The political economy of churches in Denmark over 700 years

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Abstract: This paper reports new macro time-series for the number and size of churches in Denmark from year 1300 to 2000. Church densities are defined as the series per capita. The densities are interpreted as a proxy for religiosity. It is falling throughout all 700 years, but two events gave an extra fall: 1) The Reformation of Catholicism into Lutheranism in the first half of the 16th century caused a fall of 9%, and 2) modern economic growth after 1820 caused a fourfold fall as predicted by the theory of the religious transition. We suggest that similar data for all European countries would show the same strong reaction of church densities to modern economic growth.

Keywords: Church stock, religiosity, transition

Jel: N13, N14, Z12

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1.   Introduction: A time-series over 700 years

The paper has three purposes presented in section 1.1, while section 1.2 introduces the concepts and main theories behind the analysis.

Three issues of definition should be mentioned from the outset: (i) The term 'Church' is the organization of the dominating Danish religion, while 'church' is a cult building of the Church. (ii) Since 1300, the area of the Danish Kingdom has changed several times. The series cover the area of present Denmark as fixed in 1920 in accordance with the Versailles Peace Treaty. (iii) Required Danish words are included in square brackets [ ].

1.1   The three purposes of the paper

The first purpose is to report new time-series over 700 years. They give a quantitative aspect of Danish history. We believe that if similar data were compiled for other European countries, they would tell a similar story.

The second purpose is to develop the *church-density* variable. It is defined as churches per capita. Section 4 argues that the density is a good proxy for religiosity in the long run. The data shows a moderate increase in the number of churches. This supports three observations that are documented in section 5:

(1)   The density *falls* slowly but *steadily* from 1300 to 1750.

(2)   A *small downward shift* of 9% in the density occurs after 1500.

(3)   A *large fall* of 80% in the densities begins in 1750.

The third purpose is to interpret the three observations. We argue that (1) is largely due to improved means of transportation; (2) is the effect of the Reformation from Catholicism to Lutheranism; and (3) is explained by the *religious transition*.

In addition, a non-observation should be noted. The church data show no effect of the vicious Black Death epidemic that hit the country in 1349.

1.2   Introduction to concepts and theory and some institutional background

For the purpose of this paper, a *religion* is a package of beliefs and practices that change very slowly; it is a qualitative variable. *Religiosity* is a quantitative measure of the importance of a given religion in all aspects of people's lives.

Our theoretical framework is Public Choice and the theory of growth and development, notably the theory of the *grand transition*. It deals with the large change from a *tradi-*

tional LIC (low income) steady state to a *modern* DC (developed) steady state. In Denmark, the grand transition started as an upward kink in the population in the mid 18th century, but it only became strong in the economy after the Napoleonic Wars. Section 3 reviews the main economic and demographic data that causes transitions in all socioeconomic variables from a *traditional* to a *modern* level.

Transitions should be studied in a time-series perspective as the present. Long time-series are rare, but transitions can also be studied in a cross-country perspective in which data that covers many aspects of religiosity are available (see section 7). A typical aspect is how often people attend religious services, which determines the *demand* for churches.

Historical evidence suggests that virtually all Danes have belonged to the same religion at least since year 1100. It changed from Catholic to Lutheran at the Reformation in 1536. The Lutheran Church is the Danish *official* religion.[3] The speed of the change allows us to estimate the speed of adjustment of the church stock to an exogenous chock; see section 5.4. It took about 75 years, and 3/4 of the adjustment was in the first 25 years.

Before 1970, only scattered information exists about church attendance, but from such information it appears that it was fairly high at the turn of the 18th century. The population has grown 5.5 times since 1800, and the church stock has increased only 1.26 times. Without the religious transition, churches would have an overcrowding problem, but at present Denmark actually has a much discussed problem of church *overcapacity*. Less than 3% of the church members go to service regularly and many services are poorly attended.[4]

A church is a piece of real estate that generates little monetary rent. Thus, it is an economic burden to the owner. Church ownership has passed through four main phases: (i) In Catholic times, churches had mixed private/Church ownership. (ii) After the Reformation, churches became fully private property – normally as parts of the manor of big (feudal) landowners. (iii) After the land reforms around 1800, churches became the property of their congregations. Finally, (iv) at the turn of the 20th century, churches became public property.

The new data is in section 2 while section 3 gives data for income and population, which are necessary to understand the church data. Section 4 discusses the link to theory, while section 5 looks at the series to extract the stylized facts. Section 6 interprets these facts. Section 7 compares with cross-country evidence, and section 8 concludes.

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3. The Danish constitution (from 1849) grants freedom of religion, but gives the Lutheran Church a special 'official' status as the 'people's religion'.
4. Attendance statistics are weak. E.g., it has been discussed in the media how often religious services are canceled due to no attendance. This seems to happen from time to time, but no data is available.

2.   Churches: number C_N, sizes C_S, and densities D_N and D_S

This section reports the new series. Section 2.1 looks at the present churches, section 2.2 considers the churches built and closed, section 2.3 reports the main series for the number and sizes of churches, while section 2.4 brings the densities. Finally, section 2.5 discusses the size of the church establishment. The data is reported in so much detail that it allows readers to revise everything when more information becomes available.[5]

The historical analysis is possible because of the *church project* at the Danish National Museum (DNM). It compiles a detailed historical record, which is published online, of all existing and abolished churches.[6] Till now, about two thirds of all churches are covered.

Table 1. The church variables

		Church numbers with the bookkeeping identity: $C_N = C_{N-1} + C_B - C_A$
C_N		Number
	C_B	Built in period
	C_A	Abolished in period
C_S		Size: Index with size weights defined in Table 4
		Church densities. Reached by division by population P. Scaled by 10,000
d_N		Density: $d_N = 10,000\, C_N/P$. The main religiosity proxy
d_S		Density: $d_S = 10,000\, C_S/P$

2.1   The present churches: high precision data

The stock of Danish Lutheran churches in 2015 is covered by Table 2. The source is the official church registry (source 2) of the Ministry of Ecclesiastical Affairs. Only a few of these churches are dubious in the sense that they are rarely used or they are special churches in institutions such as prisons or cemeteries.

After the conversion to Christianity around year 1000, a wave of church building took place,[7] but few written records exist before 1300, so we decided to start in that year where a church stock was app. 1941 churches, of which 1604 (82.6%) are still in use. Table 2 shows that no less than 66.5% of the present church stock was already built in 1300. They will be referred to as *the old churches*. These churches are carefully preserved national treasures.

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5. The main geographical unit used is 'Old counties' [amter], from before 1970 as in the DNM-project. See home page of the project, for the worksheets, which also gives other geographical units.
6. The project was started by M. Mackeprang, who became director of the museum. He is the author of the pioneering study Mackeprang (1920).
7. The change from the traditional Old Norse belief system to Catholicism seems to have taken more than a century, but it was completed before 1050, when the big wave of church building started, see vol 4 of Danmarkshistorie (1989) and vol 2 of Socialhistorie (1980).

Table 2. The age of the present churches

(*n*)	*t*	(1) C_N	(2) In % of 2404	(3) C_B	(4) Built in
	Year	Number	value in 2015	Built	periods:
			Catholic time		Before 1300
1	1300	1604	66.7	1604	66.5%
2	1350	1645	68.4	41	Σ: 1300-1550
3	1400	1653	68.8	8	
4	1450	1678	69.8	25	3.9%
5	1500	1698	70.6	20	
			Protestant time		
6	1550	1718	71.5	20	Σ: 1550-1850
7	1600	1730	72.0	12	
8	1650	1744	72.5	14	
9	1700	1751	72.8	7	3.7%
10	1750	1765	73.4	14	
11	1800	1775	73.8	10	
12	1850	1787	74.3	12	Σ: 1850-2000
13	1900	1954	81.3	167	
14	1950	2214	92.1	260	25.7%
15	2000	2408	100.2	194	
All	2015	2404	100	4	100%

Nearly all churches built before 1300 has a similar and very sturdy construction with thick stone walls and a wooden roof. Even if the wooden roof caught fire, the walls remained. Churches are surrounded by cemeteries. Therefore, village fires did not normally spread to the church. Also, it is worth mentioning that Denmark has experienced rather few land wars on its territory.

2.2   New and closed churches: some uncertainty
Table 3 shows that 1027 churches have been built and 540 have been closed since year 1300.

The Table has 4 columns: (1) is the closed churches documented in the DNM-project (URL ref)[8] that has made a big effort to reach accurate data; but till now only 64% of the country is covered. Moreover, for many closed churches, information is scant. The year in which the church was abolished may be known, but sometimes the church faded gradually. However, the building year often remains uncertain. Fortunately, most were built before 1300, so it hardly influences the data.

