INSTITUTIONAL COMMITMENT AND ECONOMIC REVIVAL: EVIDENCE FROM PALACE-BUILDING IN RENAISSANCE ROME

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Abstract. I study the recovery of the Roman economy following the papacy's sojourn in France (1309-1377). I show that a reform of inheritance laws in 1480 gave rise to an era of palace-building resulting in the construction of over 35% of palaces built in Roman history. Using a novel dataset that links information on investment projects and patrons, I provide evidence that the reform, which allowed prelates to bequeath their possessions, caused a significant increase of prelate palace-building relative to their lay counterparts (who were not directly affected by the reform). Initial prelate investment then guaranteed that the papacy would remain in Rome long-term, which eventually incentivized laymen to invest – though the return of the papacy to Rome itself had failed to induce investment. Increased confidence in Rome's future also manifested in more ambitious projects, across all patrons. I disentangle the effect of commitment to long-term presence from the effects of contemporaneous papal presence in Rome to show that the irreversibility of institutional change is a necessary condition for successful intervention.

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1. Introduction

It is a truth universally acknowledged that a society in possession of resources but lacking prosperity must be in want of a good institution (Acemoglu et al., 2005). But new institutions often fail, and their good intentions and policy initiatives do not always manifest in good economic outcomes (Rodrik, 2000). Though several influential theoretical works have proposed the irreversibility of institutional change as a necessary condition for successful intervention (Acemoglu, 2012; Greif, 2006; North, 1990; Roland, 2004), the conjecture has proven difficult to test empirically due to simultaneity problems and confounding variables: the substance and longevity of policy are generally inextricably tied. In this paper, I exploit a unique economic recovery in late 15th-century Rome, a setting in which it is possible to disentangle the effects of institutional change and the irreversibility thereof. The papacy returned to Rome in 1378, following a seven-decade-long absence from the city, but the conceivably-temporary relocation only became permanent a century later, in 1480, due to a reform of inheritance laws. I use a novel dataset linking palace-construction and patron identities over the course of more than 200 years to show that the initial return of the pope was insufficient to revive a stagnant economy, while the guarantee that the papacy would never leave the city again provides an answer to a heretofore unexplained historical puzzle: the origin of palace-building in renaissance Rome.

Early-modern Rome was, in many ways, a company town. The papacy was the main employer, the philanthropist, the conspirator behind alliance and intrigue, the subject of gossip and gambling. It was, in short, the economic and cultural lifeline of the city. And so, the papacy's withdrawal to the south of France (1309-1377) brought Roman life to a halt. Contemporaries likened the derelict city to a "great stable for sheep" and a "cadaver."[1] Artists depicted Rome clad in a widow's shroud, mourning long-gone days of illustrious prosperity. It is hard to imagine that this withered, weathered, worn out thing had once been a "city of marble,"[2] the self-proclaimed capital of the world.[3] And it is harder to imagine still that its economy could recover: Rome was in ruins. Decades spent abroad cost the papacy its credibility with locals. Political tensions and frequent regime change made for an environment unconducive to fruitful policy intervention.



Allegory of Rome as a widow.
BNF (MS Ital. 81, folio 18)

Yet Rome did recover. In the following two centuries, a city suffering from decay – caused largely by institutional dereliction and impotence – became a

[1]Both epithets are due to humanist orator Aurelio Brandolini, as quoted in Blondin (2005).
[2]On his deathbed, Emperor Augustus said, "I found Rome a city of bricks and left it a city of marble."
[3]*Roma Caput Mundi* (Latin: "Rome capital [head] of the world"); an ancient expression, whose precise origin is not known (at least to this author), already in use by Ovid in the first century BC.

renaissance metropolis. Of all recorded *palazzi*[4] erected in Rome from antiquity to the 21st century, 35% were constructed between 1378 and 1599.[5] Palazzi remained a key contributor to the early-modern economy long after their construction: they were not only for dwelling, and often had shops at street-level, storage areas for commerce, apartments rented to shop-keepers and illustrious guests. Hospitality and display were also quasi-economic activities that paid dividends via prestige, power, and reputation. The cause of the rise of palaces from the ruins of a medieval city has, however, remained a historical and economic mystery.

Figure 1 summarizes the puzzle and setting: it presents the annual number of new investment projects in palaces in Rome over the course of more than 200 years. It is clear that, though the pope's return to Rome in 1378 did correspond to a modest increase in investment, it alone cannot explain most of the recovery. A century would pass between the return of the papacy and the dawn of the era of palace-building; mere institutional presence was not enough to revive the economy.

This is the first paper in economics both to raise the question of the origin of Roman palace-building, and to provide causal evidence in favour of an explanation. Particular attention is devoted to developing a mechanism which explains how the pope's return to Rome became irreversible post-1480 and to testing whether this guarantee of permanence encouraged palace-building.

More concretely, I construct a novel dataset, obtained from a seminal map of Rome and supplemented with a manual data classification effort, in which I identify patrons of palace-building projects 1300-1599. I measure changes in investment patterns and establish that a 1480 reform of inheritance laws for the political elite had a real, causal effect on incentivizing beneficiaries' palace-construction.[6] I then argue that this transformed the papacy's relocation to Rome from a potentially-temporary institutional change to an irreversible one. Finally, I show that the eventual increase in palace-building for patrons who did not directly benefit from the reform was driven specifically by this long-term guarantee, and not by the mere return of the pope, contemporaneous papal presence, or by a wealth spillover.

The significance of the 1480 papal bull ("etsi de cunctarum civitatum"[7]) vis-à-vis palace-building has been echoed in the conjectures of several historians' works but has never been

[4]Edifices usually serving as residences. To abstract from patterns driven by nomenclature, I broaden the category to include all plausibly-inheritable real estate according to historians' records; see section 5.

[5]And 40% of all recorded palaces saw some construction activity during the time-period. Of these, conditional on the availability of data on the present condition, 84% are today extant, and an additional 8% are partially extant. The unconditional rates (i.e., including also landmarks for which present condition is not reported) are 82% and 8%.

[6]This includes constructions, renovations, acquisitions, etc. This allows for a more granular examination of the evolution of trends in the intensive margin vis-à-vis investors' project choice.

[7]A papal bull is a charter issued by the Pope. The term derives from the seal (*bulla*) used to attest to the legitimacy and authenticity of the document. Such bulls were a common way for popes to issue public decrees, and ranged in content from executive legislation to theological commentary. They are traditionally referred to by the first few words of the Latin text.

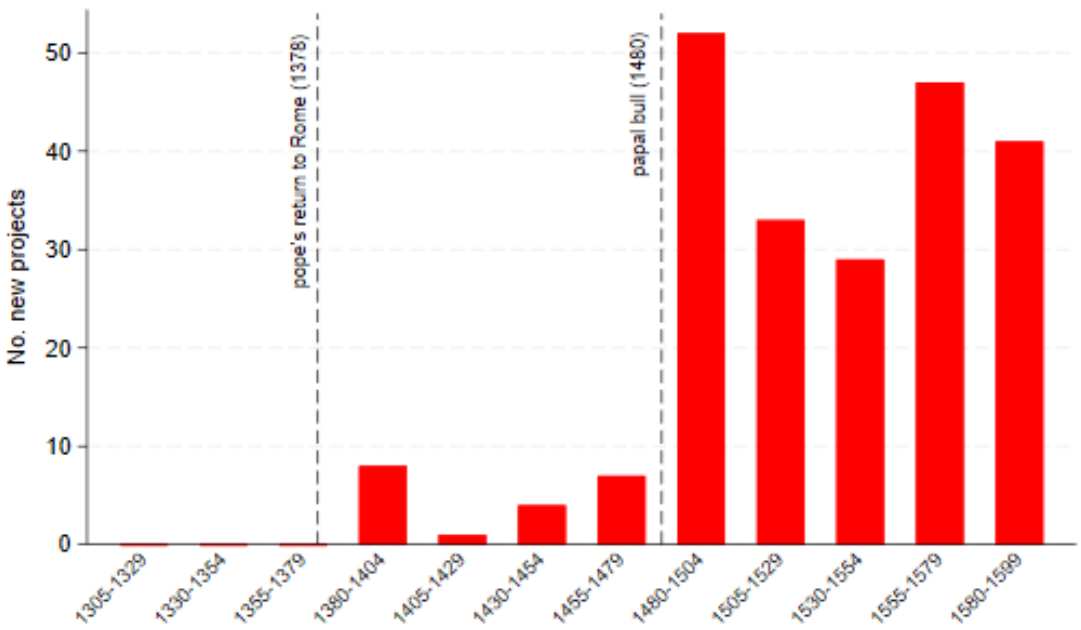


FIGURE 1. Number of new palace-building projects

This figure presents the total number of new projects in palace-building by 25-year intervals, from just before the start of the Avignon Papacy (1309-1377) until the end of the sixteenth century. Indicated by vertical lines are the return of the pope to Rome (1378), and the hypothesized cause of the change in investment patterns: the 1480 papal bull, which constituted a dramatic reform of inheritance laws.

formally articulated or tested.[8] The bull itself was introduced by Pope Sixtus IV (r. 1471-84) and allowed high-ranking ecclesiastical officials (prelates) to bequeath their possessions, from which they had been precluded by virtue of not being allowed to conceive a legitimate heir. This effectively dropped the tax rate on inheritance from 100% to 0% for prelates. Laymen continued to face no constraints on inheritance (i.e., an effective tax-rate of 0%). The reform thus gave a considerable financial incentive to prelates to invest in real estate, and did not directly affect laymen.

Prelates, as the direct beneficiaries of the de facto tax cut, were the first to engage in palace-building. By comparing their investment decisions to those of their lay counterparts in a difference-in-difference set-up, I estimate a 350% increase in per-capita new investment projects among prelates relative to their pre-reform mean attributable to the papal bull. More tangibly, this corresponds to an additional 5.6 new palace projects per decade among prelates.[9]

[8]I first discovered mention of this papal bull in Bartlett (2013) and am grateful to the author for introducing me to this reform and to the subject of Rome's revival.

[9]Or, equivalently, a 4.1 p.p. higher probability of a new project at an average site every decade among prelates post-1480. The analysis relies on data from 1378-1526, starting at the return of the pope to Rome from Avignon, and ending at the Sack of Rome by foreign soldiers, which represents a natural cut-off.

This suggests that the papal bull galvanized investment in real estate. But the de facto tax-cut alone is arguably insufficient to explain the rise of palace-building, especially among laymen not directly affected by the reform: in a precarious political and economic environment, having no meaningful guarantee that the papacy would remain in Rome long-term, patrons were hesitant to invest in local real estate. Indeed, in a theoretical work, Titman (1985) establishes uncertainty[10] as a cause of urban underdevelopment, and shows that government interventions aimed at encouraging real estate development can have limited or even adverse effects if they do not address the uncertainty that forestalled the development in the first place.

In early-modern Rome, too, financial incentives alone – important though they were in a stagnant economy – likely could not assuage the fears of patrons unsure of whether the city had a future worthy of investment. Frequent regime change and political turbulence meant policy could not be expected to be long-lived. This, of course, is a problem not unique to Rome, but common to many contexts in which a lack of credibility renders policy intervention aimed at economic revival ineffective.[11]

I argue that the 1480 reform had such a dramatic effect on Rome's recovery precisely because its longevity was credible. A crucial institutional detail rendered the 1480 papal bull self-sustaining: cardinals elect popes and popes appoint cardinals. Prelates heavily invested in Rome would never elect a pope who would leave the city or who would annul this papal bull, devaluing their own investments.[12] A pope who wanted to stay in Rome would not promote to a cardinalate a bishop averse to his agenda. Future generations would – in recursive fashion – be bound by the same incentive constraints.

By contrast, none of the previous historical shocks or policy interventions had a self-perpetuating mechanism, and so lacked the credible longevity responsible for the success of the papal bull.[13] Real estate investment, meanwhile, due to its illiquidity and construction duration, is a potent litmus test of public confidence in the city's long-term prospects. The Roman setting thus presents a unique laboratory for testing how investment appetites respond to institutional credibility, not necessarily feasible with more modern data due to insufficiently long time-horizons and a preponderance of confounding variables.

[10]The uncertainty in Titman (1985) pertains primarily to the future value and use of the land, which is perfectly commensurate with Rome's reliance on the papacy.

[11]The emphasis on credibility and reputation as determinants of effective policy intervention can be traced back, at least, to Fellner (1976, 1979), Kydland and Prescott (1977) and Barro and Gordon (1983a,b) in the context of monetary policy, and has since proliferated to a wide variety of literatures, including those on development and urban revival.

[12]In fact, post-1379, only cardinals have been elected popes, though, in principle, any Catholic man is eligible for the role.

[13]The mechanism I describe here is, therefore, fundamentally different from temporary financial relief or a single pope signalling his good intentions via an ambitious building agenda. Optimism about a single pope or statesman gives little reason to have faith in his successors.

I confirm that the papal bull had a real effect on long-term papal presence in Rome. Post-1480, papal absences decreased by 81.5%, and discretionary papal absences (which were plausibly interpretable as signals of the pope's unwillingess to be in Rome) disappeared altogether. This supports the interpretation that pre-1480, the papacy's presence in Rome was plausibly temporary and easily-reversible, and became truly permanent only after 1480.

To show that contemporaneous presence of the pope alone was not enough to drive the economic recovery, I consider the effects of papal presence on investment and include a control for the irreversibility of papal presence (as measured by an interaction term for the introduction of the papal bull). Contemporaneous papal presence has no significance before or after 1480. It follows that, pre-papal-bull, the pope's presence was not a meaningful predictor of future presence, and post-papal-bull, any papal absences were understood to be temporary.

I then show that, after 1480, laymen learned about papal commitment by observing past prelate investment, and increased their investment commensurately.[14] In the first 50 years following the implementation of the papal bull, 10 new prelate projects in one decade translate into 2.1 additional new lay projects in the subsequent decade. After this pivotal half-century, during which about 80% of cardinals started an investment project, the commitment mechanism was meaningfully in place, and lay beliefs were fully updated to reflect the guarantee of papal presence. Past prelate investment stopped having an effect on future lay investment thereafter.

I find no new post-reform relationships between lagged and future investment for other combinations of patron groups. That the effect is so limited in scope and time suggests that lagged prelate investment conveys information not found in other patrons' investment choices. This is strongly suggestive of a developing belief in the permanence of the papacy's presence in Rome and is inconsistent with generic spillover channels.

Due to patrons' increased confidence in the city's long-term future, project ambition – as measured via novelty – also increased post-reform among both patron groups. In the first 25 years after the papal bull, the number of novel projects increased eight-fold, while projects aimed at the refurbishment of existing palaces only tripled. The increased ambition was most pronounced among lay patrons, who benefited only from the guarantee of long-term papal presence in Rome.

The paper proceeds with a survey of the relevant literature (section 2) and of the historical setting (section 3). The conceptual framework and corresponding hypotheses are outlined in section 4. Section 5 introduces the data. Section 6 presents the empirical assessment of the policy's effects and the evidence in favour of the proposed mechanism. Section 7 concludes with a discussion of the results.

[14]This suggests that all estimates of the direct effect of the papal bull obtained via a dynamic comparison of prelates and laymen ought to be taken as a lower bound on the true effect.

2. Literature Review

The relationship of institutions to economic growth has received abundant attention from economists; particularly influential works include Acemoglu et al. (2005), Acemoglu and Robinson (2008), Greif (2006) and North (1990).[15] A number of papers, including Nunn (2008) and Dell (2010), show empirically that a deterioration of institutional quality – caused, in particular, by short-termist or extractive attitudes[16] – has long-lasting harmful effects on economic development.

Successful institutional interventions have also been documented, though causal identification of mechanisms remains more elusive. North and Weingast (1989) demonstrate the role of constitutional changes following the Glorious Revolution, while Stasavage (2002) shows how political representation enhanced sovereign credibility in early-modern Europe. State capacity and (fiscal) credibility are explored by Drelichman and Voth (2014) in Spanish sovereign debt markets; by Cantoni et al. (2024) through administrative innovations in the Holy Roman Empire; and by Besley and Persson (2009) through an analysis of state investments in fiscal and legal capacity. In a theoretical work, Acemoglu and Robinson (2006) highlight the contribution of democratic institutions, characterized by their credibility and by aligned incentives among the elites and the governed.[17]

Thus, while a causal link between specific kinds of destructive institutional behaviour and negative economic outcomes is well-established, it remains difficult to empirically identify a mechanism explaining the success of certain institutions and the failure of others to stimulate economic growth. The challenge arguably owes, at least in part, to the asymmetry of institutional credibility: trust is easier lost than (re-)gained,[18] and institutional practices which could positively contribute to credibility frequently co-occur, so necessary conditions are difficult to identify.

I derive one particular conjecture from a few seminal works on the subject (Acemoglu, 2012; Greif, 2006; North, 1990; Roland, 2004): that the irreversibility of institutional change is a necessary condition for successful intervention. I exploit the papal return to Rome to test one conjecture in particular. In the theoretical literature (Aoki, 2001, 2011; Greif,

[15]For a broader survey of sources of economic development, see Mokyr (1990), which describes the scholarly consensus that growth has historically been attributable to one of four factors: gains from trade and specialization, technological change, capital accumulation, and efficiency growth (the latter primarily due to attenuated misallocation of resources). The explanation posited in this paper fits well with the notion of efficiency growth: the prohibition on clerical bequests and the lack of long-term institutional commitment on the part of the papacy stifled opportunities for investment and hence growth.

[16]Slave trades and exploitative mining practices, respectively.

[17]Commitment and institutions are also discussed, in the context of policy-implementation, in a theoretical work by Bassetto et al. (2024).

[18]See, e.g., Nunn and Wantchekon (2011), which shows that effects of deteriorated trust in individuals and institutions persist for centuries.

2006; Schotter, 1981), institutions are often thought of as equilibria and analyzed in game-theoretic fashion; "irreversibility" is, therefore, naturally understood as precluding profitable deviation.

The present study benefits from a unique historical setting to overcome the simultaneity issue and isolate the effect of the irreversibility of the pope's return: a century elapsed between the return of the papacy and the reform of inheritance laws[19] that arguably rendered impossible another papal departure.[20] Consistent with the game-theoretic notion of forward induction,[21] perceived irreversibility obtains from a recursive incentive constraint on prelates charged with electing future popes: prelate palace construction is irrational unless prelates also intend to exercise their voting powers to ensure that the pope remains in Rome; otherwise, their real-estate holdings will lose all value.

This paper also contributes to the literature on the papacy and its effect on European economic development. No institution has been more influential in medieval and early-modern European political, economic and social affairs than was the Catholic Church.[22] In existing scholarship, the importance of the papacy has been inferred from the consequences of its absence in cities affected by the Reformation. The institutional vacuum left by the withdrawal of the papacy from Protestant German cities was typically filled by local secular actors: Cantoni et al. (2018) characterize the implications of the Reformation on German universities and human capital; Dittmar and Meisenzahl (2020) also find the development of secular infrastructure in post-Reformation Germany. The return of the papacy to Rome offers an exceptional opportunity to consider the effect of the papacy on economic development directly.

[19]Research on inheritance typically considers effects on inequality by examining the role of marginal changes to inheritance taxes. (See Piketty and Zucman (2015) for a survey.) This paper makes no comment on marginal effects, due to the non-marginal nature of the reform, but suggests that bequests are a necessary condition for real-estate investment. Of course, the peculiarity of the setting is such that I make no claim of external validity for a modern context beyond the intuition that inheritance and long-term beliefs are a motivation for investments at long time-horizons. (See Botticini and Siow (2003) and Botticini (1999) for a discussion of strategic considerations related to property transfer. The authors propose dowries, in Renaissance Italy among other settings, as an optimal form of premortem bequests in view of the heterogeneity in incentives among sons and daughters.)

[20]That the reform had a more limited scope (only prelates' inheritance constraints were affected) than set of beneficiaries (lay and prelate patrons responded favourably) – in combination with analysis ruling out spillovers – furthermore lends credibility to the view that effects are attributable to long-term commitment to institutional presence, not to the de facto tax cut per se.

[21]Forward induction suggests that future behaviour will be informed by past actions, which are assumed to be rational. It is the natural counterpart to backwards induction, which defines present rationality by considering future optimal play. Most pertinent to this setting is Battigalli and Siniscalchi (2002), which models how players revise beliefs in the face of unexpected actions by others, such as surprising institutional changes; other foundational works in the forward induction literature include Cho and Kreps (1987), Govindan and Wilson (2009), Kohlberg and Mertens (1986), Man (2012) and Vida and Honryo (2021).

[22]Such was the importance of the Church in the early-modern European economy that Buringh et al. (2020) proposed Church constructions in the so-called Age of Cathedrals as a proxy for overall construction and economic development.

3. The 1480 Papal Bull & its Historical Context

In this section, I discuss the context surrounding the legislation – notably, why there was room for doubt regarding the papacy's intentions to stay in Rome and how this weighed on the city – and the details of the papal bull itself. Appendix I presents a more comprehensive survey of Roman early-modern history.

3.1. **Why past attempts at rebuilding Rome failed.** How could it be that a single papal bull was so influential when other efforts of policy-makers proved futile and important historical events had little effect? The answer lies in the degree to which the Roman economy was reliant on the papacy.

Most of the citizenry was in the service of the papacy and its two main (and related) governance agendas: of the institutional church and of the pope's secular state. Even those who were not employed by the Church directly often provided auxiliary services to those who were. In the papacy's absence, economic activity stagnated. The population declined. The city fell prey to crime and violence, tacitly supported – if not outright sponsored – by powerful families vying for power, and legitimized, partly, by a vendetta culture widespread in early-modern Italy.[23] There is a widespread argument that Rome was a non-industrial city, providing services and high-end consumption goods, and otherwise relying on pilgrims and cultural tourists; the pervasive lack of infrastructure and economic activity grew ever more prohibitive: the more pronounced Rome's shortcomings became, the less the city attracted the scholars, builders, architects, merchants, artists and humanists capable of bringing it into a new age (see, e.g., p.120-1 of Bartlett, 2013; Esch, 2021).

The Avignon Papacy[24] made it clear that Romans could not afford to lose the pope, and that they could not trust him either. When Gregory XI passed away in March of 1378 some two months after returning the papacy to Rome – having defied the French king and the largely-French College of Cardinals – Romans took to the streets.

"We want a Roman pope, or at least an Italian," the mob threatened, "or else you will die!" A heckler added the vivid description: "If you cardinals don't give us one, we will make your heads as red as your hats" (Baumgartner, 2003). The cardinals gave in and elected an Italian pope, hoping to coerce him into resigning shortly thereafter. But resign Urban VI did not. He had a violent and unpredictable temper, and, by October of the same year, the cardinals elected another pope who, after an unsuccessful attempt to depose Urban VI, retreated to Avignon with his coterie. The Western Schism had begun.

[23]See, for instance, Cohen (forthcoming). Hunt (2016) surveys violence and society in Rome during interregna in the 16th-17th centuries. Carroll (2023) and Rose (2019) discuss violence in early-modern Europe and in early-modern Italy, respectively.

[24]The Avignon Papacy was christened, by poet Francesco Petrarca (1304-1374), the "Babylon Captivity," drawing an evocative comparison between the papacy's sojourn in France and the forced relocation of Judeans to Babylonia after the siege of Jerusalem in 597 BC (and again after the destruction of Jerusalem and Solomon's Temple in 587 BC).

During the Schism (1378-1417), there were multiple simultaneous popes in Rome, Avignon, and later Pisa, each of whom claimed to be the true pope and excommunicated the others. It was impossible to know who the true pontiff was, or where the papacy would come to reside.[25] Consolidating internal political authority was itself a challenge as local families were, at first, reluctant to cede control; tensions were eventually quelled following the reinstatement of the ancient practice of house-destruction as severe legal punishment by Pope Paul II (r.1464-1471) and probably last-exercised early in the tenure of Sixtus IV (Raedt, 2022). Rome was trapped in a vicious cycle of economic decay and political instability.

