

# From Investiture to Worms: A Political Economy of European Development and the Rise of Secular Authority\*

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## Abstract

The endogenous consequences of competition between the Roman Catholic Church and secular rulers set into motion by the Investiture Controversy contribute new insights into European economic development, the rise of secular political authority, and the decline of the Catholic Church's political power. In particular, the resolution of the Investiture Controversy in the Concordat of Worms (1122) resulted in a significant increase in the bargaining power of secular rulers in wealthier polities relative to poorer polities. This created an institutional environment in which the Catholic Church had incentives to limit economic development while secular rulers could expand their political control by promoting development within their domain. Empirical evidence shows that the behavior of popes and of secular rulers changed in ways consistent with these incentives. The evidence indicates that the incentives created at Worms played a central role, starting hundreds of years before the Protestant Reformation, in the rise of secular political authority and its association with economic prosperity.

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At least since the seminal work of [Weber \(1930\)](#), discussions of the political and economic development of Europe have sought to understand the linkage between economic prosperity, the rise of secular authority, and the decline of the Catholic Church as a political power. We shed new light on these issues by focusing on the strategic implications of a critical portion of Europe’s economic, political, and religious development, namely the resolution of the Investiture Controversy through the Concordat of Worms (1122). Although the impact of new rules governing the selection of bishops established at Worms was substantial, it is largely misunderstood or underestimated. For instance, [Cantor \(1993\)](#) and [Spruyt \(1994\)](#), as well as others, have noted that the Investiture Controversy influenced subsequent changes in secular authority, but they lack an explanatory mechanism and miss the linkage between Europe’s economic development and the secularization of its politics. Our political economy analysis specifies a mechanism that directly links variation in secularization of politics across Europe to variation in economic prosperity and shows how both shaped the declining political role of the Church in much of Europe.

We develop a formal model that captures the new institutional incentives that were codified in the Concordat of Worms and show that the model’s predictions are consistent with diocese-level data on the rise of secular authority. The model elucidates the implications of secular leaders’ newly extracted power to reject bishops and, in so doing, temporarily retain control of local economic resources that would otherwise belong to the Church. We show that this feature of the Concordat of Worms shifted bargaining power, expanding substantially the bargaining power of secular leaders in their dealings with the Church in wealthier dioceses while sustaining the Church’s bargaining power in poorer dioceses. As a consequence, secular leaders in wealthy dioceses were able to assert increased control over territory and policy, leading to the endogenous rise of secular power.

The model also shows that the incentives institutionalized at Worms drove a wedge between the interests of secular leaders and the Church. In particular, secular leaders benefited from policies that fostered economic development, thereby improving their bargaining leverage, while the Church had incentives to limit such development in order to contain the loss of political control.

Our approach is a departure from the conventional terms of debate. The literature (which we discuss in more detail in [Section 6](#)) has examined the implications of the Investiture Controversy and its resolution for the absolute level of power of central versus local and religious versus secular authorities. Our arguments and evidence, by contrast, are about the differential impact of the Concordat of Worms on the power of religious versus secular leaders in wealthier versus poorer dioceses. This interaction between the political,

religious, and economic is essential to our account of the incentives created at Worms and their implications for next several centuries of European development.

We provide several pieces of evidence in support of our new theoretical account. We show, quantitatively, that the period when the Concordat of Worms was in force was indeed associated with a significant increase in the bargaining power of secular leaders in more prosperous dioceses—comparing the Worms period to periods before and after, a one-standard deviation increase in a diocese’s trade exposure during the Worms period is associated with an additional 13 percentage point decrease in the likelihood that the diocese’s bishop is aligned with the pope rather than the secular leader (relative to a mean of 74%). Then we discuss qualitative, historical evidence in support of the model’s prediction that, following the resolution of the Investiture Controversy, the interests of secular rulers and popes diverged. In particular, we show that, while secular rulers pursued economic development, popes often imposed policies designed to curtail economic development and the consequent erosion of Church power.

Our conceptual approach to the Concordat of Worms is most closely aligned with [Bueno de Mesquita \(2000\)](#). That study, however, differs in important respects from this one. First, [Bueno de Mesquita’s \(2000\)](#) analysis focuses on the contribution of Worms to the origin of sovereign states. In contrast, we are interested in the bargain between popes and secular rulers over secular political control of religious institutions and the relationship to economic development. Moreover, [Bueno de Mesquita’s \(2000\)](#) empirical analysis only covers France during the reign of King Philip Augustus (1179-1223). It shows that, of the 82 French bishops during that time period, those who were the king’s blood relatives were more likely to be located in wealthy dioceses while those from the pope’s court were more likely to be located in poorer dioceses. That analysis is unable to say anything about changes in the distribution of bargaining power that resulted from the Concordat of Worms, since the data are drawn exclusively from a period in which the Concordat was operative. Such comparative conclusions are precisely the point of our empirical analysis.

Our study complements, as well, recent research on economic secularization following the advent of the Protestant Reformation. [Cantoni, Dittmar and Yuchtman \(Forthcoming\)](#) present evidence of an emphatic shift away from the religious and toward the secular, showing, for instance, that there was a swift and dramatic increase in the study of secular topics in universities, a shift to construction of major secular edifices at the expense of religious construction, and so forth. That work establishes, in the German context, a plausible causal path from the Reformation to the secularization of Protestant Europe’s economy. But, as [Cantoni, Dittmar and Yuchtman \(Forthcoming, p. 7\)](#) note, “[s]urprisingly

little evidence exists establishing a direct link from the Reformation to secularization”. We propose to establish that differential *political* secularization was fostered by the crisis in Europe launched in 1046 and resolved at Worms. This political secularization in Europe’s more prosperous regions was already established by the time of the Avignon papacy in 1309, two hundred years before the Protestant Reformation.

In addition to being a case study of the economic and political forces underlying a critical historical period of European development, our analysis relates to important broader themes. Our focus on how the rules put in place by the Concordat of Worms affected European development is clearly related to the literature on how institutions shape development (e.g., [North and Thomas, 1973](#); [North and Weingast, 1989](#); [Przeworski and Limongi, 1993](#); [Acemoglu, Johnson and Robinson, 2001](#); [Bueno de Mesquita et al., 2003](#); [Acemoglu and Robinson, 2013](#)). Moreover, our account of how secular authority emerged through a process of bargaining away the power of centralized religious authority relates to questions about the emergence of the modern state (e.g., [Tilly, 1992](#); [Ertman, 1997](#); [Alesina and Spolaore, 2005](#); [Gancia, Ponzetto and Ventura, 2017](#)), the spread of secularism (e.g., [Dimont, 2004](#); [Barro and McCleary, 2005](#); [Gruber and Hungerman, 2008](#); [Cantoni, 2012](#)), and the relationship between religion and economic development (e.g., [Weber, 1930](#); [McCleary and Barro, 2003](#); [Durlauf, Kourtellos and Tan, 2012](#); [Cantoni, 2015](#)).

The paper proceeds as follows. Section 1 provides a brief historical background to the Investiture Controversy and its culmination in the Concordat of Worms. Section 2 analyzes a model that captures the key institutional incentives created by the Concordat of Worms. The model generates testable predictions and elucidates a wedge driven between religious and secular rulers. Section 3 introduces the data and variables used to evaluate the empirical implications of the model. Section 4 tests the theoretical implications regarding the relationship between local economic prosperity and secularization of political control. Section 5 discusses qualitative evidence to suggest that secular rulers in fact pursued policies designed to foster economic development and wrest political power from the Church, while the Church pursued the opposite. Section 6 concludes by situating our account relative to other views in the literature on Europe’s economic, political, and religious development, including literatures on the causes and consequences of the Protestant Reformation.

## 1 Brief Historical Background

The eleventh century saw major struggles between Europe’s religious and secular rulers over political and economic authority. Much of this conflict revolved around who had the power

to appoint bishops (including the pope)—the key religious-political figures. This Investiture Controversy began in 1046, when Pope Benedict IX sold the papacy to his godfather, Gratian, who became Pope Gregory VI. The Holy Roman Emperor, Henry III, stepped in, usurping the role of bishops in choosing popes. He deposed Gregory VI, installing in his place, Suidger of Bamberg, a German, like Henry. The emperor, in removing the pope, raised the potential for secular authority to trump the ecclesiastical in the selection and removal of high church officials.

The Church fought back against this possibility. Speaking to the selection of the pope, the anonymous author of the influential *De Ordinando Pontifice* (“On the Establishment of the Pope) argued in 1048, “Who elects the one that we work for? Those who stand closest to the church; if he is not called by the bishops, he is not received immediately by the church; if so, he is not legitimate.” (Melve, 2007, p. 151). And, according to the views of the reformist Pope Gregory VII (1073-85), a similar argument applied more broadly. Only the Church, he claimed, could appoint or select bishops. As Bishop Abo explained,

[T]he Holy Spirit has said through the mouth of the blessed Pope Gregory ‘that that benediction shall turn for them into a malediction who is thus promoted to be a heretic, and by this malediction he shall have no profit who thinks for the sake of money to invade an office in the church.’ The custom has now grown so much that laymen sell bishoprics. . . And if you ask them who made them bishops they will answer quite freely, saying ‘I was recently ordained by the archbishop, and gave him a hundred shillings to have episcopal consecration.’ (Lutz, 1977, p. 43-50)

Gregory VII was seeking a way to normalize and institutionalize the selection of bishops. For several centuries bishops had been selected through varying, even haphazard practices. Depending on locale and time period, bishops might have been chosen through local election (*a clero et populo*), appointment by Church authorities (e.g., archbishops), appointment by local secular authorities, by monarchs, or other practices. King Clovis (466-511), for instance, launched the Christianization of the nascent country of France and almost always respected the Church’s authority to select bishops. Subsequent Merovingian monarchs, however, intruded themselves in the process with the Church fighting back through Councils such as in 533 and 535 to restore selection *a clero et populo* in keeping with previous canons, but with mixed results. Charlemagne (742-814), like Clovis, respected Church authority over the appointment of bishops but subsequent Carolingian monarchs as well as powerful dukes did not. Similarly mixed practices could be found across western Europe (Costigan, 1966).

Thus, in the run up to the Investiture Controversy, bishops had been appointed sometimes exclusively by Church practices, sometimes by local rulers like dukes and counts and even in France by the mayors of the palace rather than the king, making for poorly established norms for the appointment of high clerics.

These struggles between religious and secular power over the appointment of bishops culminated in a diplomatic treaty signed at Worms in 1122. In the Concordat of Worms, the Holy Roman Emperor, Henry V, and the Pope, Calixtus II, resolved that popes alone would have the right to nominate bishops; the right of the secular authorities was to accept or reject the papal nominee; and in the event that the nominee was rejected then during the time of the interregnum between bishops, the income from the diocese would go to the secular ruler. This latter condition—which we will argue critically shaped the conflict between religious and secular leaders over the next several hundred years—overrode canon 25 agreed to in 451 at Chalcedon. That canon stated, “Let the ordination of bishops be within three months: necessity however may make the time longer. But if anyone shall ordain counter to this decree, he shall be liable to punishment. The revenue shall remain with the *œconomus*”; that is, the Church’s chosen financial manager or steward of the diocese’s temporal accounts.<sup>1</sup> During the 11<sup>th</sup> and 12<sup>th</sup> centuries, the Church was by far the largest land holder in Europe, so control over these revenues was a non-trivial matter (Brown, 2015).

These terms were legally binding on the Pope, the Holy Roman Emperor, and the secular rulers of France, Burgundy and Italy (who were subjected to terms that were slightly different, but not in consequential ways) through the Concordat of Worms and on the secular leaders of England through the similar Concordat of London.<sup>2</sup>

The competition between the Church and secular rulers over the appointment of bishops was indicative of broad issues surrounding power and wealth. The identity and loyalty of bishops was critical to the relative political power of the Church and monarchs. As Gilchrist (1969, p. 22) notes, control of the bishoprics had important implications for “control of church property and money.” But the power of bishops was not limited just to syphoning revenue to the Church or to the secular ruler. The office of bishop could be and was used to muster the local community’s loyalty on behalf of the pope or on behalf of the secular ruler. By way of illustration, consider how policy was influenced by the loyalties of bishops during the reign of Philip Augustus (1179-1223) in France and Pope Innocent III in Rome.

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<sup>1</sup>see [http://www.earlychurchtexts.com/public/chalcedon\\_/canons.htm](http://www.earlychurchtexts.com/public/chalcedon_/canons.htm).

<sup>2</sup>In terms of modern states, the Concordats applied largely to what is today Germany, Austria, France, Belgium, the Netherlands, Italy, and England.

Pope Innocent III interdicted Philip, depriving Philip's subjects of access to the sacraments unless Philip succumbed to the pope's will on important political questions of the day. The interdiction was faithfully observed by virtually every French bishop whose background indicated close personal ties to the pope. Almost every bishop who was a blood relative of the king, by contrast, ignored the interdiction and continued to provide the king's subjects in their domain with the sacraments (Baldwin (1986, appendix), Bueno de Mesquita (2000)).

The agreement at Worms was reached against this backdrop of secular-religious political struggle to control the selection of bishops, and thereby, the flow of political authority and diocesan revenue. By granting secular rulers the newly institutionalized right to refuse bishops-nominees and making them residual claimants to diocesan income in the event of an interregnum, the Concordat of Worms, we will argue, formalized and institutionalized conditions that differentially affected the bargaining power of secular rulers in a way that depended on the wealth of their dioceses.

Popes, of course, also had bargaining power. In addition to proposal power, popes had an arsenal of punishment tools at their disposal. They could challenge a secular leader's credibility through harsh public declarations (Melve, 2007); by absolving subjects of oaths given on behalf of the ruler as Pope Innocent III did to England's King John in 1208; by excommunicating the secular ruler or his entire domain. They could interdict specific territories (dioceses) controlled by the secular ruler, denying the people access to some or all of the sacraments, thereby denying them any hope of entry into heaven. Even if a secular ruler were not religious, he would surely have been mindful that the Church was the monopoly provider of salvation and so its support was essential for his political well being.

In codifying the shifting relations between religious and secular leaders during the period of the Investiture Controversy, the Concordat of Worms fostered an alteration in the balance of power between these two domains. By the late thirteenth century, Church authority over prosperous dioceses was so challenged that Pope Boniface VIII found it necessary to try to reassert papal power. He issued the Bull *Clericis Laicos*, banning the clergy from paying taxes to secular leaders without papal approval. He did so in response to the efforts of England's King Edward I and France's King Philip IV, who were at war with each other and tried to raise their war chests at the expense of the local Church. Matters further deteriorated in 1302 when Boniface, reacting to continued assaults on the Church's authority, issued the Bull *Unam Sanctam*. Here he declared his unique right, as Pope, to depose any secular ruler, including kings. This resulted in Philip IV sending an army against Boniface. Philip's army seized the Pope, who died a short while later. The rift between Church and secular authorities deteriorated still further, ultimately resulting in

the appointment of a new French Pope, Clement V, in 1305. In 1309 Clement moved the papacy to Avignon. Although Avignon was nominally not in France, it was nevertheless subject to strong political influence by the French king.

