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A Macroeconomic Perspective on the Reformation and the Downscaling of the Church in Denmark, 1500-1600

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Abstract: In 1536, the Reformation of Denmark changed the state religion from Catholic to Lutheran. The paper assesses that the Church sector in the economy peaked around year 1500, where its share of GDP was about 11%. After the Reformation, the share fell to less than half. These assessments combine the few macroeconomic facts known about the period and our knowledge about the structure of the economy today in countries at the same level of development as Denmark at that time. It is discussed how the fall in the share of the Church was accommodated and how it influenced the political structure in the country.

Keywords: Religious change, economic history, patterns of development
JEL: E02, N13, Z12

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1. Introduction

In 1536, King Christian III changed the Danish state religion from Catholic to Lutheran. A change known as the Reformation. The paper considers the change in a macroeconomic perspective and assesses the share of the Church sector in percent of GDP and the income/expenditure balance of the Church. It had monopoly until 1849, when a new democratic constitution gave religious freedom. The paper finds that the Church sector peaked at the end of the Catholic time when the share of GDP was about 11%. Today it is about 1%.

The fall has two independent parts: (1) The Reformation cut the income of the Church to about half. This caused a similar fall in the activity of the Church. (2) The *Religious Transition* (see Table 1) from about 1800 has reduced religiosity five times until now, causing a similar fall in the share of the sector. This paper tells the first part of the story, while Paldam (2021) tells the second part.[1] Hence, the paper deals with the 16th century.

Most of the macroeconomic data needed for the analysis do not exist before 1820. The analysis patches together data from three sources: (1) A new time-series for the church stock. (2) A few commonly accepted facts about Danish history,[2] and (3) some stylized facts from the patterns of development literature.

Three points should be made from the start: (i) A macro perspective is used; thus, it disregards Danish regional differences. (ii) The main data assessed are GDP-shares, which are stable in steady state, and robust to territorial changes. (iii) It is reported precisely how the calculations are done to allow the reader to reassess the results.

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[1] Paldam (2021) deals with the transition of institutions, including the religious transition. Transitions are underlying long-run changes. The period covered is fully within the traditional steady state, but the backward projections of the data must bypass the transition. Chapter 11 in Paldam (2021) on the religious transition builds on three papers: Two are with Erich Gundlach (2012, 2013), giving a formal theory and an analysis using cross-country data. One is with Ella Paldam (2017). It reports and analyzes the long data series for Danish churches.

[2] The main sources for the Danish history used are Olsen (1988, 2005) vol. 5-7, Dansk Socialhistorie vol. 2-4, Kirkens Historie both volumes, Lausten (1987), and the website Danmarkshistorien.

Table 1. Terms and abbreviations for easy reference

Variable	Content
Church	Organization of religion. Before 1536 Catholic Church. After 1536 Lutheran Church
church	Building of church, for religious services
gdp	Real gross national product per capita, historical data from Maddison Project
P	Population in million, historical data from Maddison project
LIC	Low-income country today. Close to the traditional steady state
Transition	The change from the traditional to modern society. In Denmark from ap 1750 to ap 1960

Table 2. Kings in the period

	Name	Lived	Ruled	Start	End
Catholic period before 1536					
(1)	Christian I	1426 – 1481	1448 – 1481	Appointed [a)]	Died in power
(2)	Hans	1455 – 1513	1481 – 1513	Son of (1)	Died in power
(3)	Christian II	1481 – 1559	1513 – 1523	Son of (2)	Deposed [b)]
(4)	Frederik I	1471 – 1533	1523 – 1533	Son of (1)	Died in power
	Interregnum, three contenders		1533 – 1534	Civil war	Victory of (5)
Protestant (Lutheran) period after 1536					
(5)	Christian III	1503 – 1559	1534 – 1559	Son of (4)	Died in power
(6)	Frederik II	1534 – 1588	1559 – 1588	Son of (5)	Died in power
(7)	Christian IV	1577 – 1648	1588 – 1648	Son of (6)	Died in power

a) Appointed after a search among distant family. b) The deposition was violent, and the ex-king fled and traveled Europe trying in vain to find money to finance an army to reconquer power. He was jailed from 1532 until he died in 1559. Even when he was in jail, he was a 'shadow' contender in the civil war, in the sense that one contender (from more distant royal family) claimed to fight for him.

Table 2 is meant for readers who are not familiar with Danish history of the 16th century. The three contenders in the civil war were all from the royal family.

Section 2 is an introduction to the pattern of development literature, reporting the stylized facts used in the next sections. Section 3 deals with the Catholic period around 1500, while section 4 deals with the Lutheran period around 1600. Finally, section 5 concludes.

