European
Historical
Economics
Society

EHES Working Paper | No. 245 | December 2023

Holy Cows and Spilt Milk: The Impact of Religious Conflict on Firm-Level Productivity

Jeanet Bentzen,
University of Copenhagen, CAGE, CEPR

Nina Boberg-Fazlic,
TU Dortmund University

Paul Sharp,
University of Southern Denmark, CAGE, CEPR

Christian Volmar Skovsgaard,
University of Southern Denmark

Christian Vedel,
University of Southern Denmark

EHES Working Paper | No. 245 | December 2023

Holy Cows and Spilt Milk: The Impact of Religious Conflict on Firm-Level Productivity*

Jeanet Bentzen,
University of Copenhagen, CAGE, CEPR

Nina Boberg-Fazlic,
TU Dortmund University

Paul Sharp[1],
University of Southern Denmark, CAGE, CEPR

Christian Volmar Skovsgaard,
University of Southern Denmark

Christian Vedel,
University of Southern Denmark

Abstract

We consider the impact of non-violent religious conflict on firm-level productivity. We zoom in on a Protestant and otherwise very homogeneous country: early twentieth century Denmark. We exploit variation due to the emergence of pietist movements who fought for the hearts and minds of Danes. In the countryside, much of the religious debate concerned whether or not creameries - the main catalyst of the industrial revolution in Denmark - should be closed on Sundays in accordance with the Third Commandment. We construct a rich microlevel dataset for 964 creameries and combine this with various measures of the intensity of the religious conflict. Exploiting variation in preaching by a prominent religious figure, we provide plausibly causal evidence that religious conflict hampered firm-level productivity. Examining the mechanism, we proceed to demonstrate that the reduction in productivity is due to the religious conflict rather than whether or not the factory produced on Sundays.

JEL Codes: N33, N34, O12, O13, Z12

Keywords: Dairying, Denmark, productivity, religiosity

[1]**Corresponding Author: Paul Sharp** (pauls@sam.sdu.dk)

* This work was made possible through generous funding by Independent Research Fund Denmark (DFF-6109-00123) We would like to thank Peter Baunsgaard, Peter Gerner Ejersbo, Nick Ford, Jakob Baltzer Henriksen, Iga Jozefiak, Maja Uhre Pedersen, Andreas Slot Ravnholt, as well as Xanthi Tsoukli during her time as a PhD student, for extremely conscientious research assistance. Thanks are also due to Lisbet Christoffersen, professor of law, who provided valuable insights on nineteenth century Danish church law. This paper has also benefited from feedback from Philipp Ager, Gregory Clark, Niel Cummins, Kerstin Enflo, Casper Worm Hansen, and Niklas Møller Rendbo. Early iterations of this project were presented in an internal seminar of the HEDG research group and at the PhD seminar series, as well as at the 11th Annual Workshop on "Growth, History and Development", April 28-29 2022, all at the Department of Economics at the University of Southern Denmark. It was also presented at the 2023 Swedish /Scandinavian Economic History meeting in Lund. We would like to thank all participants at the events for insightful questions and comments.

Notice

The material presented in the EHES Working Paper Series is property of the author(s) and should be quoted as such. The views expressed in this Paper are those of the author(s) and do not necessarily represent the views of the EHES or its members

1. Introduction

> Missionary: "It is a question of heaven or hell..."
> Dairy farmer in rural dialect: "And then I thought that heaven was the more comfortable place to be."
> (Quoted by Haue, 1978)

Since Max Weber more than a century ago traced economic differences to religion, a growing literature has examined the causes and consequences of religious belief, exploring for instance - like Weber (1905) - differences in productivity across Protestants and Catholics.[1] More recently, research has focused on the consequences of different intensities of religious belief within each of the religious denominations.[2] The impact of religion or religiosity on economic development is ambiguous and depends on the dimension of religion examined. As a coping tool, religion may benefit stress relief (Pargament, 2001; Bentzen, 2019). As a set of rules ensuring good conduct, religion may improve economic outcomes (Weber, 1905; Andersen et al., 2017). Viewed instead as a set of rules contradicting science, religion may slow scientific progress (Bénabou et al., 2015; Squicciarini, 2020; Andersen and Bentzen, 2022; Cabello, 2023). We zoom in on another dimension. Models of cooperation or conflict often list religion as one dimension along which individuals can differ, alongside factors such as ethnicity and socio-economic status. These differences may make cooperation more difficult (Tabellini, 2008; Guiso et al., 2006). We ask: what happens when managers fight over religion rather than managing their firm? We demonstrate that even non-violent conflicts fueled by increased religiosity of one part can have considerable negative productivity implications.

We examine the impact of religiosity on productivity through the example of Denmark, which witnessed rapid industrialization at the same time as it experienced a pietist revivalist movement.[3] Our overarching question is to what extent religious conflict spurred by religiosity can impact productivity and thus, in the aggregate, economic development more generally. The Danish industrial revolution owed much to the rapid spread of creameries.[4] Such progress may have come into conflict with pietist movements with an emphasis on reflecting Jesus' life and works (Lodberg, 2016; Petersen, 1999). The major spread of revivalism in Denmark had to wait until the passing of the relatively liberal constitution of 1849, which guaranteed freedom of religion and of association, giving both revivalist associations and cooperative creameries legal protection. Pietists looked to the creameries and their peasant shareholders for members and even as locations to hold their meetings. The established Lutheran church in Denmark split into two main factions, the mainstream and relatively liberal Grundtvigians, and the Sabbatarian Inner Mission (IM). The latter began to argue forcefully that production should be halted on Sundays following the Third Commandment[5]. This brought them into conflict with agricultural economists and scientists, who

[1] See reviews on the causes and consequences of the Protestant Reformation by Becker et al. (2016) and of Islam Kuran (1997, 2018), and more general reviews by Iannaccone (1998); Iyer (2016).

[2] See for instance review by Bentzen (2021).

[3] Strictly speaking a movement for *fromhed* (a Danish word meaning a state of fervent and godly religiosity).

[4] For more details on these creameries, see Lampe and Sharp (2014, 2015).

[5] The Third Commandment according to for example Catholic and Lutheran teachings: "Remember the sabbath day, to keep it holy" (The Holy Bible, King James Version).

noted that the cows themselves were not able to observe the Sabbath, and that milk delivered late on Monday might be spoiled, as one of several issues facing this religious constraint on production. In turn, rival groups of farmers debated the question of Sabbatarianism, i.e. whether work should be permitted on Sundays.[6]

To examine whether areas more impacted by this conflict experienced lower productivity, we have gathered data on productivity, location, and other information for 964 creameries over the period 1898-1920. From this, we can compute a key productivity measure, which was standard at the time (Henriksen et al., 2011): the milk to butter ratio (the lower, the less milk is necessary to produce a kilogram of butter, thus indicating higher productivity). We combine this with data on the location and time of construction of 673 mission houses, the buildings in which the IM held their meetings and spread the word to the local community. We thus measure the potential for conflict with mainstream belief through the strength of the IM movement, as measured by the presence of mission houses. We find that increased influence by IM lowers efficiency of butter production in a creamery. We conduct our analysis at the creamery level, including creamery fixed effects throughout. This reduces concerns that the density of mission houses might reflect greater population density or prior development, an issue when considering church density, since churches were often built as status and wealth symbols (Buringh et al., 2020). We note that unlike churches, mission houses were built with the aim of proselytizing, both in rich and poor areas. We also note that positive impacts of religiosity on productivity, such as that envisioned by Max Weber, might be working simultaneously, but the negative effect due to conflict seems to dominate in our data.

Our empirical setup has several advantages. First, restricting analysis to within-country analysis of Denmark limits potential differences substantially from the outset. Second, since we have time-varying information on creameries and IM intensity, we can account for all time-invariant differences across creameries (by adding creamery fixed effects). Nevertheless, a concern is that we are missing important differences that explain the identified relation. We thus implement two identification strategies based on instrumental variables, both based on prior determinants of the spread of IM. The first relies on the distance to the influential preacher, Carl Moe (and we thus assume that the exposure variable is exogenous), the second relies on the distribution of the IM before the period of our analysis (and we thus assume that national shocks are exogenous). Both are used as Bartik-style instruments, determining the later spread of religiosity and conflict (Goldsmith-Pinkham et al., 2020).

[6]Such debates resonate today in various different settings. For example, the US fast food outlet Chick-fil-A is closed on Sundays, following the beliefs of its founder, the devout Southern Baptist, S. Truett Cathy. Resembling the words of the Danish farmer quoted at the beginning, he proclaimed in "Five-Steps for Business Success": "I was not so committed to financial success that I was willing to abandon my principles and priorities. One of the most visible examples of this is our decision to close on Sunday. Our decision to close on Sunday was our way of honoring God and of directing our attention to things that mattered more than our business." [https://www.allbusiness.com/truett-cathys-recipe-for-business-success-3874449-1.html. Retrieved March 30, 2023.] Such religiosity does not come without controversy, and the firm's strong stance against same-sex marriage has led to boycotts.

Our results may cover two potential mechanisms. First, sabbatarian obedience in itself may have had an impact on productivity. Exploiting information on which creameries were closed on Sundays, we find that this does not explain our results. Instead, we find evidence that the lower productivity is caused by the conflict arising from the disagreement around whether or not creameries should obey the Third Commandment. When creameries and their management are in conflict, attention may be driven away from running the creamery. Based on the work of historians, we formulate four separate potential indirect tests of this mechanism, the results of which support this as a plausible mechanism. Thus, creameries more impacted by IM are (1) more likely to have more than one creamery in a parish, since disagreements might lead to creameries splitting and farmers supplying the one which operates according to their beliefs. If this happened it would mean that they were (2) supplied by fewer (farmer-) shareholders who were thus more widely spread, meaning that each creamery (3) had to collect milk from longer collection routes. The end result was (4) that they earned less and thus paid smaller dividends to their owners.

Thus, religious conflict, even when not violent, can hamper productivity. Indeed, the potential impact might be large: our results imply that a one standard deviation increase in the intensity of IM was associated with an increase in the milk/butter ratio of 0.36, corresponding to a loss of appr. 23,500 2010 USD for the median creamery - equivalent to 7.45 pct of the dividends paid out to the farmer/shareholders. This relates to the work of O'Rourke (2006), who argued that there were major obstacles to the establishment of cooperative creameries in Ireland, where there was significant rivalry between Catholics and Protestants, and, comparing to Denmark, concludes that "Denmark's homogeneity, not its Protestantism, led to the success of cooperation there" (O'Rourke, 2007). Denmark was certainly more homogeneous than Ireland, but there were nevertheless significant divisions between rival Protestant groupings.