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8. The term (URL ref), means that the net address (URL) is given in the references.

Column (2) gives the number of churches built in each period; (3) and (4) holds our prognosis for how the full DNM data will come to look. The pattern proved to be rather stable within most counties covered. Consequently, we have projected the missing counties proportionally. More refined projection was also tried, but the difference was so small that the method used was preferred, see section 5.3 below.

Table 3. New and closed churches

		(1)	(2)	(3)	(4)
	Year	Covered by the DNM project 64% of the country covered		Prediction of full sample Using the factor: 1.565	
N	t	Built	Closed	Built, C_B	Closed, C_A
			Catholic time		
1	1300	-	-	-	-
2	1350	25	1	39	2
3	1400	31	4	49	6
4	1450	37	7	58	11
5	1500	23	4	36	6
			Protestant time		
6	1550	16	85	25	133
7	1600	20	66	31	103
8	1650	22	18	34	28
9	1700	23	29	36	45
10	1750	29	18	45	28
11	1800	20	27	31	42
12	1850	16	17	25	27
13	1900	116	36	182	56
14	1950	157	21	246	33
15	2000	121	12	189	19
	All	656	345	1027	540

Note: From 2000 to 2015 the church stock has fallen by 4.

Approximately 224 of the 540 church closings occurred in connection with the Reformation; see sections 5.4 and 6.2. Since 1800, only 139 churches have been closed. Once a church has survived for 300 years, it 'lives forever'.[9] The data in Columns 3 and 4 are shown as the bar-diagrams of Figure 1.

9. Danish homes, which are much less sturdily built than churches, have an age profile where they live 'forever' once they survive 140 years (Andersen 1990). After 140 years, surviving houses turns into 'treasure' that people are willing to spend large amounts of money to preserve. Also, a public protection agency identifies buildings that should be protected and ensures that they become very difficult to change.

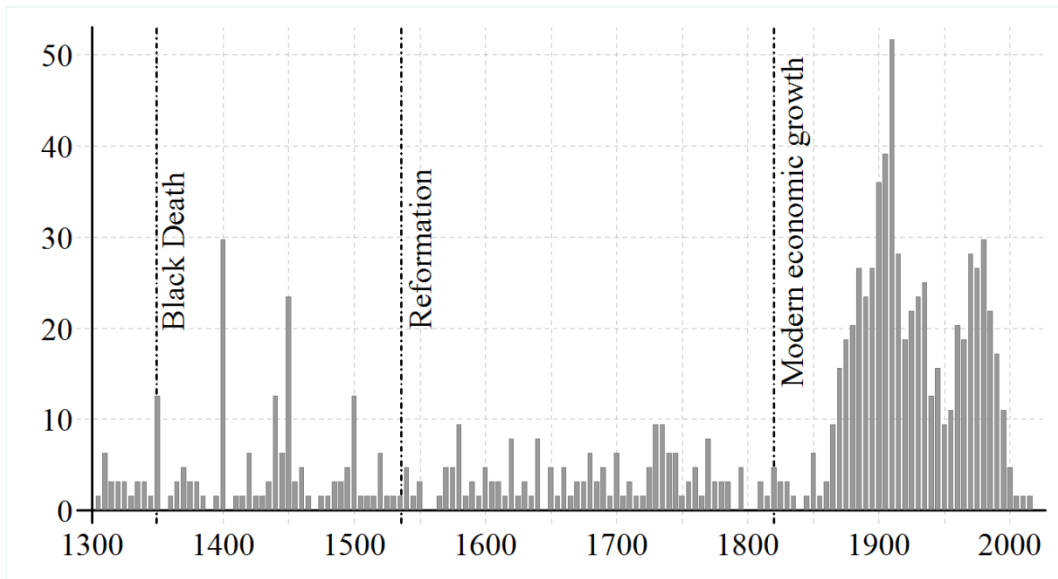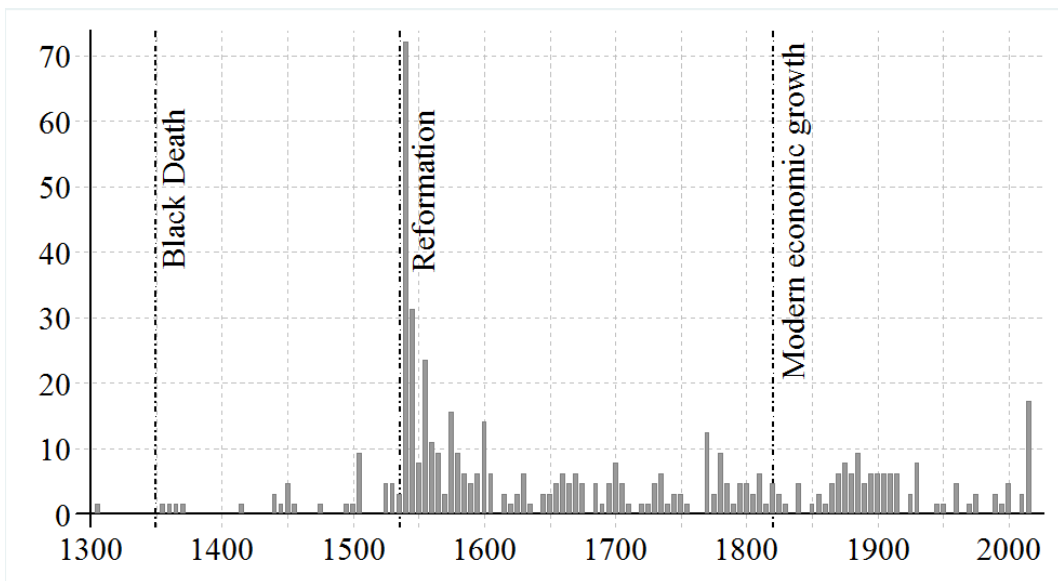Figure 1a. The building of new churches per 5-year period

Figure 1b. The closing of churches per 5-year period

For now, it should be noted that the main wave of church building in the data occurred after modern economic growth was well under way from 1860 to 2000, while the main wave of church closings were just after the Reformation in 1536. The reader should also note that the average number of churches in Denmark is just above 2000, so even when 70 churches were closed just after the Reformation, it is not more than 3.5%. The change per 5-year period is normally tiny relative to the stock.

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The reasons why a church was closed (e.g., 400 years ago) are rarely fully known. Some of the closed churches were built less sturdily, so that the present old churches partly represent the survival of the fittest. However, in most cases the DNM volumes provide a dynamic explanation:

Churches were often closed after a process in which the key factor was a *loss of demand* causing church maintenance to slip. This led to a deterioration of the building, so that demand went further down making the process dynamic, till the building was so depilated that it had to be closed. The initial reason for the loss of demand was often that a neighboring church was preferred by the congregation. Also, sometimes villages moved.

Two special cases should be mentioned: (i) In 1530, Denmark had 95 Catholic monasteries. After the Reformation nearly all were closed. If the monasteries were in thinly populated parts of the country, their churches had no further use, but many of the churches of the monasteries in the towns remained as Lutheran churches. (ii) Feudal manors had a large labor force, and thus needed a church. Land reforms in the early 19th century and the agricultural transition caused the labor force of the manors to decrease, and most of the manor-churches were closed.

Finally, it should be mentioned that in 2013, the Diocese of Copenhagen started a process to reduce overcapacity by recommending that 17 fairly large churches (built around 1900) should be closed, but the Minister of Ecclesiastical Affairs resolved that only eight of these churches should be closed. They were closed the same year.

The fact that 540 churches have been closed shows that it has been perfectly doable to adjust supply of churches to demand. Before 1800, most churches were private property and as they were an economic burden, the owner had an interest in closing down excess church capacity, as further discussed in section 4.5.

2.3   The number and the size of churches

Old village churches have a fairly well defined traditional architectural form which is known to all Danes. Nearly all of the 1833 churches from before 1300 have this form, which has inspired many later churches, so that they look like 'real' churches. The largest Danish church [Grundtvigskirken] was built 1921-40 in a (then) new suburb to Copenhagen.[10] It was made to look like a giant village church.

The size of all churches has been classified in the three categories defined in Table 4.

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10. Characteristically for the religious transition, the chairs in this church have been rearranged. The original number was 1915 chairs, but it is now 750 chairs.

The classification in sizes is simplified by the high frequency of the traditional church form. From Tables 2 and 3 it is easy to calculate the number and the size weighted churches are reported in Table 5, which also reports the *ratio* between C_S and C_N that measures the size of the average church.