Decades of political manipulation for personal gain and a sequence of unpopular popes further eroded trust in the papacy long after the end of the Schism. Popes' attempts to revitalize the city were perceived – rightly or wrongly – as halfhearted, or as self-serving and outright exploitative. Fear that the pope could still take off at any moment and move back to Avignon or elsewhere, plunging Rome back into one of her darkest chapters, manifested in an unwillingness to make any meaningful long-term investment in the city. Romans' skepticism was justified: some popes did have extended sojourns outside Rome,[26] and most popes who stayed still made a clear priority of pursuing projects for their own aggrandizement or sought to find ways to help their families.[27] Frommel (1986) identifies this egoism, particular in its degree to Rome,[28] as a major contributor to Rome's infrastructure's falling considerably behind that of cities like Florence, Siena, and Venice. The prevalent ethos was one of opportunistic short-termism.[29]

Even on the rare occasions where they were evidently infrastructural and not aimed at the immortalization of the pontiff's name, papal commissions were too sparse to inspire confidence. Nor could they meaningfully reshape the city itself. Spending programs designed to attract wealthy immigration were likewise ineffective.

[25]In fact, despite the ensuing turmoil and various attempts to return the papacy to France, Gregory XI was the last French pope to date, excluding the antipopes of the Schism.

[26]Out of his 16-year-long papacy (1431-1447), Eugenio IV spent over nine years away from Rome. See also Table 3 for more on papal absences from Rome.

[27]It is worth noting that a majority of popes prior to the early 16th century had come from unassuming backgrounds. Promotion to the papal mandate quite late in life allowed only for a few years to pursue an agenda. Unsurprisingly, the priority for men of humble origins was their own legacy and the immortalization of their name, not the amelioration of the city.

[28]Frommel (1986) also points out that such a pronounced obsession with glory-seeking projects on the part of rulers could not have been sustained in republics nor in principalities with dynastic rule, and, therefore, constituted a problem whose severity was unique to Rome. This further highlights the optimality of the Roman setting for the investigation of stakeholder behaviour in the context of commitment problems.

[29]With the exception of Sixtus IV, Nicholas V (r.1447-1455) was the 15th-century pope most recognized for his dedication to public infrastructure. On his deathbed, Nicholas said his effort to modernize the city, notably the Capitol and the Vatican palace, was "not for ambition, nor pomp, nor vainglory, nor fame, nor the eternal perpetuation of my name, but for the greater authority of the Roman church and the greater dignity of the Apostolic See"(Westfall, 1974, pp.33, 94-101, 129-165, quoted in Frommel (1986)). But Frommel (1986) is quick to point out that Nicholas V, like his predecessors, only embarked on a public campaign after having been in power for many years – having, first, satisfied his own private ambitions.

Lured to the city by promises of absolution, pilgrims would flock to Rome at most every quarter-century for Papal Jubilees. Large sums of money spent on the city's temporary beautification were never recovered: pilgrims left just as they had come; rent prices fell back to pre-Jubilee levels within months (Curcio (1986)). Papal attempts to suggest investment in other cities were likewise in vain: Mack (1987) finds that Pius II (r. 1458-64) wished to turn Corsignano into a papal city, renamed Pienza in his own honour, and tried to encourage palace-construction in the would-be summer residence town. Very few patrons followed suit, and the pope's death put a swift end to that investment campaign.

3.2. **The Papal Bull Hypothesis.** Sixtus IV, unlike his predecessors, displayed a deep care for the development of Rome from his first days as pope. He took up the improvement of the city's infrastructure: roads, bridges, hospitals, churches (Blondin, 2005; Ackerman, 1982; Madonna and Cerioni, 1983; Buddensieg, 1983).

Sixtus IV intentionally broadcast his ambition vis-à-vis urban revival. In the 1480 papal bull itself, the pope articulated his vision that Rome merited and required restoration because of its exceptional position as "the city consecrated to our lord Jesus Christ by the glorious blood of the martyred apostles Peter and Paul [...] and because the most high established in it the principate of his bishop and the capital of the Christian religion, and because he chose in it the seat of his vicar, to which the faithful gather in large numbers from all parts of the world" (papal bull translated in (Fernandez, 2003, p.233); see (Richardson, 2009, p.301-302) discussing (Müntz, 1878, p.179-180)). The public was aware of and responded favourably to these changes: Torch (2024) finds that correspondence between two prominent humanist contemporaries, Bussi and Gaza, exalted Sixtus IV's patronage and governance as the virtues of a prince "we often wished for." In other words, it was clear to Romans that this pope actively sought to revitalize the city.

And find a way he did. Sixtus IV's 1480 ingenious papal bull exploited self-interest, graft, and preferment[30] within the Church to fuel the rebuilding of the city. Prior to 1480, prelates took advantage of papal coffers, but were unable to produce a legitimate heir due to clerical vows of celibacy. The obligation to bequeath all of their possessions to the Church was meant to temper their appetites. Rather than encourage austerity, however, this constraint inadvertently promoted the most frivolous forms of conspicuous consumption. As they could leave nothing to family, prelates spent papal wealth on feasts, hunts, and entertainment, and made few meaningful investments in the Roman economy (Bartlett, 2013).

[30]A big element of papal power was the right to nominate, and to transfer, from one to another office outside of Rome. So preferment was a common way to accumulate wealth: a cardinal could simultaneously be the bishop of Ravenna, the abbot of some wealthy monastery. He could then install a vicar to do the work on-site and cull the income. Graft, too, was wide-spread: prelates made a habit of hiring nephews and otherwise of using the offices of the Church to their advantage. Hallman (1985) traces the businesses of churchmen from 1494 to 1563, including the sale of offices, an essential part of clerical income, and various cases of financial abuse. See Ago (1990) for a discussion of prelates as a source of wealth for their families, albeit in a later time-period (during the Baroque era).

The 1480 papal bull reformed inheritance laws to allow prelates to appoint a beneficiary, without renouncing their vows of chastity. This effectively reduced their "inheritance tax rate" from 100% to the 0% rate faced by their lay counterparts.[31] Suddenly, prelates had a financial reason to invest in the city.

What remains to be explained, then, is how the papal bull assuaged concerns over the possibility of a reprise of an Avignon Papacy to the point of making investment desirable, even among those who did not benefit directly from the tax cut. Indeed, the papal bull solved this problem, too – again by exploiting the institutional structure of the Church.

Popes are elected by the College of Cardinals, and, from 1379, have come only from the College itself. Thus, for there to be a pope who decides to leave Rome (or otherwise act against the best interests of the city), the sentiment would, in principle, have to be tolerated by a majority of electors.[32] Cardinals with significant investment in the city's real estate would clearly be reluctant to move and would not lend their support to a pope who did so, and few candidate-popes could even conceivably have different incentives, given that popes were chosen from among cardinals. A pope elected on the promise to remain would not, in turn, appoint cardinals opposed to his agenda. The reform thus gave rise to a "commitment channel": the more invested in the city cardinals became, the less likely was the papacy's departure.

Prelate palace-building assuaged laymen's concerns. They now had a reason to believe that the Vatican was committed to remaining in Rome long-term and hence had the incentive to invest in the city's real estate, too.

4. A Conceptual Framework

The present sketch posits a mechanism to explain the rise of palace-building in the late 15th-early 16th centuries (cf Figure 1).[33] It is well-established that demand for palazzi was high and ubiquitous across Italy throughout the renaissance[34] – but this, especially as there were no known changes in preferences in this regard, is insufficient to account for

[31]There was no mandatory tax on inheritance at the time. Custom, however, obliged bequests to include some donations, especially to charitable or religious organisations (e.g., confraternities). See, e.g., Cohen (2025) for a microhistorical account of a specific instance of the practice in Rome, and Jr. (2012) for a broader discussion of the economic and cultural significance of inheritance and associated behavioural patterns in Renaissance Italy.

[32]Are surprises possible? Certainly. But cardinals have every reason to vet nominated colleagues carefully to prevent this, and have a corrective mechanism (i.e., the next election) at their disposal.

[33]The increase in palace-building c.1380-1400, tepid and underwhelming, was likely the result of the papacy's return to Rome. (The degree to which mere papal presence in Rome, without any commitment to remain long-term, affected investment is discussed in s.6.2). By the end of the 16th century, palace construction slowed, the complicated interaction of many factors – including the Reformation and the adoption of primogeniture (– which are mentioned in s.3 but otherwise beyond the scope of this conceptual framework). And in-between, a remarkable century of prolific palace-building...

[34]See, e.g., Goldthwaite (1993), Goldthwaite (1982).

the sudden observed rise in investment.[35] A compelling mechanism must explain (1) why investment overall was stagnant pre-1480 but flourished post-1480, and (2) both why there was a response among laity and prelates, and why it was different across the two groups. This conceptual framework is summarized in Figure 2 and the testable hypotheses the mechanism generates are as follows.

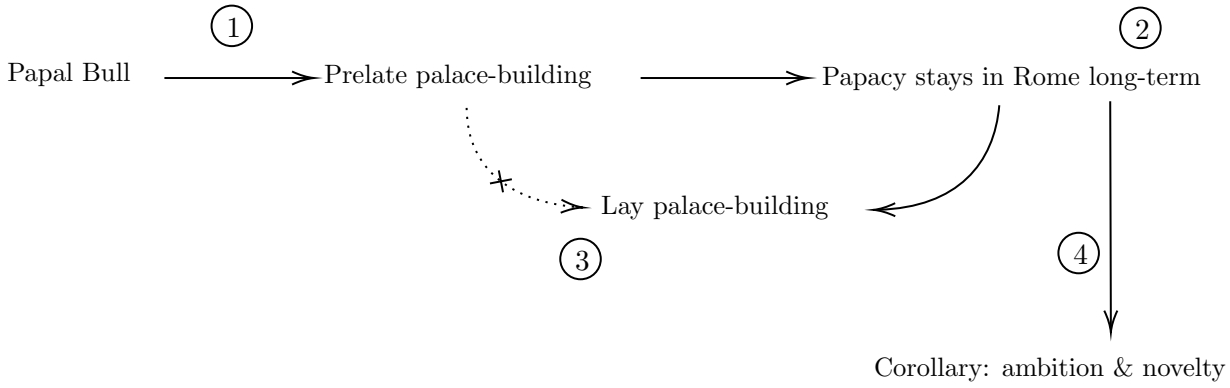


FIGURE 2. The Papal Bull and its effects

Labels correspond to Hypotheses 1-4 and corroborating evidence is presented in s.6.1-6.4. In short: (1) The papal bull should have a (treatment) effect on incentivizing prelate palace-building. (2) There should be a real effect on papal absences from Rome, and patrons should respond to the guarantee of long-term absence. (3) Lay palace-building should be explained by "learning" of the guarantee of papal presence. (4) The irreversibility of papal presence in Rome should result in increased project ambition, as captured by novelty.

In order that the proposed mechanism have any explicatory power, it is important that the papal bull have a real effect:[36]

Hypothesis 1. *Post-1480, investment per-capita must increase more, in relative terms, among prelates than among laymen.*

It is more challenging to explain why the papal bull would have an effect at all, given the pervasive lack of construction pre-1480. It was quite obvious to all patrons that, should the papacy remain and flourish, the city, too, would prosper. But equally obvious was the risk that another departure would prove as devastating as it had been in the early fourteenth century. The memory of the Avignon papacy and, above all, the unallayed fear of its reprisal, were enough to stifle all appetite for investment.

[35]Indeed, conditional on a general willingness to build, patrons must actively find Rome in particular a desirable location for their investment. Even if no other city were suitable, the outside option of not investing in local real estate remains.

[36]Estimating the true real effect, insofar as I claim that the laymen – who are the natural comparison group – will eventually benefit from the reform via the generated commitment, is complicated. The results I obtain represent lower bounds on the true effects, as the response among the laity can only bias downwards the estimation. Comparisons to investors outside Rome would be even more problematic, due to substantial differences in settings and institutions.

The reform encouraged prelates to build in Rome, and to make the city their permanent home and that of their families. Once cardinals were invested in the city, the financial future of the ecclesiastical ruling class and the economic well-being of Rome became inextricably linked. By forward induction, cardinals with real-estate holdings in the city would never vote for a pope who would leave Rome, nor would they allow this legislation to be repealed.[37] The commitment was uniquely robust to papal turnover.[38] This was a rare quality for papal policy to boast: executive legislation enacted by one pope could, in principle, be repealed by his successors with relative ease.[39] Indeed, the papacy never left again.[40]

In short, since cardinals are charged with electing future popes, and are themselves appointed by popes, their investment in the city became a long-term guarantee that the papacy would remain in Rome. The promise of long-term presence in Rome was sufficient to inspire confidence in the future and to foster a belief in the profitability of real-estate investment. Laity, despite not benefiting directly from the papal bull, began to invest in the city as well.

For completeness, one should also note that Sixtus IV, via his early policy and the bull in question (as well as the investment decisions of his beloved nephew), had sent an unambiguous signal that he himself had no desire to leave Rome. Thus, the self-perpetuating mechanism of prelate investment and long-term papal presence could be launched.[41]

To test this, I must, therefore, confirm the salience of papal presence to investment decisions, and show that the papal bull changed investors' views on the permanence of the papacy's sojourn in Rome. If the commitment really is meaningful, these updated beliefs should furthermore be accurate; that is, political incentives post-1480 must in fact constrain the papacy to remain in Rome in a more meaningful way than before.[42]

[37]While popes' powers are not constrained by formal mechanisms as in modern democratic states and though suffrage was not universal in early-modern Rome, that the pope was elected aligned incentives between the prelate elites and the laity in a way similar to that discussed in Acemoglu and Robinson (2006) for democratic institutions.

[38]Roland (2004) and North (1990) are theoretical works which bear on on institutional persistence and on the ways in which informal constraints reinforce formal rules, repsecitvely.

[39]Popes were, in many ways, elected princes and were not officially bound by precedent, by early-career (pre-pontificate) stances, or even by preferences of their closest advisors. Clement V, for instance, revoked support of the Templars, leading to the dissolution of the order c. 1312 (Barber, 2006). Likewise noteworthy was Pius II's rebuke of conciliar theory c.1460, despite conciliar movements being a common practice in which he had personally been involved and which facilitated his own ascent to the papal throne (Izbicki (2006), Oakley (2003)).

[40]And the one (unsuccessful) attempt to put an end to this policy lasted for a few short years in the late 17th century; the pope who launched the venture and launched a war on nepotism (which temporarily collapsed palace-building) to this day boasts a reputation as one of the least popular in the entire history of the papacy (Krautheimer, 1985).

[41]See Greif (2006) and North (1990) for a theoretical analysis of how institutions create self-reinforcing incentive structures.

[42]In other words, it would not be enough to produce evidence that patrons' beliefs changed but were misguided, as the core of the mechanism pertains to the real incentives of the prelate governing class.

Hypothesis 2.

(1) Papal absences from Rome should have no effect on investment once a control for the implementation of the papal bull (i.e., a post-1480 interaction term) is included.

(2) The number of papal absences should decrease post-1480, relative to the pre-1480 trend.

Hypothesis 2.1 is much stronger than just arguing that papal absences post-1480 should have no effect on investment.[43] I claim also that papal absences should not have a significant effect on investment pre-1480, too – not because papal presence was not important for Rome per se, but because contemporaneous presence, in the absence of institutional commitment, was not an indicator of the economically-salient variable: the continued presence of popes in Rome centuries to come. If long-term papal commitment is critical enough, a post-1480 dummy alone should absorb any effect of papal absence or presence.

As per the flowchart in Figure 2, it will be particularly important to establish the effects in Hypothesis 2 for laymen, in order to suggest that papal commitment drives the changes.

It is furthermore crucial to show that the laity responds to the prelate reaction to the bull (not to the papal bull itself) due to the induced papal commitment, and also that prelate investment in general does not matter (to exclude a general spillover channel). This suggests the following hypothesis:

Hypothesis 3. *Lay investment should respond favourably to past prelate investment for a brief period post-1480, but should otherwise not be affected by past prelate or lay investment.*

The anticipated short time horizon of the effect is quite important: it distinguishes between the aforementioned commitment channel and some kind of spillover channel.[44] In particular, as the mechanism takes effect and it becomes clear that the College of Cardinals is indeed bound to the city, prelate investment should stop being a sign of increased commitment of the papacy and should fail to predict lay investment long-term.

An effect unrestricted by time-horizon or patron-class would be more consistent with a spillover channel. A short-term effect with such restrictions, conversely, is strongly indicative of the proposed commitment mechanism. (Given the small population of prelates of whom there are about 40 in any year in the late 15th century, on average, and who represent, at most, a quarter of the plausible patron class (cf Figure 9), it is also unlikely for there to be a significant spillover from prelate construction, and no spillover from comparable lay palace-building.)

[43]This could, for instance, be a consequence in a belief that absences post-1480 are sure to be transitory, due to the papacy's commitment to remain in Rome, whereas there was no guarantee absences pre-1480 would not become permanent.

[44]One could have in mind an alternative hypothesis about past construction driving down costs for new patrons – e.g., due to complementarities, or because the required labour force would then already be present in the local market – and thus that early reform-induced prelate investment would make future investment for all patrons more affordable.

The increased confidence should also manifest at the intrinsic margin with the nature of projects pursued: more ambitious projects should become (relatively) more prominent.

Hypothesis 4. *Post-1480, there should be an increase – among both patron-types – of new construction, relative to projects aimed at refurbishment of existing sites.*

The proposed commitment mechanism explains the pre-1480 economic stagnation, despite a number of economic shocks. The return of the papacy to Rome c. 1378 had had a muted effect precisely because there was no reason to believe this to be a permanent return: the Schism began with the very next pope. Other positive shocks to the financial incentives had little effect on investment as they failed to inspire confidence in the future of the city. The overall potency of the 1480 papal bull, conversely, is due to the meaningful commitment it represented on the part of the papacy.

Importantly, this commitment channel is also quite distinct from a simple signal of Sixtus IV's personal intent to keep the papacy in Rome or to otherwise pursue policy favourable to the city's growth – given the relatively short tenure of any single pope, such a signal would not be very meaningful[45] – but an assurance that the costs for any future pope attempting to leave the city would be prohibitively high.[46]

Evidence in favour of the voting patterns posited in the commitment mechanism is present even in the very next papal conclave. Sixtus IV passed away in 1484, four years after introducing the papal bull, and Cardinal Giovanni Battista Cibò (Pope Innocent VIII) was elected his successor. His candidacy had been championed by a cardinal-nephew of Sixtus IV – Cibò was thus positioned as the natural heir to Sixtus IV's agenda – and opposed by the de facto pro-Neapolitan faction,[47] who had lobbied for a rival-candidate (Burkle-Young, 2022). The College of Cardinals was careful to elect popes with an eye to preserving Sixtus IV's legacy and to avoiding negative foreign influence.

[45]There were good popes who tried to revitalize the city before Sixtus IV, too. Were signaling to be enough, one would have to explain the strange differential effects. On the other hand, a lack of long-term commitment is plausibly the reason that the seven decades of the Avignon Papacy never gave rise to significant private palace-building in Avignon. Just as there was a fear of the papacy leaving Rome once more, there had been an understanding that the sojourn in Avignon might be a temporary affair.

[46]This is a story that may sound familiar to inhabitants of many old cities: elites take advantage of state coffers or local resources, but, in exchange, take a stake in the city's future (and begin to invest their wealth into local projects). See also (Acemoglu and Robinson, 2008) for a theoretical rationalization of the phenomenon.

[47]According to Burkle-Young (2022), one faction prioritized the advancement of papal power, and another supported a pan-Italian alliance, the Italian League. In practice, as there was a consensus among non-Venetian cardinals that Sixtus IV's adherence to the Peace of Bagnolo, to curb the influence of Venice, was to be preserved, cardinals' choice of faction reflected mostly their preference vis-à-vis the power and influence to be afforded to the Kingdom of Naples at the expense of the papacy.



FIGURE 3. Giambattista Nolli's "La pianta grande di Roma" (c. 1748)

5. DATA

I manually construct a comprehensive panel dataset at the project-patron level along with patron demographic weights. To do so, I combine data from Giambattista Nolli's map of Rome, digitized and populated with the city's architectural history, from Consistories of cardinals, and from lists of Rome's upper civic officials, compiled by archivists. I supplement this with a manual data-classification effort to identify all patrons (as prelate or lay) and the nature of the construction. Around 34% of entries required additional sources to complete the classification.[48] The map-based dataset spans Roman history, from classical antiquity to 2017; I perform my classification for the years 1300-1599 and retain data for 1378-1599 for empirical analysis.

5.1. **Instances of investment: the Nolli Map.** While some other early-modern Italian cities boast treasure troves of well-organized granular data, with detailed *catasti* and censuses, meticulously collected and even digitized, Rome does not.[49] Indeed, Rome has no

[48]I explain the rationale behind each classification, including the sourced by which it is informed, in the database.

[49]There is one Roman census from 1527 that has been published by Lee (1985), and no other good census, to the best of my knowledge. The annual parish census, *stato di anime*, is rich but fragmentary, never complete, not published, has no economic variables – and begins c.1590. More broadly, while Drelichman

database from which one could obtain data on construction or real-estate investment, no resource documenting who built what, when, why, and for how much. There are several complex reasons for this, including – but certainly not limited to – the idiosyncrasies associated to governance in the Papal See and the damage to archives caused during the Sack of Rome (1527).[50] The compilation of the first database of Roman construction projects with economically-relevant classifications is one of the contributions of this paper.

To gather data on investment in real estate, I rely heavily on Giambattista Nolli's seminal 1748 map of Rome, *La pianta grande di Roma* (known affectionately among historians, and hereafter referred to, as the Nolli Map; see Figure 3). The project took him a decade to complete, was the first to use surveyors' methods for all of Rome, and remains among the most accurate and detailed maps of the city ever created.[51] The original map is a masterpiece comprised of twelve engraved copper plates and measuring 1.76m by 2.08m; so extraordinary is the level of attention that even the interiors of some structures are accurately depicted.

In 2005, it was first digitized by a team of urban historians and architects under the leadership of Tice et al. (2021). The researchers populated the map with entries such that a detailed history of each landmark is available, including all important construction projects, restoration work, major acquisitions, and any other events relevant to the architectural history of the city. An example of an entry for a single landmark is presented in Figure 4.

I use these entries to collect data on the name (historical and modern), "type" (e.g., church, palazzo, street, fountain, etc.), prominent architects and patrons, and current condition of 1320 landmarks. I also collect descriptions of all events, and the corresponding start and end years of the project, associated to each landmark. My compilation yields over 5,000 project observations over the course of the city's history. Table 1 presents an overview.

5.2. **Classification.** I classify each project based on the type of event, making note of whether, in the course of that project, the landmark was built, destroyed, abandoned, repaired, restored, repurposed, and/or acquired. For the purposes of the empirical analysis, I retain only instances of investment, which I then partition into two broad categories: "built" and "rebuilt" projects. (The latter subsumes reparations, restorations, repurposed sites, and acquisition.)

To be able to elicit the causal effect of the bull, I must also identify the patron of a given project between prelate or layman.[52] Given a patron, I determine "prelate status" by

and González Agudo (2014) offer a uniquely comprehensive characterization of the housing and rental market in early-modern Toledo, datasets on early-modern real estate, particularly of the level of detail I obtain, are otherwise uncommon.

[50]The governance of Rome was complicated, split between the lay Capitol and the Church, often with competing interests, and the pope also had the *Stato della Chiesa* (State of the Church), distinct from the Holy See. Prodi (1988) describes the papacy evolution into a prototype of the modern sovereign state, particularly from the 15th to the 17th centuries.

[51]Modern satellite data suggests negligible margins of error Tice et al. (2021).

[52]The definition of the term "prelate" is somewhat elusive. The boundaries between religious and secular were blurred, and careers could cross lines. Some non-clerical offices in the Church could be bought by



FIGURE 4. A view of the digital Nolli map interface. Pictured is the entry on Palazzo Millini.