Our findings also contribute to research documenting the direct productivity reducing impact of certain religious practices, such as church attendance (Barro and McCleary, 2003) or Ramadan fasting (Campante and Yanagizawa-Drott, 2015). On the contrary, across Indonesian villages, Bryan et al. (2021) document that exogenously induced greater Protestant religiosity increased household income but had no statistically significant effect on total labor supply, consumption of a subset of goods, food security, or life satisfaction. They further document that the rise in income is caused by increased grit, rather than social capital, locus of control, optimism, or self-control. These results are thus consistent with Weber's ideas: Believers who more strongly believe their work effort will be rewarded in the afterlife will be more likely to engage in hard labor, ceteris paribus. On the other hand, history is filled with examples of religion and innovation being incompatible, the trial of Galileo probably the most famous of them all (Bénabou et al., 2015; Mokyr, 2010; Andersen and Bentzen, 2022; Cabello, 2023). Other studies have documented that higher (Catholic) religiosity reduced the extent of technical curriculum in schools in late nineteenth-century France (Squicciarini, 2020), slowing the second industrial revolution in that country, that innovation rates are lower among more religious societies across the globe today (Bénabou et al., 2015), and that science withered more quickly in medieval Islamic societies where religious institutions were stronger (Chaney, 2016). In a theoretical model used on two cases of medieval Europe and nineteenth century China, Cantoni

and Yuchtman (2013) argue that governments heavily based on traditional religious beliefs will be slower to adopt new human capital central for the transition to modern growth. We are not aware of other studies considering the impact of non-violent religious conflict, and certainly none estimating this at the firm level.

The remainder of the paper proceeds as follows. The following section provides some historical background, Section 3 introduces our data, and Section 4 presents our empirical strategy. Section 5 provides our results, Section 6 tests for the potential mechanisms, and Section 7 concludes.

2. Historical background

Denmark has been Christian since the tenth century, when the Danish Vikings were converted under King Harald Bluetooth. In common with much of Northern Europe, the connection to Rome was cut off with the Protestant Reformation in the 1500s, which witnessed the establishment of the Danish state church, under the king who became an absolute monarch from 1660. Between 1800 and the 1840s, scattered meeting movements (*forsamlingsbevægelser*) had emerged, and from these two revivalist movements within the state church were founded around 1860: first, the more liberal Grundtvigian movement, and second, the more conservative Inner (or Home) Mission, IM[7] (Wåhlin, 1986).

Grundtvigianism was spread by young clergymen from the 1840s inspired by NFS Grundtvig (1783-1872), an educator, clergyman and writer who is central to understanding modern Danish history, identity and development (Boberg-Fazlic et al., 2023). The movement was strengthened during the 1850s and 1860s, and promoted democracy and education through for example Danish Societies (*Danske Samfund*), folk high schools for the education of adults (in the countryside, mostly farmers), and private, independent Grundtvigian primary schools, so-called free schools (*friskoler*), the latter two of which are still a large part of the Danish educational infrastructure today. Community houses (*forsamlingshuse*) were established around the country for their religious and other local cultural activities, which would also have their IM counterpart in the form of mission houses.

IM emerged out of a small pietist movement founded in 1853 and was, in contrast to the Grundtvigian movement, dominated by laymen preachers and supported by the weekly newspaper *Indre Missions Tidende* (IMT, the Inner Mission Times). In 1861, riven by internal conflict, it was in a sense rescued or given new life by the clergyman Vilhelm Beck (1829-1901). He served as editor of IMT from 1862-1901 and from 1881 as chairman of IM. Under Beck, the organization became more centralized and more strongly influenced by a group of young clergymen, although its local influence was strengthened by laymen as itinerant lay preachers, representatives and traveling salesmen of Christian literature (Lauridsen and Kjærgaard, 1999). Beck's saying that "faith is not democratic" was reflected in his anti-democratic leanings, seeing the constitution of 1849 as only good for the freedom of association which allowed him to organize meetings. A popular breakthrough came in the 1880s and 1890s, and IM followed the Grundtvigian

[7] Officially: *Kirkelig Forening for den Indre Mission i Danmark*, "Churchly Society for the Inner Mission in Denmark".

example by establishing institutions to support their activities: not least their own version of community houses, mission houses[8], but also their own folk high schools and youth associations (YMCA and YWCA). Under Beck and his revivalist laymen backers, IM became associated with a belief in the literal word of the Bible, and that salvation must come through deeds during life, and they thus frowned upon such frivolities as dancing and drinking in line with much mainstream Lutheran thought abroad. Grundtvigians and thus the majority of the Danish Church, by contrast, had a more optimistic focus on "living and confessing" with life seen as a gift to be enjoyed. Indeed, this was noted by Americans among Danish migrants to the United States, where the former were known as "holy" or "gloomy" Danes, and the latter as "happy Danes" (Brøndal, 2013).

We exploit the location of the mission houses below as our principle measure of the religiosity embodied by IM and the resultant conflict with the Grundtvigians. Larsen (2005) explains that they were often built out of a need to have room for a Sunday school, but might also be born out of conflict with for example Grundtvigians, or as an outpost in an area where IM wished to expand. They usually began as private initiatives and were donated to IM when the initiators were free of debt, but their origins differed from parish to parish. Although they could be completely local or private initiatives, they were sometimes built with support from a larger area, and even with financial support from the IM Society itself in strategic cities. There were however usually certain commonalities. First, they might be established in an attempt to bring the Christian message to children and adults in the local area, often suburbs or newly cultivated districts on the heath where there was no church. Second, they might be formed to offset the influence of sects and free (anti-Lutheran) churches [9]. And finally, they were formed to keep a clear churchly-pietistic line in the work of the church (anti-Grundtvig). Indeed, mission houses were often built within a few years prior to or subsequent to the establishment of their Grundtvigian competitors, the community houses (Kærgård, 2010). Importantly for our empirical analysis, there is nothing to suggest that mission houses followed parish borders, the size of which might reflect historical development. Only 624 (out of close to 2000) parishes had one at all, 125 had more than one, and the 2 parishes with the greatest number had five each.

The question remains as to why the movements emerged in the first place, and of course why they were stronger in some areas than others. Regarding the first, a consensus has emerged that it was not socio-economic conditions but rather local personalities who played the decisive role. Older historians such as Lindhardt (1978) (first edition 1951) explained revivalism with production and class relations, and presented IM as the natural home for the rural proletariat and fishermen, in contrast to the optimistic faith in progress embodied by Grundtvigianism and favored by the peasant farmers who went on to found most of the cooperatives, and came to dominate both politics and the economy. By contrast, Pontoppidan Thyssen (1960) questioned the class origins, and by looking at signatures on thousands of petitions presented to

[8] A name they received since IM was known as "the Mission"

[9] These might be for example Baptists or Mormons both of which, however, never became particularly strong in Denmark, in part because many members migrated to the United States.

the king in the 1830s found a movement which was broadly based with no clear socioeconomic bias, and little different from the typical rural population. This, together with more recent macro-historical and local studies, has given a complex picture within which revivalism should be understood from at least four perspectives (following Larsen (2005)):

1. Continuity from the eighteenth century;
2. Diffusion from core areas, as small beginnings took off in the nineteenth century, particularly under the freedoms guaranteed under the 1849 constitution;
3. Local socio-economic conditions whereby groups experiencing change or pressure, such as those marginalized during the great agrarian reforms of the late-eighteenth century, might be more inclined to join revivalist movements; and
4. Interaction with trends of development in society as a whole, in particular the creation of an "ideological market" after 1849, together with the emergence of cheaper printing and transportation.

This relates to the literature on the determinants of religiosity (Azzi and Ehrenberg, 1975), which is considered to be the result of supply side factors (churches, mission houses, etc.) and demand side factors (insecurity, coping, adversity, etc.). The aforementioned Danish historical scholarship argues, however, that none of these factors are enough to explain the spatial pattern of IM support in Denmark. On the local level, strong personalities mattered much more (Haue, 1978), and in particular the priest Carl Moe.

Carl Moe (1848-1927) was a priest in Harboøre in the northwest of the Jutland peninsula from 1877 to 1885 and in Skanderup in the southeast of Jutland from 1885 to 1922, and became famous for his powerful revivalist speeches. He served as chairman of IM from 1915 to 1927. He is particularly remembered for his sermon following a drowning accident on the night between November 20 and 21, 1893, where 26 fishermen from Harboøre lost their lives (estimated to be around 10 percent of all fishermen in the area). On this occasion he argued that they had brought it on themselves through their sinfulness. His words were judged harshly and condescendingly by the Copenhagen press, not least *Politiken*, a newspaper launched in 1884 in support of naturalism (a philosophy with a focus on the development of worldly and material values), giving him strong local support but national notoriety (Lausten, 2002; Lings, 2018). He was also famous for his "akvavit sermon" (*brændevinsprædiken*), encouraging his congregation to go home and dispose of their alcohol. His influence on the communities where he worked, and the wider IM, cannot be overemphasized.[10]

Importantly for our identification strategy, we can treat Moe's arrival in the two parishes as quasi-exogenous and independent of local revivalist movements. With the passing of the constitution in 1849 the governance of the state church was left to future negotiations. The appointment of priests remained the exclusive

[10]Moreover, the bond between the communities where he preached is reflected by the fact that it became a tradition lasting over a century for his former flock to visit Skanderup by direct train (the Skanderup wagon, Skanderupvognen) once a year in September, first to hear him, and later his successors (Lings, 2018).

privilege of the king, now on the advice of the government of the time. There was no local influence[11], and instead junior priests were generally allocated to areas with less profitable rectory farms (which until reforms in the early twentieth century, alongside tithes and donations, formed the basis for the income of the priest) (Matzen and Timm, 1891).[12] Thus, Carl Moe, like many priests of his time, began his career in a relatively isolated and poor part of Denmark, but later moved to a more populous and richer area[13]. This obviates concerns about soil quality or relative development determining support for IM, and we find evidence below that IM's mission houses were more concentrated in areas closer to where Moe preached.

