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RELIGIOUS COMPETITION AND REALLOCATION:  
THE POLITICAL ECONOMY OF SECULARIZATION IN THE PROTESTANT REFORMATION

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Religious Competition and Reallocation: The Political Economy of Secularization in the Protestant Reformation

Davide Cantoni, Jeremiah Dittmar, and Noam Yuchtman

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**ABSTRACT**

Using novel microdata, we document an unintended, first-order consequence of the Protestant Reformation: a massive reallocation of resources from religious to secular purposes. To understand this process, we propose a conceptual framework in which the introduction of religious competition shifts political markets where religious authorities provide legitimacy to rulers in exchange for control over resources. Consistent with our framework, religious competition changed the balance of power between secular and religious elites: secular authorities acquired enormous amounts of wealth from monasteries closed during the Reformation, particularly in Protestant regions. This transfer of resources had important consequences. First, it shifted the allocation of upper-tail human capital. Graduates of Protestant universities increasingly took secular, especially administrative, occupations. Protestant university students increasingly studied secular subjects, especially degrees that prepared students for public sector jobs, rather than church sector-specific theology. Second, it affected the sectoral composition of fixed investment. Particularly in Protestant regions, new construction shifted from religious toward secular purposes, especially the building of palaces and administrative buildings, which reflected the increased wealth and power of secular lords. Reallocation was not driven by preexisting economic or cultural differences. Our findings indicate that the Reformation played an important causal role in the secularization of the West.

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# 1 Introduction

How does religious competition influence the allocation of resources between religious and secular uses? In this paper, we study the paradigmatic case of the Protestant Reformation: the moment when the most powerful institution in Western Europe—the Catholic Church—experienced a profound competitive shock. We document how the introduction of religious competition during the Reformation transformed the European economy, sharply shifting the allocation of resources from religious to secular uses. We argue that the interaction between religious competition and politics was critical to this process.

Prior research on religious competition focuses on the relationship between producers and consumers of religion in a market for salvation (Iannaccone, 1998; Ekelund et al., 2006; Iyer, 2016). We argue that the introduction of religious competition crucially affects a second market—in which state authorities secure political legitimacy from religious elites (Rubin, 2017). Introducing this missing market generates novel hypotheses. First, competition should induce resource reallocation away from the church sector and towards secular uses. Second, competition should drive resource reallocation towards uses specifically favored by secular rulers. We examine rich microdata on the allocation of resources in early modern Germany, and find evidence supporting both hypotheses.<sup>1</sup> While the Reformation was a religious movement, we find that its unintended consequence was to promote economic secularization: a significant shift in the balance of power toward secular authorities, and a sharp and immediate reallocation of resources toward secular purposes.

We present a conceptual framework that captures a core feature of religion in history: the role of religion in legitimizing political elites (Weber, 1978; North et al., 2009). Within our framework, the pre-Reformation era can be understood as an equilibrium in which a monopolist religious producer (the Catholic Church) provided political legitimacy to secular authorities at a high price—charged in the form of control over resources, tax exemptions, and some degree of political power.<sup>2</sup> The Reformation represented a competitive shock in the market for salvation, as studied by Ekelund et al. (2006): Protestant reformers offered a popular, lower-cost alternative to the Catholic Church. Crucially, this shock to the market for salvation also impacted the market for political legitimacy. During the Reformation, the value of Catholic legitimacy fell and the bargaining power of secular rulers *vis-à-vis* religious elites rose. Protestant reformers' need to strike a bargain with secular lords meant that they would accept a lower price in exchange for conferring legitimacy. Where Protestants were willing to grant secular authorities extensive control of church resources, the need to maintain doctrinal consistency restricted the bargains Catholics could offer.

The posited new equilibrium in the market for legitimacy has implications for the allocation of

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<sup>1</sup>We use “Germany” as a short-hand to refer to the German-speaking lands of the Holy Roman Empire.

<sup>2</sup>Even before the Reformation, rulers in early modern Europe were arguably less reliant on political legitimation by religious authorities than rulers in, for example, the Islamic world or in earlier periods in Europe history (Rubin, 2017). We discuss the pre-Reformation equilibrium in the market for legitimacy in further detail below.

resources between secular and religious uses. Increased labor demand by enriched and empowered rulers, and the decline in clerical services required for salvation in Protestant theology, will reduce church-sector labor demand relative to the secular sector. As a consequence, returns to investments in human capital specific to church careers will fall and forward-looking students will shift their human capital investments accordingly. Shifts in resources toward secular authorities will also be reflected in fixed investments, such as large scale urban construction, which embody a full set of factors of production. The new equilibrium will also have implications for the allocation of resources *within* the secular sector: specifically, resources will shift toward uses that reflect the enhanced bargaining power of secular rulers.

We begin to evaluate these hypotheses by documenting the new equilibrium in the market for political legitimacy in the years after 1517, when Martin Luther posted his famous 95 Theses. As indicators of the shifting bargain between secular and religious authorities, we examine the expropriation of monasteries and wealth transfers from the Catholic Church to secular lords. Qualitative and quantitative evidence show sharp reallocations toward secular control of resources—not just a transfer from Catholic church uses to Protestant ones. Transfers of resources from the control of church elites to secular lords occurred in both Catholic and Protestant territories, but were particularly pronounced in the latter.

We then directly test the implications of our framework for resource allocation using rich microdata. We assemble new, highly disaggregated data on the degrees received by, and occupational outcomes of, German university graduates, and on construction events at the town-by-year level, across over 2,000 German towns. We distinguish between religious and secular human capital investments, occupations, and fixed capital investments. Specifically, we assign to the religious sector the study of theology; taking a position as a monk, priest, etc.; and the construction of a church. We assign to the secular sector, non-theological degrees; occupations in public administration and the private sector; and the construction of a palace, hospital, or merchant hall.<sup>3</sup> Our data also allow us to test for shifts within the secular sector between uses favored by state authorities and other private uses.

To study the market for highly skilled labor, we examine individual-level data on the career choices of university graduates before and during the Reformation.<sup>4</sup> We show that during the Reformation, graduates from Protestant universities shifted toward secular occupations, and away from religious ones (e.g., becoming city councillors or guild masters, rather than priests or monks).<sup>5</sup> We find no pre-Reformation differences in occupational choice trends between univer-

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<sup>3</sup>Our classification of religious and secular sectors of the economy includes some areas of ambiguity: for example, hospitals were funded and staffed by both religious and secular agents. We discuss the implications of such ambiguity further below.

<sup>4</sup>The important roles played by human capital elites in European history have been explored by Mokyr (2009); Cantoni and Yuchtman (2014); Squicciarini and Voigtländer (2015); Dittmar and Meisenzahl (2016). We build on their work by discussing a specific source of variation in university students' selection into fields of study and careers.

<sup>5</sup>Particularly in light of Protestant attacks on Catholic Church corruption, this result calls to mind of work by Murphy et al. (1991), who study the allocation of talent between a rent-seeking and productive sector. We focus here on

sities that would become Protestant and those that would remain Catholic. Our results reflect the transmission of the shock to the market for religion into causal effects on the labor market.<sup>6</sup> Reflecting the new political economy equilibrium, we specifically find an increase in administrative jobs among graduates from Protestant universities.

A second implication of the new equilibrium is the allocation of forward-looking students' human capital investments away from church-specific degrees, toward secular ones. Indeed, we find that immediately after the start of the Reformation, individuals at Protestant universities reallocated their human capital investments away from theology degrees, and toward the study of more general, secular subjects.<sup>7</sup> The data are consistent with the Reformation playing a causal role in driving educational choices: we do not observe pre-Reformation declines in the study of theology or pre-Reformation differences in degrees granted between universities that would become Protestant and those that would remain Catholic. We additionally find significant shifts towards degrees in law and arts, subjects that differentially prepared students for careers in public administration.

We finally consider a third measure of resource allocation: major construction events as summary statistics for the allocation of bundles of resources, embodying land, physical, financial, and human capital. During the Reformation new construction events shifted from religious purposes toward secular ones (e.g., from churches to administrative buildings and lords' palaces). Figure 1, panel A, shows a striking pivot from church sector construction to secular sector construction precisely at the time of the Reformation. This sectoral reallocation away from church uses occurred differentially more in Protestant territories, as we document below. Again, the evidence is consistent with the Reformation playing a causal role: we find no evidence of a pre-Reformation shift toward secular construction, or of differential pre-Reformation trends in construction between Catholic and Protestant territories. Consistent with our conceptual framework, Figure 1, panel B, shows that within the category of secular construction, there was a sharp pivot precisely toward the uses favored by empowered secular lords: the construction of palaces and administrative buildings.

The disaggregated nature of our construction data allows us to test an additional hypothesis: to the extent that the resource reallocation we observe was ultimately driven by religious competition, one would expect to observe larger differences in construction between Protestant regions and Catholic regions far from Protestant lands—the latter being exposed to less religious competition than Catholic lands on a Protestant border (Ekelund et al., 2006 emphasize the importance of such spatial variation in religious competition). Indeed, we find a larger shift toward secular

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documenting the reallocation of resources across sectors, leaving the study of efficiency or productivity consequences to future work.

<sup>6</sup>Note that the causal effect of the Reformation on occupational choice reflects both changes in labor supply and changes in labor demand.

<sup>7</sup>See Altonji et al. (2012) for a contemporary analysis of how students' college major choices are affected by expectations of future labor market outcomes.

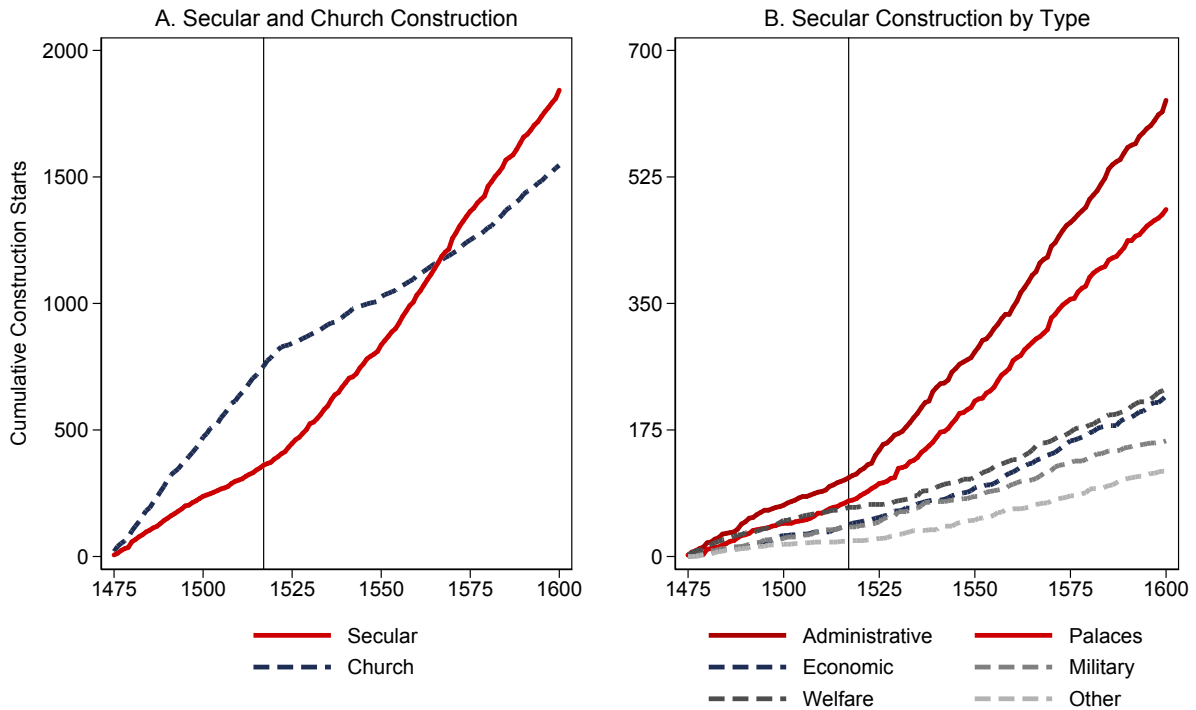


Figure 1: Construction Activity Around the Time of the Reformation

Cumulative construction events by sector and sub-sector, over time. Left-hand panel shows the cumulative number of new construction events in the religious and secular sectors in Germany. Right-hand panel disaggregates the secular sector construction events into mutually exclusive and exhaustive sub-sectors. The “Administrative” sub-sector includes courts, town halls, and customs houses. The “Economic” sub-sector comprises private sector construction, such as mills, restaurants, and breweries. The “Welfare” sub-sector includes schools and hospitals. The “Palaces” sub-sector includes castles and hunting lodges. The “Military” sub-sector includes barracks and arsenals. Town-level construction data come from the *Deutsches Städtebuch* and are aggregated for all of Germany. Vertical line marks 1517, when Martin Luther circulated his 95 Theses.

construction in comparing Protestant regions to Catholic regions far from a Protestant border than in a comparison with Catholic regions close to a Protestant border.

Our construction data also allow us to rule out competing explanations for our findings. One alternative to our proposed political economy mechanism is that what appears to be secularization is a mere relabeling of activities that were simply transferred from Catholic Church jurisdiction to Protestant secular lords. For example, historical construction supporting social service provision is difficult to assign definitively to the religious or secular sectors. However, when we disaggregate secular construction into finer categories, we do not observe a shift in construction for potentially ambiguous social service provision during the Reformation; we see a shift in unambiguously secular construction (lords' palaces and administrative buildings, as suggested by Figure 1, panel B). Another alternative is that the apparent secularization reflects the transfer of spending commitments to religious warfare conducted by secular authorities. However, in our analysis of finer categories of secular construction, we observe no shift in military construction through 1600.

In assessing whether the Reformation played a *causal* role in driving sectoral reallocation one first worries about unobserved differences between eventually-Protestant and Catholic territories and universities. However, it is unlikely that territory- or university-specific unobservables explain our findings: territories and universities that would become Protestant exhibit *no* significant differences in human and physical capital investment trends prior to the Reformation.<sup>8</sup>

Another natural concern is that time-varying and territory-specific unobservables may have driven both the adoption of Protestantism and the reallocation of resources toward secular purposes. A large literature documents a wave of urban support for the Reformation and that cities were key locations where reformist ideas and constituencies developed (Ozment, 1975; Hamm, 1994). One might wonder whether cities at the leading edge of the Reformation drive our findings. However, we find virtually identical results when we limit our analysis to small towns. Another possibility is that changes in economic conditions drove both the adoption of Protestantism and secularization. To explore this possibility, we examine a set of territories where the *timing* of adoption was plausibly exogenous—due to unanticipated changes in rulers. We find that within these territories, where the timing of religious change was independent of underlying economic conditions, the same pattern of reallocation ensues.

Our findings provide new empirical evidence on the links among the Reformation, secularization, and economic change. Ekelund et al. (2006) link the Reformation to growth via secularization, focusing on the market for salvation and arguing that the Reformation shifted resources from the Catholic Church directly to the private sector in the 16th century. Rubin (2017) suggests another crucial dimension, arguing that the Reformation was associated with the emergence of a more

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<sup>8</sup>The question of why particular territorial lords adopted the Protestant religion is an important one, addressed in Cantoni (2012), Rubin (2014), and Curuk and Smulders (2016). Our findings of parallel pre-Reformation trends in monastery closures, occupational choices, human capital investments, and construction activity, discussed below, suggest that the sources of variation in adoption were generally not associated with our outcomes of interest prior to the Reformation.

secular political economy, particularly in Protestant regions. He specifically highlights the historic association between secularization and growth, contrasting Europe with the Islamic world (see also Chaney, 2008 and Kuran, 2011). Our work conceptually synthesizes Ekelund et al. (2006) and Rubin (2017) and quantitatively tests hypotheses from the resulting framework. Supporting both Ekelund et al. (2006) and Rubin (2017), we provide the first quantitative empirical evidence identifying the Reformation as playing a causal role in the emergence of a more secular society in Protestant Europe. Our finding that the Reformation in fact shifted resources to the *state* (i.e., territorial lords) underscores the interaction of religion and politics, as suggested by our conceptual framework and by Rubin (2017). It suggests a different (perhaps complementary) path leading from the Reformation to growth from that emphasized by Ekelund et al. (2006).<sup>9</sup>

More broadly, previous research has considered the *long-run* effects of the Reformation on the European economy through its influence on culture (Weber, 1904/05), education (Becker and Woessmann, 2009), and politics (Rubin, 2017).<sup>10</sup> Up to now, there has been little empirical work documenting the Reformation’s economic consequences prior the 19th century.<sup>11</sup> We shed light on the path from the Reformation to long-run economic change, identifying the causal impact of the Reformation on the emergence of a more secular society in Europe, and in Protestant Europe in particular. The process of economic secularization that we document can be seen as having two components: first, the strengthening of territorial lords—promoting institutional secularization—and second, a reallocation of economic inputs toward secular purposes, specifically those favored by territorial lords—reflecting allocational secularization.<sup>12</sup> Both components played an important role in producing a modern, secular West (Durkheim, 1893; Mills, 1959; Saint-Simon, 1975) and also—very early by global standards—produced conditions that have been linked by scholars to modern economic growth (Weber, 1904/05; Kuran, 2011; Rubin, 2017).<sup>13</sup>

Our findings also provide empirical evidence allowing us to contribute to classic debates in social science. In perhaps the most famous social science work on the Reformation, Max Weber argued that religious reform shaped economic behavior and thus contributed to the rise of capitalism.<sup>14</sup> Subsequent research has tested for a causal effect of Protestantism on economic growth,

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<sup>9</sup>To be clear, while we do not observe reallocation of resources toward private secular purposes, the introduction of religious competition may have stimulated private sector economic activity along margins other than those we study.