Throughout the Avignon papacy, popes were French and the seat of Church power (the curia) resided in Avignon rather than Rome. So strong was the French king's influence over the papacy, that in 1314 he got the pope to back the main elements of his condemnation of the Knights Templar (allowing Philip, who owed a great deal of money to the Templars, to seize much of their banking wealth). The Avignon papacy prevailed from 1309-1376, resumed as the Western schism in 1378, ending with the Council of Constance in 1417. During that period, some of the Avignon popes can be said to have acted fully on behalf of the French king. Others, such as the first, Clement V, understood the importance of survival and so frequently, as necessary, succumbed to the king's pressures. As [Stephen \(1855, p. 240\)](#) observed, "the Popes were little more than vassals of the French monarchs at Avignon."

In short, the Avignon popes generally acted as the agents of the King of France, who was often in partnership with the Holy Roman Emperor in that period. Since the Avignon papacy turned the pope and his bishops on secular matters into agents of secular rule, from our perspective, the beginning of the Avignon papacy in 1309 marks the end of the period beginning in 1122 in which the Concordat of Worms defined relations between religious and secular authorities in a consequential way ([Gilchrist, 1969](#)).

## 2 The Model

In this section we introduce a theoretical model that captures, in stylized form, the key institutional features created by the Concordat of Worms. The model highlights the consequences of the pope's power to nominate bishops, a secular ruler's right to accept or reject, and the secular ruler's status as residual claimant on local church resources. In particular, the model addresses the conditions under which the bishop (and, thus, local religious policy) could be expected to be aligned with the pope or secular ruler; who ended up with control over the economic resources of the diocese; and the likelihood of a bishop being successfully appointed and approved. Our model's predictions will be implicitly compared to a pre-Worms baseline in which bargaining power was more dispersed, as discussed in [Section 1](#).

There are two players: the Pope and the (secular) Ruler. The game occurs over an infinite number of periods.

The game begins with no bishop in office. At the beginning of each period  $t$  in which there is no bishop in office, the Pope nominates a bishop with policy position  $r_t \in [r, \bar{r}] \subset \mathbb{R}$ . The Ruler either accepts or rejects the nominee. If the Ruler accepts the nominee, that nominee serves as bishop for the remainder of the game. If the Ruler rejects the nominee, there is no bishop in office in the next period.

In each period, the diocese has income  $y > 0$ . (For the remainder of the paper, we will use the terms “income” and “wealth” interchangeably, since they are not distinguished in our model or our data.) If no bishop is accepted, the diocese has a status quo policy  $q \in [r, \bar{r}]$ , which represents whatever policy will be pursued until a new bishop is in place, and the Ruler suffers an instantaneous cost  $c > 0$ , representing punishments imposed on the Ruler or diocese by the Pope.

Finally, we assume that, whenever a bishop is nominated in period  $t$ , there is a shock,  $\epsilon_t$ , to the Ruler’s instantaneous payoff from accepting the bishop. This shock captures a variety of unforeseen local diocesan political, economic and social conditions that may influence the Ruler’s willingness to accept a nominee in the short-run. Equivalently, it could represent a shock to the costs the Pope is able to impose on the Ruler for rejecting a bishop-nominee.<sup>3</sup> The  $\epsilon$ s are independently and identically distributed according to a cumulative distribution function,  $F$ , with full support on the real line and associated log-concave density  $f$ . We slightly abuse notation by using  $\epsilon$  to refer both to the random variable and to its realization.

All players discount the future with a common discount factor  $\delta \in (0, 1)$ .

Payoffs are as follows. In each period in which there is a bishop of position  $r$  in office, the Pope’s payoff is:

$$\lambda_P r + (1 - \lambda_P)y.$$

In any period in which there is no bishop in office, the Pope’s payoff is

$$\lambda_P q,$$

where  $\lambda_P \in (0, 1)$  is the relative weight the Pope puts on policy relative to income.

In any period in which the Ruler rejects the bishop, the Ruler’s payoff is

$$-\lambda_R q + (1 - \lambda_R)y - c.$$

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<sup>3</sup>Of course, without some such shock, the model would predict that a bishop-nominee is never rejected. The exact form that such shocks take (e.g., short-run versus persistent) is unimportant for any of the conclusions of the model.

If the Ruler accepts a nominee of position  $r$  in period  $t$ , his payoff in that period is

$$-\lambda_R r + \epsilon_t$$

and his payoff in all future periods is

$$-\lambda_R r.$$

The parameter  $\lambda_R \in (0, 1)$  is the weight the Ruler puts on policy relative to income.

## 2.1 Comments on the Model

Before turning to the analysis, it is worth commenting briefly on a couple aspects of the model.

First, the key feature of the payoffs is that the Ruler and Pope disagree about the kind of policy positions they would like the bishop to have. The utility functions capture this idea by assuming the Ruler always prefers a lower  $r$  and the Pope always prefers a higher  $r$ . This is meant to reflect the idea that the bishop's alignment determines whether he pursues policies favored by the Ruler or the Pope. As such, we can interpret the equilibrium value of  $r$  as indicating the extent to which the bishop is aligned with the Ruler or Pope. A model in which each of the Ruler and the Pope had different ideal points and disliked deviations from that ideal point would be qualitatively equivalent to this model.

Second, we assume that the Ruler and Pope do not have diminishing marginal utility from money. One might worry that allowing for diminishing marginal utility would introduce a counter-veiling effect to the one we emphasize. On the one hand, there is more income to lose in a wealthier diocese. On the other hand, the ruler of a wealthier diocese might be wealthier and, thus, value money less on the margin. In practice, because both Church and secular leaders collected revenues from many dioceses, rather than just one, we think this latter effect is likely to be second order. As such, we believe the assumption of linear utility focuses us on the first-order forces at work.

## 2.2 Equilibrium

We now turn to characterizing equilibrium. The solution concept is pure strategy Subgame Perfect Nash Equilibrium (with the natural extension to games with moves by Nature). Because the game is stationary, we focus on stationary equilibria.

We begin with the Ruler's strategy and then turn to the Pope's. Suppose the Ruler conjectures that the Pope's strategy is  $s_P$ . The Ruler's payoff from accepting a bishop of

alignment  $r_t$  in period  $t$  is:

$$-\lambda_R \frac{r_t}{1-\delta} + \epsilon_t.$$

His expected payoff from rejecting is:

$$-\lambda_R q + (1 - \lambda_R)y - c + \delta \max_{s_R} V_R(s_R, s_P),$$

where  $\max_{s_R} V_R(s_R, s_P)$  is the Ruler's discounted expected payoff for the continuation game under his best response ( $s_R$ ) to the Pope's strategy  $s_P$ . Comparing these two payoffs, the Ruler accepts if and only if:

$$\epsilon_t \geq \lambda_R \left( \frac{r}{1-\delta} - q \right) + (1 - \lambda_R)y - c + \delta \max_{s_R} V_R(s_R, s_P). \quad (1)$$

This gives the following result.

**Lemma 1** *In any equilibrium, the Ruler's strategy is a vector of cutoff rules  $(\bar{\epsilon}_t(\cdot))_{t=1,2,\dots}$  such that, if a bishop of alignment  $r_t$  is nominated in period  $t$ , the Ruler accepts if  $\epsilon_t > \bar{\epsilon}_t(r_t)$  and rejects if  $\epsilon_t < \bar{\epsilon}_t(r_t)$ .*

**Proof.** Follows from the argument in the text. ■

Lemma 1 tells us that, no matter what strategy the Pope uses, the Ruler uses a cutoff rule in every period. From this, it is straightforward that if the Pope uses a stationary strategy, the Ruler does too. (All omitted proofs are in Appendix A.)

**Lemma 2** *Suppose the Pope's strategy calls for proposing a bishop of alignment  $r$  in every period. Then the Ruler's best response is stationary. In particular, there is a function  $\bar{\epsilon}^*(\cdot) : [\underline{r}, \bar{r}] \rightarrow \mathbb{R}$  such that, if a bishop of alignment  $r_t$  is nominated in period  $t$ , the Ruler accepts if  $\epsilon_t > \bar{\epsilon}^*(r_t)$  and rejects if  $\epsilon_t < \bar{\epsilon}^*(r_t)$ .*

We have seen that, if the Pope uses a stationary strategy, then the Ruler's best response is the stationary cutoff rule  $\bar{\epsilon}^*(\cdot)$ . To establish that a stationary equilibrium exists, then, all that remains is to see that if the Ruler uses that stationary strategy, it is a best response for the Pope to use a stationary strategy. This is straightforward, since the Pope faces the same optimization problem in every period.

**Lemma 3** *If the Ruler's strategy,  $\bar{\epsilon}^*(\cdot)$ , is a best response to a stationary strategy by the Pope, then the Pope has exactly one stationary best response,  $r^*$ . It has the following form:*

There exist numbers  $\underline{y} < \bar{y}$  such that

$$r^* = \begin{cases} \bar{r} & \text{if } y < \underline{y} \\ \hat{r} & \text{if } y \in [\underline{y}, \bar{y}] \\ \underline{r} & \text{if } y > \bar{y}, \end{cases}$$

where  $\hat{r}$  satisfies the following first-order condition:

$$\frac{f}{(1-F)}(\bar{\epsilon}^*(\hat{r})) = \frac{\lambda_P(1 - \delta F(\bar{\epsilon}^*(\hat{r})))}{\lambda_R(1 - \delta)} \left( \frac{1}{\lambda_P(\hat{r} - q) + (1 - \lambda_P)y} \right).$$

Putting these results together, we have the following.

**Proposition 1** *There exists a stationary equilibrium of the game,  $(\bar{\epsilon}^*(\cdot), r^*)$ . In such an equilibrium, the Pope proposes  $r^*$  as defined in the statement of Lemma 3 in every period. The Ruler accepts the bishop-nominee in any period in which  $\epsilon_t > \bar{\epsilon}^*(r_t)$  and rejects in any period in which  $\epsilon_t < \bar{\epsilon}^*(r_t)$ .*

**Proof.** Follows immediately from Lemmas 2 and 3, which establish that stationary strategies are mutual best responses for the players and the form they take. ■

### 2.3 Empirical Implications

The model yields comparative statics with respect to a variety of parameters. But, for both conceptual and empirical reasons, we are focused on one: diocesan income ( $y$ ). Here, we ask how this parameter affects the expected alignment of bishops ( $r^*$ ) and the frequency and length of interregna—i.e., periods in which no bishop is in office.

As diocesan income ( $y$ ) increases, the Pope's costs and Ruler's benefits from having a nominee rejected increase. As a consequence, the Pope nominates a bishop more aligned with the Ruler, as recorded in the next result.

**Proposition 2** *In a stationary equilibrium, if  $r^*$  is interior, it is strictly decreasing in  $y$ .*

There is an interregnum if a nominee is rejected. In any given period, this occurs with probability:

$$\Pr(\text{interregnum}) = F(\bar{\epsilon}^*(r^*)).$$

Similarly, the expected length of an interregnum, conditional on one occurring, is

$$\text{Expected Length of Interregnum} = \frac{1}{1 - F(\bar{\epsilon}^*(r^*))}.$$

The comparative statics of these two quantities are the same.

At an interior  $r^*$ , increasing the income of a diocese has competing effects. On the one hand, as income increases, the Ruler becomes less inclined to accept nominees. On the other hand, the Pope becomes more keen to have his nominee accepted and, as such, offers nominees who are more favorable to the Ruler. Whether the probability and length of an interregnum increases or decreases as a function of the income of the diocese thus depends on whether the Ruler's demands or the Pope's willingness to accommodate change more. As the next result shows, this depends on the relative weights that the Ruler and Pope put on economic gain versus political alignment of the bishop.

**Proposition 3** *In a stationary equilibrium, if  $r^*$  is interior, then the probability and expected length of an interregnum is strictly increasing in  $y$  if  $\lambda_R < \lambda_P$ , strictly decreasing in  $y$  if  $\lambda_R > \lambda_P$ , and constant in  $y$  if  $\lambda_R = \lambda_P$ .*

*If  $r^*$  is a corner solution, the probability and expected length of an interregnum is strictly increasing in  $y$ .*

Proposition 3 shows that, according to theory, the relationship between diocesan income and the occurrence or length of interregna could go either way. Without a measure of  $\lambda_R - \lambda_P$ , we don't know whether they should be positively or negatively associated.

It is, perhaps, worth pausing to note that it is not ex ante obvious which should be larger,  $\lambda_R$  or  $\lambda_P$ . One might be tempted to think popes must care more than secular rulers about religious policy. But recall from Section 1 that bishops were important local political figures with considerable sway over a broad range of issues in a secular ruler's domain. Thus, it is entirely possible that a secular ruler, with a more limited domain to secure political control, might care more about the alignment of local bishops than a pope whose potential political power extended across all of Europe. Moreover, there might be heterogeneity among secular rulers and popes regarding the relative importance of income and political control.

## 2.4 Welfare

Finally, it is important to know how a diocese's wealth affects the players' overall welfare from the game, since this will elucidate the wedge the Concordat of Worms drove between

the economic policy interests of secular rulers and popes.

The Ruler always benefits from an increase in the diocese's wealth because any such increase improves both the Ruler's outside option and the alignment of bishop-nominees.

For the Pope, there are trade-offs of increased income for the diocese. On the one hand, when an agreement is reached, the Pope controls the diocese's income and so would like it to be large. On the other hand, the greater the diocese's income, the less willing the Ruler is to accept a bishop-nominee and, thus, the less bargaining power the Pope has. As a consequence, the Pope's welfare is non-monotone in diocesan wealth.

To get a more detailed intuition for this non-monotonicity, start by considering a diocese with wealth  $y \in (\underline{y}, \bar{y})$ , so that the bishop-nominee is neither totally aligned with the Ruler nor the Pope, i.e.,  $r^* \in (\underline{r}, \bar{r})$ . As  $y$  goes up, Proposition 2 shows that  $r^*$  goes down—the Pope makes a better offer to the Ruler. Proposition 3 shows that, if the Ruler cares more about income than the Pope ( $\lambda_R < \lambda_P$ ), then, despite this improved offer, the Ruler rejects the offer more often. Because the Pope is therefore getting the increased income less frequently and getting a bishop-nominee who is less aligned with his interests, his welfare is decreasing. By contrast, if the Ruler cares less about income than the Pope ( $\lambda_R > \lambda_P$ ), then Proposition 3 shows that the Ruler accepts the Pope's more generous offer more often. Hence, the Pope gets to consume the increased income more often and, despite getting a bishop who is less aligned with him, the Pope's welfare is increasing. Thus, the Pope's welfare can be increasing or decreasing in  $y$ , depending on  $\lambda_R$  vs.  $\lambda_P$ .