The conflict between economic and religious considerations played out strongly within dairying, which industrialized early in Denmark[14], and within small rural communities (Bjørn, 1982; Haue, 1978; Rasmussen, 1982). There, peasant farmers formed cooperative creameries (Boberg-Fazlic et al., 2022) based on a new technology, the centrifugal separator. This was invented in the 1870s, and was operated using imported coal from abroad (Henriques and Sharp, 2016). As IM and the industrialization of dairying gathered strength in the 1880s and 1890s, a conflict flared up between the economic interests of farmers, and those who believed that Sunday operation was incompatible with God's Third Commandment (Haue, 1978). For IM, this was a test of faith. Work on Sunday had been the rule in dairying also before industrialization, but, with mechanization and centralization, milk wagons and smoke from chimneys during church services made this provocatively clear. Pressure emerged within IM circles in particular for the creamery to obey the Sabbath and thus become a Sabbatarian creamery (*Søndagshvilende mejeri*), and in 1885 an "Association for the Promotion of the Correct Use of Sunday" was founded. In reality, and somewhat ironically, the closure of the creamery on Sunday and/or holidays did not have a great impact on the working life of the rural population. Thus, with cows unable to observe the Sabbath themselves, only a few people could actually stop work on Sunday, besides perhaps three employees at the creamery, and 7-10 drivers. It was still necessary for a farmer to milk and feed his cows, and his chances of getting to church on a Sunday were not greatly improved (Bjørn, 1982).

Where Sabbatarian creameries were founded, they were forced to enact rules to determine how much extra milk could be delivered on Mondays, while others made various compromises such as making it voluntary to deliver milk on Sundays or allowing Sunday production during peak seasons. At the other extreme were creameries that might sometimes be closed for much of the week: for example, if Christmas Eve (not otherwise a holiday at the time, in contrast to December 25 and 26) was a Sunday, they would be closed three days in a row. Often, the Articles of Association, which determined the management of the

[11]With the exception of private churches, typically on manorial land.

[12]It was not until 1902 that democratic elections for local church councils were introduced, although within these IM and Grundtvigians ran competing lists, and a central question turned out to be the issue of Sunday operation of creameries. These councils gradually gained influence over the appointment of priests, although long after the time of Carl Moe (Christoffersen, 1998; Gregersen and Bach-Nielsen, 2017; Stenbæk, 1999).

[13]Skanderup is today located in an area known as *Trekantsområdet*, or the "Triangle Region", made up of three major cities in the south east of Jutland.

[14]See Boberg-Fazlic et al. (2023); Lampe and Sharp (2018).

cooperative, stated that these rules could not later be changed by general meetings. It should be noted that the most fervent opponents of work on Sunday were not in fact IM but a small and very localized group known as "the Strong Jutlanders" (*de stærke jyder*), who had their origin in the first popular revival in the eighteenth and nineteenth centuries around the villages of Hedensted and Løsning. Otherwise, Sunday closure was often dependent on local conditions, for example a local revival or a local IM priest.

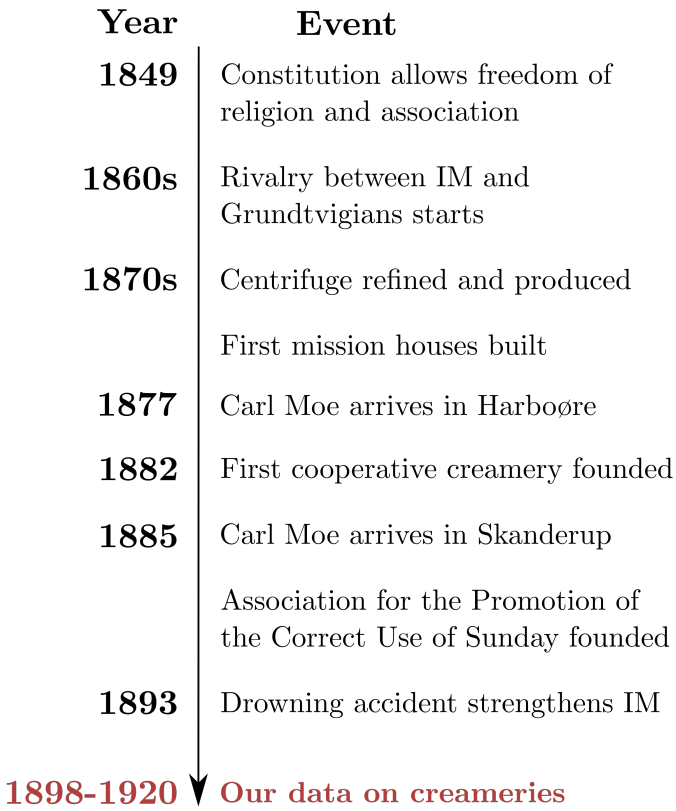
Once the question of closing on Sundays was raised, the members of the cooperative creamery held a vote. If local communities could not agree, two rival creameries were established. With just one exception, this happened because those farmers wanting Sunday production were in a minority. They then left the cooperative and established their own, smaller, non-Sabbatarian creamery. The scientific elites of Danish agriculture argued strongly against this division of creameries. For example, the editors of the volumes from which we draw our microlevel data on creameries warned against this, although they refrained from explicitly targeting religious sensibilities: "the small creameries are expensive to run in direct costs, and on top of this comes that they are unable to deliver products to a greater price or in another way justify themselves... it must be warned against dividing creameries, since it is – from the perspective of agricultural economics – irresponsible." (MDS 1911, p. XVI). In fact, early on there was agreement among experts that closing on Sunday, and not least splitting creameries, was undesirable. Thus, although the dairying journal, *Mælkeritidende* (the "Dairy Times"), at first hosted a lively debate on this, addressing for example concerns about quality, by 1889 it had concluded that "propaganda" was not welcome on its pages and this topic was no longer covered. Other experts, such as the renowned dairy consultant Bernhard Bøggild, weighed in with his book *Andelsmælkerier* ("Cooperative Creameries") from 1887, distancing himself from the idea of closing on Sundays and arguing that most work could be completed by Sunday afternoon, making it possible for workers to participate in the Sunday afternoon service.

There were at least four costs of splitting the creamery: first, there was a fine for leaving an existing cooperative, which courts generally enforced (Henriksen et al., 2012, 2015); second, there was the cost of building the new creamery; third, it was sometimes necessary to pay a large member to join, often encouraged by "friendly" visits from IM representatives; and finally there were the costs of setting up new transportation routes. Where rival creameries coexisted, this meant that roughly the same distance would have to be traveled to collect less milk, an expense incurred by both creameries.

In sum, the existence of Sabbatarian creameries presents a clear example of how spiritual arguments could outweigh rational economic views, and believers were prepared to pay the considerable costs involved, encouraged by IM itself. The group cohesion created in the mission house extended to the creamery, the most vital part of the local economy, and the cooperative's Annual General Meeting would have started and ended with prayers and hymns. As Haue (1978) concludes: "The controversy surrounding the Sunday operation of the dairies added an intensity to the spiritual life of many parishes which would otherwise have been difficult to obtain. The creation of the Sabbatarian creamery was not only a consequence of the revival, but also an instrument for its reinforcement." (Haue, 1978, p. 384) Thus, conflict bred

religiosity. We test for both below: religiosity using the intensity of the IM presence, and conflict as the mechanism whereby effected creameries became less productive. Figure 1 provides a timeline of the important historical events described here.

Figure 1: Timeline



In the interwar period, the Sabbatarian movement began to lose steam for a variety of reasons. These include practical difficulties resulting from increasing production over time, difficult economic conditions after the First World War, and the fact that priests lost their rectory farms in 1919 so they were no longer directly involved with agriculture. The final blow seems to have been new rules from 1931 about milk quality measurement and payment, which caused issues when delivering older milk on Mondays. Moreover, eventually even the IM changed its tone, and became less opposed to Sunday operation. The last Sabbatarian creamery, in Harboøre, where Carl Moe had started his career, merged with another concern in 1979.

3. Data description

We rely on a rich set of newly digitized data on production, location and other relevant characteristics of creameries. Production statistics for creameries are taken from *Dansk Mejeri-Drifts-Statistik* (MDS,

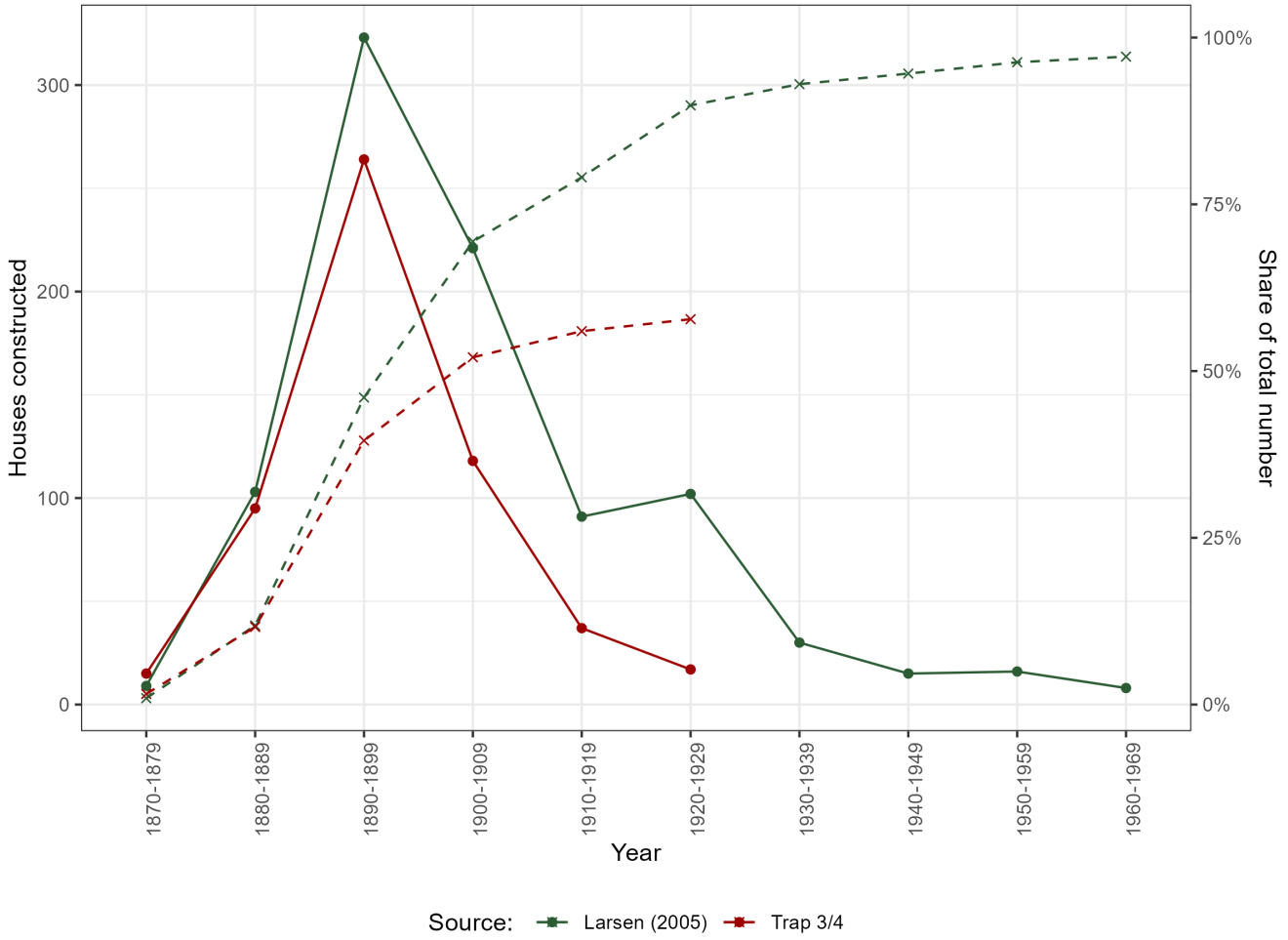
'Operational Statistics for Danish Creameries').[15] This constitutes an unbalanced panel of microlevel production statistics for most cooperative creameries over the period 1898-1945, based on voluntary reports from the creameries. MDS contains 133 variables covering various aspects of butter production. The MDS data was enriched with information from *Danske Mejerier* (DM, 'Danish Creameries') - a book published in three volumes between 1915 and 1918. This contains a small prose text of every creamery in Denmark at the time. The ambition of DM was to be a complete survey of all creameries in existence (cooperative and private) at the time. For this purpose, a representative was sent to each creamery to ensure the quality of the data collected. We therefore trust that the data represents the entire population of creameries at the time. Importantly, DM contains postal addresses, which we have converted to geographical coordinates.