The digitized map is presently hosted on the servers of Stanford University where it can be freely accessed and explored: `https://nolli.stanford.edu/`

		All			Prelates		Laity	
Sample: Nolli Map	all records	1378-1599	1378-1479	1480-1599	1378-1479	1480-1599	1378-1479	1480-1599
Panel A: Roman construction								
No. map mentions	5026							
No. sites	1319							
No. active palace sites	323	161	30	151	12	45	18	106
Currently extant	247	134	24	127	10	38	14	89
Partially extant	23	13	4	10	0	4	4	6
Demolished	49	13	2	13	2	3	0	10
Panel B: Inheritable projects								
No. inheritable projects		222	20	202	10	70	10	132
No. palaces built (sites)		115	13	102	6	24	7	78
No. palaces reconstructed (sites)		111	9	102	5	48	4	54
Panel C: Inheritable project lengths (years)								
min length		1	1	1	1	1	1	1
max length		152	101	152	51	101	101	152
mean length		22.91	37.1	22.08	13.3	10.48	60.9	29.72
median length		1	29	1	3	1	51	1

TABLE 1. Summary Statistics: Project Characteristics

Sites are precise geographic identifiers (akin to a street address). A "palace" pools together all plausibly-inheritable real estate. Condition status (extant, partially extant, demolished) refers to the current condition of a site and is sometimes missing in the data. A "map mention" is any entry in the digitized map with an event (start-)date. Palaces are often built and later reconstructed, so entries in Panel B need not be additive. Precise definitions (e.g., of the distinction between "built" and "reconstructed" projects, of "inheritability," etc.) are presented in Table 6 and discussed further in s.5.2.

lay officials; some clergymen were not sufficiently close to the Pope to take advantage of his coffers. The definition I use relates directly to the 1480 papal bull and whether a patron can benefit from the legal change.

whether the individual was in the direct "treatment group" of the papal bull: the patron must have faced a binding inheritance constraint alleviated by the reform and have otherwise been plausibly wealthy enough to have the capacity to invest in palaces. If the patron is not a prelate, then he is a layman. Thus, it is not mere affiliation with the papacy but the precise nature of that association that determines a patron's status. In the cleaned dataset, there are 222 projects that were classified; for about 34% of projects, the patron status (or project nature, though this is rare) is not obvious from the project description. It is in these cases that I rely on external sources, for which there is no centralized database: I rely on a hand-collected set of history papers, biographies, encyclopedia entries, and other resources which allow for the idiosyncratic identification of a given patron; I retain records of all sources I employ.

The classification of prelate-vs-lay occurs not at the level of a landmark, but at the level of a project. A single landmark can have a number of projects sponsored by different patrons and different patron-types. It is not the de jure owner of a palazzo, but the recorded sponsor who determines the classification of a particular project. A project with multiple patrons is classified as a prelate project if at least one patron is a high-ranking prelate.[53] That is, I construct the "prelate patron" dummy variable to reflect whether the project is directly "treated" by the papal bull. In addition to more accurately identifying the set of treated projects, this helps mitigate concerns over family-level spillovers or complementarities – so that family projects potentially benefiting from the papal bull are also included (see also s. 7.3).

Finally, I note whether or not the project in question represents an inheritable investment – that is, whether it falls into the category of investment projects of interest – and retain only these.[54] I also drop instances of disinvestment (destruction or dereliction of a palace) and mentions of a palace being rented out to a tenant (of which there are only two in the sample), as well as projects I am unable to classify (of which there are nine in the sample; none of which have a start-date strictly within 1400-1500).[55] Thus, of a total of 290 projects

[53]For example, the Palazzo Cesi Armellini is listed as having been acquired by the Cesi family in 1565. In 1570 a major renovation is undertaken by Angelo Cesi, Pier Donato, and Paolo Emilio Cesi, all three of whom I verify to be cardinals. The 1570 project is classified as one with a prelate patron, independently of the identity of the contemporaneous owner of the palazzo.

[54]For a complete discussion of the merits of "inheritability" as the classification criterion, see section 7.2.

[55]There are two main reasons to drop the rental mentions: first, the rental market was extremely prominent in Rome; it is clear that these two mentions, being no more distinguished than any other rental project, only add noise without being representative. That is, most instances of rental agreements simply do not appear in the digitized Nolli map, and consistency dictates that one either include data on all rent or none. Second, rent does not fit particularly well the notion of investment studied in this paper, which bears on construction (as does the digitized map). In any case, the two mentions are in 1561 and 1596 – so not close enough to 1480 to complicate identification.



(a) Nolli map excerpt annotated with classification details



(b) Baldassini's tomb in Chaalis Abbey, France (Image from Wikipedia Commons)

FIGURE 5. An Example of data classification: the Palazzo Baldassini

Palazzo Baldassini – in those days, the Palazzo Palma con Torre – is, the Nolli map entry tells, "constructed by Antonio da Sangallo the Younger under Melchiorre Baldassini" between 1515 and 1518. Now, Sangallo the Younger is a fashionable architect: his are Palazzo Farnese (completed later by Michelangelo), Santa Maria di Loreto, Villa Madama (following the death of Raphael), even parts of St. Peter's Basilica. To hire an architect of this calibre, Melchiorre Baldassini can be no ordinary patron. But just who he is remains a mystery. The furtive Baldassini declines all requests for closer acquaintance and takes his secret to the grave. Rather literally, in fact. It is his tomb that reveals the answer. A marble effigy sleeps peacefully on a bed of books; a Latin inscription pays homage to an illustrious career as a jurist. Then comes a paper by Sénéchal (1999) marvelling at a surprising discovery in Chaalis of the tomb of one Melchiorre Baldassini, one of the most eminent Roman legal scholars of the early 16thC. The mystery is solved, the patron identified as a layman, the project classified. (In general, I consider a patron's occupation sufficient grounds to identify a patron as prelate or lay. All classifications retained in the final dataset are unambiguous; the few projects for which it was not possible to produce compelling direct evidence of a patron's status have been dropped from the final dataset.)

pertaining to plausibly-inheritable real estate,[56] I retain 222. The full list of variables and their descriptions may be found in Table 6.

Whenever the descriptions in the Nolli map are too sparse to allow for a classification in my framework, I supplement the accounts furnished by Tice et al. (2021) with other sources, of which I maintain a record and bibliography at the level of each project. At times, the map data contain typos at the level of the dates (e.g., an obviously impossible end-date set in the future). I correct these by hand and note the nature of the correction and the source corroborating it. In the data pertaining to inheritable constructions, I make two such corrections.[57]

About 34% of the entries required extra data collection; most often, this pertained to the identity (i.e., prelate or lay) of the patron. This identification process constitutes a major portion of the data contribution of this paper (see Figure 5 for an example).

5.3. **Demographic weights.** I perform all quantitative analysis on a per-capita level. There were many more powerful laymen than there were prelates – and the number of (powerful) laymen grew with the prosperity of the city, while the number of prelates grew slowly, determined by the needs of the papacy – so it is easy for laymen to "out-build" prelates on aggregate over time. To avoid this issue, I construct population weights to capture the population dynamics of the patron-groups of interest. This paper tracks the commissions of powerful men: palazzi are significant architectural constructions, monuments that shaped the skyline and defined the cultural and economic environment. These were not the work of individual monks, bound by vows of asceticism, nor were these the commissions of middle-class merchants. The demographics of interest should reflect the sizes of the sub-groups consisting of the powerful and wealthy, not of a representative sample of the entire Roman populace.

5.3.1. *Prelate weights: Consistories of Cardinals.* To construct the demographic weights for prelates, I must identify the those who have the means to build a palace and who benefit from the reform. I approximate the group of "plausible ecclesiastical patrons" by the number of living cardinals. While a broader set of ecclesiastical officials were affected by the reform,

[56]I consider the following types (as classified in the Nolli map) as plausibly-inheritable real estate: Castle; Palace; Palace, Arch; Palace, Chapel; Palace, Gardens; Palace, Obelisk; Palace, Orphanage; Palace, Prison; Palace, Ruins; Palace, Tower; Palace, Tower, Prison; Palace, Villa; Residence; Residence, Tower; Tower; Tower, Residence.

[57]If supplementary data suggests the addition of another event altogether or offers the possibility of increased precision, I do not make the amendment so as not to disrupt the integrity and consistency of the data collection effort. Thus, for instance, I do correct impossible dates (e.g., an end date further in the future than the writing of this paper), but do not render more precise vague dates (e.g., construction is indicated as spanning a century when more precise details are available), but do make a note of these in the data. I rely on this additional information to add nuance to the interpretation of an existing event, however.

in practice, ecclesiastical officials lower-ranked than cardinals engaging in palace-building was very exceptional, and does not warrant a dilution of the per-capita weights.[58]

Furthermore, although cardinals are chosen from among bishops, only the cardinals themselves have direct voting power in papal elections, so they alone participate meaningfully in the commitment mechanism described before. Hence for the purpose of identifying a reasonable proxy, it is natural for the discussion to bear on cardinals (with the inclusion of the pope).[59]

I collect data from the consistories of cardinals which contain the mention of every cardinal promoted to the office by each pope. For each ecclesiastical official who attains at least a cardinalate, I collect data on the start and end year of his tenure (the end year corresponds to the death of the cardinal[60]). I use these records to construct an index of the number of high-ranking ecclesiastical officials in office in every year from 1099 to 1700.

I discard any cardinals who pass away before assuming office, those who decline the promotion, and those for whom the year of death is not known. In the entire time-interval from 1305 to 1700, there are a total of 1248 active cardinals; there are also 2 who declined promotions and 6 who are dropped for the above reasons, all of whom are found in consistories pre-1450. I retain data on "antipopes" and "pseudocardinals" in an effort to produce conservative estimates, though the inclusion of pseudocardinals is not a consequential decision: after 1450, there are none at all.

5.3.2. *Lay weights: Lista d'Oro.* There is a diverse cast of candidate "powerful laymen," from ancient noble families to merchants and an emergent nouveau riche immigrant class. Meanwhile the concept of a "hereditary nobility" – traceable and codified as it was, for example, in Venice – did not exist in fifteenth-century Rome.

In the absence of censuses and consistent measures of wealth, high-ranking local statesmen offer a natural proxy. Historians often consider political office to be an excellent indicator of considerable power, wealth and influence, and make use of records of public servants where nobles are difficult or impossible to capture. Perhaps most importantly, there were significant barriers to entry for illustrious careers in public office – not dissimilar, in fact, from those associated to rising in the Church.

[58]In the entire sample, there are eight prelate projects not sponsored by cardinals. Except one, who is a wealthy abbot, the patrons are all bishops. Of the eight, only two launch their projects before 1550, one of whom is promoted to a cardinalate within eight years. These are so clearly outliers that to include all bishops would render uninterpretable the per-capita measures.

[59]The hierarchy of the Catholic Church, from top to bottom, is as follows: the pope, cardinals, archbishops, bishops, priests, and deacons. With very few exceptions, only cardinals were required to reside in Rome.

[60]The data contain only three exceptions: over the course of over 700 years, there were four cardinals who left office to marry or who, due to the sudden death of a family-member, were compelled to change careers as the sole heirs of a family fortune. Among these is the famous example of Ferdinand de' Medici, who, following his brother's death, assumed the role of Grand Duke of Tuscany and Duke of Siena, and submitted his resignation so as to be able to marry and secure a continuation of the dynasty.

Created and managed by the archivist, genealogist, and historian Claudio de Dominicis, the Accademia Moroniana is an invaluable resource for the study of important Roman families. The Accademia's comprehensive *lista d'oro della magistratura capitolina* meticulously records the names and extremal dates of tenure of all capitoline magistrates[61] in the city from 1305 to 1865 (De Dominicis, 2009). I likewise use these data to construct an index of the number of powerful laymen in office in a given year.

Equating "laity" with high-ranking capitoline magistrates necessarily underestimates the number of powerful laymen, leading to a more conservative estimate. This is because departure from office seldom corresponded to a death (as was the case for prelates), because some old powerful families (the so-called great barons) almost never held civic office, and, finally, because it is natural to expect the city population to grow even faster than the number of civic offices (indeed, the latter were set by statute). All of this means that the estimates that follow should be taken as a lower bound.[62] In all cases, results are unit-free or given in real terms (e.g., in numbers of projects).[63]

5.3.3. *Populations.* Figure 9 presents the populations of cardinals and high-ranking civil officials and confirms the validity of the empirical design. First, given differences in growth rates, empirical analysis ought to rely primarily on per-capita measures, else the results will be driven by the demographics; second, the "local smoothness" suggests that the observed changes in investment are not the result of a discontinuity at the population level. That there are no drastic jumps throughout the sample period, but especially in the prelate population c.1480 or shortly thereafter, obviates concerns over results driven by possibly-endogenous aggregate entry into the cardinalate.

5.4. **The Panel Datasets.** The datasets capture (per-capita) project investment shares by patron type (lay, prelate) with two different measures: by project start-year, and by project active-year.

[61]As captured by the Magistratura capitolina (which includes the conservatori and priori dei caporioni). Elite and semi-elite Romans, mostly civic nobles, rotated though the offices with rather short tenure, via a kind of curated lottery.

[62]As all identification is dynamic, treatment effects are underestimated if the proxy increasingly underestimates the true lay population over time (which is contextually most probable). Treatment effects would be overestimated if and only if the proxy grew faster than the true lay population. (Treatment effects would be immune to the population estimate if the underestimate of the lay population is consistent over time.) However, it is extremely improbable that governmental offices would grow faster than the number of powerful lay families.

[63]The only exercise in which the possibility of underestimating the lay patron population could conceivably have been problematic is in the calculation of the effect of prelate investment on laymen. This is because underestimating the number of laymen presumably could then lead to an overestimate of the sensitivity of lay investment to prelate investment. In order to avoid this issue (and for general ease of interpretation), I present the corresponding estimates in terms of number of new projects:

$$10 \text{ new prelate projects} \mapsto \left(\frac{10}{\text{prelate pop. } t} \times \hat{\beta}_{t,\text{prelate} \to \text{ lay per-capita investment}} \times \text{ lay pop. } t \right) \text{ new lay projects,}$$

which is immune to mismeasurements of populations.

To construct the datasets, I restrict data collected from the Nolli map to inheritable projects only and to sites that see at least one inheritable project from 1378-1599. There are 139 such distinct "feasible sites." I then transform the dataset so that each observation is a patron-project pair, identified by:

- palace site ID i ;
- patron type $s \in \{\text{lay, prelate}\}$; and
- year $t \in \{1378, \ldots, 1599\}$

Inheritable projects (hereafter used interchangeably with "projects" – given the sample restriction to projects of this type) are assigned a 1 for every year in which they are active in the active-year dataset, or a 1 for the year in which they are begun in the start-year dataset. Values of 0 denote the absence of projects. The result is two balanced panels with two observations (distinguished by patron-type) per site, per year. In other words, for each site-year pair, at the level of patrons, the data can take the values: $(0, 0)$ (no one builds); $(1, 0)$ (prelates build); or $(0, 1)$ (laymen build). $(1, 1)$ is the only combination that is not possible.

I construct per-capita measures by dividing the aforementioned project dummy variable (indicator function) by the relevant patron population in each year. Then, the per-capita share of a project at a site is:

$$\text{inv_dw}_{i,s,t} = \frac{\mathbb{1}_{i,s,t}^{\text{new project}}}{\text{population size}_{s,t}} \times 100$$

for the start-year data (in percentage points), and

$$\text{inv_dw}_{i,s,t} = \frac{\mathbb{1}_{i,s,t}^{\text{active project}}}{\text{population size}_{s,t}} \times 100$$

for the active-year data (in percentage points), where "population size" is the size of the involved patron class. Considering project active-years is one way to reduce the noisiness of the data: as projects are sparse (which is natural, given the caliber of recorded projects), the start-year data is very saturated with zeroes; the active-year data - less so.

5.4.1. *Data cleaning: the reigning pope's relatives and measurement error.* A small pre-trend appears in the raw data in 1470-1479 (see Figure 6(a)). The natural hypothesis is that of an anticipation effect: as Sixtus IV was ordained pope in 1471, might cardinals have responded to some auspicious signals foreshadowing the papal bull? The reality is even simpler. All prelate projects of that decade were the work of two of Sixtus IV's nephews, undertaken after their uncle assumed office.[64]

[64]In fact, the favouritism Sixtus IV showed his nephews frequently draw the ire of contemporaries. The word "nepotism" itself derives from the Italian *nipote* (nephew), and first emerged with a narrower meaning, related to the excessive power and privileges bestowed on papal nephews.

Thus, I collect data on whether patrons are close relatives (up to cousinry, including nephews) of the reigning pope at the time of the project's inception. Controlling for – or explicitly removing – projects sponsored by a close relative of the reigning pope immediately removes the pre-trend, and otherwise removes irregularities from the data (as, plausibly, close papal relatives of either patron class face systematically different incentive and information constraints than do prelates and laymen not part of the ruling family).

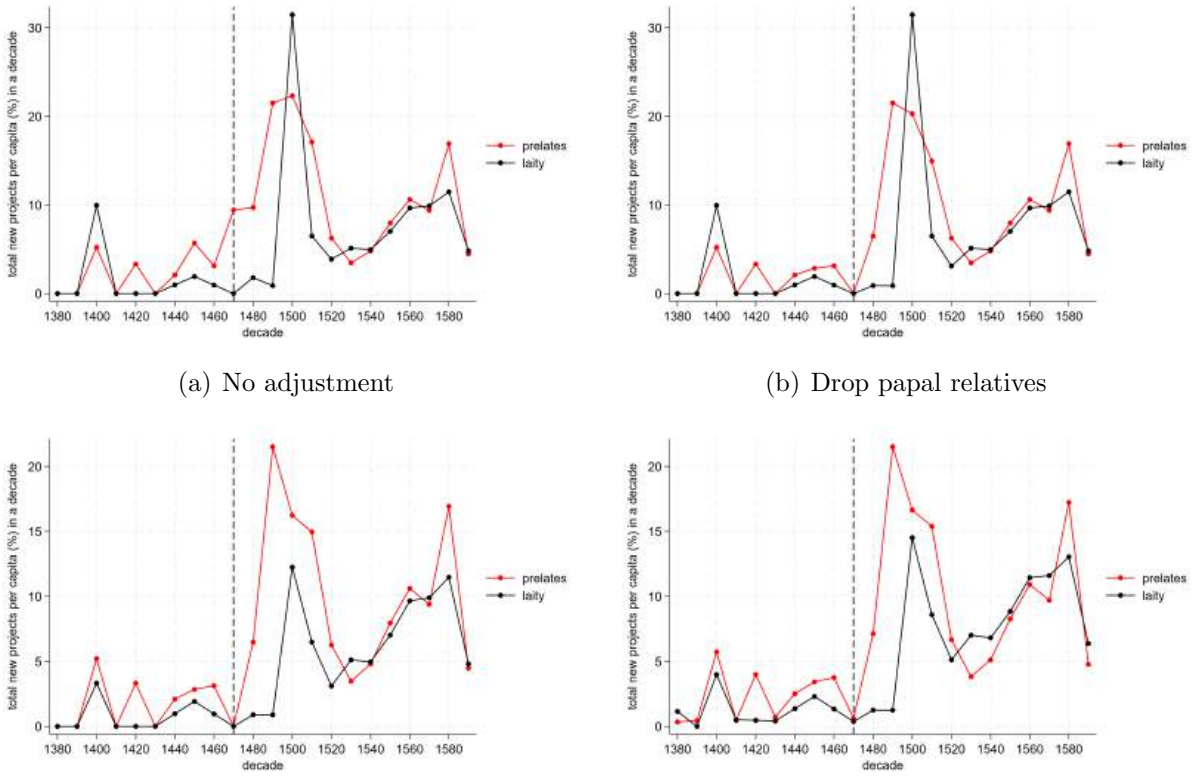
Figure 10 displays the distribution of project lengths with start years from 1400-1600. Over 50% of the projects launched in 1400-1600 take up to 1 year to complete, with projects in upper percentiles making for obvious candidates for outliers. Extreme length and round project dates are best taken as evidence of poor record-keeping rather than of outsized ambition and a genuine affinity for simple numbers on the part of investors. In particular, projects which are recorded as taking place exactly from 1400 to 1500, or from 1500 to 1600, and for which the furnished record is the terse description "constructed," are clearly indicative of measurement error, due to sometimes-poor quality data available to historians. I address this issue in several ways: by removing the projects of exactly a century with the dates 1400-1500 and 1500-1600, and by smoothing the start date of these projects across the stated active period. In the active-project datasets, I also smooth the start date across the stated active period and impute a project length based on the average post-treatment project length, by patron-type.[65]

Figure 6 presents the various proposed adjustments (with alternative correction methods shown in Figure 11). In the graphs, it is apparent that there is a considerable differential impact of the papal bull on prelates and the laity, followed by a "catching-up" effect, suggestive of long-term convergence, about a half-century later.

5.4.2. *Interpreting results.* Most literally, $\text{inv_dw}_{i,s,t}$ measures the share (as a percent) of new or active project (depending on the data-set) funded by representatives of a particular patron-group s, at a particular palace-site i, in a particular year t. Multiplying the figure by the corresponding population size recovers the probability of construction, while multiplying further by the number of feasible sites interprets the figure in terms of the number of projects (or, equivalently, the number sites with active or new projects). An aggregation of the palace-level $\text{inv_dw}_{i,s,t}$ to a city-level $\text{inv_dw}_{s,t}$ can further be interpreted as a patron-group investment rate.[66]

[65]In principle, given the format of the Nolli map, it is not possible to distinguish projects for which it is known that the project was started and was completed within a year from those for which only a start-year is precisely known and an end-year is omitted. However, start-year-only projects have detailed descriptions and are not clustered around round dates, suggesting that data paucity is not an issue. Furthermore, short projects are not universally suspicious per se (e.g., in the case of acquisitions or smaller projects). The risk of underestimating project length is, in any case, not a threat to identification: all of the main analysis is performed on the dataset organized by (accurately-identified) project start-year.

[66]This interpretation requires the benign assumption that patrons face a binary investment decision ("to build or not to build?"). The assumption is perfectly-verified in the yearly data, and is an almost-perfect approximation even at very coarse time-intervals.



(a) No adjustment

(b) Drop papal relatives

(c) Drop papal relatives & measurement errors

(d) Drop papal relatives & uniform smoothing of measurement errors

FIGURE 6. New investment projects by start-year per-capita

Figure 6(a) presents the raw data. Projects identified as started by papal relatives are those whose patrons are, at most, cousins or nephews of incumbent popes at the time of the project launch. Such projects account for the entirety of the pre-trend 1470-1479 (and it should be noted that they occur during the tenure of the pope who instituted the reform in 1480), and are dropped in Figure 6(b). Projects identified as suffering from measurement error are those indicated as active for exactly a century, with round start and end dates (i.e., at exactly the start of a new century) and with no substantive project description provided. These are dropped in Figure 6(c), and the smoothing in Figure 6(d) is performed over all active years, with a uniform share of such projects assigned to each decade in which it is active. Figure 11 presents alternative corrections for the measurement error projects; the pattern is unchanged.

6. RESULTS

6.1. **Hypothesis I: Real effect of the papal bull.** The first test seeks to establish that the papal bull had a real treatment effect by means of a difference-in-difference analysis of per-capita shares of annual new projects. Recall that this measure of investment with demographic weights (dw), as a percentage, is constructed as:

$$\text{inv_dw}_{i,s,t} = \frac{\mathbb{1}_{i,s,t}^{\text{new project}}}{\text{population}_{s,t}} \times 100.$$

I will test whether the difference in inv_dw among patron groups is systematically different post-papal-bull compared to the pre-reform trend. I first run a regression to obtain the average treatment effect of the papal bull on prelates (by having a static treatment effect but including time effects not interacted with the treatment). In particular, I estimate the following equation:

$$(1)\quad \text{inv_dw}_{i,s,t}^{\text{new project}} = \alpha + \beta_1 \mathbb{1}_{t\geq 1480} + \beta_2 \mathbb{1}_{s=\text{prelate}} + \beta_3 \mathbb{1}_{t\geq 1480} \times \mathbb{1}_{s=\text{prelate}} + \gamma X_{i,s,t} + \varepsilon_{i,s,t},$$

for $i \in \{\text{palace sites}\}$, $s \in \{\text{lay, prelate}\}$, $t \in \{1400, 1401, \ldots, 1526\}$.[67] The parameter α is the constant term. $X_{i,s,t}$ include the fixed effects (including 5-year time effects) and various controls: indicators for whether the project is started by a reigning pope's relative and for plausible instances of measurement error,[68] and continuous variables for time elapsed since a previous project at the same site and the length of the previous project, and an indicator for the group identity of the previous patron; see Table 6 for a complete description.