Now consider situations in which the diocese is either very rich or very poor, so that the alignment of the bishop-nominee is at a corner. If the diocese is sufficiently poor, then the Ruler accepts the bishop-nominee almost with certainty. Thus, as  $y$  increases, the Pope benefits because he gets to consume a larger amount of income with virtual certainty. Hence, in sufficiently poor dioceses, the Pope's welfare is increasing in income, even if  $\lambda_R < \lambda_P$ . Similarly, if the diocese is sufficiently rich, then the bishop-nominee is rejected with virtual certainty, even though he is perfectly aligned with the Ruler. As  $y$  increases, the Ruler becomes even less willing to accept the bishop-nominee, which makes the Pope less likely to get the income. Hence, in sufficiently rich dioceses, the Pope's welfare is decreasing in income, even if  $\lambda_R > \lambda_P$ .

Figure 2.1 illustrates the non-monotonicity and Proposition 4 states the results formally.

**Proposition 4** *In a stationary equilibrium:*

- *The Ruler's ex ante expected payoff from the game is strictly increasing in  $y$ .*

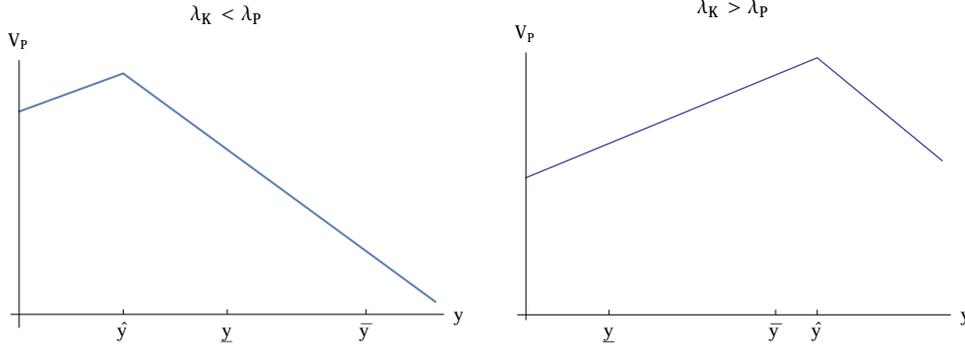


Figure 2.1: Pope's welfare from the game as a function of  $y$ .

- *There is a unique  $\hat{y}$  such that the Pope's ex ante expected payoff from the game is increasing in  $y$  for  $y < \hat{y}$  and decreasing for  $y > \hat{y}$ . Moreover,*
  - *if  $\lambda_R < \lambda_P$ , then  $\hat{y} < \underline{y}$  and*
  - *if  $\lambda_R \geq \lambda_P$ , then  $\hat{y} > \bar{y}$ .*

Proposition 4 suggests that the incentives created at Worms drove a wedge between the interests of secular authorities and the Church. Secular rulers had unequivocal incentives to support policies that increased local economic development because such policies increased the power of secular political authorities relative to the Church. The Church, by contrast, had at best mixed incentives. In sufficiently poor dioceses, secular rulers had little enough bargaining power that the Church benefitted from the increase in income it consumed when a bishop was in place. But as Europe became wealthier, the Church's loss of bargaining power from increased local income, and the associated loss in political authority, more than off-set the benefits. Moreover, thinking dynamically (slightly outside the model), the Church could anticipate this loss of bargaining power and, thus, had incentives to limit economic development even in dioceses with wealth  $y < \hat{y}$ .

## 2.5 Summing Up

To sum up, our theoretical analysis provides several empirical implications which we take to the quantitative and qualitative evidence. These are as follows:

- (i) During the period in which the Concordat of Worms was in effect, secular rulers had greater bargaining power in wealthier dioceses, so that, conditional on a bishop being

in office, the wealthier the diocese, the more likely the bishop was to be aligned with the secular ruler.

- (ii) The relationship between a diocese's wealth and the frequency and length of interregna is expected to be positive (resp. negative) if, on average, policy is less (resp. more) important to secular rulers relative to income than it is to popes.
- (iii) The Concordat of Worms drove a wedge between secular and Church rulers with respect to economic development. Secular rulers had unambiguous incentives to foster local economic development. By contrast, Church leaders had incentives to limit economic development to curtail the loss of political power.

### 3 The Data

Our data consist of information on as complete a set of Roman Catholic dioceses covered by the Concordat of Worms (and London) and their bishops as could be assembled for the years from the fourth century through the Protestant Reformation. We also collect data on archbishops, though the Concordat of Worms did not extend to the selection of archbishops. Archbishop appointments remained primarily the choice of the pope and were not subject legally to rejection by secular rulers. As such, we treat the archbishops as an additional control group in some analyses.

Each diocese in our data had many bishops over our time period. Dioceses are recorded as long as they had their own bishop. Over the centuries some dioceses merged, some split, some ceased to exist, and new ones were created. Observations are at the diocese-year level, though for analysis these are collapsed to the diocese-bishop level. The data include 269 unique dioceses and 5,306 diocese-bishop pairs. Of the more than 5,000 bishops, approximately 67 percent were from diocese in France, 27 percent were from diocese in Italy, and the remaining approximately six percent were distributed across the other countries covered by the Concordat of Worms (or London); that is, in terms of modern states, today's Germany, Austria, Belgium, the Netherlands, and England.<sup>4</sup>

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<sup>4</sup>We considered using European countries not covered by the Concordat of Worms as a control group. While our results are robust to doing so, these countries were relatively minor (and remote) Catholic outposts during our sample period, so the data are sufficiently spotty that we do not consider them reliable. The relevant modern countries include Bosnia and Herzegovina, Croatia, Czech Republic, Denmark, Finland, Hungary, Iceland, Ireland, Latvia, Lithuania, Northern Ireland, Norway, Poland, Portugal, Scotland, Slovakia, Sweden and Switzerland.

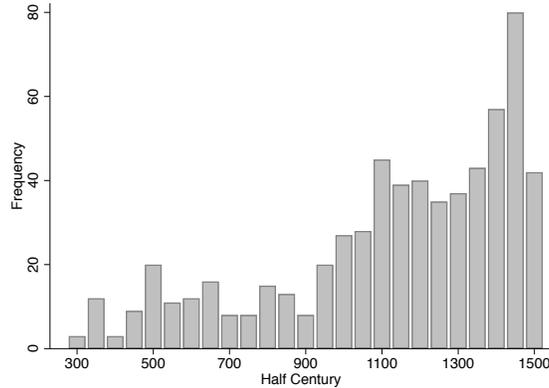


Figure 3.1: Number of bishops for whom alignment is observed by half-century.

### 3.1 Outcome Variables

The main outcome variables is the secular versus religious alignment of each bishop. We also study the occurrence and length of interregna. Data about the alignment of bishops and their consecration and departure dates are derived by scraping Catholic Church websites and Wikipedia.

We classified the alignment of bishop-nominees into two categories: religious or secular. Bishops are coded as religious (or, aligned with the pope) if their position prior to becoming bishop for the first time (as many held several bishoprics sequentially and a few held more than one simultaneously) was a religious post such as abbot, monk, deacon, archdeacon, or priest. Bishops are classified as secular if their prior post was as an agent of the secular authorities, such as court ambassador, chancellor, and the like or if the biographical information indicates they were specifically linked to the secular ruler. We summarize the classification process in Appendix B.

Our data collection yielded biographies for 632 bishops and 397 archbishops that were sufficiently detailed to allow us to code their alignment. Of the 632 bishops for whom we found adequate biographical data, 474 (75%) met the criteria to be classified as religious, while the remaining 158 (25%) were categorized as secular.<sup>5</sup> Figure 3.1 shows the number of bishops for whom we observe alignment by half-century.

<sup>5</sup>Recall that following the advent of the Avignon papacy, the pope had become the agent of the French king in non-religious matters and so even when a bishop with a “religious” background was chosen he was likely to be expected to be loyal to the secular authority who largely controlled the papacy and chose the pope.

We have a large number of additional bishops whose biographies did not provide sufficient information to code alignment. These observations are excluded from the analysis when the bishop’s religious or secular alignment is needed. The useful biographies span the years between 300 and 1517. Of course there are some missing dioceses and some missing bishops simply because records could not be found. There is, however, no reason to believe that missing data reflect any more than information lost through fires, disasters, wars, and other destructive forces over the very large number of years investigated here. We discuss the implications of missingness due to lack of biographical data (for any reason) in greater detail in Section 4 below and in Table 4 in Appendix C.

The exact date of consecration for many European bishops between 300 and 1517 is unknown, but the year of consecration (or, sometimes, of their designation as bishop) is known. Hence, we code the occurrence of an interregnum in a diocese-bishop observation if at least a full calendar year passed between the death (or removal) of the diocese’s previous bishop and the installation of the new bishop. If a year or less passed, then we code there having been no interregnum. Thus, a bishopric that became vacant say in 1100 and was filled in 1101 is coded as having had no interregnum. Since information more precise than the year generally is not known, this means that a vacancy of as little as a day and, in principle, as much as one day shy of two years is coded as having no interregnum.

Our data contain some instances that appear as negative interregna (i.e., one bishop coming in before the other leaves). Many of these are cases of very short duration (1 to 2 years), likely reflecting a bishop having been put in place when the previous bishop was no longer able to serve (e.g., for health reasons), but had not yet left office. We code these cases as zeros. There are also cases of longer negative interregna, most of which result from papal schisms leading to a single diocese having more than one (contested) bishop at the same time. We drop these cases, although their presence does not affect any results.

### 3.2 Diocese Wealth

Unfortunately, detailed, systematic diocese-level income data is difficult to find prior to the Protestant Reformation. Other studies have measured diocese-level wealth using proxies such as population, urbanization, or construction (e.g., [Cantoni, 2015](#); [Cantoni, Dittmar and Yuchtman, Forthcoming](#)). Those studies, however, focus on later time periods, around the Protestant Reformation. Data such as these are not available for the much earlier time period required for our purposes.

As such, as an indicator of diocesan income we rely on data on the location and years

of operation for major trade routes from the Old World Trade Routes Project.<sup>6</sup> The data cover all of Europe and designate trade routes, pilgrimage routes, ports and other movement corridors (e.g., navigable rivers) as well as some of the goods produced and exported from the location.<sup>7</sup> Using these data we code a dummy variable,  $trade_{dt}$ , for each diocese year. A diocese ( $d$ ) in year ( $t$ ) is coded as having  $trade_{dt}$  equal to 1 if the diocese in the observed year satisfied any of the following: it was on a major trade or pilgrimage route, had a port or river route, or it produced and exported goods such as textiles and so forth. Of the 269 unique diocese in our data, 221 (82%) are never on a trade route, 19 (7%) are always on a trade route, and the remaining 29 (11%) switch at least once during the sample period.

As already mentioned, for analysis we collapse our data to diocese-bishop pairs. We will label by  $trade_{db}$ , the value of the  $trade_{dt}$  variable in the year bishop  $b$  was consecrated. The data include 4,388 diocese-bishop pairs (83%) for which the  $trade$  variable is 0. The remaining 918 (17%) met the criteria for coding  $trade$  equal to 1.

The dichotomous trade variable is used to construct two additional variables:  $\% trade\ 20\ years_{dt}$  and  $\% trade\ all\ years_{dt}$ . For diocese  $d$  in year  $t$ ,  $\% trade\ 20\ years_{dt}$  is the share of the past 20 years (up to and including  $t$ ) for which that diocese was on a trade route:

$$\% trade\ 20\ years_{dt} = \frac{\sum_{\tau=t-19}^t trade_{d\tau}}{20}.$$

For diocese  $d$  in year  $t$ ,  $\% trade\ all\ years_{dt}$  is the share of years up to the year of observation for which that diocese was on a trade route. So, if a diocese came into existence in year  $T$ , we have:

$$\% trade\ all\ years_{dt} = \frac{\sum_{\tau=T}^t trade_{d\tau}}{T - t}.$$

The variable  $\% trade\ 20\ years$  has a mean of approximately 0.18 and a standard deviation of approximately 0.38. The variable  $\% trade\ all\ years$  has a mean of approximately 0.11 and a standard deviation of approximately 0.29.

In the main text, we use  $\% trade\ 20\ years$  as our measure of a diocese's wealth. But we report the results using  $trade$  and  $\% trade\ all\ years$  in Appendix C. Our results are not sensitive to this choice.

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<sup>6</sup><http://www.ciolek.com/owtrad.html>

<sup>7</sup>For studies using these data, see (among others), Pella (2014), Yue, Lee and Wu (2017), and Harrower and Dumitru (2017).

## 4 Testing Secularization

The key empirical implication of our model that can be tested in our data concerns the relationship between bishop alignment and diocesan wealth (measured through exposure to trade). We expect that, during the period the Concordat of Worms was in effect (1122-1309), the probability of having a bishop aligned with the Pope should have decreased in wealthier dioceses relative to poorer dioceses. Further, we can use the relationship between a diocese’s wealth and the occurrence and frequency of interregna during this period relative to other periods to learn about the relative importance of policy vs. wealth to secular rulers as compared to popes.

A comparison of the alignment of bishops in dioceses with more or less trade exposure is, of course, subject to the concern that there may be persistent differences between wealthier and poorer dioceses that have nothing to do with the incentives created by the Concordat of Worms. To partially address such concerns, we compare the period during which the Concordate of Worms was in effect to period in which it was not.

To implement these ideas, we estimate linear probability models of the following form:

$$Y_{db} = \beta_0 + \beta_1 \cdot \text{Wealth}_{db} + \beta_2 \cdot \text{Worms}_{db} + \beta_3 \cdot \text{Worms}_{db} \cdot \text{Wealth}_{db} \\ + \psi \cdot \text{Diocese} + \xi \cdot \text{Half-Century} + \epsilon_{db}. \quad (2)$$

$\text{Wealth}_{db}$  is a trade-based measure of diocese  $d$ ’s wealth (in the main text % *trade 20 years*) in the year bishop  $b$  was consecrated.  $\text{Worms}_{db}$  is a dummy variable that takes a value of 1 when diocese  $d$  was under the jurisdiction of the Concordat of Worms in the year that bishop  $b$  was consecrated (i.e., for the years 1122-1309) and zero otherwise.<sup>8</sup> The variables *Diocese* and *Half-Century* represents fixed effects for each diocese and each 50 year period, respectively. Standard errors are clustered by diocese.