We obtain data on religiosity and the spread of IM via their religious buildings (Larsen, 2005; Lodberg, 2016). In particular, we construct a panel of 673 mission houses from the third and fourth edition of a geographical encyclopedia colloquially known as 'Trap' (Trap et al., 1906; Trap and Knudsen, 1928)[16]. Both editions contain a small prose text for each of around 2000 parishes in the entire country. Mission houses were reported in each parish that had one. Using this information, we have digitized a novel parish-level panel of mission houses and the year of their construction. We use only data for 1898-1920, for which period we have both creamery statistics and data on mission houses. A risk is that some mission houses were not reported because the authors did not have knowledge of their existence or simply because they were closed before the publication of Trap et al. (1906). To validate this, we can rely on the more complete (although unfortunately not parish-level) survey of all mission houses, and their construction, presented by Larsen (2005). Figure 2 shows the number of Mission houses constructed in each decade as reported in Larsen (2005); Trap et al. (1906); Trap and Knudsen (1928).

[15]The data is also described in Henriques et al. (2023); Henriques et al. (2022); and McLaughlin et al. (2021)

[16]The third edition, Trap et al. (1906), was published in five volumes between 1898 and 1906. Trap and Knudsen (1928) was published in 11 volumes between 1920 and 1932.

Figure 2: Number of Mission Houses



Notes: The figure shows the number of mission houses constructed in each period (left axis and solid line) and the cumulative share of mission houses (right axis and dashed line) from both sources. The share (on the right axis) are estimated as a share of the total measured in Larsen (2005).

We measure the potential influence of the IM as the outcome of two properties. First, a creamery closer to a mission house is expected, *ceteris paribus*, to experience a higher degree of influence from mission houses. Second, density should matter.[17] A commonly used approach with theoretical support is market potential in the spirit of Harris (1954). Intuitively, the market potential of mission houses measures the potential influence of IM as the availability of mission houses at some coordinate discounted by the cost of getting there, where the cost is proxied by distance, e.g. the potential for Sunday schools to reach pupils, rooms for prayer being available, etc. This measure is calculated as the sum of all mission houses at inverse

[17]For instance, if a creamery is within 3 km of a mission house but the next mission house is 20 km away, then that creamery probably experiences less influence than a creamery within 3 km of a mission house but where the second mission house is 4 km away.

euclidean distances from a location x to all mission houses that exist at the time.

$$IM_x = \sum_{\forall h} (dist(h, x) + 1)^{-1} \tag{1}$$

Here IM_x denotes the potential influence of the Inner Mission in a location of a creamery specified by coordinates x. h iterates over the coordinates of all mission houses. $dist(h, x)$ is the euclidean distance function between x and h. The 1 is added to avoid exploding estimates when distances approach 0. Figure 3 uses this to show the potential influence of the IM in 1920 and the location of mission houses on which it is based. In that year, the creamery with the lowest IM was 3.883 and the highest was 11.138. This is a measure of the count of mission houses discounted by their inverse distance. In any application of this we standardize to mean zero and unit variance. This means that one unit change in IM is a one standard deviation change.[18]

Haue (1978) provides an overview of all the creameries that were completely or partially closed on Sundays (to the best of his knowledge): 104 in total. Of these, we can identify 95 in MDS and DM. Nine creameries were found in MDS and Haue (1978), but not DM. This gives a total of 85 Sabbatarian creameries found in all three data sources. This overlap suggests that our data, while not perfect, is likely as comprehensive as possible. The number of Sabbatarian creameries and creameries in general over time (based on when they reported to MDS), is shown in Figure 4. We supplement the data with geographical information. Parish borders are obtained from the *Digital Atlas of the Danish Historical-Administrative Geography* (downloadable at Digdag.dk, 2021). Data on soil types comes from Pedersen et al. (2019). Summary statistics of all variables used in regressions can be found in the summary Table 1.[19]

[18] In the appendix we show the main result using alternative measures, which make no qualitative difference to our results.

[19] The southernmost part of Jutland (Sønderjylland) is excluded since it was part of Germany until 1920.

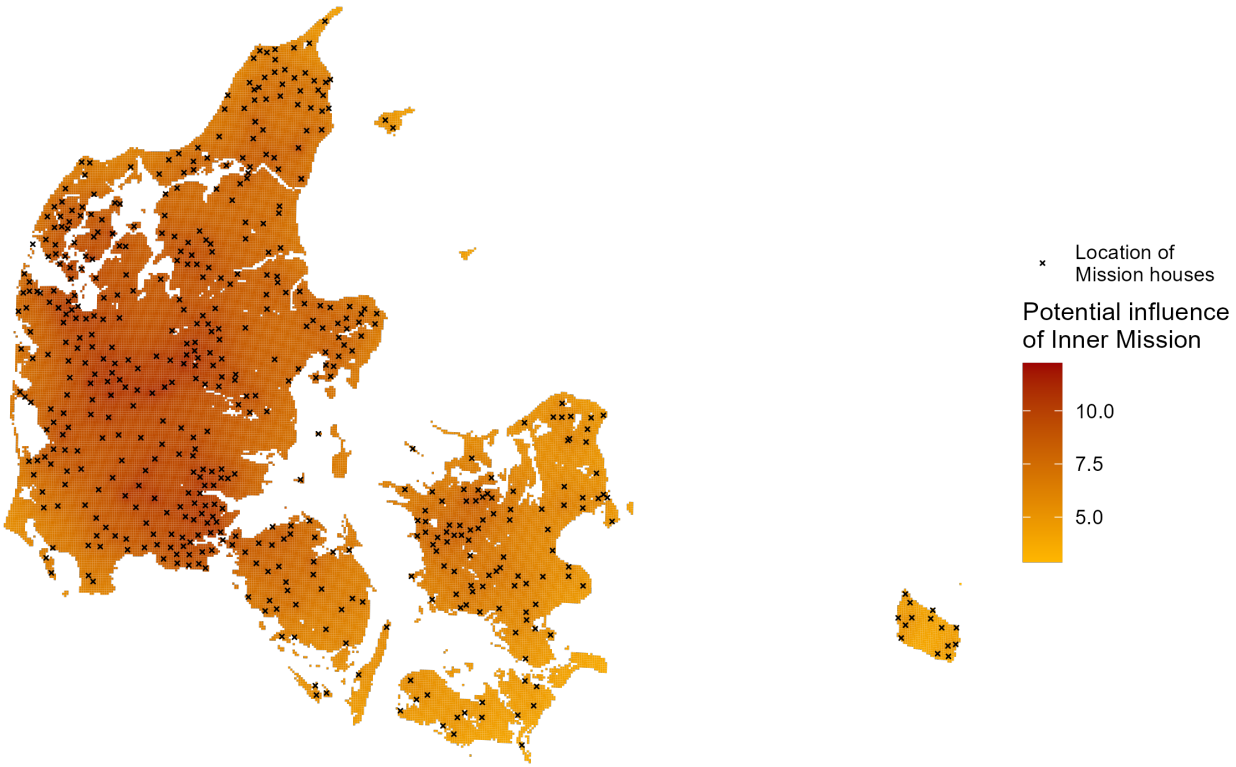
Table 1: Summary statistics

	Units	N	Mean	SD	Min	Q25	Median	Q75	Max
IM	std	11685	0.00	1.00	-3.06	-0.69	0.01	0.68	3.02
MB ratio	ratio	11685	25.43	0.77	20.40	25.00	25.40	25.90	29.60
Butter	kg.	11685	85644	40551	4434	55687	78855	109980	273927
Milk	kg.	11685	2174733	1025430	113054	1415286	2011536	2793024	7039911
PI Moe	std	11685	0.06	0.98	-0.64	-0.35	-0.12	0.16	15.85
IM_{1890}	std	11685	-0.59	0.14	-0.90	-0.68	-0.61	-0.54	-0.03
$\overline{IM}_t$	std	11685	0.88	0.21	0.27	0.78	0.95	1.04	1.14
Sabbatarian	$\{0, 1\}$	11685	0.05	0.22	0.00	0.00	0.00	0.00	1.00
Shareholders	Count	11487	154.14	71.69	3.00	100.00	142.00	194.00	560.00
Dividends	DKK	10689	36351	25876	0.00	18806	31151	47195	299780

Notes: We show the number of observations, the mean, standard deviation, minimum, quantiles and maximum values.

