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RELIGIOUS FESTIVALS AND ECONOMIC DEVELOPMENT: EVIDENCE FROM CATHOLIC SAINT DAY FESTIVALS IN MEXICO

Eduardo Montero
Dean Yang

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ABSTRACT

Societies worldwide spend substantial resources celebrating religious festivals. How do festivals influence economic and social outcomes? We study Catholic patron saint day festivals in Mexico, exploiting two features of the setting: (i) municipal festival dates vary across the calendar and were determined in the early history of towns after Spanish conquest, and (ii) there is considerable variation in the intra-annual timing of agricultural seasons. We compare municipalities with "agriculturally-coinciding" festivals (those that coincide with peak planting or harvest months) to other municipalities, examining differences in long-run economic development and social outcomes. Agriculturally-coinciding festivals have negative effects on household income and other development outcomes. They also lead to lower agricultural productivity and higher share of the labor force in agriculture, consistent with agriculturally-coinciding festivals inhibiting the structural transformation of the economy. Agriculturally-coinciding festivals also lead to higher religiosity and social capital, potentially explaining why such festivals persist in spite of their negative growth consequences.

Eduardo Montero
Ford School of Public Policy
University of Michigan
735 S. State Street
Ann Arbor, MI 48109
and NBER
emontero@umich.edu

Dean Yang
University of Michigan
Department of Economics and
Gerald R. Ford School of Public Policy
735 S. State Street, Room 3316
Ann Arbor, MI 48109
and NBER
deanyang@umich.edu

An appendix is available at http://www.nber.org/data-appendix/w28821

1. Introduction

Religious festivals are prominent features of social life worldwide, and often account for substantial expenditures in even the poorest societies (Banerjee and Duflo, 2011). What impacts do religious festivals have on long-run economic development? Religious festivals may promote economic development, for example if they foster the development of social capital, enhance voluntary public good provision, or raise levels of trust in society (Putnam, 2000, McCleary and Barro, 2006a). On the other hand, devoting substantial resources and time to religious festivals may be detrimental to long-run economic growth if such devotion crowds out growth-stimulating investments (Barro and McCleary, 2003).

Well-identified, causal estimates of the long-run impacts of religious practices have been difficult to obtain. This is because religious festivals are not generally assigned exogenously across geographic areas. The timing and features of religious festivals could be directly affected by economic development itself, or by other omitted variables that also affect development. Festival characteristics could be chosen (or could evolve endogenously) to maximize positive effects or minimize negative effects on economic development. Additionally, religious festivals often affect an entire country at once, making it difficult to exploit within-country variation in festival characteristics. These challenges have led to an absence of causally well-identified evidence on how religious festivals impact long-run economic development.

In this paper, we make progress on a piece of the puzzle of religion's impact on society by studying religious festivals that were introduced by European conquerors. Many developing countries had religious festivals imposed on them by colonial powers, replacing endogenously-developed local religious traditions (Henrich, 2020). We investigate a particular religious practice in Mexico: patron saint day festivals. In Mexico and many other Roman Catholic countries, towns and cities celebrate the "patron saint day" of a particular saint or other holy figure that has been historically associated with the town. Hundreds of such celebrated figures have their saint day festivals that are spread throughout the calendar year, on dates set by the Catholic hierarchy in the Vatican.[1] These saint day festivals are typically local public holidays, and involve substantial financial expenditures by local households and governments. In Mexico and most

[1] For example, towns whose patron saint is St. Arcadius (in Spanish, *Arcadio*) have their festival on January 12, while those with St. Fructus (in Spanish, *Fructuoso*) as their patron celebrate on October 25. For a fascinating exploration of the determinants of the number and geographic origins of Catholic saints since 1590, see Barro and McCleary (2016).

of Latin America, patron saints were typically established at the time of a town's founding by Spanish colonizers, often centuries ago, and remained set thereafter.

To examine how religious festivals affect economic development, we take advantage of two features of the setting. First, festival dates vary greatly across localities, and were determined in the early history of towns following Spanish conquest. Second, the intra-annual timing of the main agricultural planting and harvest times varies tremendously across localities. This means that, for some municipalities, the saint day festival coincides with the planting or harvest season, whereas in other municipalities there is no such coincidence.

We exploit this variation in festival timing, comparing municipalities where the festival coincides with the planting or harvest season to municipalities where they do not coincide, to examine impacts on economic development and social outcomes. We hypothesize that festivals that coincide with the planting or harvest seasons ("agriculturally-coinciding", or just "coinciding" festivals) negatively affect long-run development outcomes. During the planting and harvest seasons, households need to undertake investments and expenditures for agriculture. If households are liquidity-constrained, festival expenditures in these key time periods may crowd out agricultural investments. In the planting season, festival expenditures reduce funds available for investment in agriculture (e.g., in land preparation, fertilizer, and seeds). Festivals occurring during harvest times reduce households' total harvest income by requiring them to sell crops during peak harvest times, when crop prices are low (Burke et al., 2019). Harvest festivals therefore reduce the realized value of harvested crops, as well as savings and investment for the next planting season. Coinciding festivals thereby lead to lower agricultural productivity. Lower agricultural productivity impedes the structural transformation of the economy from agriculture to manufacturing and services, hampering long-run economic development.

To conduct our analysis, we created a new dataset of patron saint day festival dates for Mexican municipalities, assembling data from online data sources and phone interviews with municipality officials. We combine these data with data on locally-specific optimal planting and harvest dates to determine whether festivals occur during local planting or harvest periods. We then use numerous data sources from the Mexican government to explore municipality-level development outcomes in the present day.

The main identification assumption of our cross-sectional analysis is that the coincidence of a locality's festival date and the timing of its agricultural seasons is exogenous. This is a different and more plausible assumption than assuming festival dates are exogenous. While the history of saint day festival determination in Mexico is consistent with our main identification assumption, we present a number of empirical tests to examine whether this assumption is plausible, particularly after controlling for state fixed effects and exploiting only cross-town variation within Mexican states. First, we demonstrate that municipalities in Mexico show no tendency to have festivals occur away from planting or harvest periods. This helps rule out an important endogeneity concern, that municipalities intentionally choose the timing of festivals to avoid planting or harvest times. If this were occurring differentially for municipalities with certain characteristics, it would raise concerns about selection bias. Second, we show that the propensity to have a festival coincide with planting or harvest is not associated with important geographic and historical characteristics that may affect development. These tests provide evidence that the coincidence between a town's festival date and the timing of its agricultural season is plausibly exogenous, and can be used to examine the impacts of festival timing on economic development.

We first investigate the impact of agriculturally-coinciding festivals on development outcomes in the long run. We find that municipalities with agriculturally-coinciding festivals have lower household income, and also score worse on an index of economic development constructed from Mexican Census outcomes. These results are consistent with the hypothesis that religious festivals crowd out investments when they coincide with key agricultural periods.

In additional analyses, we explore potential mechanisms behind our results. We provide evidence that the long-run negative impacts of coinciding festivals occur due to negative impacts on the agricultural sector. Locations with coinciding festivals are less productive in agriculture. They have also experienced less structural transformation: they have higher shares of the labor force in agriculture, and lower shares in manufacturing and services. This latter finding is telling, given that improvements in agricultural productivity and the subsequent transition from agriculture towards the modern sectors is one of the most prominent features of the economic development process (Caselli, 2005, Herrendorf et al., 2014).

Further, we provide evidence that helps explain why planting and harvest festivals continue to persist, even given their negative impacts on economic outcomes: they lead to higher religiosity and social capital. We use detailed survey data from the Americasbarometer from 2008 to 2018 and examine a variety of measures of religiosity and social capital. We find that municipalities with coinciding festivals have higher religious group participation and higher propensity to say that religion is important in one's life. Higher religiosity may lead to greater adherence to religious customs and traditions, including the celebration and timing of festivals, explaining why coinciding festivals are not changed even if they have negative development consequences. There may thus exist a self-reinforcing cycle in which coinciding festivals reduce development, but raise religiosity, and the increased religiosity helps coinciding festivals persist.

We also find that areas with coinciding festivals have lower income inequality. Lower income inequality may be a consequence of the negative development impact of coinciding festivals. This equity-efficiency trade-off is consistent with Mexican localities being on the initial development stage (left hand side) of the Kuznets curve (e.g. Kuznets, 1955, Robinson and Acemoglu, 2002).

The paper contributes to several literatures. First, we contribute to the literature on the impact of religion on economic development (see Iyer, 2016 and McCleary and Barro, 2006a, 2019 for reviews), which is part of a broader literature on culture and development (see reviews by Guiso et al., 2006 and Nunn, 2012). Prior work has found a negative correlation between religious behavior (e.g., attendance at religious services) and economic growth in cross-country comparisons (Barro and McCleary, 2003), and that individuals' religious beliefs are associated with attitudes conducive to economic growth (Guiso et al., 2003).[2] Our work is part of a more recent literature studying the impact of specific religious practices, with a strong focus on identifying causal effects. Campante and Yanagizawa-Drott (2015) exploit exogenous differences in the length of Ramadan fasting across countries and time due to the rotating Islamic calendar, finding that longer Ramadan fasting has short-run negative impacts on economic growth in Muslim countries.[3] Bryan et al. (2021) study the impacts of randomly-assigned Christian values education on labor market outcomes in the Philippines. Auriol et al. (2020) carry out experimental games to explore the interaction between religiosity and insurance choices in Ghana. Relative to this more recent body of work, our paper is distinct in that we examine: 1) impacts of religious festivals using plausibly exogenous historical and geographic variation, and 2) long-run (rather than short-run) impacts on economic development outcomes.

Second, we contribute to the large social science literature on the impacts of religious practices on religiosity and social capital. Prior research has argued that religious practices have social

[2] Alesina et al. (2020) study differences in inter-generational mobility within geographic regions across religious groups in Africa.

[3] Similarly, Stifel et al. (2011) explore the impacts of work-day taboos on agricultural outcomes in Madagascar, while Beam and Shrestha (2020) exploit differences in the importance of various Chinese Zodiac calendar years to examine impacts on fertility choices of ethnic Chinese in Malaysia.

capital benefits (e.g. Putnam, 2000, Deaton and Stone, 2003, Lim and Putnam, 2010). Clingingsmith et al. (2009) estimate the impact of the Muslim Hajj pilgrimage by examining visa lottery applicants in Pakistan, and find that pilgrimage increases religiosity and cultural values. These social capital benefits of religion are often cited as a potential reason for their persistence despite their effects on economic growth (Bentzen, 2019). Campante and Yanagizawa-Drott (2015) find that longer Ramadan fasting has positive impact on subjective well-being despite negative effects on economic growth. We contribute to this literature with evidence that a religious practice with negative economic effects, agriculturally-coinciding festivals, may nonetheless persist because of its positive impacts on religiosity.

Finally, we contribute to the literature on the comparative development of Latin America. Scholars have posited many reasons for Latin America's relatively poor long-run development path, including differences in factor endowments (Engerman and Sokoloff, 2002); the prevalence of colonial extractive institutions (e.g. Acemoglu et al., 2001, Acemoglu and Robinson, 2012, Dell, 2010); the high incidence of disease and use of labor coercion during Spanish colonial rule (Sellers and Alix-Garcia, 2018); missionary presence (e.g. Valencia Caicedo, 2019, Waldinger, 2017); and the negative consequences of the dismantling of local pre-colonial institutions (e.g. Diaz-Cayeros, 2011, Diaz-Cayeros and Jha, 2016). However, while the Catholic religion is a central part of many people's lives in Latin America, its economic consequences remain understudied. While we cannot say whether the prominence of Catholicism in Latin America explains its development performance compared to other world regions, we do shed light on the economic impacts of variation in an important element of Catholic religious life, patron saint day festivals.

Our findings concord with those of anthropologists who have highlighted potential negative impacts of saint day festivals on development. Harris (1964) argued that these festivals involved "enormous economic burdens" and "irrational uneconomic" behaviors that impeded development in Latin America, and Greenberg (1981, pg. 153-158) notes that the consequences of festivals for development depended on the exact timing of festival expenditures vis-a-vis the agricultural calendar.

The paper is organized as follows. Section 2 presents a conceptual framework linking festival timing with economic development. Section 3 provides background on Catholic saint day festivals in Mexico, their cultural and economic importance, and how they were chosen. Section 4 describes the data, and Section 5 describes the empirical strategy and tests the main identifying assumptions. Section 6 presents our primary empirical analyses. Section 7 explores the mechanisms underlying the main findings. Section 8 explores the impact of festivals on religiosity, social capital, and inequality. Section 9 concludes.

2. Conceptual Framework

We first consider theoretically how festivals occurring at different times of the year might affect long-run development. The overall argument is as follows. Some festivals occur in periods that have other high-return and time-sensitive investment opportunities. Given our interest in long-run development processes, and the fact that the vast majority of our locations historically began as agricultural areas, we focus on key time periods when there are high-return, time-sensitive agricultural investment opportunities: the planting and harvest periods. Festivals require expenditures, and because of liquidity constraints, an "agriculturally-coinciding" (or simply "coinciding") festival crowds out agricultural investments. Because festival timing is persistent, coinciding festivals lead to long-run reductions in agricultural productivity. Persistently lower agricultural productivity hinders the structural transformation out of agriculture and long-run economic growth. Agriculturally-coinciding festivals could persist in the long run, despite their development consequences, if they also lead to higher religiosity. This could occur via two mechanisms. First, coinciding festivals may be a costlier signal of religious devotion, so areas with coinciding festivals could develop higher religiosity. Second, lower development also slows the secularization process, leading to higher religiosity. Increased religiosity can lead to resistance to changing religious traditions, including the celebration and timing of religious festivals. This can constitute a self-reinforcing cycle in which coinciding festivals persist due to higher religiosity, in spite of their negative economic consequences. Areas with coinciding festivals end up with lower levels of economic development in the long run.

2.1. Planting and Harvest Investment Opportunities

Agricultural production is seasonal, with distinct planting and harvest seasons. Planting and harvest seasons are locally-specific: they vary across localities due to climatic and geographic variation, but are common to households in the same locality. In these key seasons, households have the opportunity to undertake high-return investments, but face liquidity constraints that may limit their ability to take advantage of them.

In the planting season, there are high returns to investing in agricultural inputs such as fertilizer and seeds, as well as devoting intensive labor time to planting activities. A large literature in development economics documents the importance of liquidity and financial constraints in developing countries in general, and in agriculture specifically.[4]

Investments in the planting season are realized in the harvest season, some months later. Households in the same locality harvest simultaneously, leading to an outward shift in the local supply of crops. Markets are incompletely spatially integrated, so high local harvest-period supply leads to lower local crop prices. Gibson (1964) documents that this intra-annual maize price variation – with dramatic price declines at harvest time – was prominent in colonial Mexico owing to high transport costs between localities. This crop-price seasonality creates a high-return investment opportunity in the harvest period: delaying sale of harvested crops until later months when prices are higher. Households can take advantage of this investment opportunity by storing (not consuming) harvested crops, using savings or credit for household consumption during peak harvest months. Savings or credit constraints may limit the ability to take advantage of this harvest-period investment opportunity (Burke et al., 2019, Augenblick et al., 2021).