Table 4. The three size categories

Weight	The typical	Length of the church room	Seats today
1	Village church	Below 30 m [a)]	Below 200
2	Town church	Above 30 m	Between 200 and 800
3	Cathedral	Cathedral or similar size	Above 800

(a) For normal proportions. The church room consists of nave, chancel, and apses.

Table 5. The number and size of churches in Denmark

		(1)	(2)	(3)	(4)	(5)
	Year	Number	New built	Abandoned	Size	Ratio
n	T	C_N	C_B	C_A	C_S	C_S/C_N
			Catholic time			
1	1300	1941	-	-	2093	1.078
2	1350	1978	39	2	2137	1.080
3	1400	2021	49	6	2187	1.082
4	1450	2068	58	11	2243	1.085
5	1500	2097	36	6	2288	1.091
			Protestant time			
6	1550	1989	25	133	2177	1.094
7	1600	1917	31	103	2102	1.096
8	1650	1924	34	28	2116	1.100
9	1700	1914	36	45	2105	1.100
10	1750	1931	45	28	2129	1.102
11	1800	1921	31	42	2118	1.103
12	1850	1919	25	27	2116	1.103
13	1900	2044	182	56	2277	1.114
14	1950	2257	246	33	2528	1.120
15	2000	2428	189	19	2720	1.121

Note: The size measure use the weights defined in Table 4.

Our assessment is that the number of churches that existed in year 1300 is known $\pm$ 50. The uncertainty falls steadily to about $\pm$ 5 for the last periods. Before 1300, the information about the building year is normally rather uncertain, but from 1300, a great deal of written

documentation exists.[11]

In addition to the size component, churches also have a 'luxury' component that, in principle, is reflected in the construction price per m^2. Our data disregards this component as further discussed in section 4.4.

2.4 The densities: $d_N = C_N/P$ and $d_S = N_S/P$

The church density, d_N, is the number of churches, C_N, divided by population, P from section 3 below, and the church size densities, d_S are the church size, C_S, divided by population, P. Both densities are scaled by multiplying by 1,000.

Table 6. The two densities

(n)	(t)	P	C_N	C_S	$d_N = C_N/P$	$d_S = C_S/P$
	Year	Population	Number	Size	Church density	Size density
		From Table 8	From Table 5	From Table 5	D_N	D_S
Catholic time						
1	1300	489	1941	2093	3.969	4.280
2	1350	515	1978	2137	3.842	4.149
3	1400	542	2021	2187	3.728	4.034
4	1450	570	2068	2243	3.627	3.935
5	1500	600	2097	2288	3.496	3.814
Protestant time						
6	1550	624	1989	2177	3.188	3.489
7	1600	650	1917	2102	2.950	3.234
8	1650	675	1924	2116	2.850	3.135
9	1700	700	1914	2105	2.735	3.007
10	1750	862	1931	2129	2.241	2.469
11	1800	1063	1921	2118	1.807	1.992
12	1850	1499	1919	2116	1.280	1.412
13	1900	2561	2044	2277	0.798	0.889
14	1950	4271	2257	2528	0.528	0.592
15	2000	5337	2428	2720	0.455	0.510

2.5 A note on the size of the church staff

Until now, the data has some documentation, but Table 6 allows some speculation about the

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11. A famous baseline is the recorded delivery of church bells in 1526 to the royal cannon foundry. Here, many churches are mentioned for the first time, but it would be wrong to use the year 1526 as the building year. Experts in architectural history can often determine that an existing building is (much) older. However, the building materials of closed churches have often been recycled.

size of the church staff. A crude assessment is given in Table 7.

One element in the decline of the staff is that Denmark had about 95 monasteries before the Reformation. The staff was quite big as monasteries often ran hospitals and schools. In principle, all monasteries were phased out (or closed right away) after the Reformation, though two (small) monasteries have somehow survived till today, but now they are not institutions of the People's Church, hence the gray shading.

Table 7. The population and the church staff in years 1500, 1600 and 2000

Variable	Source	Catholic time, 1400		Protestant time, 1600		Today, 2000	
Population	Table 8	540,000		650,000		5,300,000	
		Buildings	Staff	Buildings	Staff	Buildings	Staff
Churches	Table 5	2,020	8,080	1,920	7,700	2,400	7,000 [a)]
Monasteries	Wiki-Dk	95	1,500	10	100	2	15
Total (minus overlap)			9,000		7,700		7,000
Per 100 people			1.67		1.18		0.13
Index 1500 := 100			100		71		8

Note: I assume that churches had a staff of 4, and monastery had a staff of 15. The overlap is the work done by staff of the monastery in the churches.

a. Today, many churches are run jointly, so the staff is smaller than 4 per church.

The data suggests that 1.7% of the population or 3.4% of the labor force (with a participation ration of 0.5) worked for the church before the Reformation. This fell to 1.2% or 2.4% of the labor force after the Reformation. Today it is 0.13% or 0.3% of the labor force.

By these assessments, the presence of church employees in the life of the average Dane has fallen twice as fast as the church density. Think of the chance that when you meet a person at random, it is a church employee. This chance has fallen ten times since the 14th century. This is in an important part of the religious transition. Here causality is likely to go both ways.[12]

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12. Also, you may not even notice since clergy dresses like everybody else, except during actual services.

3. Background: Population and income

The population and income data used are reported in Table 8. The data is the assessments of Maddison (2003) and later (URL ref). For Denmark, the data builds on Hansen (1984) linked up to the PENN World Tables (URL ref).

From 1820, Maddison reports annual data which builds on at least some primary data, while the earlier data is (even) more uncertain. The population numbers are trend-based. They do not report, e.g., the Black Death epidemic in 1349 discussed in section 5.4 below. Note that the population had an upward kink in the early 19th century.

Table 8. Population and income

(*n*)	(*t*)	(1)	(2)	(3)	(4)	(5)
		Population		GDP per capita, i.e., gdp		
	Year	Number	Growth	gdp	Growth	Income
		1,000	% pa.		% pa.	ln gdp
	1000	**360**	**-**	**400**	**-**	**-**
1	1300	489	0.10	578	0.12	6.36
2	1350	515[a]	0.10	614	0.12	6.42
3	1400	542[a]	0.10	653	0.12	6.48
4	1450	570	0.10	694	0.12	6.54
5	**1500**	**600**	0.10	**738**	0.12	6.60
6	1550	624	0.08	804	0.17	6.69
7	**1600**	**650**	0.08	**875**	0.17	6.77
8	1650	675	0.07	953	0.17	6.86
9	**1700**	**700**	0.07	**1039**	0.17	6.95
10	1750	862	0.42	1131	0.17	7.03
11	1800	1063	0.42	1231	0.17	7.12
	1820	**1155**	0.42	**1274**	0.17	7.15
12	**1850**	**1499**	0.87	**1767**	1.10	7.48
13	**1900**	**2561**	1.08	**3017**	1.08	8.01
14	**1950**	**4271**	1.03	**6943**	1.68	8.85
15	**2000**	**5337**	0.45	**22975**	2.42	10.04

Source: Maddison (2003 with updates), the gdp data are in 1990 international Geary-Khamis dollar. The data in bold is the ones reported by Maddison. The cells shaded in gray are used for interpolation only. Rows in normal text are our interpolations. (a) Smaller due to the Black Death epidemic.

Thus, the population has a weak trend from 1300 to 1800, where it grew 2.2 times, but from 1800 to 2000 it increased 5.0 times. After 1980, however, population growth in Denmark has fallen to 0.1% once again. The term 'demographic transition' is used for the period between the traditional stable population (before 1700) and the modern stable population.[13]

Columns (4) to (6) report the corresponding calculations for real (PPP) **gdp**, which is GDP per capita and **income**, $y(t)$, which is the natural logarithm to the gdp. Hence a change of 1 **lp** (logarithmic points) is a change of 2.7 (= e) times in the gdp.

Income changed from 6.36 lp in 1300 to 10.04 in 2000. This amounts to 3.68 lp which is a rise in gdp of 40 times. However, the change from 1300 to 1800 is 0.79 lp while the change from 1800 to 2000 is 2.93 lp. This is 2.2 and 18.7 times respectively. Thus, the development had an important kink at the start of the 19th century – see also Figure 7 below.

In Denmark, the transition in the population began in the middle to late 18th century, but it was interrupted by the Napoleonic Wars in which Denmark participated on the losing side. This led to a serious budget crisis with high inflation, so modern economic growth was delayed until the 1820s, but it is certainly clear in the data for 1850 that something new has happened.