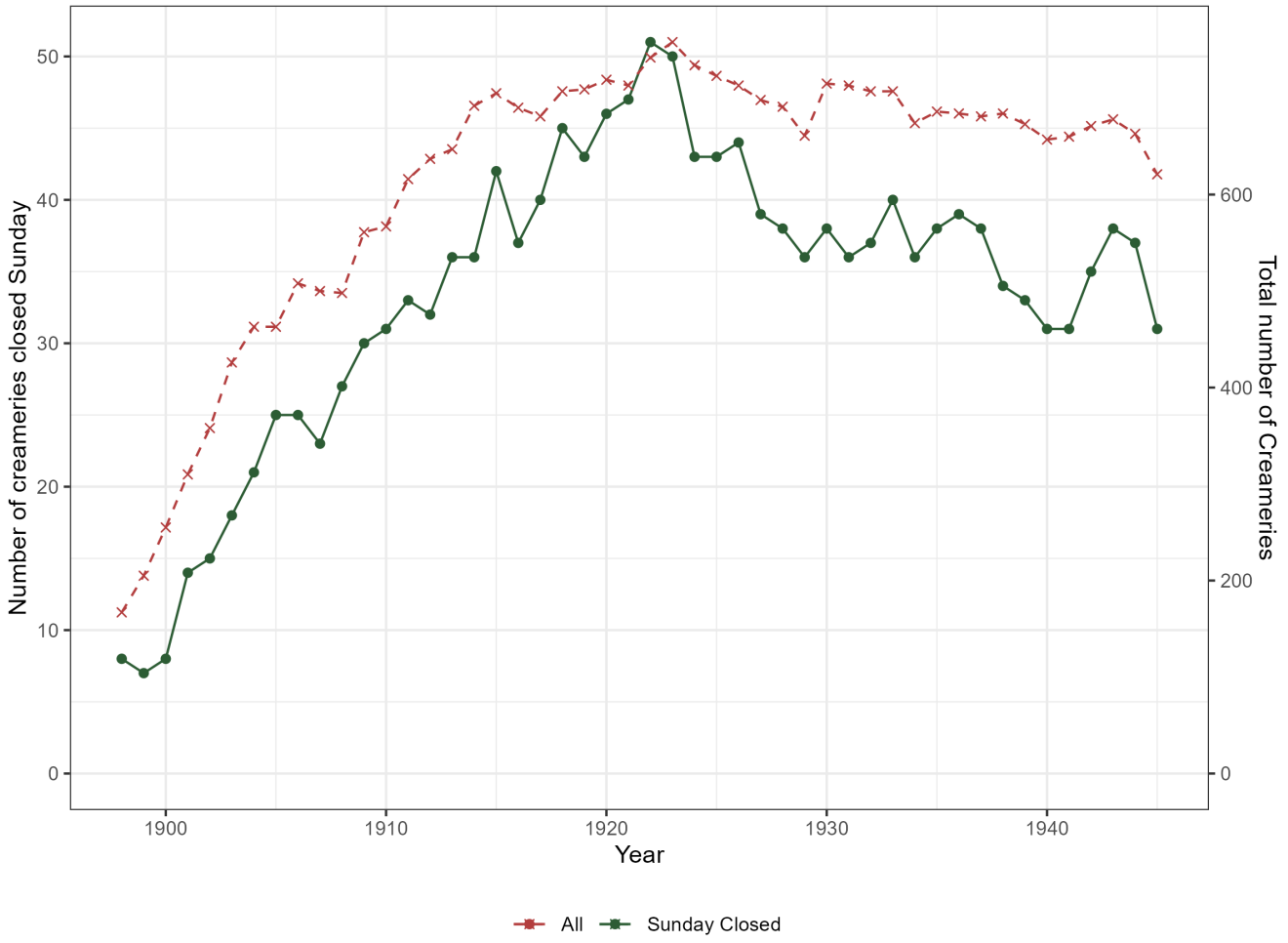
Source: (Trap et al., 1906; Trap and Knudsen, 1928), MDS, DM

Figure 3: Potential Influence of the Inner Mission



Notes: This map shows the location of mission houses in 1920 together with our constructed measure of the potential influence of the Inner Mission. Places closer to the coast naturally experience lower influence by the Inner Mission simply because it is impractical to build a mission house in the water.
Source: (Trap et al., 1906; Trap and Knudsen, 1928)

Figure 4: Sabbatarian Creameries



Notes: This plot shows the number of Sabbatarian creameries (left axis) and total number of creameries (right axis).
Source: Haue (1978); Henriques et al. (2020).

4. Empirical strategy

The historical background suggests that an increase in the influence of IM might have an adverse effect on the efficiency of creameries due to the resultant conflict. As noted above, an alternative hypothesis might be that the extreme Lutheranism embodied by IM might lead to Weberian productivity increases. To test which effect dominates, we start off with a very simple specification:

$$MB\ ratio_{it} = \alpha_t + \alpha_i + IM_{it}\beta_1 + \mathbf{z'}_{it}\gamma + \varepsilon_{it} \tag{2}$$

where *MB ratio* measures the efficiency of the creamery in the so-called milk/butter ratio (the lower, the "better"), and *IM* gives the potential influence of the IM for time t and creamery/location i. α_t and α_i capture year and creamery fixed effects respectively. This implicitly controls for any confounders which are constant for the creamery or any shocks which affect all creameries in a particular year. $\mathbf{z'}_{it}$ includes additional controls in the form of year by soil type fixed effects and year by NUTS2[20] region fixed effects. This captures any contemporaneous developments common to the same soil type or the same region. Given this, β_1 reflects the effects of a change in the level of the potential influence of the IM on the efficiency of the creameries.

We also consider whether our results are robust to the alternative functional form of the (log of) butter production on the (log of) milk production:

$$log(Butter)_{it} = \alpha_t + \alpha_i + log(Milk_{it})\beta_1 + IM_{it}\beta_2 + \mathbf{z'}_{it}\gamma + \varepsilon_{it} \tag{3}$$

One concern is spatial correlation as demonstrated by Kelly (2019), which might drive the results. We follow Boberg-Fazlic et al. (2022) and supplement clustered standard errors by Conley errors with a 50 km cutoff, which is large and conservative for a relatively small country like Denmark, where nowhere is further than that from the coast. A threat to identification would be if a third factor, which varies both over time and space, caused both IM and creamery efficiency. One example of this would be if a bad crop caused both adverse effects on the milk supply chain and a change in religiosity. We attempt to address such concerns by including year by geography fixed effects, but to test the robustness of our results we also employ two Bartik-inspired instruments.

Bartik instruments use a measure of exposure multiplied by national yearly averages to capture time-varying developments in some otherwise potentially endogenous variable. These instruments are valid if A) the exposure variable is exogenous, or B) the national shocks are exogenous (Goldsmith-Pinkham et al., 2020). We use two such instruments that rely on either assumption being valid. The location of Carl Moe, our first instrument, is exogenous to the future development of IM. The location of mission houses in 1890, our second instrument, is valid if the national shocks to IM are exogenous. Specifically, we use the following first stages:

[20]NUTS2 is the second level of the standardized European Union administrative units, of which there are five in Denmark.

$$
\begin{aligned}
IM_{it} &= \alpha_t + \alpha_i + Moe_i \times \overline{IM}_t + \mathbf{z'}_{it}\gamma + \varepsilon_{it} \\
IM_{it} &= \alpha_t + \alpha_i + IM_{i,1890} \times \overline{IM}_t + \mathbf{z'}_{it}\gamma + \varepsilon_{it}
\end{aligned}
\tag{4}
$$

Here α_i and α_t represent fixed effects and Moe_i represents the sum of inverse distances to places where Carl Moe preached (Harboøre and Skanderup).

$IM_{i,1890}$ is the potential influence of IM in the location of a creamery, i, in the year 1890. This identification strategy is based on the stated goals of the IM movement. Places with an early IM presence would act as seedlings for the further spread of the movement. As such, the local density of IM predicts an even greater density later on. The shares of IM in 1890 are used because this was before the MDS data begins, but also because it was when IM already had a wide geographical presence.

5. Results

5.1. OLS results

Our OLS results are presented in Table 2. Columns 1 and 2 estimate equation 2, with the former giving the simplest estimate, where we include year and creamery fixed effects and the latter including geographical characteristics interacted with year fixed effects. Columns 3 and 4 estimate equation 3, the first as a simple production function of milk and butter modulated by the influence of IM, the second again including geography by year fixed effects. The results all point in the same direction. Column 1 suggests that an additional standard deviation of IM influence is associated with an increase in the milk/butter ratio of 0.3574, i.e. 0.3574 kg more milk was required to produce one kg of butter. We can convert this to 2010 USD equivalents using the method provided by Henriques et al. (2021). For the median creamery, we find that an additional standard deviation of IM is associated with a 23,471 2010-USD loss for a year of production or 13.4 pct of the size of the median dividends paid to shareholder/farmers. Columns 3 and 4 demonstrate that an additional standard deviation of IM is associated with around 1.5 percent lower output of butter, a result which is similar to columns (1) and (2) in terms of USD equivalents.

Figure 5 shows the partial regression plots for column 2 in Table 2 in panel (a) and for column 4 in Table 2 in panel (b). Both plots include both a linear fit (solid line) and a semi-parametrically fitted line (dotted line).[21] All results are robust to excluding all observations outside of two standard deviations (results available on request). Our preferred specification is the estimate in column 2. This is the simplest precise estimate, which also captures the main identification concerns. To take account of the threat to

[21]The semi-parametric line is estimated with GAM as implemented by Wood (2017) and does not impose any functional form on the relationship between the outcome and our measure of IM. For panel (a) it is hard to see the dotted line because it lies exactly on top of the linear fit. For panel (b) the line is similarly linear. For very low values of IM the line does not seem perfectly linear. However, this is all within the confidence interval.