<sup>10</sup>This literature is itself closely related to a larger literature on the economic consequences of religion and culture (e.g., Barro and McCleary, 2003; McCleary and Barro, 2006; Guiso et al., 2006; Nunn, 2009; Kuran, 2011; Alesina and Giuliano, 2015).

<sup>11</sup>This gap in the literature has been noted by Becker et al. (2016). Dittmar and Meisenzahl (2016) provide evidence on both long- and short-run consequences of the Reformation operating through changes in city-level institutions that varied across Protestant cities, highlighting within-Protestant differences, as opposed to territory-level differences in religion we study here.

<sup>12</sup>Our findings on resource reallocation in response to a shock to the religious sector complement a large contemporary literature on sectoral shocks and the allocation of economic inputs, particularly labor (e.g., Davis and Haltiwanger, 2001; Autor et al., 2016; Charles et al., 2016a,b).

<sup>13</sup>Surprisingly little evidence exists establishing a direct link from the Reformation to secularization, with many scholars arguing for the importance of intermediate factors such as industrialization, social conflict, or nationalism (e.g., McLeod, 1981; Norris and Inglehart, 2004; Martin, 2005; Becker and Woessmann, 2013; Becker et al., 2017).

<sup>14</sup>To be fair, this is a simplification of the “Weberian” argument. In the original, Weber’s focus is specifically on



finding mixed results (Becker and Woessmann, 2009; Cantoni, 2015; Dittmar and Meisenzahl, 2016). Our evidence suggests a causal effect of the Reformation on economic activity—as suggested by the stylized Weberian view—but along a very different margin, and working through a different mechanism from that which is traditionally emphasized.

Tawney (1926) provides the classic response to Weber, emphasizing prior socioeconomic changes that drove the Reformation. The rich data we assemble on the allocation of resources before and after the Reformation allow us to observe patterns of economic activity that might have foreshadowed the Reformation. In data on human capital and fixed investments, we do not observe any trends towards secularization prior to the Reformation. In occupational choice we do observe overall trends away from church employment, though we do not observe any differential pre-trends towards secularization in regions that would adopt Protestantism. This suggests that the post-Reformation resource reallocation we observe was not previously in motion, and was not inevitable.

Yet, initial conditions were critical to the process that we document. First, prior to the Reformation, European society was already characterized by important forms of secularization—including the separation of secular and religious power that is central to the political market that we emphasize in our conceptual framework. Second, growing commerce and economic change framed the religious critiques of the reformers themselves: Catholic Church corruption was attacked precisely in the commodification and marketization of salvation, as exemplified by Luther’s critique of the sale indulgences. Indeed, our conceptual framework highlights the conflict between lords and the Catholic Church that plays an important role in Tawney’s thinking about the underlying causes of the Reformation. We thus emphasize that we identify a causal role for the Reformation on the allocation of resources, but we do not rule out economic factors driving the Reformation.<sup>15</sup>

In what follows, we first, in Section 2, present a historical overview of the Reformation viewed through a framework linking religion to Europe’s political economy and the allocation of resources. In Section 3, we describe the datasets that we constructed to study the Reformation’s economic consequences and document the reallocation of resources between the religious and secular sectors and across uses within the secular sector. In Section 4 we offer concluding thoughts.

## **2 Religious competition: conceptual framework and historical evidence**

We model the Reformation as a competitive shock to the Catholic Church, which had been a monopolist producer of salvation for believers and the sole source of religiously-derived political legitimacy for secular rulers in Western Europe for hundreds of years. In this section, we first present our informal model of religious competition in Western Europe. We then discuss the

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Calvinism and does not exclude reverse causality, i.e. economic factors shaping religious change (Weber, 1904/05).

<sup>15</sup>Tawney’s (1926) analysis receives further support in our finding of unintended secularization produced by a religious movement; he writes that the Reformation’s political economy consequences were “without design, and against the intention of most reformers” (Tawney, 1926, p. 88).

pre-Reformation equilibrium. Next, we describe the Reformation as a shock to competition and discuss the post-Reformation equilibrium, providing historical evidence on the changed bargain between secular and religious elites. Finally, we discuss the implications of the new equilibrium for the allocation of resources in Europe, laying out the hypotheses that we test in our empirical analysis below.

## 2.1 Overview

Much prior work on the economics of religion has considered churches as producers and believers as the consumers of salvation and perhaps other “club goods” (e.g. Ekelund et al., 2006). Believers pay a price, comprising financial, time, and other costs. This approach to the analysis of religious service provision provides a powerful lens through which to view religious monopoly and the entry of a competitor. A monopolist church will charge a price above marginal cost, as would any monopolist service provider, and a perfectly price-discriminating monopolist will extract all of the surplus in the market. Entry by a competitor will reduce prices in the market for salvation, leaving consumers better off.

To understand the economy-wide effects of the introduction of religious competition, we believe that a model must also incorporate a second market: one in which secular authorities pay a price to churches in exchange for political legitimacy, in the form of the church’s endorsement of a ruler. The price paid by the secular lord for the church’s endorsement is typically the lord’s own endorsement and protection of the church’s theology, as well as some set of temporal concessions: money, land, economic privileges, and political power. The bargains struck in this market for political legitimacy have been critical to the organization of human societies for millennia, but have been relatively understudied by economists (see Chaney, 2013, and Rubin, 2017, for important exceptions).

Entry of a competitor in a monopolistic religious environment will affect both markets. First, the entrant will charge a lower price than the incumbent in the market for salvation. The incumbent will lower its price of salvation as well, but will be constrained in changing the price too much: changes in price typically amount to a change in doctrine, which is extremely costly for a religion’s legitimacy. Thus, the prices in the market for salvation will fall, particularly for believers purchasing salvation from the entrant. The market for legitimacy will in turn be affected through three channels. The entrant will reduce the ability of the incumbent church to confer legitimacy by questioning its theology. The attraction of believers to the entrant religion will also reduce the value of legitimacy conferred by the incumbent. Finally, the ability to bargain with two providers of religiously-derived political legitimacy will allow secular rulers to bargain down the price paid to either entrant or incumbent. Thus, entry will unambiguously reduce the price paid by secular lords to religious authorities.

Our model delivers predictions that are not a feature of existing models that emphasize the market for salvation. By focusing on the political market, our model additionally predicts a shift

in the bargain between secular and church elites. This shift—the lower price in the market for church-derived political legitimacy—could have first order economic consequences, as we discuss below.

## 2.2 Before the Reformation: the Catholic religious monopoly in Western Europe

At the start of the 16th century, just prior to the Reformation, the Catholic Church enjoyed a virtual monopoly in the market for religion in Western Europe and extraordinary wealth and power (the foundation stone of St. Peter's Basilica in Rome was laid in 1506). The Church functioned as an expensive intermediary between lay people and the divine, with services conducted in Latin and substantial resources devoted to supporting specialist clerics (Cameron, 1991). It is unsurprising that the Church was so rich: as a monopolist producer of salvation for believers and of religiously-derived political legitimacy for rulers, it was able to extract enormous rents from the payment of tithes and sacramental fees, as well as from its huge land holdings.<sup>16</sup>

However, the Church's ability to extract rents was not unlimited. Its privileges and the monetization of salvation through the sale of indulgences produced discontent among some believers, thus threatening the Church's authority—this would come to a head, of course, in Luther's posting of his 95 theses in 1517. The Church was also constrained in its ability to extract rents from secular lords, with whom there was continual conflict over the control of resources, jurisdiction over territory, and the authority to appoint individuals to positions of powers (e.g., bishops).<sup>17</sup> Secular princes in Europe claimed their authority as derived directly from God, arguably making them less reliant on religious endorsements for their political legitimacy than rulers in, for example, the Islamic world. Rubin (2017) argues that this relatively limited reliance on religious elites by secular authorities in Europe, relative to the Islamic World, played a crucial role in shaping political economy in the two regions for centuries.

The pre-Reformation relationship between secular authorities and Church elites was one of continual bargaining over power and resources. Bargaining reflected the political structure of the Holy Roman Empire, which was an imperial federation of semi-autonomous principalities. At the highest level was conflict between the Holy Roman Emperor and the Pope over the "price" of endorsement of secular rulers—in particular, the Holy Roman Emperor—by the Catholic Church. During the 11th century "Investiture Controversy," the Pope and Emperor contested the right to appoint clerics to positions of immense power and wealth. Pope Gregory VII appeared to have succeeded in extracting a higher price for Church endorsement when he excommunicated

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<sup>16</sup>For example, the Catholic Church controlled approximately one-third of all farmland in the principality of Württemberg before the Reformation (Ocker, 2010, p. 56), and approximately 26 percent of farmland in the lordship of Ruppin (Cohn, 1987, p. 172).

<sup>17</sup>Evidence of shared rents before the Reformation can be seen in the cooperation and agreements between secular and church elites. For example, before the Reformation monasteries provided the majority of baggage carts used to supply the armies of lords and were obliged to provide food and hospitality for lords and their entourages when lords traveled through their domains. See Cohn (1987) for details.

Emperor Henry IV (withdrawing the Emperor’s legitimacy), leading Henry to beg Gregory for reentry into communion, famously standing barefoot in the snow at Canossa in 1077. Yet, the Church was far from being all powerful, and after further bargaining—often in the form of violent conflict—secular and Church authorities agreed to a compromise in the Concordat of Worms of 1122, which granted secular lords *de facto* power in the appointment of bishops, while respecting the Church’s *de jure* right to invest bishops with their spiritual symbols of power.<sup>18</sup> However, conflict over resources continued: for example, just prior to the Reformation, the great defender of the Catholic Church, Emperor Charles V, took control of Catholic Church assets—e.g. the domain of the Bishop of Utrecht, as well as Arras and Cambrai (Ocker, 2010, p. 60).

Analogous conflicts characterized the relationships between religious elites and the territorial lords and we study in this research. Church institutions possessed numerous privileges (e.g., tax exemptions and monopoly rights) and controlled huge swathes of land within the principalities of the Holy Roman Empire. Secular lords were regularly engaged in attempts to claw back some of the revenues lost: passing laws eliminating tax exemptions and imposing obligations on the Church as landowner (Cohn, 1987, p. 162).

### 2.3 The Reformation: the introduction of religious competition

**Entry in the market for religion** — In October 1517, Martin Luther posted his famous 95 theses critiquing Church practices. Luther’s critiques focused on the exorbitant price of salvation due to corruption in the Catholic Church, and particularly the sale of “indulgences,” which believers purchased to secure early release from purgatory. While Luther did not set out to challenge the religious monopoly of the Catholic Church, a clear break between the Church and Luther emerged in 1521, when the Edict of Worms condemned him as a heretic (see Table 1 for a summary of the major events of the Reformation). Luther and his supporters responded by developing an agenda for religious reform. Protestant reformers disseminated their ideas widely, rapidly, and relatively cheaply using the newly invented printing press (Rubin, 2014; Dittmar and Seabold, 2016).

Table 1: Timeline of Major Reformation Events in Germany, 1517–1648

Date	Event
1517	Luther posts 95 theses in Wittenberg
1521	Edict of Worms condemns Luther as a heretic
1530	Formation of Schmalkaldic League of Protestant princes
1546–1547	Schmalkaldic War
1555	Peace of Augsburg establishes <i>cuius regio, eius religio</i> principle
1618–1648	30 Years’ War

<sup>18</sup>See Berman (1983) for a discussion of the consequences of this conflict and the reforms of Pope Gregory VII for the development of legal institutions in Europe.

Protestant innovations attracted believers and princes by lowering prices in the markets for salvation and for legitimacy. In the market for salvation, the key Protestant innovation was *disintermediation* between the believer and God, which significantly lowered the cost, and price, of salvation.<sup>19</sup> Luther emphasized the importance of an individual believer's relationship with God and salvation by faith alone; he also reduced the number of sacraments from seven to two. These innovations reduced the need for a priestly bureaucracy in Protestant regions. Cameron (1991, p. 159) writes that, "For laypeople, the point about the Reformation was that it abolished the expensive and complicated apparatus to which they had resorted so regularly for the good of their souls."

Protestants also developed a critique of monasticism and argued that monastic control over resources was unjustified. This message was popular with believers. A declaration from the 1520s captures the popular spirit: "It is well known and clear to all that everywhere there are too many monasteries, and that they unashamedly claim to be outside the world, and yet together with the large foundations they even bring into their own possession all the goods of the world . . . we have considered together and decided to tolerate no monastery any longer, but to close them" (quoted in Cohn, 1979, p. 28).

The wealth held by monasteries represented the largest share of the Catholic Church's income-producing real estate (Ocker, 2010, p. 56) and was central to the Reformation-era bargain in the market for religiously derived political legitimacy. Expropriation of monastery wealth was enormously tempting to secular lords, but it required a legal and religious justification. Secular lords attempted to extract from Protestant theologians religious and legal arguments for the seizure of Catholic Church property; this was precisely an attempt to bargain down the price of religiously-derived political legitimacy at the center of our conceptual framework.<sup>20</sup>

Secular rulers began expropriating monasteries in the 1520s and the Catholic Church responded by filing claims for restitution at the *Reichskammergericht*—the highest court of the Holy Roman Empire. Reflecting the "better bargain" secular rulers were offered by the religious entrant, Protestant theologians provided detailed *legal* support for the reallocation of resources in memoranda. These memoranda justified the property rights claims of Protestant rulers with arguments, "constructed around meticulous citations of Canon and Roman law" (Ocker, 2010, p. 57). Thus, Protestant theologians based their arguments on the body of ecclesiastical law developed by *Catholic* jurists over previous centuries.<sup>21</sup> Protestant theologians argued that secular lords who

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<sup>19</sup>We emphasize differences between Catholic and Protestant theology. Lutheranism was the predominant form of Protestantism in the territories we examine. However, it should be emphasized that Lutheran doctrine developed over the period we study and that there were multiple currents within Lutheranism and Protestantism more broadly—e.g. Zwinglianism and Calvinism also offered low cost salvation relative to Catholicism, but did not assign such centrality to salvation by faith alone (Pettegree, 2004, p. 33). Similarly, while we emphasize the salience of material incentives, religious choices were clearly also shaped by beliefs (Cohn, 1987).

<sup>20</sup>Note that some negotiation between lords and religious elites over lords' rights to Church property also existed in regions that remained Catholic.

<sup>21</sup>Ocker (2006, p. 13) describes these memoranda as "among the most overlooked works of the sixteenth century reformers".

adopted Protestantism and took control of church property were: (i) preventing misappropriation by (Catholic) church agents and (ii) acting in a manner consistent with their legally recognized role as lay administrators of church property (i.e., as church wardens or *Kirchenvögte*).

A purge of Protestant jurists from the *Reichskammergericht* threatening secular lords' claims to formerly monastic wealth was followed by the formation of the Schmalkaldic League—a military defense alliance—in 1530. A key objective of the Schmalkaldic League was to maintain secular rulers' control over former church property (Cohn, 1987).<sup>22</sup>

Given the legal and political uncertainty, some Protestant rulers proceeded with caution; the Elector of Saxony only put confiscated properties under his own chancellery in the 1540s, following the suspension of the *Reichskammergericht* (Ocker, 2010, p. 56, 60). The settlement after the Schmalkaldic War (1545–6) effectively provided legal sanction to prior property transfers (Whaley, 2011). Similar timing characterized the settlement of related property claims: for example, Protestants also moved to expropriate the assets of some bishoprics, in “a lengthy process usually only completed after 1555” (Ocker, 2010, p. 172). We study the implications of these evolving changes in lords' control of property for resource allocation, below.

It is important to note that Protestant theologians' justification of the expropriation of Catholic property did not by itself establish a “low price” of legitimacy for secular rulers. There remained the question of how expropriated wealth could be used: would territorial lords be able to use confiscated resources for themselves—indicating a true reallocation of resources from the religious to the secular sphere? Or, would the allocation of resources simply shift from formerly Catholic religious purposes to Protestant ones (including social welfare)? We next investigate the details of the bargains struck between Protestant territorial lords and religious elites within this open-ended policy, presenting evidence on monastery closure and the reallocation of monastic resources during the Reformation.

**Monastery closure and the reallocation of resources** — We first document patterns of closure, gathering data on 3,094 monasteries described in Jürgensmeier and Schwerdtfeger (2005–2008). For each monastery, we collect data on its location, date of foundation, and date of closure, if applicable.<sup>23</sup> In Figure 2, we present a map of the monasteries open in the German lands of the Holy Roman Empire, highlighting those that closed in the 16th century.

Our analysis of monastery closure focuses on over 2,200 towns contained in the *Deutsches*

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<sup>22</sup>The importance of property rights to the League is apparent in negotiations between Protestant princes and the (Catholic) emperor: the official 1540 position paper of the Schmalkaldic League addresses the question of property rights *first* and religious doctrine second.

<sup>23</sup>The data include both monasteries and convents, and we use the term “monasteries” as a short-hand. Closure dates are directly coded from Jürgensmeier and Schwerdtfeger (2005–2008). For over 67 percent of monasteries, Jürgensmeier and Schwerdtfeger (2005–2008) provide information on foundation dates. For the remaining monasteries, we first gather evidence on initial monastery construction by order and location from the *Deutsches Städtebuch*. We identify the foundation dates of any residual monasteries from territorial archives. For example, for monasteries in Baden-Württemberg we review the databank “Klöster in Baden-Württemberg” maintained by the Landesarchiv Baden-Württemberg (the State Archive) at <https://www.kloester-bw.de/index.php>. We then cross-check against individual monastery entries on [www.wikipedia.de](http://www.wikipedia.de). In total, we identify foundation dates for 3,085 of 3,094 monasteries.