Imagine that a large additional population since year 1800 had demanded to be supplied with churches at the level of the previous centuries. This would have given a large church-building boom. With the large increase in incomes, it would surely have been possible. But somehow, only a modest increase in the church stock occurred, mainly in the new suburbs around Copenhagen and other major towns.

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13. Note that the demographic transition started 100 years before the economic kink. The same pattern is found in the UK, see Clark (2007). Galor (2011) refers to the period before 1700 as the Malthusian period, and he presents a model where population growth has a causal role in the later economic development.

4.   The link between the data and theory

Religion and religiosity are concepts used by people who approach the matter from different angles. Ours approach is socioeconomic – it demands simple operational definitions and measurement. Section 4.1 presents these definitions, while section 4.2 deals with our theoretical framework. Section 4.3 covers the link to the complex web of theories about secularization. Section 4.4 looks at our limitation to the 'cult' room of the churches, and finally section 4.5 argues that church densities are determined by demand.

The discussion in sections 4.1 to 4.4 is rather sketchy, but it is being developed in more detail in Paldam and Paldam (2015).

Our data covers the official religion. About 98% of the population belonged to the Church in 1950 (see Paldam 2013).[14] In recent decades, unofficial religions and spiritual practices have spread, and the membership of the Church has dropped below 80%. Immigration has introduced new institutionalized religions such as Islam, Hinduism, and East-Asian Buddhism. Furthermore, new religious and spiritual movements have gained following in the form of, i.a., New Age practices and westernized forms of Buddhism.[15] The unofficial religions are poorly covered by statistics. Since a 700 years period is covered, this recent trend is a minor problem.

4.1   The operational concepts of religion and religiosity used in the paper

Nearly everybody knows which religion (if any) they belong to.[16] This means that religions can be treated as a set of binary variables (are you Catholic: yes or no; are you…), while religiosity is a quantitative variable that measures the intensity of that religion.

A *religion* is thus a certain 'package' of immaterial goods and prescribed behavior. It is determined by the theology and traditions of the religion. It changes, but only slowly. People who have grown up in the religion are likely to have some knowledge of the theology, but tradition is more important. A central component in the package is the religious service that is practiced in a church.

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14. Membership Statistics started in 1975 when 95% of the population was member of the Church. Since then, membership has dropped to just below 80%. About half of the non-members hold another faith. Also, most of the 80% members are passive members. Statistics from the Ministry for Ecclesiastical Affairs and Statistics Denmark (both URL refs).
15. See 'Recognized religions in Denmark' (URL ref).
16. Some people have sympathy for several religions, and others are strongly religious in some ways, but not in others. At the individual level, considerable variability exists, but in national aggregates, the picture turns out to be simple and consistent, see section 7.

Religiosity is defined *as the importance of people's religion in all aspects of their life.* Thus, it gives the 'intensity' by which the package is used/consumed. It should be measured by polls asking respondents directly about the importance of their religion in as many aspects of life as possible. Such polls actually exist – notably in the form of the World Value Survey (WVS). Section 7 compares the results of the present study with an analysis of the WVS data. It shows that all polled items studied are strongly correlated in the national aggregates, and that the reported frequency of attendance to services is a typical aspect.

Historical data are scarce, so we have looked for an indicator. Church attendance measures the demand for churches, and section 4.5 argues that demand determines the stock of churches in the long run. Hence, the density of churches is a proxy for religiosity. As the data shows a substantial decrease in church densities – notably after 1850 – it follows that they show a corresponding drop in religiosity.

4.2 The theory of the religious transition

Section 3 above is a brief presentation of the basic numbers for the Danish economic development. It is characterized by an almost stable equilibrium before 1750 and subsequent modern economic growth since 1820. This development is rather typical for Western Europe, and it has caused transitions in all socioeconomic variables, as illustrated by Figure 2.

Figure 2. The typical transition curve
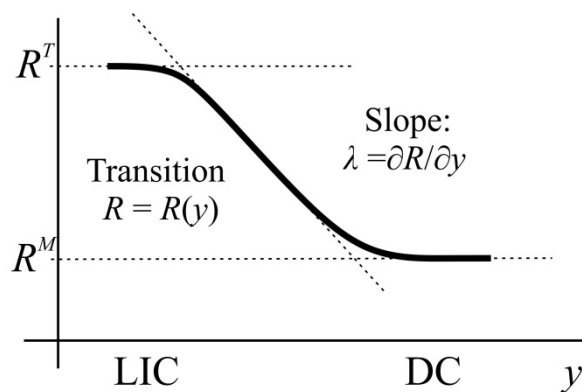
Note: The curve has a traditional level x^T when the country is a LIC (low income country) and a different modern level x^M when the country turns into a modern DC (developed country). In between, the transition from one steady state to the other takes place.

Imagine that R in Figure 2 is a measure of religiosity. In the traditional steady state, $R = R^T$ was high. People were poor, badly educated, and surrounded by threats that gave a high

mortality. The technologies of agriculture were low, and little could be done when crops were attacked by disease, bugs, and bad weather. The medical profession had little to offer, so many diseases had a far higher mortality rate than today. Uncertainty and low levels of control meant that people relied more on the mercy of God (cf. Malinowski 1948).

Also, formal healthcare, most schools, and the little social protection available were in the hands of the Church. As explained in Paldam and Gundlach (2013), the development has demanded an expansion of these sectors far beyond what can be financed from alms. Thus, they have been taken over by the secular public sector. This is one reason why people meet the church much less today than before, as shown in section 2.5.

Today, people are much better educated and have larger safety margins. Even when there are still threats, these are less dangerous. The medical sector has grown 5 times relative to GDP, and today it can actually cure many diseases. Partly as a result of this, mortality has dropped almost to half. Also, a net of insurance and social security has developed. Thus, people now have effective alternatives rather than to rely solely on the mercy of God. Hence, the theory predicts that the modern level of religiosity, R^M is lower than R^T. The fall in religiosity $F = R^T/R^M$ is termed *the religious transition*. It happens while society changes from traditional to modern society. There is a fine parallel to the transition in other socio-economic variables.

From an economic point of view, religion is used both as a factor of production and as a consumption good. The transition is probably stronger as regards the use of religion as a factor of production. This can be generalized as a process through which religion is substituted with science in the production function. As science is more efficient, this gives an endogenous growth process where the share (importance) of religion – i.e., religiosity – falls as formalized in Gundlach and Paldam (2012).

One part of the transition is difficult to measure: It is the *mellowing* of religion: In the Lutheran (and most other) churches, the interpretation of the Bible becomes less literal and more philosophical. Women were permitted into the clergy about 50 years ago and they are now in majority; recently, homosexuals have been permitted to marry in the church, etc. This process is often met with resistance by more conservative elements – in Denmark by the 'Home Mission [Indre Mission]' movement that has been a strong wing of the Church from the middle of the 19th century.[17] However, with a delay of a century, it has mellowed as well.

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17. For about a century before 1950, the Church had two rather clear wings: The 'liberal' Grundtvigianism' and the 'conservative' Home Mission. It did split many congregations, but somehow the church managed to keep

4.3   The link from our findings to the web of secularization theory

The religious transition is in broad concordance with the classic theories of secularization developed in the late 19th and early 20th centuries (cf. e.g. Marx; Durkheim; Weber.[18]). They view religion as decreasingly important in the lives of people living in post enlightenment modern societies. Focusing on different processes, these theories predict that modern rationality will replace religiosity. Nevertheless, even though religiosity has decreased, it has not vanished and religions have not disappeared. Transition theory predicts that religiosity converges to a new level in modern societies, but this level is unlikely to be zero.

During the 20th century, the resilience of religion became clear to most observers, and the secularization debate became (even) more complex. Today, most scholars agree that religion has undergone large changes as society has become still more individualized and globalized (see Paldam and Paldam (2015) for a discussion of our results in relation to secularization theories). In the West, traditional majority religions are challenged by new forms of spirituality that has a low degree of institutionalization. The response of traditional religions to spiritual beliefs and practices ranges from rejection to embracement.

Spiritual beliefs and practices are often not believed to be religious in the eyes of the practitioners, and they find their way into otherwise secular areas such as healthcare,[19] and even business management philosophy. Thus, spirituality and new religious movements are hard to measure.[20] In the last five decades, scholars of religion have challenged the classic secularization theories because they do not take these new forms of less institutionalized religiosity into account. Maybe, the increasing role of spirituality in late or post-modern Western societies somewhat replaces official religions.