Table 2: Regression results

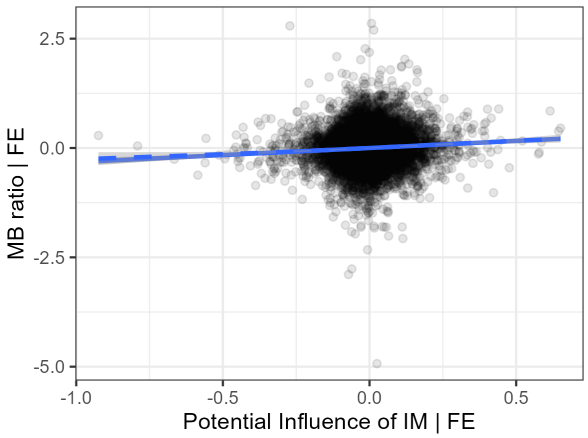
Dependent Variables:	MB ratio		log(Butter)	
	(1)	(2)	(3)	(4)
IM (std)	0.3574	0.3910	-0.0147	-0.0158
	(0.0815)***	(0.0927)***	(0.0032)***	(0.0037)***
	[0.1251]***	[0.0901]***	[0.0049]**	[0.0035]***
log(Milk)			0.9995	0.9997
			(0.0023)***	(0.0023)***
			[0.0026]***	[0.0025]***
2010 USD equiv.	-23,471	-25,643	-24,829	-26,648
As a share of dividends	-7.45 pct	-8.14 pct	-7.88 pct	-8.45 pct
Creamery FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Geo. × Year FE		Yes		Yes
Observations	11,685	11,685	11,685	11,685
R^2	0.70390	0.73809	0.99896	0.99908
Within R^2	0.00705	0.00562	0.98436	0.99908

Notes: Columns 1 and 2 contain results when estimating the effect to MB ratio directly. Columns 3 and 4 contain results for estimating the effect of IM on the log of Dividends. All results are converted to approximate 2010 USD equivalents and also as a proportion of median dividends paid out to farmer/shareholders. No matter the method, an additional standard deviation of IM presence is associated with similar adverse effects to efficiency in production. Standard-errors in parentheses clustered at creamery level. Conley errors at 50km cutoff in brackets. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$. *Source: Trap et al. (1906); Trap and Knudsen (1928), MDS, DM*

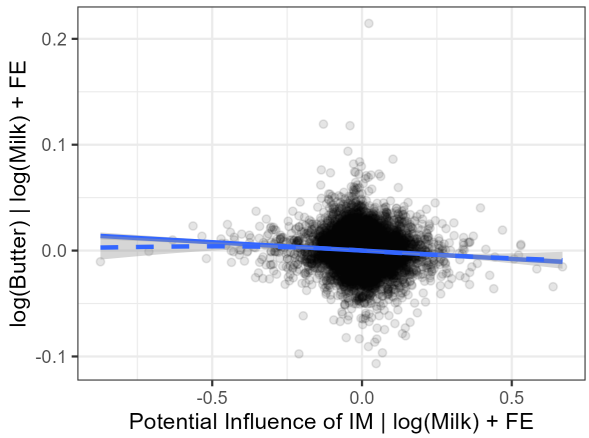
identification represented by shocks to both religiosity and agricultural productivity such as a bad harvest for a certain crop, column 2 includes fixed effects that interact each year with geographical characteristics. These include 12 different soil types and five NUTS2 regions.[22] However, it is hard to argue that this will absorb any possible third factor which might affect both IM and butter production efficiency. This motivates our use of instruments in the next section.

Figure 5: Partial Regression plots

(a) Partial regression plot, col. 2 in table 2



(b) Partial regression plot, col. 4 in table 2



Notes: Partial regression plots for columns (2) and (4) of table 2.
Source: (Trap et al., 1906; Trap and Knudsen, 1928), MDS, DM.

5.2. IV results

Table 3 contains our IV results. Columns 1 and 3 show the results using the distance to Carl Moe interacted with *IM* as an instrument, following equation (4). Columns 2 and 4 show the results using IM in 1890 as instruments. The first-stage F-statistic is very large and above conventional levels for both instruments. Columns (5) and (6) includes both instruments, thus allowing us to test overidentifying restrictions with the Sargan-Hansen test. This does not indicate that the instruments are endogenous, although it should be noted that it is only valid if at least one of the instruments is exogenous in the first place.

Both instruments point to an effect of IM of a similar magnitude to that observed in Table 2. The Carl Moe instrument yields an imprecise estimate of a 0.6522 increase in MB ratio for a one standard deviation increase in IM or an approximate 2.9 percent reduction in butter output. The IM in 1890 instrument shows similar but more precise results. Importantly, all the IV estimates are within 2 standard deviations

[22]These determine soil suitability for different crops in an exogenous way and allow the regression to absorb the type of shocks we are concerned about.

of the OLS results.[23]

[23]For the Carl Moe instrument, we can test the validity further. Thus, we document in Appendix B that IM presence increased as a result of Carl Moe's appointment to a parish in a difference-in-differences setting.

Table 3: Instrumental variables results

Dependent Variables:	MB ratio		log(Butter)		MB ratio	log(Butter)
	(1)	(2)	(3)	(4)	(5)	(6)
Second stage						
IM (std)	0.6522	0.5816	-0.0292	-0.0229	0.5864	-0.0233
	(0.4394)	(0.3138)*	(0.0170)*	(0.0126)*	(0.3049)*	(0.0122)*
	[0.2302]***	[0.3326]*	[0.0093]***	[0.0130]*	[0.3122]***	[0.0121]*
log(Milk)			0.9998	0.9998		0.9998
			(0.0023)***	(0.0023)***		(0.0023)***
			(0.0022)***	(0.0024)***		[0.0023]***
First stage						
Carl Moe $\times$ $\overline{IM}_t$	0.0802		0.0807		0.0238	0.0244
	(0.0278)***		(0.0281)***		(0.0145)	(0.0147)*
	[0.0455]*		[0.0449]*		[0.0257]	[0.0254]
IM (std) in 1890 $\times$ $\overline{IM}_t$		1.549		1.561	1.470	1.480
		(0.1208)***		(0.1210)***	(0.1326)***	(0.1327)***
		[0.2550]***		[0.2499]***	[0.2342]***	[0.2319]***
log(Milk)			0.0135	0.0254		0.0265
			(0.0142)	(0.0136)*		(0.0135)**
			[0.0292]	[0.0264]		[0.0260]
2010 USD equiv.	-42,347	-37,865	-49,180	-38,574	-38,169	-39,305
As a share of dividends	-13.4 pct	-12.0 pct	-15.6 pct	-12.2 pct	-12.1 pct	-12.5 pct
Creamery FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Geo. $\times$ Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Instrument	Moe	IM 1890	Moe	IM 1890	Both	Both
Observations	11,685	11,685	11,685	11,685	11,685	11,685
First stage F-stat	453.8	2,256	458.5	2,283	1,152	1,167
P(Sargan-Hansen-J=0)					0.99894	0.975819
R^2 (second stage)	0.99453	0.99526	0.99453	0.99527	0.99527	0.99528
Within R^2 (second stage)	0.03862	0.16647	0.03913	0.16825	0.16944	0.17137

Notes: Instrumental variables results showing the effect of IM on MB ratio and log(Butter) using two different instruments: distance to Carl Moe (columns 1 and 3) and IM in 1890 (columns 2 and 4). The first-stage F-statistic is large for both instruments. The estimates from the instruments are of a similar magnitude to the OLS estimates, and all within 2 standard deviations of the OLS results. Standard-errors in parentheses clustered at creamery level. Conley standard errors at 50km cutoff in brackets. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$.
Source: (Trap et al., 1906; Trap and Knudsen, 1928), MDS, DM

5.3. Robustness of results

Appendix A contains various robustness checks. We consider two aspects: alternative measures of IM influence and sensitivity to outliers. Regarding the former, we replicated Table 2 using two alternative measures of IM, namely a dummy variable for the presence of a mission house in the same parish and a count of mission houses within a 25km radius. Both of these measures are closely correlated with our main measure (Table A1 and Figure A1). The dummy specification yields a small and insignificant result (Table A2 in the appendix). This suggests that it is the local density of IM, rather than just the presence of a single mission house, which determines the effect on the efficiency of creameries. This is in line with Haue (1978) who describes how creameries under IM influence would look to farmer-shareholders from further away than just the local village. The results for the alternative using the number of mission houses in a 25km radius are presented in Table A3. For every standard deviation of mission houses in a 25 km radius, the MB ratio worsens by 0.2808. This result is consistent in direction and magnitude with our main finding.

A natural concern is whether any of the results are driven by outliers or extreme observations. To address this, we restricted our sample to observations within 2 standard deviations of both IM and MB ratio after the fixed effects. A partial regression plot of this exercise is shown in Figure A2. From this, it can be seen that the estimated relationships are unchanged. This can also be observed when the coefficients are compared: they are almost exactly equal, as illustrated in Figure A3. Our results are therefore not driven by outliers.

6. Mechanism

Taken together, our results point to a major impact on butter productivity in the order of a 0.39 higher MB ratio or a -25,600 in 2010 USD equivalents loss of production efficiency for creameries which are more affected by the IM by one standard deviation. This would have been huge in the formative years of the important Danish dairy sector. Moreover, this association is plausibly causal. Further support for a causal interpretation comes from a demonstration of plausible mechanisms, for which the historical background points to two potential mechanisms: 1) lower Sabbatarian production or 2) increased levels of conflict.

6.1. Sabbatarian status as mediator

Being closed on a Sunday is likely to imply production losses since milk is left unprocessed. We test this by controlling for Sabbatarian status as a mediator in equation 2, with the usual caveats regarding endogenous controls. We therefore include a dummy, which takes the value one if creamery i is closed on Sundays in year t. If all of the effect of IM is carried simply by Sabbatarian creameries being less productive, this implies that the effect of IM, would disappear when we control for this, and we should observe a positive coefficient on the control.

The results are presented in Table 4. Column 1 contains the simplest specification including only creamery and year fixed effects. Column 2 includes region-by-year and soil-by-year fixed effects. Columns 1 and 2 show that creameries that are closed on Sundays have a 0.17 and 0.08 respectively worse milk/butter ratio than non-sabbatarian creameries. However, this is generally not significant, except when using Conley standard errors in column 1. In both columns 1 and 2, the influence of IM has almost exactly the same influence on the outcome as that we observed in Table 2. As such we can rule out that this is the mediator of the negative effect of IM.

However, a concern is that most creameries do not change status in the data we observe. That is, if a creamery starts reporting to MDS, it is either Sabbatarian or non-Sabbatarian. This is the reason why, despite observing a total of 85 Sabbatarian creameries, only nine of these change status. When we include creamery fixed effects, this differences out everything which is constant for the creamery, including the Sabbatarian status for all except these nine. To account for this problem, in column 3 we focus on the creameries which are Sabbatarian at some point and match them with the closest creamery which was never closed on Sundays. This is an implicit way of controlling for geography, which means that the creamery fixed effects and the geographical fixed effects can be left out. We can thus utilize the variation from all 85 creameries which at some point were closed on Sundays. Furthermore, since the creameries are geographically close, they will also be very similar in their exposure to the potential influence of IM and the potential for conflict.[24] The coefficient in this setting is 0.0219, which is both economically and statistically insignificant, confirming that being closed on Sundays is not what is causing the decline in productivity.