The estimated regression results are reported in Table 2. Results remain robust to the inclusion of controls and fixed effects (including at the location × year and location × patron-type levels). Clustering in this analysis is performed at the palace-location × patron-group level, as that is the level on which treatment is administered. Specifications with alternative clustering (at the palace-location level only) and with an alternative methods of addressing measurement error projects (via uniform smoothing over the problematic projects' active periods, instead of the inclusion of a dummy variable) are presented in Appendix II, Tables 7 and 8, respectively. The findings remain unchanged.

The baseline specification (Column 2 of Table 2) and subsequent specifications consistently estimate the average treatment effect of the papal bull on the treated prelate class post-1480 as a roughly 350% increase increase in the difference between shares of prelate- and lay-funded new projects per capita per year at an average palace site, relative to the pre-1480 difference.[69]

There are two natural ways to interpret this result. The average treatment effect on the treated corresponds to a 4.1 p.p. higher probability of a new project on average among the prelates post-1480 per decade at a given palace-site,[70] relative to pre-1480 prelate averages. This is equivalent to an additional 5.6 new projects in the city per decade[71] for the same group. (These likewise represent an approximately 350% increase relative to the pre-reform mean among the prelates.)

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[67] The Sack of Rome (1527) offers a natural end-point for this analysis.

[68] The precise identification of these was discussed in s. 5.4; in short, these are the century-long projects with perfectly round start and end dates and terse descriptions, suggesting that the recorded project dates suffer from data paucity.

[69] The increase is of .007 p.p., which translates into: $\frac{\hat{\beta}_{\mathbb{1}_{t\geq 1480}\times\mathbb{1}_{s=\text{prelate}}}}{\hat{\beta}_{\mathbb{1}_{s=\text{prelate}}}+\text{constant}} = \frac{.00748}{.00141+.000729} \approx 3.5$.

[70] $\hat{\beta}_{\mathbb{1}_{t\geq 1480}\times\mathbb{1}_{s=\text{prelate}}} \times \text{avg. prelate pop. post-1480} = .00748 \times 54.775 = .409717$ p.p./year ≈ 4.1 p.p./decade

[71] $\hat{\beta}_{\mathbb{1}_{t\geq 1480}\times\mathbb{1}_{s=\text{prelate}}} \times 1/100 \times \text{avg. prelate pop. post-1480} \times \text{no. feasible sites} = 0.00748 \times 1/100 \times 54.775 \times 139 = .56$ per year $= 5.6$ new projects per decade

	(1) inv_dw	(2) inv_dw	(3) inv_dw	(4) inv_dw	(5) inv_dw	(6) inv_dw	(7) inv_dw
papal bull=1	0.00573***	0.00239**	0.00165*	0.00164*			
	(0.00100)	(0.000782)	(0.000775)	(0.000776)			
prelate patron=1	0.00110	0.00141	0.000721	0.000722	0.000721		
	(0.000762)	(0.000887)	(0.000568)	(0.000690)	(0.000690)		
papal bull=1 × prelate patron=1	0.00448	0.00748**	0.00780**	0.00780**	0.00779**	0.00781***	0.00644***
	(0.00253)	(0.00274)	(0.00247)	(0.00248)	(0.00248)	(0.00184)	(0.00159)
century-long project=1		1.074***	1.074***	1.077***	1.074***	1.079***	1.003***
		(0.0728)	(0.0728)	(0.0729)	(0.0730)	(0.0728)	(0.102)
relative of reigning pope=1			2.416***	2.413***	2.414***	2.383***	1.896***
			(0.369)	(0.371)	(0.370)	(0.368)	(0.483)
has prev proj							1.032***
							(0.259)
has prev proj=1 × years since previous project							0.0286*
							(0.0112)
has prev proj=1 × years since prev project^2							-0.000132*
							(0.0000522)
has prev proj=1 × length of previous project							-0.343
							(0.504)
has prev proj=1 × prev patron prelate=0							0.410
							(0.296)
Constant	0.00103**	0.000723**	0.000723**	0.000722	0.00124**	0.00160***	0.00103***
	(0.000336)	(0.000232)	(0.000232)	(0.000470)	(0.000444)	(0.000304)	(0.000302)
location ID FE	–	–	–	✓	✓	–	–
location ID × patron FE	–	–	–	–	–	✓	✓
5-year time FE	–	–	–	–	✓	–	–
location ID × 5-year time FE	–	–	–	–	–	✓	✓
_cons	✓	✓	✓	–	–	–	–
standard errrors	robust	ID × patron	ID × patron	ID × patron	ID × patron	ID × patron	ID × patron
years	1378-1526	1378-1526	1378-1526	1378-1526	1378-1526	1378-1526	1378-1526
Adjusted R2	0.00179	0.0911	0.237	0.237	0.237	0.230	0.415

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 2. New projects per capita: difference-in-difference

This table presents regression results for the difference-in-difference analysis of new project shares per capita (i.e., at the start-year level). The dependent variable in all specifications captures the per-capita share of new investment projects per year at a palace-site as a percent, with the demographic weight referring to the corresponding patron-group. "Patron," in the fixed effects and the clustering alike, refers to the patron-group (prelate or lay); "[location] ID" refers to the identifier assigned to a palace-site by Nolli in his map (these are sufficiently granular as to uniquely identify a palace location – one can think of them as a street address).

The various specifications of this equation, including those without fixed effects, explain between 23.7 and 41.5% of observed variation, as measured by the adjusted R^2. [72]

The treatment effect can be decomposed over time, by 5-year intervals, to examine dynamics and persistence (or 10-year intervals, with an analogous equation):

(2)

$$\text{inv_dw}_{i,s,t} = \alpha_0 + \sum_{\substack{t=1400 \\ t\neq 1475,\ldots,1479}}^{1595} \beta_{t-\text{mod}(t,5)} \text{half_decade}_{t-\text{mod}(t,5)} \times \mathbb{1}_{s=\text{prelate}} + \gamma X_{i,s,t} + \varepsilon_{i,s,t},$$

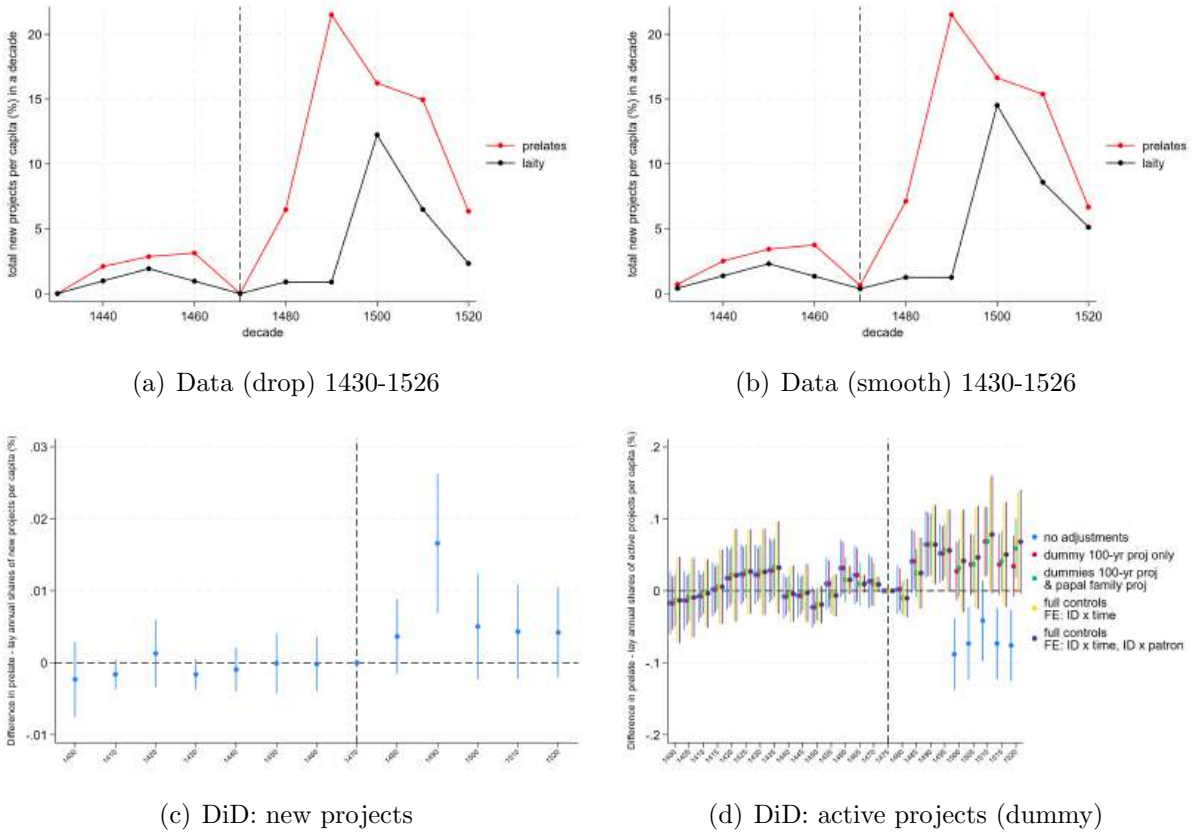
again for $i \in \{\text{geographic IDs}\}$, $s \in \{\text{lay, prelate}\}$, $t \in \{1400, 1401, \ldots, 1599\}$ (with the 1475-1479 half-decade omitted as the reference category). The variables $\{\text{half_decade}_{t-\text{mod}(t,5)}\}_t$ are indicator variable for the corresponding half-decades.[73] Fixed effects always subsume the uninteracted time and patron effect (i.e., $\text{half_decade}_{t-\text{mod}(t,5}$ and $\mathbb{1}_{s=\text{prelate}}$). The $\{\hat{\beta}_t\}_t$ capture the average yearly difference between prelates and laity in a given 5-year window, relative to 1475-1479 as the reference.

Figure 7 displays the $\hat{\beta}_t$ coefficients from an estimation of Equation 2. The plots confirm the existence of a treatment effect, and then a convergence to an equilibrium. The inclusion of control variables and fixed effects does not alter the character of the findings relative to the baseline. As new projects are a scarce occurrence, dynamic difference-in-difference analysis with start-year data is hard to perform on a sufficiently granular level with the desired statistical power. Thus, while presenting those results, I pass also to active-year data and repeat the tests for active projects. In Figure 7, I correct irregularities in the data (those caused by relatives of reigning popes and by projects suffering from measurement error) via the inclusion of dummies. In Appendix II, I present the same analysis, but with alternative corrections: the removal of problematic observations from the sample entirely (Figure 14 contains the graph and Table 9 the regression output for control variables), the inclusion of only measurement error controls (Figure 15 and Table 15), and the inclusion of only a continuous project-length control instead of a dummy variable (Figure 16 and Table 11).

All of the aforementioned difference-in-difference results are, of course, to be taken only as lower bound estimates of the true effects of the bull. As I argue throughout the paper, lay investment increases post-1480, as lay patrons benefit from the papacy's commitment, secured by reform-induced prelate investment, even though they do not benefit from the reform directly. These confounding effects are mitigated by the constrained time-horizon of the analysis, but are likely still present. However, they can only bias downwards the estimate of the effect of the bull, and so do not threaten the validity of findings.

[72] I include here only the specifications which have a control both for the plausible measurement-error projects and for those constructed by relatives of reigning popes.

[73] The construction is such that the 1480 half-decade bin is comprised of the years 1480, 1481, 1482, 1483, and 1484 .



(a) Data (drop) 1430-1526

(b) Data (smooth) 1430-1526

(c) DiD: new projects

(d) DiD: active projects (dummy)

FIGURE 7. Investment per capita difference-in-difference: by project start-year and by project active-year

Figure 7(a) and 7(b) show the data for the difference-in-difference analysis, with projects by reigning popes' relatives dropped in both cases. In Figure 7(a), measurement error projects are dropped, and in Figure 7(b) they are uniformly smoothed across their active period. Figure 7(c) shows the corresponding difference-in-difference analysis for new projects (with dummy variables for projects by reigning popes' relatives and for measurement error projects, and with location $\times$ decade and location $\times$ patron-type fixed effects); the analysis has slightly weaker statistical power due to the general scarcity of new projects. Statistical significance is easily recovered in the static regressions (cf Table 2), as well as by passing to project active-year data. Figure 7(d) shows more granular dynamic difference-in-difference analysis (at half-decade levels) for active projects, likewise with dummies accounting for measurement error projects and those undertaken by reigning popes' relatives. Alternative specifications (with different ways of accounting for these projects) are shown in Appedix II. ("No adjustments" – the first presented specification in Figure 7(d) – refers to the use of raw data, with no corrections or controls for the aforementioned data challenges.)

6.2. **Hypothesis II: Papal absences, the papal bull, and investment.** I collect data on papal absences from Rome and study whether absences correspond to lower investment. A complete description of all papal absences is provided in Table 3. I repeat all of the ensuing analysis at two levels: focusing on all patrons' investment, and restricting to lay patrons only. The latter isolates patrons who benefit from only the papacy's presence, not

from the 1480 papal bull per se. I report findings for laymen in the main text of the paper, and reserve the pooled regressions for the appendix; results are unchanged.

I first establish that the papal bull has a real effect on whether the papacy stays in Rome: the number of years of papal absences significantly decreases post-1480 (Column 1 of Table 3), such that the probability of absence in a given year drops by 81.5% (or, equivalently, by 18.84 p.p.). So-called "endogenous" absences – that is, those that are, in any way, discretionary and plausibly interpretable as a signal of the pope's waning willingness to remain in Rome vanish post-1480 altogether.

I next test whether contemporaneous papal presence itself might be a plausible driver of investment. That is, I test the alternative hypothesis that papal presence per se matters for palace-construction even controlling for the introduction of commitment, and I find no evidence in favour of this explanation. The negative relationship between papal absence and investment disappears with the inclusion of a control for commitment to long-term papal presence in Rome, as captured by the introduction of the papal bull (Columns 3 and 5). It follows that, pre-1480, patrons were not naïve enough to take the pope's contemporaneous presence as a guarantee that he – and, more importantly, his successors – would remain in the city long-term. Conversely, post-1480, patrons had reason to believe that the papacy as an institution was bound to Rome long-term; the location of a single pope, therefore, did not matter. Thus, I argue that it is not contemporaneous institutional presence that drives the increase in investment post-1480, but specifically commitment to long-term presence.

To ensure that results are not driven or diluted by political tensions extra muros, I repeat the exercise but include periods of externally-contested papal authority (during which antipopes outside of Rome challenge the reigning pontiff's authority) in Table 18.[74] External challenges to papal authority follow the same pattern as normal papal absences: their effect on investment vanishes with the inclusion of a post-1480 dummy; they also do not change the effect of local papal absences in joint analysis, as desired (Columns 4-9 of Table 18). In table 18, as in Table 3, I consider the effects of all absences together and endogenous (discretionary) ones separately.

[74]Results are also not affected by the inclusion, into periods of contested rule, the 1453 plot of the humanist Stefano Porcari to overthrow the popes and establish a republic. He was caught and hanged before violence could erupt. (Not reported as effects of interest are identical.)

	No. Absences		Investment (lay)			
	(1) endog.	(2) all	(3) inv_dw	(4) inv_dw	(5) inv_dw	(6) inv_dw
post-1480	-0.216***	-0.184***		0.005***		0.005***
	(0.041)	(0.045)		(0.001)		(0.001)
endogenous absence			-0.004***	-0.001		
			(0.000)	(0.001)		
endogenous × post-1480				0.000		
				(.)		
papal absence					-0.003***	-0.001
					(0.001)	(0.001)
papal absence × post-1480						-0.001
						(0.002)
Constant	0.216***	0.225***	0.004***	0.001**	0.004***	0.001**
	(0.041)	(0.042)	(0.000)	(0.000)	(0.000)	(0.000)
N	222	222	30,637	30,637	30,637	30,637
Adjusted R2	0.125	0.072	0.000	0.002	0.000	0.002
Years absent 1378-1479	22	23	22	22	23	23
Years absent 1480-1599	0	5	0	0	5	5

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 3. The effect of papal absence from Rome on per-capita investment

Papal absences include all meaningful stays of the pope outside Rome, due, for instance, to flights during invasions of Rome, wars waged on foreign soil and treaty negotiations that requires the pope's presence elsewhere. Endogenous absences are those interpretable as a plausible sign of the pope's waning willingness to remain in Rome long-term – e.g., a disagreement between (a subset of) Romans and the pope, the purchase and active construction of property in another city (with the pope present to oversee the construction) – are isolated in the variable "endogenous." Regressions in Column 1-2 are run at the year-level (robust standard errors), and at the palace-year level in Columns 3-6 (standard errors clustered by palace). This exercise is repeated in Table 18 to consider effects on investment across patron-types, as well as periods of contested papal authority (as measured by the presence of antipopes – competing popes – elsewhere).

6.3. **Hypothesis III: The Effect of past prelate investment.** If the increased lay investment post-1480 is induced by increased confidence that the papacy will remain in Rome, which is driven by prelate construction, then past prelate investment should be a predictor of future lay investment for a brief period after 1480. The brevity of the relationship attests to the role of past prelate investment for laymen: it matters only insofar as it generates the papacy's commitment to stay in Rome in an observable way, and does not itself carry intrinsic economic value.

I will test this by running the regression in Equation 3, both in a dynamic and static set-up, with the start-year and active-year measurements, for each patron class separately (i.e., twice; once for laymen and once for prelates):

$$\begin{aligned} \text{inv_dw}^{s}_{i,t} = \alpha &+ \beta_0 \, \mathbb{1}_{t\geq 1480} \times \text{prev_prelate_investment}_{t-\text{mod}(t,10)-10} \\ &+ \beta_1 \, \mathbb{1}_{t\geq 1480} \times \text{prev_lay_investment}_{t-\text{mod}(t,10)-10} \\ &+ \beta_2 \, \mathbb{1}_{t\geq 1480} \\ &+ \beta_3 \, \text{prev_prelate_investment}_{t-\text{mod}(t,10)-10} \\ &+ \beta_4 \, \text{prev_lay_investment}_{t-\text{mod}(t,10)-10} \\ &+ a_i + \varepsilon_{i,t} \end{aligned} \tag{3}$$

for site-specific location fixed effects in a_i. The variable $\text{prev_prelate_investment}_{t-\text{mod}(t,10)-10}$ captures the total[75] per capita investment by prelates in the city in the previous decade, and analogously for $\text{prev_lay_investment}_{t-\text{mod}(t,10)-10}$. In the dynamic specifications, $\mathbb{1}_{t\geq 1480}$ is replaced by a set of indicator variables for half-centuries (with the interval 1430-1479 omitted as the reference category).

6.3.1. *Predicting lay investment:* For previous prelate investment to be a predictor of future lay investment post-1480, in the estimation of Equation 3, we need:

$$\hat{\beta}^{L}_{0} = \hat{\beta}^{L}_{\mathbb{1}_{t\geq 1480}\times \text{prev_prelate_investment}_{t-\text{mod}(t,10)-10}} > 0 \tag{4}$$

but only for a short period after 1480.

However, past lay investment should not have a discernible differential effect on post-1480 investment according to this channel.[76] Thus, we should observe:

$$\hat{\beta}^{L}_{1} = \hat{\beta}^{L}_{\mathbb{1}_{t\geq 1480}\times \text{prev_lay_investment}_{t-\text{mod}(t,10)-10}} = 0. \tag{5}$$

By decomposing Equation 3 to have time-varying coefficients (at the half-century level due to the preponderance of zeroes in the data), one can verify whether the effect of past prelate investment on future lay investment decreases over time. Indeed, this is confirmed in Table

[75]Calculated as the sum.

[76]Recall that past prelate investment, post-1480, serves as a meaningful guarantee that the papacy will remain in Rome. The pre-1480 prelate investment does not have the same interpretation. The interpretation of past lay investment does not change over time.

4, where the effect is pronounced during the first 50 years post-papal-bull and negligible otherwise. (Table 16 contains the full regression output and Table 12 presents the same analysis in a 2×2 (static) framework.)

A 10 p.p. increase of prelate per-capita new project shares in the past decade corresponds to an additional (compared to 1430-1479) 2 p.p. increase in lay per-capita new project shares in 1480-1529. A back-of-the-envelope calculation suggests that, in 1480-1529, 10 new projects among prelates in the past decade translate into 5.42 additional new lay projects in the subsequent decade relative to 1430-1479.[77] The analogous result for active projects (i.e., measured by active-year) is presented in Table 17.

The high sensitivity of laymen's responses to past prelate investment hints at a low prior probability assigned by laymen to the papacy remaining in Rome long-term. Otherwise, had prelate investment only confirmed what laymen already believed, it could not have elicited a strong response, whose magnitude diminishes as patrons update beliefs.

That the effects vanish at longer time horizons and that they are not present at all for the prelate patron-class (see, e.g., Table 4) grants further credibility to the commitment channel. This finding cannot be explained by a wealth spillover.

To directly rule out general spillover effects driving the change c.1480, I consider the predictive power of past investment pooled across patron types in Table 12 and Table 14 for new and active projects, respectively. There is no statistically significant differential effect of past investment on future investment over time,[78] and the effect of past investment per se – without dynamic interaction terms – is very weak.

In fact, even the static variable measuring lagged lay investment is never a positive predictor of later lay investment (see Table 16).[79] Together, these findings are inconsistent with an explanation on the basis of spillovers, both in explaining investment in general, and as pertains to the the change post-1480.

6.3.2. *Predicting prelate investment:* Because prelates do not need to learn about the papacy's intentions – or about the voting incentives of cardinals – from observed investment,

[77] $\frac{\text{10 new prelate projects}}{\text{avg. prelate pop. post-1480}} \times \hat{\beta}_{\text{post-1480} \times \text{prelate per-capita prev. investment}} \times \text{avg. lay pop. post-1480} = \frac{10}{42.44} \times 0.2 \times 115.1 \approx 5.42$ new lay projects

[78] The coefficient on the interaction term of lagged investment $\times$ post-1480 time effects is insignificant.

[79] On the contrary, there is even a brief negative effect, 1480-1529. The effect is not very strong, and should not be interpreted as meaningful evidence of a between-patron substitution effect. It seems mechanical, as building a palace in one decade reduces one's appetite for building a palace in the next decade. When investment rates are sufficiently low, this within-patron substitution effect is diluted, but when construction rates are sufficiently high, it can be observed. (A heuristic: if patrons are willing to build at most once every two years, a year with no construction may or may not be followed by a more active year, while a year with high investment will necessarily be followed by one in which investment is low.) This within-patron substitution is not very interesting in and of itself, but it is further evidence that positive spillovers are not the primary driving force.

