinary Economic Voting Behavior in the Extraordinary Election of Adolf Hitler." *The Journal of Economic History* 68(4): 951–96.
- Klingebiel, Thomas. 1990. "Aspekte zur Ansiedlung von Hugenotten in den norddeutschen Territorien." In *Die Hugenotten und das Refuge: Deutschland und Europa: Beiträge zu einer Tagung*, Berlin: Colloquium Verlag, 67–80. <https://hdl.handle.net/2027/mdp.39015019844185>.
- Kopsidis, Michael, Katja Bruisch, and Daniel W. Bromley. 2015. "Where Is the Backward Russian Peasant? Evidence against the Superiority of Private Farming, 1883–1913." *The Journal of Peasant Studies* 42(2): 425–47.
- Kronmal, Richard A. 1993. "Spurious Correlation and the Fallacy of the Ratio Standard Revisited." *Journal of the Royal Statistical Society. Series A (Statistics in Society)* 156(3): 379–92.
- Landes, David S. 1983. *Revolution in Time: Clocks and the Making of the Modern World*. Cambridge, Mass.: Belknap Press of Harvard University Press.

- Lienhard, John. 1988. "The Black Death." *Engines of our Ingenuity*.  
<https://uh.edu/engines/epi123.htm> (February 21, 2020).
- Lippmann, Walter. 1922. *Public Opinion*. New York: Harcourt, Brace and Company.
- Markevich, Andrei, and Ekaterina Zhuravskaya. 2018. "The Economic Effects of the Abolition of Serfdom: Evidence from the Russian Empire." *American Economic Review* 108(4–5): 1074–1117.
- Martin, Henri Jean. 1984. *Livre, pouvoirs et société à Paris au XVIIe siècle: (1598-1701)*. Réimpression de l'édition de Genève, 1969. Genève: Droz.
- Matranga, Andrea, and Timur Natkhov. 2019. "All Along the Watchtower: Defense Lines and the Origins of Russian Serfdom." Presented at the Economic History and Historical Political Economy of Russia (Мэдисон, Moscow).  
<https://www.hse.ru/en/staff/natkhov#sci> (July 11, 2020).
- McElroy, Brendan. 2020. "Peasants and Parliaments: Agrarian Reform in Eighteenth Century Europe." Ph.D. dissertation. Harvard.
- Middell, Katharina. 2007. "Hugenotten in Kursachsen. Einwanderung und Integration." In *Hugenotten und deutsche Territorialstaaten: Immigrationspolitik und Integrationsprozesse*, Pariser historische Studien, Munich: Oldenbourg, 51–70.
- Mironov, Boris Nikolaevich. 2012. *The Standard of Living and Revolutions in Russia, 1700-1917*. Oxon [England]: Routledge.
- Moon, David. 1999. *The Russian Peasantry, 1600-1930: The World the Peasants Made*. London ; New York: Longman.
- Neal, Larry. 2000. "A Shocking View of Economic History." *The Journal of Economic History* 60(2): 317–34.
- Neal, Larry, and Rondo E. Cameron. 2016. *A Concise Economic History of the World: From Paleolithic Times to the Present*. Fifth edition. New York: Oxford University Press.
- Nordhaus, William. 2004. *Schumpeterian Profits in the American Economy: Theory and Measurement*. Cambridge, MA: National Bureau of Economic Research.  
<http://www.nber.org/papers/w10433.pdf> (July 10, 2020).
- North, Douglass C., and Robert Paul Thomas. 1973. *The Rise of the Western World; a New Economic History*. Cambridge [Eng.: University Press.
- Nunn, Nathan, and Leonard Wantchekon. 2011. "The Slave Trade and the Origins of Mistrust in Africa." *American Economic Review* 101(7): 3221–52.