While it is obvious that unofficial religion has taken new forms, it is much less clear that it is more widespread today than it has been through the times. It seems that folk beliefs always thrived alongside the Church. [21] From folk tales it is clear that a wide range of folk beliefs have played an important role in people's lives in the past. We have no available way of measuring neither folk beliefs nor spirituality.

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together, although some rather complex solutions were worked out. The top clergy is often accomplished diplomats, also within the Lutheran Church.

18. The theories differ: Karl Marx (1843) wrote about religion as the opium of the people and predicted that it will disappear in advanced socialist societies; Emile Durkheim (1893) explained how solidarity changes from mechanic to organic as a society becomes modern; and Max Weber (1903/04) argues that the still more rationally oriented modern society has been disenchanted. The discussion is surveyed in Pals (2008).

19. Healthcare used to be a main field for the church. However, in Denmark the Church has been fully replaced in healthcare, education, and social welfare by secular sectors.

20. The World Values Surveys tries to catch some aspects of such belief systems, but it is difficult.

21. The most detailed description of life in Denmark 500 years ago is still the multi-volume study by Troels Lund (1879-1901). It shows that both official and unofficial religion (superstition) played a large role.

In our perspective, these theories of secularization are far too diverse and rich relatively to available data. This paper uses a simpler framework that links religiosity to the few, but well-known, facts about long-run development.

4.4   Churches and the buildings of the Church

Martin Luther (1483-1546) wrote rather strongly against the excess luxury in Catholic churches (see e.g., Luther, WA 6, 355), and consequently churches became more austere after the Reformation. Many churches were even treated with a whitewash in which colorful murals were chalked over. However, Lutheranism has gradually mellowed. Symbolically, in many churches the whitewash has been removed and the old murals have been restored.

New churches in Denmark are often unique buildings designed by star architects and decorated with modern art, all done at considerable costs.[22] The development during the 20th century towards more 'fancy' church buildings may be due to the political economy of the *Church Building Fund*. It is set up so that funds accumulate, and as demand for churches are falling, the fund has an outlet problem which can be reduced by increasing building costs.

Thus, the number and size of churches have to do with the demand side, while the cost per m^2 is determined from the supply side.

By using 'cult' room as a measure of religiosity, we do not take other buildings connected with the church into consideration. This, e.g., applies to church towers (mostly built 1300-1500). More recently, the two main border cases are mission houses (mainly built 1850-1950) and community centers built (mainly after 1950) in connection with churches.

The Home Mission movement built more than 1000 mission houses between 1850 and 1930 (Larsen 1996). They were usually funded by local groups. Mission houses are used for Bible study groups and meetings in the missionary organization. Sometimes, they have a designated service room. Where these rooms are used as church room for a congregation within the official Church, they are included in our study.

Since 1950, about 200 community centers have been built by the Church.[23] These are used for meetings in the local church councils, activities in connection with church services such as wakes after funerals, and teaching of teenagers going through confirmation. But they are also, perhaps predominantly, used for cultural events such as lectures on many topics, art exhibitions, and musical playrooms for mothers with babies. These new centers may reflect a

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22. Scandinavian architecture and design has a tradition for reducing form to function. This gives an austere look which should not be confused with cheap.

23. Data is missing for the numbers of church run community centers, but many such centers have home pages that can be accessed from the home pages of the churches found in source 2.

renewed interest in the church, or they may be an attempt to win back some of the cultural institutions previously connected with church life. It is also possible that they arise due to the outlet problem of the Church Building Fund. Either way, it seems likely that increased religiosity brought on by a new church community center or a mission house in a community should be reflected in church attendance and as such covered by our measure.

4.5   Theory: Supply, S, adjusts to demand, D, but slowly

Thus, we propose that church density is a good long-run proxy for religiosity. Strictly speaking, church density is a supply side variable, *S*, while religiosity is a demand side variable. In the short run, the church stock (per capita), is fixed, so the adjustment is in the capacity utilization, *c* as shown on Figure 3.

Figure 3. Supply and demand for churches per capita
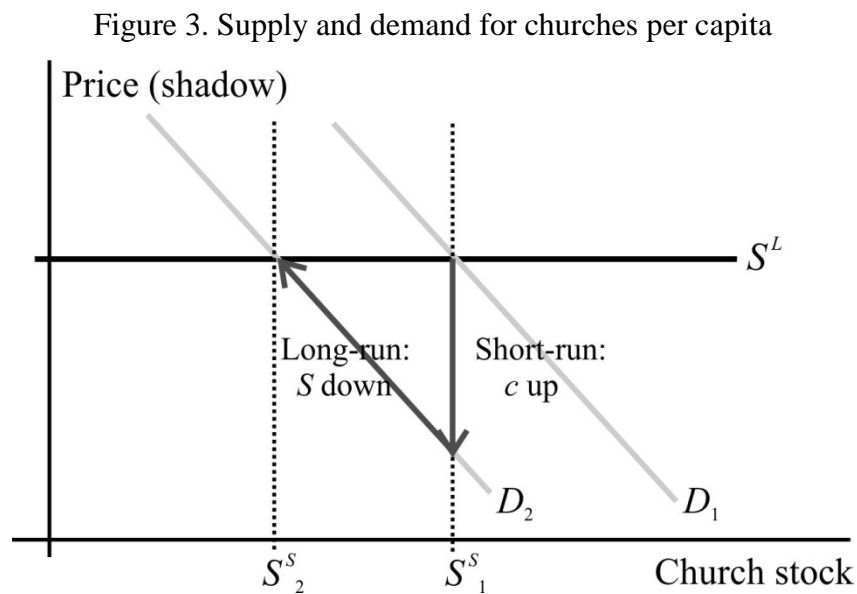
(1) $S_t^S(ct) = D(\rho_t, R_t) + c_t$, where ρ is the religion, and R is the religiosity, and c determines the adjustment. Time t is in years:

(2) $\partial S_t^S / \partial c_t = f(\omega_t)$, where ω is the ownership system, and $f(\omega_t) << S_t^S$ for all ω.

(2) gives the convergence, $S^S \rightarrow S^L$, to the long-run equilibrium:

(3) $S^L = D(\rho, R)$, where S^L is fully adjusted to c, and hence fully demand driven.

This is the capital adjustment model, with a slow adjustment speed as the existing church stock cannot be rapidly changed, both for physical and institutional reasons.

Figure 3 allows the reader to follow the adjustment process to a demand chock, where *D* falls from D_1 to D_2. This moves the equilibrium from E_1 to E_2. Note that the (shadow) price

reflects opportunity costs. The supply function is a function of the church ownership system, ω, which, as mentioned, has gone through four main phases: (i) Church property, (ii) private property, (iii) church property, and (iv) public property. The demand function is a function of the religion, ρ, which has changed once. Section 5.4 shows that the adjustment of supply to that change took ¾ of a century. Adjustment of supply to demand is slow indeed, but it does happen. Church owners do look at c. Private owners are likely to react faster to capacity variation, but public owners also react eventually.

An adjustment of the church stock to an upward jump in demand is likely to take a great deal of time too, but it is probably not symmetrical.

A gradual upward adjustment of demand took place from 1800 to 1950 the where population increased 5 times due to the demographic transition. This obviously led to a wave of church building, but it only started with a delay of 30-50 years, and it was amazingly small due to the religious transition. Since two adjustments with the reverse sign took place at the same time, it is difficult to sort them out, but it appears that the adjustment of the church stock to the religious transition is still going on.

In addition to the complications already mentioned, churches have a local character, so that when the geographical distribution of the population changes, the church stock needs a geographical change. When the population grows at the same time as its geographical distribution changes, it is likely that most of the adjustment can take place via the building of new churches.

5.   The path of the series: Three observations

Section 5.1 looks at the paths in the numbers and sizes of churches. Section 5.2 shows that the ratio between the two is almost linear. Section 5.3 considers the effect of the Reformation, and section 5.4 compares the path of the densities with the paths of income and population.

5.1   The paths of C_N and C_S and the three observations in the first version

Figure 4 shows the two series over the seven centuries. The two curves suggest the first version of the three observations from section 1.1:

(1a)   The two curves have an underlying positive *trends* throughout.

(2a)   A *downward shift* of about 9% occurs after 1500.

(3a)   After 1820, the church stock increases by about 26%.

The curve also show an amazing fact: The Black Death epidemic is a non-event in the data.