	(1) inv_dw_lay	(2) inv_dw_lay	(3) inv_dw_prel	(4) inv_dw_prel
1380-1429 × prelate per-capita investment prev. decade	-0.156*	-0.156*	-0.535*	-0.535*
	(0.0732)	(0.0732)	(0.256)	(0.256)
1480-1529 × prelate per-capita investment prev. decade	0.200***	0.200***	0.0958	0.0958
	(0.0327)	(0.0327)	(0.0785)	(0.0785)
1530-1579 × prelate per-capita investment prev. decade	0.0506	0.0488	0.0799	0.107
	(0.0511)	(0.0511)	(0.0987)	(0.0949)
1580-1599 × prelate per-capita investment prev. decade	-0.0511	-0.0511	-0.0999	-0.0999
	(0.0339)	(0.0339)	(0.0723)	(0.0723)
location FE	–	✓	–	✓
_cons	✓	–	✓	–
Observations	30361	30360	30361	30360
Adjusted R^2	0.006	0.004	0.001	0.003

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 4. Effects of previous investment: Dynamic DiD; by project start-year

Clustering in all regressions is performed at the location-ID level. 1430-1479 is the omitted category. The regressions include interactions for lagged investment by laymen by half-century and are presented in Table .

past investment per se is uninformative and not useful under this channel.[80] So, it should have no treatment effect:

$$\hat{\beta}_0^P = \hat{\beta}^P_{\mathbb{1}_{t\geq 1480}\times \text{prev_prelate_investment}_{t-\text{mod}(t,10)-10}} = 0 \tag{6}$$

I repeat the analysis in Table 12 to predict new prelate investment in Tables 13 and 15 for new and active prelate, respectively, and there are no statistically significant positive relationships. This finding is consistent with the interpretation that laymen stand to learn something from past prelate investment in the pivotal half-century from 1480 to 1529.

6.4. **Hypothesis IV: An increase in project ambition.** When Sixtus IV issued the 1480 papal bull, he ensured that prelates would wish to build in Rome and, in so doing, encouraged them to settle down in the city. A College of Cardinals thus attached to Rome would never allow a pope to leave the city, nor would they allow this legislation to be repealed. This increased commitment ought to have had an effect on patrons' confidence and risk tolerance.

I provide some illustrative evidence consistent with increased patron ambition. To this end, I consider changes in project characteristics over time. An increase in "building" (entirely new projects) rather than "rebuilding" (contributions to existing palaces)[81] could be

[80]Prelates do not learn about the likelihood that the papacy would remain in Rome or about the popularity of the papal bull by observing their colleagues' investment: proximity allows for far more direct gauges of papal and cardinal attitudes, so past investment does not carry any information. More importantly, it is the prelates themselves who elect future popes.

[81]See Table 6 in Appendix II for a thorough classification guide.

taken as evidence of a shift in patrons' risk-tolerance for profitable investments. Building something completely new likewise requires a less transactional or less short-term relationship with the city than does an acquisition or reconstruction of an existing site due to the additional risk and complicated nature of a completely new project. Patrons of "new" projects incur (non-financial) costs associated to various bureaucratic constraints (e.g., the procurement of building permits, superfluous for contributing to existing palaces).

The decompositions of investment rates by project type are presented in Figure 8. The data confirms that, while there is no considerable difference between patrons' pre-1480 project choices, post-1480, there was an increase in per-capita rates of new construction ("building") projects. The disproportionate increase was driven primarily by the laity; prelates did not exhibit a marked preference change and increased investment in both types of projects rather homogeneously. This is consistent with the hypothesis that risk-tolerance and optimal investing time-horizons are positively affected by the papal bull – and that laymen are responding positively to the prospect of the papacy staying in Rome long-term.

7. Discussion & Further Robustness Checks

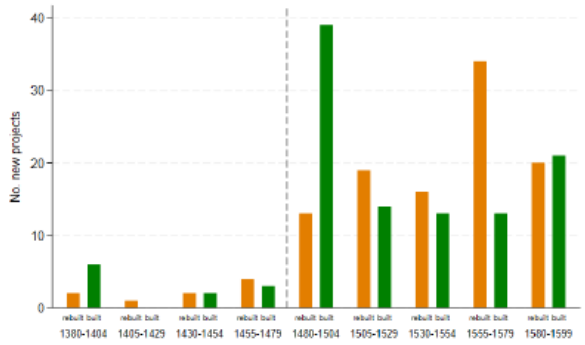
7.1. **Attenuating factors.**

7.1.1. *Who was doing the committing?* The notion of commitment proposed in this paper does not rely on Sixtus IV being selfless or far-sighted (– once again emphasizing the distinction to be drawn with a signalling channel, where discerning the pope's true motivations would matter much more). Even if his ambitious building programs were all for his own self-aggrandizement (as were those of his predecessors), even if his own nepotism was the goal of the reform, the proposed mechanism worked for the whole elite.

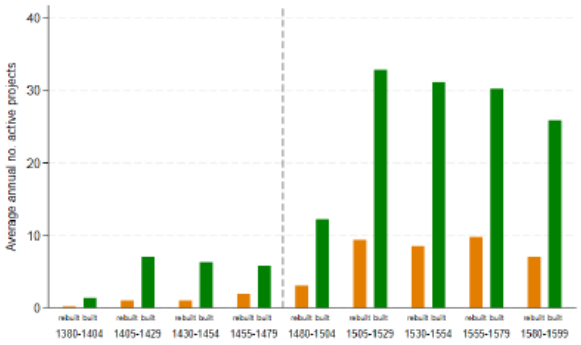
7.1.2. *What exactly was being committed to? A word on institutional presence vs quality.* Throughout the paper, I argue that it is long-term papal presence that matters for patrons' investment decisions. Is it possible that the guarantee of long-term papal presence also induced a change in the quality of governance? Is quality salient?

On the one hand, the interests of a land-owning political class, committed to staying in the city, would, presumably, be much more closely-aligned with those of residents, than were those of a potentially-transitory elite class with no stake in the city's future. This could conceivably manifest in better governance from the perspective of the lay elite. On the other hand, the increased opportunities for personal profit for the political elite could have created perverse incentives and led to policies designed to make prelates wealthier at the expense of laymen.[82]

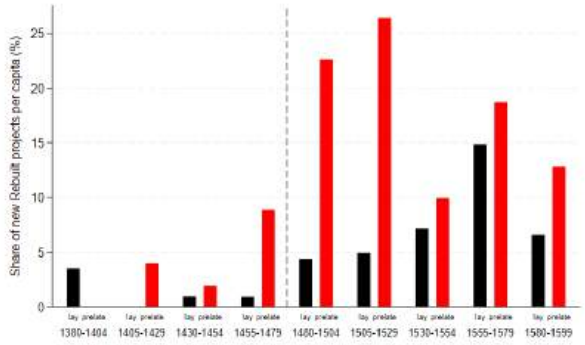
[82]For instance, family names start to repeat much more in Cardinal Consistories starting from the mid-16thC: there seems to be an emergent quasi-dynastic prelate elite, much more hereditary than in it had been in the past. This paper does not take a stance on whether this was good or bad for Rome. Modern political theories, however, might suggest a preference for more meaningful turnover.



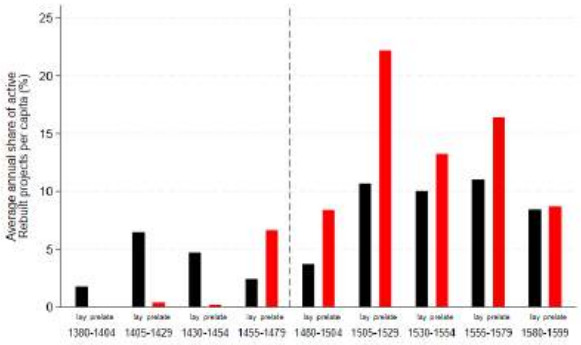
(a) New projects by project type



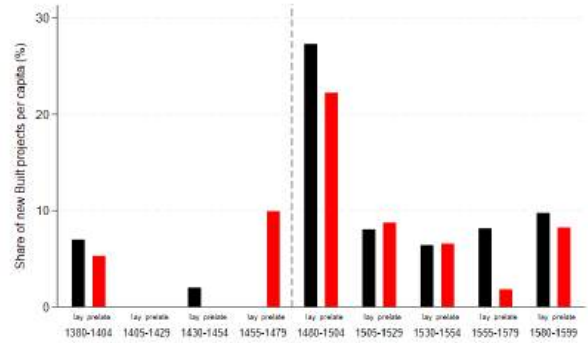
(b) Average annual active projects by project type



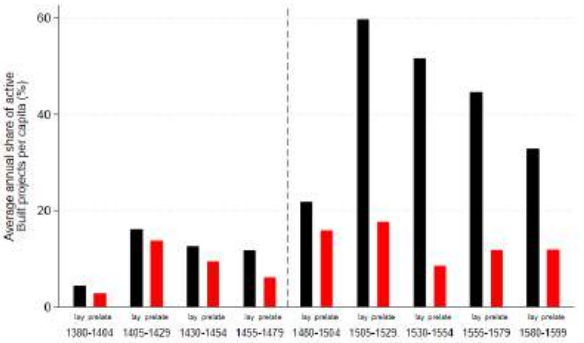
(c) New projects by patron type (per capita): "rebuilt"



(d) Average annual active projects by patron type (per capita): "rebuilt"



(e) New projects by patron type (per capita): "built"



(f) Average annual active projects by patron type (per capita): "built"

FIGURE 8. Decomposition of per-capita project shares by project and patron type.

"Built" projects are those that see some fundamentally novel construction, while "rebuilt" projects entail a reconstruction or refurbishment of an existing palace. Refer to Table 6 for a more detailed classification. Note that "active project" graphs present the average share of active projects in a year while the "new projects" graphs present the per-capita share of all projects started in the relevant quarter-century. I use the raw data, with no adjustments, due to the coarser time bins which already absorb much of the spurious variation.

This ambiguity vis-à-vis likely effects on quality of governance further suggests that the salient factor for lay decision-making really was long-term papal presence per se (and not expectations of quality shifts, which were hard to predict and measure even for contemporaries). Indeed, were favourable governance to be a sufficient condition for lay palace-construction, the period of the papal sojourn in Avignon – during which laymen could rule the city with few external constraints – should presumably have seen some non-zero lay palace-building.

Thus, while certain dimensions of papal policy might well have changed in discontinuous fashion after the papal bull, this corollary is difficult to test, and those changes, even if quantifiable, would be difficult to aggregate to an overall welfare verdict: the quality of governance is no easier to assess in the renaissance than it is today. Sixtus IV did much to revive the city, but was perpetually embroiled in nepotism-related scandals. Leo X was popular and a great spender, but he accused a group of cardinals of plotting to kill him, and he created cardinals in such a flock that he may have diluted the prestige of the cardinalate. It is hard to determine what makes a pope "good" or "bad" on the whole, and harder still to measure. Identifying the more granular changes in papal policy may represent a promising avenue for future research.

7.1.3. *Could the papal bull have been purely nominal? Why did it have any real effects?* It is natural to ask whether tax avoidance or corruption could have been prominent enough that the inheritance reform would not, in practice, change constraints for prelate, making the reform purely nominal. It is not impossible that some papal money was being funneled to prelates' families before 1480 and that there was some circumvention of the prohibition on bequests. It does not seem likely that this would have been particularly meaningful, however; large sums of money were difficult to steal and hide, and the most common way to help relatives was via job procurement. Most importantly, pre-1480 investment among laymen was similarly low: even if there was a flow of money from cardinals to beloved nephews – and even if those nephews resided in Rome – the funds were seldom allocated to Roman palazzo construction.

Given the fact that entry into and ascent in the Church was costly and time-consuming, that the legislation came very early in the pope's tenure, and that the parallel trends assumption appears to be verified pre-1480, there are compelling grounds for causal interpretation of the post-papal-bull changes. Furthermore, the strong quantitative "treatment effect" obtained in the empirical difference-in-difference analysis is not consistent with a purely nominal tax cut, so such an interpretation is probably excessively conservative. But it serves as a useful reminder that it is the incentivization of prelates to invest – and not the degree to which the tax-cut is financially meaningful on aggregate per se – that bounds the papacy to Rome, which, in turn, drives lay investment.

7.1.4. *Were there wealth spillovers after all?* The tests in s.6.2 and s.6.3 indicate that lay investment increases in response to the papacy's commitment to stay in Rome long-term.

This mechanism relies on the importance of the papacy to the Roman economy. But if the papacy was so crucial to economic activity that a mere promise of its presence was enough to incentivize investment, one may ask whether papal presence could have also generated economic activity, and whether this economic activity could have driven lay construction. In other words, instead of a spillover channel relying on complementarities (which is already addressed in s.6.2-6.3), the question bears on wealth accumulation: did the papacy's presence in Rome make laymen wealthy, after which they invested their new wealth in palaces?

Two comments are in order. First, as there is a marked discontinuity in investment trajectories, it is clear that, even if there were to be a wealth-accumulation effect, it was necessarily different – at least in size, if not in nature – post-1480. This suggests that the papacy's commitment to remain in Rome long-term is still salient: in that case, institutional commitment generates wealth which laymen turn into investment.

The difference is thus not between

(7) papal bull → papal commitment to stay in Rome → lay investment

and

(8) papal bull → wealth generation → lay investment,

but between the mechanism in (7) and

(9) papal bull → papal commitment to stay in Rome → wealth generation → lay investment.

The possibility of an intermediate step of wealth-creation (the sole difference between mechanisms (7) and (9)) does not change the fundamental importance of the papacy's long-term commitment.

Second, wealth-accumulation (as in mechanism (9)) is not very likely to be a driving force for this particular kind of investment. That is, it is indubitable that there is indeed wealth being created in Rome, as described above. It is just unlikely to be salient for palace-construction in particular. The economic sectors that most benefited from (the prospect of) long-term papal presence would have been associated primarily to middle-class occupations: labourers, food and service provision, and so forth. The laymen who built palaces, conversely, were not stonemasons or shopkeepers. They typically made their fortune from landholdings (outside Rome) and dynastic marriages, or in other cities (Brentano, 1991).[83]

7.2. **Why inheritable investment?** The choice to track real estate is motivated not only by the optimality of the setting in which to study the effects of the papal bull: this kind of real estate is the asset-class most directly targeted by the reform; it captures very well

[83]Though mostly outside the temporal scope of the present paper, Ferraro (1994) should be mentioned as a particularly authoritative work on the sources of wealth of Roman nobility from 1560 to 1700.

investors' long-term beliefs about the future of a city; and is, finally, uniquely salient and prevalent as a form of economic activity.

7.2.1. *Eliciting long-term attitudes.* The illiquidity of real estate is an important property. Investment into liquid or movable assets reveals little, if anything, about investors' confidence in the city's future economic prospects. Large family palaces were designed to remain in the family, as a primary store of wealth and sign of power for many generations. Investing in such a palace was not strictly necessary: there was an active (upper-class) rental market. Rome had an unusually transitory elite, and every new pope, every new cardinal, every ambassador wanted lodgings – but very few, pre-1480, built new ones.

7.2.2. *Ubiquity.* As for the prevalence of such investment, narrative evidence is abundant in confirming that early-modern Romans delighted in opportunities to spend illustrious sums of money on projects they thought would advantage their family for generations (Nussdorfer (1997), Goldthwaite (1993)).

A palazzo served many purposes. It was not just a residence. It was a family heirloom; a symbol of power and wealth; an impressive reminder to friends and a warning to enemies; a fortress and a hub of economic activity. That it also happened to be the investment of choice throughout the Renaissance (see Goldthwaite (1993)) underscores the ambition – and consequently the potency – of the 1480 papal bull. Palaces also played a vital role in commercial and rental markets long after their construction was over, with floors reserved for vendors (including storefronts and storage) and tenants.

7.2.3. *Significance.* Unlike the occasional Church commission, which brought, at best, sporadic economic activity, sustained investment in real estate meant a steady income for artisans, stonemasons, builders, and skilled and unskilled labourers at all stages of the construction process (Goldthwaite (1993), Bartlett (2013)). Palace-building was, in other words, one of the primary economic engines of the Renaissance.

Especially for a city with almost no industry and whose most meaningful export was the sale of indulgences and mediation,[84] consistent labour demand was a promise of long-term economic activity – and a hope for a natural corrective to the demographic problems that plague a city with a minimal natural birthrate. Partner (1980) and Bartlett (2013) even suggest that the construction boom in the late fifteenth century and early sixteenth century led to an influx of workers from Lombardy settling in the city. Expectations of stable future employment lured entire families to Rome. Temporary spikes in labour demand induced,

[84]There was a market for masses, dedicated prayers, for Romans as for visitors, and another kind of indulgences: an absolution from solemn vows. So petitioners would come to Rome to litigate for absolution and remission. Rome exported justice, too: it was a court of last appeal (Southern, 1961), and – earlier than many monarchies – Rome exported its capacity to arbitrate and rule on cases, for instance in the *Sacra Romana Rota*, the highest ecclesiastical tribunal in the Church, which handled cases from across Europe (Salonen, 2016). See also Blastenbrei (2006), Fosi (1993) and Fosi (2011) for examples of seminal historical accounts of criminal justice in sixteenth century papal Rome.

at best, temporary relocation of workers, and seldom led to mass migrations of wives and children.[85]

7.2.4. *Why measure "inheritable" and not "private" (or "private, residential") investment? A word on classification.* The dichotomy between "private" and "public" spheres may appear natural now, but would have been meaningless in early-modern Italy – and so would a classification of investment projects on such grounds. Several urban historians and micro-historians (cf, e.g., Cohen and Cohen (2001-2002) and Nussdorfer (1997)) demonstrate that distinctions of "private" and "public" were not easily drawn in early-modern Roman space. Public life was full of private matters and of relations of friendship, kinship, loyalty, and enmity. Private institutions like the family, the kin-group, the band of friends, the clientele were all susceptible to political trends (Cohen and Cohen, 2019, chapter 9). Projected onto the spaces they occupied, public and private life remained just as difficult to disentangle. Private spaces often had public functions and vice versa. To classify palace-building projects along these lines in hopes of identifying purely-residential spaces would, then, be artificial and overly reductionist. Even the word "space" had not yet taken its contemporary meaning as a theatre or domain of existence; it described only concepts relating to measurement and objects.[86]

Inheritability – whether a building can be (or is) bequeathed –, on the other hand, is a meaningful, concrete, verifiable property, and one far better suited to our discussion of investment patterns. It is also reflective of the way early-modern Romans thought. "Family" was a broader word than it is today; the connection was felt and maintained through property transfer.

7.3. **How robust is the distinction between prelate and lay?** Lee (1983) notes that, in the fifteenth century, most cardinals came from outside Rome, and were, therefore, easily distinguishable from the powerful lay families. Until the Sack of Rome (1527), these are two largely distinct groups.

Eventually, family-rise and palace-building became a two-brother effort: one layman for marriage and begetting an heir; the other – clerical, for career advancement, even the cardinalate. By the late sixteenth century, this was the usual story, maybe even the modal case, which renders somewhat meaningless the distinction between lay and prelate on the individual level – the family becomes the relevant unit of analysis.

[85]For more on Lombard workers in Rome, see, for example, Pineiro (2020) and Fregna (1990).

[86]A thorough discussion of early-modern "space" can be found in Cohen and Cohen (2019) and Agnew (2005). Separating space along the private-public dichotomy would be anachronistic. Nonetheless, some distinctions were felt in the sovereignty one exercised, mediated primarily by boundaries created by windows and doors (Cohen and Cohen (2001-2002)). Agnew (2005) points out that measurement of space was somewhat teleological, and reflected purpose and effort: the distance of a stone's throw or an arrow's flight, the number of days it would take to plow a field.

Thus, I extend the definition of the prelate-patron dummy variable to ask whether the project has at least one prelate patron. (The two propositions are empirically equivalent when one restricts to the constrained time-horizon.) The comparison effectively becomes one between powerful families with and without access to the Church. This is another reason I limit the specifications designed to test the direct effects of the papal bull at the Sack of Rome. It explicitly rules out the possibility of within-family collusion.

That selection into the prelate group becomes endogenous over time mitigates the degree to which one can quantify the effects of the bull (hence the restriction of the difference-in-difference analysis), but it in no way detracts from the crucial qualitative observation that palace construction is helped by the presence of beneficiaries of the papal bull.

I will not endeavour to argue that families with and without high-ranking ecclesiastical officials by the late 16th century are still close to indistinguishable. Nor do I need to do so. After the boundary between the two groups becomes permeable, treatment is endogenized to some degree, and available on a costly and lagged "opt-in" basis. If pursuing access to the Church becomes more desirable than it was in the past as a result of the papal bull, this only underscores its efficacy. In fact, this suggests another dimension of wisdom to the policy: it is plausible that the bull allowed the papacy to simultaneously foster economic growth in the city and attract representatives of powerful families – or otherwise more competent workers – to join its ranks.

7.4. **Survivorship bias & data imperfections.** As with any historical inquiry, concerns over attrition and data imperfections are well-founded; as much as possible, they are mitigated by a combination of a careful data-collection effort and a difference-in-difference design.

That the city changed between the mid-quattrocento and Nolli's day need not threaten the quality of the data: though the visual map reflects what Nolli himself saw, the entries capture what stood on the site before and after the given landmark, and are, therefore, sufficient to reconstruct the cityscape of Rome in any year of interest. That being said, there is a certain survivourship bias; it is necessarily more difficult for historians to obtain data on landmarks that no longer stand. The list of projects collected is not exhaustive for another reason, too: the historians populating the entries in Nolli's map concerned themselves only with projects of historical significance. So, while major renovations of palazzi certainly appear in the data, the purchase of new tapestries or the refurbishment of a room will not, valid investments in real estate though they are.

As far as projects of a particular calibre are concerned, however, one can be quite confident in the comprehensiveness of the compiled data. In this regard, the Nolli map – owing to the meticulous work of scholars who curated data on the history of landmarks – is as close to a complete database as one can hope to acquire for a project of this nature. As far as I know, there is no reason to believe that 1480 represents a cut-off in terms of record-keeping,

or that records for one patron class are systematically more prone to erasure or preferential treatment than another – and differentially so, with a change in 1480.

I check whether there is a discontinuity at the level of the data with a regression discontinuity design (RDD). I collect all mentions of events from the Nolli map: investment projects, demolitions and catastrophes, special events, idiosyncratic notes about famous inhabitants. And not only inheritable buildings: I now include churches, parks, fountains, streets. Anything, in short, where a record date is available. While there is, of course, growth in data availability over time, there are no sharp discontinuities. In fact, applying a logarithmic scale suggests a smooth linear growth rate. Summary statistic graphs and the main placebo RDD results for data evolution over time are reported in Figure 17; alternative specifications and regression tables are relegated to Figure 18 and the corresponding regression results are in Table 19. The placebo RDD analysis confirms that there is no meaningful discontinuity in data sources used to construct the Nolli data at the 1480 threshold – which ought to assuage concerns of results being driven by survivorship bias.

It is, therefore, reasonable to assume that data limitations are roughly symmetric across patron groups and smooth around the 1480 cut-off. Thus, these concerns should not jeopardize the integrity of the quantitative analysis.

As for alternative data sources, other maps – and quasi-cartographic panoramic depictions – of the city do exist, though they are quite few in number. Some are ostensibly more relevant temporally, such as the 1551 Bufalini map, the 1593 Tempesta map, the 1668 De Rossi map, the 1676 Falda map, and the 1697 Barbey map. None of these, however, offer a suitable alternative to the Nolli map: all are plagued by inaccuracies of varying severity from which the Nolli map does not suffer.[87] It is no accident that historians have chosen Nolli's map as the exercise in cartography to which to pair their landmark data. To the best of my knowledge, the Nolli map alone benefits from the thorough cataloguing described earlier.[88] Deferring to the better judgment of historians and cartographers, I, too, restrict my consideration to the Nolli map.

8. Conclusion

This paper is the first to shed light on the historical and economic puzzle of the origins of Roman palace-building. A comparison of prelates affected by the 1480 papal bull to unaffected laymen reveals a strong increase in inheritable investment attributable to the reform of inheritance laws. Consistent with the hypothesis that prelate construction made papal departures prohibitively costly, papal absences decreased considerably post-reform, and, while the established commitment was a significant predictor of lay investment, contemporaneous

[87]Despite an innovative geometric approach that allowed Leonardo da Vinci to map Imola perfectly in 1502, the general practice of cartography adapted only by the 1700s. Until then, maps resembled townscapes, drawn, first, en face, later, from a bird's-eye view (Cohen, forthcoming).