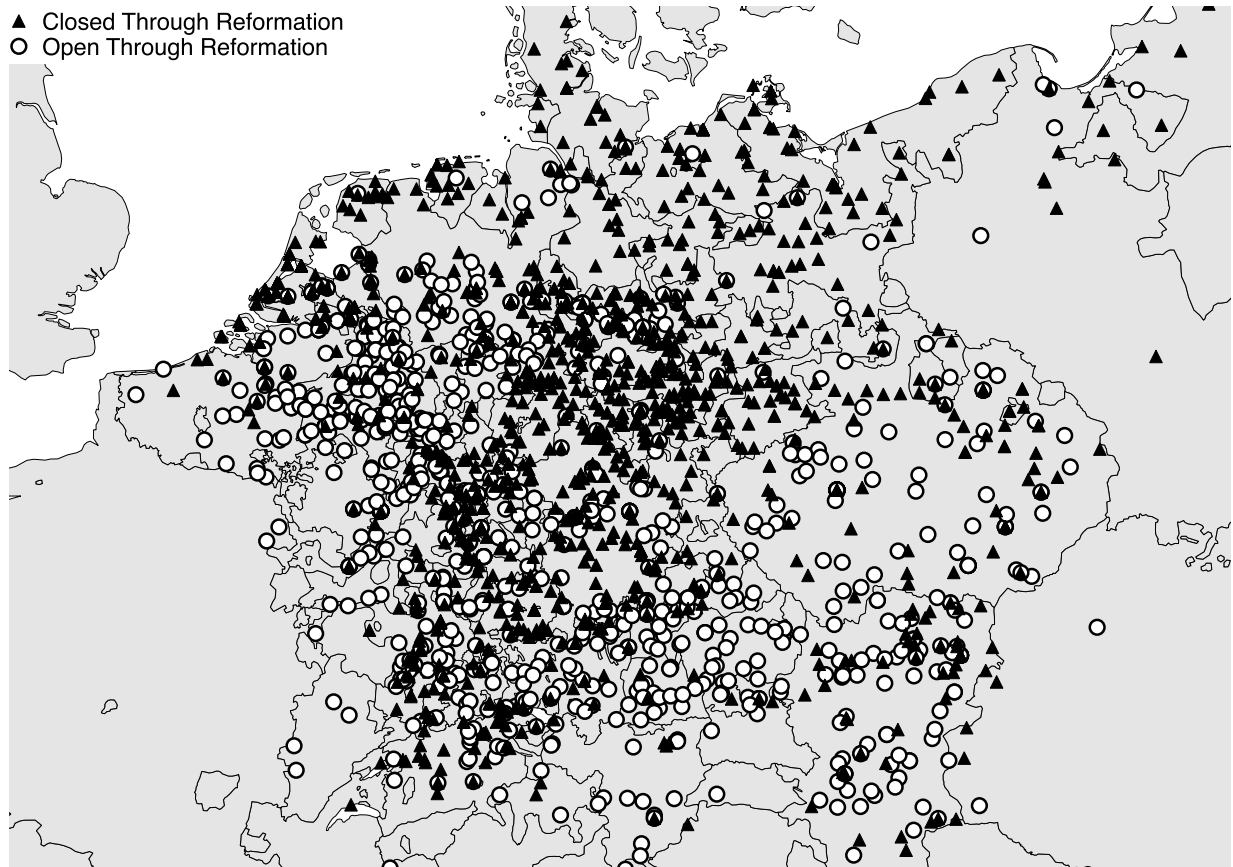


Figure 2: Monasteries and Monastery Closure During the Reformation in Germany

Map of all monasteries in Jürgensmeier and Schwerdtfeger (2005–2008). White circles indicate monasteries that remain open throughout the time period under study. Black triangles indicate monasteries that were opened prior to the Reformation but closed between 1517 and 1600. Territorial boundaries come from Nüssli (2008).

*Städtebuch*.<sup>24</sup> For every town, we calculate the number of monasteries within 25 kilometers open in each year. We exploit cross-sectional variation in territorial religion, assigning each town to its secular lord following Nüssli (2008) for 1500 (we refer to this as the “EurAtlas” coding of territories) and coding religion using Cantoni (2012).<sup>25</sup>

We present the pattern of monastery closure during the Reformation in Figure 3. We plot

<sup>24</sup>We use “town” to describe the generic entry in the *Deutsches Städtebuch*, as the modal location was small. But it is worth noting that the *Deutsches Städtebuch* covers, and our data include, all incorporated units of Germany, including large cities.

<sup>25</sup>Jurisdiction in early modern Germany involved fluid and overlapping claims among authorities. We thus view the EurAtlas region as a proxy for actual jurisdiction over the time period we study. Another complication is posed by the existence of a small number of “free cities” that are not subject to a territorial lord. Most of these free cities are dropped from our analysis, and our results are robust to excluding them entirely. A complete list of territories and their (eventual) religion can be found in Online Appendix Table A1. Because not every city can be assigned a religion using this mapping, as a robustness check, we directly code the religion of as many towns as possible using hand-collected evidence from the *Deutsches Städtebuch*, and find very similar results.

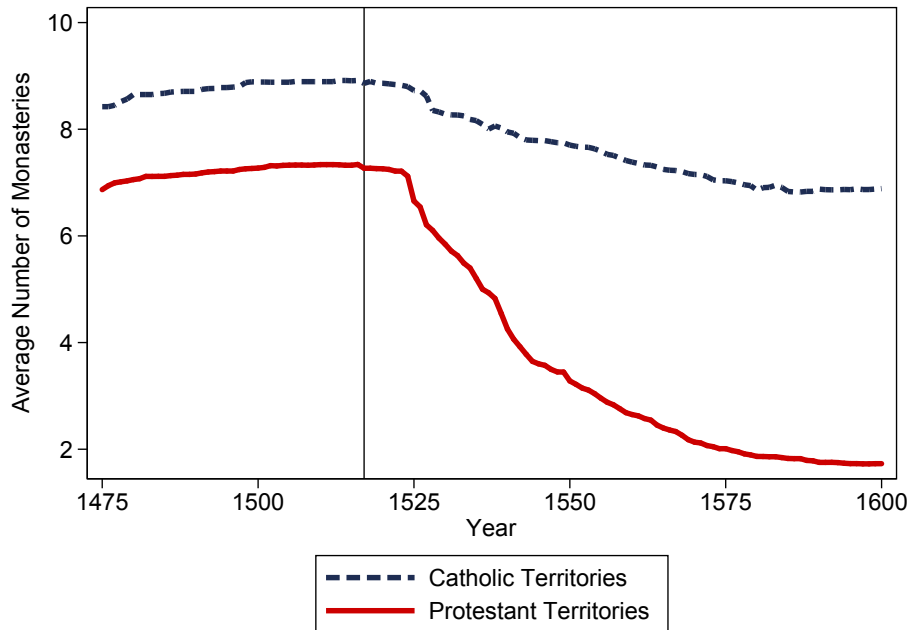


Figure 3: Monastery Closure in Catholic and Eventually-Protestant Germany

Average number of monasteries within 25 km of towns included in the *Deutsches Städtebuch*. Assignment of towns to religious denominations is done by matching each town to its territorial lord identified in the EurAtlas for 1500, and using the territorial lord’s religion as coded by Cantoni (2012). Vertical line marks 1517, when Martin Luther circulated his 95 Theses.

the average number of monasteries within 25 kilometers of towns that would become Protestant and that would remain Catholic. Prior to 1517, the average number of monasteries proximate to towns was quite steady. The number of monasteries near towns that would remain Catholic was somewhat higher than near towns that would become Protestant, a fact that can be explained by the location of Catholic cities—more likely to be in the “older,” southern and western parts of the Empire. Importantly, however, trends are very similar in the two sets of towns prior to 1517. Following the posting of Luther’s 95 theses in 1517, the density of monasteries declined across Germany, but with important heterogeneity across religions. In towns whose territorial lords adopted Protestantism, there was a sharp decline in the number of monasteries during the Reformation: a reduction of over two-thirds by 1600. In towns whose lords remained Catholic, the decline was significantly smaller.

The fundamental question we next address is whether the closure of monasteries produced *inter*-sectoral reallocation of resources or *intra*-sectoral reallocation. The allocation of formerly Catholic resources would be determined by the bargain between secular and church elites. The “price” Protestant theologians initially offered to secular rulers was high: formerly Catholic resources were to be devoted to religious uses. Ocker (2010, pp. 54–55) writes that Protestant clergy



proposed using confiscated monastic wealth to support Protestant pastors and to establish a “common chest” for social welfare; he continues, “theologians only granted rulers a free hand in church property when property remained after the needs of schools, poor relief, and public welfare had been met.” Historical evidence suggests that some formerly Catholic resources were, indeed, used for church and social welfare purposes. In the Electorate of Saxony (Luther’s home), monastic resources were transferred to a common chest that provided support for orphans and the poor. Incomes were also used to support former monks. For example, in Württemberg monks were offered annual pensions of 25 guilders, equivalent to 254 days of skilled wages (Wolgast, 2014, p. 110).<sup>26</sup>

Over time, however, the price fell, and Protestant theologians conceded a greater share of resources to lords. While the theologians advising the Schmalkaldic League drafted an agreement assigning confiscated lands to Protestant church uses, this agreement was rejected by the rulers of Pomerania and Württemberg and never adopted by the League (Wolgast, 2014, p. 130).<sup>27</sup> Historical evidence indicates that large-scale transfers of wealth to secular rulers became the norm; Wolgast (2014) provides numerous descriptions of secular lords seizing church property and enriching themselves, of which we highlight several here. In Hesse, Landgrave Philipp received annual revenues of 16,500 guilders in 1532 from monastery lands and 25,000 guilders in 1565, equivalent to one-seventh of total state revenues and around 1,000 person-years of skilled wages. Overall, 40 percent of monastic wealth in Hesse went to the ruler—not to religious, educational, or social welfare purposes. In East Frisia, Count Enno II converted the monastery in Norden into a summer residence for himself and converted the monastery at Ihlow into a residence for his brother. In Württemberg, Duke Ulrich extracted 40,000 guilders’ income from monastery lands. In Brandenburg, monasteries were allowed to keep their privileges following the adoption of Protestantism in exchange for a payment of 300,000 guilders. Protestant theologians provided legal justifications for these property transfers and thus served as “the technicians of religious legitimacy” (Ocker, 2006, p. 13).

In Table 2, we summarize the historical evidence on church property expropriation by secular lords in the Protestant regions we study. We find evidence of significant enrichment of territorial lords in 16 of 18 territories, indicating a shift in the bargain between secular and religious authorities and inter-sectoral resource allocation: lands and riches that once belonged to the Catholic Church were conceded by Protestant religious elites to secular lords’ control.

The shift of bargaining power from religious to secular elites transferred not only resources toward secular lords, but also political power. Cohn (1987, p. 176) writes that “The acquisition of church property and the strengthened administration which it encouraged were bound up with many less tangible advantages gained by the means of the Reformation. Functions that had once

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<sup>26</sup>Guilders here and below (traditionally abbreviated as “fl.”) are converted to person-year equivalents using average wage data for skilled labor in Munich, Augsburg, and Leipzig, taken from Allen (2012).

<sup>27</sup>The incumbent Catholic Church also made concessions over the control of resources to secular lords in territories that remained Catholic.

Table 2: Monastery closure and expropriation in Protestant territories

Territory	Year Reformed	% Monasteries Closed	Transfer to by Lord	Evidence from Wolgast (2014)
Anhalt	1537	83%	Yes	Monasteries expropriated, e.g. Ballenstedt and Mehringen (p. 76)
Baden	1555	32%	No	—
Brandenburg	1539	74%	Yes	Treasures taken to Berlin, covering 300,000 fl. state debt (pp. 71-72, 150)
Brunswick-Calenberg	1584	46%	Yes	Expropriation and taxation to pay for ruler's servants and horses (p. 161)
Brunswick-Lüneburg	1529	80%	Yes	Expropriation of monasteries, churches (p. 57)
Brunswick-Wolfenbüttel	1568	55%	Yes	Expropriation of monasteries (p. 230)
Denmark	1536	64%	Yes	Expropriation, monastery at Husum converted to palace (see note)
East Frisia	1535	92%	Yes	Conversion of monasteries to palaces and stone quarries (pp. 114-115)
Hesse	1526	76%	Yes	Diversión of monastic incomes (p. 47)
Mecklenburg	1549	75%	Yes	Monastery expropriation, conversion to palace at Güstrow (p. 195)
Nassau	1542	42%	Yes	New taxes on monasteries and palace construction (see note)
Palatinate	1546	60%	Yes	Expropriation of monasteries, income of 100,000 fl. per year (pp. 177, 220)
Pomerania	1534	94%	Yes	Monastery expropriation (p. 101)
Ruppin	1539	56%	Yes	Ruler doubles land ownership appropriating monastery lands (see note)
Saxony (Ducal)	1539	96%	Yes	Property seizure and sale revenues of 150,000 fl. (pp. 141-142)
Saxony (Electorate)	1527	92%	No	—
Upper Palatinate	1546	45%	Yes	Expropriation of monasteries, income of 50,000 fl. per year (pp. 220)
Württemberg	1534	67%	Yes	Expropriations, silver melted down, gold seized (p. 107)

Table lists Protestant territories and the year of territorial reform as in Cantoni (2012). Data on monasteries and monastery closures are from Jürgenmeier and Schwerdtfeger (2005–2008). Evidence on the transfer of church resources and property to secular lords is from Wolgast (2014). We calculate the percentage of monasteries closed as the mean town-level closure rate in a territory, with town-level closures measured by the closure rate of monasteries within 25 kilometers of each town. Towns are located in territories using EurAtlas (Nüssli, 2008). In Nassau, new taxes were imposed on monasteries starting in 1525 and helped fund construction of the castle at Weillburg from 1533-1549 (Schliephake, 1884, pp. 235-236). In Ruppin, the ruler's share of territorial lands rose from 21% to 39% between 1500 and 1600 due to the appropriation of church lands (Cohn, 1987, p. 172). In historic Denmark, monastery resources were diverted, e.g., the monastery at Husum was converted into a palace (Christian-Albrechts-Universität zu Kiel, 2017). For Denmark, we only examine monasteries in the Schleswig-Holstein region.

been dispersed among several authorities became concentrated in the state. Officialdom penetrated more pervasively than before in towns, villages and families. Ecclesiastical jurisdiction was swept away.”

## 2.4 Implications of religious competition for the broader economy

During the Reformation, secular lords paid significantly less to church elites for the provision of legitimacy, especially in Protestant territories. Secular authorities retained greater political power, acquired new land, and gained control of wealth expropriated from the Catholic Church. Many of the resources acquired from the Catholic Church were *not* reallocated toward Protestant church purposes, but were retained by secular lords, as shown above. The change in the market for church-derived political legitimacy suggests the following hypotheses regarding resource reallocation during the Reformation.

**The allocation of human capital** — Enriched and empowered lords across Germany, and particularly in Protestant regions, demanded more labor for their own aggrandizement and for the administration of their territory. An ordinance from Württemberg from 1546 notes that “Men [we]re needed to serve in preaching offices, governments, temporal posts, [and] administrative offices” (Strauss, 1988). In addition, in Protestant regions, the church sector demanded significantly less labor owing to the lower cost salvation production function in Protestant theology. This freed labor for uses other than salvation. There was a supply-side effect of the Reformation as well: Ocker (2010, p. 62) writes, “The new faith rebutted the most compelling reason to become a monk or a nun—to save one’s soul and the souls of others. This rebuttal coincided with, and surely abetted, widespread attrition in monasteries.”

*Hypotheses:* Our analysis leads to the following hypotheses regarding the allocation of human capital. We expect a shift in occupations from the church sector to the secular sector during the Reformation, particularly in regions that became Protestant. We also expect a shift toward occupations supporting the aims of secular lords—for example, administrative and military positions—following the Reformation, particularly in regions that became Protestant.

**Human capital investments** — Forward looking students should have perceived the sectoral shift in labor demand and adjusted their human capital investments accordingly, away from church-sector specific theology study, and toward studies in more general fields.<sup>28</sup>

*Hypotheses:* Our framework leads to the following hypotheses regarding human capital investments. We expect a shift in degrees granted from theology toward secular subjects (arts, law and medicine) during the Reformation, particularly in universities that became Protestant. The empowering of secular lords suggests a shift specifically toward degrees that led to jobs in public

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<sup>28</sup>Reflecting their increased demand for skilled labor, secular princes provided support for investments in university education. It is important to note, however, that university degrees initially fell following 1517, as students left the universities to follow preachers and join the new religious movements. University attendance increased again with the institutionalization of the Reformation and formal support provided by princes (Seifert, 1996).

administration—law and the arts—during the Reformation, particularly in regions that became Protestant.

**Fixed capital investments** — The increase in power and resources controlled by secular lords during the Reformation, particularly in Protestant regions, should also have been reflected in fixed investments. Construction activity—reflecting the allocation of land and physical, financial, and human capital—can be seen as a summary statistic that characterizes the allocation of resources in early modern Europe. In our context, empowered and enriched secular rulers used their new wealth to construct palaces that provided consumption value and signaled their power, and built new administrative buildings from which their expanded authority was projected.