Figure 4. Number of churches C_N and their sizes C_S
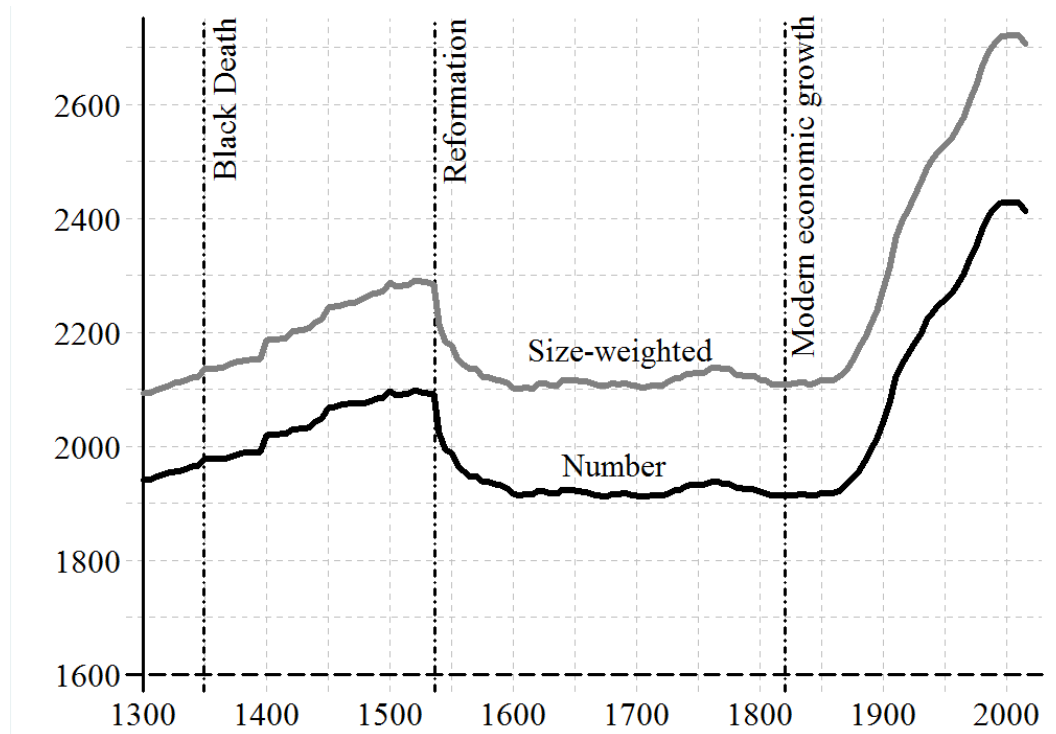
Note: The figure uses a 5-year period as given at the home page of the project, see http://www.martin.pal-dam.dk/GT-Religious.php. The 5-year data are also used for Figures 1, 5 and 6.

At present, the church overcapacity problem has led to discussions about church closures. It seems likely that the number of churches in 2050 will be smaller than in 2000, so that the two peaks will be the years 1500 and 2000, which differ by 500 years.

5.2 C_N and C_S has almost the same path

The simplest way to analyze the relation between the two series is to consider the ratio *S/N*, corresponding to column (5) in Table 5. It increases from 1.08 to 1.12, i.e., with 4% or with about 0.6 percentage point per century.

The path is depicted on Figure 5, which shows that it is close to a straight line. The same analysis has also been made for the number of seats, which are available for about half of the churches. As this analysis gave the same results, they are not presented. The size dimension thus adds about 4% only over the 700 years. When we started our quest, we had more ambitious plans for measuring the size, but it soon appeared that the marginal benefits from polishing this variable is small.

Figure 5. The ratio C_S/C_N, showing the size of the average church
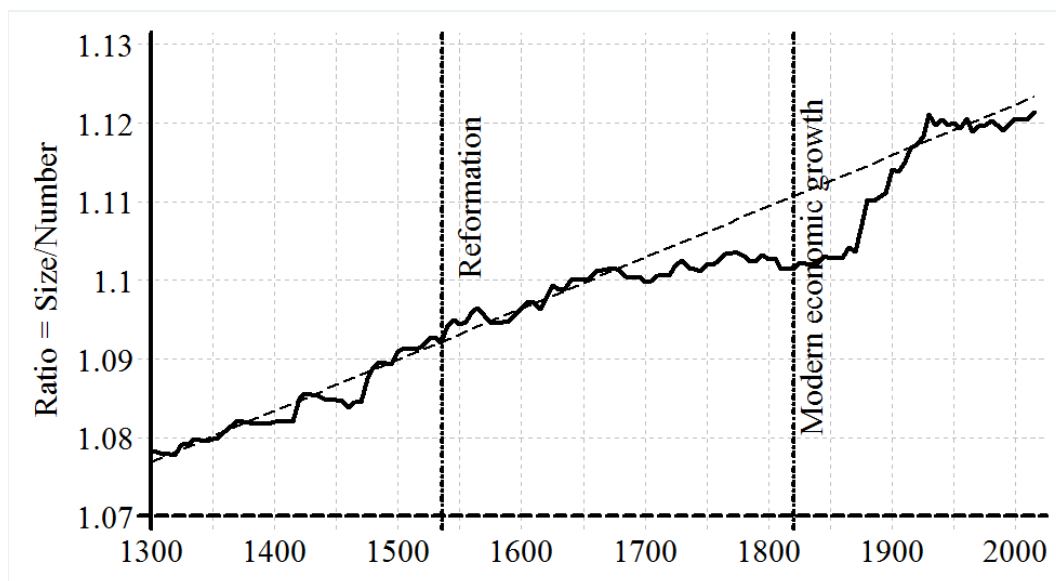
5.3   The share of Greater Copenhagen:[24] It only matters after 1850

The simple proportionality used to project the number of churches to the whole country assumes that the 64% of the country covered is representative. The pattern is rather similar in

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24. Greater Copenhagen is the sum of three old counties (pre 1970): Copenhagen town, Copenhagen county, and Frederiksborg.

most counties, but Copenhagen may be a problem, as it became the residential town of the king in 1443, and after that it gradually became the most important town in the country.

Figure 6. The share of churches in Greater Copenhagen relative to all churches in the sample
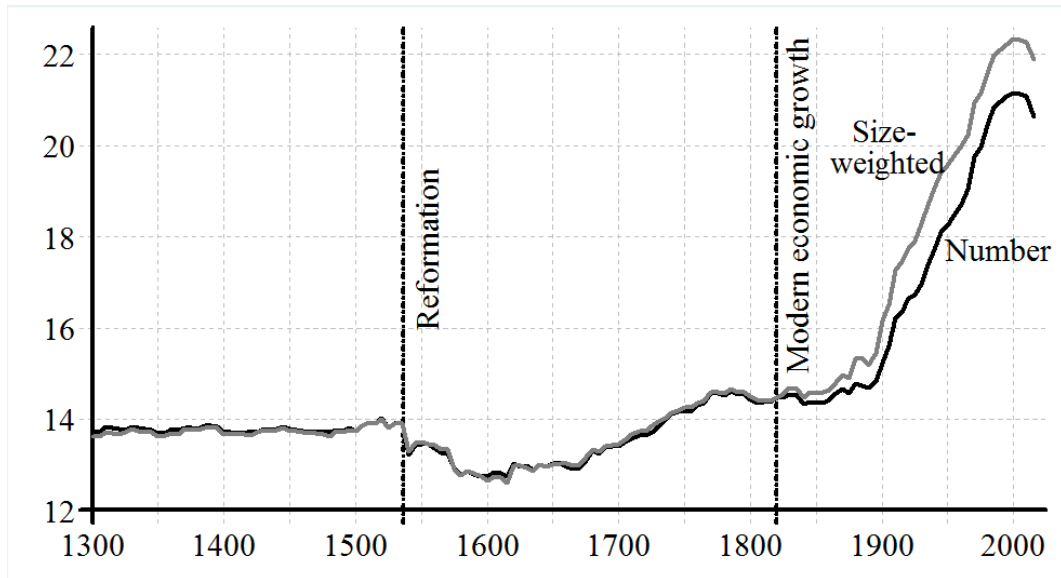

Figure 6 shows the share of churches in Copenhagen in per cent of the churches covered. From 1300 till 1900 Copenhagen had about 14% of the churches. Then it went up by seven percentage points. Thus, the projection used exaggerates a little, but only for the last century. Here, the exaggeration applies to 36% of the churches, so it is about 2%.

5.4   The downward shift after the Reformation and the invisibility of the Black Death
The data contains two downward shifts in demand: The Reformation and the Black Death.

The Reformation was amazingly fast in Denmark, as it took two to three decades only.[25] Martin Luther started his movement in 1517, and the change of religion in Denmark was officially decreed by the King in 1536 after a civil war (1634-36) involving two royal contenders and a number of other conflicts not directly relevant to the change of religion.