Finally, column 4 tests whether creameries under greater IM influence were more likely to be closed on Sundays. We find that they are indeed 5.36 percent more likely if they are under one standard deviation greater influence of IM. This amounts to the base rate of Sabbatarian creameries which for the entire panel is 5.30 percent. This is a large impact, which we would expect as Sunday closure was an important part of IM beliefs. However, since there was no apparent impact on efficiency, this is in line with the findings of Haue (1978), who describes how Sabbatarian creameries compensated for the loss of production during the remainder of the week.[25]

[24] In a regression setup we can test whether IM exposure and soil type are the same for Sabbatarian and non-Sabbatarian creameries in the matched sample. The result of this exercise is affirmative. We do however also find that Sabbatarian creameries tend to be larger, in line with the fact that it was often the minority of farmers who wished to continue producing on Sundays who broke away from the original creamery, when such a split occurred. This might in part explain why the size of the coefficient falls (and remains insignificant) relative to the full sample (results available on request).

[25] We also use the estimator proposed by Callaway and Sant'Anna (2021) at the 'herred' (hundred) administrative level (Appendix C). In this setting, we also fail to find an effect of Sunday production.

Table 4: Sabbatarian production as mechanism

Dependent Variables:	MB ratio			Sabbatarian
	(1)	(2)	(3)	(4)
IM (std)	0.3568	0.3912		0.0536
	(0.0817)***	(0.0929)***		(0.0016)***
	[0.1249]***	[0.0896]***		[0.0213]**
Sabbatarian	0.1737	0.0793	0.0219	
	(0.1341)	(0.1084)	(0.0213)	
	[0.0114]***	[0.0591]	[0.0590]	
Creamery FE	Yes	Yes		
Year FE	Yes	Yes	Yes	Yes
Geo. × Year FE		Yes		
Sample	Full sample	Full sample	Matched	Full sample
Observations	11,685	11,685	1,290	11,685
R^2	0.70400	0.73811	0.30677	0.04697
Within R^2	0.00742	0.00570	0.00035	0.04588

Notes: Results for testing whether Sabbatarian status is the mechanism behind the negative effect of IM on efficiency. Column 1 and 2 tests directly whether Sabbatarian production can explain away the effect of IM on MB ratio. Column 3 and 4 tests the causal link of Sabbatarian to MB ratio and IM to Sabbatarian respectively. Standard-errors in parentheses clustered at creamery level. Conley errors at 50km cutoff in brackets. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$.

Source: (Trap et al., 1906; Trap and Knudsen, 1928), MDS, DM

6.2. Conflict as mechanism

We now turn to the second proposed mechanism, conflict. We consider several channels, following the work of Haue (1978), who describes the impact of conflict on the organization and ultimately the profitability of creameries. From his work, we can derive the following channels, all of which we can test due to our detailed data: *I. More creameries:* Creameries split in cases where the local farmers had religious disagreements. In this case, we expect that the number of creameries in a parish would increase, if the influence of IM increased. We measure this channel by the number of creameries in the parish. *II. Smaller creameries:* If creameries were split due to conflict, we expect these to be smaller. On the other hand, Haue (1978) suggests that creameries in general maintained a certain size, for instance by recruiting shareholders from further away and often beyond parish borders. We measure the size of the creamery by the number of shareholder-farmers. *III. More collection routes:* According to Haue (1978), the recruitment of shareholders located further away in order to maintain a divided creamery required more complicated collection routes. Collection routes may have been longer, or there was a need to split collection routes, making it necessary to collect more than once a day. This channel is measured by the number of collection routes recorded for the creamery. *IV. Lower dividends:* Channels II and especially III affected the profitability of creameries. We measure profitability by dividends paid out to shareholders. We thus estimate the following regressions:

$$\begin{aligned} I: \ & 1[n>1]_{pt} = \alpha_t + \alpha_p + IM_{pt}\beta_1 + \mathbf{z'}_{pt}\gamma + \varepsilon_{pt} \\ II: \ & \log(Shareholders_{it}) = \alpha_t + \alpha_i + IM_{it}\beta_1 + \mathbf{z'}_{it}\gamma + \varepsilon_{it} \\ III: \ & \log(Collectionroutes_{it}) = \alpha_t + \alpha_i + IM_{it}\beta_1 + \mathbf{z'}_{it}\gamma + \varepsilon_{it} \\ IV: \ & \log(Dividends_{it}) = \alpha_t + \alpha_i + IM_{it}\beta_1 + \mathbf{z'}_{it}\gamma + \varepsilon_{it} \end{aligned} \tag{5}$$

Where $1[n>1]_{pt}$ is an indicator function, which is equal to one if there is more than one creamery in parish p. Note that the level of analysis in equation 5 is shifted to the parish level. Otherwise, the setup is the same as in equation 2. The results of columns 2, 3 and 4 might just be carried by lower productivity but all results are robust to the inclusion of controls for productivity measured as either MB ratio or $log(Butter)$.[26] It is not trivial to control for parish-level productivity in column 1, but we note that higher productivity, in this case, would imply more producers not less.

[26]These results are available on request.

Table 5: Conflict as mechanism

Dependent Variables:	$1[n > 1]$	$log(Shareholders)$	$log(Collection\,routes)$	$log(Dividends)$
	(1)	(2)	(3)	(4)
IM (std)	0.0373	-0.0114	0.0772	-0.3915
	(0.0196)*	(0.0381)	(0.0398)*	(0.0934)***
	[0.0261]	[0.0326]	[0.0551]	[0.0906]***
Parish FE	Yes			
Creamery FE		Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Geo. × Year FE	Yes	Yes	Yes	Yes
Data	Parish	Creameries	Creameries	Creameries
Observations	40,710	11,487	11,189	10,681
R^2	0.87492	0.95407	0.89051	0.78972
Within R^2	0.00200	6.18×10^{-5}	0.00147	0.00573

Notes: Results for testing whether conflict production is a plausible mechanism behind the negative effect of IM on efficiency. Column 1 tests whether more creameries open when IM gains more influence. Column 2 tests whether IM influence has an effect on the number of shareholders. Column 3 tests whether IM influence lowers the number of collection routes for a creamery. Column 4 tests the impact of IM on dividends. Standard-errors in parentheses clustered at the creamery level. Conley errors at 50km cutoff in brackets. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$.

Source: (Trap et al., 1906; Trap and Knudsen, 1928), MDS, DM

Our results in Table 5, where the columns correspond to the hypotheses outlined above, are consistent with all four predictions. Column 1 shows that an increase in IM by one standard deviation is associated with 3.73 percent higher probability that there is more than one creamery in a parish. Column 2 shows an average of 1.14 percent fewer shareholders for every standard deviation increase in IM. Column 3 shows that an average of 7.7 percent collection routes are added for every standard deviation increase in IM. Finally, column 4 shows that dividends on average are approximately 39.15 percent lower for every standard deviation increase in IM. Although the results are only strongly statistically significant for column 4, we take this as striking indirect evidence in favor of the conflict channel.

7. Conclusion

We have demonstrated that even non-violent religious conflict spurred by religiosity can have a substantial impact on productivity. Our setting was that of early-twentieth century Denmark, an otherwise small and homogeneous country, where rival Lutheran factions within the established church fought over deeply held beliefs: the more liberal Grundtvigians versus the conservative Inner Mission. This came to a head within the large dairy industry which was itself at the heart of Danish industrialization. Creameries where the debate about Sunday closure was strongest were characterized by lower productivity caused, not by Sabbatarianism itself, but by the resulting conflict. As evidence of this, we found that areas where there was a greater presence of Inner Mission, as revealed by their mission houses, were associated with more creameries, supplied by fewer farmers, each supplying the creamery which most satisfied their consciences. This in turn required longer collection routes. The dividends paid out to each farmer were correspondingly lower.

From the perspective of economic history, future work might consider the case of the Danes who took their religious conflict with them to the United States, where the Inner Mission came to dominate. What impact did this have on a community which otherwise assimilated rapidly into American society and played an important role in transmitting knowledge on modern dairying to the United States (Boberg-Fazlic and Sharp, 2024)? Finally, our result may improve our understanding of rising contemporary polarization, which has been attributed to religious polarization by some (e.g, Putnam and Campbell (2012)). Another question for future research could therefore be when new religious ideas result in conflict and when they result in peaceful cohabitation (which was ultimately the case for the two factions in Denmark). We have focused on one particular dimension of religion; the dimension along which world views and opinions may differ. Focusing on other dimensions would be fruitful. For instance, Sunday closures may influence society in alternative ways, such as reducing work-related stress or increasing pro-sociality.

References

Andersen, L. H. and Bentzen, J. (2022). In the name of god! religiosity and the transition to modern growth.

Andersen, T. B., Bentzen, J., Dalgaard, C.-J., and Sharp, P. (2017). Pre-reformation roots of the protestant ethic. *The Economic Journal*, 127(604):1756–1793.

Azzi, C. and Ehrenberg, R. (1975). Household allocation of time and church attendance. *Journal of political Economy*, 83(1):27–56.

Barro, R. J. and McCleary, R. M. (2003). Religion and economic growth across countries. *American Sociological Review*, 68(5):760.

Becker, S. O., Pfaff, S., and Rubin, J. (2016). Causes and consequences of the Protestant Reformation. *Explorations in Economic History*, 62:1–25.

Bénabou, R., Ticchi, D., and Vindigni, A. (2015). Forbidden fruits: the political economy of science, religion, and growth. Technical report, National Bureau of Economic Research.

Bentzen, J. (2021). Religiosity and Development. *Oxford Research Encyclopedia*.

Bentzen, J. S. (2019). Acts of God?: Religiosity and Natural Disasters Across Subnational World Districts. *The Economic Journal*, 129(622):2295–2321.

Bjørn, C. (1982). *Dansk mejeribrug 1882-1914*. De danske Mejeriers Fællesorganisation, Odense, Denmark.

Boberg-Fazlic, N., Jensen, P. S., Lampe, M., Sharp, P. R., and Skovsgaard, C. (2023). 'Getting to Denmark': The Role of Elites for Development. *Journal of Economic Growth*. forthcoming.

Boberg-Fazlic, N., Lampe, M., Martinelli, P., and Sharp, P. R. (2022). Winners and losers from agrarian reform: Evidence from Danish land inequality 1682-1895. *Journal of Development Economics*, (155):102813.

Boberg-Fazlic, N. and Sharp, P. (2024). Immigrant Communities and Knowledge Spillovers: Danish-Americans and the Development of the Dairy Industry in the United States. *American Economic Journal: Macroeconomics*.

Brøndal, J. (2013). Danes and Danish Americans, 1870-1940. In *Immigrants in American History: Arrival, Adaption, and Integration, Vol. 1*, pages 323–331. ABC-CLIO, Santa Barbara, CA.