*Hypotheses:* Our framework leads to the following hypotheses regarding fixed investments. We expect new construction activity to shift toward secular purposes during the Reformation, particularly in Protestant regions. And, reflecting the enhanced powers of secular lords, one would expect that the shift in construction to reflect the aims and desires of secular lords, e.g., the construction of palaces, military, and administrative structures. The historical evidence also suggests that secular construction should have increased with some lag, reflecting the insecurity of secular lords' property rights claims to newly appropriated assets prior to the mid-16th century. Finally, prior research (Ekelund et al., 2006) suggests that the heightened intensity of religious competition in Catholic border regions could lead resource allocation in these regions to resemble those in Protestant territories. We thus expect that the most pronounced differences in construction between Protestant and Catholic regions should be found between Protestant regions and Catholic regions *away* from borders.

We test these each of these hypotheses in our empirical work below.

### 3 The reallocation of resources

#### 3.1 Data sources

Our analysis is focused on two sets of data: (i) German university graduates' degrees and careers, which provide evidence on the consequences of the Reformation for the allocation of skilled labor and investments in human capital; and, (ii) construction activity across Germany over time, providing evidence on the allocation of land, labor, and capital in fixed investments. In this section, we describe the sources from which these data are drawn, in turn. We also discuss our assignment of towns, territories, and universities to religious denominations.

**University graduates: degrees and careers** — Our main source of information on German university graduates is the *Repertorium Academicum Germanicum* (Schwinges and Hesse, 2015), a research program (and online database) developed by historians at the Universities of Berne and Giessen, collecting individual-level information on the universe of recipients of academic degrees from German universities through the year 1550. The German universities are: Basel, Erfurt, Frank-

furt an der Oder, Freiburg, Greifswald, Heidelberg, Ingolstadt, Köln, Leipzig, Mainz, Marburg, Rostock, Trier, Tübingen, Wittenberg, and Würzburg.<sup>29</sup>

Schwinges and Hesse (2015), which we refer to as “RAG” henceforth, collect information on each degree recipient’s degree subject(s) and year(s) from university registry sources. The degrees granted include bachelor’s degrees, licenses, master’s degrees, and doctorate degrees. To measure post-1550 human capital investments, in particular after the Schmalkaldic War (1546) and the Peace of Augsburg (1555), we hand collect data on university degrees granted by the German universities included in the RAG dataset between 1540 and 1600, consulting Bauch (1897); Erler (1895, 1897, 1909); Eulenburg (1904); Kleineidam (1983); Leinweber (1991); Rüegg (1996); Steinmeyer (1912).<sup>30</sup> We thus have two datasets on university degrees: one covering the years through 1600 at the university  $\times$  year level, and one covering the years through 1550 at the individual level. In our empirical analysis below, we will present results based on both datasets.

Degrees were granted by one of the four traditional faculties that universities of the time featured: arts, law, medicine, and theology. We classify degrees in arts, law, and medicine as “secular” to distinguish them from more church sector-specific training in theology. We will also focus more narrowly on arts and law degrees, which were more likely to lead to careers in the service of territorial lords. Evidence on career paths associated with degrees in different fields is provided in Section 3.3, below.

In addition to information on degrees received, the RAG database contains information on careers for 5,102 of 14,704 students receiving degrees between 1470 and 1550. Unfortunately, we are unable to extend the coverage to individuals receiving degrees after 1550, so we rely on a single careers dataset at the individual level, covering the years through 1550. The RAG provides over 400 different occupational titles in its database. For example, the top five occupations in terms of frequency are: *Professor*, *Kanoniker* (Canon), *Domherr* (Canon, typically receiving a stipend), *Dekan* (Deacon), and *Kleriker* (Priest). Other occupations include judges, bakers, guild masters, mayors, city councillors, teachers, headmasters, and goldsmiths. Many of the occupation titles are archaic; we thus rely on the *Thesaurus Professionum Forschungsstelle für Personalschriften* (Marburg, 2015), which categorizes historic occupations into seven one-digit categories with subcategories. In our empirical analysis, we divide the occupations into two broad categories: “church” (including priests, monks, etc.) and “secular” (including professors, judges, mayors, etc.). We also examine the specific subset of secular occupations that were administrative.

Below, we study the heterogeneous effects of the Reformation on degrees received and occupations selected into depending on the religious denomination of the university at which an individ-

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<sup>29</sup>Note that we do not consider in our analysis universities attended by Germans outside of the borders of modern Germany, such as Louvain or Prague; nor do we include several small universities opened after 1550, such as Jena. Basel joined the Swiss Confederation only during the period of our study.

<sup>30</sup>Online Appendix Figure A1 presents the overall pattern of degrees in the RAG data, and in our own data collection, and these line up closely. As an additional check, we collect data from 1540–1550 to directly compare our data collection to the RAG data using a decade of overlap: we again find that our data and the RAG data closely match. The numbers of degrees granted by level and by individual subject can be seen in Table A2 in the Online Appendix.

ual studied. We rely on Sehling (1902-2013), Spitz (1981), Grendler (2004), Naragon (2006) to identify the universities that adopted Protestantism: Basel, Erfurt, Frankfurt an der Oder, Greifswald, Heidelberg, Leipzig, Marburg, Rostock, Tübingen, and Wittenberg. The adoption of Protestantism occurred in a wave between 1520 and 1550, and the choice was nearly always permanent.<sup>31</sup>

**Construction events** — We hand-code several thousand unique, major construction “events” at the town level, described in the *Deutsches Städtebuch*. Each town’s entry in the *Deutsches Städtebuch* includes a section (section 5) titled, “Die Stadt als Siedlung” (“The City as Settlement”) within which exists a subcategory (5b) titled, “Markante Gebäude” (“Notable/Important Construction”).

We code each construction event by location, start date, and sector.<sup>32</sup> We assign the finely detailed construction events to “church construction” (e.g., churches or monasteries) and “secular construction” (e.g., town halls, bridges, malls, palaces, or schools) and examine these broad categories in much of our analysis.<sup>33</sup> We also specifically study secular administrative buildings and palace construction as indicators of fixed investments for purposes favored by secular lords. Construction events are linked to Protestant or Catholic regions based on the town of the event: as we did in the analysis of monastery closure, we assign towns to territorial lords following the “EurAtlas” mapping provided by Nüssli (2008) and use information on the religion of territorial lords from Cantoni (2012).

### 3.2 Occupational choice

We begin our analysis of the allocation of highly-skilled labor by examining the occupational choices of university graduates. Our conceptual framework and historical evidence above suggested that the Reformation should have immediately reduced the demand for skilled labor in the religious sector and increased the demand for skilled labor for secular purposes, with effects being concentrated in Protestant territories. We compare the rates at which university graduates took jobs in the church sector and the secular sector across time and depending on the religious denomination of the university from which they graduated.

In Figure 4, we present the shares of first jobs by sector—church and secular—by year, separately for graduates of universities that would adopt Protestantism and for those that would remain Catholic. One can see that in both types of universities, shares of jobs in the church and

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<sup>31</sup>Note that one university, the University of Erfurt, became Lutheran in 1521 and returned to Catholicism in 1530s. We thus treat Erfurt as a Catholic university. In Online Appendix Figure A2 we show the time series of the number of German universities as well as the number that adopted Protestantism.

<sup>32</sup>Not all construction events are associated with a precise year. For the purposes of our research here, we limit the analysis to those construction events with clearly-specified first years (i.e., “construction starts”). Note, too, that any potential differences in the original collection of data across volumes of the *Deutsches Städtebuch* will be accounted for in panel regressions with fixed effects.

<sup>33</sup>As noted above, we make a sharp distinction between the “church” or religious sector and the secular sector, when in practice there was certainly a grey area between the two. We do believe that our coding is generally accurate; for example, schools served both religious and secular purposes, but as Strauss (1988, p. 193) notes, post-Reformation compulsory schooling laws “placed the supervision of all educational institutions firmly in the hands of princes and magistrates, who were the owners and wielders of the instruments of public power.”

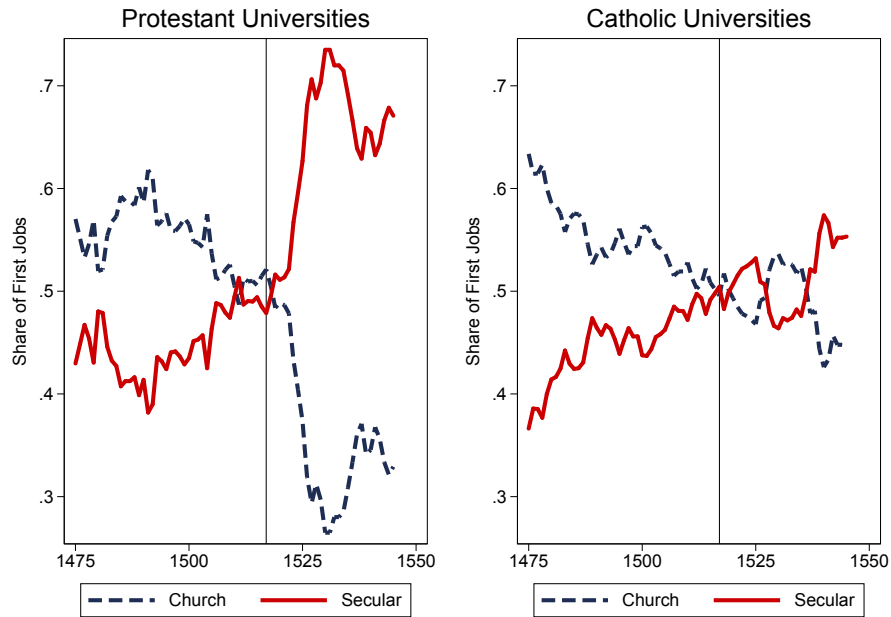


Figure 4: Careers among Eventually-Protestant and Catholic University Graduates

Shares of first job by sector by (eventual) university denomination. Figure shows the share of first jobs in secular and religious economic sectors (which are exhaustive and mutually exclusive) among individuals with occupations listed in the *Repertorium Academicum Germanicum*, by an individual's year of first university degree attainment and by the degree-granting university's eventual denomination (smoothed using an 11-year moving average). Occupations are classified into economic sectors using the *Thesaurus Professionum* (Marburg University, 2015). Vertical line marks 1517, when Martin Luther circulated his 95 Theses.

secular sectors converged on an even 50-50 split at the time of the Reformation. While there is an overall trend toward secular occupations observed prior to the Reformation in both universities that would adopt Protestantism and those that would remain Catholic, it is important to note that there is not a differential pre-Reformation trend depending on eventual religious denomination.

After the Reformation, the patterns of occupational sorting look distinctly different across university denominations, with a very clear break in trend toward first jobs in the secular sector among graduates of Protestant universities, and a slower, smoother continuation of the pre-existing trend toward secular first jobs among graduates of Catholic universities. Thus, we see in the raw data a shift toward secular sector first jobs after the Reformation, specifically among graduates of Protestant universities, as predicted. It is important to emphasize that Figure 4 reveals a post-1517 reduction in religious employment *overall*, not only a decline in monastic jobs, which mechanically resulted from monastery closure, and which could have been offset by increases in other religious occupations.

We next more formally test for differences in the likelihood that university graduates would take first jobs in the church sector (rather than the secular sector), comparing graduates from

universities that remained Catholic and graduates from universities that adopted Protestantism, decade by decade. Specifically, we estimate the following flexible difference in differences model:

$$church_{iut} = \alpha_u + \delta_t + \sum_{\tau=1480}^{1540} \beta_{\tau}(prot_u \times decade_{\tau}) + \epsilon_{iut}, \quad (1)$$

where  $church_{iut}$  is an indicator capturing whether student  $i$  graduating from university  $u$  in decade  $t$  took a first occupation in the church sector.<sup>34</sup> The  $\alpha_u$  terms are a full set of university fixed effects;  $\delta_t$  are a full set of decade fixed effects, and the explanatory variables of interest are the interactions between decade fixed effects and an “eventually Protestant university” dummy variable (the omitted reference decade is 1510–1519, just prior to the Reformation). We estimate standard errors allowing for clustering at the university  $\times$  decade level.

In addition to the more flexible decade-by-decade model, we estimate a more aggregated difference-in-differences model with three time periods: first, the three decades from 1480–1509; next, the omitted reference decade from 1510–1519; finally, the three decades following the omitted decade, from 1520–1549. In this specification, the interaction between the “eventually Protestant university” dummy variable and the 1480–1519 time period dummy allows for a formal test of differential pre-Reformation trends between graduates of universities that would become Protestant and those that would remain Catholic. The interaction between the “eventually Protestant university” dummy variable and the post-Reformation (1520–1549) dummy variable allows us to identify the differential shift in occupations among graduates from Protestant universities in the Reformation era. That model is as follows:

$$church_{iut} = \alpha_u + \delta_t + \sum_{\tau=1}^3 \beta_{\tau}(prot_u \times period_{\tau}) + \epsilon_{iut}, \quad (2)$$

where the only change relative to equation 1 is that instead of seven decade dummies interacted with the “eventually Protestant university” dummy variable, we now have three time periods (1480–1509, 1510–1519, and 1520–1549).

Figure 5, panel A, presents all of our estimates from equations 1 and 2 graphically. We plot dots indicating the decade-by-decade “eventually Protestant university” interaction estimates (and bars indicating their 90% confidence intervals). These estimates show the difference between Protestant and Catholic university graduates’ likelihood of having a first job in the church sector in a particular decade, relative to the difference in 1510–1519. One can see that prior to 1510, the difference in first jobs between Protestant and Catholic university graduates was small, and was not strongly trending. Then, beginning in 1520, Protestant university graduates became significantly less likely than Catholic university graduates to have first jobs in the church sector. Each Protestant  $\times$  decade interaction is negative from 1520, and two of the three are statistically significantly less than zero.

<sup>34</sup>The subscript  $t$  indicates the first year of the decade from 1480 through 1540, inclusive.



Figure 5, panel A, also shows the estimated coefficients on the interactions between the more aggregated time period dummy variables and the “eventually Protestant university” dummy from estimating the pooled specification. The point estimates are drawn in as horizontal lines, and their 90% confidence intervals are depicted as boxes. One can see in the figure that the prior to the Reformation there were small, statistically insignificant differences in occupational sectors between graduates of universities that would eventually be Protestant and those that would remain Catholic. There was no differential pre-Reformation trend. One also can see a statistically significant fall in the likelihood of Protestant university graduates having a first job in the church sector during the Reformation era of around 12.6 percentage points. This represents a large decline relative to the pre-Reformation mean of around 57% of students taking a job in the church sector, and supports the prediction of our conceptual framework.

While we document an unambiguous reallocation of upper tail human capital across sectors, an important question about the patterns seen in Figure 5 is whether the decline in church-sector employment among university graduates was offset by increases in the employment of non-university graduates in the religious sector in Protestant territories.<sup>35</sup> However, abundant historical evidence indicates that religious sector employment sharply declined across the board in Protestant regions. For example, McLaughlin (2003, p. 70) observes:

The Protestant preachers in German cities represented only a small fraction of the number of Catholic priests found there during the later Middle Ages. . . . The abolition of religious orders and the suppression of non-parochial shrines and pilgrimage churches released their attendant clergy. The elimination of minor orders—subdeacons, acolytes, exorcists, doorkeeper—contributed to the decline, as did the dismantling of the higher ranks of bishop and archbishop. The numerous clergy who had staffed episcopal courts and offices disappeared as well. In fact, the enormous bureaucratic structure, developed in the Catholic Church during its long history, simply disappeared.

In addition to changes in the sector of employment, a second prediction arising from our conceptual framework is that within the secular sector, university graduates should specifically have sorted into secular occupations in the service of territorial lords in the Reformation era, particularly in Protestant regions. We use administrative occupations as a proxy for occupations in the service of secular lords. For illustration, the five most common administrative occupations in our data are procurator (*Prokurator*), notary (*Notar*), city councillor (*Ratsherr*), councillor (*Rat*), and public notary (*Öffentlicher Notar*).<sup>36</sup> To test whether there was a differential shift toward administrative occupations among graduates of Protestant universities during the Reformation, we

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<sup>35</sup>It is important to note, however, that educational standards for Protestant clergy were relatively high—if anything higher than for Catholic clergy. Still, only a minority of priests had obtained a degree from a university. The requirement that simple priests would have to attend or obtain a degree from a university was enforced only later, in the 17th century (Kaufmann, 2003, pp. 125–30).