One of the factors in the Reformation was the increasing demand from the Catholic Church of transfer of tithe to Rome. This, combined with many stories about the way Church funds were spent in Rome, helped pave the way for the Reformation. It may explain why Luther stressed austerity in the church buildings.

If the Reformation is considered as a sudden shock that took place in 1536 Figure 4

25. See vol 7 of Danmarkshistorie (1989) and vol 3 of Socialistorie (1980).

shows the adjustment curve. It has the typical form that is fastest in the beginning, but then it levels out as the curve converges to its new level that is reached after ¾ of a century. The adjustment is about 200 churches or just 9%.

Figure 7. The population and income over the 7 centuries
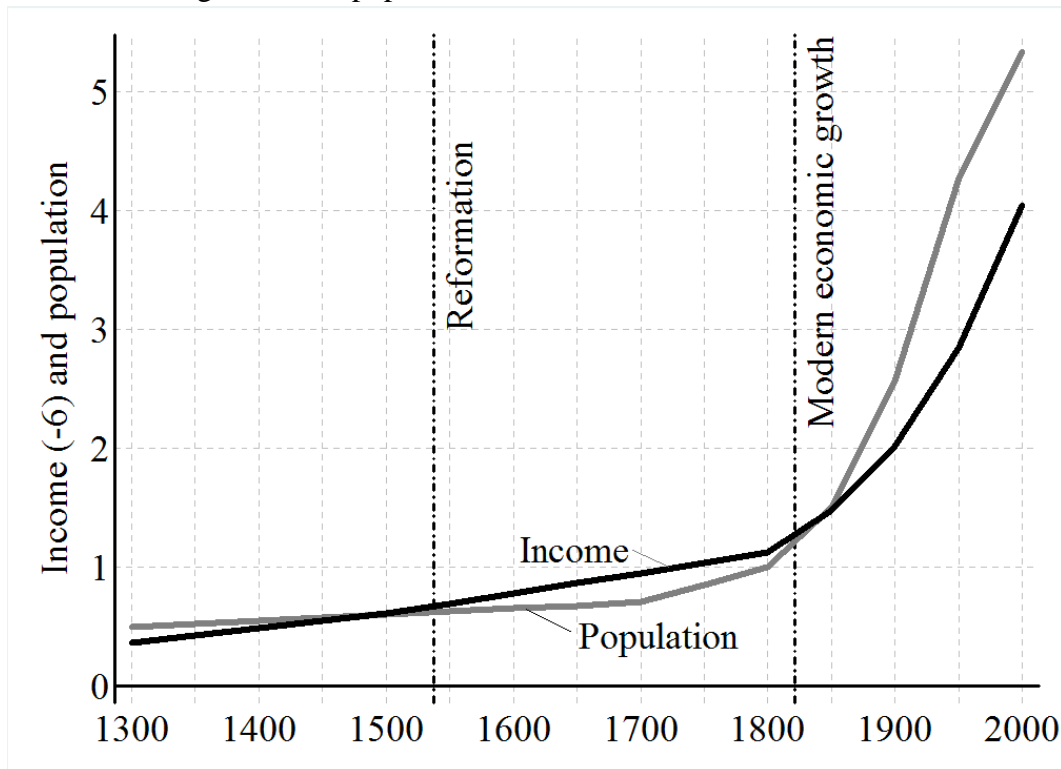
Note: Population, P, measured in millions. Income is measured as the log to gdp, To make the numbers easy to compare 6 is deducted from all income data. Note that these data are shown with a time interval of 50 years

This brings us to the Black Death mystery in the data: The epidemic started in 1349, and within 5 years it killed 25-50% of the population. It took at least 100 years for the population to return to the previous level. This whole tragedy is not reflected in the number of churches as shown on Figures 1b and 3. The DNM-project mentions a few churches that were closed after the epidemic, but the aggregate series does not point to an unusual amount of closed churches after 1350.

This must mean that people considered the Black Death epidemic as a temporary catastrophe – within the adjustment period of the church stock. Thus, there was no reason to adjust the stock. Moreover, widespread sickness and high mortality rates meant that demand for health care and funeral services went up. Consequently, the no-adjustment provides further evidence of the long-run nature of the relation between demand and the church stock.

5.5   *The paths of D_N and D_S and the three observations*

Figure 7 depicts the development of population and income, and Figure 8 shows the development of the two church densities in the same format.

The series in Figure 7 have the typical path of such series as discussed in section 4.2: For a long time, they are fairly flat which points to the traditional equilibrium, and then a well defined kink occurs and the series moves to the modern equilibrium. It is no wonder that society changed dramatically. Figure 8 looks as figure 6, but mirrored, so that when development turns up, the densities turn down. The three observations from section 5.1 thus become:

Figure 8. The two densities D_N and D_S
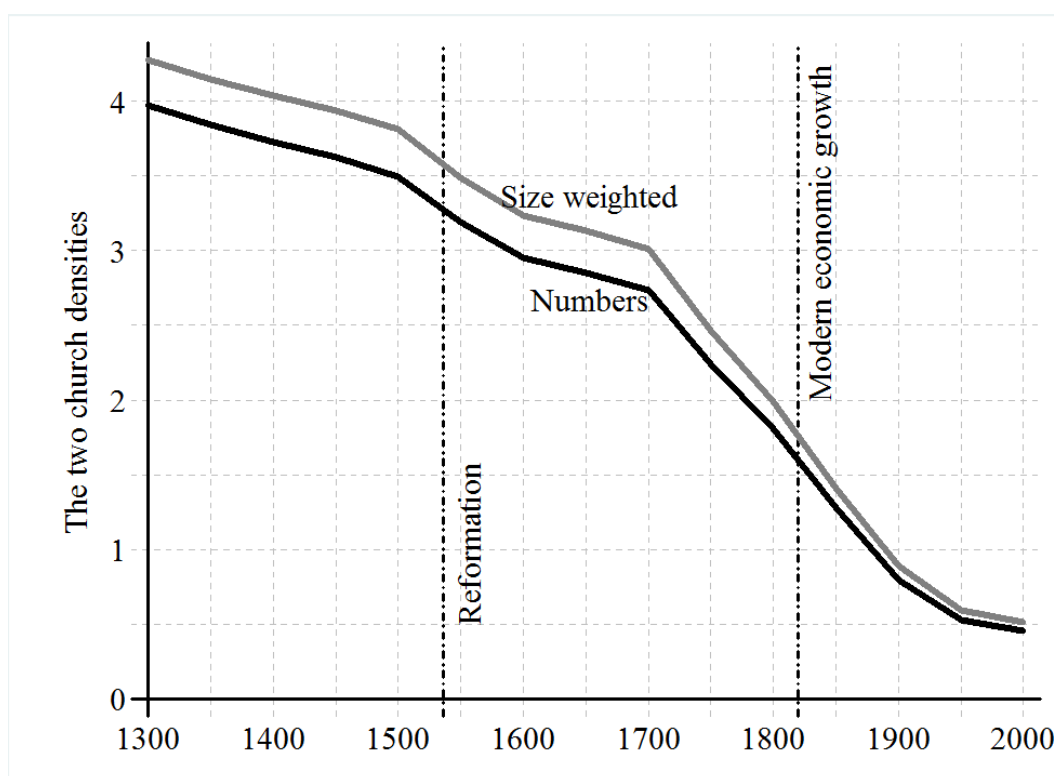
Note: This figure uses the same 50-year period as in Figure 7 and Table 6.

(1)   The densities *fall slowly* from 1300-1700.

(2)   A *small downward shift* occurs after 1500. This is due to the Reformation.

(3)   A *large fall* in densities starts in 1750. This is due to the religious transition.

6.   Interpreting the three observations (1) to (3)

The three observations from sections 5.1 and 5.5 will now be interpreted one at the time.

6.1   Interpreting (1) the slow downward trend in densities

The 500 years from 1300 to 1800 saw a gradual reduction of the forests coverage from maybe 75% to less than 10% of the land. This allowed much better roads, and also the population of horses went up. Thus, the area that could be serviced by one church increased.

Consequently, the building boom of churches from 1050 to 1200 ceased. Instead, most churches were provided with extra rooms, such as porches, offices for the priests, and large towers. The traditional Danish church has a substantial tower, advertising the presence of a church to the environments, especially as many churches were built on hilltops.

The biggest increase of population took place in the towns, and most of the (few) new churches in the 500-year period were relatively large town-churches.