[88]Scholarly work involving any of the other maps has not been nearly as comprehensive. See StudiumUrbis (2019) for a discussion of the maps of Rome of the sixteenth and seventeenth centuries.

papal absences and presences had no effect on lay palace-building. Laymen discerned that the papacy would remain in the city by observing past prelate investment: during the first fifty years after the papal bull, lay investment followed prelate investment with a lag, and the two patron-groups converged thereafter. Newfound confidence in the city's long-term prospects also manifested in increased ambition across all patron types.

All of this suggests that the irreversibility of an institutional change is very significant: the 1480 papal bull had such a striking effect while the return of the pope to Rome, a century earlier, did not. Indeed, the century-long delay between the pope's return to Rome and meaningful commitment to remain in the city shows that papal presence alone had been insufficient to foster economic growth in the absence of a guarantee that the pope would not be able to leave the city again. That irreversibility of institutional changes is indeed a necessary condition for successful intervention is difficult to convincingly test in other contexts where there is no clear temporal demarcation between the the substantive change and its perceived longevity.[89]

A city in ruins – with an economy in decline, struck by political intrigue, crisis and turmoil – is not the mise-en-scène of a historical melodrama. There is still much that can be learned from it. Perhaps this paper and the setting it describes might be relevant to how we think about public policy, incentives, investment, urban renewal, and even the behaviour of powerful stakeholders.

Early-modern Rome presents itself as a unique and natural laboratory in which one can disentangle and further study factors of interest in questions of political economy and institutional economics. What does meaningful participation of elites look like? Does democratization inevitably lead to better institutions, growth, and hence more democratization? Many events that appear concurrently in contemporary settings (e.g., stakeholder presence and commitment, improvement in institution quality and the credibility thereof) are staggered here, and make such questions more tractable. It is now clear, for instance, that the mere presence of the powerful stakeholder did little for Rome until there was a sign that the stakeholder's and city's future were inextricably tied. Likewise, while the Church arguably became more prone to nepotism, more susceptible to the existence of a hereditary political elite, Roman institutions benefited and even appreciated in credibility – and so did the economy.

Many research avenues remain unexplored. The interaction of the 1480 reform with political incentives seems particularly promising. There is reason to suspect that private investment drove future patronage: elites who suddenly no longer had a transactional or transitory relationship with the city were more likely to become philanthropists (motivated, surely, by concerns of public appeal and politics). Families would also attempt to curry

[89]As laymen were not directly affected by the substantive policy of the reform and as the reform came a century after the pope's return to Rome, it is possible to establish a convincing link between the papacy's commitment to the city's future and the ensuing lay increase in investment.

favour with popes via various commonalities (e.g., shared migrant origins, etc.). All of this would undoubtedly manifest in investment behaviour at politically-salient moments, such as at times of papal turnover.

The dusk of palace-building would also benefit from further analysis. There are many factors that plausibly contributed to the decline (surveyed in Appendix I). Among the most important is likely primogeniture, a practice of making firstborn sons the sole heirs of family property, implemented via *fidecommesso* contracts. An attempt to consolidate inheritance and take advantage of convex returns, the strategy was extremely risky: with daughters sent to nunneries and surplus sons - to the Church, the custom inadvertently led to the extermination of noble families. While the demographic consequences are well-established by historians, the effects on palace-construction (and the economy more broadly) have not been studied. Primogeniture can, for example, simultaneously account for the rapidly-diminishing number of palaces (via the extinction of powerful families) and the gargantuanism and illustriousness of the palaces that were built (via consolidated wealth).

And as for Sixtus IV himself, he was, in the end, a complicated man with a complicated legacy. His was a papacy tainted by nepotism, an indulgent attitude towards the slave trade and the Spanish Inquisition. His, too, was a papacy characterized by patronage of the arts and humanism, and the start of a much brighter future for Rome. Little doubt remains that his 1480 papal bull completely transformed the Roman skyline. It is no wonder that eulogies drew parallels between a famed Emperor and the pope who "made Rome from a city of brick into stone just as Augustus of old had turned the stone city into marble."[90]

Rome fut tout le monde, et tout le monde est Rome.
Et si par mêmes noms mêmes choses on nomme,
Comme du nom de Rome on se pourrait passer,
La nommant par le nom de la terre et de l'onde :
Ainsi le monde on peut sur Rome compasser,
Puisque le plan de Rome est la carte du monde.

—Joachim du Bellay, 1558

Rome was th' whole world, and all the world was Rome,
And if things nam'd their names do equalize,
When land and sea ye name, then name ye Rome;
And naming Rome ye land and sea comprise:
For th' ancient plot of Rome displayéd plain,
The map of all the wide world doth contain.

—translated by Edmund Spenser, 1591

[90]From a eulogy by the poet Raffaelo Maffei, quoted by (Partridge, 1996, p.21).

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Appendix I: Historical surveys

8.1. **A brief survey of major shocks to investment in early-modern Rome.** We are now ready to embark on a quick tour of Rome – a tour that necessarily begins in a small city in the south of France.

Avignon Papacy (1309-1377): The papacy is in Avignon; Rome is consequently deprived of her economic engine. During this time, the Black Plague (1346-1353) devastates Europe. In 1378, Gregory XI moves the papacy back to Rome, but passes away before the change becomes truly permanent. The population of Rome dwindles to about 17 000 inhabitants by the time the Pope returns.[91] Several questions remain unanswered: is the papacy back definitively? will that be enough for the economy to recover?

Western Schism (1378-1417): Geopolitical and religious intrigue leads to a fracture of the Church and the factionalization of Catholic states. After the death of Gregory XI, Urban VI is elected in Rome. French cardinals wishing to return to Avignon refuse to acknowledge the legitimacy of the conclave and elect Clement VII. Reconciliation between the Avignon and Roman papacies is impossible, and the Council of Pisa (1409) results in the election of yet another pope. The Pisan Pope John XXIII eventually calls the Council of Constance (1414-1418), which culminates in the excommunication of the Avignon antipope and the renunciation of his Pisan and Roman counterparts, and the election of a new Roman Pope, Martin V.

While the return of the papacy to Rome must be important, the effect is dampened by the prevailing uncertainty. Fear that the pope could leave Rome once more – along with the implications of being excommunicated by his rivals – is enough to preclude a complete recovery.

Council of Basel (1431-1439): The Council of Basel challenges papal authority. Only when it is over is the papacy on solid footing. The council tries to depose Eugenio IV; the pope feels the effects of hostility throughout his tenure, and even flees the city from 1434 to 1443.

Falsification of the Donation of Constantine (1439-1440): Humanist Lorenzo Valla proves the *Donatio Constantini* to be a forgery. The text, supposedly written by Emperor Constantine (but in fact likely an invention of the 8th century), conferred dominion over Rome and the Western part of the Roman Empire to the popes, significantly enlarging the mandate of the papacy.[92] Though the manuscript's authenticity had been doubted as early as 1001, Valla's argument proves decisive. Presumably, this ought to have dealt a serious blow to

[91]The classic estimate of 17 000 – owed to Boccaccio? – is disputed by some modern historians. For a thorough critical discussion, see Hubert (2001).

[92]Though it had amplified Rome's power, some, including Valla, argued that the forgery had had a corrupting effect on the Church. The document served to excuse greed and a tyrannical geopolitical agenda. Dante, for instance, wrote in the *Divina Commedia* (c.1308-1321): "Ahi, Costantin, di quanto mal fu matre, // non la tua conversion, ma quella dote // che da te prese il primo ricco patre!" ("Ah, Constantine, what wickedness

the papacy's legitimacy where governance was concerned – and, by extension, its capacity to pursue its agenda. Initial surprise and outrage at the discovery dissipates rather quickly, however, and the authority of the papacy is not significantly undermined.

Death of Eugene IV (1447): Historians date the end of an era of conflict and unrest by the death of this unpopular pope. Eugene IV's tenure had been marked by conflict, fluctuations in policy, and feuds with powerful Roman families and reforming movements alike. He almost immediately acquired an unsavoury reputation. Inexperienced, tactless, embittered by early-career disappointments, he alienated the clergy with false promises and waged violent war against a popular and influential family. Policy reversal on major issues (including on the morality of slavery) and a poor handling of dissent further increased his unpopularity.

The estrangement of prelates under Eugene IV's rather hostile rule was important: his death, and the popularity and diplomacy of his successor, Nicholas V, restored good relations between the papacy and prelates. This was plausibly associated with an immediate, though still modest, boom in construction. Those who were too uneasy with Eugene IV's governance to build before, along with those reassured by Nicholas V's wisdom (and patronage of the arts), now did so.

The prosperity and optimism were short-lived. By the election of Pope Paul II in 1464, cardinals had been long dissatisfied with papal policy (Weber (1911)). His pontificate did not change this; Paul II was secretive and paranoid, and the distrust was mutual. Paul II was also a rather staunch opponent of humanism, which, culturally, was absolutely necessary to Rome's future.

Thus, that the death of Eugene IV was, indeed, a turning point is clear only ex-post; contemporaries could not have fully anticipated the true effect. Indeed, the response appears rather muted.

Fall of Constantinople (1453): Rome is now the only "focal point" of the Christian world and the sole heir to the Roman Empire. While plausibly good for Rome overall in terms of consolidation of power, the reality is that the "shared market" between Constantinople and Rome is not very large.

Papal bull "etsi de cunctarum civitatum" (1480): Pope Sixtus IV introduces the reform of "inheritance taxes" which is the subject of this paper. The 1480 papal bull represents a significant positive shock for prelates' incentives and ability to invest: the effective tax rate on inheritance dropped from 100% to 0%. That only a segment of the population (high-ranking ecclesiastical officials) were directly affected by the policy leads to a natural identification via a difference-in-difference design. For a thorough description of the papal bull, refer to s.3.2.

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was born – // and not from your conversion – from the dower // that you bestowed upon the first rich father [pope]!") (Alighieri, 1995, Inferno; canto 19; lines 115-117; trans: Mandelbaum)

Reformation (1517): On October 31, Martin Luther disseminates his 95 Theses, a potent critique of the Catholic Church which gives rise to the Reformation. The Reformation was one of the great watershed moments of early-modern history. As Protestantism spread in Northern Europe, papal influence waned, and the revenue stream from erstwhile Catholic states ran dry. The blow to papal coffers (especially pronounced c.1520-1550) was an immediate negative shock to the Roman economy.

Perhaps even more importantly, doubts surfaced as to whether the Vatican would remain the centre of the Christian world. If it would not – or if its hold on Europe would continue to deteriorate – Rome, too, would lose much of its power and wealth.

Sack of Rome (1527): The horribly violent destruction of Rome by "barbarians" – over 20 000 (mostly foreign) soldiers of Holy Roman Emperor Charles V storm the city, despite contervailing orders. War has come to Rome. Traces of barbaric vandalism remain visible even in the city today.

Conflict more broadly is surely a factor – and Italy had a lot of war from 1494 to 1559, and then total peace between states until c. 1625, the epoch of *Preponderanza spagnuola* (Spanish Dominace). When, in 1560, civil war breaks out in France for almost 40 years, the bi-polar contest for power in Italy falls silent. Only with the consolidation of Henri IV can France meddle once more in Italian affairs, and the troubles flare up again.

Council of Trent (1545-1563): The Counter-Reformation movement resolves to fight back with a vigorous public campaign. On the agenda are illustrious spending programs aimed at the beautification of Rome. As the centre of the Catholic world, Rome's power and wealth waxes once more. That other states have come to the Vatican's rescue bolsters confidence in Rome's future. In 1550, there is a dramatic inflow of money from the New World – generally a good thing for Rome. (This capital from the new world also plausibly contributed to peculiar inflationary trends until silver mines (most notably in present-day Mexico) were exhausted in c. 1625.)

Money currents (c.1540-1590): An ambitious and aggressive geopolitical agenda induces a sharp rise in Rome's expenditures outside the city, as the Church subsidizes wars against heretics: the Schmalkaldic Wars of 1546-7 and 1552-1555 [end disputed] in Germany; the French Civil War 1561-98; and conflicts in the Netherlands c.1570-1659. Rome participates in the funding of war also against the Ottoman Empire, especially around the Lepanto campaign of 1571, and more generally in Hungary for decades.[93] This was sustained in part by Spanish monies, vast subsidies, especially 1560-1590, until bankruptcies put an end to the money flow.[94]

[93]See Hanlon (1997).
[94]See Dandelet (2001).

Entail (after c.1550): Noble families move to primogeniture[95] via *fidecommesso* contracts. The precise effects on palace-construction are yet to be investigated in detail, but the demographic consequences are quite clear. The custom inadvertantly lead to the extermination of noble families. Primogeniture was a risky way to consolidate family wealth and power. Almost all of daughters would be sent to nunneries; surplus sons would pursue careers in the Church. Then, often enough, some accident would claim the life of the heir and the family name would vanish. Roman families become much more fragile under this new inheritance regime. But this concentration of wealth on one heir might also explain some of the gigantism of the palaces of the late 16th century and beyond: the Borghese, Pamphilij, and Barberini palaces, for instance, are huge and splendorous by earlier standards.

Famine (1590-1599): A terrible famine in Rome; one of the most devastating shocks of the 16thC.

[95]A practice of making firstborn sons the sole heirs of family property.

8.2. **Papal absences from Rome.** The following table presents a summary of all salient papal absences from Rome (1378-1599), and notes periods of contested rule (characterized by the existence of antipopes).

Dates	Description
1378 - 1417	Western Schism
1383 - 1385	Urban VI left Rome temporarily to secure his position against Antipope Clement VII in Avignon; fought with and tortured own cardinals
1417 - 1420	Martin V travels around Florence and other Italian states after being elected in the Council of Constance
1423 - 1429	Antipope Clement V
1424 - 1429	Antipope Benedict X
1434 - 1443	Eugenio IV flees to Florence (and briefly Bologna) due to a popular uprising against him
1439 - 1449	Antipope Felix V
1449	Nicholas V flees due to plague
1459 - 1460	Pius II attends the Congress of Mantua (to organize a crusade against Ottoman Empire)
1459 - 1464	Pius spent considerable time in Pienza[a]
1464	Pius II dies in Ancora during crusade
1494	Alexander VI briefly flees due to French invasion of Italy in 1494
1506	Julius II attacks Bologna
1511	Julius II attacks Mirandola
1527	Clement VII flees during Sack of Rome
1545	Paul III spent a bit of time at the Council of Trent

Table 5. Papal absences and periods of contested papal governance

[a] With the possible exception of 1461, Pius regularly spent extended periods of time Pienza, in an effort to transform the city into a (summer) residence for the papal court. According to Adams (1985), there is construction activity in Pienza sponsored by Pius II in every year 1459-1464 except 1461. To be conservative, I, therefore, exclude 1461 as a year of absence – though, of course, that he did not build there in that particular year does not mean he did stay in the city.

Appendix II: Tables & Figures

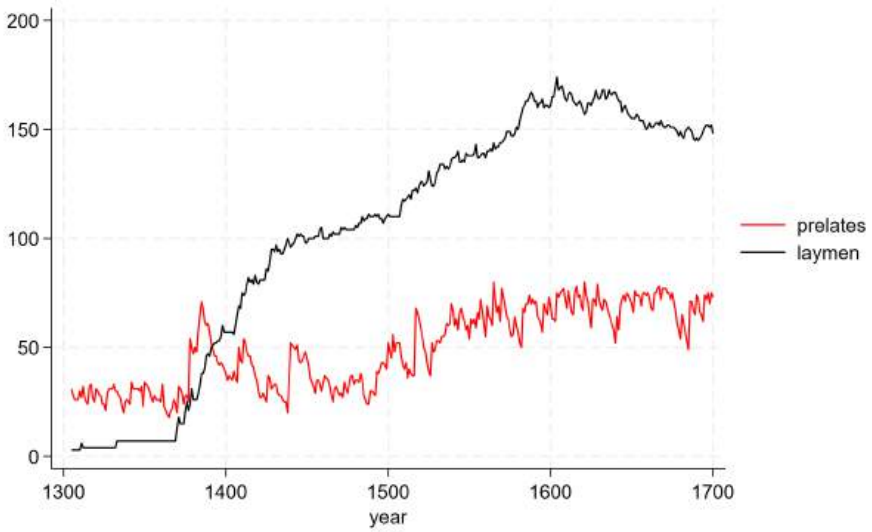


Figure 9. Prelate and Lay populations

The number of cardinals remains quite constant over time: their population is a reflection of the needs of the papacy. The number of powerful laymen grows with the overall prosperity and size of Rome.

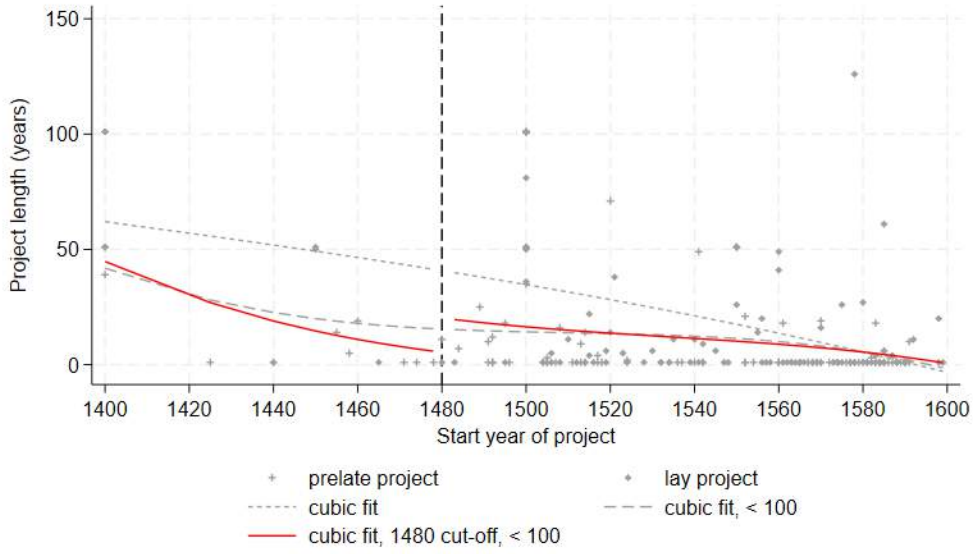
Variable	Description
	Data obtained from the map
ID	Location ID on the Nolli Map; a unique identifier of a (palace-)site
Name	Name when Nolli was making the map (c. 1736-48)
Modern Name	Name in the 21st century
Type	Landmark type in its "final" form (e.g., palazzo, street, academy, church, etc.)
Architects	All (prominent) architects engaged with connections to building over its "lifetime"
Patrons	All (prominent) patrons engaged with connections to building over its "lifetime"
Start year	First year of project
End year	Last year of project
Current condition	Condition in 21st century, if available
Description	Description of event (furnished by historians)
	Manual classification of events
All investment (= active project)	A dummy variable capturing an instance of real estate investment.
Built	The building was built/some institution was established for the first time, or very significant construction took place.[a]
Rebuilt	Work was done on an existing building (reconstruction, improvement, etc.).[b]
Inheritable	Records whether or not the construction associated to the project was inheritable (e.g., a residential palazzo). Need not reflect current state.
Prelate patron	Records whether there is a patron who is a high-ranking ecclesiastical official overseeing the particular project.
Reigning pope's relative	The patron is a close relative of the reigning pope at the time of the project's inception.
Supplementary notes	A record of additional sources consulted, separate from Nolli map, used to classify the entry.
	Constructed variables
Prelate population	The number of active prelates, as per the Cardinal consistories.
Lay population	The number of active laymen, as per the Lista d'Oro.
Log of the total population	The natural logarithm of the number of prelates plus the number of laymen. (A proxy for the growth rate of the population of interest. Not a proxy for the population of Rome.)
Prelate previous patron	A dummy denoting whether the previous patron of a project at the given site was a prelate.
Since last project[c]	Number of years since the last project at the same site (and higher-order polynomial terms).
Previous project length[c]	Total length of the previous project at the same site (and higher-order polynomial terms).
Project length	Number of years in which project is active (and higher-order polynomial terms).
Century-long project	Plausible measurement error: project is exactly a century long, with start- and end-dates exactly at the turn of a century.

Table 6. Description of variables

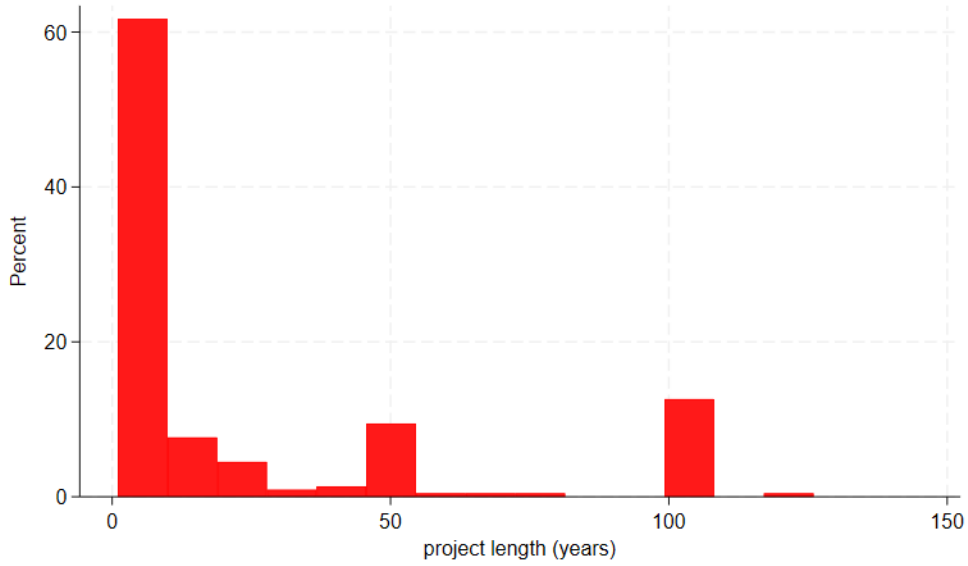
[a] For example, if, on the territory, there was a palace, and they added a military fort, that merits the "built" tag because the purpose of the added infrastructure is different. Adding a chapel or cloister to an existing church is best classified as an "improvement" rather than as new construction.

[b] "All investment" is a union of "built" and "rebuilt" projects.

[c] Censored variables. In quantitative analysis, these are modulated by a dummy variable ("has a previous project").



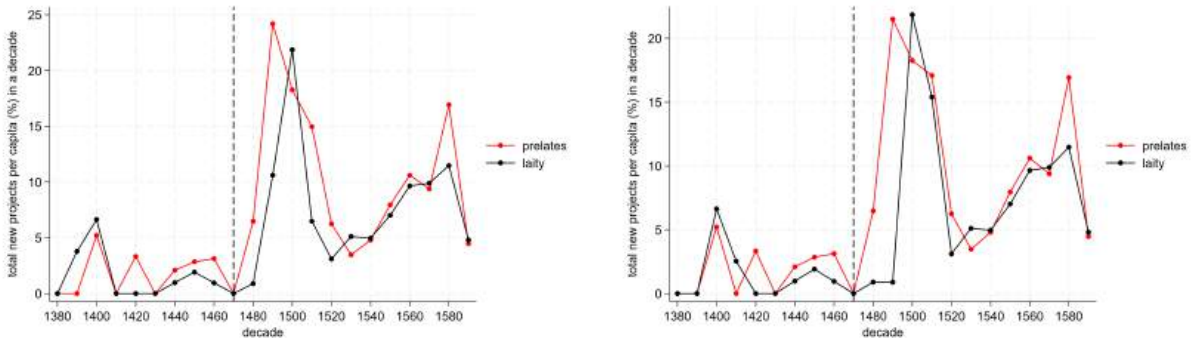
(a) Scatterplot



(b) Histogram

FIGURE 10. Length of new inheritabe projects with start years from 1378 to 1599.

In these graphs, each inheritable project appears once, irrespective of its attributes. The scatterplot in the first subfigure allows for a discontinuity at the 1480 threshold; no statistically-significant discontinuity is observed.