<sup>36</sup>Note that because education and health occupations (e.g., professors and doctors) were less clearly linked to the service of territorial lords, we do not include them in our proxy. We do include the very small number of military

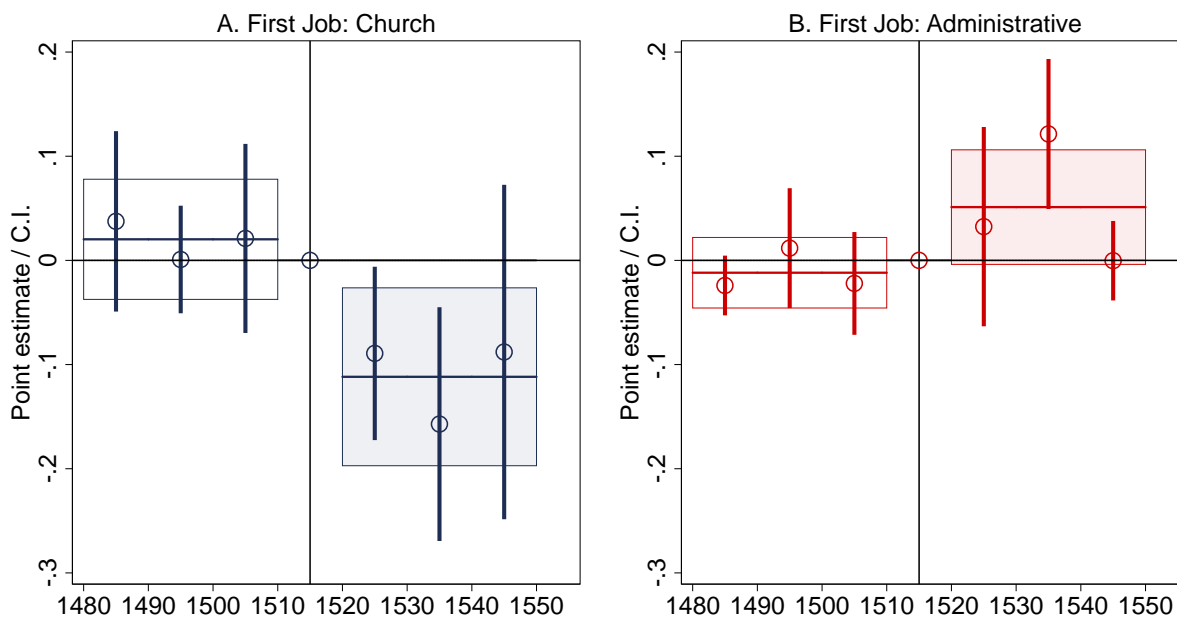


Figure 5: Effects of the Reformation on Careers (Difference in Differences Estimates)

Regression estimates of sorting into occupational sectors over time and by university denomination. Panel A presents the differential probability that graduates from eventually-Protestant universities take a first job in church occupations, relative to graduates from universities that remain Catholic. Panel B presents the differential probability that graduates from eventually-Protestant universities take a first job in administrative occupations, relative to graduates from universities that remain Catholic. Regressions are estimated using OLS at the student level, for 2,385 students, and include university and decade fixed effects. Decadal regression coefficients of interest are interactions between an “eventually Protestant university” dummy variable and decade fixed effects and are estimated relative to the omitted interaction with the 1510–1519 decade. In the aggregate specification, coefficients of interest are interactions between an “eventually Protestant university” dummy variable and a 1480–1509 dummy (Panel A:  $\beta = 0.02$ ,  $p = 0.56$ ; Panel B:  $\beta = -0.01$ ,  $p = 0.56$ ), and between an “eventually Protestant university” dummy variable and a 1520–1549 dummy (Panel A:  $\beta = -0.11$ ,  $p = 0.03$ ; Panel B:  $\beta = 0.05$ ,  $p = 0.13$ ), estimated relative to the omitted interaction with the 1510–1519 decade. Coefficient estimates on the decade interactions are plotted as dots with their 90% confidence intervals indicated with vertical lines. Coefficient estimates on the aggregate interactions are shown with horizontal lines, and their 90% confidence intervals are indicated as boxes. Standard errors are clustered at the university  $\times$  decade level.

estimate regressions analogous to those presented in Figure 5, panel A, but now considering as the outcome variable a dummy indicating that an individual’s career was administrative. That is, we estimate equations 1 and 2, but substitute  $admin_{iut}$  for  $church_{iut}$ .

One can see in Figure 5, panel B, suggestive evidence consistent with our conceptual framework’s prediction. While there was essentially no difference in the probability of (eventually) Protestant or Catholic university graduates taking administrative jobs before the Reformation, a gap emerged in the first decades of the Reformation.<sup>37</sup> This gap should be interpreted cautiously,

occupations in our classification of careers in the service of territorial lords (this is inconsequential for our findings). For concision, we use the label “administrative” for the slightly broader set of occupations.

<sup>37</sup>Kim and Pfaff (2012) show that Protestant university graduates also affected the political economy of Germany by

Table 3: The Association Between Fields of Study and Occupations

Type of university graduate	No. of individuals	% with church job	% with administration job
At least one theology degree	524	90%	34%
No theology degree	2,648	54%	25%
Statistical significance		< 1%	< 1%
At least one arts or law degree	3,027	58%	27%
No arts or law degree	145	92%	11%
Statistical significance		< 1%	< 1%

Table examines the relationship between field of study and occupational sector among individuals earning degrees between 1480 and 1550, inclusive, and who have at least one occupation recorded in the *Repertorium Academicum Germanicum* dataset. Careers in the church and administrative sectors are determined using the *Thesaurus Professionum* (Marburg University, 2015).

as only one of the three decade interactions is significantly different from zero, and over the entire Reformation era, we find a marginally statistically insignificant effect ( $p = 0.126$ ). Still, the estimated 5 percentage point increase in the likelihood of Protestant university graduates sorting into administrative positions is economically large relative to the baseline rate of administrative employment: prior to the Reformation, only around 10% of students took jobs in administration.

### 3.3 Investments in church-specific versus more general human capital

An implication of the reduced employment prospects in the church sector is that forward-looking students should invest less in human capital that specifically has a high payoff in the church sector. In addition, increased demand for labor by secular lords should lead students to invest in human capital that is associated with administrative career paths.

While highly-skilled individuals entered church employment from a range of educational backgrounds, there was a particular human capital investment that was essentially church specific: the study of theology. As can be seen in Table 3, while 54% of students in the RAG database without a theology degree had some church sector employment in their careers, this number jumps to 90% among individuals with a theology degree (the difference in proportions is highly statistically significant).<sup>38</sup> Thus, one would expect a shift away from the study of theology in Protestant regions during the Reformation.

There was no human capital investment that was specific to careers in administration; however, one can see in Table 3 that individuals with degrees in law or the arts were more than

shaping the spread of the Reformation itself; this would have tended to reinforce the processes we document.

<sup>38</sup>Note that we include in Table 3 university students with a first job that was not readily classified by sector and hence are not included in our regression analysis of first job outcomes. Restricting our analysis of associations between degrees and career paths to individuals included in our regression analysis does not affect our findings.

twice as likely to take administration jobs than individuals without these degrees (e.g., individuals who only studied theology or medicine—note that some individuals would have studied in multiple fields). One might therefore also expect a shift toward the study of arts and law in Protestant regions during the Reformation.

We thus examine whether there was not only a shift in the occupations of the highly skilled during the Reformation, but also a shift in the type of human capital they acquired. We begin, in Figure 6, by presenting the shares of students investing in church-specific human capital (studying theology) and in more general, secular human capital over time, by the denomination of the university attended. One can see in the figure that, indeed, following the Reformation, particularly among students at Protestant universities, there was a striking shift away from the study of theology. Prior to the Reformation, around 10% of degrees were awarded in theology, and, if anything, universities that would become Protestant granted a slightly higher share of theology degrees than universities that would remain Catholic. After the Reformation, the share of theology degrees granted fell below 2% in Protestant universities; in Catholic universities, the share of theology degrees granted fell in the middle of the 16th century, but by 1600 the share had returned to the level observed prior to the Reformation.<sup>39</sup>

We next formally test for the statistical significance of this divergence in human capital investments, estimating models analogous to those from our analysis of university graduates' careers, but now considering as our outcome the subject of an individual's degree. Specifically, we estimate:

$$theology_{iut} = \alpha_u + \delta_t + \sum_{\tau=1480}^{1540} \beta_{\tau}(prot_u \times decade_{\tau}) + \epsilon_{iut}, \quad (3)$$

where  $theology_{iut}$  is an indicator capturing whether student  $i$  graduating from university  $u$  in decade  $t$  earned a theology degree. As in equation 1, the  $\alpha_u$  terms are a full set of university fixed effects;  $\delta_t$  are a full set of decade fixed effects, and the explanatory variables of interest are the interactions between decade fixed effects and an “eventually Protestant university” dummy variable (and the omitted reference decade is 1510–1519, just prior to the Reformation). As was done above, standard errors will be estimated allowing for clustering at the university  $\times$  decade level.

In addition to the more flexible decade-by-decade estimates, we again estimate a more aggregated difference-in-differences model with three time periods, analogous to equation 2. Specifically, we estimate:

$$theology_{iut} = \alpha_u + \delta_t + \sum_{\tau=1}^3 \beta_{\tau}(prot_u \times period_{\tau}) + \epsilon_{iut}, \quad (4)$$

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<sup>39</sup>The increase in theology degrees in Catholic regions coincides with the Counter-Reformation. Note that these patterns appear within degree levels as well: both examining only bachelor's degrees, or examining only advanced degrees.

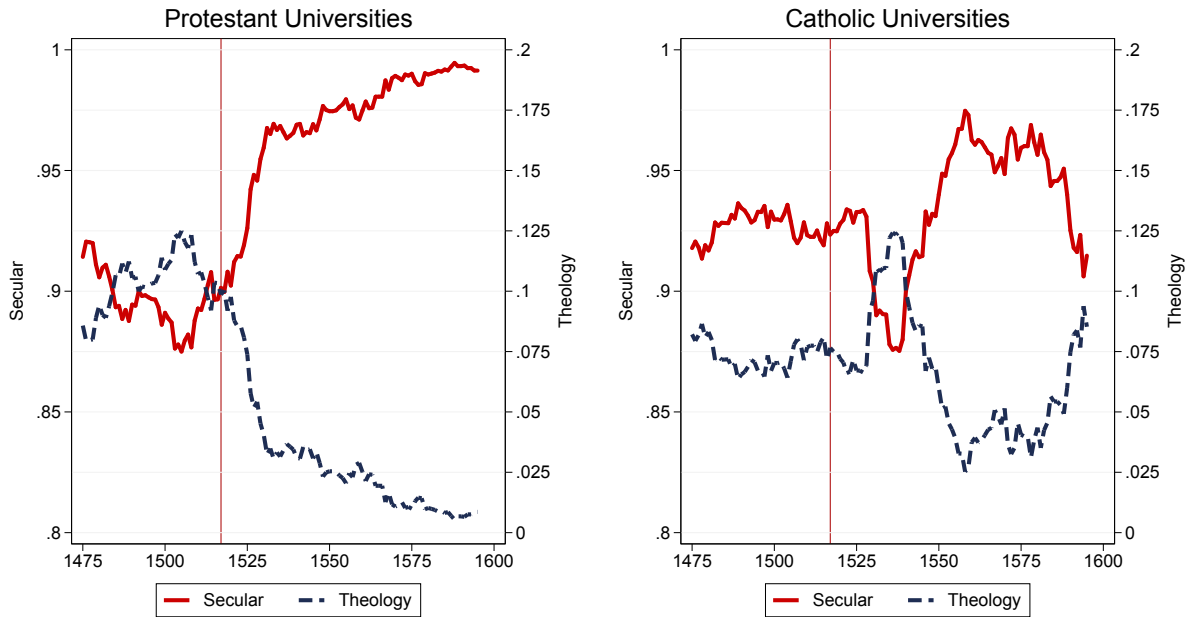


Figure 6: Degrees Granted in Eventually-Protestant and Catholic Universities

Shares of theology and secular degrees granted by (eventual) university denomination (smoothed using an 11-year moving average). Theology and secular degree categories are exhaustive and mutually exclusive. The secular degree category includes degrees in the arts, law, and medicine. Data come from the *Repertorium Academicum Germanicum* for degrees granted through 1550 and own data collection (consulting Bauch, 1897; Erler, 1895, 1897, 1909; Eulenburg, 1904; Kleineidam, 1983; Leinweber, 1991; Rüegg, 1996; Steinmeyer, 1912) for degrees granted from 1550 through 1600. Vertical line marks 1517, when Martin Luther circulated his 95 Theses.

where the only change relative to equation 3 is that instead of seven decade dummies interacted with the “eventually Protestant university” dummy variable, we now have three time periods: (1480–1509, 1510–1519, and 1520–1549). As was the case in the analysis of careers, the interaction between the “eventually Protestant university” dummy variable and the 1480–1519 time period dummy allows for a formal test of pre-Reformation trends. The interaction between the “eventually Protestant university” dummy variable and the post-Reformation (1520–1549) dummy variable allows us to identify the differential shift in degrees among graduates from Protestant universities in the Reformation era.

Figure 7 panel A, presents all of our estimates from equations 3 and 4 graphically, in a manner analogous to our analysis of careers. One can see in the figure that during the Reformation, there was an economically and statistically significant decline in the likelihood of Protestant university graduates receiving a degree in theology. The coefficient on the more aggregated post-Reformation interaction shows around a 4.5 percentage point decline in theology degrees—very large relative to the pre-Reformation mean share of theology degrees of around 6%—and statistically significant at the 5% level as well. Prior to the Reformation there was no significant differ-

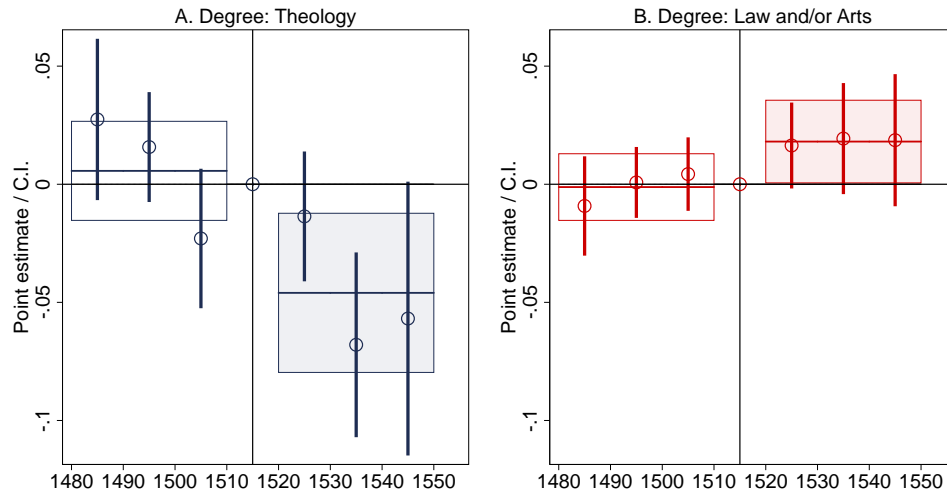


Figure 7: Effects of the Reformation on University Degrees (Difference in Differences Estimates)

Regression estimates of human capital investments across fields over time and by university denomination. Panel A presents the differential probability that graduates from eventually-Protestant universities earned a degree in theology, relative to graduates from universities that remain Catholic. Panel B presents the differential probability that graduates from eventually-Protestant universities earned degrees in law or the arts, relative to graduates from universities that remain Catholic. Regressions are estimated using OLS at the student level, for 9,901 students, and include university and decade fixed effects. Decadal regression coefficients of interest are interactions between an “eventually Protestant university” dummy variable and decade fixed effects and are estimated relative to the omitted interaction with the 1510–1519 decade. In the aggregate specification, coefficients of interest are interactions between an “eventually Protestant university” dummy variable and a 1480–1509 dummy (Panel A:  $\beta = 0.01$ ,  $p = 0.66$ ; Panel B:  $\beta = -0.00$ ,  $p = 0.89$ ), and between an “eventually Protestant university” dummy variable and a 1520–1549 dummy (Panel A:  $\beta = -0.05$ ,  $p = 0.03$ ; Panel B:  $\beta = 0.02$ ,  $p = 0.09$ ), estimated relative to the omitted interaction with the 1510–1519 decade. Coefficient estimates on the decade interactions are plotted as dots with their 90% confidence intervals indicated with vertical lines. Coefficient estimates on the aggregate interactions are shown with horizontal lines, and their 90% confidence intervals are indicated as boxes. Standard errors are clustered at the university  $\times$  decade level.

ence between graduates of Catholic and (eventually) Protestant universities in the likelihood of an individual receiving a theology degree: individual decade-level interactions are insignificantly different from zero, and the coefficient on the more aggregated pre-Reformation interaction is tiny. There is, admittedly, some evidence of a differential decline in the likelihood of theology study in (eventually) Protestant universities from 1480–1509, but this was reversed in the last decade before the Reformation, suggesting that pre-Reformation trends do not drive the post-Reformation patterns we observe.

We next test whether there was a differential shift toward degrees that were more likely to lead to administrative occupations among graduates of Protestant universities during the Reformation. To do so, we estimate regressions analogous to those presented in Figure 7, panel A, but now considering as the outcome variable a dummy indicating that an individual's degree was in law or the arts. That is, we estimate equations 3 and 4, but substitute *law or arts*<sub>itut</sub> for *theology*<sub>itut</sub>. One can see in Figure 7, panel B, evidence consistent with our prediction. While there was essentially no difference in the probability of (eventually) Protestant or Catholic university graduates earning degrees in law or the arts before the Reformation (and no differential trend), a gap emerged between Protestant and Catholic university graduates' degrees in the first decades of the Reformation. The coefficient on the more aggregated post-Reformation interaction shows around a 2 percentage point increase in the likelihood of a Protestant university graduate earning a degree in law or the arts after 1520 (marginally statistically significant, with  $p = 0.09$ ).

### 3.4 Construction activity

We view construction activity as approximating a summary statistic for the allocation of economic resources due to the requirements of land and financial, human, and physical capital. Our highly disaggregated data on construction activity allow us to test a rich set of hypotheses that arise from our conceptual framework.

**Construction activity across territories around the time of the Reformation** — Our conceptual framework and historical evidence lead us to expect a shift in resources—and thus construction activity—toward secular purposes during the Reformation, particularly toward uses favored by secular lords, and in territories that adopted Protestantism. Because lords' expropriation of church resources was not consolidated in the initial decades of the Reformation, we expect reallocation reflected in construction starts to be particularly pronounced beginning in the 1550s. We also expect to observe differences between Protestant and Catholic territories reflecting variation in the *intensity* of religious competition in Catholic areas—which prior research suggests was more intense in the border regions of Catholic territories (Ekelund et al., 2006).