2.2. *Agriculturally-Coinciding Festivals*

Religious festivals are costly, but yield religious and possibly material benefits. Prior research has emphasized that costly signals of religious devotion can screen out less-devoted community members, raising religious participation rates among the remainder (Iannaccone, 1992, Berman, 2000, Campante and Yanagizawa-Drott, 2015) and improving productive cooperation among adherents (Levy and Razin, 2014). Contributing to and participating in religious festivals can be seen as just such a costly signal of religiosity.

Festivals are locally-specific, celebrated by entire localities at once, but their specific timing on the calendar varies across localities. Because festivals happen at a particular point in calendar time, agriculturally-coinciding festivals can be particularly costly, as they affect liquidity-constrained households' ability to take advantage of other investment opportunities. Planting festivals divert resources and labor time from agricultural investments and activities. Harvest festivals lead households to sell more of their crops at times when crop prices are unusually low (to get access to funds for festival expenditures), reducing their ability to take advantage of

[4]See Besley (1995) and Karlan and Morduch (2010) for reviews.

storage and delayed crop sale.[5] The realized value of agricultural income is lower as a result, and fewer resources are available to save and invest in the next planting season. Negative economic consequences of Mexican saint day festivals, particularly "coinciding" ones that overlap with key agricultural periods, have been noted by anthropologists (e.g., Harris, 1964 and Greenberg, 1981).[6]

2.3. *Impact on Structural Transformation and Long-Run Economic Growth*

Planting festivals reduce the ability to invest in planting inputs and activities. Harvest festivals lead farm households to sell crops earlier than they would otherwise, reducing the returns to agriculture overall. The upshot is that areas with agriculturally-coinciding festivals have persistently lower agricultural productivity.

Persistently lower agricultural productivity in places with coinciding festivals could lead to worse long-run development outcomes. A long-running literature in development economics has argued that agricultural productivity growth can lead to overall economic growth by facilitating the structural transformation of the economy towards modern (manufacturing and services) sectors (declining shares of agriculture in GDP and in the labor force).[7] Recent theoretical work has formalized this point in two-sector growth models with an agricultural and a modern or non-agricultural sector.[8] When there are subsistence constraints (a minimum agricultural or food consumption requirement), demand for agricultural goods is income-inelastic, and the economy is closed to trade (so that domestic agricultural production is necessary), agricultural productivity needs to rise before labor moves from agriculture to the modern sectors. Agricultural productivity growth leads to overall economic growth and a structural transformation out of agriculture. Recent empirical studies have examined this question, with some finding causal evidence that increases in agricultural productivity lead to structural transformation and economic growth.[9]

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[5] In a related vein, Dillon (2020) finds that a shift in the Malawian school calendar that made school-fee payments due closer to the harvest period (when crop prices are unusually low) led to higher crop sales in that low-price period to pay for the school fees, and thus lower overall harvest income.

[6] One could imagine that harvest festivals may also have negative consequences for another reason: they may lead to higher temptation spending than festivals in other times of the year, because harvest time is an unusually high-income period. Duflo et al. (2011) study how temptation spending can deplete harvest earnings, so that fewer resources are available for investment in the next planting season. But there is actually little evidence that temptation spending rises when liquidity constraints are loosened (Banerjee et al., 2017, Evans and Popova, 2017, Kerwin et al., 2020).

[7] Key references include Schultz (1953), Johnston and Mellor (1961), Johnston and Kilby (1975), Timmer (1998), Johnson (2000). Outside of economics, Diamond (1997) makes a similar argument.

[8] See, among others, Laitner (2000), Caselli and Coleman (2001), Caselli (2005), Gollin et al. (2002, 2004, 2007), Restuccia et al. (2008). Herrendorf et al. (2014) review the literature on structural transformation and growth.

[9] See, among others, Foster and Rosenzweig (2004, 2007), Nunn and Qian (2011), Hornbeck and Keskin (2014), Gollin et al. (2018), Bustos et al. (2020).

2.4. *Religiosity and the Persistence of Coinciding Festivals*

In empirical analyses below, we show that it is rare for a community to change their saint day festival celebration date, and find no empirical evidence of selective changing of patron saints to avoid agriculturally-coinciding festivals. If coinciding festivals lead to worse long-run development outcomes, why would they persist? Why don't communities simply celebrate their saints on different dates, or change their celebrated saints to ones whose festival dates do not coincide with planting or harvest?

There is the possibility of a self-reinforcing cycle, in which coinciding festivals raise religiosity, and the increased religiosity leads to persistence of coinciding festivals. Prior research suggests two channels through which coinciding festivals may raise religiosity. First, agriculturally-coinciding festivals have particularly high economic costs (because they crowd out agricultural investments), which may make them particularly effective signals of religious commitment, leading localities with coinciding festivals to have higher religiosity. In club goods models of religion (Iannaccone, 1992, Berman, 2000), costly religious signals can raise religious participation by inducing substitution towards religious from non-religious activities, and also by screening out less-devoted community members. Second, lower economic development may itself increase religiosity. Many scholars have argued that low economic development leads to higher religiosity (lower secularization) (e.g., Durkheim, 1912). Empirical studies have found that higher income levels across societies are associated with more secular attitudes (lower religiosity),[10] and that higher education contributes to secularization.[11]

Whether coinciding festivals lead to higher religiosity directly (by making participation in festivals a more costly religious signal) or indirectly (through their effects on economic development), the increased religiosity may increase adherence to religious traditions such as saint day festivals, and increase opposition to changing them. Overall then, there may then be a self-reinforcing cycle in which coinciding festivals reduce development and raise religiosity, and the increased religiosity promotes persistence of coinciding festivals.

[10]For example, Barro and McCleary (2003), Lipford and Tollison (2003), McCleary and Barro (2006a), Paldam and Gundlach (2013).

[11]See McCleary and Barro (2006b), Hungerman (2014), Becker et al. (2017).

3. Saint Day Festivals in Mexico

3.1. Cultural and Economic Significance of Saint Day Festivals

Patron saint day festivals are yearly celebrations that occur in Catholic countries, especially those influenced by Spanish culture.[12] A saint day festival is usually dedicated to a patron saint or virgin who was determined to be the patron (protector) of a given locality. Hundreds of such celebrated saints have their saint day festivals on dates all throughout the calendar year, on dates set by the Catholic hierarchy in the Vatican. Festivals involve concerts, fireworks, feasting, and music, often for days before and after the festival date itself. Saint day festivals often begin and close with a mass in the saint's honor. Saint day festivals are typically local public holidays, and involve substantial financial expenditures by local governments as well as households (Lastra et al., 2009).

In Mexico, saint day festivals acquired major economic and cultural significance following Spanish conquest. As part of efforts to convert local populations to Catholicism, saint day festivals became "one of the most important activities of the municipal governments" (Tanck de Estrada, 2005, pg. 31). The historian Charles Gibson calculated that villages in the Valley of Mexico spent three fourths of their annual municipal income on religious festivals and church ornaments (Gibson, 1964). Villages held at least three religious festivals per year – the patron saint festival, Corpus Christi, and Holy Thursday – but the patron saint festival was considered the most important festival (Tanck de Estrada, 2005, Tanck de Estrada and Marichal, 2010). Historians and anthropologists have argued that the patron saint day festivals became particularly popular because they naturally commingled Spanish and indigenous religious elements, and allowed indigenous groups to celebrate saints in their own way, with their own interpretations, traditions, and customs (such as dances, music, and food) (Lastra et al., 2009, Beezley and Meyer, 2010).[13] Historically, the festivals generally lasted at least three days, began with a mass the first night, and was followed by elaborate processions, masses, sermons, music, dancing (combining Hispanic and indigenous dances), markets, fireworks, bull runs, and a communal meal for the whole village (Tanck de Estrada, 2005, Tanck de Estrada and Marichal, 2010).

[12] We use the terms "patron saint day festival" or "saint day festival" in this paper. This phrasing is synonymous with other terms used in the literature such as "patron saint day fiesta" and "patron saint fiesta".

[13] In fact, in many parts of Mexico, the name of the patron saint became part of the name of the town (O'Connor and Kroefges, 2008, pg. 310).

By the 1790s, patron saint day festivals had become so large that the colonial government imposed limits on municipal governments' festival spending, calling the "excesses" of the festivals "superfluous and vicious" (Tanck de Estrada and Marichal, 2010, pg. 352). These laws led to the formalization and increased prominence of the distinctive *mayordomia* (or *cargo*) social system, where a rotating set of households assumed responsibility for organizing and financing the annual festival of their town's patron saint (Beezley and Meyer, 2010, Lastra et al., 2009, Monaghan, 1990, Dewalt, 1975).[14]

Becoming a *mayordomo* (festival steward) brought great respect from the community, but involved significant expenditures, "in many cases to [the *mayordomos*'] own financial detriment" (Beezley and Meyer, 2010, pg. 159). *Mayordomos* had little flexibility on the required expenditure amounts because festival expenses were "fixed by custom and agreement" and "varied hardly at all from year to year" (Gibson, 1964, pg. 130). The financial strain for *mayordomos* was particularly high during years with poor harvests, as income "depended on the agricultural year and the market price of the produce" (Gibson, 1964, pg. 130). In fact, Brandes (1981, pg. 212) noted that the "invariably high" financial outlays for *mayordomos* were often so large "that villagers were forced to sell parcels of land in order to meet ritual responsibilities".

Estimates for *mayordomia* expenditures in the historical period are hard to come by; however, even in modern times, *mayordomia* households spend considerable amounts of money: Monaghan (1990, pg. 760) found that, in 1985, the *mayordomia* of the *Virgen del Rosario* in Santiago Nuyoó distributed "204,937 pesos worth of foodstuff" alone, which is equivalent to approximately \$46,425 in 2020 dollars. Greenberg (1981, pg. 149-152) finds that in Santiago Yaitepec, Oaxaca, in 1973, each *mayordomo* spent an average of 4,566 pesos (\$2,211 in 2020 dollars) for the patron saint festival. Food and drink expenses made up about half of the *mayordomos'* expenditures and he calculated that these food expenditures alone would be enough "to provide [the village] 13.5 days worth of food per capita annually" (Greenberg, 1981, pg. 149).

In the 1960s and 1970s, anthropologists became very interested in understanding the saint day festival *mayordomia* system (and its persistence) in Mexico (for reviews, see Dewalt, 1975, Smith, 1977, Greenberg, 1981, Chance and Taylor, 1985). Dewalt (1979, pg. 201) noted that

[14] Historians and anthropologists have noted that the *mayordomia* social system became popular in Mexican villages (and other parts of Latin America, where it is also known as the *cargo* system) because it combined aspects of the *cofradía* system from Spain – religious co-fraternity groups – and indigenous communal associations (Lastra et al., 2009, Beezley and Meyer, 2010).

the "most striking element of these [*mayordomia*] systems is that generally poor peasants spend considerable time and money sponsoring fiestas to honor the saints", constituting "what appears to be economically irrational behavior".[15] They have proposed at least two main reasons for the persistence and importance of the *mayordomia* system (Chance and Taylor, 1985). First, serving as a *mayordomo* was a costly signal of religiosity and wealth to the community (Monaghan, 1990, Chance and Taylor, 1985). In the view of some anthropologists, serving as a *mayordomo* was a form of "conspicuous consumption" that allowed households to gain community respect (Dewalt, 1979). Second, due to the rotating nature of the *mayordomia* system, anthropologists argued that the system also served an important redistribution role within the community, both within a given year across households (Greenberg, 1981, Rosales Martínez et al., 2020), but also across time: *mayordomos* are found to receive preferential access to resources from future *mayordomos* because they are seen as having more reciprocity and religiosity (Monaghan, 1990).[16] (The view that serving as a *mayordomo* is a costly signal of religiosity, helping explain the system's persistence, concords with economics research on religious signaling that we discussed previously in Section 2.4.)

Today, saint day festivals continue to be highly significant in the lives of the people who believe and practice them to this day (Lastra et al., 2009, Rosales Martínez et al., 2020). Whereas larger cities have become more secular and the saint day festivals there have lost importance, festivals continue to be held in rural and agricultural villages in Mexico (Lastra et al., 2009). In rural villages, the festivals continue to be quite elaborate and costly, and continue to follow a "rigorous protocol... there must be vigils (*velaciones*), masses, ritual blessings and cleansings (*limpias*), processions, dances or dance dramas, music, fireworks, ritual meals, and the ritual handling of special objects and flowers" organized by the *mayordomos* and involve "the participation of men, women, and children of all ages" (Lastra et al., 2009, pg. 2).

[15] Likewise, Chance and Taylor (1985, pg. 7) note that for anthropologists "a salient feature of modern fiesta systems in [central Mexico] is that the offices of the ritual celebrations are considered to be *cargos*, a great economic burden."

[16] According to Chance and Taylor (1985), first- and second-wave anthropologists proposed two additional explanations – empowerment and exploitation – for the popularity of the festivals and the *mayordomo* system. First, by allowing indigenous groups to easily mix in their own religious traditions with the saint day festival organization and celebrations, the *mayordomo* system empowered local populations. Second, in contrast, because the festivals were imposed on indigenous groups by the Spanish and cost considerable sums of money, some anthropologists argue that the "repressive and abusive" festivals extracted wealth from poor households "originally into the hands of the clergy, then after Independence into those of *hacendados* and merchants" and these outsiders maintain the festivals for their own benefit (Harris, 1964, pg. 25-34).

3.2. *Exogeneity of Saint Day Festival Timing*

In Mexico and most of Latin America, patron saints were typically established at the time of a town's founding by Spanish colonizers. Because the timing of saint day festivals (relative to key agricultural periods) is central to our analysis, it is important to consider how localities came to celebrate their particular saint days. For countries where conquest and settlement by Europeans goes back centuries (to the 1500s in the case of Mexico), the origins of local festival celebrations are often shrouded in mystery, so the best one can do is collect a set of historical and ethnographic accounts of different places. The key question we have kept in mind is whether the localities ever intentionally choose the timing of saint day festivals (or inadvertently end up doing so) with an eye towards their long-run consequences, such as by avoiding the planting and harvest seasons. Evidence of such timing considerations would raise concerns about selection bias in our estimates.