(a) Drop papal relatives & smooth (earlier) measurement errors

(b) Drop papal relatives & smooth (later) measurement errors

FIGURE 11. New investment projects by start-year per-capita: alternative corrections

Figure 11(2) and (f) present the measurement error projects evenly distributed among the first recorded active decade and the preceding or following decade, respectively.

	(1) inv_dw	(2) inv_dw	(3) inv_dw	(4) inv_dw	(5) inv_dw	(6) inv_dw	(7) inv_dw
papal bull=1	0.00573***	0.00239**	0.00165*	0.00164*			
	(0.00100)	(0.000787)	(0.000782)	(0.000781)			
prelate patron=1	0.00110	0.00141	0.000721	0.000722	0.000721		
	(0.000762)	(0.000901)	(0.000580)	(0.000580)	(0.000580)		
papal bull=1 × prelate patron=1	0.00448	0.00748**	0.00780**	0.00780**	0.00779**	0.00781**	0.00644**
	(0.00253)	(0.00266)	(0.00246)	(0.00246)	(0.00246)	(0.00246)	(0.00212)
century-long project=1		1.074***	1.074***	1.077***	1.074***	1.079***	1.003***
		(0.0730)	(0.0729)	(0.0730)	(0.0731)	(0.0726)	(0.102)
relative of reigning pope=1			2.416***	2.413***	2.414***	2.383***	1.896***
			(0.366)	(0.367)	(0.367)	(0.367)	(0.448)
has prev proj							1.032***
							(0.270)
has prev proj=1 × years since previous project							0.0286*
							(0.0112)
has prev proj=1 × years since prev project^2							-0.000132*
							(0.0000522)
has prev proj=1 × length of previous project							-0.343
							(0.474)
has prev proj=1 × prev patron prelate=0							0.410
							(0.287)
Constant	0.00103**	0.000723**	0.000723**	0.000722	0.00124**	0.00160***	0.00103**
	(0.000336)	(0.000233)	(0.000233)	(0.000470)	(0.000447)	(0.000394)	(0.000374)
location ID FE	–	–	–	✓	✓	–	–
location ID × patron FE	–	–	–	–	–	✓	✓
5-year time FE	–	–	–	–	✓	–	–
location ID × 5-year time FE	–	–	–	–	–	✓	✓
_cons	✓	✓	✓	–	–	–	–
standard errrors	robust	ID	ID	ID	ID	ID	ID
years	1378-1526	1378-1526	1378-1526	1378-1526	1378-1526	1378-1526	1378-1526
Adjusted R2	0.00179	0.0911	0.237	0.237	0.237	0.230	0.415

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 7. New projects per capita: difference-in-difference

This table presents regression results for the difference-in-difference analysis of new project shares per capita (i.e., at the start-year level) with alternative clustering to that presented in the main text of the paper: here, the clustering is performed at the palace-location level (whereas in the main text, clustering is at the palace-location × patron-group level, corresponding to the level at which treatment is administered). The dependent variable in all specifications captures the per-capita share of new investment projects per year at a palace-site as a percent, with the demographic weight referring to the corresponding patron-group. "Patron", in the fixed effects and the clustering alike, refers to the patron-group (prelate or lay); "[location] ID" refers to the identifier assigned to a palace-site by Nolli in his map (these are sufficiently granular as to uniquely identify a palace location – one can think of them as a street address).

	(1) inv_dw	(2) inv_dw	(3) inv_dw	(4) inv_dw	(5) inv_dw	(6) inv_dw	(7) inv_dw
papal bull=1	0.00326***	0.00327***	0.00252***	0.00252***			
	(0.000737)	(0.000708)	(0.000705)	(0.000706)			
prelate patron=1	0.00160*	0.00160	0.000911	0.000912	0.000911		
	(0.000721)	(0.000884)	(0.000564)	(0.000680)	(0.000680)		
papal bull=1 × prelate patron=1	0.00635**	0.00634*	0.00666**	0.00667**	0.00665**	0.00667***	0.00528***
	(0.00240)	(0.00272)	(0.00245)	(0.00246)	(0.00246)	(0.00183)	(0.00157)
century-long project=1		-0.00380***	-0.00313***	-0.000621	-0.00531	0.00205**	-0.0756
		(0.000724)	(0.000691)	(0.000616)	(0.00287)	(0.000627)	(0.0656)
relative of reigning pope=1			2.416***	2.413***	2.414***	2.383***	1.893***
			(0.369)	(0.371)	(0.370)	(0.368)	(0.484)
has prev proj							1.035***
							(0.257)
has prev proj=1 × years since previous project							0.0294**
							(0.0107)
has prev proj=1 × years since prev project^2							-0.000135**
							(0.0000498)
has prev proj=1 × length of previous project							-0.346
							(0.504)
has prev proj=1 × prev patron prelate=0							0.393
							(0.287)
Constant	0.000532*	0.000533*	0.000533*	0.000532	0.00133**	0.00179***	0.00121***
	(0.000225)	(0.000221)	(0.000221)	(0.000458)	(0.000439)	(0.000292)	(0.000285)
location ID FE	–	–	–	✓	✓	–	–
location ID × patron FE	–	–	–	–	–	✓	✓
5-year time FE	–	–	–	–	✓	–	–
location ID × 5-year time FE	–	–	–	–	–	✓	✓
_cons	✓	✓	✓	–	–	–	–
standard errrors	robust	ID × patron	ID × patron	ID × patron	ID × patron	ID × patron	ID × patron
years	1378-1526	1378-1526	1378-1526	1378-1526	1378-1526	1378-1526	1378-1526
Adjusted R2	0.00175	0.00173	0.164	0.164	0.164	0.156	0.365

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 8. New projects per capita: difference-in-difference (with smoothing)

This table presents regression results for the difference-in-difference analysis of new project shares per capita (i.e., at the start-year level) with an alternative method to address plausible cases of measurement error. The dependent variable in all specifications captures the per-capita share of new investment projects per year at a palace-site as a percent, with the demographic weight referring to the corresponding patron-group. Projects likely recorded with measurement error (due to their perfectly round length and start- and end-dates) are uniformly smoothed over the periods during which they are active. "Patron", in the fixed effects and the clustering alike, refers to the patron-group (prelate or lay); "[location] ID" refers to the identifier assigned to a palace-site by Nolli in his map (these are sufficiently granular as to uniquely identify a palace location – one can think of them as a street address).

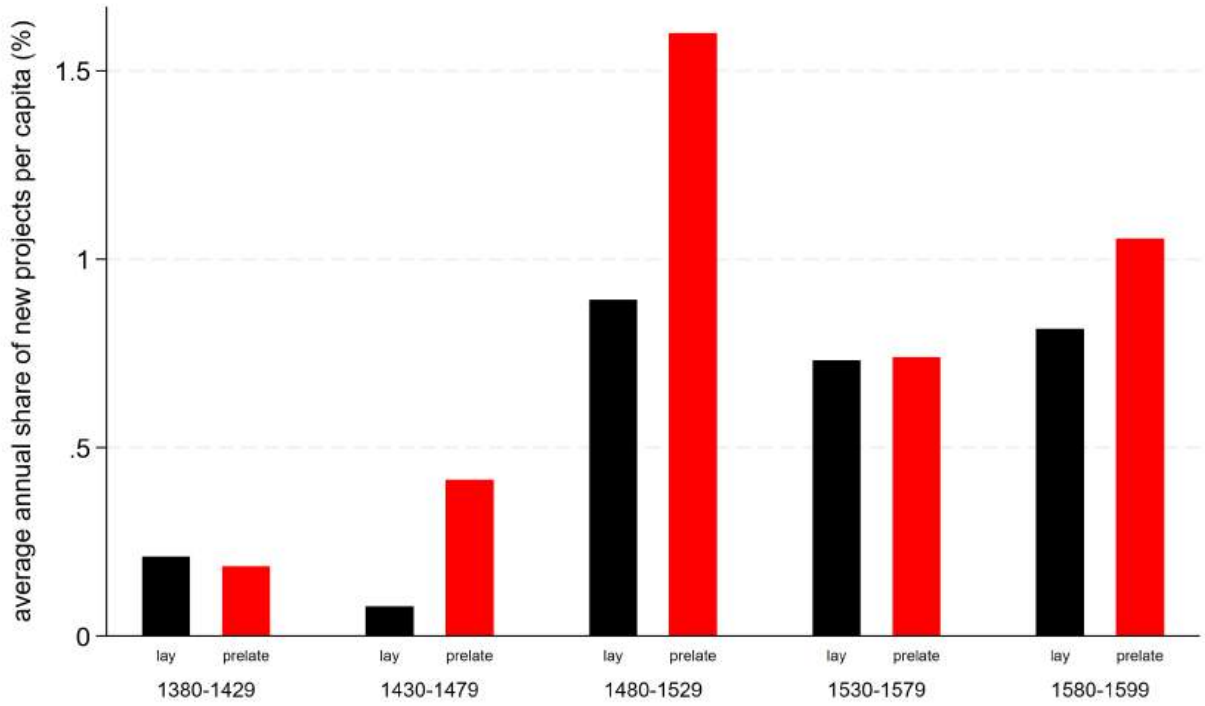


FIGURE 12. Annual average shares of new projects per-capita, by patron-type

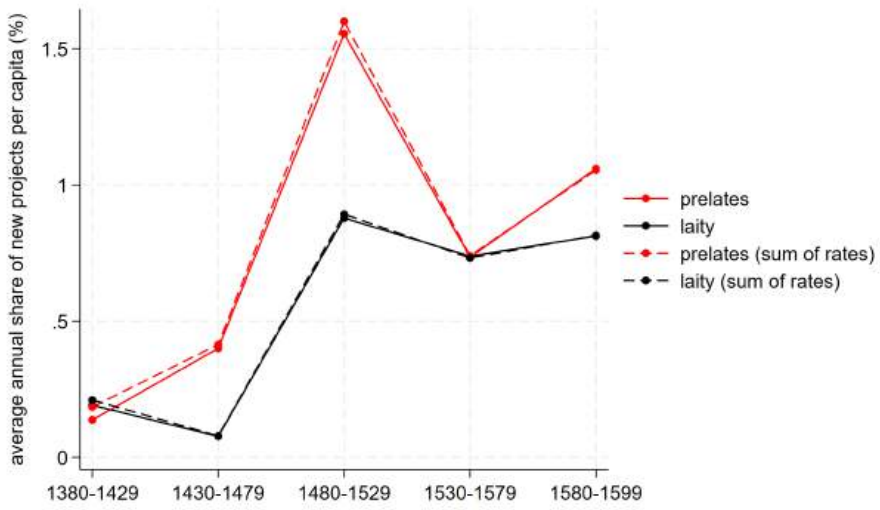


FIGURE 13. Prelate and Lay new construction per-capita rates by start year: Different measures of rates

This graph presents the occurrence of each (inheritable) new project in its start year. Each project appears only once, in the year of its inception. Weights are by population only. Two methods of constructing these investment rates are compared. The solid lines are obtained via an aggregation: in a given period the total number of projects sponsored by a patron-class is divided by the average population of the corresponding patron-class. The dashed lines take the sum of the yearly per-capita investment rates. The results are extremely similar, and are demonstrably not sensitive to the precise measuring technique used.

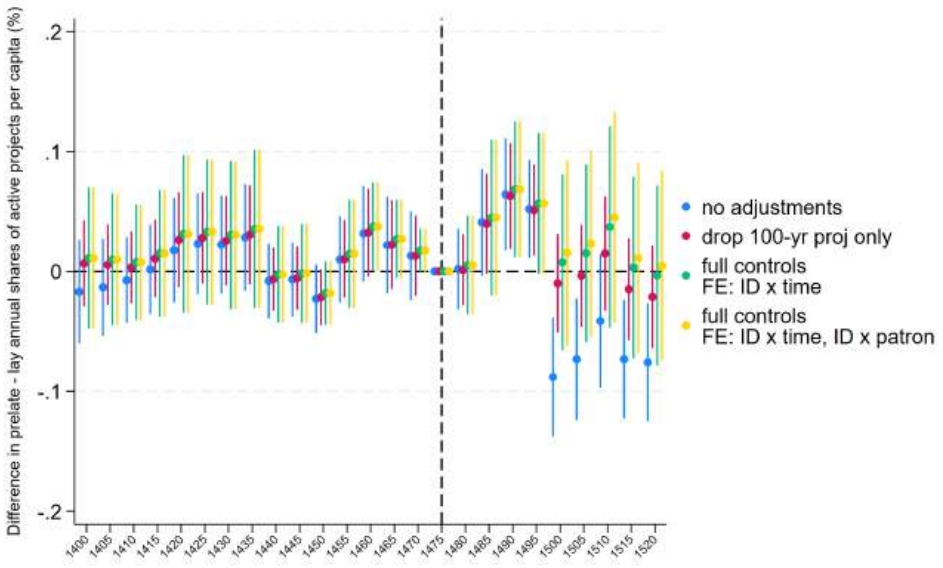


FIGURE 14. Investment per capita DiD: active projects (dropping measurement error projects)

The graph shows the dynamic difference-in-difference analysis (at half-decade levels) for active projects for the specifications in which measurement error projects are removed from the sample. See Table 9 for the corresponding regression output.

	(1)	(2)	(3)	(4)
	inv_dw	inv_dw	inv_dw	inv_dw
prelate patron	-0.0191	0.00732	0.00392	
	(0.0119)	(0.0104)	(0.0152)	
prev patron prelate			2.701***	2.685***
			(0.00855)	(0.0155)
Constant	0.0403***	0.0138**	0.0277**	0.0289**
	(0.00719)	(0.00434)	(0.00899)	(0.00894)
location × patron-type FE	–	–	–	✓
location × 5-year time FE	–	–	✓	✓
_cons	✓	✓	–	–
standard errrors	robust	robust	ID × patron	ID × patron
Adjusted R2	0.0246	0.00832	0.374	0.499

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 9. Investment per capita DiD: active projects (drop measurement error projects)

Regression output corresponding to Figure 14

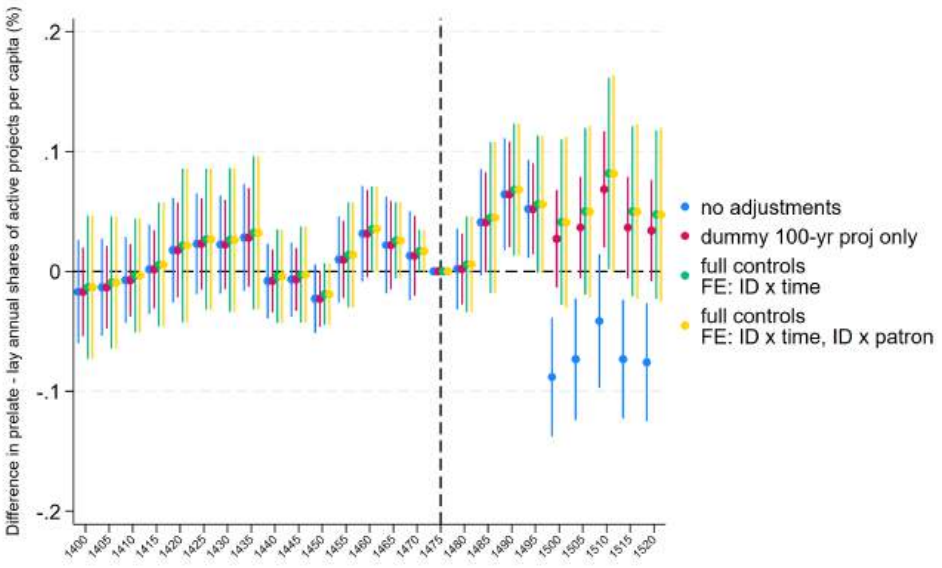


FIGURE 15. Investment per capita DiD: active projects (dummy for measurement error projects)

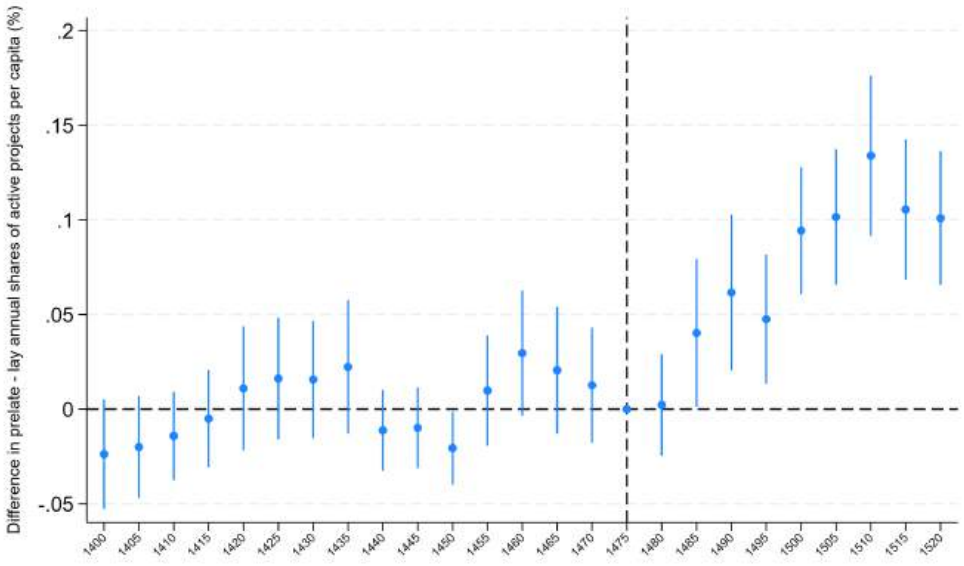
The graph shows the dynamic difference-in-difference analysis (at half-decade levels) for active projects for the specifications in which measurement error projects are accounted for via a dummy.

	(1) inv_dw	(2) inv_dw	(3) inv_dw	(4) inv_dw
prelate patron	-0.0191	0.00834	0.00682	
	(0.0119)	(0.0104)	(0.0149)	
proj_100=0		0	0	0
		(.)	(.)	(.)
proj_100=1		0.947***	1.030***	1.028***
		(0.0113)	(0.0402)	(0.0628)
prev patron prelate			2.699***	2.686***
			(0.00863)	(0.0144)
Constant	0.0403***	0.0128**	0.0220*	0.0255**
	(0.00719)	(0.00424)	(0.00937)	(0.00925)
location × patron-type FE	–	–	–	✓
location × 5-year time FE	–	–	✓	✓
_cons	✓	✓	–	–
standard errrors	robust	robust	ID × patron	ID × patron
Adjusted R2	0.0246	0.240	0.525	0.613

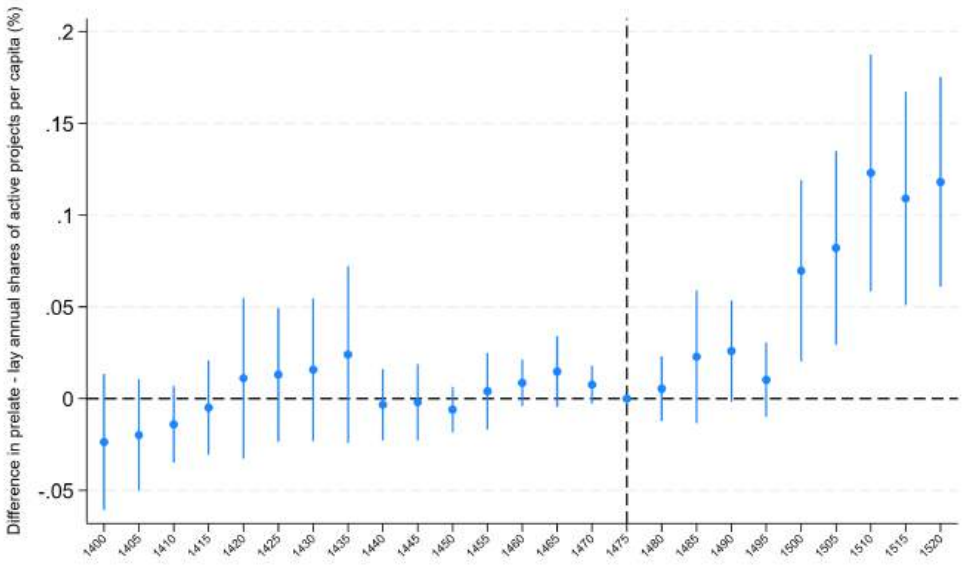
Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 10. Investment per capita DiD: active projects (dummy for measurement error projects)

Regression output corresponding to Figure 15



(a) DiD: Active Projects (Baseline)



(b) DiD: Active Projects (Full Controls)

FIGURE 16. Investment per capita DiD: active projects (with continuous project-length control)

The graph shows the dynamic difference-in-difference analysis (at half-decade levels) for active projects for the specifications in which measurement error projects are accounted for via a continuous project-length control. Corresponding regression output in Table 11.

	(1) inv_dw	(2) inv_dw	(3) inv_dw	(4) inv_dw	(5) inv_dw	(6) inv_dw	(7) inv_dw	(8) inv_dw
prelate patron	-0.0191	0.0254*	0.0160	0.0160**	0.0158***			
	(0.0119)	(0.00924)	(.)	(0.00430)	(0.00419)			
project length		0.0126***						
		(0.00103)						
has active proj			2.473	2.473***	2.442***	2.430***	2.306***	2.301***
			(.)	(0.346)	(0.342)	(0.339)	(0.312)	(0.314)
has active proj=1 × project length			-0.0283	-0.0283*	-0.0272*	-0.0273*	-0.0231*	-0.0229*
			(.)	(0.0127)	(0.0124)	(0.0119)	(0.0110)	(0.0110)
has active proj=1 × proj length^2			0.000139	0.000139	0.000130	0.000130	0.000102	0.000101
			(.)	(0.000100)	(0.0000979)	(0.0000930)	(0.0000859)	(0.0000863)
prelate population								-0.00175*
								(0.000712)
lay population								-0.00134
								(0.000801)
ln(total pop)								0.120
								(0.104)
prev patron prelate								0.432
								(0.307)
Constant	0.0403***	-0.00569	-0.00993	-0.0218**	-0.0210*	-0.0117	-0.0125	-0.402
	(0.00719)	(0.00348)	(.)	(0.00613)	(0.00817)	(0.00692)	(0.00710)	(0.405)
location FE	–	–	–	–	✓	–	–	–
location × patron-type FE	–	–	–	–	–	✓	✓	✓
5-year time FE	–	–	–	✓	✓	✓	–	–
location × 5-year time FE	–	–	–	–	–	–	✓	✓
_cons	✓	✓	✓	–	–	–	–	–
Observations	34500	34500	34500	34500	34500	34500	34500	34500
Adjusted R^2	0.025	0.453	0.821	0.821	0.837	0.850	0.904	0.905

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 11. Investment per capita DiD: active projects (continuous control for project length)

Regression output corresponding to Figure 16

	(1) inv_dw_lay	(2) inv_dw_lay	(3) inv_dw_lay	(4) inv_dw_lay	(5) inv_dw_lay	(6) inv_dw_lay
pooled per-capita investment prev. decade	-0.0200*					
	(0.00821)					
post-1480	0.00457***	-0.000221	0.00526***	-0.000159	-0.000210	
	(0.000891)	(0.00127)	(0.000824)	(0.00126)	(0.00126)	
post-1480 × pooled per-capita investment prev. decade	0.0197					
	(0.0105)					
prelate per-capita investment prev. decade		-0.0286*		-0.0286	-0.0286	-0.00663
		(0.0142)		(0.0173)	(0.0174)	(0.0202)
post-1480 × prelate per-capita investment prev. decade		0.0674***		0.0865***	0.0868***	0.120***
		(0.0164)		(0.0214)	(0.0214)	(0.0286)
lay per-capita investment prev. decade			-0.0137**	-0.0000247	-0.0000247	-0.0142
			(0.00509)	(0.00445)	(0.00445)	(0.0137)
post-1480 × lay per-capita investment prev. decade			0.00580	-0.0296**	-0.0298**	-0.0304
			(0.00826)	(0.0108)	(0.0108)	(0.0180)
Constant	0.00134**	0.00161**	0.00124**	0.00161**	0.00161**	-0.00150
	(0.000441)	(0.000572)	(0.000398)	(0.000579)	(0.000520)	(0.000943)
location FE	–	–	–	–	✓	–
location × half-century FE	–	–	–	–	–	✓
_cons	✓	✓	✓	✓	–	–
Observations	30361	30361	30361	30361	30360	30360
Adjusted R^2	0.002	0.003	0.002	0.003	0.001	0.002

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 12. Effects of previous investment for lay investment: Binary treatment (pre-vs-post) DiD; by project start-year

Clustering in all regressions is performed at the location-ID level. Notice that this is equivalent, given that the dependent variable restricts to lay projects only, to clustering by location-ID × patron-group. The first column tests for general spillovers, by considering all past investment. Columns 2 and 3 consider, separately, past prelate and past lay investment, respectively. Column 4 nests past investment by both patron groups separately in the same regression. Columns 5 and 6 repeat the test in Column 4 by adding fixed effects at different levels.