We begin our analysis of construction activity across church and secular sectors by showing, in Figure 8, new construction events per town per year by sector (church and secular are exhaustive and mutually exclusive categories of construction). We show the time series of construction sep-

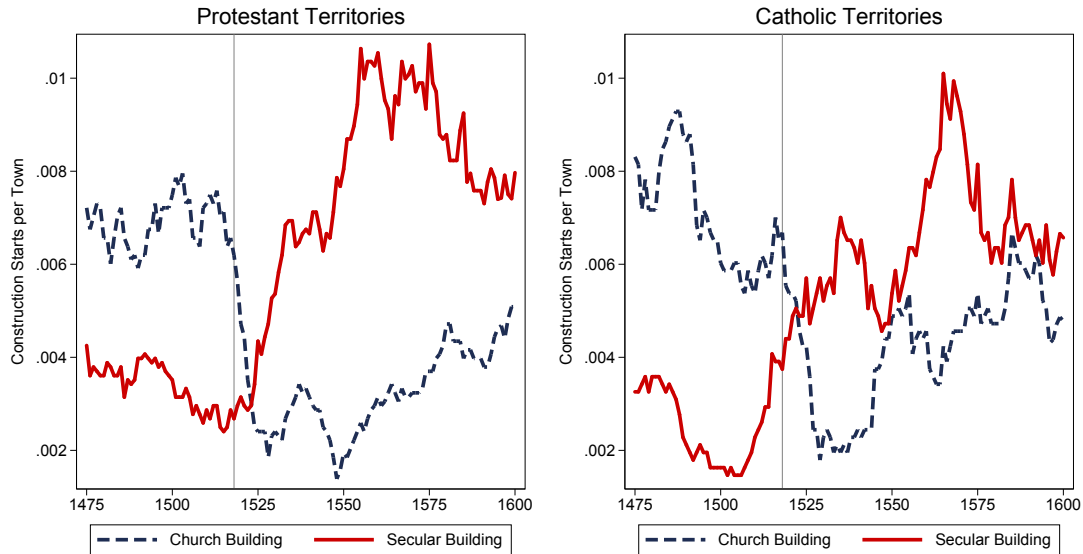


Figure 8: Religious and Secular Construction in Eventually-Protestant and Catholic Germany

Construction starts per town $\times$ year disaggregated by sector for towns in (eventually) Protestant and (remaining) Catholic territories (smoothed using an 11-year moving average). Town-level construction data come from the *Deutsches Städtebuch*. Assignment of towns to religious denominations is done by matching each town to its territorial lord identified in the Euratlas for 1500, and using the territorial lord’s religion as coded by Cantoni (2012). Vertical line marks 1517, when Martin Luther circulated his 95 Theses.

arately for towns whose territorial lords eventually adopted Protestantism and for towns whose lords remained Catholic. Note that the likelihood of a major construction event is small for a given town $\times$ year observation: on average, German towns had one to two major construction events per century in the early-modern era.

Several clear facts emerge from Figure 8. First, in both territories adopting Protestantism and those that remained Catholic, church-sector construction predominated prior to the Reformation. Second, in both “eventually Protestant” and “always Catholic” towns, secular construction increased and church construction decreased just after Luther posted his 95 theses in 1517. Third, the shift in resources was much greater and more sustained in regions that adopted Protestantism: by the end of the 16th century, rates of new secular construction were nearly double rates of new church construction in Protestant towns. In Catholic towns, in contrast, church and secular construction were roughly equal at the end of the 16th century.

We next more formally examine the Reformation-era differences in construction between Catholic and Protestant regions using a regression framework. We aggregate our construction event data to territory $\times$ decade-level units in order to more precisely estimate differences in a context in which the vast majority of towns have zero construction events in a given year. In addition, we examine counts of construction events by sector (rather than a sector’s share of events) due to the presence



of cells with zero total construction.

We estimate the following “flexible” difference in differences model separately for the church sector and the secular sector:

$$construction_{jt} = \alpha_j + \delta_t + \sum_{\tau=1480}^{1590} \beta_{\tau}(prot_j \times decade_{\tau}) + \epsilon_{jt}, \quad (5)$$

where  $construction_{jt}$  is a count of the construction events in territory  $j$ , in decade  $t$ ;  $\alpha_j$  is a set of territory fixed effects;  $\delta_t$  is a set of decade fixed effects; and the explanatory variables of interest are the interactions between an “eventually Protestant territory” dummy variable and decade fixed effects (with 1510–1519 the omitted reference decade). Standard errors are estimated allowing for clustering at the territory level.

In addition, we estimate models with four more aggregate time periods that we interact with the “eventually Protestant territory” dummy. First, the three decades from 1480–1509; next, the omitted reference decade from 1510–1519; third, the three decades of political instability following the omitted decade, from 1520–1549; finally, the post-Schmalkaldic War era decades from 1550–1599. In this specification, the interaction between the “eventually Protestant territory” dummy variable and the 1480–1519 time period dummy allows for a formal test of differential pre-Reformation trends in construction activity between territories that would become Protestant and those that would remain Catholic. The interaction between the “eventually Protestant territory” dummy variable and the first post-Reformation (1520–1549) dummy allows us to identify the differential shift in construction in Protestant territories in the early Reformation era. And, the interaction with the second post-Reformation (1550–1599) dummy variable allows us to identify the differential shift in construction in Protestant territories after territorial lords’ seizures of church property were consolidated and after political stability was established. This more aggregated difference in differences model, again estimated separately for construction in the church and in the secular sector, is as follows:

$$construction_{jt} = \alpha_j + \delta_t + \sum_{\tau=1}^4 \beta_{\tau}(prot_j \times period_{\tau}) + \epsilon_{jt}, \quad (6)$$

where the only change relative to equation 5 is that instead of twelve decade dummies interacted with the “eventually Protestant territory” dummy variable, we now have four time periods: (1480–1509, 1510–1519, 1520–1549, and 1550–1599).

In the left-hand frame of Figure 9, panel A, we present all of our estimates from equations 5 and 6 for the church sector. One can see in the decade-level interaction estimates that prior to the Reformation, (eventually) Protestant territories saw somewhat fewer church sector construction events than (remaining) Catholic territories. The gap between them was closing in the early 16th century, then opens widely in the Reformation era, with Protestant territories experiencing statistically significantly less church sector construction than Catholic territories.

When we examine the more aggregate interactions, these patterns are reinforced: prior to 1510, there was less church sector construction in territories that would adopt Protestantism, but not significantly so, and if anything the trend was toward eliminating the difference just before the Reformation. Then, after the Reformation, both before and after the Schmalkaldic War, there was statistically significantly less church sector construction in Protestant than Catholic regions.

Next, in the left-hand frame of Figure 9, panel B, we present all of our estimates from equations 5 and 6 for the secular sector. This is nearly an inverted image of panel A (note that this is not mechanical, as we do not study construction shares). The decade-level interaction estimates show that prior to the Reformation, (eventually) Protestant territories saw somewhat more secular sector construction events than (remaining) Catholic territories; this difference was statistically significant for the decades from 1490–1509, indicating a move toward *less* secular construction in (eventually) Protestant territories just prior to the Reformation, in the 1510–1519 decade. One can see that in the Reformation era, there is again greater secular sector construction in Protestant territories than in Catholic ones, and that this gap is particularly pronounced in the decades after the Schmalkaldic War (1550–1599).

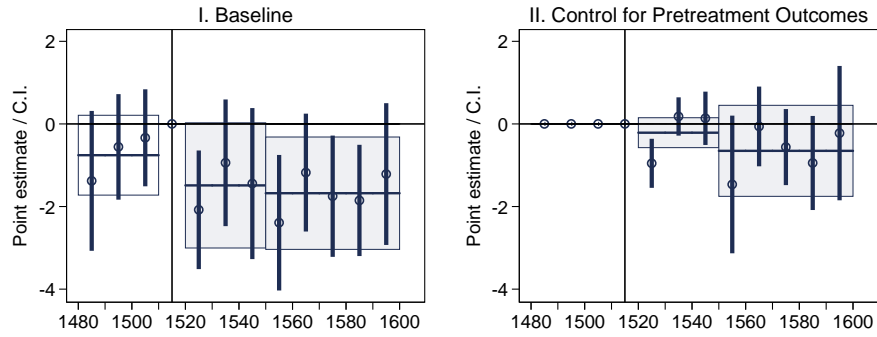
Examining the aggregated interactions, one first sees a statistically significant pre-1510 interaction. It is worth discussing this in some detail: first, this result does *not* imply that the post-1520 patterns we observe were merely the continuation of a pre-Reformation trend. Just the opposite: just prior to the Reformation—moving from the 1480–1509 interaction to the omitted 1510–1519 decade—shows a *negative* pre-Reformation trend in secular construction in (eventually) Protestant territories relative to Catholic ones. Rather, the major concern raised by the significant pre-1510 interaction is that the post-Reformation results simply reflect a reversion to the pre-Reformation mean. The interaction for 1520–1549 of similar magnitude to the aggregated pre-Reformation interaction does not alleviate this concern. However, observing an interaction for 1550–1599 that is nearly twice as large as the other two suggests that the post-Reformation increase in secular sector construction in Protestant territories far exceeds mean reversion. We will further consider concerns about pre-Reformation differences in construction between (eventually) Protestant and Catholic regions in the analyses presented in the right-hand frames of Figure 9.

Finally, in the left-hand frame of Figure 9, panel C, we present all of our estimates from equations 5 and 6, but examining construction that specifically reflected the interests of secular lords: namely, new palaces and administrative buildings.<sup>40</sup> One can see that the patterns qualitatively match those in the left-hand frame of Figure 9, panel B: somewhat greater construction of palaces and administrative buildings in (eventually) Protestant territories prior to the Reformation (in this case not statistically significantly so); a negative differential trend in palace and administrative construction in the last decade before the Reformation in (eventually) Protestant territories; a reversion to earlier differences in the 1520–1549 period; finally, a much larger, statistically significant

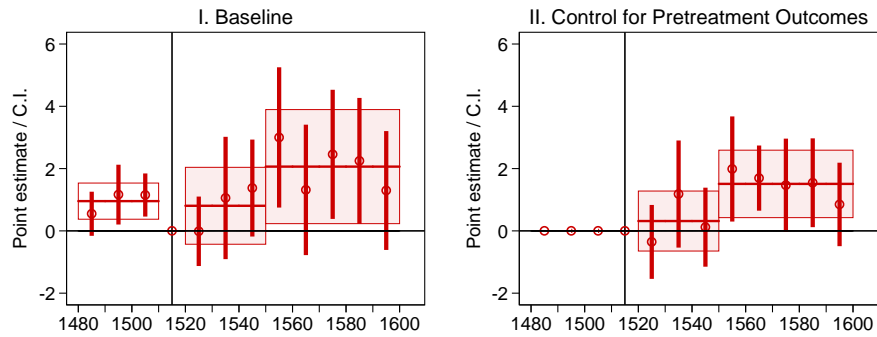
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<sup>40</sup>These estimates simply use counts of palaces and administrative buildings—a subset of secular construction—as outcomes in equations 5 and 6.

## A. Church Construction



## B. Secular Construction



## C. Palace, Administrative, and Military Construction

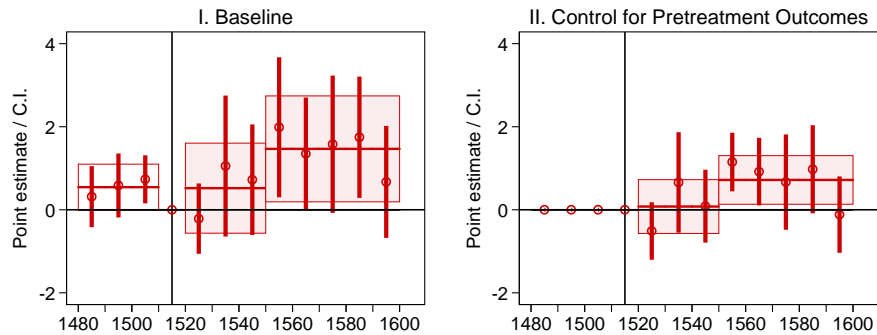


Figure 9: Effects of the Reformation on Construction (Difference in Differences Estimates)

Regression estimates of construction events in a territory×decade by sector, over time and by territorial religious denomination. Panel A presents differential counts of church sector construction events in eventually-Protestant territories, relative to territories that remain Catholic. Panel B presents differential counts of secular sector construction events in eventually-Protestant territories, relative to territories that remain Catholic. Panel C presents differential counts of palace or administrative building construction events in eventually-Protestant territories, relative to territories that remain Catholic. Regressions are estimated using OLS at the territory×decade and include territory and decade fixed effects. The right-hand frames include interactions between the stock of a territory’s construction in 1470 and a full set of decade dummies, as well as interactions between each territory’s level of construction in each pre-Reformation decade and a full set of decade dummies. Decadal regression coefficients of interest are interactions between an “eventually Protestant territory” dummy variable and decade fixed effects and are estimated relative to the omitted interaction with the 1510–1519 decade. In the aggregate specification, coefficients of interest are interactions between an “eventually Protestant territory” dummy variable and: (i) a 1480–1509 dummy (Panel A:  $\beta = -0.75$ ,  $p = 0.20$ ; Panel B:  $\beta = 0.96$ ,  $p = 0.01$ ; Panel C:  $\beta = 0.55$ ,  $p = 0.11$ ); (ii) a 1520–1549 dummy (Panel A, left:  $\beta = -1.48$ ,  $p = 0.11$ ; Panel A, right:  $\beta = -0.21$ ,  $p = 0.33$ ; Panel B, left:  $\beta = 0.81$ ,  $p = 0.28$ ; Panel B, right:  $\beta = 0.32$ ,  $p = 0.58$ ; Panel C, left:  $\beta = 0.52$ ,  $p = 0.42$ ; Panel C, right:  $\beta = 0.08$ ,  $p = 0.84$ ); and, (iii) and a 1550–1599 dummy (Panel A, left:  $\beta = -1.67$ ,  $p = 0.05$ ; Panel A, right:  $\beta = -0.65$ ,  $p = 0.33$ ; Panel B, left:  $\beta = 2.06$ ,  $p = 0.07$ ; Panel B, right:  $\beta = 1.51$ ,  $p = 0.02$ ; Panel C, left:  $\beta = 1.47$ ,  $p = 0.06$ ; Panel C, right:  $\beta = 0.72$ ,  $p = 0.05$ ), estimated relative to the omitted interaction with the 1510–1519 decade. Coefficient estimates on the decade interactions are plotted as dots with their 90% confidence intervals indicated with vertical lines. Coefficient estimates on the aggregate interactions are shown with horizontal lines, and their 90% confidence intervals are indicated as boxes. Standard errors are clustered at the territory level.

difference after 1550.

The left-hand frames of Figure 9 thus broadly confirm the predictions of our conceptual framework: following the Reformation, resources were differentially shifted away from church purposes in Protestant territories (panel A). Political power and control of resources shifted toward secular lords, a process which was consolidated after the Schmalkaldic War; this is reflected in the significant increase in secular construction, and specifically the construction of palaces and administrative buildings, after 1550 (panels B and C).

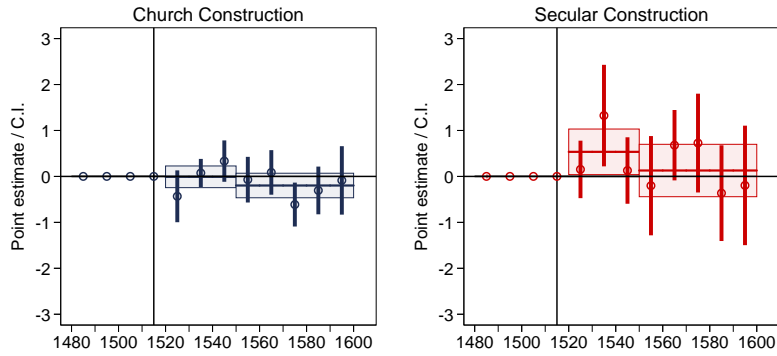
Still, the left-hand frames of Figure 9, panels A through C, raise several questions. First, one might be concerned with the pre-Reformation differences in construction levels between Catholic and (eventually) Protestant territories. Although there was not a trend toward the Reformation-era patterns of construction activity just before 1520, it seems possible that some of the difference between denominations in construction post-1520 reflects mean reversion to pre-Reformation differences (or other unobserved territory differences associated with differential pre-Reformation construction patterns). To address this concern, we next introduce controls that allow pre-Reformation construction levels in a territory to affect post-Reformation outcomes very flexibly.

We first allow for different construction patterns during the Reformation depending on the stock of construction just prior to our analysis, including interactions between the total construction observed in a territory our data up to the 1470s and a full set of decade dummy variables. We also allow pre-Reformation construction flows to affect Reformation-era construction, including interactions between each territory's level of construction in each pre-Reformation decade and a full set of decade dummies. This absorbs all of the pre-Reformation differences in construction in our analyses, and some of the post-Reformation variation, but makes our post-Reformation comparisons close to *ceteris paribus*.