6.2   Interpreting (2) the Reformation shift

The amazingly fast path of the Reformation in Denmark has already been briefly discussed. In some towns the reformation was quite dramatic,[26] but in other towns and in the countryside much continued as it used to. Also, many of the Catholic priests decided to keep their job, and continue as Protestant pastors.

Lutheran theology puts less emphasis on the trappings of the religion and more on the belief of the individual: This is likely to have reduced the demand for church room. Also, most chapels to saints were converted to 'common' church rooms and (nearly) all monasteries were closed. On the other hand, the Reformation led to a religious upheaval that must have increased religiosity, and furthermore, church services became more interesting for people as the language changed from Latin to Danish.

All said, the Reformation caused a downward shift in church densities. It amounted to a 9% reduction in the church stock.

6.3   Interpreting (3) the large fall starting in 1750

When Figures 6 and 7 are compared, they look fairly symmetrical: All 4 curves are rather flat from 1300 to 1750 after which the church densities start to fall. The increase in the economy

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26. In Ribe town, six out of eight churches were closed and torn down.

takes place a little later. But the rise in population already started after 1700. The increase in population from between 1700 and 1800 may have a causal role for the economic transition.

The strong growth of income from year 1820 leads to a further increase in the population, which went up by 5 times till year 1950. This is known as the demographic transition. With constant utilization of the churches – i.e., with constant religiosity – it should have caused a corresponding building of new churches. This has not happened, so the church densities have fallen with $F = 4$ times. The fall has occurred over two and a half centuries. It seems to be leveling out, but it has not stabilized.

Probably, some further generational effects are involved – people keep their childhood beliefs to some extent, but they do not necessarily pass them on to their children,[27] especially if they have some doubts. Thus, the fall in church densities will continue for some time before it stabilizes.

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27. The records of the Ministry of Ecclesiastical Affairs show that only about 62% of all children are baptized today.

7. The second dimension: Cross-country evidence

Transitions should be studied in two dimensions: The time-series dimension as done in this paper. The cross-country dimension is covered by Paldam and Gundlach (2013), which uses polled data. Section 7.1 discusses why the comparison makes sense and section 7.2 compares the results.

7.1 *The equivalence hypotheses and the cross-country data*

The time-series dimension compares DCs today with the same countries when they were LICs.[28] The cross-country dimension compares DCs today with LICs today. The equivalence hypothesis claims that the LICs today are close in socio-economic structure to the DCs when they were LICs, so that the two dimensions tell the same story. A lot speaks for this hypothesis, but it is surly not perfectly true.

Statistical bureaus that systematically collect and publish data about society are quite old, but for long it was a rather modest activity.[29] So few long time-series exists and they are often replete with breaks and gaps.

Religiosity is a more 'subjective' variable that is best analyzed by polls. The largest polled cross-country data set is the World Values Surveys. The first 5 waves contain a total of 240 polls that covers a total of 95 countries. Each poll consists of a large number of items posed to in average 1800 representatively chosen respondents. The polls are made in 5 (now 6) waves over 23 years. If all countries had been covered in all polls, there would be a panel of (5 *x* 95) = 475 polls, but only about half were actually done. The items cover people's opinions, values, and beliefs.

7.2 *The results: A clear transition*

Paldam and Gundlach (2013) study the religious transition on these data. 14 items are chosen to represent the importance of religion in a broad spectrum of different aspects of life. One of these items is whether people attend services regularly.

The analysis starts by calculating the fraction of the respondents at each poll who declare themselves (rather) religious for each item. This gives 14 macro numbers for

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28. The argument uses the World Bank terminology: Rich countries are termed DCs and poor countries are termed LICs.
29. Maddison (2003) gives a fine survey of the history of macroeconomic statistics. The Danish Statistical year-book was first published in 1895 as a thin pamphlet with less than 10% of the data it now contains.

religiosity for each country and wave. Income has a significantly negative correlation to all 14 individual items.

The data for each wave is then subjected to a factor analysis. The main results are: The first factor dominates, while the second factor is unstable and dubious. Higher factors are truly irrelevant. The factor loadings to the first factor are all large and positive, and the pattern is stable across waves. Consequently, it is chosen as, R_{ti}, the best general measure of religiosity, where $i = 1,…, 95$ countries, and $t = 1, …, 5$ waves. R is measured in%.

The densities used above are proxies, while R is a theory-near measure of religiosity, income loads negatively and substantially to R, and to every component series. The analysis of the R-data finds that R^T in LICs is a little above 80%, and in the DCs it is a little below 40%, so here the fall is $F = 2$.

As discussed in section 3, income is taken to be the logarithm to GDP per capita in fixed PPP prices. The income changes are measured in lps (logarithmic points). The fall per lp is the transition slope of 11 percentage points which corresponds to the range of income of 3.5 lps from the poorest LICs to the richest DCs.

The analysis in the preceding sections shows that that the change of religion in 1536 caused a (small) structural shift, but not a new trend. The data for the different country groups produce similar results. The countries in East Asia have a lower level of religiosity than other countries, but religiosity falls much the same when incomes grow. Similarly, the Muslim countries have a little higher level of religiosity, but once again the fall when incomes rise is much the same. However, income is a problematic proxy for development in oil countries.

In Denmark, R^T is 30% so the transition-fall is almost 3 times. This is fairly consistent with the fall of about 4 times found in the two densities. The difference is certainly not larger than can be explained by the conceptual difference in the measure applied in the two dimensions.

8.   Conclusion

This study brings new data for a period that extends over 700 years. These data has a much higher precision than the few other long time-series available. Moreover, the data gives an aspect of the Danish history and hopefully they will be useful for others as well.

The church density (per capita) is considered as a demand driven variable that in the longer run is a proxy for religiosity. Hereby, a proxy for the development of religiosity over 700 years has been compiled for one West European country. It is not a perfect measure, but it provides a picture of the main movement in the data. Two observations have been in focus:

First, the densities fall by 9% in connection with the Reformation. This confirms that Protestantism is less church-space intensive than Catholicism. Giving the standard interpretation of the message of Martin Luther, it is surprising that the difference is not larger. The adjustment of the church stock to the religious change took approximately ¾ of a century.

Second, from the turn of the 19th century until now, incomes grew by 3 logarithmic points corresponding to an increase in real GDP per capita of 20 times. This caused the demographic transition in which the population increased more than 5½ times. And it has caused a large fall in church densities. The church stock only increases by 26%, so the density drops 4 times. This fall is interpreted as a fall in religiosity, precisely as expected from the theory about the religious transition. Thus, the new data provides strong time-series evidence for the theory which has previously been confirmed only by cross-country evidence.

The long series are only compiled for Denmark where it has been possible for two reasons. First, Danish churches have been very sturdily built for a long time. Second, the large church-registration project of the Danish National Museum has provided reliable data for 64% of the churches.

We believe that the transition pattern found for Denmark generalizes to all West European countries and probably also to the East European countries. When traveling in Europe it is noteworthy how old most churches are. When you meet a new church, it often replaces an old church that has been damaged by fire or war.

Most observers will probably agree that the religious transition is an important part of the development of our societies. Some people still doubt that it takes place, but when all data are considered, it is amazing that anyone can be in doubt.

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30. The home page of the project is at URL: http://www.martin.paldam.dk/GT-Religious.php.
31. Maddison (1926-2010) updated his data till 2008 one month before he passed away. His project is continued by a group of economic historians.

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Sources for church data:

1	DNM-Project (at National Museum) www.danmarkskirker.natmus.dk	Detailed ongoing registration. Only systematic source on closed churches. Project started 1930 – app 32% missing.[a]
2	Sogneportalen http://sogn.dk/index.html	Official list from the Ministry of Church affairs. Cover all churches in use, addresses etc. Links to the home pages of the church.
3	Wiki-Danmark www.wikipidea.dk	Ongoing data collection project, p.t., covering about 70% of the churches. Fine and concise reporting. Also, fine coverage on Medieval Danish Monasteries [Middelalderklostre]
4	Kirsten M. Jensen's project http://www.kirkehistorie.dk	Ongoing data collection project. Cover age and seats in app 60% of the churches.
5	Poul Reitoft's project www.reitoft.dk/kirker.html	Only names of churches and year of construction, and regional classification based on the church classification.

Sources 3 to 5 are typical hobby-projects, done with great care and a strong interest in the subject. To some extent they use the DNM data as a source.

a). The DNM-project does not have a fixed format in the reports, and the many people, who have worked in the project are (nearly) all from a qualitative tradition – also the project has run for more than 80 years, which has seen a development in the reporting. Our aim has been to quantify. This has not always been easy.

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