In a review of the historical and ethnographic literature on saint day festivals in Mexico (e.g., Brewster, 1904, Nutini, 1968, Nutini, 1976, Ragon, 2002), we have found little evidence that such timing considerations come into play. The most important focus appears to be on choosing the saint itself, with typically little mention of the date of the saint's festival. Once a locality has been matched to a saint, in nearly all cases it celebrates their saint day festival on the date given by the Catholic hierarchy in the Vatican that is common for all communities worldwide celebrating that saint.[17]

Some examples of the reasons behind the choice of particular saints illustrates that considerations are typically orthogonal to the timing of the festival on the calendar. In many cases, saints were chosen based on structural, functional, or symbolic similarities with indigenous gods worshipped in the area (Nutini, 1968). Spanish friars seeking to convert the populations to Catholicism believed they would be more effective if they chose saints that had some resemblance to an indigenous god. For example, the village of San Juan Tianguismanalco was originally associated with the cult of the Aztec god *Tezcatlipoca*. The village was assigned the patron saint Saint John the Apostle given that this saint and Tezcatlipoca both represented youth (Nutini, 1976). In other cases, localities were assigned a patron saint based on salient characteristics of

[17] In rare cases, we found in our data collection that communities in our sample celebrated a saint day festival on a date different from the official date prescribed by the Vatican (fewer than 5% of municipalities in our sample). These dates typically diverge by only a few days from the official date (on average two days of divergence). To rule out endogeneity of festival dates, in our analyses we use the official festival date prescribed by the Vatican for each saint, not a locality's potentially endogenously-chosen festival date.

their community and particular functions of saints (Ragon, 2002). The patron saint of cooks, San Pascual Bailon, was chosen in Puebla, a region known for its cuisine (Brewster, 1904).

One category of explanation for the choice of saints does involve consideration of the *date* of the festival celebration. In some localities, Spanish conquerors chose saints whose festival date coincided with key dates in the Spanish conquest of or arrival in the locality. Many cities in Mexico take their saints (and often their locality names) on the basis of the saint whose feast was celebrated on the day the Spanish established or first visited the town (Ragon, 2002). For instance, the patron saint of Zacatecas was chosen to be the Virgin Mary because her feast day occurred on the date of the first camp of Juan of Tolosa – a Spanish *conquistador* – upon his arrival in Zacatecas. Importantly, the reason for the preference for certain festival dates has to do with historical events at the time of conquest, and should have no systematic relationship with the timing of agricultural seasons in the locality.

Interestingly, in some places saints were actually chosen at random. Some oral histories describe saint names being physically pulled out of a bowl, or the like. The motivation behind this method was that random selection would allow saints to "choose" the locality, and that this would enhance the supernatural protection thus afforded (Ragon, 2002).

Even if we believe that the choice of saints in the early history of towns (and the resulting coincidence of festival timing with agricultural seasons) is plausibly exogenous, one might worry that localities would seek to change their festival dates, once the consequences of their timing revealed themselves. There are indeed cases when communities changed their patron saints, but such cases appear to be rare. Patron saint celebrations are key components of a local community's history and culture. Perhaps unsurprisingly then, the few reported cases when communities changed their patron saint were motivated by a major negative shock, such as a flood, fire, or earthquake, and the switch was to a saint thought to protect against natural disasters (Ragon, 2002).[18]

Additional qualitative evidence on the exogeneity of the timing of saint day fiestas is provided by Atkinson and Fowler (2014), who studied how saint day festivals that coincide with voting days affect voter turnout. Atkinson and Fowler (2014) surveyed Catholic priests and officials in Mexico and asked how their particular parish chose their patron saint.[19] They found that "no

[18] However, in most cases following shocks, towns would often add additional patron saints to worship rather than replace the original saint (Ragon, 2002).

[19] Their sample was drawn from an online directory of dioceses and archdioceses in Mexico.

respondent indicated that the time of year for the fiesta was considered in this decision. Rather, patron saints resulted from idiosyncratic events" and that in many cases "Spanish colonizers chose the patron saint of the community for arbitrary reasons" (Atkinson and Fowler, 2014, pg. 47). This survey evidence from Atkinson and Fowler (2014) provides additional evidence that the saint day festival date of a particular town is exogenous to local characteristics.[20]

In sum, we find no evidence in historical and ethnographic accounts that endogeneity of festival dates is a worry. In no case have we found a mention that a saint day was set (or changed) to avoid or coincide with important periods in the agricultural calendar. It is key that the focus is usually on choice of the saint (based on a diversity of rationales), and that the festival date then follows the annual religious calendar set by the Vatican. In other cases where early Spanish conquerors sought to implement a specific festival date, the choice was based on coincidence with initial dates of conquest or settlement, rather than anything to do with agricultural seasons.

4. Data

4.1. Data on Saint Day Festivals

We assembled a dataset of saint day festival dates for Mexican municipalities from a variety of sources. First, we determined the patron saint for each municipality. An online data source, the *Encyclopedia of Municipalities in Mexico* (INAFED, 1988), provided information on the patron saint for 77.85% of municipalities. To collect a more complete set of patron saints across municipalities, we supplemented the data by (i) directly contacting the municipalities in question by phone (13.97% of municipalities) and (ii) conducting online searches and finding at least two sources for each municipality (7.49%). For the direct phone calls, we focused on contacting municipal government officials, local churches, or schools. Overall, we were able to determine a patron saint for 99.3% of municipalities in Mexico.[21] Appendix A.1 provides information how we determined patron saints across municipalities in Mexico and the sources we used.

Once we had determined the patron saint for (nearly all) municipalities, we then sought to ascertain the "official" (Vatican-prescribed) festival celebration date for that saint. We focus on

[20] Atkinson and Fowler (2014, pg. 47) provide the translated account for one parish on how their patron saint was chosen: "The people of God were consulted with the approval of the bishop. Here in Tamaulipas, there is great devotion to *Our Lady of Refuge* because we were officially put under the patronage of *Our Lady of Refuge* by the Spanish royalty during colonial times."

[21] For two municipalities, officials reported that they do not celebrate a patron saint. For the other 16 municipalities, we were unsuccessful in determining a patron saint.

the official timing rather than the date each municipality actually celebrates their festival, as the latter might be endogenous to local conditions and outcomes.[22] To determine the official saint day associated with each patron saint, we used a variety of sources. For 95.58% of municipalities, we used Roman Catholic Church documents to determine the official saint day.[23] For saints that were not included in Catholic Church records, we used online searches to determine the saint day (3.43% of municipalities). This sub-sample of saints is comprised of two types of saints: (i) saints celebrated in other countries on specified official dates but that are not mentioned in Vatican documentation (1.75%);[24] and (ii) saints that are "local" saints: saints not recognized or celebrated outside of that municipality in Mexico (1.68%). For our main analysis, we exclude this second subcategory ("local" saints) as the timing of their festivals is potentially endogenous; however, we show that our results are robust to their inclusion.[25] In Appendix A.1, we provide more information on the saint day dataset construction and the sources we used.

Overall, we are able to assign both a patron saint and a specific saint day festival date to 95.12% of municipalities in Mexico. The festival date is missing for 0.69% of municipalities for which we were unable to determine the patron saint from any source. The festival date is also missing for 4.19% of municipalities that celebrate "moving festivals" that do not have a fixed calendar date.[26] Our primary sample for analysis in this paper excludes municipalities with missing festival dates, but our results are robust to various ways of treating these missing-date municipalities.[27] Figure 1 provides a map of patron saint day festivals across Mexico (including "local" saints).

[22] As mentioned previously, most municipalities in our sample (86.23%) celebrate their saint day festival on exactly the date officially prescribed by the Vatican or other Roman Catholic authority outside of Mexico. Among those that do deviate from the official date, the mean number of days of divergence from the official date is seven.

[23] In some cases, municipalities reported celebrating a saint that is derived from a Vatican-recognized saint and celebrated on the same festival date, but the saint is referred to in the municipality by a different, local name. In these cases, we identified the relevant Vatican-recognized saint, and used the Vatican-prescribed festival date for that saint. We explain this process, the saints and municipalities affected, and the sources we used in detail in Appendix A.1.4.

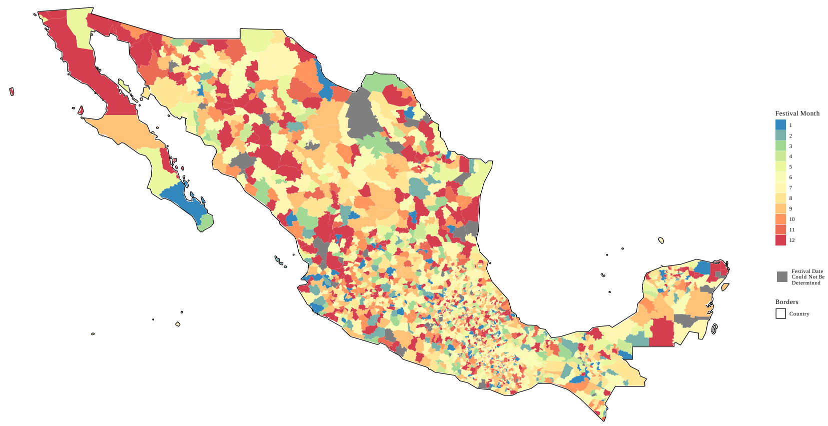
[24] For instance, the *Cristo Burgos* festival originated in Burgos, Spain as a veneration of the image of Christ on the cross, and is celebrated in Spain on September 14th (Archdiócesis de Burgos, 2015). The festival then spread to Mexico and other Catholic countries worldwide. One municipality in Mexico celebrates *Cristo Burgos*, and we assign the festival date of September 14th to this municipality.

[25] In Appendix Table A7, we show that municipalities with local saints are similar on geographic characteristics to municipalities where the saint is non-local. Additionally, Appendix Table A10 shows the main results are robust to inclusion of local saints in the sample.

[26] For example, the *Sagrado Corazón de Jesús* festival is celebrated on the Friday following the second Sunday of Pentecost – the seventh Sunday after Easter. Easter varies in timing year to year.

[27] In Appendix Table A5, we show that municipalities with missing dates have similar geographic characteristics to other municipalities. We also show the main results are very similar when we classify municipalities with missing festival dates either as having coinciding or non-coinciding festivals (see Tables A8 and A9).

Figure 1: Saint Day Festival Months - All of Mexico



Notes: The map presents the month that each municipality in Mexico celebrates its respective Catholic patron saint day festival. Municipalities where we were unable to determine the festival date are shaded in dark grey. See Appendix A.1 for more information on the construction of the festival date dataset.

4.2. Data on the New Spain Region of Mexico

Our primary analyses focus on a relatively homogeneous sample of municipalities in the former "New Spain" (*Nueva España*) region of Mexico. Municipalities in this region are nearly all suitable for growing maize, which simplifies the analysis by allowing us to focus on maize planting and harvest periods for each locality. Maize has been the primary staple crop in the region since pre-colonial times (Gibson, 1964). In other parts of Mexico outside of New Spain, there is more heterogeneity in both agricultural suitability and in the choice of the primary crop – which is often not maize. Thus, the choice of primary crop outside New Spain could possibly reflect endogenous choices to focus on certain non-maize crops in periods closer to the present day.[28] Focusing on New Spain therefore excludes areas that have historically been less suitable for agriculture. By focusing on an area that has been primarily maize-growing since pre-colonial times, we can sidestep concerns that a locality's primary crop (identified using modern-day data such as the Caloric Suitability Index) may be endogeneous to the economic development process.

New Spain is also distinct from other parts of Mexico on other dimensions relevant for our study. It was the first part of Mexico to be conquered and settled by the Spanish, and was the main administrative unit during early colonial history. The area thus has the longest history of colonial influence in Mexico, which may make Catholic religious traditions like saint day festivals

[28] The difference in agricultural suitability and in primary crops derives from differences in climate: New Spain is largely temperate and subtropical, while the north is mostly semi-arid and arid desert, while the southeast is tropical (Ricketts et al., 1999).

comparatively more important in this region. The historical accounts we cite above about the importance of festivals and the *mayordomia* system all refer to localities in New Spain. Today, saint day festivals remain more important in the former New Spain (central Mexico) than in the rest of the country (Lastra et al., 2009). Municipalities in New Spain are also distinctive in being much smaller in land area and more densely populated compared to municipalities in the rest of the country.[29] More compact, denser populations in New Spain may enhance the role of town-based community celebrations such as saint day festivals.

Figure 2 presents a map of the borders of the New Spain region of Mexico along with the main administrative borders of Mexico. We use the definition of New Spain as of 1786, as in Map 8 of Gerhard (1993a). Figure 3 presents a map of festival months across New Spain municipalities.[30]

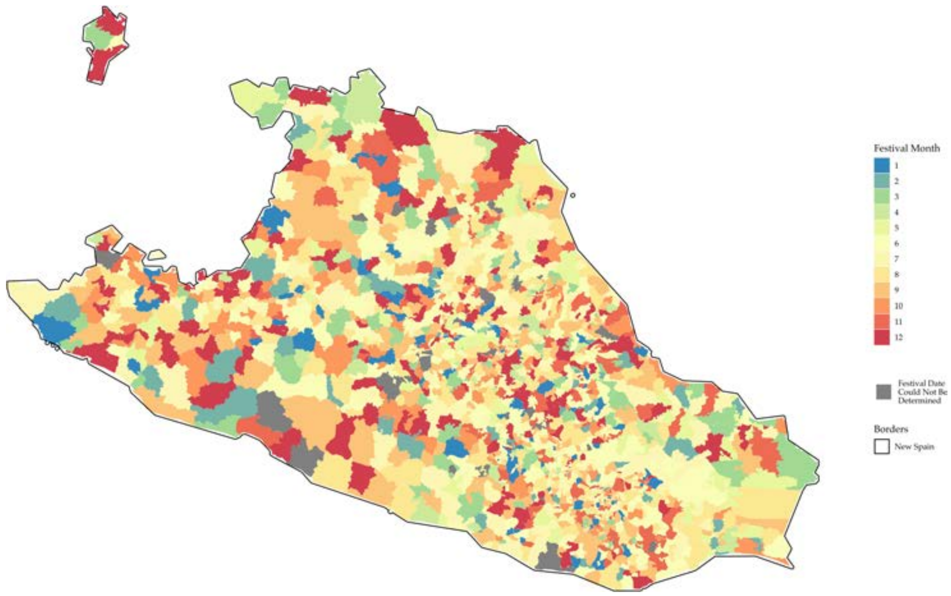
Figure 2: Administrative Borders and New Spain Region of Mexico

Notes: This map presents the administrative borders of Mexico in varying shades of gray: country border, state borders, and municipality borders. Additionally, the map presents the borders for the New Spain region of colonial Mexico as defined by Gerhard (1993a) in black.

[29]New Spain municipalities have mean land area of 336.1 square kilometers, compared with non-New Spain municipalities' mean of 2,385.9 square kilometers. Mean population density is 308.6 persons per square kilometer in New Spain municipalities vs. 98.0 persons per square kilometer in non-New Spain municipalities. Municipalities in New Spain comprise 60% of the Mexican population (authors' calculations from the 2010 Mexican Census).

[30]In Section 6, we show that our results are robust to considering the sample of all Mexican municipalities for which we have festival dates.

Figure 3: Saint Day Festival Months - *New Spain* Region of Mexico



Notes: The map presents the month that each municipality in the New Spain region of Mexico celebrates its respective Catholic patron saint day festival. Municipalities where we were unable to determine the festival date are shaded in dark grey. Additionally, the map presents the border for the New Spain region of colonial Mexico as defined by Gerhard (1993a) in black and the modern borders of States and Municipalities in gray. See Appendix A.1 for more information on the construction of the festival date dataset.