In the right-hand frames of Figure 9, panels A–C, we replicate the analyses from the left-hand frames, but including these very flexible controls for pre-Reformation differences in territories' construction. As noted, by design, there are no pre-Reformation differences in either construction levels or trends between (eventually) Protestant and Catholic territories. Reassuringly, the Reformation-era patterns of reallocation observed in the left-hand frames are qualitatively preserved even including this very demanding set of controls. Most strikingly, secular construction exhibits a statistically significant differential increase in Protestant regions during the 1550–1599 period. The 1.5 additional secular construction events per territory  $\times$  decade and 0.75 palaces or administrative buildings in Protestant regions between 1550 and 1599 represent a large increase relative to pre-Reformation means of 2.2 and 1.4, respectively, and even relative to total construction, which averaged 4.7 events per territory  $\times$  decade prior to 1520.

Up to now, our analysis has focused on the “extensive margin” of religious competition: comparing Protestant territories—where religious competition produced successful entry—with Catholic territories. However, historical evidence suggests that within Catholic regions, religious competition was more intense along borders with Protestant territories (Ekelund et al., 2006); that is, there

### A. Catholic Border Towns: High Competition



### B. Catholic Towns Not on Border: Low Competition

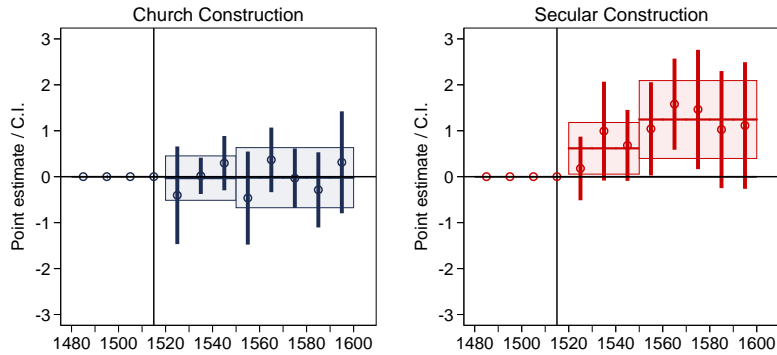


Figure 10: Heterogeneous Effects of the Reformation: Intensity of Religious Competition

Regression estimates of construction events in a territory  $\times$  decade by sector, over time, by territorial religious denomination, and by intensity of religious competition. The left-hand frame of Panel A presents differential counts of church sector construction events in eventually-Protestant regions, relative to regions that remain Catholic and that are on the border with Protestant territories. The right-hand frame of Panel A presents differential counts of secular sector construction events in eventually-Protestant regions, relative to regions that remain Catholic and that are on the border with Protestant territories. Panel B presents analogous analyses, but presenting differential counts of construction events in eventually-Protestant regions, relative to regions that remain Catholic and that are *not* on the border with Protestant territories. Catholic regions are defined at the town level based on the religious denomination of the nearest town (Protestant nearest town implies border region, Catholic nearest town implies non-border regions, and a nearest town with religion unknown is excluded from the analysis). Regressions are estimated using OLS at the territory  $\times$  decade and include territory and decade fixed effects. The right-hand frames include interactions between the stock of a territory's construction in 1470 and a full set of decade dummies, as well as interactions between each territory's level of construction in each pre-Reformation decade and a full set of decade dummies. Decadal regression coefficients of interest are interactions between an "eventually Protestant territory" dummy variable and decade fixed effects and are estimated relative to the omitted interaction with the 1510–1519 decade. In the aggregate specification, coefficients of interest are interactions between an "eventually Protestant territory" dummy variable and: (i) a 1520–1549 dummy (Panel A, left:  $\beta = -0.01$ ,  $p = 0.95$ ; Panel A, right:  $\beta = 0.54$ ,  $p = 0.08$ ; Panel B, left:  $\beta = -0.03$ ,  $p = 0.92$ ; Panel B, right:  $\beta = 0.62$ ,  $p = 0.07$ ) and (ii) a 1550–1599 dummy (Panel A, left:  $\beta = -0.20$ ,  $p = 0.22$ ; Panel A, right:  $\beta = 0.13$ ,  $p = 0.70$ ; Panel B, left:  $\beta = -.02$ ,  $p = 0.96$ ; Panel B, right:  $\beta = 1.25$ ,  $p = 0.02$ ), estimated relative to the omitted interaction with the 1510–1519 decade. Coefficient estimates on the decade interactions are plotted as dots with their 90% confidence intervals indicated with vertical lines. Coefficient estimates on the aggregate interactions are shown with horizontal lines, and their 90% confidence intervals are indicated as boxes. Standard errors are clustered at the territory level.

was an “intensive margin” of religious competition as well. To the extent that the resource reallocation we observe following the Reformation was ultimately driven by religious competition affecting the bargain between religious and secular elites, one would expect that the differences between Protestant and Catholic regions seen in Figure 9 should have primarily been driven by differences between Protestant territories and Catholic regions far from Protestant lands (i.e., those Catholic regions experiencing less religious competition).

To examine this hypothesis, we conduct empirical exercises analogous to those presented in the right-hand frames of Figure 9, panels A and B, but comparing Protestant territories to a split sample of Catholic regions. The first, “high competition,” subsample comprises the set of Catholic towns whose nearest town is known to have had a Protestant territorial lord. The second, “low competition,” subsample comprises the set of Catholic towns whose nearest town is known to have had a Catholic territorial lord. Note that we restrict this analysis to towns (whether Protestant or Catholic) that do not border territories whose lord and religion are unknown to us. Hence this analysis does not precisely aggregate to the results in Figure 9.

In Figure 10, panel A, one can see that comparing Protestant regions’ construction patterns with those in “high competition” Catholic regions, there is only a small difference in Reformation era construction activity, with secular construction being slightly higher in the 1520–1549 period in Protestant regions. In Figure 10, panel B, one can see that Reformation era construction for secular purposes was far greater in Protestant regions than in “low competition” Catholic regions far from Protestant territories (particularly after 1550). These results suggest that religious competition was indeed important both on the “extensive margin” of successful entry and on the “intensive margin” of more contestable religious markets.

Another question about the pattern of reallocation we observe in Figure 9 is whether our results are explained by the mis-classification of construction events. Two types of mis-classification are of particular concern: first, while we assign construction for social welfare purposes to the “secular” category, hospitals and schools were often attached to churches and were staffed by church personnel, making their assignment ambiguous. Second, military construction, which makes up a component of our secular category as well as a component of our count of events reflecting the interests of secular lords, may have served religious purposes in an era of religious conflict.

To more closely examine the types of construction events that drive the observed reallocation, Figure 11 presents evidence on secular construction by specific purpose, in Protestant territories. One can see in the figure that the overall pattern of secularization in Protestant regions is not driven by the ambiguous social welfare or military construction events. Rather, the increased construction in the secular sector is driven by palaces and administrative buildings, precisely the categories that reflect the increased power and wealth of secular authorities.<sup>41</sup>

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<sup>41</sup>We also consider the possibility that while the *count* of church building in Protestant territories shrank after the Reformation, perhaps church building *sizes* increased. We collect data on church sizes from the 124-volume series *Denkmaltopographie Bundesrepublik Deutschland* (Dellwing, 1988/2011) and its various predecessor series (a full set of references is provided in the online appendix) which provides us with information on the area of 14% of the new church

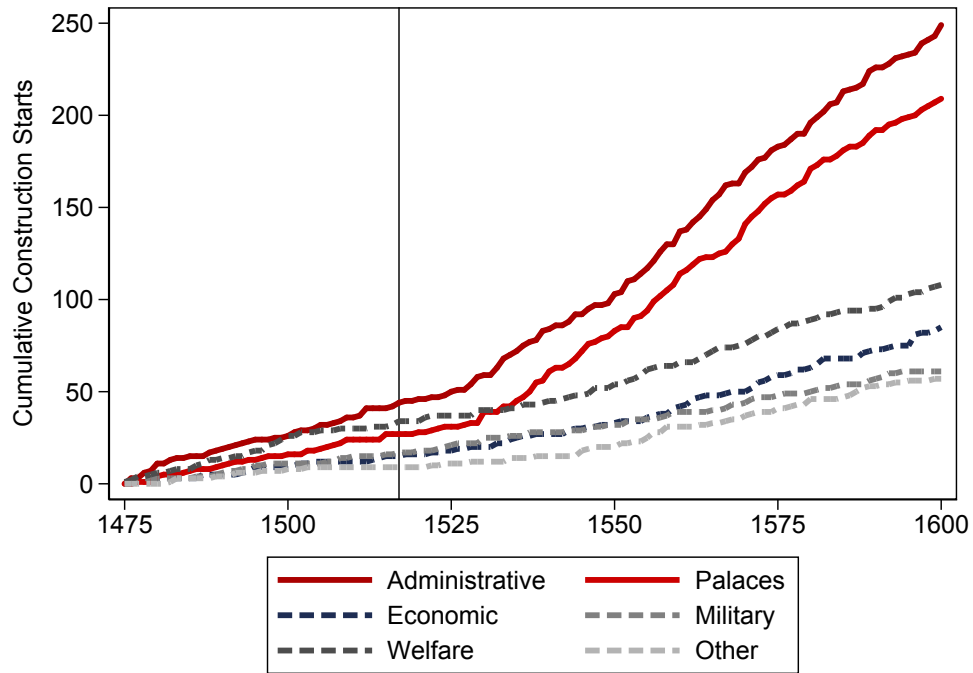


Figure 11: Secular Construction by Purpose in Eventually-Protestant Germany

Cumulative number of new secular sector construction events, disaggregated by specific purpose, for towns in (eventually) Protestant territories. Secular sector construction events are disaggregated into mutually exclusive and exhaustive sub-sectors. The “Administrative” sub-sector includes courts, town halls, and customs houses. The “Economic” sub-sector comprises private sector construction, such as mills, restaurants, and breweries. The “Welfare” sub-sector includes schools and hospitals. The “Palaces” sub-sector includes castles and hunting lodges. The “Military” sub-sector includes barracks and arsenals. Town-level construction data come from the *Deutsches Städtebuch*. Assignment of towns to religious denominations is done by matching each town to its territorial lord identified in the Euratlas for 1500, and using the territorial lord’s religion as coded by Cantoni (2012). Vertical line marks 1517, when Martin Luther circulated his 95 Theses.

**Interpretation of cause and effect** — An overarching question regarding our analysis is whether the reallocation we observe reflects a causal effect of the Reformation or merely the effects of unobserved differences across territories. Perhaps territories that became Protestant were already economically or culturally different prior to the Reformation, with this underlying difference driving both the Reformation and the reallocation of resources we document. Evidence presented thus far supports a causal interpretation: territories and universities that would become Protestant exhibit *no* significant differences in human and physical capital investment trends prior to the Reformation. We observe no indication that these territories would have diverged had the Reformation not occurred.

One might remain concerned about time-varying, territory-specific unobservables that drove both the adoption of Protestantism and resource reallocation. For example, a large literature documents a wave of urban support for the Reformation across Germany and that cities (as opposed to towns) were the locations where reformist ideas and constituencies developed (Ozment, 1975; Hamm, 1994).<sup>42</sup> This suggests a possible alternative theory: just at the time of the Reformation, urban areas may have experienced socioeconomic change that drove both the Reformation and the economic change we observe. However, our findings are *not* driven by large cities. In Figure 12, one can see a pattern of reallocation from church to secular construction in both small Protestant towns and large Protestant cities.

A final concern could be that economic shocks hit particular regions, shifting both the likelihood of the adoption of Protestantism and the incentives for reallocating resources toward secular purposes. To explore this possibility, we narrow our focus to three territories where the timing of religious change was unrelated to local economic conditions. To be precise, we study three settings in which the timing of religious change was driven by the exogenous timing of ruler change. We examine evidence on the change of rulers and religion in the Electorate of Brandenburg, the Duchy of Saxony, and the Duchy of Württemberg.<sup>43</sup> In these three territories, an unobserved territory-by-time economic shock does not explain the timing of the adoption of Protestantism, but we observe the same pattern of resource reallocation coinciding with religious change that we observe throughout Germany.

*Electorate of Brandenburg* — The Electorate of Brandenburg at the time of the Reformation was ruled by Joachim I (Nestor), who, with his brother Albert, personified the corrupt practices that Luther criticized in his theses. In particular, Joachim I and his Hohenzollern family purchased the archbishopric of Mainz for Albert using loans guaranteed by future sales of indulgences. A

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buildings we observe in eventually-Protestant territories between 1470 and 1600. We find that church areas increased slightly, but statistically insignificantly from the pre-Reformation era to the post-Reformation era: from around 450 square meters to around 495 in the sample of churches for which we have data (see Online Appendix Table A3).

<sup>42</sup>As Brady (2009, p. 161) observes, “cities became the nurseries and schoolhouses of religious change, it is hardly going too far to say that the Protestant reformation was, at least in its youth, ‘an urban event’.” This is also consistent with the Tawney hypothesis (Tawney, 1926).

<sup>43</sup>Note that these territories are not unusual in the intensity of monastery closure or the timing of the adoption of the Reformation, as can be seen in Table 2.



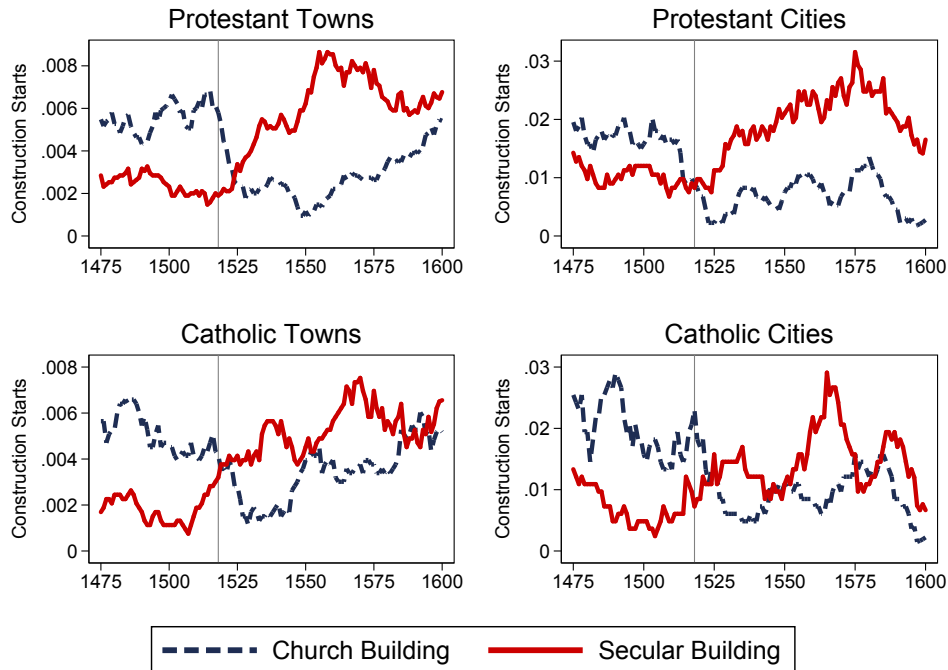


Figure 12: Heterogeneous Effects of the Reformation: Town Size

Construction starts per city  $\times$  year or town  $\times$  year disaggregated by sector for cities and towns in (eventually) Protestant and (remaining) Catholic territories (smoothed using an 11-year moving average). Town-level construction data come from the *Deutsches Städtebuch*. Assignment of towns to religious denominations is done by matching each town to its territorial lord identified in the EurAtlas for 1500, and using the territorial lord's religion as coded by Cantoni (2012). "Cities" for the purpose of this figure are the subset of towns in the dataset with population data available in Bairoch et al. (1988); "towns" for the purpose of this figure are the complementary subset. Vertical line marks 1517, when Martin Luther circulated his 95 Theses.

staunch Catholic, Joachim I had his son, Joachim II (Hector) sign an inheritance contract in which Joachim II promised to remain Catholic. One can see in the top panel of Figure 13 that during the period of Catholic rule (until the death of Joachim I, in 1535), the Electorate of Brandenburg experienced very few monastery closures and saw very little increase in secular construction.

However, after the death of Joachim I in 1535, Joachim II reneged on his pledge to remain Catholic. In the top panel of Figure 13, one can see that shortly after Joachim II took power, the political shock produced a sharp increase in monastery closure, and, as measured by construction activity, a shift of resources toward secular and away from church uses.

*Duchy of Saxony* — The Duchy of Saxony was ruled in the early 16th century by Duke Georg, an ardent Catholic. In 1539, Georg's last remaining (Catholic) son, Frederick died. Knowing that his Protestant brother Heinrich was in line to inherit the Duchy if he died, Georg attempted to secure the inheritance for the Catholic Ferdinand (who would eventually become Holy Roman Emperor). Georg initiated the legal process necessary to transfer his inheritance to Ferdinand; however, before this could be completed, Georg himself died in 1539, leading to the accession of Heinrich and the conversion of the Duchy to Lutheranism.

In the middle panel of Figure 13, one can see some monastery closure and some shift in construction away from the church sector during the Reformation era even under the Catholic Georg. However, at precisely the moment when the Protestant Heinrich took power (marked by a vertical red line), monastery closure sharply accelerated, and resources were allocated differentially toward secular and away from church uses.

*Duchy of Württemberg* — In 1519, Duke Ulrich was exiled from the Duchy of Württemberg after killing the husband of his mistress. Control of the Duchy was given to the Catholic future emperor Ferdinand. In 1523, Ulrich adopted the Protestant faith and attempted to retake the Duchy on the back of the Peasants' Revolt, but this attempt failed. One can see in the bottom panel of Figure 13 that in the first decade after the Reformation, under the Catholic Frederick, there is almost no monastery closure in the Duchy of Württemberg, and very little shifting of construction toward secular purposes.