We report results for two sample periods. In what we consider our main specification, we include the years prior to the Worms period and the years during the Worms period, so the sample years run from the beginning of our sample through the beginning of the Avignon Papacy (i.e., 300-1309). In our second specification, we consider our full sample, from 300 to 1517, so that the comparison group includes years before and after the Worms period. We prefer the first specification because, as already discussed, the exact meaning of bishop alignment is more difficult to parse after the advent of the Avignon papacy. That

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<sup>8</sup>English dioceses were subject to the very similar Concordat of London (1107-1309). However, this does not affect our coding because we do not observe alignment for any new English bishops in the short interval between 1107-1121.

said, the results are comparable across the two specifications.

In both specifications, our prediction with respect to alignment is that  $\beta_3$  is expected to be negative. That is, we expect wealthier dioceses to have increased bargaining power compared to poorer dioceses during the Worms period relative to the periods before and after.

There are certainly reasons that the correlations we report might not be causal. And we can by no means offer unimpeachable identification. Hence, for the most part, we must content ourselves to ask whether the differential change in correlations goes in the way predicted by theory. That said, we can offer one additional potential improvement in identification. The selection of archbishops was not governed by the Concordat of Worms. Hence, we have no institutional reason to expect a change in bargaining power with respect to the selection of archbishops nor a differential change in such bargaining power for wealthier dioceses. As such, it is perhaps reasonable to consider archbishops as an additional control group.

Of course, there are issues with this strategy. For instance, as popes lost power over local bishops, perhaps they shifted their strategy with respect to the choice of archbishops. Or, since archbishops are typically chosen from the ranks of bishops, perhaps a change in alignment within the pool of bishops has a mechanical effect on the average alignment of archbishops. Nonetheless, this seems a worthwhile additional test. In order to implement it, we expand our sample to include archbishops in addition to regular bishops. We define a variable called *regular bishop*<sub>db</sub> which takes value of zero if bishop *b* in diocese *d* is an archbishop and a value of 1 otherwise. We then estimate the following linear probability model:

$$\begin{aligned}
 Y_{db} = & \gamma_0 + \gamma_1 \cdot \text{Wealth}_{db} + \gamma_2 \cdot \text{Worms}_{db} + \gamma_3 \cdot \text{Regular Bishop}_{db} \\
 & + \gamma_4 \cdot \text{Worms}_{db} \cdot \text{Regular Bishop}_{db} + \gamma_5 \cdot \text{Wealth}_{db} \cdot \text{Regular Bishop}_{db} \\
 & + \gamma_6 \cdot \text{Worms}_{db} \cdot \text{Wealth}_{db} + \gamma_7 \cdot \text{Worms}_{db} \cdot \text{Wealth}_{db} \cdot \text{Regular Bishop}_{db} \\
 & + \alpha \cdot \text{Diocese} + \phi \cdot \text{Half-Century} + \varepsilon_{db}. \quad (3)
 \end{aligned}$$

(The main effect of *regular bishop* is not absorbed by the diocese fixed effects because some diocese switch from bishoprics to archbishoprics or vice versa.) Here, we expect  $\gamma_7$  to be negative—reflecting the fact that the changes in bargaining power should be working through dioceses governed by a bishop, not by an archbishop.

## 4.1 Three Identification Concerns

While we do not make strong causal claims about our estimates, it is worth discussing three noteworthy identification concerns before turning to the analysis.

As we have already noted, because of the age and nature of our data, there are many bishop-diocese pairs for which we observe the date of consecration and our wealth measure, but cannot classify the bishop as religious or secular. This missingness is of gravest concern if it is correlated with the interaction of *wealth* and *Worms*; that is, if wealth is differentially correlated with missingness during the Worms period. To explore this possibility, Table 4 in Appendix C reports the results of a regression akin to Equation 2, using missingness of the alignment measure as the dependent variable. These regressions use the full sample period and gradually add fixed effects. Table 4 shows no significant correlation between wealth and missingness and certainly no evidence that any such correlation was different during the Worms period. In particular, the regression coefficient on the interaction term is always substantively small (between -0.01 and -0.03, depending on fixed effects) and never close to statistically distinguishable from zero.

A second concern involves panel imbalance resulting from the spread of Catholicism across Europe over the course of our sample period. The addition of new, geographically and politically different dioceses over the course of time raises the possibility that our results are due to compositional changes. Our first line of defense against such concerns, of course, is the inclusion of diocese fixed effects in all of our models. But to further address these issues, we also construct a balanced panel, consisting exclusively of dioceses that existed in the year 700 and continued to exist through the year 1309 (or 1517, depending on the analysis). We report all results on bishop alignment for both our full sample and the balanced panel. No results are sensitive to this choice.

A third concern involves other major events that happened around the same time as the Concordat of Worms. Most notably, Crusades took place from 1096-1099, 1145-1149 and 1189-1192. The latter two Crusades, therefore, coincide with the Worms period. Because large armies moved across Europe to the Middle East, it is possible that those that went overland both affected local politics and caused the creation of new trade routes, as goods and services would have been needed to support these armies. While we cannot entirely rule out this possibility, we can show that trade routes do not appear to respond to the Crusades in problematic ways in our data. In particular, all of the dioceses that were on trade routes in our data during a Crusade, were also on trade routes in our data five years before the Crusade. That is, no place not on a trade route five years before a Crusade found

itself on one during the Crusade. Moreover, no diocese that was not on a trade route in our data 5 years before a Crusade appeared on a trade route in our data 5 years after the Crusade. Thus, the evidence suggests that the Crusader overland routes neither created trade routes where they did not exist before the Crusades nor sustained such new trade routes afterward. Still, the Crusades could be a confounder if, for instance, they traveled along existing trade routes and affected local politics along the routes they travel. While we cannot directly rule out this possibility, Figures 4.2 and 4.3 (which we discuss in detail later) present results on the timing of the effects we identify which line up with the Worms period to a degree that would, we think, be surprising if they were driven entirely by the Crusades.

## 4.2 Alignment of Bishops

Before turning to the regression analysis, Figure 4.1 illustrates the key pattern in the data. For each century, the dark curve shows the fraction of bishops who were aligned with the pope in dioceses that were on trade routes ( $trade_{dt} = 1$ ), while the light curve shows the fraction of bishops who were aligned with the pope in dioceses that were not on trade routes. As the figure shows, there appears to be no systematic difference either prior to the Investiture Controversy or after the Avignon papacy. But during the Worms period, wealthier dioceses were systematically less aligned with the pope relative to poorer dioceses. (We offer more detailed and systematic evidence on timing of the divergence in Figures 4.2-4.3 below.)

Table 1 reports results for a regression corresponding to Equation 2 with bishop alignment as the dependent variable.<sup>9</sup> The findings are as predicted by our theoretical model. During the Worms period, wealthier dioceses were more likely than poorer diocese to have bishops aligned with secular rulers. And this relationship was stronger during the Worms period than before or after. Using the point estimate from column 1, during the Worms period (compared to the earlier period), a one standard deviation increase in trade exposure (0.38 for  $\% trade\ 20\ years$ ) results in approximately an additional 13 percentage point ( $0.38 \cdot -0.35 \approx -0.13$ ) decrease in the likelihood of having a bishop aligned with the Pope. This is a reduction of approximately 18% relative to the mean probability of having a bishop aligned with the Pope, which is 74%.

Table 2 shows results corresponding to Equation 3—i.e., using Archbishops as a con-

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<sup>9</sup>Robustness to measuring diocese wealth with  $trade$  and  $\% trade\ all\ years$  are in Tables 5-6 in Appendix C.

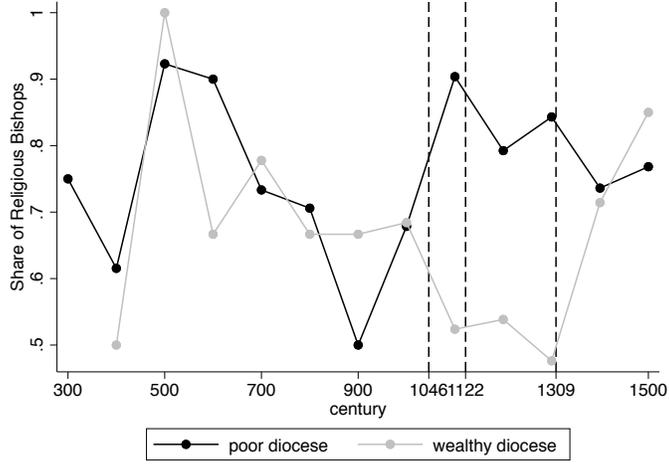


Figure 4.1: Average bishop alignment with pope in diocese on and off of trade routes, by century.

Table 1: Correlates of bishop alignment with pope.

	(1)	(2)	(3)	(4)
Worms	0.16 (0.12)	0.13 (0.12)	0.04 (0.10)	-0.00 (0.12)
Wealth	-0.22 (0.14)	-0.21 (0.15)	-0.22 (0.12)	-0.21 (0.13)
Worms * Wealth	-0.35*** (0.11)	-0.39*** (0.12)	-0.32*** (0.09)	-0.37*** (0.09)
N	286	255	480	382
half-century fixed effects	yes	yes	yes	yes
diocese fixed effects	yes	yes	yes	yes
balanced panel	no	yes	no	yes
sample years	300-1309	700-1309	300-1517	700-1517

Wealth measured as % trade 20 years. Standard errors clustered by diocese.

\*\*  $p < 0.05$  \*\*\*  $p < 0.01$

trol.<sup>10</sup> Again, the evidence shows that the increase in bargaining power occurred only in wealthy dioceses and only during the Worms period. Moreover, this analysis shows that the shift in bargaining power during the Worms period occurred in dioceses governed by regular bishops, but not in those governed by archbishops.

Table 2: Correlates of bishop alignment with Pope using archbishops as a control.

	(1)	(2)	(3)	(4)
Worms	-0.24 (0.15)	-0.38*** (0.12)	-0.30*** (0.09)	-0.42*** (0.08)
Wealth	0.30 (0.26)	0.31 (0.26)	0.37** (0.17)	0.41** (0.19)
Regular Bishop	0.10 (0.27)	0.07 (0.27)	0.39 (0.21)	0.39 (0.24)
Worms * Regular Bishop	0.30** (0.15)	0.41*** (0.13)	0.28*** (0.10)	0.36*** (0.09)
Wealth * Regular Bishop	-0.43 (0.28)	-0.43 (0.28)	-0.50** (0.20)	-0.52** (0.22)
Worms * Wealth	0.22 (0.16)	0.30** (0.15)	0.21 (0.11)	0.27** (0.11)
Worms * Wealth * Regular Bishop	-0.56*** (0.20)	-0.69*** (0.18)	-0.54*** (0.14)	-0.63*** (0.14)
N	484	439	822	675
half-century fixed effects	yes	yes	yes	yes
diocese fixed effects	yes	yes	yes	yes
balanced panel	no	yes	no	yes
sample years	300-1309	700-1309	300-1517	700-1517

Wealth measured as *% trade 20 years*. Standard errors clustered by diocese.

\*\*  $p < 0.05$  \*\*\*  $p < 0.01$

**Timing** We have argued that the institutional incentives created by the Concordat of Worms are key for understanding the secularization of politics in wealthier dioceses. As such, it is worth probing the data to assess whether the timing of the divergence between wealthier and poorer dioceses is in fact consistent with Worms being critical. Of course,

<sup>10</sup>Robustness to measuring wealth with *trade* and *% trade all years* are in Tables 7-8 Appendix C.

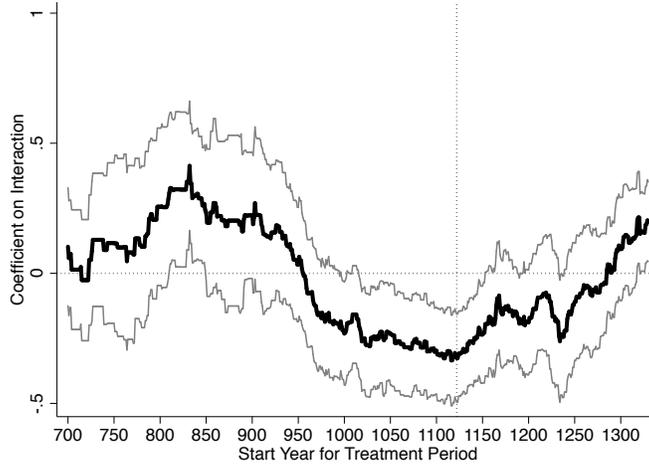


Figure 4.2: Re-estimating Equation 2 using each possible 187 year treatment period.

given the nature of our data and the process of bishop turnover, we cannot pin down the timing precisely. But we can offer some evidence in the form of two additional analyses.

First, we run a series of placebo regressions using a moving window for the treatment period. The Worms period (our true treatment period), from 1122-1309, is 187 years long. So, in each of our placebo regressions we estimate a regression analogous to Equation 2, but with a different 187 year-long treatment period. We do so for each possible 187 year window from 700-1517. (There is too little data prior to 700 for this exercise.) That is, for each placebo regression, we estimate the following linear probability model:

$$Y_{db} = \beta_0 + \beta_1 \cdot \text{Wealth}_{db} + \beta_2 \cdot \text{Treatment}_{db} + \beta_3 \cdot \text{Treatment}_{db} \cdot \text{Wealth}_{db} \\ + \psi \cdot \text{Diocese} + \xi \cdot \text{Half-Century} + \epsilon_{db}.$$

In our first placebo regression, the treatment period is 700-887. In our second placebo regression, the treatment period is 701-888. This continues all the way through our final placebo regression, where the treatment period is 1330-1517. (The placebo regression with a treatment period of 1122-1309 corresponds to our actual regression.) In Figure 4.2 we plot our estimate of  $\beta_3$  for each placebo regression, along with its 95% confidence interval. As the figure shows, the estimated effect is most negative in the regressions with a treatment period starting in the 1120s, corresponding exactly to the true Worms period.