4.3. *Data on Crop Planting and Harvest Dates (FAO)*

Data on the optimal planting and harvest dates for a number of crops are constructed based on data from the Global Agro-Ecological Zones (GAEZ) project from the Food and Agriculture Organization (FAO). The GAEZ data provides global estimates for crop growth cycles and crop yields for a number of crops at a global grid-cell level (where each grid is $5' \times 5'$, or approximately 100 km^2). For each crop, the GAEZ data supplies the estimates on crop growth cycles and yields under two possible sources of water (rain-fed or irrigation) and under three alternative levels of inputs (low, medium, and high). For each input-water-crop combination, the GAEZ data offers estimates under conditions that are potentially unaffected by human intervention, and under conditions that could potentially reflect human intervention. The estimates incorporate the effect of moisture and temperature on the growth of the crop, the disease environment, as well as climatic-related pest, "workability", and disease constraints. The estimates used in the analysis in this paper for the planting and harvest dates are based on the agro-climatic growth cycles under rain-fed agriculture and low levels of inputs. We use these restrictions to remove potential concerns that the irrigation method and level of agricultural inputs reflect endogenous choices that could be potentially correlated with economic development.

We focus primarily on the planting and harvest cycle for maize, as maize is and has historically been the most important crop in New Spain. Figure 4 presents a map of the optimal maize planting month in New Spain according to the GAEZ estimates, while Figure 5 displays a corresponding map of the length of the maize growth cycle.[31] The maps highlight the large amount of spatial variation in the optimal maize planting and harvest dates.[32]

We use the GAEZ data to construct the optimal planting date for each municipality by taking the average estimated planting date within grid cells in a municipality. Similarly, we construct the optimal harvest dates across Mexican municipalities by taking the average estimated optimal planting date and adding the average number of days until harvest from the GAEZ estimates for grid cells within each municipality.[33] Note that some municipalities in Mexico are not suitable for maize; we exclude these municipalities from the main analysis as we are not able to determine optimal planting and harvest dates for these municipalities.[34]

We then use the data on festival dates across Mexican municipalities detailed in Section 4.1 to construct a measure of the coincidence of timing of a municipality's saint day festival with its planting and harvest periods. Figure 6 presents a map of municipalities and whether they have agriculturally-coinciding festivals. We define agriculturally coinciding as an indicator variable equal to 1 if the saint day festival in municipality occurs either within 0 to 30 days before the optimal maize planting date or 0 to 30 days after the optimal maize harvest date according to FAO GAEZ data.[35]

We also use data on the potential caloric yield for crops across Mexico using the Caloric

[31] In some regions of Mexico, maize production is split into two seasons: a primary season that accounts for approximately 75 percent of total production (usually with planting occurring spring/summer), and a shorter secondary season (usually with planting occurring in the fall/winter) (USDA, 2017). The FAO GAEZ planting and harvest cycle estimates are for the primary season for each grid cell (Fischer et al., 2012). We focus on this primary maize season because it accounts for the majority of production.

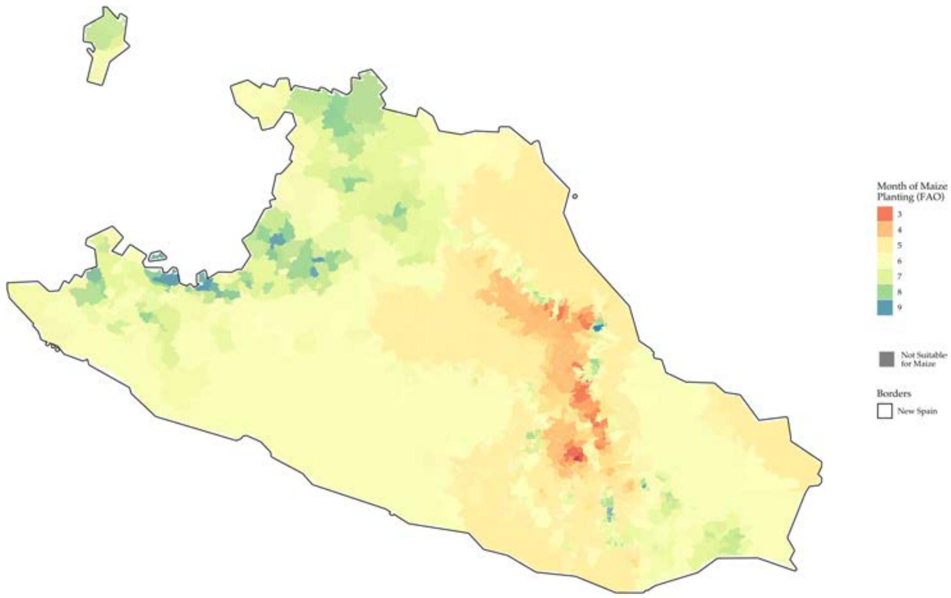
[32] Appendix Figures A5 and A6 present the equivalent maps for maize planting dates and maize growth cycle lengths for all of Mexico.

[33] One potential concern with the GAEZ data is that the predicted optimal planting and harvest dates might not be strong predictors of actual planting and harvest dates. Using data on the timing of maize harvesting from the *Servicio de Información Agroalimentaria y Pesquera (SIAP)*, we show in Appendix Figure A11 that the GAEZ optimal harvest month strongly predicts observed maize harvest timing across Mexico.

[34] This maize suitability restriction affects 0.53% of municipalities in the *New Spain* region of Mexico, and 2.07% of municipalities in Mexico as a whole.

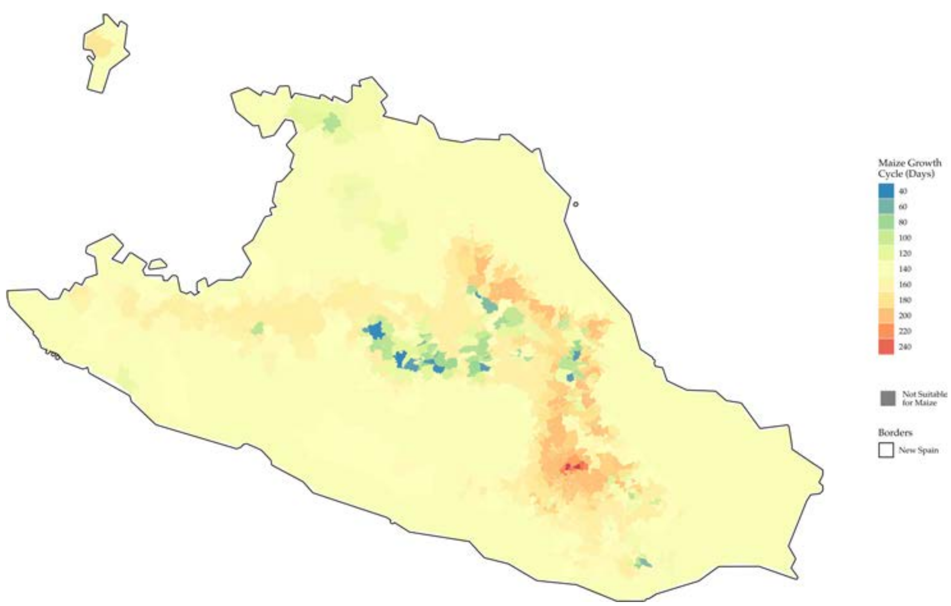
[35] Figure A1 presents a map of the number of days between the saint day festival date and the optimal maize planting date and Figure A2 presents a map of the days between the saint day festival date and optimal maize harvest date in New Spain. Figures A7 and A8 present the equivalent maps for the distance between the saint day festival and maize planting and maize harvest dates for all of Mexico.

Figure 4: Optimal Maize Planting Date (FAO data) - *New Spain* Region of Mexico



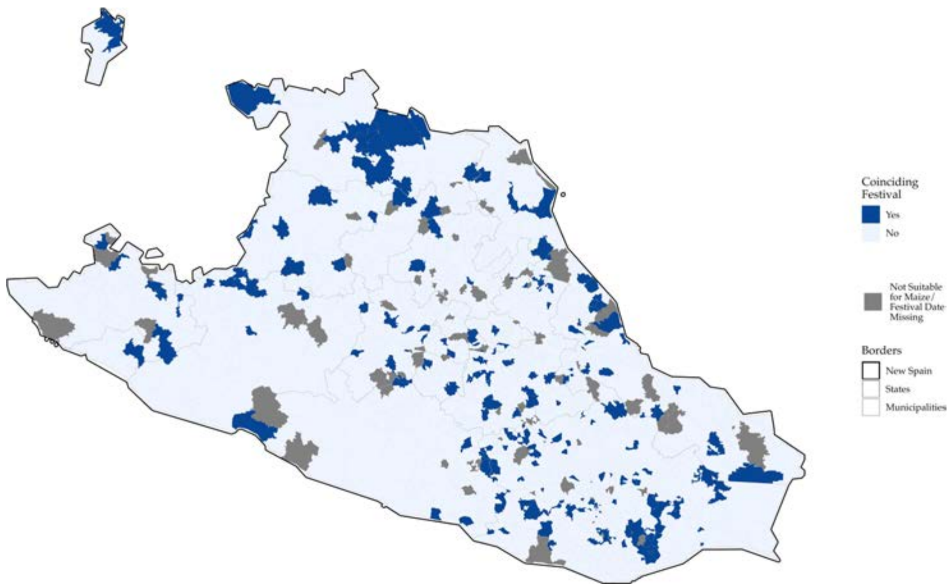
Notes: Optimal maize planting month according to FAO GAEZ data in the New Spain region of Mexico.

Figure 5: Maize Growth Cycle Length (FAO data) - *New Spain* Region of Mexico



Notes: Length (in days) of the optimal maize growth cycle according to FAO GAEZ data in the New Spain region of Mexico.

Figure 6: Agriculturally-Coinciding Festivals - *New Spain* Region of Mexico



Notes: Coinciding Festival is equal to "Yes" if the saint day festival in a municipality occurs either 0 to 30 days prior to the optimal maize planting date or 0 to 30 days after the optimal maize harvest date for a municipality using FAO GAEZ data and "No" otherwise for each municipality in the New Spain region of Mexico. Municipalities where we were unable to determine the festival date or are unsuitable for maize are shaded in dark grey.

Suitability Index (CSI) measures developed by Galor and Ozak (2016). The CSI measures calculate the potential caloric yield per hectare per year under rain-fed agriculture and low level of inputs for a variety of crops. The CSI is meant to ensure comparability in the measures of crop yields across space by capturing the nutritional differences across crops. We use the CSI data to determine the optimal planting and harvest date for the highest caloric-yielding crop in each municipality (instead of only examining maize crop cycles) as a robustness check. As expected, the highest caloric-yielding crop across Mexico tends to be maize according to the CSI measure (for crops where we have both CSI estimates and GAEZ growth cycle estimates). This is the case for 73.15% of municipalities. The other max CSI crops across Mexico are: foxtail millet (9.93% of municipalities), wetland rice (8.38%), wheat (5.25%), and groundnuts (0.53%).[36]

4.4. Data Sources for Development Outcomes

Our primary outcome variables (household income and an index of economic development) are at the municipality level, and come from the 2010 *Censo de Población y Vivienda* (Population Census

[36]Maize and groundnuts are crops native to the Americas. Foxtail millet, wetland rice, and wheat are not native to the Americas pre-1500 CE.

henceforth) from Mexico's National Institute of Statistics and Geography (INEGI).[37] This census interviewed over 106 million households across Mexico about their economic well-being, labor supply, asset ownership, and education. We also use municipality-level data on agricultural production from the *Servicio de Información Agroalimentaria y Pesquera* (SIAP) in our analysis of maize productivity. See Appendix A for further details.

4.5. *Data on Additional Covariates*

4.5.1. *Geographic Data*

We use several GIS and satellite datasets aside from the FAO GAEZ dataset described in Section 4.3. We use temperature and precipitation data from the Global Climate Database (Hijmans et al., 2005) and land suitability measures using data from the Atlas of the Biosphere (Ramankutty et al., 2002). We combine these datasets with the administrative shape file of municipality boundaries for the 2010 Population Census from the geo-statistics division of INEGI to construct municipality-level covariates. Additionally, we use the municipality shape file to construct municipality land area and municipality-centroid latitude and longitude. We describe these geographic datasets and variables in more detail in Appendix A.

4.5.2. *Historical Data*

We use historical measures of population density and climate from Sellers and Alix-Garcia (2018). The population measures during the colonial era were digitized from Gerhard (1993a,b). This source contains various data on the colonial governorships of New Spain, including records from Spanish administrators on the number of individuals paying tribute to the Spanish Crown.[38] Population data for 1900 are from the Mexican Historical Archive of Localities (AHL), maintained by INEGI. Drought severity data in the early colonial era are from the *North American Drought Atlas* (Cook and Krusic, 2004). Drought severity is an important predictor of the dramatic decline in tributary population during the early colonial era and subsequent development (Sellers and Alix-Garcia, 2018).

[37] For more information on this census, see INEGI documentation.

[38] There are no other proxies for population for the colonial era. For the tribute data, certain groups – such as indigenous nobility and the clergy – were exempt. See Sellers and Alix-Garcia (2018) on how the tributary data are converted to population measures.

5. Empirical Strategy

5.1. *Estimating Equation*

In order to examine the economic effects of festival celebrations coinciding with planting and harvest seasons, we estimate the following empirical specification:

$$y_m = \alpha_{s(m)} + \beta \, \textit{Festival Coincides with Planting or Harvest}_m + \mathbf{X}_\mathbf{m}^{'}\mathbf{B} + \epsilon_m \tag{1}$$

where m indexes municipalities; y_m is our outcome of interest; $s(m)$ is a function mapping municipalities to Mexican states; $\alpha_{s(m)}$ represent state fixed effects to account for all time-invariant differences across states, such as geography or cultural factors that do not vary over time;[39] *Festival Coincides with Planting or Harvest*$_m$ is an indicator variable equal to 1 if the saint day festival in municipality m occurs either within 0 to 30 days before the optimal maize planting date or 0 to 30 days after the optimal maize harvest date according to FAO GAEZ data;[40] $\mathbf{X_m}$ is a vector of controls that includes fixed effects for the planting calendar month, fixed effects for the harvest calendar month,[41] fixed effects for the festival calendar month, and controls for geographic, climatic, and historical characteristics for municipality m; and ϵ_m is the error term of municipality m.[42]

The coefficient of interest is β, the effect of having festivals coincide with planting or harvest. Based on the social science literature on the economic impacts of religious celebrations, we hypothesize that $\beta < 0$ when examining long-run development differences; that is, having saint day festivals occur in periods when they may crowd out other long term investments leads to worse development outcomes.

[39] Across Mexico, there are 32 states. In the *New Spain* region of Mexico, there are 13 different states. Section 6.3.1 shows the results using the full sample of Mexican municipalities.