- Onorato, Massimiliano, Kenneth Scheve, and David Stasavage. 2014. "Technology and the Era of the Mass Army." *The Journal of Economic History* 74(2): 449–81.
- O'Rourke, Kevin H., and Jeffrey G. Williamson. 1999. *Globalization and History: The Evolution of a Nineteenth-Century Atlantic Economy*. Cambridge, Mass.: MIT Press.
- Ottinger, Sebastian, and Nico Voigtländer. 2020. *History's Masters: The Effect of European Monarchs on State Performance*. Cambridge, MA: National Bureau of Economic Research. <http://www.nber.org/papers/w28297.pdf> (August 15, 2021).
- Overty, Joanne Filippone. 2008. "The Cost of Doing Scribal Business: Prices of Manuscript Books in England, 1300–1483." *Book History* 11(1): 1–32.
- Pamuk, S. 2007. "The Black Death and the Origins of the 'Great Divergence' across Europe, 1300-1600." *European Review of Economic History* 11(3): 289–317.
- Parker, Geoffrey. 1996. *The Military Revolution: Military Innovation and the Rise of the West, 1500-1800*. 2nd ed. New York: Cambridge University Press.
- Pettegree, Andrew. 2010. *The Book in the Renaissance*. New Haven: Yale University Press.
- Prestwich, Menna. 1988. "The Revocation of the Edict of Nantes." *History* 73: 63–73.
- Rasmussen, Carsten Porskrog. 2010. "Innovative Feudalism. The Development of Dairy Farming and 'Koppelwirtschaft' on Manors in Schleswig-Holstein in the Seventeenth and Eighteenth Centuries." *The Agricultural History Review* 58(2): 172–90.
- Raster, Tom. 2019. "Serfs and the Market: Second Serfdom and the East-West Goods Exchange, 1579-1857." MA thesis. Paris School of Economics. <https://sites.google.com/view/tom-raster/home> (April 18, 2020).
- Reichman, Henry. 1987. *Railwaymen and Revolution: Russia, 1905*. Berkeley: University of California Press.
- Rosenberg, Hans. 1943. "THE RISE OF THE JUNKERS IN BRANDENBURG-PRUSSIA, 1410-1653: (Part I)." *The American Historical Review* 49: 1–22.
- . 1944. "The Rise of the Junkers in Brandenburg-Prussia, 1410-1563: Part II." *The American Historical Review* 49(2): 228–42.
- Rubin, Jared. 2014. "Printing and Protestants: An Empirical Test of the Role of Printing in the Reformation." *The Review of Economics and Statistics* 96(2): 270–86.

- Russell, Josiah C. 1976. "Population in Europe 500-1500." In *The Middle Ages*, Ed. Carlos Cipolla; Chap. 1, Fontana Economic History of Europe, Brighton, England, and New York: Harvester Press and Barnes & Noble.
- Sasaki, Yu. 2017. "Publishing Nations: Technology Acquisition and Language Standardization for European Ethnic Groups." *The Journal of Economic History* 77(4): 1007–47.
- Scheidel, Walter. 2017. *The Great Leveler: Violence and the History of Inequality from the Stone Age to the Twenty-First Century*. Princeton, New Jersey: Princeton University Press.
- Schmidt, Georg. 2003. *Der Dreissigjährige Krieg*. 6. Aufl. München: Beck.
- Scott, Hamish, and Edgar Melton. 2015. "The Agrarian East." In *The Oxford Handbook of Early Modern European History, 1350-1750*, ed. Hamish Scott. Oxford University Press.  
<http://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199597253.001.0001/oxfordhb-9780199597253-e-16> (May 4, 2020).
- Scoville, Warren. 1952a. "The Huguenots and the Diffusion of Technology, I." *The Journal of Political Economy* 60: 294.
- . 1952b. "The Huguenots and the Diffusion of Technology. II." *The Journal of Political Economy* 60: 392.
- . 1953. "The Huguenots in the French Economy, 1650-1750." *Quarterly journal of economics* 67(3): 423–44.
- Scullard, H. H. (Howard Hayes). 1970. *From the Gracchi to Nero: A History of Rome from 133 B.C. to A.D. 68*. 3rd ed. London : New York: Methuen.
- Seckendorff, Veit Ludwig von. 1711. *Herrn Veit Ludwigs von Seckendorff. Teutscher fürstenstaat, mit einer gantz neuen zugabe ... um ein grosses theil verm.* Franckfurt und Leipzig: J. Meyers wittive.  
[https://go.gale.com/ps/retrieve.do?tabID=Monographs&resultListType=RESULT\\_LIST&searchResultsType=SingleTab&hitCount=87&searchType=BasicSearchForm&currentPosition=1&docId=GALE%7CU0110690182&docType=Monograph&sort=Relevance&contentSegment=ZMMC&prodId=MOME&pageNum=1&contentSet=GALE%7CU0110690182&searchId=R2&userGroupName=uclosangeles&inPS=true](https://go.gale.com/ps/retrieve.do?tabID=Monographs&resultListType=RESULT_LIST&searchResultsType=SingleTab&hitCount=87&searchType=BasicSearchForm&currentPosition=1&docId=GALE%7CU0110690182&docType=Monograph&sort=Relevance&contentSegment=ZMMC&prodId=MOME&pageNum=1&contentSet=GALE%7CU0110690182&searchId=R2&userGroupName=uclosangeles&inPS=true) (August 25, 2021).
- Sinha, Pranay et al. 2019. "Undernutrition and Tuberculosis: Public Health Implications." *The Journal of Infectious Diseases* 219(9): 1356–63.

Smith, Roger C. 1993. *Vanguard of Empire: Ships of Exploration in the Age of Columbus*. New York: Oxford University Press.