But in 1534, supported by his friend, the Protestant Philip of Hesse, the Duchy was restored to Ulrich. Immediately thereafter, Ulrich expropriated many of the Duchy's monasteries; by 1535, one-third of the Duchy's farmland was transferred from the monasteries into Ulrich's possession (Ocker, 2010, pp. 55–56). One can see in the bottom panel of Figure 13 that exactly at this time secular construction begins to rise and overtakes religious construction in the Duchy.

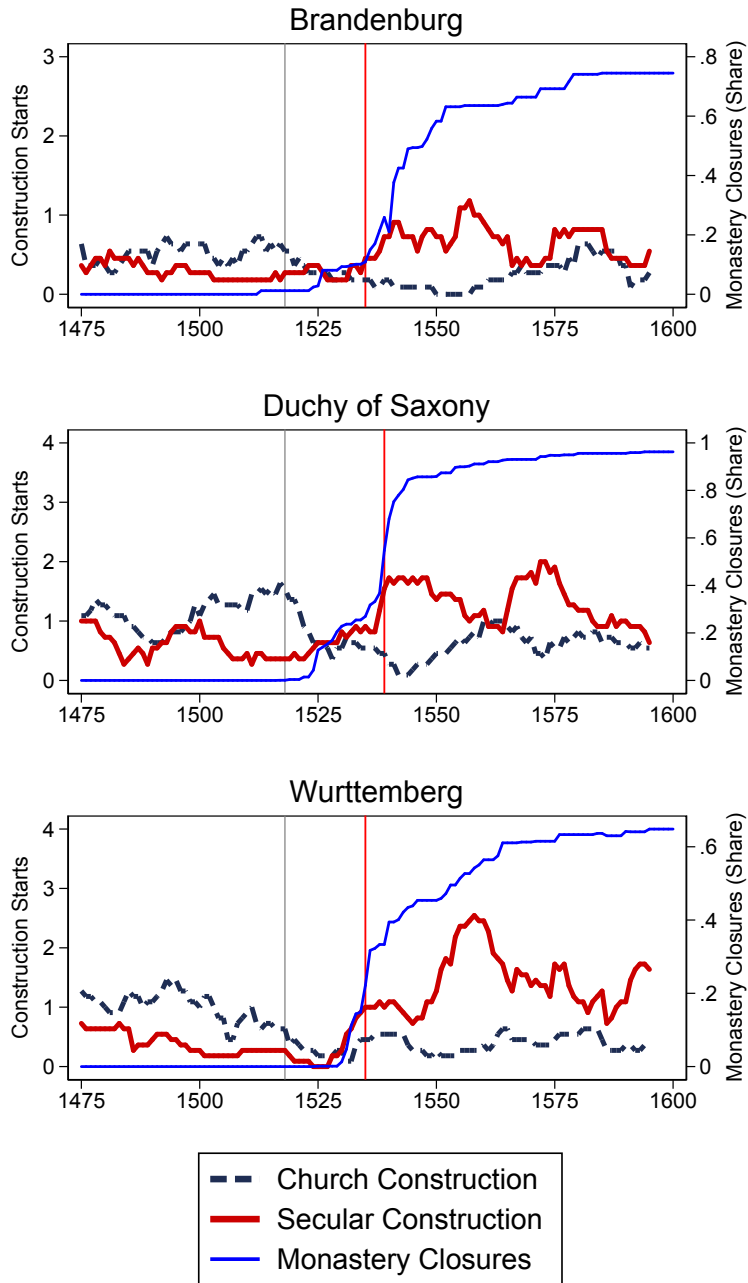


Figure 13: Effects of Reformation: Territorial Case Studies

Monastery closure and construction in three territories: Brandenburg, Ducal Saxony, and Württemberg. Each figure shows the fraction of monasteries closed and the number of construction events in the church and secular sectors (construction events are shown as 11-year moving averages). The posting of Luther's theses in 1517 is marked in all figures, as are the dates of each change in territorial lord leading to the adoption of Protestantism: 1535 for Electorate of Brandenburg, 1539 for the Duchy of Saxony, and 1534 for the Duchy of Württemberg.

## 4 Conclusion

We find that the introduction of religious competition during the Protestant Reformation had an unintended consequence: a significant reallocation of economic resources from religious uses to secular ones. We argue that to understand how economic secularization results from the rise of a religious movement, one must consider the interaction of religious and political elites in a market for religiously derived political legitimacy. Considering this market, one indeed expects that the introduction of religious competition will shift political and economic power from religious elites to secular rulers, producing the secularization we observe.

Our analysis brings rich empirical evidence to some of the major intellectual debates in the social sciences. First, we reinforce Tawney's (1926) emphasis on important pre-conditions for the Reformation: specifically, the relative independence of secular rulers from religious institutions, and conflict between secular and religious elites over Europe's growing wealth play a crucial role in our conceptual framework. However, we also provide evidence that the Reformation marked a decisive break from existing patterns of resource allocation: far from being a continuation of pre-existing trends, the Reformation played a causal role in reshaping Europe's political economy. We identify a massive resource reallocation resulting from the Reformation, but provide a very different mechanism for long-run economic consequences from the cultural channel emphasized by Weber (1904/05).

Our findings also provide the beginnings of an empirical bridge between the Reformation and consequences for long-run growth studied by numerous scholars (Weber, 1904/05; Becker and Woessmann, 2009; Kuran, 2011; Rubin, 2017). Several extensions of this bridge are plausible. First, the shifting of power to secular lords and the weakening of religious elites—particularly in Protestant regions—may have significantly shaped policy choices and legal institutions; this mechanism has been emphasized with respect to corporate law and usury restrictions (Kuran, 2011; Rubin, 2017). Both allocational and institutional secularization strengthened territorial rulers and might have contributed to the development of early modern states of greater state capacity (Besley and Persson, 2009, 2010; Gennaioli and Voth, 2015). Finally, both the reallocation of resources (particularly upper tail human capital) and the weakening of religious elites, might have set in motion a process of cultural and intellectual change that culminated in the enlightenment, the scientific revolution, and modern economic growth (Mokyr, 2005, 2017). While these links extend beyond the scope of our study, we believe they deserve further attention.

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## Supplementary Appendix – For Online Publication

### Additional references

The *Denkmaltopographie Bundesrepublik Deutschland* cited in the main text (Dellwing 1988/2011) was preceded by separate series of volumes listing and describing all historical buildings in the single states of Germany. We looked up sizes of church buildings in these volumes as well, to extend and complement the analysis based on the *Denkmaltopographie Bundesrepublik Deutschland*.

*Die Kunstdenkmäler des Grossherzogtums Baden*, 15 volumes, Tübingen: Mohr, 1887–1913.

*Die Kunstdenkmäler von Bayern*, 112 volumes, München: Oldenbourg, 1892–1972.

*Berlin und seine Bauten*, 3 volumes, Berlin: Ernst, 1877–1896.

*Die Kunstdenkmäler der Provinz Brandenburg*, 6 volumes, Berlin: Dt. Kunstverlag, 1907–1921.

*Bau- und Kunstdenkmäler des Herzogthums Braunschweig*, 5 volumes, Wolfenbüttel: Zwissler, 1896–1910.

*Die Kunstdenkmäler der Provinz Hannover*, 26 volumes, Hannover: Provinzialverwaltung, 1899–1939.

*Kunstdenkmäler im Großherzogthum Hessen*, 5 volumes, Darmstadt: Bergstraesser, 1885–1898.

*Die Baudenkmäler des Regierungsbezirks Wiesbaden*, 6 volumes, Frankfurt am Main: Keller, 1902–1921.

*Die Bau- und Kunstdenkmäler in den Hohenzollern'schen Landen*, Stuttgart: Neff, 1896.

*Kunst- und Geschichts-Denkmäler des Großherzogthums Mecklenburg-Schwerin*, 5 volumes, Schwerin: Bärensprung, 1896–1902.

*Kunst- und Geschichts-Denkmäler des Freistaates Mecklenburg-Strelitz*, 2 volumes, Neubrandenburg: Brünslow, 1921–1934.

*Bau- und Kunstdenkmäler des Herzogtums Oldenburg*, 5 volumes, Oldenburg, 1896–1909.

*Die Bau- und Kunstdenkmäler der Provinz Ostpreußen*, 9 volumes, Königsberg, 1891–1899.

*Die Baudenkmale in der Pfalz*, Ludwigshafen, 1884–1897.

*Bau- und Kunstdenkmäler der Provinz Pommern*, 24 volumes, Stettin, 1881–1909.

*Die Kunstdenkmäler der Rheinprovinz*, 20 volumes, Düsseldorf, 1891–1937.

*Die Kunstdenkmäler der Provinz Sachsen*, 33 volumes, Leipzig, 1838–1850.

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*Verzeichniss der Kunstdenkmäler der Provinz Schlesien*, 6 volumes, Breslau, 1886–1902.

*Die Bau- und Kunstdenkmäler der Provinz Schleswig-Holstein*, 6 volumes, Kiel, 1887–1925.

*Bau- und Kunstdenkmäler Thüringens*, 24 volumes, 1888–1928.

*Die Bau- und Kunstdenkmäler von Westfalen*, 38 volumes, Münster, 1881–1913.

*Die Bau- und Kunstdenkmäler der Provinz Westpreußen*, 14 volumes, Danzig, 1884–1919.

*Die Kunst- und Altertums-Denkmale im Königreich Württemberg*, 4 volumes, 1893–1928.

## Appendix figures and tables

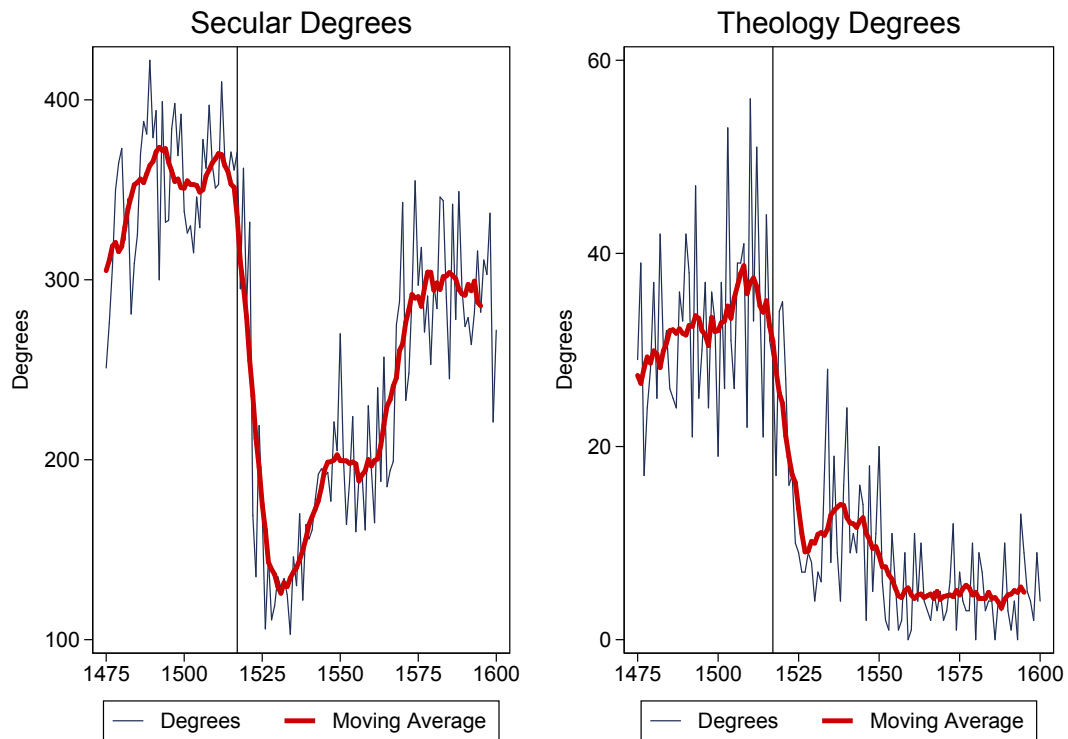


Figure A1: Number of theology and secular degrees granted (yearly data and 11-year moving average). Theology and secular (arts, law, and medicine) degree categories are exhaustive and mutually exclusive. Data come from the *Repertorium Academicum Germanicum* for degrees granted through 1550 and own data collection (consulting Bauch, 1897; Erler, 1895, 1897, 1909; Eulenburg, 1904; Kleineidam, 1983; Leinweber, 1991; Rüegg, 1996; Steinmeyer, 1912) for degrees granted from 1550 through 1600.

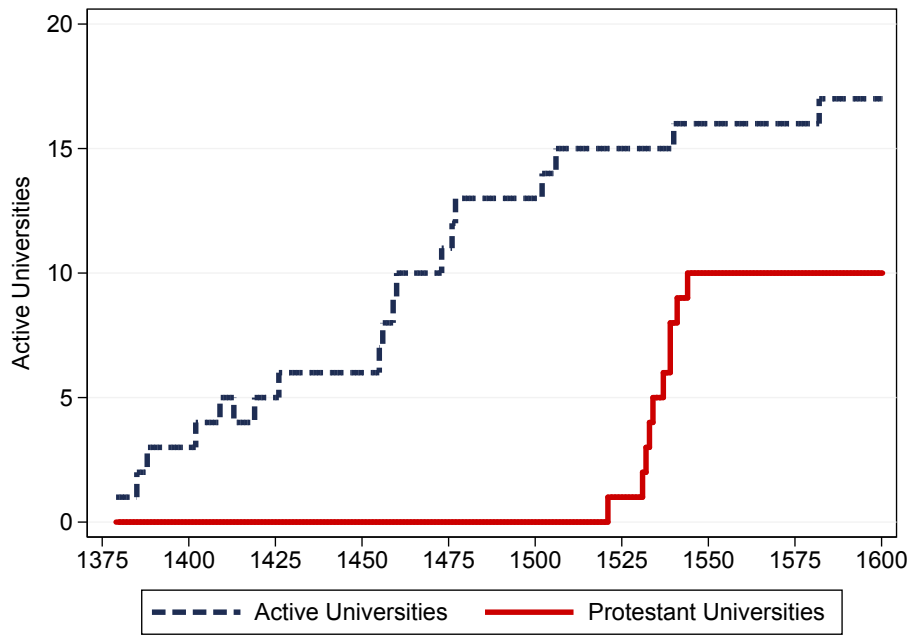


Figure A2: Number of German universities (total and Protestant only) within our sample. Adoption of Protestantism is coded based on Sehling (1902-2013), Spitz (1981), Grendler (2004), and Naragon (2006).

Table A1: Territories and assignment to (eventual) religion

Territory	Protestant	Territory	Protestant
Anhalt	1537	Lorraine	—
Baden	1555	Mainz	—
Bavaria-Landshut	—	Mecklenburg	1549
Bavaria-Munich	—	Nassau	1542
Bohemia	—	Palatinate	1546
Brandenburg	1539	Passau	—
Brunswick-Calenberg	1584	Poland	—
Brunswick-Lüneburg	1529	Pomerania	1534
Brunswick-Wolfenbüttel	1568	Ruppin	1539
Burgundian Netherlands	—	Salzburg	—
Cleves-Mark	—	Saxony (Ducal)	1539
Cologne	—	Saxony (Electorate)	1527
Denmark	1536	Small States of the HRE	.
East Frisia	1535	Swiss Confederacy	.
Guelders	—	Trier	—
Habsburg Monarchy	—	Upper Palatinate	1546
Hesse	1526	Württemberg	1534
Jülich-Berg	—		

Table lists territories present in the Euratlas (Nüssli, 2008) for 1500, and their assignment to the territorial lord's (eventual) religion through the dates of introduction of the Reformation as in Cantoni (2012). Note: Cities matched by the Euratlas digital maps to "Small States of the HRE" and to the "Swiss Confederacy" are discarded in our analysis. Territories, and their names, reflect borders as of 1500: Bavaria-Landshut and Bavaria-Munich, e.g., merge after the War of the Succession of Landshut (1503–1505).

Table A2: Degrees awarded by level and subject

Subject	Bachelor's	License	Master's	Doctor	Total
Arts	17608	4163	15179	450	37400
Law	1210	892	1	896	2999
Medicine	239	211	7	486	943
Theology	2085	767	38	898	3788
Across subject total	21142	6033	15225	2730	45130

Data come from the *Repertorium Academicum Germanicum*.

Table A3: The Size of Church Construction Projects in Protestant Territories

	Pre: 1470-1517			Post: 1518-1600			<i>p</i> -value
	n	Mean	SD	n	Mean	SD	diff. in means
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>All New Church Construction</i>							
Indicator: Church Size Recorded	125	0.18	0.38	88	0.08	0.27	0.03
<i>Where Church Size is Recorded</i>							
Church Size in Square Meters	22	453.24	302.43	7	494.93	196.42	0.68

This table presents summary statistics on physical sizes of new churches built in German territories that ultimately adopted Protestantism. We study new church construction in cities and towns recorded over the period 1470–1600 in the *Deutsches Städtebuch*. We obtain data on church sizes by finding each new church in the 124-volume series *Denkmaltopographie Bundesrepublik Deutschland* (Dellwing, 1988/2011), which provides a record of cultural monuments in Germany. The first row provides summary statistics for the binary outcome indicating whether a given church construction event mentioned in the *Deutsches Städtebuch* is recorded with original floor dimensions in the *Denkmaltopographie Bundesrepublik Deutschland* (1 = ‘yes’, 0 = ‘no’). The second row provides summary statistics on church sizes for construction events on which the *Denkmaltopographie Bundesrepublik Deutschland* provides information on the original size of church buildings. Church sizes are measured in square meters, calculated as the sum of the church nave area and church choir area, using data on floor plan widths and lengths.