[40] We also show results separately for festivals that coincide with planting and festivals that coincide with harvest in Section 6.2. When we show results separately, we include p-values for testing differences across coefficients for festivals that coincide with planting and festivals that coincide with harvest; in almost all cases, we fail to reject the null hypotheses that the coefficients are the same. Additionally, we explore the sensitivity of the results to the definition of the 30-day windows in Appendix C and show that the results are robust to various windows prior to planting and following harvest.

[41] There are 22 planting and calendar month fixed effects (11 for planting and 11 for harvest; one calendar month in each set is the excluded category.)

[42] For municipality-level outcomes, we present robust standard errors. For individual-level outcomes, we cluster standard errors at the municipality level. We also show that our results are robust to spatial autocorrelation; we present our main results with Conley (1999) standard errors in Table A11. The Conley (1999) standard errors are very similar to the robust standard errors, suggesting that festival timing across Mexico does not display considerable spatial correlation.

The main identifying assumption needed to interpret β as the causal impact of having festivals coincide with planting and harvest is that $E[\epsilon_m \,|\, \textit{Festival Coincides with Planting or Harvest}_m] = E[\epsilon_m] = 0$. That is, whether a municipality's saint day festival coincides with planting or harvest is exogenous to features of the municipality that could also affect economic development. We provide a number of empirical tests in the following section to examine whether this identifying assumption is valid.

Note that the measures we use for both festival dates and crop growth cycles are meant to increase confidence that the independent variables of interest are exogenous. First, for festival dates, instead of using the date when the municipality actually celebrates the saint, we use the official celebration date defined in the Roman Catholic Church's calendar for a municipality's patron saint (see Section 4.1). Second, for agricultural seasons, we use estimates from the FAO GAEZ data based on geographic and climate characteristics rather than the dates when households in a municipality perform planting and harvesting, which might be endogenous to levels of economic development. Using these measures for festivals and agricultural seasons increases confidence that the coincidence between festivals and the agricultural season is plausibly exogenous to other important municipality characteristics that might affect development.[43]

5.2. *Testing Identifying Assumptions*

One concern with estimating equation (1) is that perhaps saint day festivals were strategically assigned by Spanish colonizers (or subsequently changed by inhabitants) to avoid the agricultural season in some municipalities, but not in others.[44] This strategic assignment would imply that it would be less likely that municipalities have festivals that coincide with planting or harvest months compared to other time periods.

We first construct a dataset at the municipality-date level, with 365 observations per municipality (one for each calendar date). The dependent variable, $\textit{Festival Date}_{mt}$, is an indicator equal to one if municipality m's festival occurs on date t, and is zero otherwise. We then test whether

[43] Additionally, Section 3 provides qualitative historical evidence that saint day festival dates were often chosen due to plausibly exogenous reasons such as the date of conquest and similarities in features between a saint and local gods (but importantly, not on the basis of coincidence with agricultural planting or harvest seasons).

[44] For instance, in more populous municipalities, perhaps patron saints whose festival dates would coincide with agricultural periods were avoided. This would imply that municipalities that happen to have festivals coincide with planting or harvest may be less developed today due to omitted variables (e.g. less populous to begin with) rather than the festival directly.

municipalities are less likely to have festival days that coincide with planting and harvest months in the data by estimating the following regression equation:

$$Festival\ Date_{mt} = \beta\ Planting\ or\ Harvest\ Month_{mt} + \alpha_{s(m)} + \theta_t + \epsilon_{mt} \tag{2}$$

where *Planting or Harvest Month*$_{mt}$ is an indicator equal to one if calendar date t is either 0 to 30 days prior to the optimal maize planting date or 0 to 30 days after the optimal maize harvest date for municipality m using FAO GAEZ data; $\alpha_{s(m)}$ represent state fixed effects; θ_t represent date-of-the-year fixed effects to account for all time-invariant differences across calendar dates in the popularity of a saint (to account for differences across dates in the propensity to have saint days according to the Roman Catholic Church calendar); and ϵ_{mt} is the error term of municipality m for date t. We cluster standard errors by municipality. If saint day festivals were strategically chosen by municipalities (or assigned by Spanish conquerors) taking into account agricultural planting and harvest times, then we would expect that $\beta \neq 0$. However, if the saint day festivals were assigned without taking into account the timing of the agricultural season, then we would expect that $\beta = 0$.

Table 1 presents the estimates for equation (2) examining the relationship between festival dates and planting and harvest months for maize, the main staple crop in Mexico. (To improve visibility of the coefficients, we multiply coefficients by 100.) Panel A presents the results examining whether the festival date coincides with either the planting or harvest month, while Panel B shows the results separately for coinciding with planting and coinciding with harvest. Once date-of-the-year fixed effects are included in the regression (Column 2 and after), coefficient estimates are consistently small in magnitude and are not statistically significantly different from zero at conventional levels. Across both panels, there is no evidence that festivals are more or less likely to coincide with planting or harvest months. Instead, the estimates suggest that festival dates occur throughout the calendar in a way that is consistent with festival days not being assigned strategically to avoid or coincide with planting and harvest. This evidence supports taking the coincidence of festival dates with planting or harvest to be exogenous.[45]

[45]In Appendix Table A3, we conduct a similar analysis for municipalities in all of Mexico (including non-New Spain municipalities). Coefficient estimates are very similar, and lead to the same conclusions: once all control variables are included in the regression, there is little evidence that festival months tend to be more or less likely in planting or harvest months.

Table 1: Relationship Between Festival, Maize Planting, and Maize Harvest Months

	Dependent Variable: *Festival Date*			
	(1)	(2)	(3)	(4)
	Panel A: Planting or Harvest			
Maize Planting or Harvest Month	-0.092^{***}	-0.018	-0.018	-0.010
	(0.016)	(0.017)	(0.017)	(0.018)
Calendar Date Fixed Effects	N	Y	Y	N
State Fixed Effects	N	N	Y	N
Date by State Fixed Effects	N	N	N	Y
Observations	581,445	581,445	581,445	581,445
Clusters	1,593	1,593	1,593	1,593
Mean Dep. Var.	0.274	0.274	0.274	0.274
	Panel B: Planting and Harvest Separately			
Maize Planting Month	-0.143^{***}	-0.013	-0.013	0.001
	(0.019)	(0.021)	(0.021)	(0.022)
Maize Harvest Month	-0.041^{*}	-0.024	-0.024	-0.021
	(0.024)	(0.028)	(0.028)	(0.028)
Calendar Date Fixed Effects	N	Y	Y	N
State Fixed Effects	N	N	Y	N
Date by State Fixed Effects	N	N	N	Y
Observations	581,445	581,445	581,445	581,445
Clusters	1,593	1,593	1,593	1,593
Mean Dep. Var.	0.274	0.274	0.274	0.274

Notes: Observations are at the municipality-calendar date level for municipalities in the *New Spain* region of Mexico for which we have festival data. Standard errors are clustered at the municipality level. *Festival Date* is an indicator variable equal to 1 if the festival for a municipality occurs on that date. For ease of interpretation, we multiply all regression coefficients by 100. *Maize Planting or Harvest Month* is an indicator variable equal to 1 if a date falls within 0 to 30 days prior to the optimal maize planting date or 0 to 30 days after the optimal maize harvest date for a municipality using FAO GAEZ data. *Maize Planting Month* is an indicator variable equal to 1 if a date falls within 0 to 30 days prior to the optimal maize planting date for a municipality using FAO GAEZ data. *Maize Harvest Month* is an indicator variable equal to 1 if a date falls within 0 to 30 days after the optimal maize harvest date for a municipality using FAO GAEZ data. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A second concern with equation (1) is that if festivals were assigned exogenously depending on characteristics that might matter for economic development – such as geography and climate – then municipalities that happen to have festivals coincide with planting or harvest would not be comparable to municipalities where this is not the case. If this were the case, then the estimates from equation (1) for our independent variables of interest would not be causal and would instead be capturing impacts of these other differences between municipalities.

To examine whether this is the case, we estimate equation (1) and have the outcome y_m be a series of geographic, climatic, and historical characteristics that might affect development. Figure 7 presents the estimates for this exercise.[46] The estimates suggest that, conditional on fixed effects for state, planting month, harvest month, and festival month, municipalities that happen to have festivals coincide with planting or harvest are generally not significantly different than municipalities where this not the case for a number of characteristics that are potentially important for economic development.[47] The findings provide additional support for taking the coincidence of festival dates with planting or harvest seasons as plausibly exogenous (the identifying assumption of equation (1)).

6. Results: Differences in Development

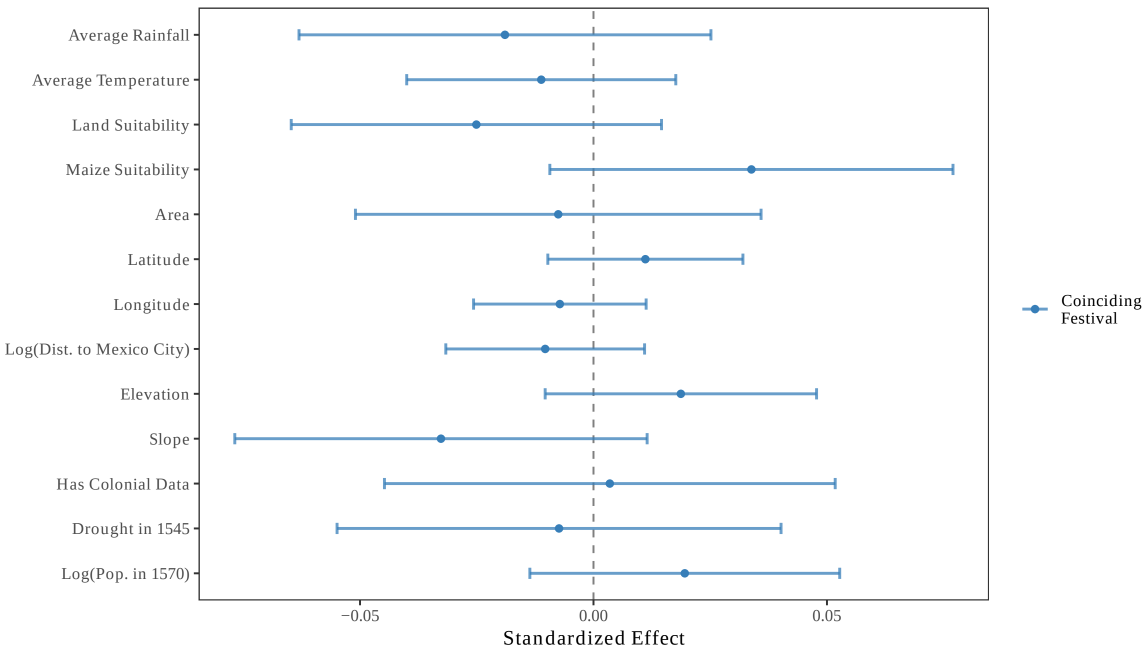
6.1. Differences in Development

We now present regression results examining whether having saint day festivals coincide with planting and/or harvest seasons leads to differences in economic development in Mexico. We use data from the 2010 population census to estimate equation (1). To discipline the analysis and avoid data mining and specification search concerns for multiple outcomes, we focus on two main outcomes. The first is simply (the log of) mean household income in the municipality. Second, we construct an index of economic development using all questions in the census related to economic development within a municipality. Log household income is one component of the index, but other components are a wide range of municipality characteristics related to employment, educational attainment (by gender and for various age groups), and asset ownership. We construct

[46] We present the estimates in table form in Table A1.

[47] Note that we do find that municipalities with coinciding festivals are more likely to be suitable for maize (statistically significant at the 10% level). To the extent that higher maize productivity should improve a locality's long-run development prospects, this pre-existing difference would suggest that our estimates may be lower bounds of the true effects of coinciding festivals. In subsequent regression tables we show how our estimates are sensitive to the inclusion of this and other controls. Results are always robust to their inclusion or exclusion.

Figure 7: Municipality Characteristics and Coinciding Festivals



Notes: Data are from the 2010 Mexico Population Census for *New Spain* region of Mexico. Colonial drought and population density data are from Sellers and Alix-Garcia (2018). The figure presents the estimated standardized coefficients and respective 95% confidence intervals from estimating equation (1) on various municipality characteristics (denoted on the y-axis), conditional on state fixed effects, planting-month and harvest-month fixed effects, and festival month fixed effects. *Coinciding Festival* is an indicator variable equal to 1 if the saint day festival in a municipality occurs either within 0-30 days prior to the optimal maize planting date or 0-30 days after the optimal maize harvest date for a municipality using FAO GAEZ data, and 0 otherwise. Note that we do not have colonial characteristics for all observations in our sample; therefore, we also show results for *Has Colonial Characteristics*, an indicator equal to 1 if a municipality is not missing colonial characteristics.

the index as the first principal component of these measures of development. We explain the component measures in detail in Appendix A.

Table 2 presents the estimates for equation (1) for log household income (Panel A) and for the index of economic development (Panel B) as the dependent variables. Column (1) does not include state fixed effects, while columns (2)-(5) (our preferred specifications as explained in Section 5) include state fixed effects. Columns (3) and (4) include additional geographic controls and historical controls, respectively. Column (5) includes planting-month, harvest-month, and festival-month fixed effects to account for potential direct (time-invariant) impacts of having planting or harvest occur at different points in the calendar, or for having a festival occur in a particular calendar month. The estimates presented in Table 2 show that having an agriculturally-coinciding festival is associated with significantly lower levels of economic development: an approximately 0.15 standard deviation decrease in log household income and in the index of economic development.

It is of interest to explore what index sub-components are driving these impacts on the overall index of economic development. We therefore present the estimated effects for all the individual index components in Figure 8. We find that in regressions for the vast majority of the sub-components, the coefficient on coinciding festivals is negative, and most estimates are statistically significant. When we examine which components tend to have the largest negative effects, we find that having a coinciding festival is associated with significantly lower household income, literacy, employment, and education. The results in Figure 8 provide evidence for the wide-ranging negative development consequences of agriculturally-coinciding festivals.

One natural question is whether the results are similar for festivals that coincide with planting and festivals that coincide with harvest. Table A4 presents the results separately examining the impacts of festivals that coincide with planting and festivals that coincide with harvest on log household income and the index of economic development. We find that both planting-coinciding and harvest-coinciding festivals are associated with worse development outcomes. For both planting-coinciding and harvest-coinciding festivals, the estimated effects are similar to the results from Table 2 in both magnitudes and statistical significance. Table A4 also shows p-values from testing the null hypothesis that the coefficients for planting-coinciding festivals and harvest-coinciding festivals are the same. Across all specifications, we fail to reject the null hypotheses that the effect of planting-coinciding and harvest-coinciding festivals are identical.