Second, for the period 700-1517 (again, there is too little data prior to 700 to be used

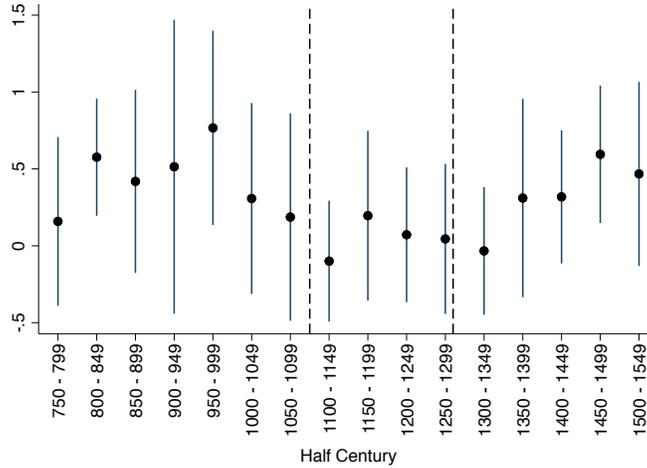


Figure 4.3:  $\gamma$  coefficients from Equation 4.

in this approach), we interact each of our half-century dummy variables with our wealth measure. Let  $Half-Century_1$  be a dummy that takes a value of 1 if the year is 700-749 and zero otherwise,  $Half-Century_2$  be a dummy that takes a value 1 if the year is 750-799 and zero otherwise, and so on through  $Half-Century_{18}$ . We estimate the following linear probability model:

$$Y_{db} = \beta_0 + \beta_1 \cdot Wealth_{db} + \sum_{k=1}^{18} \gamma_k Half-Century_k \cdot Wealth_{db} + \psi \cdot Diocese + \xi \cdot Half-Century + \epsilon_{db}. \quad (4)$$

In Figure 4.3, we plot the  $\gamma$  coefficients and their standard errors (the omitted category is 700-749). While there is, of course, a lot of noise, the figure shows that the point estimates are indeed smallest during the Worms period (and the half century immediately following)—that is, it is during this period that wealthier dioceses were most different from poorer dioceses in terms of getting bishops less aligned with the pope.

Each of these results suggests that the timing of the divergence of the alignment of bishops between wealthier and poorer dioceses is consistent with the Concordat of Worms having been a key event. Moreover, it seems unlikely that we would have gotten results that conformed so closely to the Worms period were our results entirely driven by other historical events, such as the Crusades of the 12th century.

### 4.3 Interregna

Table 3 reports results for the correlates of the occurrence and length of interregna.<sup>11</sup> In the first two columns, the outcome is a dummy variable indicating whether an interregnum occurred when the bishop left office. In the remaining three columns, the outcome is a variable indicating the length of an interregnum in years (it takes the value 0 in the event that no interregnum occurred).

One additional concern arises in the analysis of interregnum length. In the data, there are a small number of observations (about 3.5%) that have interregna of over 100 years. It is possible that some of these are actual long interregna. But others may reflect missing data on some bishops. Thus, for the regressions on interregnum length, we run the analysis both with and without these outliers.

As is evident, except in Column 3 (which includes these outliers), Table 3 indicates no change in the relationship between the occurrence or length of interregna and diocese wealth during the Worms period. These null results are, perhaps, not surprising. Our theory showed that the direction of the relationship depends on the relative values of the parameters  $\lambda_P$  and  $\lambda_R$ , for which we have no measures. Moreover, there may be heterogeneity in the mix of  $\lambda_R$  and  $\lambda_P$  across rulers and over time. Thus, if our theory is right, null results could arise either because secular rulers and popes weighed financial and policy matters similarly (i.e.,  $\lambda_P$  close to  $\lambda_R$ ) or because we are averaging across cases, in some of which  $\lambda_P$  was greater than  $\lambda_R$  and in others of which the relationship was reversed. In any event, such evidence should be read neither as supporting nor contradicting our account, since we have no specific predictions about these relationships. It is presented only for descriptive interest.

## 5 Investiture, Worms, and Incentives for Development

In the previous section, we saw quantitative evidence that the Investiture Controversy and its resolution at Worms created a linkage between local wealth and secular political power. In this section, we turn to some qualitative historical evidence to explore two further features of the argument represented by the model. First, the model implies that the Church lost bargaining power, and hence political control, in places where the bishop controlled significant economic resources. Hence, Worms created incentives for the Church to shift the locus of resources away from local bishops and towards the center. Second,

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<sup>11</sup>Robustness tests using *trade* and *% trade all years* to measure diocese wealth are in Tables 9-10 in Appendix C.

Table 3: Correlates of interregnum occurrence and length.

	(1)	(2)	(3)	(4)	(5)
	Occur	Occur	Length	Length	Length
Worms	0.01 (0.06)	0.02 (0.04)	-1.41 (3.94)	0.31 (1.91)	0.76 (1.26)
Wealth	-0.08 (0.10)	-0.03 (0.08)	-35.68** (14.88)	-1.15 (3.74)	1.76 (2.68)
Worms * Wealth	0.06 (0.08)	-0.04 (0.04)	20.40*** (5.92)	4.20 (2.16)	0.06 (1.35)
N	2370	4526	2370	2209	4316
half-century fixed effects	yes	yes	yes	yes	yes
diocese fixed effects	yes	yes	yes	yes	yes
drop outliers	no	no	no	yes	yes
sample years	300-1309	300-1517	300-1309	300-1309	300-1517

Wealth measured as % trade 20 years. Standard errors clustered by diocese.

\*\*  $p < 0.05$  \*\*\*  $p < 0.01$

Worms drove a wedge between the incentives of Church and secular leaders with respect to economic development. Secular leaders benefited from local economic prosperity, while, as localities became wealthier, the Church was harmed by the resulting loss of political control. We explore these two implications by examining historical evidence on the different strategies employed by secular rulers and popes on both these fronts.

Of course, many factors contributed to the behavior of both secular and religious leaders in this period. We do not mean to suggest that the incentives we identify are all that was going on, only that understanding these incentives helps to make sense of some important patterns of historical behavior.

The constraints on Church authority implied by Worms were not taken passively. Popes endeavored to shift Church revenues away from local moneys paid to the bishop toward moneys paid directly to the pope. In so doing, the pope could mitigate the increased bargaining power secular leaders of wealthier dioceses gained at Worms.

One instance of this shift was the creation of entrepreneurial monastic orders, like the Cluniacs, Templars, and Hospitalers, which came into existence just as the Investiture Controversy came to an end with the agreement at Worms. These new monastic orders received papal protection from taxation by secular authorities and even by their local bishops, diminishing the revenue a secular ruler might have derived by rejecting a bishop-nominee. They

were, instead, put directly under the supervision of the pope. The pope derived a significant portion of his income from the new entrepreneurial orders during the long periods of secular-Church political conflict. So, the new orders served to finance the pope against the secular authorities, with that financing seriously damaged when, for instance, the Knights Templar were destroyed by Philip IV in the period from 1307-1314. In exchange for their financial support, these new monastic orders were given a free hand to generate great wealth for themselves (and the papacy), an activity that had been anathema for earlier monastic orders.

Moreover, during the Worms period, the Church also went out of its way to make it difficult for secular leaders to know how much wealth a diocese had. For instance, lords of the manor from time to time insisted on re-measurement of Church lands to better assess local church wealth. The Church sought to undermine this practice. As [Bartlett \(1993, p. 140\)](#) reports, for example, a Cistercian monastery in Mecklenburg, instructed, “if the lords of the lands [i.e. the dukes of Mecklenburg] ask what is the number of *mansi*, care should be taken to dissimulate as much as possible.”

The Church also pursued policies that limited the economic development that threatened its bargaining power and political standing. For instance, following the Investiture Controversy, the Church convened four Lateran Councils (1123, 1139, 1179 and 1215). Perhaps most importantly, the Council issued a crucial ruling regarding usury:

... we condemn that practice accounted despicable and blameworthy by divine and human laws,... namely the ferocious greed of usurers; and we sever them from every comfort of the church, forbidding any archbishop or bishop, or an abbot of any order whatever or any one in clerical orders, to dare to receive usurers, unless they do so with extreme caution; but let them be held infamous... and, unless they repent, be deprived of a Christian burial.

The fourth Lateran Council (1215) further strengthened the usury ban by improving its enforcement. In particular, Lateran IV made annual oral confession mandatory for all Catholics, providing priests with the opportunity to uncover usurers. This period saw the spread of confessors’ manuals with specific instructions for dealing with merchants and others likely to have engaged in usury ([Le Goff, 1982](#)). The risks and costs for usurers had been raised and so, naturally, the expected rate of return had to rise commensurately ([De Roover, 1948, 1974](#)). The upshot was to make loans scarcer and costlier, thereby slowing economic development (and the rise of secular political power) relative to what it otherwise would have been. And, indeed, [Brown \(2015\)](#) argues that it wasn’t until the 14th century

(notably, after the end of the Worms period) that the Church began to soften its views on merchants and usury.

Ekelund, Hébert and Tollison (1989, p. 320), noting that the usury ban was bad for economic development, write that “[p]aradoxically, the most outwardly economic directive of the medieval church, the doctrine of usury, has proven most resistant to purely economic explanations.” Our account of the incentives created by the Concordat of Worms provides an explanation: a ban on usury was a way for the Church to use religious policy to pursue its political interests relative to secular leaders by curtailing economic development outside of monasteries and other ecclesiastical institutions.

The Church also used religious policy to limit economic development and the attendant rise of secular authority in other ways. For instance, during the twelfth century, the Church began to revise its views on (menial) labor in order to limit the spread of efficiency-enhancing machines, such as mills (Le Goff, 1982). Relying on Proverbs 16:27-29, it promoted the view that idle hands are the work of the devil. Moreover, the Church viewed more productive economic activity as a base activity until well into the Middle Ages. Le Goff (1982, p. 111) summarizes the Church’s attitude toward productive economic activity through trades and crafts in the Middle Ages as follows: “[h]ow often the Middle Ages must have witnessed the inner drama of men anxiously wondering whether they were really hastening toward damnation because they were engaging in a trade suspect in the eyes of the Church. The merchant comes naturally to mind.” By opposing both the spread of machines and increased labor productivity, the Church seems to have been trying to reduce a key driver of economic development.

Secular rulers, the model suggests, had the opposite incentives from the Church. And they were no less innovative than the pope in erecting institutions to wrest political control and to increase wealth. The decades immediately after the Concordat of Worms, for instance, saw a dramatic flowering of secular institutions in England and France that were designed to encourage development. Consider, for instance, the series of legal reforms introduced by Henry II (1133-1189) in England during the mid-twelfth century. Henry II countered papal economic strategies with an expanded curia regis (loosely, the central government administration) and four important writs. The first two provided an improvement in a tenant farmer’s commitment to the land he farmed and contributed to improving its productivity, helping tenant farmers secure the property rights that are essential to economic development while also enhancing the king’s unique credibility as the person who would protect the common man’s interests (Taylor, 1889; Van Caenegem, 1988; Barzel, 1989). The third and fourth writs restricted ecclesiastical rights.

Further, the kings of England and France sought new ways to raise revenue, often at the expense of the very resources the Church was trying to move away from localities and towards the center. Richard the Lionhearted greatly increased his tax take, including from Church property. His successor, John, went so far as to seize Church lands. Philip IV followed a similar path in France, prompting a backlash from Pope Boniface VIII that led to war.

## 6 Europe's Medieval Economic, Political, and Religious Development

Europe's economic, political, and religious development in the years roughly between 1000 and the end of the Thirty Years War in 1648 has been the subject of enormous scholarly debate by economists, historians, political scientists, and others. In this concluding section, we link our argument to a few strands of this literature, necessarily in a somewhat speculative way. We start by discussing our relationship to other arguments about the relationship between economic and political development in Europe. We then turn to discussions of religious development and the rise of Protestantism.

We have argued that the Investiture Controversy and its resolution in the Concordat of Worms marked the beginning of the end of Church political dominance in wealthier parts of Europe and the concomitant rise of secular authority. In an important sense, this political process reached its apex in the Avignon Papacy, where the political leadership of France (which was quite wealthy relative to much of the rest of Europe) asserted secular control over the Church.

Other scholars highlight entirely different economic, social, and political factors to help understand European development. [Tabellini \(2010\)](#), [Stark \(2014\)](#), and [Mead \(2015\)](#) attribute Europe's economic or political development to special elements of European culture or people. Others reflect more on the political circumstances in different parts of Europe that may help explain why the Church was more successful in some places than in others. Some report, for instance, that Europe's profile of competitive state-based political systems resulted from its feudal approach to military commitments, the domestic interdependencies imposed by taxation and borrowing, the use of warfare to create states, or patterns of dynastic marriage alignments ([Blaydes and Chaney, 2013](#); [North and Weingast, 2012](#); [Tilly, 1992](#); [Sharma, 2005](#)). [Kokkonen and Sundell \(2014\)](#), building on [Tullock \(1987\)](#), contend that Europe's shift to primogeniture contributed to its politically distinctive evolution. The evidence shows that there is substantial truth in each of these analyses. Finally, some eco-

nomic analyses focus on access to revenue and its associated transaction costs (e.g., [North and Thomas, 1973](#); [Levi, 1988](#); [Ertman, 1997](#)). These accounts place economic considerations in the causal role and political outcomes as their consequences.

Our account is in some ways related to [Spruyt's \(1994\)](#) argument regarding the rise of governments with secular control over defined territory.<sup>12</sup> Like us, [Spruyt \(1994, p. 50\)](#) argues that, “[t]he Investiture Conflict in a sense necessitated rulers to invent ‘secular’ rule”. However, his reasoning follows a different path from ours. He contends that the Investiture struggle weakened both Church and state, whereas we argue that the incentives created at Worms strengthened secular leaders in wealthy areas. Spruyt also views European economic development as largely independent of the emergence of secular governments, whereas we argue that the ability to secularize politics and the incentives to stimulate or stifle economic development endogenously affected one another. In support of our contention, we show that during the Worms period, differential outcomes in secularization across Roman Catholic Europe were associated with variation in access to trade.

Of course, much of the interest in European development revolves around the claims by [Smith \(1904\)](#) and [Weber \(1930\)](#) that the rise of Protestantism explains variation in European post-Reformation economic performance. Weber’s account has come under criticism by scholarship showing that capitalism, contrary to Weber, was invented well before the Protestant Reformation ([Tawney, 1926](#)), that Europe experienced rapid economic growth starting perhaps as early as the global warming trend and longer growing seasons that began around 900 ([Ladurie, 1988](#)), and that ideas akin to the Protestant ethic existed well before the Reformation ([Andersen et al., 2017](#)). That said, recent work in economic history has re-ignited the debate over Protestantism’s causal importance. [Becker and Woessmann \(2009\)](#) present evidence that Protestantism’s requirement that people attain literacy so they could study the Gospels led to greater human capital accumulation and economic growth in Protestant countries. However, using within-country variation, [Cantoni \(2012\)](#) finds no difference between Catholic and Protestant areas of Germany. [Cantoni, Dittmar and Yuchtman \(Forthcoming\)](#) show evidence that the adoption of Protestantism in Germany led to a shift in resource investment away from the religious and toward the secular.