	(1) inv_dw_prel	(2) inv_dw_prel	(3) inv_dw_prel	(4) inv_dw_prel	(5) inv_dw_prel	(6) inv_dw_prel
pooled per-capita investment prev. decade	-0.0166					
	(0.0119)					
post-1480	0.00517**	0.00275	0.00287	0.00287	0.00253	
	(0.00193)	(0.00205)	(0.00205)	(0.00205)	(0.00202)	
post-1480 × pooled per-capita investment prev. decade	0.0253					
	(0.0197)					
prelate per-capita investment prev. decade		0.00202	0.0294	0.0294	0.0294	-0.00800
		(0.0299)	(0.0484)	(0.0484)	(0.0484)	(0.0531)
post-1480 × prelate per-capita investment prev. decade		0.0277	0.00656	0.00656	0.00902	0.000608
		(0.0340)	(0.0528)	(0.0528)	(0.0528)	(0.0664)
lay per-capita investment prev. decade			-0.0315	-0.0315	-0.0315	-0.00741
			(0.0234)	(0.0234)	(0.0234)	(0.0297)
post-1480 × lay per-capita investment prev. decade			0.0218	0.0218	0.0212	0.0102
			(0.0292)	(0.0292)	(0.0292)	(0.0384)
Constant	0.00242*	0.00213*	0.00203*	0.00203*	0.00203*	0.00595***
	(0.000947)	(0.000883)	(0.000871)	(0.000871)	(0.000925)	(0.00171)
location FE	–	–	–	–	✓	–
location × half-century FE	–	–	–	–	–	✓
_cons	✓	✓	✓	✓	–	–
Observations	30361	30361	30361	30361	30360	30360
Adjusted R^2	0.001	0.001	0.001	0.001	0.003	0.008

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 13. Effects of previous investment for prelate investment: Binary treatment (pre-vs-post) DiD; by project start-year

Clustering in all regressions is performed at the location-ID level. Notice that this is equivalent, given that the dependent variable restricts to prelate projects only, to clustering by location-ID × patron-group. The first column tests for general spillovers, by considering all past investment. Columns 2 and 3 consider, separately, past prelate and past lay investment, respectively. Column 4 nests past investment by both patron groups separately in the same regression. Columns 5 and 6 repeat the test in Column 4 by adding fixed effects at different levels.

	(1) inv_dw_lay	(2) inv_dw_lay	(3) inv_dw_lay	(4) inv_dw_lay	(5) inv_dw_lay	(6) inv_dw_lay
pooled per-capita investment prev. decade	0.0343**					
	(0.0125)					
post-1480	0.0356***	0.0000127	0.0472***	0.00219	0.00218	
	(0.0100)	(0.0120)	(0.01000)	(0.0129)	(0.0129)	
post-1480 × pooled per-capita investment prev. decade	0.0202					
	(0.0218)					
prelate per-capita investment prev. decade		0.0287**		-0.00367	-0.00367	-0.00218
		(0.0109)		(0.00496)	(0.00496)	(0.0186)
post-1480 × prelate per-capita investment prev. decade		0.0881**		0.0985***	0.0985***	0.144***
		(0.0314)		(0.0217)	(0.0217)	(0.0324)
lay per-capita investment prev. decade			0.0313**	0.0337**	0.0337**	0.0335**
			(0.0114)	(0.0123)	(0.0123)	(0.0127)
post-1480 × lay per-capita investment prev. decade			0.00998	-0.0206	-0.0206	-0.0450***
			(0.0184)	(0.0165)	(0.0165)	(0.0132)
Constant	0.0241**	0.0291**	0.0240**	0.0241**	0.0241*	0.0243
	(0.00893)	(0.0106)	(0.00887)	(0.00888)	(0.0109)	(0.0145)
location FE	–	–	–	–	✓	–
location × half-century FE	–	–	–	–	–	✓
_cons	✓	✓	✓	✓	–	–
Observations	30361	30361	30361	30361	30360	30360
Adjusted R^2	0.055	0.058	0.054	0.059	0.338	0.688

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 14. Effects of previous investment for lay investment: Binary treatment (pre-vs-post) DiD; by project active-year

Clustering in all regressions is performed at the location-ID level. Notice that this is equivalent, given that the dependent variable restricts to lay projects only, to clustering by location-ID × patron-group. The first column tests for general spillovers, by considering all past investment. Columns 2 and 3 consider, separately, past prelate and past lay investment, respectively. Column 4 nests past investment by both patron groups separately in the same regression. Columns 5 and 6 repeat the test in Column 4 by adding fixed effects at different levels.

	(1) inv_dw_prel	(2) inv_dw_prel	(3) inv_dw_prel	(4) inv_dw_prel	(5) inv_dw_prel	(6) inv_dw_prel
pooled per-capita investment prev. decade	0.0353					
	(0.0186)					
post-1480	0.0545*	0.0235	0.0313	0.0313	0.0311	
	(0.0246)	(0.0266)	(0.0265)	(0.0265)	(0.0265)	
post-1480 × pooled per-capita investment prev. decade	-0.0275					
	(0.0239)					
prelate per-capita investment prev. decade		0.0284	-0.00524	-0.00524	-0.00524	-0.00541
		(0.0204)	(0.0271)	(0.0271)	(0.0271)	(0.0502)
post-1480 × prelate per-capita investment prev. decade		0.00804	0.0619	0.0619	0.0625	0.0544
		(0.0356)	(0.0418)	(0.0418)	(0.0418)	(0.0602)
lay per-capita investment prev. decade			0.0350	0.0350	0.0350	0.0351
			(0.0214)	(0.0214)	(0.0214)	(0.0223)
post-1480 × lay per-capita investment prev. decade			-0.0472	-0.0472	-0.0474	-0.0404
			(0.0247)	(0.0247)	(0.0247)	(0.0242)
Constant	0.0131*	0.0186*	0.0134*	0.0134*	0.0134	0.0276
	(0.00635)	(0.00893)	(0.00638)	(0.00638)	(0.0116)	(0.0191)
location FE	–	–	–	–	✓	–
location × half-century FE	–	–	–	–	–	✓
_cons	✓	✓	✓	✓	–	–
Observations	30361	30361	30361	30361	30360	30360
Adjusted R^2	0.006	0.006	0.007	0.007	0.187	0.476

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 15. Effects of previous investment for prelate investment: Binary treatment (pre-vs-post) DiD; by project active-year

Clustering in all regressions is performed at the location-ID level. Notice that this is equivalent, given that the dependent variable restricts to prelate projects only, to clustering by location-ID × patron-group. The first column tests for general spillovers, by considering all past investment. Columns 2 and 3 consider, separately, past prelate and past lay investment, respectively. Column 4 nests past investment by both patron groups separately in the same regression. Columns 5 and 6 repeat the test in Column 4 by adding fixed effects at different levels.

	(1) inv_dw_lay	(2) inv_dw_lay	(3) inv_dw_prel	(4) inv_dw_prel
prelate per-capita investment prev. decade	-0.0299	-0.0299	-0.0874	-0.0874
	(0.0214)	(0.0214)	(0.0605)	(0.0605)
1380-1429	0.00109	0.00109	-0.00144	-0.00144
	(0.00100)	(0.00100)	(0.00217)	(0.00217)
1430-1479	0	0	0	0
	(.)	(.)	(.)	(.)
1480-1529	-0.0168***	-0.0168***	0.00738	0.00738
	(0.00285)	(0.00285)	(0.00739)	(0.00739)
1530-1579	0.000413	0.000814	-0.00220	-0.00285
	(0.00221)	(0.00218)	(0.00369)	(0.00363)
1580-1599	0.00736	0.00736	-0.00382	-0.00382
	(0.00582)	(0.00582)	(0.0163)	(0.0163)
1380-1429 × prelate per-capita investment prev. decade	-0.156*	-0.156*	-0.535*	-0.535*
	(0.0732)	(0.0732)	(0.256)	(0.256)
1480-1529 × prelate per-capita investment prev. decade	0.200***	0.200***	0.0958	0.0958
	(0.0327)	(0.0327)	(0.0785)	(0.0785)
1530-1579 × prelate per-capita investment prev. decade	0.0506	0.0488	0.0799	0.107
	(0.0511)	(0.0511)	(0.0987)	(0.0949)
1580-1599 × prelate per-capita investment prev. decade	-0.0511	-0.0511	-0.0999	-0.0999
	(0.0339)	(0.0339)	(0.0723)	(0.0723)
lay per-capita investment prev. decade	0.0783	0.0783	0.309*	0.309*
	(0.0432)	(0.0432)	(0.152)	(0.152)
1480-1529 × lay per-capita investment prev. decade	-0.137**	-0.137**	-0.312*	-0.312*
	(0.0442)	(0.0442)	(0.156)	(0.156)
1530-1579 × lay per-capita investment prev. decade	-0.0342	-0.0404	-0.228	-0.250
	(0.0756)	(0.0754)	(0.190)	(0.189)
Constant	0.000820	0.000820	0.00312	0.00312
	(0.000633)	(0.000661)	(0.00192)	(0.00173)
location FE	–	✓	–	✓
_cons	✓	–	✓	–
Observations	30361	30360	30361	30360
Adjusted R^2	0.006	0.004	0.001	0.003

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 16. Effects of previous investment: Dynamic DiD; by project start-year

Clustering in all regressions is performed at the palace-ID level. 1430-1479 is the omitted category. The interactions for 1380-1429 and 1580-1599 × lay per-capita investment prev. decade is omitted due to colinearity (driven by very scarce investment in pre-1430 and the artificially-constrained bin-size in 1580-1599). It is not omitted in the active-year regression result in Table 17. (Pure time effects are insignificant for prelate investment due to data paucity: restricting to prelate-only construction makes the data too full of zeroes for statistical power to emerge.)

	(1) inv_dw_lay	(2) inv_dw_lay	(3) inv_dw_prel	(4) inv_dw_prel
prelate per-capita investment prev. decade	-0.00246	-0.00246	-0.0217	-0.0217
	(0.0122)	(0.0122)	(0.0403)	(0.0403)
1380-1429	-0.0000910	-0.0000910	0.117	0.117
	(0.0716)	(0.0716)	(0.220)	(0.220)
1430-1479	0	0	0	0
	(.)	(.)	(.)	(.)
1480-1529	-0.0652	-0.0652	0.137	0.137
	(0.0615)	(0.0615)	(0.215)	(0.215)
1530-1579	0.0435	0.0427	0.293	0.294
	(0.116)	(0.116)	(0.242)	(0.242)
1580-1599	0.118	0.118	-0.00588	-0.00588
	(0.346)	(0.346)	(1.234)	(1.234)
1380-1429 × prelate per-capita investment prev. decade	0.0541**	0.0541**	0.468	0.468
	(0.0198)	(0.0198)	(0.274)	(0.274)
1480-1529 × prelate per-capita investment prev. decade	0.259***	0.259***	0.101	0.101
	(0.0527)	(0.0527)	(0.0708)	(0.0708)
1530-1579 × prelate per-capita investment prev. decade	0.0101	0.00982	0.0386	0.0399
	(0.0193)	(0.0193)	(0.0460)	(0.0459)
1580-1599 × prelate per-capita investment prev. decade	-0.0465	-0.0465	-0.246	-0.246
	(0.166)	(0.166)	(0.622)	(0.622)
lay per-capita investment prev. decade	0.0318	0.0318	0.240	0.240
	(0.0990)	(0.0990)	(0.344)	(0.344)
1380-1429 × lay per-capita investment prev. decade	-0.0277	-0.0277	-0.453	-0.453
	(0.0981)	(0.0981)	(0.465)	(0.465)
1480-1529 × lay per-capita investment prev. decade	-0.0893	-0.0893	-0.256	-0.256
	(0.101)	(0.101)	(0.345)	(0.345)
1530-1579 × lay per-capita investment prev. decade	0.00640	0.00678	-0.294	-0.295
	(0.107)	(0.107)	(0.347)	(0.347)
Constant	0.0243	0.0243	-0.104	-0.104
	(0.0681)	(0.0690)	(0.212)	(0.216)
location FE	–	✓	–	✓
_cons	✓	–	✓	–
Observations	30361	30360	30361	30360
Adjusted R^2	0.065	0.344	0.008	0.188

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 17. Effects of previous investment: Dynamic DiD; by project active-year

Clustering in all regressions is performed at the palace-ID level. 1430-1479 is the omitted category.

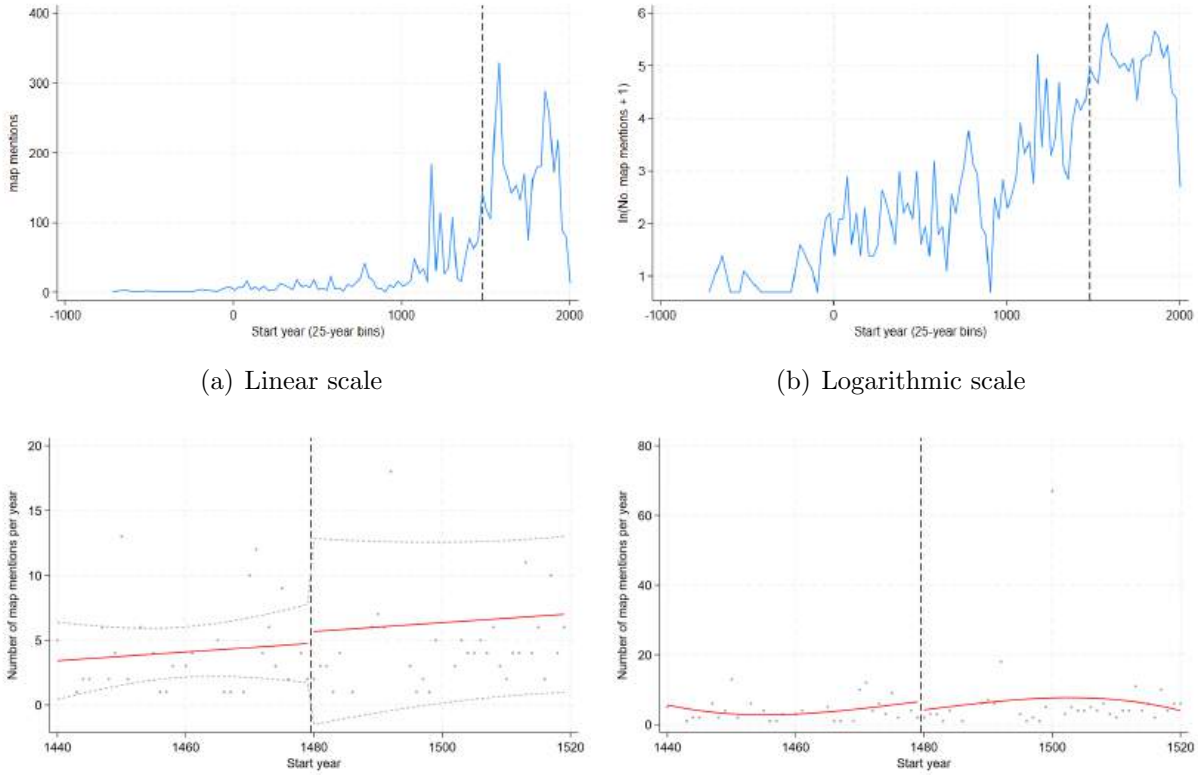
	Investment (all)						Investment (lay)	
	(1) inv_dw	(2) inv_dw	(3) inv_dw	(4) inv_dw	(5) inv_dw	(6) inv_dw	(7) inv_dw	(8) inv_dw
post-1480		0.005***		0.006***		0.005***		0.005***
		(0.001)		(0.001)		(0.001)		(0.001)
endogenous absence	-0.004***	-0.001						
	(0.001)	(0.001)						
endogenous× post-1480		0.000						
		(.)						
antipope					-0.004***	-0.000	-0.003***	0.001
					(0.001)	(0.001)	(0.001)	(0.001)
antipope × post-1480						0.000		0.000
						(.)		(.)
papal absence			-0.004***	-0.001		-0.001		-0.001
			(0.001)	(0.001)		(0.001)		(0.001)
absence × post-1480				-0.003		-0.003		-0.002
				(0.002)		(0.002)		(0.002)
Constant	0.005***	0.002**	0.005***	0.002**	0.006***	0.002	0.004***	0.001
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
N	61,274	61,274	61,274	61,274	61,274	61,274	30,637	30,637
Adjusted R2	0.000	0.001	0.000	0.001	0.000	0.001	0.001	0.002
Years antipopes 1378-1479	-	-	-	-	58	58	58	58
Years antipopes 1480-1599	-	-	-	-	0	0	0	0
Years absent 1378-1479	22	22	23	23	-	23	-	23
Years absent 1480-1599	0	0	5	5	-	5	-	5

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 18. The effect of periods of contested rule on per-capita investment

Papal absences include all noteworthy stays of the pope outside Rome, due, for instance, to political exile or assassination attempts. "Endogenous papal absences" isolate the absences plausibly interpretable as signals of the pope's waning willingness to remain in Rome. The variable "antipope" measures whether the (Roman) pope's authority is contested in a particular year by a rival claim to his office – that is, by the existence of an antipope elsewhere. Regressions are run at the year-level, with each observation corresponding to a palace-location pair. All clustering is performed at the palace-ID level. For the effects of papal absences on investment, see Table 3.



(a) Linear scale

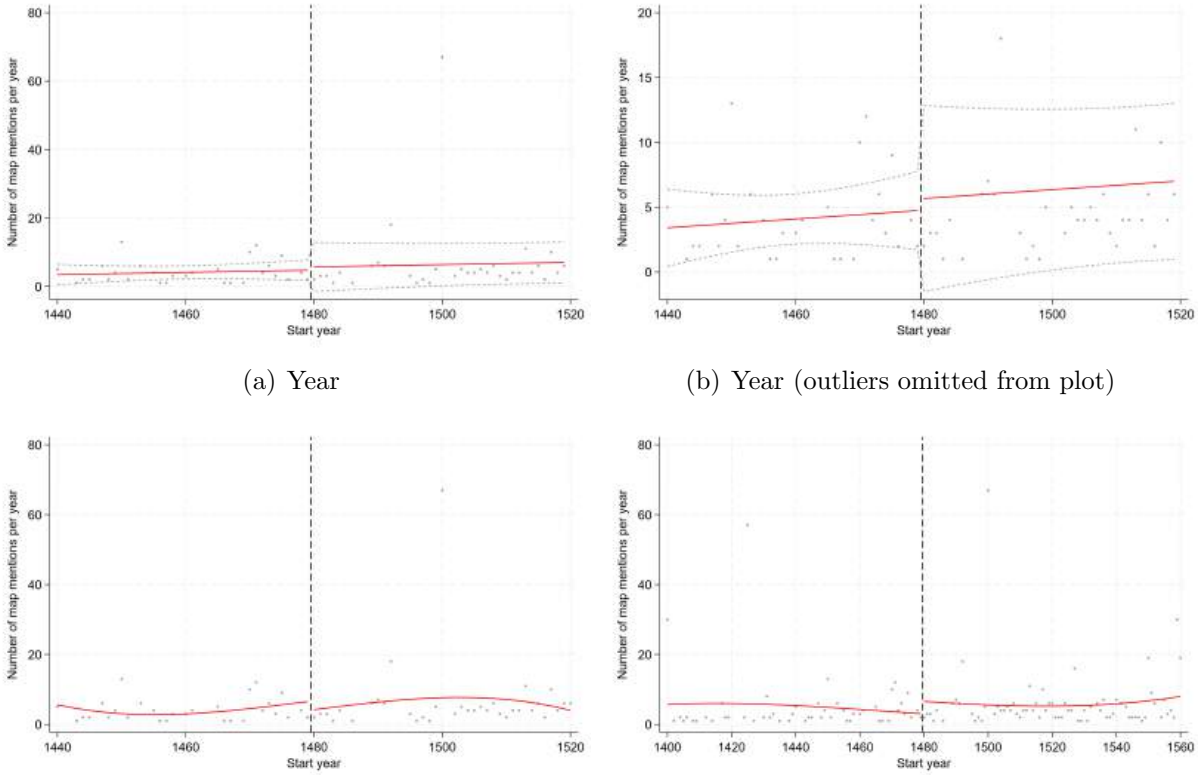
(b) Logarithmic scale

(c) Linear fit (outliers omitted from graph)

(d) Polynomial fit

FIGURE 17. Map Mentions

The first two figures present the summary statistics for all data available in the digitized Nolli Map. In particular, the graphs display the total number of events (unconditional on type) mentioned whose start is in a given 25-year bin. The bottom two figures are the results of a placebo RDD design, with linear and polynomial specifications respectively. To make the graph easier to read, the linear plot omits visual outliers (though these are retained in the regression used to generate the plot). Where indicated, I omit outliers (years with more than 20 map mentions) from the plot to make the graph more visually informative. There are 7 such years between 1378 and 1599, of which only one falls between 1440 and 1520. They are retained in the quantitative analysis leading to the generation of the graphs.



(a) Year

(b) Year (outliers omitted from plot)

(c) Polynomial fit (1440-1520)

(d) Polynomial fit (1400-1560)

FIGURE 18. Survivorship bias robustness check: placebo RDDs to test for data discontinuities.

These figures provide the plots for additional RDD specifications (see Table 19 for the corresponding table.

	(1) mentions	(2) mentions	(3) mentions	(4) mentions	(5) ln(mentions + 1)	(6) ln(mentions + 1)
Start year (decade)	0.0914*					
	(0.0449)					
papal bull	-1.432	0.905	-2.584	3.551	-0.182	-0.343
	(1.930)	(2.811)	(2.548)	(3.622)	(0.295)	(0.316)
Start year		0.0339	-921.0	51.59	0.00939	-44.48
		(0.0369)	(983.7)	(92.72)	(0.00535)	(60.66)
Start year^2			0.623	-0.0352		0.0300
			(0.666)	(0.0626)		(0.0410)
Start year^3			-0.000140	0.00000800		-0.00000674
			(0.000150)	(0.0000141)		(0.00000924)
Constant	-128.9	-45.41	453830.0	-25156.5	-12.26	21977.5
	(65.36)	(53.82)	(484652.9)	(45713.9)	(7.808)	(29907.8)
Time	1440-1519	1440-1519	1440-1520	1400-1560	1440-1520	1440-1520
N	63	63	64	124	64	64
R^2	0.0328	0.0201	0.0371	0.0123	0.0563	0.0647
Adj. R^2	0.000611	-0.0125	-0.0282	-0.0209	0.0254	0.00124

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 19. Placebo RDD to test for overall data discontinuity in 1480

The corresponding coefficient plots for the time dummies are found in Figures 17 and 18. The variable "mentions" counts the number of map mentions of any kind of project or event having a given start-year. All standard errors are heteroskedasticity-robust. The reason for excluding 1520 from the first regression is purely mechanical: it falls into the next decade and would be the unique observation in that decade. This data-point is included in the subsequent regressions (where the time-variable is measured on a yearly, rather than decade, basis) to show that there is nothing remarkable about it.