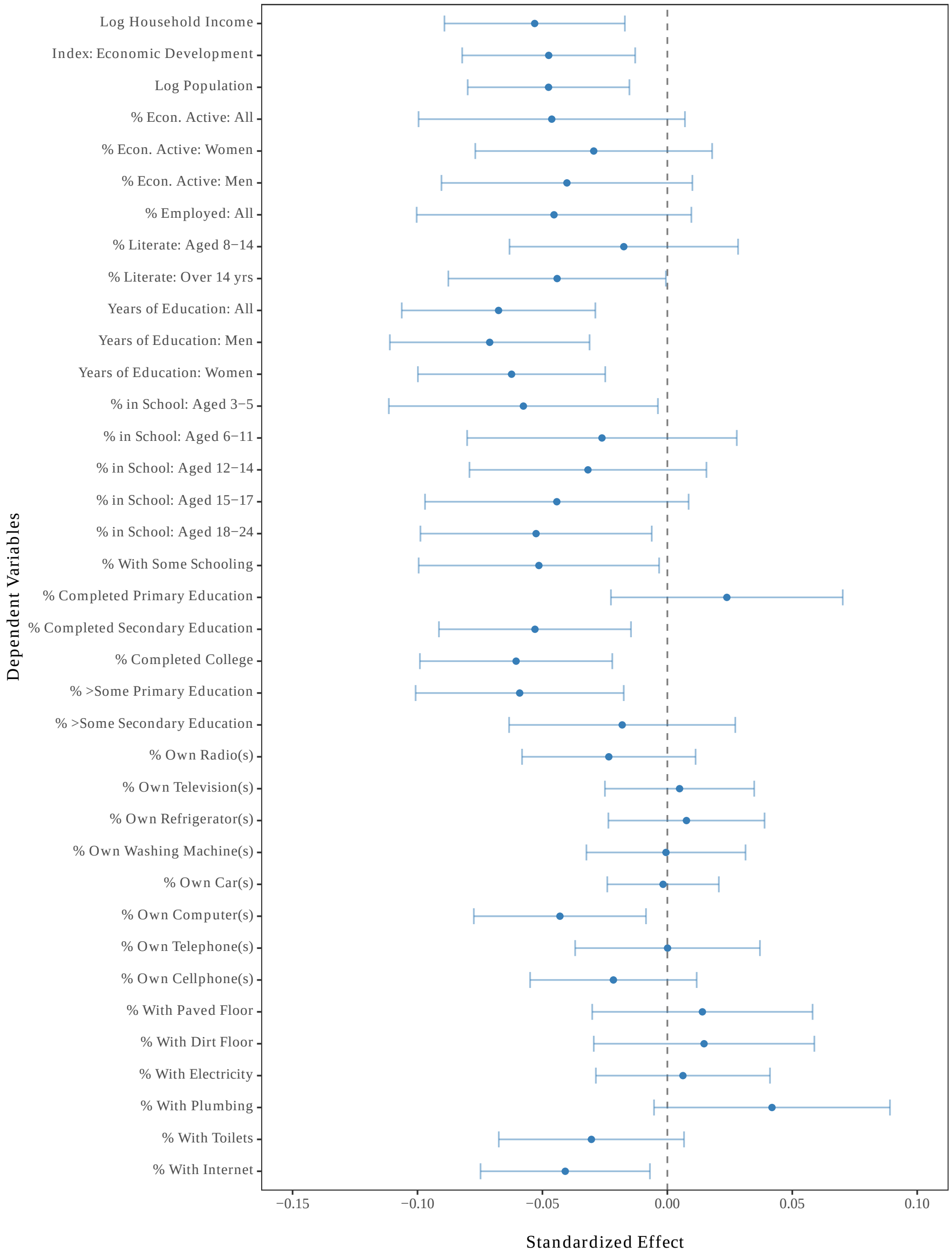
Table 2: Impact of Agriculturally-Coinciding Festivals on Development Outcomes

	Dependent Variable: Panel A: *Log HH Income*				
	(1)	(2)	(3)	(4)	(5)
Festival Coincides with Maize Planting or Harvest	-0.275^{***}	-0.204^{**}	-0.251^{***}	-0.255^{***}	-0.216^{***}
	(0.099)	(0.080)	(0.071)	(0.070)	(0.075)
State Fixed Effects	N	Y	Y	Y	Y
Geography Controls	N	N	Y	Y	Y
Colonial Controls	N	N	N	Y	Y
Planting-Month Fixed Effects	N	N	N	N	Y
Harvest-Month Fixed Effects	N	N	N	N	Y
Festival-Month Fixed Effects	N	N	N	N	Y
Observations	1,593	1,593	1,593	1,593	1,593
Adjusted R2	0.004	0.347	0.538	0.543	0.563
Mean Dep. Var.	3.234	3.234	3.234	3.234	3.234
SD Dep. Var.	1.330	1.330	1.330	1.330	1.330

	Dependent Variable: Panel B: *Index of Economic Development*				
	(1)	(2)	(3)	(4)	(5)
Festival Coincides with Maize Planting or Harvest	-0.695^{**}	-0.422^{*}	-0.593^{***}	-0.613^{***}	-0.598^{***}
	(0.300)	(0.240)	(0.209)	(0.208)	(0.222)
State Fixed Effects	N	Y	Y	Y	Y
Geography Controls	N	N	Y	Y	Y
Colonial Controls	N	N	N	Y	Y
Planting-Month Fixed Effects	N	N	N	N	Y
Harvest-Month Fixed Effects	N	N	N	N	Y
Festival-Month Fixed Effects	N	N	N	N	Y
Observations	1,593	1,593	1,593	1,593	1,593
Adjusted R2	0.002	0.348	0.566	0.572	0.593
Mean Dep. Var.	-0.589	-0.589	-0.589	-0.589	-0.589
SD Dep. Var.	4.039	4.039	4.039	4.039	4.039

Notes: Data are from the 2010 Mexico Population Census. Observations are municipalities in the *New Spain* region of Mexico. Robust standard errors are presented in parentheses. *Index of Economic Development* is the first principal component index for a number of development outcomes in the census for a municipality (see Data Appendix). *Festival Coincides with Maize Planting or Harvest* is an indicator variable equal to 1 if the saint day festival in a municipality occurs either 0 to 30 days prior to the optimal maize planting date or 0 to 30 days after the optimal maize harvest date for a municipality using FAO GAEZ data. *Geography Controls* includes mean temperature, mean precipitation, mean land suitability, the surface area, centroid latitude, centroid longitude, mean elevation, mean slope, log distance to Mexico City, and mean maize suitability for the municipality. *Colonial Controls* includes drought intensity in 1545 and log population density in 1570 using data from Sellers and Alix-Garcia (2018). For these colonial controls, values for municipalities with missing information are set to zero, and we control for an indicator variable equal to 1 if the municipality is not missing these colonial characteristics. *Planting & Harvest Month Fixed Effects* are fixed effects for the optimal planting-month and harvest-month for maize for each municipality according to FAO GAEZ data. *Festival Month Fixed Effects* are fixed effects for the calendar month of the municipality's saint day festival. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 8: Impact of Agriculturally-Coinciding Festivals on Development Outcomes: Estimates for *Economic Development Index* Components



Notes: Data are from the 2010 Mexico Population Census for *New Spain* region of Mexico. The figure presents the estimated standardized coefficients and respective 95% confidence intervals from estimating equation (1) on the sub-components of the *Index of Economic Development*. The dependent variables are denoted on the y-axis. We first show the estimates for log household income, then for the *Index of Economic Development*, followed by estimates for each of the individual sub-components of the index (note, log household income is also one of the index components). See Data Appendix for more information. The independent variable is *Festival Coincides with Maize Planting or Harvest*: an indicator variable equal to 1 if the saint day festival in a municipality occurs either 0 to 30 days prior to the optimal maize planting date or 0 to 30 days after the optimal maize harvest date for a municipality using FAO GAEZ data. The regressions control for the full set of controls: *State Fixed Effects*, *Geography Controls*, *Colonial Controls*, and *Festival, Planting, & Harvest Month Fixed Effects*.

Given this evidence that the effects of planting-coinciding and harvest-coinciding festivals are similar, in all remaining analyses of this paper we simply focus on estimating the impact of festivals coinciding with either planting or harvest (as specified in equation (1)).

6.2. *Impacts by Festival Timing Relative to Planting & Harvest*

A key hypothesis in Section 2 is that agriculturally-coinciding festivals have their negative effects by tightening liquidity constraints in periods when other high-return but time-sensitive investments are available. If so, then the negative impacts of coinciding festivals should be largest in magnitude in the months closest to harvest and planting, and closer to zero in months further away from these key time periods. We now test this prediction by estimating the impacts of festivals coinciding with *other* months further in time from the planting and harvest months.

We estimate the following specification:

$$y_m = \alpha_{s(m)} + \sum_{i=-3}^{3} \beta_i \, \textit{Festival: } i \textit{ Months from Planting}_m + \sum_{j=-3}^{3} \gamma_j \, \textit{Festival: } j \textit{ Months from Harvest}_m + \mathbf{X_m}'\mathbf{B} + \epsilon_m \quad (3)$$

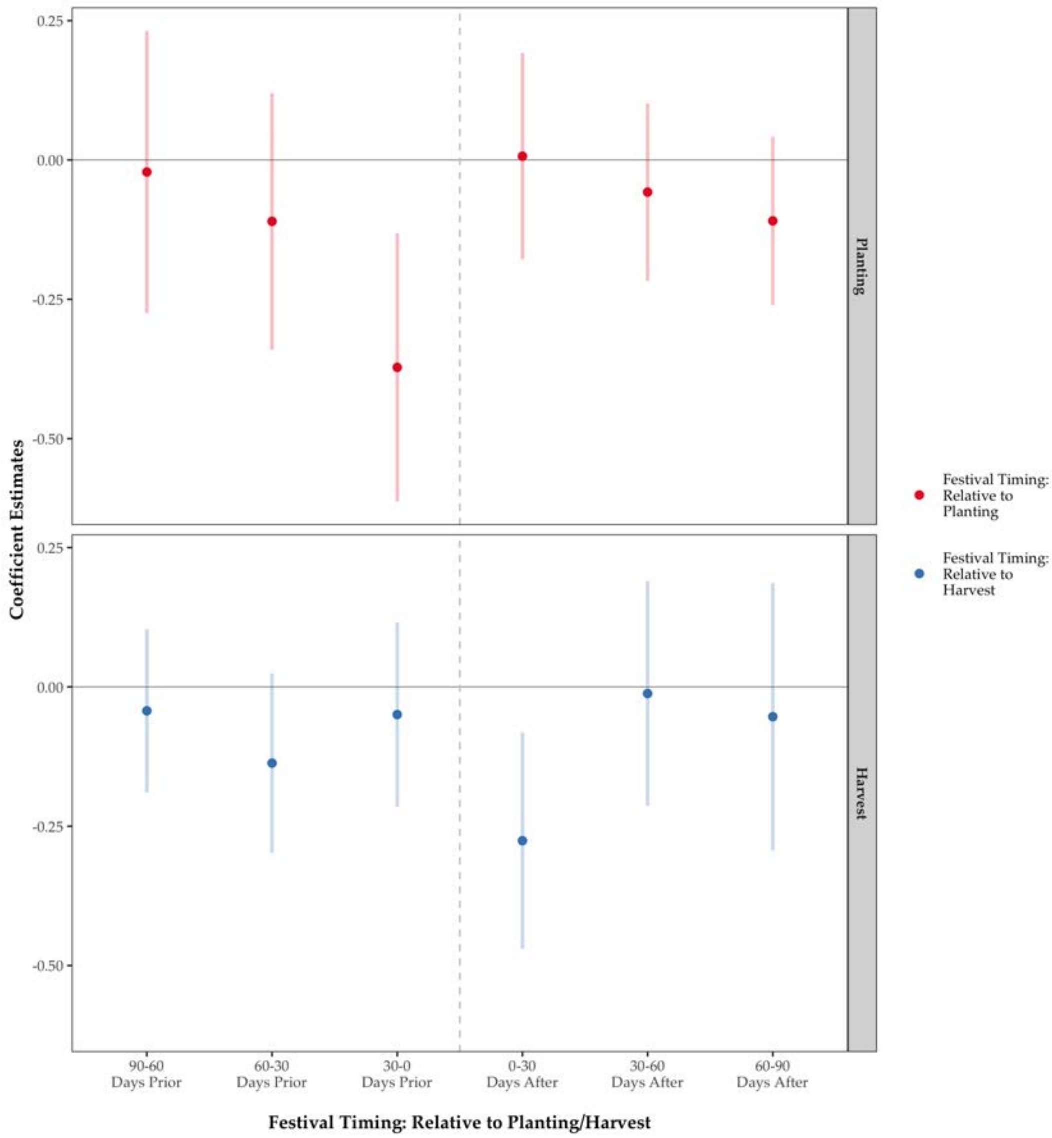
where our coefficients of interest are β_i and γ_j, the effect of festivals occurring i or j months from planting or harvest, respectively; and other variables are defined as before in equation (1).

Figure 9 presents these estimates of interest from estimating equation (3) on log household income. The estimates are consistent with the hypothesis from Section 2: the largest estimated effect occurs when the festival coincides exactly with the period prior to the planting month or following the harvest month. The planting-month and harvest-month effects are both statistically significantly different from zero. Effects of other months adjacent to planting or harvest are much closer to zero, and none are statistically significantly different from zero. These results are consistent with the hypothesis that festivals tighten liquidity constraints and crowd out key investments in the crucial planting and harvest periods.

6.3. *Extensions & Robustness*

In this section, we conduct a number of robustness tests for our main results. First, we show that the results are robust to expanding the sample to include all municipalities in Mexico. Second, we show that our results are robust to using the agricultural seasons for the maximum Caloric Suitability Index (CSI) crop within each municipality instead of focusing solely on maize planting

Figure 9: Impacts of Festival Coincidence with Other Months Relative to Planting and Harvest



Notes: Data are from the 2010 Mexico Population Census for the *New Spain* region of Mexico. The figure presents the estimated β_i and γ_j coefficients and respective 95% confidence intervals from estimating equation (3). The outcome variable is *Log Household Income*. *Festival Timing: Relative to Planting/Harvest* is defined as the number of months before/after a municipality celebrates its festival relative to planting (top panel) and harvest (bottom panel) according to FAO GAEZ data. The regressions control for the full-set of controls: *State Fixed Effects*, *Geography Controls*, *Colonial Controls*, and *Festival, Planting, & Harvest Month Fixed Effects*.

and harvest seasons. Third, we conduct a randomization inference exercise assigning placebo festival dates to show that the estimated impacts are not driven by outliers or observations with high leverage.

6.3.1. *Expanding Sample to Include All Mexican Municipalities*

For reasons detailed in Section 3, our main results limit the sample to municipalities in the former *New Spain* region of Mexico. In this section, we present our main results expanding the sample to include all municipalities in Mexico where we could determine the festival date.[48]

Table 3 presents coefficient estimates on the indicator for coinciding festivals (from estimating equation (1)) in regressions for log household income and for the index of economic development in the sample of all municipalities in Mexico. The results are very similar to the results presented in Table 2: coinciding festivals are associated with significantly lower household income and lower economic development index values.[49] These results confirm the findings from the previous section and show that the results are robust to considering an alternative and larger sample.