The most relevant strand of this literature for us is the argument, made by some, that Protestantism might not only be a cause of economic development, but a consequence of it. [Dimont \(2004\)](#), for instance, argues that Protestantism was adopted by economically

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<sup>12</sup>Since the focus here does not encompass Spruyt’s thesis about the post-secularization spread of a sovereign state system, we draw attention only to the portions of his arguments that are pertinent to secularization and to economic development.

motivated leaders. As he observes, “[t]hrough Protestantism had begun as a strictly religious reform movement, the people behind the new economic forces seized the Reformation and bent it to their own economic needs” (quoted in [Becker, Pfaff and Rubin, 2016](#), first page decoration). In a closely associated thesis, [Cantoni \(2015, p. 15\)](#) notes that, “territories which were already more inclined to commercial activity saw the growth-promoting potential of the Protestant Reformation and therefore chose to adopt it.” In these explanations, Protestantism, a religious movement, offered an opportunity for greater economic control that resulted in subsequent, rapid growth.

Although speculative, our argument offers another possible twist on these reverse-causality type stories. In particular, on our account, during the period that the Concordat of Worms was in force, local economic development was associated with the rise of secular control over politics. It seems plausible that this secular control set the stage for the emergence of Protestantism. As we have seen, the wealthy French were already prepared to substantially break with Church authorities in 1309, resulting in the Avignon Papacy. The Church’s monopoly on salvation meant that a complete break was inconceivable at that time. This possibility had to wait for Luther’s theological innovations to break the Church’s monopoly. But once that happened, perhaps leaders of wealthier dioceses, who had achieved greater secular, political control thanks to the incentives created at Worms, were freer to in fact break with the Church. On this account, polities that were economically successful might have adopted Protestantism not only because Protestant ideas were conducive to their economic path, but because their economic path had created the political pre-conditions for an assertion of secular control. In this sense, both economic and political factors that preceded the Protestant Reformation by two-hundred years may have played a role in its variable adoption.

Testing such a thesis rigorously is well beyond the scope of this paper and is certainly not possible with the current data. Many major events (e.g., the Great Famine and the Black Death) had dramatic effects on European economics, politics, and religion in the two-hundred years between the Avignon Papacy and the Reformation, which would make detecting such an effect difficult at best. Nonetheless, as scholars continue to attempt to understand patterns of economic, political, and religious development in Europe, our account suggests that it is worthwhile to consider the role played by institutional incentives, like those created at Worms, that affected the interplay of these domains well before the dramatic events surrounding the Protestant Reformation that have occupied much of the literature.

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## A Proofs of Numbered Results

**Proof of Lemma 2.** Suppose the Pope uses a strategy that calls for proposing  $r$  in each period. Slightly abuse notation by writing the Pope's strategy as simply  $r$ .

From Equation 1, if a bishop of type  $r_t$  is proposed in period  $t$ , the Ruler accepts if:

$$\epsilon_t \geq \lambda_R \left( \frac{r_t}{1-\delta} - q \right) + (1-\lambda_R)y - c + \delta \max_{s_R} V_R(s_R, r).$$

Notice, since the Popes' strategy is stationary, this condition is the same in all periods  $t$ . The one-shot-deviation principle thus establishes that the Ruler's strategy is stationary. ■

**Proof of Lemma 3.** Using the argument in the proof of Lemma 2, if the Ruler's strategy is a best response to a stationary strategy,  $r$ , by the Pope, then it is an  $\bar{\epsilon}^*(\cdot)$  satisfying:

$$\bar{\epsilon}^*(r_t) = \lambda_R \left( \frac{r_t}{1-\delta} - q \right) + (1-\lambda_R)y - c + \delta \max_{s_R} V_R(\bar{\epsilon}^*(\cdot), r), \quad (5)$$

for each  $r_t$ . If the Pope conjectures that the Ruler is using such a strategy, the Pope's expected utility from proposing  $r_t$  in period  $t$  and using a stationary strategy in which he proposes  $\hat{r}$  in all other periods is:

$$(1 - F(\bar{\epsilon}^*(r_t))) \left( \frac{\lambda_P r_t + (1-\lambda_P)y}{1-\delta} \right) + F(\bar{\epsilon}^*(r_t)) (\lambda_P q + \delta V_P(\bar{\epsilon}^*(\cdot), \hat{r})).$$

The one-shot-deviation principle implies that his best response in period  $t$  must maximize this expected utility. Moreover, since this problem is the same in every period, the Pope's strategy must be stationary as long as the optimum is unique.

To see that the optimum is unique, first suppose it is interior. Then it satisfies the following first-order condition:

$$\frac{f}{1-F(\bar{\epsilon}^*(r_t^*))} \frac{d\bar{\epsilon}^*(r_t^*)}{dr_t} = \frac{1-\delta}{\lambda_P} \left( \frac{\lambda_P r_t^* + (1-\lambda_P)y}{1-\delta} - (\lambda_P q + \delta V_P(\bar{\epsilon}^*(\cdot), \hat{r})) \right)^{-1}.$$

From Equation 5, we have

$$\frac{d\bar{\epsilon}^*(r_t^*)}{dr_t} = \frac{\lambda_P}{1-\delta}.$$

We can, thus, rewrite the first-order condition as:

$$\frac{f}{1-F}(\bar{\epsilon}^*(r_t^*)) = \left( \frac{1-\delta}{\lambda_P} \right)^2 \left( \frac{\lambda_P r_t^* + (1-\lambda_P)y}{1-\delta} - (\lambda_P q + \delta V_P(\bar{\epsilon}^*(\cdot), \hat{r})) \right)^{-1}. \quad (6)$$

The right-hand side of Equation 6 is strictly decreasing in  $r_t^*$  and the log-concavity of  $f$  implies that the left-hand side is strictly increasing, so there is a unique solution to the first-order condition.

For this to be a stationary best response, we need  $r_t^* = \hat{r}$ . Hence, there will be a unique, stationary, interior best response if there is a unique  $r^* \in [\underline{r}, \bar{r}]$  that satisfies:

$$\frac{f}{1-F}(\bar{\epsilon}^*(r^*)) = \left( \frac{1-\delta}{\lambda_P} \right)^2 \left( \frac{\lambda_P r^* + (1-\lambda_P)y}{1-\delta} - (\lambda_P q + \delta V_P(\bar{\epsilon}^*(\cdot), r^*)) \right)^{-1}. \quad (7)$$

Using the standard recursive approach, if the Pope uses a stationary strategy,  $r$ , his continuation value for the game is implicitly defined by:

$$V_P(\bar{\epsilon}^*(\cdot), r) = (1 - F(\bar{\epsilon}^*(r))) \left( \frac{\lambda_P r + (1 - \lambda_P)y}{1 - \delta} \right) + F(\bar{\epsilon}^*(r)) (\lambda_P q + \delta V_P(\bar{\epsilon}^*(\cdot), r)).$$

Rearranging, this yields:

$$V_P(\bar{\epsilon}^*(\cdot), r) = \frac{(1 - F(\bar{\epsilon}^*(r))) \left( \frac{\lambda_P r + (1 - \lambda_P)y}{1 - \delta} \right) + F(\bar{\epsilon}^*(r)) \lambda_P q}{1 - \delta F(\bar{\epsilon}^*(r))}. \quad (8)$$

Substituting this into Equation 7, a stationary, interior best response exists if there is an  $r^* \in [\underline{r}, \bar{r}]$  satisfying:

$$\frac{f}{(1-F)}(\bar{\epsilon}^*(r^*)) = \frac{\lambda_P(1-\delta F(\bar{\epsilon}^*(r^*)))}{\lambda_R(1-\delta)} \left( \frac{1}{\lambda_P(r^* - q) + (1-\lambda_P)y} \right), \quad (9)$$

as required in the statement of the Lemma. The left-hand side of Equation 9 is increasing and the right-hand side is decreasing, so  $r^*$  is unique if it exists.

It is straightforward from the first-order condition that if  $y$  is sufficiently large or small, then there is not an  $r^*$  satisfying Equation 9. Define  $\bar{y}$  such that

$$\frac{f}{(1-F)}(\bar{\epsilon}^*(\underline{r})) = \frac{\lambda_P(1-\delta F(\bar{\epsilon}^*(\underline{r})))}{\lambda_R(1-\delta)} \left( \frac{1}{\lambda_P(\underline{r} - q) + (1-\lambda_P)\bar{y}} \right).$$

And define  $\underline{y}$  such that

$$\frac{f}{(1-F)}(\bar{\epsilon}^*(\bar{r})) = \frac{\lambda_P(1-\delta F(\bar{\epsilon}^*(\bar{r})))}{\lambda_R(1-\delta)} \left( \frac{1}{\lambda_P(\bar{r}-q) + (1-\lambda_P)\underline{y}} \right).$$

Then  $r^*$  exists for any  $y \in [\underline{y}, \bar{y}]$  and does not otherwise.

Now consider  $y \notin [\underline{y}, \bar{y}]$ . Precisely the argument given above implies that  $\bar{r}$  is a stationary best response if  $y < \underline{y}$  and  $\underline{r}$  is a stationary best response if  $y > \bar{y}$ .

■

The following Lemma will be useful throughout:

**Lemma 4**

$$\frac{\partial \bar{\epsilon}^*(r^*)}{\partial r^*} = \frac{\lambda_R}{1 - \delta F(\bar{\epsilon}^*(r^*))}.$$

$$\frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} = \frac{1 - \lambda_R}{1 - \delta F(\bar{\epsilon}^*(r^*))}$$

$$\frac{\partial \bar{\epsilon}^*(r^*)}{\partial c} = \frac{-1}{1 - \delta F(\bar{\epsilon}^*(r^*))}.$$

**Proof.** From Lemma 2, the cutoff rule that the Ruler uses in response to a nomination  $r^*$  is implicitly defined by:

$$\bar{\epsilon}^*(r^*) = \lambda_R \left( \frac{r^*}{1-\delta} - q \right) + (1-\lambda_R)y + \delta V_R(\bar{\epsilon}^*(\cdot), r^*).$$

Now, use the standard recursive approach to calculate  $V_R(\bar{\epsilon}^*(\cdot), r^*)$ . First, write:

$$V_R(\bar{\epsilon}^*(\cdot), r^*) = (1 - F(\bar{\epsilon}^*(r^*))) \left( \frac{-\lambda_R r^*}{1-\delta} + \mathbb{E}[\epsilon \mid \epsilon \geq \bar{\epsilon}^*(r^*)] \right) + F(\bar{\epsilon}^*(r^*)) (-\lambda_R q + (1-\lambda_R)y + \delta(\bar{\epsilon}^*(\cdot), r^*)).$$

Now rearrange to get:

$$V_R(\bar{\epsilon}^*(\cdot), r) = \frac{(1 - F(\bar{\epsilon}^*(r))) \left( \frac{-\lambda_R r}{1-\delta} + \mathbb{E}[\epsilon \mid \epsilon \geq \bar{\epsilon}^*(r)] \right) + F(\bar{\epsilon}^*(r)) (-\lambda_R q + (1-\lambda_R)y)}{1 - \delta F(\bar{\epsilon}^*(r))}. \quad (10)$$

Substituting for  $V_R(\bar{\epsilon}^*(\cdot), r^*)$  from Equation 10, noting that we can write

$$\mathbb{E}[\epsilon \mid \epsilon \geq \bar{\epsilon}^*(r^*)] = \int_{\bar{\epsilon}^*(r^*)}^{\infty} \tilde{\epsilon} \frac{f(\tilde{\epsilon})}{1 - F(\bar{\epsilon}^*(r^*))} d\tilde{\epsilon},$$

and simplifying,  $\bar{\epsilon}^*(r^*)$  is given by:

$$(1 - \delta F(\bar{\epsilon}^*(r^*)))\bar{\epsilon}^*(r^*) - \delta \int_{\bar{\epsilon}^*(r^*)}^{\infty} \tilde{\epsilon} f(\tilde{\epsilon}) d\tilde{\epsilon} = \lambda_R(r^* - q) + (1 - \lambda_R)y. \quad (11)$$

Now the result follows immediately by implicitly differentiating Equation 11. ■

**Proof of Proposition 2.** Implicitly differentiating Equation 9, we have that at an interior solution:

$$\frac{dr^*}{dy} = - \frac{\left(\frac{f}{1-F}\right)'(\bar{\epsilon}^*(r^*)) \frac{d\bar{\epsilon}^*(r^*)}{dy} + \frac{2\delta\lambda_P(1-\delta F(\bar{\epsilon}^*(r^*)))f(\bar{\epsilon}^*(r^*))\frac{d\bar{\epsilon}^*(r^*)}{dy}}{(1-\delta)\lambda_R(\lambda_P(r^*-q)+(1-\lambda_P)y)} + \frac{\lambda_P^2(1-\delta F(\bar{\epsilon}^*(r^*)))^2}{(1-\delta)\lambda_R(\lambda_P(r^*-q)+(1-\lambda_P)y)^2}}{\left(\frac{f}{1-F}\right)'(\bar{\epsilon}^*(r^*)) \frac{d\bar{\epsilon}^*(r^*)}{dr} + \frac{2\delta\lambda_P(1-\delta F(\bar{\epsilon}^*(r^*)))f(\bar{\epsilon}^*(r^*))\frac{d\bar{\epsilon}^*(r^*)}{dr}}{(1-\delta)\lambda_R(\lambda_P(r^*-q)+(1-\lambda_P)y)} + \frac{\lambda_P^2(1-\delta F(\bar{\epsilon}^*(r^*)))^2}{(1-\delta)\lambda_R(\lambda_P(r^*-q)+(1-\lambda_P)y)^2}} < 0, \quad (12)$$

where the inequality follows two facts. First, log-concavity of  $f$  implies that  $\left(\frac{f}{1-F}\right)'(\bar{\epsilon}^*(r^*)) > 0$ . Second, Lemma 4 shows that  $\frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} > 0$ . ■

**Proof of Proposition 3.** Differentiating:

$$\frac{d \Pr(\text{interregnum})}{dy} = f(\bar{\epsilon}^*(r^*)) \left( \frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} + \frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} \frac{\partial r^*}{\partial y} \right).$$

At a corner solution, this has the same sign as  $\frac{\partial \bar{\epsilon}^*(r^*)}{\partial y}$ , which is positive, by Lemma 4.