Bryan, G., Choi, J. J., and Karlan, D. (2021). Randomizing religion: the impact of Protestant evangelism on economic outcomes. *The Quarterly Journal of Economics*, 136(1):293–380.

Buringh, E., Campbell, B. M. S., Rijpma, A., and van Zanden, J. L. (2020). Church building and the economy during Europe's 'Age of the Cathedrals', 700–1500 CE. *Explorations in Economic History*, 76:101316.

Cabello, M. (2023). The counter-reformation, science, and long-term growth: A black legend? *SSRN Working Paper*.

Callaway, B. and Sant'Anna, P. H. (2021). Difference-in-differences with multiple time periods. *Journal of Econometrics*, 225(2):200–230. Themed Issue: Treatment Effect 1.

Campante, F. and Yanagizawa-Drott, D. (2015). Does religion affect economic growth and happiness? Evidence from Ramadan. *The Quarterly Journal of Economics*, 130(2):615–658.

Cantoni, D. and Yuchtman, N. (2013). The political economy of educational content and development: Lessons from history. *Journal of Development Economics*, 104:233–244.

Chaney, E. (2016). Religion and the rise and fall of Islamic science. *Work. Pap., Dep. Econ., Harvard Univ., Cambridge, MA*.

Christoffersen, L. (1998). *Kirkeret mellem stat, marked og civilsamfund*. PhD thesis.

Goldsmith-Pinkham, P., Sorkin, I., and Swift, H. (2020). Bartik instruments: What, when, why, and how. *American Economic Review*, 110(8):2586–2624.

Gregersen, N. H. and Bach-Nielsen, C. (2017). *Reformationen i dansk kirke og kultur. Bind 3: 1914-2017*. University of Southern Denmark Studies in History and Social Sciences vol. 544. Syddansk Universitetsforlag.

Guiso, L., Sapienza, P., and Zingales, L. (2006). Does culture affect economic outcomes? *Journal of Economic perspectives*, 20(2):23–48.

Harris, C. D. (1954). The Market as a Factor in the Localization of Industry in the United States. *Annals of the Association of American Geographers*, 44(4):315–348.

Haue, H. (1978). Mejerikrigen - En undersøgelse af de søndagshvilende mejeriers udvikling i Danmark. *Fortid Og Nutid*, 1.(17):359–390.

Henriksen, I., Hviid, M., and Sharp, P. (2012). Law and peace: Contracts and the success of the Danish dairy cooperatives. *Journal of Economic History*, 72(1):197–224.

Henriksen, I., Lampe, M., and Sharp, P. (2011). The role of technology and institutions for growth: Danish creameries in the late nineteenth century. *European Review of Economic History*, 15(3):475–493.

Henriksen, I., McLaughlin, E., and Sharp, P. (2015). Contracts and cooperation: The relative failure of the Irish dairy industry in the late nineteenth century reconsidered. *European Review of Economic History*, 19(4):412–431.

Henriques, S., McLaughlin, E., Sharp, P., Tsoukli, X., and Vedel, C. (2020). Opening the Black Box of the Danish Dairy Cooperatives : A Productivity Analysis.

Henriques, S., Sharp, P., Tsoukli, X., and Vedel, C. (2021). Resilience, Adaptability and Transformability: Danish Butter Factories in the Face of Coal Shortages. *EHES Working Paper No. 220*.

Henriques, S. T. and Sharp, P. (2016). The Danish agricultural revolution in an energy perspective: a case of development with few domestic energy sources. *The Economic History Review*, 69(3):844–869.

Iannaccone, L. R. (1998). Introduction to the Economics of Religion. *Journal of Economic Literature*, 36(3):1465–1495.

Iyer, S. (2016). The new economics of religion. *Journal of Economic Literature*, 54(2):395–441.

Kærgård, N. (2010). De internationale markeder og erhvervsudviklingen: dansk landbrugs største triumf. In Nielsen, M. A., editor, *Det fremmede som historisk drivkraft: Danmark efter 1742*, pages 166–175. Det Kongelige Danske Videnskabernes Selskab.

Kelly, M. (2019). The Standard Errors of Persistence. *SSRN Electronic Journal*, (June).

Kuran, T. (1997). Islam and underdevelopment: an old puzzle revisited. *Journal of Institutional and Theoretical Economics (JITE)/Zeitschrift für die gesamte Staatswissenschaft*, 143(1):41–71.

Kuran, T. (2018). Islam and economic performance: Historical and contemporary links. *Journal of Economic Literature*, 56(4):1292–1359.

Lampe, M. and Sharp, P. (2014). Greasing the wheels of rural transformation? Margarine and the competition for the British butter market. *The Economic History Review*, 67(3):769–792.

Lampe, M. and Sharp, P. (2015). Just add milk: A productivity analysis of the revolutionary changes in nineteenth-century Danish dairying. *Economic History Review*, 68(4):1132–1153.

Lampe, M. and Sharp, P. (2018). *A Land of Milk and Butter*. University of Chicago Press Economics Books. University of Chicago Press.

Larsen, K. E. (2005). Missionshuse - om baggrunden for deres opførelse. *Kirkehistoriske Samlinger*, pages 95–133.

Lauridsen, H. R. and Kjærgaard, E. (1999). *Folk i bevægelse: folkelig vækkelse, politik og andelsfællesskab i Nordvestjylland. Folk i bevægelse*. KLO.

Lausten, M. S. (2002). *A Church History of Denmark*. Ashgate, 1. edition.

Lindhardt, P. G. (1978). *Vækkelse og kirkelige retninger*. Aros, Århus, 3. revider edition.

Lings, J. K. (2018). *Himmel og Hav og Harboøre - Drukneulykken 1893*. Lohse, Fredericia, 1st edition.

Lodberg, P. (2016). *Danskernes tro gennem 1000 år*. Kristeligt Dagblad, 1. udgave edition.

Matzen, H. and Timm, J. (1891). *Haandbog i den danske Kirkeret*. Gad, Copenhagen.

Mokyr, J. (2010). *The Enlightened economy an economic history of Britain 1700-1850*. Yale University Press.

O'Rourke, K. H. (2006). *Late nineteenth-century Denmark in an Irish mirror: Land tenure, homogeneity, and the roots of Danish success*, pages 159–196. McGill-Queen's University Press.

O'Rourke, K. H. (2007). Culture, Conflict and Cooperation: Irish Dairying Before the Great War. *The Economic Journal*, 117(523):1357–1379.

Pargament, K. I. (2001). *The psychology of religion and coping: Theory, research, practice*. Guilford press.

Pedersen, S., Hermansen, B., Nathan, C., and Tougaard, L. (2011/2019). Surface geology map of denmark 1: 200 000 (version 2). *GEUS report*, 19.

Petersen, W. W. (1999). Warm winds from the South: the spread of Pietism to Scandinavian Lutherans. *Bethany Lutheran Theological Seminary*.

Pontoppidan Thyssen, A. (1960). *Vækkelsernes frembrud i Danmark i første halvdel af det 19. århundrede (vol 1-7; 1960-1977)*. København & Aabenraa.

Putnam, R. D. and Campbell, D. E. (2012). *American grace: How religion divides and unites us*. Simon and Schuster.

Rasmussen, J. D. (1982). Dansk mejeribrug 1914-55. In Bjørn, C., editor, *Dansk Mejeribrug 1882- 2000*. De danske Mejeriers Fællesorganisation, Odense, Denmark.

Squicciarini, M. P. (2020). Devotion and Development: Religiosity, Education, and Economic Progress in Nineteenth-Century France. *American Economic Review*, 110(11):3454–3491.

Stenbæk, J. (1999). *Præsternes forening gennem 100 år*. Den danske præsteforenings forlag.

Tabellini, G. (2008). The scope of cooperation: Values and incentives. *The Quarterly Journal of Economics*, 123(3):905–950.

Trap and Knudsen, G. (1928). *Kongeriget Danmark (Trap Danmark 4th edition)*. Universitetsboghandler G. E. C. Gad, Copenhagen, 4th edition.

Trap, J. P., Falbe-Hansen, V., Westergaard, H., and Weitemeyer, H. (1906). *Kongeriget Danmark (Trap Danmark 3rd edition)*. Universitetsboghandler G. E. C. Gad, Copenhagen, 3rd edition.

Wåhlin, V. (1986). Popular revivalism in Denmark recent research trends and results. *Scandinavian Journal of History*, 11(4):363–387.

Weber, M. (1905). *The Protestant Ethic and the Spirit of Capitalism (trans. Talcott Parsons 1930)*. George Allen and Unwin London.

Wood, S. N. (2017). *Generalized additive models: an introduction with R*. CRC press.

European Historical Economics Society

EHES Working Paper Series

Recent EHES Working Papers

2023

EHES 244 Income Share of the Top 10%, the Middle 50% and the Bottom 40% in Latin America: 1920-2011
Pablo Astorga

EHES 243 Wealth, inequality, and sex: the changes in female and male wealth and their consequences for the governance of the Russian Empire from 1700s to 1850s
Elena Korchmina

EHES 242 Not the Best Fillers in of Forms? The Danish and Norwegian Graduate Biographies and Upper Tail Knowledge
Nicholas Martin Ford, Kristin Ranestad, Paul Sharp

EHES 241 Medical Technology and Life Expectancy: Evidence from the Antitoxin Treatment of Diphtheria
Philipp Ager, Casper Worm Hansen, Peter Z. Lin

EHES 240 Life and Death under Son Preference: Economic stress, Fertility and Early-life Mortality in Rural Spain, 1800-1910
Francisco J. Marco-Gracia, Francisco J. Beltrán Tapia, Víctor A. Luque de Haro

EHES 239 The Unequal Spirit of the Protestant Reformation: Particularism and Wealth Distribution in Early Modern Germany
Felix S.F. Schaff

EHES 238 The persistence of social inequality in adult mortality in rural Spain, death cohorts 1546-2010
Francisco J. Marco-Garcia, Víctor A. Luque de Haro

EHES 237 Capital, Productivity, and Human Welfare since 1870
Daniel Gallardo-Albarrán

EHES 236 Economic Freedom in Retrospect
Leandro Prados de la Escosura

EHES 235 Subjective Well-being in Spain's Decline
Carlos Álvarez-Nogal, Leandro Prados de la Escosura

All papers may be downloaded free of charge from: http://www.ehes.org/

The European Historical Economics Society is concerned with advancing education in European economic history through study of European economies and economic history. The society is registered with the Charity Commissioners of England and Wales number: 1052680