6.3.2. *Maximum Calorie Crops*

As explained in Section 4.3, we also consider an alternative measure of how festivals coincide with agricultural seasons. Specifically, instead of examining only maize planting and harvest, we use data from Galor and Ozak (2016) on the Caloric Suitability Index (CSI) for each crop within each municipality to construct measures of the coincidence between the festival date and the optimal planting/harvest date of the maximum CSI crop for each municipality. As before, the crop calendar data are from FAO GAEZ. This provides an additional check on the results presented above by considering a measure that examines a larger set of crops instead of just maize.

Table A6 presents the estimates for estimating equation (1) for household incomes (Panel A) and the index of economic development (Panel B) using the coincidence between festival month and optimal planting or harvest months for the maximum CSI crop. The results are similar to the results presented in Table 2 and show that having the festival coincide with planting or

[48]See Figure 2 for a map of municipalities in Mexico that were and were not part of *New Spain*.

[49]Appendix Table A2 presents the equivalent balance table as in Table A1 for all of Mexico and shows that coinciding festivals are not associated with differences in important geographic and historical variables in this broader sample of all Mexican municipalities.

Table 3: Impact of Agriculturally-Coinciding Festivals on Development Outcomes: All of Mexico

	Dependent Variable: Panel A: *Log HH Income*				
	(1)	(2)	(3)	(4)	(5)
Festival Coincides with Maize Planting or Harvest	-0.009	-0.099	-0.138^{**}	-0.140^{**}	-0.125^{**}
	(0.080)	(0.063)	(0.056)	(0.056)	(0.059)
State Fixed Effects	N	Y	Y	Y	Y
Geography Controls	N	N	Y	Y	Y
Colonial Controls	N	N	N	Y	Y
Planting-Month Fixed Effects	N	N	N	N	Y
Harvest-Month Fixed Effects	N	N	N	N	Y
Festival-Month Fixed Effects	N	N	N	N	Y
Observations	2,277	2,277	2,277	2,277	2,277
Adjusted R2	-0.000	0.351	0.518	0.522	0.531
Mean Dep. Var.	3.379	3.379	3.379	3.379	3.379
SD Dep. Var.	1.316	1.316	1.316	1.316	1.316
	Dependent Variable: Panel B: *Index of Economic Development*				
	(1)	(2)	(3)	(4)	(5)
Festival Coincides with Maize Planting or Harvest	0.103	-0.231	-0.348^{**}	-0.353^{**}	-0.321^{*}
	(0.249)	(0.194)	(0.171)	(0.171)	(0.180)
State Fixed Effects	N	Y	Y	Y	Y
Geography Controls	N	N	Y	Y	Y
Colonial Controls	N	N	N	Y	Y
Planting-Month Fixed Effects	N	N	N	N	Y
Harvest-Month Fixed Effects	N	N	N	N	Y
Festival-Month Fixed Effects	N	N	N	N	Y
Observations	2,277	2,277	2,277	2,277	2,277
Adjusted R2	-0.000	0.379	0.557	0.560	0.570
Mean Dep. Var.	-0.084	-0.084	-0.084	-0.084	-0.084
SD Dep. Var.	4.052	4.052	4.052	4.052	4.052

Notes: Data is from the 2010 Mexico Population Census. Observations are municipalities in Mexico. Robust standard errors are presented in parentheses. *Index of Economic Development* is the first principal component index for a number of development outcomes in the census for a municipality (see Data Appendix). *Festival Coincides with Maize Planting or Harvest* is an indicator variable equal to 1 if the saint day festival in a municipality occurs either 0 to 30 days prior to the optimal maize planting date or 0 to 30 days after the optimal maize harvest date for a municipality using FAO GAEZ data. *Geography Controls* includes mean temperature, mean precipitation, mean land suitability, the surface area, centroid latitude, centroid longitude, mean elevation, mean slope, log distance to Mexico City, and mean maize suitability for the municipality. *Colonial Controls* includes drought intensity in 1545 and log population density in 1570 using data from Sellers and Alix-Garcia (2018). For these colonial controls, values for municipalities with missing information are set to zero, and we control for an indicator variable equal to 1 if the municipality is not missing these colonial characteristics. *Planting & Harvest Month Fixed Effects* includes fixed effects for the optimal planting-month and harvest-month for maize for each municipality according to FAO GAEZ data. *Festival Month Fixed Effects* are fixed effects for the calendar month of the municipality's saint day festival. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

harvest is associated with significantly worse measures of economic development.[50] These results confirm the findings from the previous section, showing that the results are robust to considering alternative crop calendars.

6.3.3. *Randomization Inference Exercise*

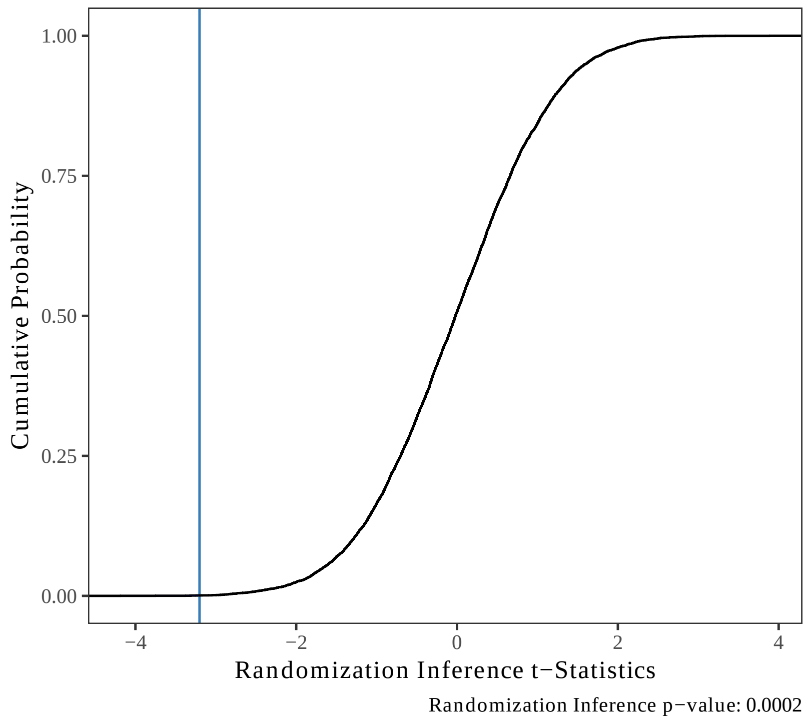
One potential concern with the main results in Table 2 is that they might be driven by outlier municipalities or high-leverage observations. To provide potentially more robust inference, we follow Young (2018) and conduct a randomization inference exercise where we randomly assign whether or not a municipality's festival coincides with planting or harvest months. Specifically, we conduct 10,000 simulations where we randomly assign whether or not a festival coincides with planting or harvest for each municipality, and estimate equation (1). Figure 10 presents the empirical cumulative distribution function of the estimated t-statistics for all the simulations, and denotes the estimated t-statistics from our sample with vertical lines. We also show the randomization inference p-value in the bottom right of the figure. We find that the estimated t-statistics in our sample for having a festival coincide with maize planting or harvest are much larger and more negative than the majority of placebo festival assignments, and that the randomization inference p-value is 0.0002. The results from this randomization inference exercise suggest the estimated impacts of festivals coinciding with planting or harvest are specific to the actual festival dates we observe across Mexico.

7. Mechanisms

The results so far establish that festivals that coincide with planting or harvest lead to worse economic development outcomes in the long-run. We now explore mechanisms behind this effect. We argue that these impacts emerge because the planting and harvest seasons have high-return but time-sensitive agricultural investment opportunities, so festivals in these times have a crowding-out effect. While there may be offsetting improvements in other outcomes (such

[50] Appendix Table A12 presents the equivalent balance table as in Table A1 and shows the municipalities where the festival coincides with the max CSI crop's planting or harvest months are similar on important geographic and historical characteristics as well. We also replicate the month-by-month analysis from section 6.2 using the CSI measure and present the results in Figure A10. We find that the effect of the coincidence between the festival and max CSI crop seasons is largest exactly when the festival coincides with the planting month.

Figure 10: Randomization Inference Exercise – Placebo Festivals



Notes: The figure presents the cumulative distribution function for the estimated t-statistics for the randomization inference exercise. Specifically, we conduct 10,000 simulations where we randomly assign whether or not a festival coincides with planting or harvest for each municipality and estimate our main specification, and then plot the cumulative distribution function for the estimated t-statistics. The dependent variable is *Log Household Income*. All regressions include state fixed effects, *Geography Controls*, *Colonial Controls*, and *Festival, Planting, & Harvest Month fixed effects*. Observations are municipalities in the *New Spain* region of Mexico. Additionally, the figure presents the estimated t-statistic for our sample, and reports the randomization inference p-value on the bottom right of the figure.

as religiosity, social capital, and inequality) stemming from festivals, the net effect of planting- or harvest-season festivals is to compromise long-run growth. To explore the mechanisms for these hypotheses, we conduct a number of empirical tests using Census data and maize yield and production data from the *Servicio de Información Agroalimentaria y Pesquera* (SIAP).

7.1. Agricultural Productivity

We first examine the effect of coinciding festivals on agricultural productivity. One important implication of the conceptual framework discussed in Section 2 is that the agricultural sector in municipalities with coinciding festivals should be less productive, because coinciding festivals persistently crowd out high-return investment opportunities in agriculture. We test whether municipalities where festivals coincide with planting or harvest have lower maize yields compared to other municipalities using data from the *Servicio de Información Agroalimentaria y Pesquera* (SIAP). Column 1 of Table 4 presents the estimate of the impact of coinciding festivals on maize yields. We find that municipalities with coinciding festivals have lower agricultural productivity: coinciding festivals lead to a 0.07 standard deviation decrease in maize yields. Consistent with the conceptual framework discussed in Section 2, we find that festivals that coincide with planting or harvest have lower agricultural productivity.

7.2. *Structural Transformation of the Economy*

We turn to examining the impact of festivals on municipality-level measures of structural transformation, guided by the conceptual framework presented in Section 2. Two-sector growth models of structural transformation would predict that lower agricultural productivity (due to having agriculturally-coinciding festivals) would lead to less structural transformation of the economy out of agriculture. (Herrendorf et al., 2014, Caselli, 2005).

To examine the impact of festivals on industrial structure, we use IPUMS microdata from the 2010 Mexican Population Census. The IPUMS microdata provides a 10 percent random sample of each census and provide population weights for each observation. We use this microdata to construct municipality-level measures of the share of workers in different industries (agriculture, manufacturing, and services), and the share of workers in rural localities (defined in the census as localities with fewer than 2500 individuals). Columns 2 to 5 of Table 4 present estimates of the impact of planting and harvest festivals on the structural transformation of the economy. We find that municipalities with coinciding festivals have higher shares of workers in agriculture and a significantly lower share of workers in services. This is consistent with the prediction that the transition away from agriculture is hampered in areas with lower agricultural productivity (due to having agriculturally-coinciding festivals). Relatedly, we find that having coinciding festivals leads to higher share of the population in rural areas. By inhibiting the development of agriculture, coinciding festivals appear to slow the structural transformation of localities out of agriculture and into the modern economic sectors.

7.3. *Development Across Time*

The results so far highlight that festivals that coincide with planting or harvest are associated with worse development outcomes, and that these effects are driven by less structural transformation. We now explore the question of when these differences in development emerged. We use a historical measure of economic development across municipalities of Mexico from Sellers and

Table 4: Impact of Agriculturally-Coinciding Festivals on Agricultural Productivity and Structural Transformation

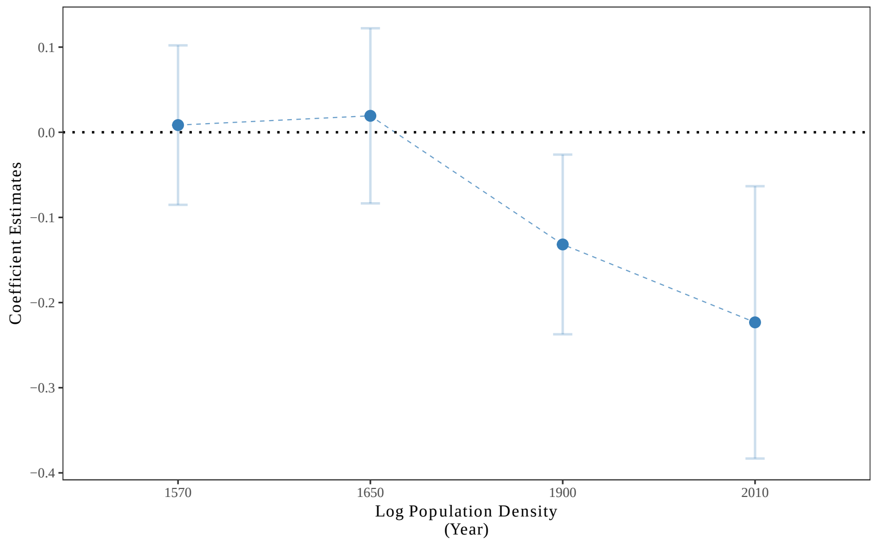
	Dependent Variables:				
	Maize Yield	*% in Agriculture*	*% in Manufacturing*	*% in Services*	*% in Rural Localities*
	(1)	(2)	(3)	(4)	(5)
Festival Coincides with Maize Planting or Harvest	-1.248^{**}	0.032^{**}	-0.004	-0.027^{**}	0.050^{**}
	(0.588)	(0.014)	(0.008)	(0.013)	(0.023)
State Fixed Effects	Y	Y	Y	Y	Y
Geography Controls	Y	Y	Y	Y	Y
Colonial Controls	Y	Y	Y	Y	Y
Planting-Month Fixed Effects	Y	Y	Y	Y	Y
Harvest-Month Fixed Effects	Y	Y	Y	Y	Y
Festival-Month Fixed Effects	Y	Y	Y	Y	Y
Observations	1,578	1,593	1,593	1,593	1,593
Adjusted R2	0.329	0.487	0.234	0.437	0.419
Mean Dep. Var.	5.396	0.414	0.114	0.465	0.622

Notes: Maize yield data are from the *Servicio de Información Agroalimentaria y Pesquera* (SIAP) for 2010, and other outcomes from the 2010 Population Census. Observations are municipalities in the *New Spain* region of Mexico. Standard errors are clustered at the municipality level. *Maize Yield* is the mean maize yield in tons per hectare for a municipality in 2010. *% in Agriculture* is the share of workers in a municipality who work in agriculture. *% in Manufacturing* is the share of workers in a municipality who work in manufacturing. *% in Services* is the share of workers in a municipality who work in the service industry. *% Rural* is the share of individuals in a municipality who reside in rural locations (defined as as localities with 2,500 or fewer inhabitants). *Festival Coincides with Maize Planting or Harvest* is an indicator variable equal to 1 if the saint day festival in a municipality occurs either 0 to 30 days prior to the optimal maize planting date or 0 to 30 days after the optimal maize harvest date for a municipality using FAO GAEZ data. *Geography Controls* includes mean temperature, mean precipitation, mean land suitability, the surface area, centroid latitude, centroid longitude, mean elevation, mean slope, log distance to Mexico City, and mean maize suitability for the municipality. *Colonial Controls* includes drought intensity in 1545 and log population density in 1570 using data from Sellers and Alix-Garcia (2018). For these colonial controls, values for municipalities with missing information are set to zero, and we control for an indicator variable equal to 1 if the municipality is not missing these colonial characteristics. *Planting & Harvest Month Fixed Effects* includes fixed effects for the optimal planting-month and harvest-month for maize for each municipality according to FAO GAEZ data. *Festival Month Fixed Effects* are fixed effects for the calendar month of the municipality's saint day festival. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Alix-Garcia (2018) to ask at what point in time the effects of coinciding festivals emerged. We focus on population density, which is often used as a proxy for economic development, particularly in historical studies in which data on other development outcomes are not available (e.g., Acemoglu et al., 2002). We examine impacts on population density in 1570, 1650, 1900, and 2010, and plot the coefficients representing the effect of coinciding festivals in Figure 11.