At an interior solution, we can substitute for  $\frac{\partial r^*}{\partial y}$  from Equation 12. Doing so, this derivative has the same sign as:

$$\frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} - \frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} \left( \frac{\left(\frac{f}{1-F}\right)'(\bar{\epsilon}^*(r^*)) \frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} + \frac{2\delta\lambda_P(1-\delta F(\bar{\epsilon}^*(r^*)))f(\bar{\epsilon}^*(r^*))\frac{d\bar{\epsilon}^*(r^*)}{dy}}{(1-\delta)\lambda_R(\lambda_P(r^*-q)+(1-\lambda_P)y)} + \frac{\lambda_P^2(1-\delta F(\bar{\epsilon}^*(r^*)))^2}{(1-\delta)\lambda_R(\lambda_P(r^*-q)+(1-\lambda_P)y)^2}}{\left(\frac{f}{1-F}\right)'(\bar{\epsilon}^*(r^*)) \frac{d\bar{\epsilon}^*(r^*)}{dr} + \frac{2\delta\lambda_P(1-\delta F(\bar{\epsilon}^*(r^*)))f(\bar{\epsilon}^*(r^*))\frac{d\bar{\epsilon}^*(r^*)}{dr}}{(1-\delta)\lambda_R(\lambda_P(r^*-q)+(1-\lambda_P)y)} + \frac{\lambda_P^2(1-\delta F(\bar{\epsilon}^*(r^*)))^2}{(1-\delta)\lambda_R(\lambda_P(r^*-q)+(1-\lambda_P)y)^2}} \right).$$

Cross multiplying and rearranging this has the same sign as:

$$\frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} \lambda_P^2 - \frac{\partial \bar{\epsilon}^*(r^*)}{\partial r} \lambda_P(1 - \lambda_R).$$

Substituting for  $\frac{\partial \bar{\epsilon}^*(r^*)}{\partial y}$  and  $\frac{\partial \bar{\epsilon}^*(r^*)}{\partial r}$  from Lemma 4, this has the same sign as:

$$(1 - \lambda_R)\lambda_P - \lambda_R(1 - \lambda_P),$$

as required. The argument for expected length is analogous. ■

**Proof of Proposition 4.** The Ruler's ex ante expected welfare is:

$$V_R(\bar{\epsilon}^*(r^*), r^*) = \frac{(1 - F(\bar{\epsilon}^*(r^*))) \left( \frac{-\lambda_R r^*}{1-\delta} + \mathbb{E}[\epsilon \mid \epsilon > \bar{\epsilon}^*(r^*)] \right) + F(\bar{\epsilon}^*(r^*))(-\lambda_R q + (1 - \lambda_R)y)}{1 - \delta F(\bar{\epsilon}^*(r^*))}.$$

Differentiating, we have:

$$\begin{aligned} \frac{dV_R(\bar{\epsilon}^*(r^*), r^*)}{dy} &= \frac{1}{(1 - \delta F(\bar{\epsilon}^*(r^*)))^2} \left[ \left( f(\bar{\epsilon}^*(r^*)) \left( \frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} + \frac{\partial \bar{\epsilon}^*(r^*)}{\partial r} \frac{\partial r^*}{\partial y} \right) (1 - \delta F(\bar{\epsilon}^*(r^*))) \right) \right. \\ &\times \left( \lambda_R \left( \frac{r^2}{1-\delta} - q \right) + (1 - \lambda_R)y - \bar{\epsilon}^*(r^*) - (1 - F(\bar{\epsilon}^*(r^*))) \frac{\lambda_R}{1-\delta} \frac{dr^*}{dy} + F(\bar{\epsilon}^*(r^*))(1 - \lambda_R) \right) \\ &\left. + \delta f(\bar{\epsilon}^*(r^*)) \frac{d\bar{\epsilon}^*(r^*)}{dy} \left( (1 - F(\bar{\epsilon}^*(r^*))) \left( \frac{-\lambda_R r^*}{1-\delta} + \mathbb{E}[\epsilon \mid \epsilon > \bar{\epsilon}^*(r^*)] \right) + F(\bar{\epsilon}^*(r^*))(-\lambda_R q + (1 - \lambda_R)y) \right) \right] \end{aligned}$$

From Equation 11, we can write:

$$\bar{\epsilon}^*(r^*) = \frac{\lambda_R(r^* - q) + (1 - \lambda_R)y + \delta \int_{\bar{\epsilon}^*(r^*)}^{\infty} \epsilon f(\epsilon) d\epsilon}{1 - \delta F(\bar{\epsilon}^*(r^*))}.$$

Making this substitution and canceling like terms, the derivative reduces to:

$$\frac{dV_R(\bar{\epsilon}^*(r^*), r^*)}{dy} = \frac{F(\bar{\epsilon}^*(r^*))(1 - \lambda_R) - (1 - F(\bar{\epsilon}^*(r^*))) \frac{\lambda_R}{1-\delta} \frac{dr^*}{dy}}{1 - \delta F(\bar{\epsilon}^*(r^*))}.$$

The derivative has the same sign as its numerator. The result now follows from the fact that, as shown in Proposition 2,  $\frac{dr^*}{dy} \leq 0$ .

The Pope's ex ante expected welfare is:

$$V_P(\bar{\epsilon}^*(r^*), r^*) = \frac{(1 - F(\bar{\epsilon}^*(r^*))) \left( \frac{\lambda_P r^* + (1 - \lambda_P)y}{1-\delta} \right) + F(\bar{\epsilon}^*(r^*)) \lambda_P q}{1 - \delta F(\bar{\epsilon}^*(r^*))}.$$

Differentiating, we have

$$\begin{aligned} \frac{dV_P(\bar{\epsilon}^*(r^*), r^*)}{dy} &= \frac{1}{(1 - \delta F(\bar{\epsilon}^*(r^*)))^2} \left[ (1 - \delta F(\bar{\epsilon}^*(r^*))) \right. \\ &\quad \times \left( -f(\bar{\epsilon}^*(r^*)) \left( \frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} + \frac{\partial \bar{\epsilon}^*(r^*)}{\partial r} \frac{\partial r^*}{\partial y} \right) \left( \lambda_P \left( \frac{r^*}{1 - \delta} - q \right) + (1 - \lambda_P) \frac{y}{1 - \delta} \right) \right. \\ &\quad \left. \left. + (1 - F(\bar{\epsilon}^*(r^*))) \left( \frac{\lambda_P \frac{\partial r^*}{\partial y} + (1 - \lambda_P)}{1 - \delta} \right) \right) \right. \\ &\quad \left. + \delta f(\bar{\epsilon}^*(r^*)) \left( \frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} + \frac{\partial \bar{\epsilon}^*(r^*)}{\partial r} \frac{\partial r^*}{\partial y} \right) \left( (1 - F(\bar{\epsilon}^*(r^*))) \left( \frac{\lambda_P r^* + (1 - \lambda_P)y}{1 - \delta} \right) + F(\bar{\epsilon}^*(r^*)) \lambda_P q \right) \right] \end{aligned}$$

This can be rewritten:

$$\begin{aligned} \frac{dV_P(\bar{\epsilon}^*(r^*), r^*)}{dy} &= \frac{1}{(1 - \delta F(\bar{\epsilon}^*(r^*)))^2} \left[ \frac{(1 - \delta F(\bar{\epsilon}^*(r^*))) (1 - F(\bar{\epsilon}^*(r^*))) (1 - \lambda_P)}{1 - \delta} \right. \\ &\quad \left. - f(\bar{\epsilon}^*(r^*)) \frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} \left( \lambda_P (r^* - q) + (1 - \lambda_P)y \right) \right. \\ &\quad \left. + \frac{\partial r^*}{\partial y} \left( (1 - \delta F(\bar{\epsilon}^*(r^*))) (1 - F(\bar{\epsilon}^*(r^*))) \frac{\partial \bar{\epsilon}^*(r^*)}{\partial r} - f(\bar{\epsilon}^*(r^*)) \left( \lambda_P (r^* - q) + (1 - \lambda_P)y \right) \right) \right]. \end{aligned}$$

This derivative has the same sign as the term in square brackets.

Now note that, by the Envelope Theorem, the term on the third-line is equal to zero. To see this, note that in the event that  $r^*$  is a corner solution,  $\frac{\partial r^*}{\partial y} = 0$ . In the event that  $r^*$  is interior, the first-order condition implies that the term in parentheses is 0.

Thus, the derivative has the same sign as:

$$\frac{(1 - \delta F(\bar{\epsilon}^*(r^*))) (1 - F(\bar{\epsilon}^*(r^*))) (1 - \lambda_P)}{1 - \delta} - f(\bar{\epsilon}^*(r^*)) \frac{\partial \bar{\epsilon}^*(r^*)}{\partial y} \left( \lambda_P (r^* - q) + (1 - \lambda_P)y \right).$$

Substituting for  $\frac{\partial \bar{\epsilon}^*(r^*)}{\partial y}$ , the derivative has the same sign as:

$$\frac{(1 - \delta F(\bar{\epsilon}^*(r^*))) (1 - F(\bar{\epsilon}^*(r^*))) (1 - \lambda_P)}{1 - \delta} - \frac{f(\bar{\epsilon}^*(r^*)) \left( \lambda_P (r^* - q) + (1 - \lambda_P)y \right) (1 - \lambda_R)}{1 - \delta F(\bar{\epsilon}^*(r^*))}. \quad (13)$$

Now we divide the analysis into several lemmas. First, focus on the case of an interior  $r^*$ .

**Lemma 5** *For any  $y \in (y, \bar{y})$ , the Pope's welfare is strictly increasing in  $y$  if  $\lambda_R > \lambda_Y$ , strictly decreasing in  $y$  if  $\lambda_R < \lambda_Y$  and constant in  $y$  if  $\lambda_R = \lambda_Y$ .*

**Proof of Lemma 5.**

From the first-order condition, we have that:

$$f(\bar{\epsilon}^*(r^*)) \left( \lambda_P(r^* - q) + (1 - \lambda_P)y \right) = \frac{(1 - F(\bar{\epsilon}^*(r^*))(1 - \delta F(\bar{\epsilon}^*(r^*)))\lambda_P}{\lambda_R(1 - \delta)}.$$

Substituting this in to Equation 13, at an interior  $r^*$ ,  $\frac{dV_P(\bar{\epsilon}^*(r^*), r^*)}{dy}$  has the same sign as:

$$\frac{(1 - \delta F(\bar{\epsilon}^*(r^*))) (1 - F(\bar{\epsilon}^*(r^*))(1 - \lambda_P))}{1 - \delta} - \frac{(1 - \delta F(\bar{\epsilon}^*(r^*))) (1 - F(\bar{\epsilon}^*(r^*))(1 - \lambda_R))\lambda_P}{(1 - \delta)\lambda_R}.$$

Rearranging shows that at an interior  $r^*$ ,  $\frac{dV_P(\bar{\epsilon}^*(r^*), r^*)}{dy}$  has the same sign as:

$$\lambda_R - \lambda_P,$$

as required. ■

Now consider when  $r^*$  is a corner solution. We will establish the result in two steps. First, we show that, when  $r$  is fixed, the Pope's welfare is decreasing in  $y$  if and only if  $y$  is sufficiently large.

**Lemma 6** *Fix an  $r$ . Then there exists a  $\hat{y}$  such that  $V(\bar{\epsilon}^*(r), r)$  is strictly decreasing in  $y$  if  $y > \hat{y}$  and strictly increasing in  $y$  if  $y < \hat{y}$ .*

**Proof of Lemma 6.** Rearranging Equation 13,  $V(\bar{\epsilon}^*(r), r)$  is increasing if

$$\frac{1 - \lambda_P}{(1 - \delta)(1 - \lambda_R)} \frac{(1 - \delta F(\bar{\epsilon}^*(r))) (1 - F(\bar{\epsilon}^*(r)))}{f(\bar{\epsilon}^*(r))} > \lambda_P(r - q) + (1 - \lambda_P)y,$$

decreasing if the sign is reversed, and constant at equality. It is straightforward that the right-hand side is increasing and going to infinity in  $y$ . Hence, it suffices to show that the left-hand side is decreasing in  $y$ .

To see this, first note that log-concavity of  $f$  implies log-concavity of  $1 - F$ . Thus, for any  $x$ , we have:

$$-f'(x)(1 - F(x)) < f(x)^2. \tag{14}$$

Differentiating, the left-hand side is decreasing in  $y$  if:

$$\frac{\partial \bar{\epsilon}^*(r)}{\partial y} \left( \frac{-\delta f(\bar{\epsilon}^*(r))^2 (1 - F(\bar{\epsilon}^*(r))) - f(\bar{\epsilon}^*(r))^2 (1 - \delta F(\bar{\epsilon}^*(r))) - f'(\bar{\epsilon}^*(r)) (1 - F(\bar{\epsilon}^*(r))) (1 - \delta F(\bar{\epsilon}^*(r)))}{f(\bar{\epsilon}^*(r))^2} \right) < 0.$$

From Lemma 4,  $\frac{\partial \bar{\epsilon}^*(r)}{\partial y} > 0$ , so this inequality holds if and only if the fraction in parentheses is negative. Rearranging, this is equivalent to:

$$-f'(\bar{\epsilon}^*(r))(1 - F(\bar{\epsilon}^*(r))) < f(\bar{\epsilon}^*(r))^2 \left(1 + \frac{\delta(1 - F(\bar{\epsilon}^*(r)))}{1 - \delta F(\bar{\epsilon}^*(r))}\right),$$

which follows from Condition 14. ■

Finally, we show that the location of  $\hat{y}$  is as in the statement of the proposition.