Soll, Jacob. 2009. *The Information Master: Jean-Baptiste Colbert's Secret State Intelligence System*. Ann Arbor: University of Michigan Press.  
[http://nrs.harvard.edu/urn-3:hul.ebookbatch.PMUSE\\_batch:muse9780472025268](http://nrs.harvard.edu/urn-3:hul.ebookbatch.PMUSE_batch:muse9780472025268) (February 24, 2021).

Statistisches Reichsamt. 1916. 1915 *Statistisches Jahrbuch für das Deutsche Reich*. Berlin: Puttkammer & Mühlbrecht.  
[http://www.digizeitschriften.de/dms/resolveppn/?PID=PPN514401303\\_1915](http://www.digizeitschriften.de/dms/resolveppn/?PID=PPN514401303_1915) (December 3, 2020).

———. 1921. 1920 *Statistisches Jahrbuch für das Deutsche Reich*. Berlin: Puttkammer & Mühlbrecht.  
[http://www.digizeitschriften.de/dms/resolveppn/?PID=PPN514401303\\_1920](http://www.digizeitschriften.de/dms/resolveppn/?PID=PPN514401303_1920) (December 3, 2020).

Tilly, Charles. 1990. *Coercion, Capital, and European States, AD 990-1990*. Oxford, UK : Cambridge, Mass., USA: BBlackwell.

Tollin, Henri. 1886. *Geschichte der französischen Colonie von Magdeburg: Jubiläumsschrift*. Halle: Niemeyer. <http://nrs.harvard.edu/urn-3:HUL.FIG:003695625> (January 21, 2021).

Tooze, J. Adam. 2008. *The Wages of Destruction: The Making and Breaking of the Nazi Economy*. New York: Penguin Books.

Voigtländer, Nico, and Hans-Joachim Voth. 2013. "How the West 'Invented' Fertility Restriction." *The American Economic Review* 103(6): 2227–64.

de Vries, Jan. 1981. "Patterns of Urbanisation in Pre-Industrial Europe, 1500-1800." In *Patterns of European Urbanisation Since 1500*, London: Croom Helm, 79–109.

Wahl, Fabian. 2016. "Participative Political Institutions in Pre-Modern Europe: Introducing a New Database." *Historical Methods: A Journal of Quantitative and Interdisciplinary History* 49(2): 67–79.

Walker, Mack. 1971. *German Home Towns: Community, State, and General Estate, 1648–1871*. Ithaca, Baltimore, Md.: Cornell University Press, Project MUSE.

Weir, Margaret, and Theda Skocpol. 1985. "State Structures and the Possibilities for 'Keynesian' Responses to the Great Depression in Sweden, Britain, and the United States." In *Bringing the State Back In*, eds. Dietrich Rueschemeyer, Peter B. Evans, and Theda Skocpol. Cambridge: Cambridge University Press, 107–64.  
<https://www.cambridge.org/core/books/bringing-the-state-back-in/state->

structures-and-the-possibilities-for-keynesian-responses-to-the-great-depression-in-sweden-britain-and-the-united-states/5BA18E8034F5D81DF757F81D6AB9950E.

Westwood, J. N. 1964. *A History of Russian Railways*. London: G. Allen and Unwin.

White, Lynn. 1962. *Medieval Technology and Social Change*. Oxford: Clarendon Press.

Williams, Eric Eustace. 1944. *Capitalism & Slavery*. Chapel Hill: Univof North Carolina Press.

Yue, Ricci P. H., Harry F. Lee, and Connor Y. H. Wu. 2017. "Trade Routes and Plague Transmission in Pre-Industrial Europe." *Scientific Reports* 7(1): 12973.

Zechini, Mariana. 2017. "Beneath Berlin: Interpreting Dietary Responses to the Black Death in Medieval Berlin Using Stable Isotope Analysis." M.A. thesis. University of West Florida.  
[https://www.academia.edu/36521549/BENEATH\\_BERLIN\\_INTERPRETING\\_DIETARY\\_RESPONSES\\_TO\\_THE\\_BLACK\\_DEATH\\_IN\\_MEDIEVAL\\_BERLIN\\_USING\\_STABLE\\_ISOTOPE\\_ANALYSIS](https://www.academia.edu/36521549/BENEATH_BERLIN_INTERPRETING_DIETARY_RESPONSES_TO_THE_BLACK_DEATH_IN_MEDIEVAL_BERLIN_USING_STABLE_ISOTOPE_ANALYSIS) (August 1, 2021).

Zimmer, Ben. 2010. "On Language: Ghoti." *New York Times Magazine*, June 25: 14.

Zipf, George Kingsley. 1949. *Human Behavior and the Principle of Least Effort; an Introduction to Human Ecology*. Cambridge, Mass.: Addison-Wesley Press.