We find that having agriculturally-coinciding festivals does not affect population density in 1570 or 1650, but does lead to lower population density in 1900 and in 2010. The negative point estimate is larger in magnitude in 2010 than in 1900, but confidence intervals are large and we cannot reject that the effects on population density are similar in 1900 and 2010. The results indicate that the impacts of coinciding festivals on development emerged sometime after 1650, were already perceptible in the data by the end of the 19th century, and have possibly become larger over the subsequent century.

Figure 11: Impact of Agriculturally-Coinciding Festivals on Population



Notes: Data on log population density for 1570, 1650, and 1900 is from Sellers and Alix-Garcia (2018). Data on population density for 2010 is from the 2010 Mexico Population Census. The figure presents the estimated coefficients and respective 95% confidence intervals from estimating equation (1) for various measures of log population density across time. Observations are municipalities in the *New Spain* region of Mexico. The independent variable is *Festival Coincides with Maize Planting or Harvest*, an indicator variable equal to 1 if the saint day festival in a municipality occurs either 0 to 30 days prior to optimal maize planting month or 0 to 30 days after the optimal maize harvest month for that municipality using FAO GAEZ data. The regressions control for the full-set of controls: *State Fixed Effects*, *Geography Controls*, *Colonial Controls*, and *Festival, Planting, & Harvest Month Fixed Effects*.

8. Religiosity, Social Capital, and Income Inequality

We now explore how festivals coinciding with planting and harvest affect religiosity, social capital, and income equality. These are outcomes of independent interest. Impacts on these outcomes – particularly on religiosity – could also potentially help explain why coinciding festivals persist, notwithstanding their negative impacts on economic development.

8.1. Religiosity and Social Capital

We now examine the impact of festivals on religiosity and social capital, using survey data from the Americasbarometer from 2008 to 2018. To examine differences in religiosity, we construct an index from three questions: the importance of religion to an individual, church attendance, and religious group attendance. For the importance of religion question, the survey asks how important religion is to a respondent. The church attendance question asks how frequently an individual goes to church. For religious group attendance, the survey asks respondents how frequently an individual participates in religious group meetings. We define our religiosity index as the first principal component of these three religion questions.[51] To measure social capital, we construct an index from questions on the frequency with which a respondent participates in four different types of group meetings: community improvement groups, parental associations, municipal meetings, and political associations.[52] We define our index as the first principal component of these four questions. We describe the questions in more detail in Appendix A.

Table 5 presents regression estimates of the impact of coinciding festivals on the religiosity and social capital indices, while Figure 12 presents estimates of the impacts of coinciding festivals on each of the individual components of the religiosity and social capital indexes. We find that municipalities with coinciding festivals have higher levels of religiosity and social capital (columns 1 and 2 of Table 5, respectively). Additionally, we find that, broadly speaking, coinciding festivals have positive effects on each of the religiosity index and social capital index components (see Figure 12). Across all the components of the indices, the only one for which coinciding festivals does not have a positive effect is political group participation.

As discussed previously in Section 2, there are two reasons why coinciding festivals could lead to with higher religiosity. Agriculturally-coinciding festivals, as higher-cost signals of religious adherence, could have a direct, positive effect on religiosity. In addition, there could be an indirect effect, as lower economic development resulting from agriculturally-coinciding festivals slows the secularization process, increasing religiosity. The resulting increase in religiosity could help explain why agriculturally-coinciding festivals persist: more religious communities may hold more tightly to their religious traditions and put up more resistance to changing them, even in the face of their negative economic consequences.

8.2. Inequality

We also investigate the impact of agriculturally-coinciding festivals on income inequality. There could be an impact of coinciding festivals on inequality, for two reasons. First, because coinciding festivals might lead to higher religiosity and social capital, these festivals might also lead to more redistribution and, therefore, lower inequality. Second, as economic growth typically coincides

[51] Note that these are the full set of religion questions in the LAPOP surveys; however, they were not asked in every wave consistently. For waves without the full set of questions, we construct our index using the subset of questions that were asked. (All survey waves have at least two out of the three questions.) However, we show in Figure 12 that the results hold for each individual component.

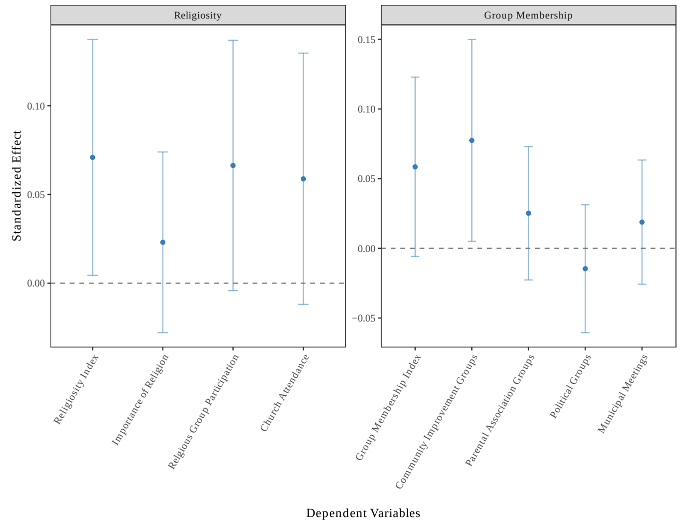
[52] These are the full set of groups that appear consistently in all waves we examine. In Figure 12, we show the results for each individual component.

Table 5: Impact of Agriculturally-Coinciding Festivals on Religiosity, Social Capital, and Inequality

	Dependent Variables:		
	Religiosity Index	*Group Membership Index*	*IQR of Earned Incomes*
	(1)	(2)	(3)
Festival Coincides with Maize Planting or Harvest	0.302^{**}	0.257^{*}	-0.303^{***}
	(0.145)	(0.144)	(0.101)
State Fixed Effects	Y	Y	Y
Geography Controls	Y	Y	Y
Colonial Controls	Y	Y	Y
Planting-Month Fixed Effects	Y	Y	Y
Harvest-Month Fixed Effects	Y	Y	Y
Festival-Month Fixed Effects	Y	Y	Y
Observations	4,796	4,818	1,593
Clusters	131	131	1593
Adjusted R2	0.122	0.044	0.551
Mean Dep. Var.	-0.187	0.063	2.168
SD Dep. Var.	1.266	1.306	1.833

Notes: Data are from the Americas Barometer (LAPOP) data (religiosity and social capital) and from the 2010 Mexico Population Censuses from IPUMS (inequality). Observations are individuals in municipalities in the *New Spain* region of Mexico. Standard errors are clustered at the municipality level. *Religiosity Index* is the first principal component of the following variables: *Importance of Religion*, *Church Attendance*, and *Religious Group Attendance*. *Importance of Religion* is a 1-4 categorical variable that measures how important religion is to a respondent, ranging from 1="Not Important at All" to 4="Very Important". *Church Attendance* is a 1-5 categorical variable that measures how frequently an individual goes to church, ranging from 1="Never" to 5="More than Once a Week". *Religious Group Attendance* is a 1-4 categorical variable that measures how frequently an individual participates in religious group meetings, ranging from 1="Never" to 4="Once a Week". *Group Membership Index* is the first principal component for the frequency with which a respondent participates in the following group meetings: community improvement, parental associations, municipal meetings, or political associations. *IQR of Earned Incomes* measures the inter-quartile range of individuals total income from their labor (from wages, a business, or a farm) in the previous month for individuals residing in a given municipality. *Festival Coincides with Maize Planting or Harvest* is an indicator variable equal to 1 if the saint day festival in a municipality occurs either 0 to 30 days prior to the optimal maize planting date or 0 to 30 days after the optimal maize harvest date for a municipality using FAO GAEZ data. All regressions controls for respondent age, age squared, gender, and include survey-wave fixed effects. *Geography Controls* includes mean temperature, mean precipitation, mean land suitability, the surface area, centroid latitude, centroid longitude, mean elevation, mean slope, log distance to Mexico City, and mean maize suitability for the municipality. *Colonial Controls* includes drought intensity in 1545 and log population density in 1570 using data from Sellers and Alix-Garcia (2018). For these colonial controls, values for municipalities with missing information are set to zero, and we control for an indicator variable equal to 1 if the municipality is not missing these colonial characteristics. *Planting & Harvest Month Fixed Effects* includes fixed effects for the optimal planting-month and harvest-month for maize for each municipality according to FAO GAEZ data. *Festival Month Fixed Effects* are fixed effects for the calendar month of the municipality's saint day festival. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure 12: Impact of Agriculturally-Coinciding Festivals on Religiosity and Social Capital: Estimates for *Religiosity Index* and *Group Membership Index* Components



Notes: Data are from the Americas Barometer (LAPOP) data for *New Spain* region of Mexico. The figure presents the estimated coefficients and respective 95% confidence intervals from estimating equation (1) on the sub-components of the *Religiosity Index* and the *Group Membership Index*. The dependent variables are denoted on the x-axis. We first show the estimates for each index, followed by estimates for each of the individual sub-components of the index. (See Data Appendix for more information.) The independent variable is *Festival Coincides with Maize Planting or Harvest*: an indicator variable equal to 1 if the saint day festival in a municipality occurs either 0 to 30 days prior to the optimal maize planting date or 0 to 30 days after the optimal maize harvest date for a municipality using FAO GAEZ data. The regressions control for respondent age, age squared, gender, and for the following set of controls: *Survey-Wave Fixed Effects*, *State Fixed Effects*, *Geography Controls*, *Colonial Controls*, and *Festival, Planting, & Harvest Month Fixed Effects*.

with increases in income inequality, we may also expect that agriculturally-coinciding festivals may reduce inequality.

We use IPUMS microdata from the 2010 Mexican Population Census to construct municipality-level measures of income inequality. The IPUMS microdata provides a 10 percent random sample of each census and provides population weights for each observation. We construct measures of the inter-quartile range (IQR) of earned income for individuals in a municipality, where earned income is defined as an individual's total income from their labor (from wages, a business, or a farm) in the previous month.

Column 3 of Table 5 presents regression estimates of the impact of coinciding festivals on income inequality. We find that municipalities with coinciding festivals have lower levels of income inequality.[53] This finding that agriculturally-coinciding festivals lead to both lower development and less inequality suggest an equity-efficiency trade-off in this context (e.g. Kuznets, 1955, Robinson and Acemoglu, 2002).

[53]Similarly, Figure A12 presents the estimates on income inequality of the timing of the festival month relative to planting and harvest month from estimating equation 3). As in Section 6.2, we find that the largest estimated effect on inequality occurs when the festival coincides with the planting or harvest month, and smaller negative effects for other months near planting or harvest.

9. Conclusion

We examine how the timing of religious festivals affects long-run economic development. Our analysis focuses on the New Spain region of Mexico, and studies the impacts of locally-specific Catholic saint day festivals (that have been set for centuries) that happen to coincide with key periods in local agricultural calendars – the planting and harvest seasons. We argue, drawing on qualitative and quantitative evidence, that whether a locality's saint day festival coincides with its planting or harvest season can be taken to be exogenous, or unrelated with other determinants of long-run development outcomes. We assembled a unique dataset of festival dates across municipalities, and combined it with data on locally-specific harvest and planting periods. We find that municipalities with "agriculturally-coinciding" festivals have worse long-run economic development, as measured by mean household income as well as an index of development outcomes. A key mechanism appears to be that festival expenditures reduce agricultural productivity and slow the structural transformation out of agriculture. We also argue that the persistence of such coinciding festivals from historical times to the present may reflect the fact that coinciding festivals also lead to higher religiosity, higher social capital, and lower income inequality. Higher religiosity, in particular, could lead localities with coinciding festivals to maintain their festival traditions even in the face of negative economic development consequences.

Our findings contribute to the literature on the economics of religion, by shedding light on the economic consequences of variation in an important and widespread religious practice, festival celebrations. We also bring a new insight to the development economics literature: festival celebrations can crowd out time-sensitive agricultural investments, and over the long run lead to persistently lower agricultural productivity and less transformation of the economy out of agriculture. Because our study relies on comparing outcomes across municipalities that (nearly) all celebrate Catholic saint day festivals, and only exploit variation in the "agricultural coincidence" of festivals, we cannot speak to whether such festivals have positive or negative consequences for development overall. It is possible that *non*-coinciding festivals could be good for development, and our finding that coinciding festivals have negative consequences is relative to that positive baseline effect. We also, of course, cannot go further and say what impacts Catholic saint day festivals have had on development in Latin America relative to other world regions.

We refrain from speculating whether our results have relevance for major economic or social policies. That said, our findings do help explain the existence of a specific institution observed in many Catholic countries: the practice by employers of withholding a portion of annual compensation until December, when a "thirteenth salary" (often referred to as *aguinaldo*) is paid (Globalization Partners, 2019). Analogously, "Christmas clubs" – no-interest commitment savings accounts to facilitate household savings for Christmas expenditures – were long popular in the United States (Crosgrave, 1927, Thaler and Shefrin, 1981). Christmas clubs and *aguinaldo* practices are typically presented as a way to provide liquidity for Christmas celebration expenses. Future research should explore whether *aguinaldo*-style practices reduce the crowd-out of economic investments whose timings coincide with festival periods.

As is the case for all empirical research, future studies should seek to determine the external validity of these findings. The rest of the Catholic world provides natural new contexts in which to conduct follow-on investigations, potentially using analogous empirical strategies exploiting the coincidence of festival dates with agricultural seasons. Researchers should also explore other contexts where there may be exogenous variation in whether localities celebrate festivals at all, to shed light on the extensive margin impacts of festivals. In addition, it would be valuable to conduct household-level studies to provide detailed evidence on the types of investments that are crowded out by coinciding festivals, and whether the incidence of such crowding out varies with household characteristics. We view these as promising directions for future research.

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