**Lemma 7** *At any  $y \in \{\underline{y}, \bar{y}\}$ , the Pope's welfare is strictly increasing in  $y$  if  $\lambda_R > \lambda_Y$ , strictly decreasing in  $y$  if  $\lambda_R < \lambda_Y$ , and constant in  $y$  if  $\lambda_R = \lambda_Y$ .*

**Proof of Lemma 7.** Rearranging Equation 13, for a fixed  $r$ ,  $\frac{dV(\bar{\epsilon}^*(r), r)}{dy}$  has the same sign as

$$\frac{1 - \lambda_P}{(1 - \delta)(1 - \lambda_R)} (1 - \delta F(\bar{\epsilon}^*(r))) (1 - F(\bar{\epsilon}^*(r))) - f(\bar{\epsilon}^*(r)) (\lambda_P(r - q) + (1 - \lambda_P)y). \quad (15)$$

Using the definitions of  $\bar{y}$  and  $\underline{y}$ , at either of these values, the second term of Condition 15 is equal to

$$\frac{\lambda_P}{\lambda_R(1 - \delta)} (1 - \delta F(\bar{\epsilon}^*(r))) (1 - F(\bar{\epsilon}^*(r))),$$

where either  $r = \underline{r}$  and  $y = \bar{y}$ , or  $r = \bar{r}$  and  $y = \underline{y}$ . Substituting this in to Condition 15, we have that at either of these values of  $y$ ,  $\frac{dV(\bar{\epsilon}^*(r), r)}{dy}$  has the same sign as

$$\frac{1 - \lambda_P}{(1 - \delta)(1 - \lambda_R)} (1 - \delta F(\bar{\epsilon}^*(r))) (1 - F(\bar{\epsilon}^*(r))) - \frac{\lambda_P}{\lambda_R(1 - \delta)} (1 - \delta F(\bar{\epsilon}^*(r))) (1 - F(\bar{\epsilon}^*(r))).$$

Rearranging one more time,  $\frac{dV(\bar{\epsilon}^*(r), r)}{dy}$  has the same sign as

$$\lambda_R - \lambda_P,$$

as required. ■

From Lemma 6, when  $r$  is fixed, there is a  $\hat{y}(r)$  such that  $V(\bar{\epsilon}^*(r), r)$  is strictly increasing in  $y$  up to  $\hat{y}(r)$  and then strictly decreasing. From Lemma 7, if  $\lambda_R > \lambda_Y$ , then  $V(\bar{\epsilon}^*(\bar{r}), \bar{r})$  is increasing at  $y = \underline{y}$ . Hence,  $\hat{y}(\bar{r}) > \underline{y}$ , so the Pope's welfare is increasing for all  $y \leq \underline{y}$ . Moreover, by Lemma 5,  $V(\bar{\epsilon}^*(r^*), r^*)$  is increasing for  $y \in (\underline{y}, \bar{y})$ . Finally, by Lemma 7,

$V(\bar{\epsilon}^*(\underline{r}), \underline{r})$  is increasing at  $y = \bar{y}$ . Hence  $\hat{y}(\underline{r})\bar{y}$ . Thus,  $V(\bar{\epsilon}^*(r^*), r^*)$  is strictly increasing in  $y$  up to  $\hat{y}(\underline{r}) > \bar{y}$  and then strictly decreasing.

From Lemma 7, if  $\lambda_R < \lambda_Y$ , then  $V(\bar{\epsilon}^*(\bar{r}), \bar{r})$  is strictly decreasing at  $y = \underline{y}$ . Hence,  $\hat{y}(\bar{r}) < \underline{y}$ . Moreover, by Lemma 5,  $V(\bar{\epsilon}^*(r^*), r^*)$  is strictly decreasing for  $y \in (\underline{y}, \bar{y})$ . Finally, by Lemma 7,  $V(\bar{\epsilon}^*(\underline{r}), \underline{r})$  is decreasing at  $y = \bar{y}$ . Thus,  $V(\bar{\epsilon}^*(r^*), r^*)$  is increasing in  $y$  up to  $\hat{y}(\bar{r}) < \underline{y}$  and then decreasing.

From Lemma 7, if  $\lambda_R = \lambda_Y$ , then  $V(\bar{\epsilon}^*(\bar{r}), \bar{r})$  is constant at  $y = \underline{y}$ . Hence,  $\hat{y}(\bar{r}) = \underline{y}$ . Moreover, by Lemma 5,  $V(\bar{\epsilon}^*(r^*), r^*)$  is constant in  $y$ , for  $y \in (\underline{y}, \bar{y})$ . Finally, by Lemma 7,  $V(\bar{\epsilon}^*(\underline{r}), \underline{r})$  is constant at  $y = \bar{y}$ . Hence,  $\hat{y}(\underline{r}) = \bar{y}$ . Thus,  $V(\bar{\epsilon}^*(r^*), r^*)$  is strictly increasing in  $y$  up to  $\underline{y}$ , constant for  $y \in [\underline{y}, \bar{y}]$ , and strictly decreasing for  $y > \bar{y}$ . ■

## B Data Sources

Here we briefly describe the data collection and sources. The replication data and do-file can be accessed <http://home.uchicago.edu/~bdm/papers.html>.

### B.1 Bishop types

To evaluate whether bishops were religious, secular or of unknown type, we scraped web sites for each European diocese. The data regarding bishops can be found by searching Wikipedia for European Roman Catholic bishops. Such a search will lead to [https://en.wikipedia.org/wiki/Category:Roman\\_Catholic\\_bishops\\_in\\_Europe](https://en.wikipedia.org/wiki/Category:Roman_Catholic_bishops_in_Europe) from which one can then choose each country in turn and each bishop in turn. Bishops coded in black font have no biographical information. Those coded in blue do have biographical information. Those coded in red may have biographies forthcoming in the future. In addition to Wikipedia, we also scraped information on individual bishops from <http://www.catholic-hierarchy.org/bishop/> or, equivalently, the Catholic hierarchy site by country. In ambiguous cases additional websites relevant to the individual bishop were also searched although they rarely turned up information not already covered by Catholic Hierarchy or Wikipedia.

To create a preliminary coding of each bishop's type, biographical texts were scanned as follows:

A bishop was given a preliminary coding of Religious if the biographical text included any of the following terms (with the appearance of multiple terms coded as well and with checks both for uppercase and lowercase entries):

Archbishop, Benedictine, monk, Bishop, Bishop-elect, Cantor, deacon, Dom-scholaster, abbey, abbot, abott, arch-deacon, archdeacon, canon, cardinal, cathedral, chaplain, choirmaster, church, clergy, cleric, dean, dean, elected, friar, hermit, cathedral, missionary, monastery, monk, monk/silversmith, papal, Pope, pope, preacher, prebend, prebendary, precenter, precentor, priest, priests, prior, proctor, rector, religious, sacrist, sub-dean, theologian, vicar, bishoprics, hermit.

A bishop was given a preliminary coding as Secular if the biographical text included any of the following terms (with the appearance of multiple terms coded as well and with checks both for uppercase and lowercase entries):

Governor, academic, ambassador, archchancellor, archduke, architect, artist, scholar, auditor, chancellor, chancery, coadjutor, diplomat, composer, count, diplomacy, doctor, duke, prince, exchequer, goldsmith, judge, government, keeper, king, kings, secretary, knight, law, writer, vice-chancellor, vice, lawyer, treasurer, privy, master, military, military/chancellor, noble, office, poet, politician, professor, advisor, council, councillor, justice, notary, official, physician, steward, scholar, secretary, secular, statesman, teacher, treasurer, prince-bishop, imperial.

After this preliminary coding, multiple coders hand read the individual text in cases for which the criteria yielded ambiguous or no coding. For instance, while law could imply secular and canon religious, canon law as a phrase would indicate the individual was more likely in the religious domain whereas Roman law or just “law” would more likely have indicated a secular occupation. About 90 percent of the codings from the list of words were unambiguous (random checks were performed) so about 10 percent of the codings required close individual readings.

## **B.2 Trade Data**

Trade data were downloaded from <http://www.ciolek.com/owtrad.html> with all routes designated as major and involving a European starting or ending point coded for the inclusive years specified on the website.

## C Additional Tables

Table 4 shows that there is no difference during the Worms period in the correlation between a diocese’s wealth and missingness of data on the religious alignment of the bishop.

Table 4: Correlates of missingness of bishop alignment data.

	(1)	(2)	(3)
Worms	0.00 (0.01)	-0.05 (0.03)	-0.02 (0.02)
Wealth	-0.10** (0.05)	-0.10** (0.05)	0.02 (0.03)
Worms * Wealth	-0.02 (0.04)	-0.01 (0.04)	-0.03 (0.02)
N	4930	4930	4920
half-century fixed effects	no	yes	yes
diocese fixed effects	no	no	yes
sample years	300-1517	300-1517	300-1517

Wealth measured as *% trade 20 years*. Standard errors clustered by diocese.

\*\*  $p < 0.05$  \*\*\*  $p < 0.01$

Table 5 and 6 replicate Table 1 using *trade* and *% trade all years*, respectively, to measure diocese wealth instead of *trade*.

Tables 7 and 8 replicate Table 2 using *trade* and *% trade all years*, respectively, to measure diocese wealth instead of *trade*.

Tables 9 and 10 replicates Table 3, using *trade* and *% trade all years*, respectively, to measure diocese wealth instead of *trade*.

Table 5: Correlates of bishop alignment with Pope, *trade*.

	(1)	(2)	(3)	(4)
Worms	0.13 (0.11)	0.13 (0.12)	0.03 (0.10)	-0.03 (0.12)
Wealth	-0.02 (0.12)	0.01 (0.12)	-0.05 (0.11)	-0.04 (0.11)
Worms * Wealth	-0.36*** (0.12)	-0.40*** (0.11)	-0.33*** (0.09)	-0.35*** (0.09)
N	339	293	567	420
half-century fixed effects	yes	yes	yes	yes
diocese fixed effects	yes	yes	yes	yes
balanced panel	no	yes	no	yes
sample years	300-1309	700-1309	300-1517	700-1517

Wealth measured as *trade*. Standard errors clustered by diocese.

\*\*  $p < 0.05$  \*\*\*  $p < 0.01$

Table 6: Correlates of bishop alignment with Pope, % *trade all years*.

	(1)	(2)	(3)	(4)
Worms	0.07 (0.11)	0.05 (0.10)	-0.00 (0.10)	-0.06 (0.11)
Wealth	-1.40*** (0.41)	-1.38*** (0.41)	-0.52 (0.36)	-0.68** (0.33)
Worms * Wealth	-0.28** (0.14)	-0.31** (0.14)	-0.32*** (0.10)	-0.34*** (0.10)
N	339	293	567	420
half-century fixed effects	yes	yes	yes	yes
diocese fixed effects	yes	yes	yes	yes
balanced panel	no	yes	no	yes
sample years	300-1309	700-1309	300-1517	700-1517

Wealth measured as % *trade all years*. Standard errors clustered by diocese.

\*\*  $p < 0.05$  \*\*\*  $p < 0.01$

Table 7: Correlates of bishop alignment with Pope using archbishops as a control, *trade*.

	(1)	(2)	(3)	(4)
Worms	-0.25 (0.16)	-0.41*** (0.13)	-0.29*** (0.10)	-0.43*** (0.09)
Wealth	0.08 (0.32)	0.10 (0.31)	0.21 (0.21)	0.27 (0.25)
Regular Bishop	-0.34 (0.31)	-0.33 (0.31)	0.02 (0.24)	0.06 (0.28)
Worms * Regular Bishop	0.28 (0.16)	0.40*** (0.14)	0.26** (0.11)	0.34*** (0.10)
Wealth * Regular Bishop	-0.05 (0.32)	-0.06 (0.31)	-0.22 (0.22)	-0.27 (0.26)
Worms * Wealth	0.18 (0.18)	0.29 (0.16)	0.18 (0.12)	0.24** (0.12)
Worms * Wealth * Regular Bishop	-0.55** (0.21)	-0.70*** (0.20)	-0.51*** (0.14)	-0.60*** (0.14)
N	561	494	946	730
half-century fixed effects	yes	yes	yes	yes
diocese fixed effects	yes	yes	yes	yes
balanced panel	no	yes	no	yes
sample years	300-1309	700-1309	300-1517	700-1517

Wealth measured as *trade*. Standard errors clustered by diocese.

\*\*  $p < 0.05$  \*\*\*  $p < 0.01$

Table 8: Correlates of bishop alignment with Pope using archbishops as a control, % trade all years.

	(1)	(2)	(3)	(4)
Worms	-0.30** (0.14)	-0.46*** (0.12)	-0.30*** (0.10)	-0.42*** (0.08)
Wealth	3.54** (1.42)	4.00*** (1.13)	1.47*** (0.43)	1.74*** (0.38)
Regular Bishop	4.45*** (1.36)	4.92*** (1.05)	1.73*** (0.52)	2.16*** (0.47)
Worms * Regular Bishop	0.30** (0.14)	0.42*** (0.12)	0.23** (0.10)	0.29*** (0.10)
Wealth * Regular Bishop	-4.83*** (1.36)	-5.31*** (1.05)	-1.89*** (0.50)	-2.33*** (0.43)
Worms * Wealth	0.25 (0.16)	0.36** (0.15)	0.25** (0.12)	0.31*** (0.12)
Worms * Wealth * Regular Bishop	-0.53** (0.20)	-0.67*** (0.19)	-0.55*** (0.15)	-0.64*** (0.15)
N	561	494	946	730
half-century fixed effects	yes	yes	yes	yes
diocese fixed effects	yes	yes	yes	yes
balanced panel	no	yes	no	yes
sample years	300-1309	700-1309	300-1517	700-1517

Wealth measured as % trade all years. Standard errors clustered by diocese.

\*\*  $p < 0.05$  \*\*\*  $p < 0.01$

Table 9: Correlates of interregnum occurrence and length, *trade*.

	(1) Occur	(2) Occur	(3) Occur	(4) Length	(5) Length
Worms	0.02 (0.06)	0.03 (0.04)	0.69 (4.14)	0.67 (1.92)	0.58 (1.29)
Wealth	-0.04 (0.08)	-0.02 (0.06)	-13.93 (10.08)	-1.77 (3.31)	0.07 (2.13)
Worms * Wealth	-0.03 (0.07)	-0.06 (0.04)	5.52 (6.09)	2.04 (2.00)	-0.14 (1.27)
N	2565	4849	2565	2400	4633
half-century fixed effects	yes	yes	yes	yes	yes
diocese fixed effects	yes	yes	yes	yes	yes
drop outliers	no	no	no	yes	yes
sample years	300-1309	300-1517	300-1309	300-1309	300-1517

Wealth measured as *trade*. Standard errors clustered by diocese.

\*\*  $p < 0.05$  \*\*\*  $p < 0.01$

Table 10: Correlates of interregnum occurrence and length, % *trade all years*.

	(1) Occur	(2) Occur	(3) Occur	(4) Length	(5) Length
Worms	0.02 (0.06)	0.02 (0.04)	1.06 (3.94)	0.64 (1.86)	0.38 (1.26)
Wealth	-0.49 (0.25)	-0.18 (0.16)	-54.62** (21.64)	-13.46 (7.71)	0.04 (5.14)
Worms * Wealth	0.00 (0.10)	-0.08 (0.06)	9.85 (7.36)	4.42 (2.64)	1.19 (1.65)
N	2565	4849	2565	2400	4633
half-century fixed effects	yes	yes	yes	yes	yes
diocese fixed effects	yes	yes	yes	yes	yes
drop outliers	no	no	no	yes	yes
sample years	300-1309	300-1517	300-1309	300-1309	300-1517

Wealth measured as % *trade all years*. Standard errors clustered by diocese.

\*\*  $p < 0.05$  \*\*\*  $p < 0.01$