2. The patterns of development literature

A large literature going back to Simon Kuznets (1901-1985) and Hollis B. Chenery (1918-1994) analyzes the pattern of economic development. This section reports a handful of standard results. Section 2.1 explains how the results were estimated. Section 2.2 looks at the transition of agriculture, while Section 2.3 presents the stylized facts about agriculture and labor. Section 2.4 considers the implications for institutions and beliefs.

2.1 The transition pattern allowing backward projections

The equivalence hypothesis says that the patterns in long time-series and wide cross-country data are the same. Many studies have found that it is a good – but not perfect – approximation.

The theory of growth and development is built around the equilibrium concept of the steady state. The key property of the steady state needed for the argument below is that the sectoral shares are stable. The traditional and the modern steady state are the basic ones. Transitions diverge from the stable traditional level, and much later they converge to the modern level. The period covered by the paper is fully within the traditional steady state, but the backward projections of the data must bypass the transition, and most data start after the transition begun.[3] Here the data for the LICs today help. It means that the structure in the economy in Denmark 500 years ago is similar to, e.g., Tanzania today.[4]

National accounting started between the two world wars. Economic

[3] Paldam (2021) deals with the transition and the stylized facts of the two steady states.

[4] Obviously, equivalence does not hold strictly, but it is often possible to adjust. Tanzania today uses trucks and busses, while in Denmark 500 years ago people used horses, bullocks, and ships. Obviously, this was less efficient.

historians have compiled national accounts for a dozen countries back to the Napoleonic Wars. Today, all countries report national accounts. If the backward projection for the time-series and of the cross-country pattern give roughly the same result, we have a solid stylized fact; see section 2.2 on the share of agriculture. The Appendix shows the robustness of backward projections.

The *traditional steady state* had an almost stable technology, giving a low and almost constant production and population.[5] The Appendix below shows how the Maddison Project estimates the macro-data for this period. The slow progress of technology gave an almost constant *gdp*-level, with average growth below 0.2% per year, or 10-20% per century, including the 16th century. This gave minor changes in the structure of the economy only.

The *population, P,* had a similarly low growth rate. The long-run growth of *pop* is the difference between high fertility and mortality rates – both were probably about 2%. This implies a Malthusian mechanism (see Galor 2011), allowing a reasonably fast recuperation of the population after a catastrophe such as the Black Death epidemic. It is labor intensive to bring land under cultivation. Thus, mass death due to an epidemic or war increases the per capita cultivated land and thus production, which decreases mortality temporarily. The population fell about 25% due to the Black Death in the 1350s. Thus, it had to increase 1/0.75 = 1.33 times to catch up. If the loss of people increased population growth by 0.5 percentage points, it took 58 years to bring the population back to the pre-epidemic level. During the 16th century, the effects of the epidemic were small.

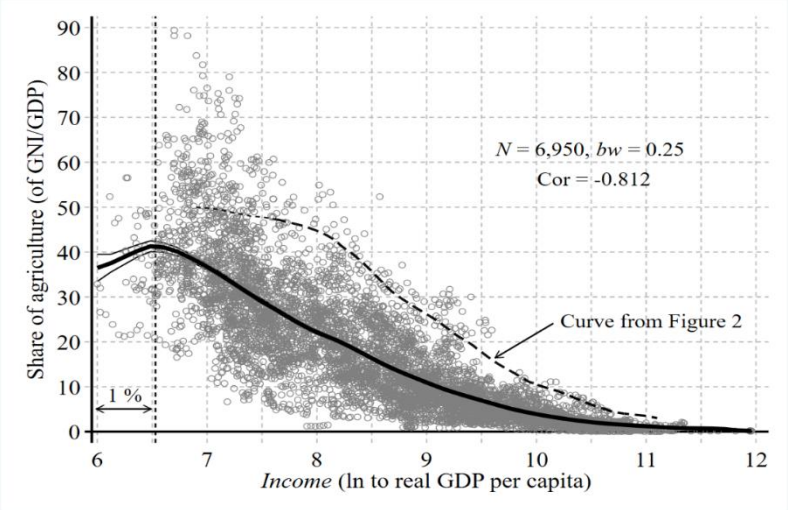
2.2 A backward projection of the share of agriculture

Figure 1 shows 6,950 observations for the share of agriculture from the World Bank, combined with income from the Maddison Project (MPD 2020). The data are from 1960-2018. The lowest 1% of the observations

[5] The *modern steady state* has a high and dynamic technology, giving a much higher production and growth. Modern technology is international, so countries converge to the same standard of living, and so do sector productivities within the countries. However, with growth some changes continue. The *Grand Transition* is the change from the traditional to the modern steady state. It affects everything in society, including religiosity.

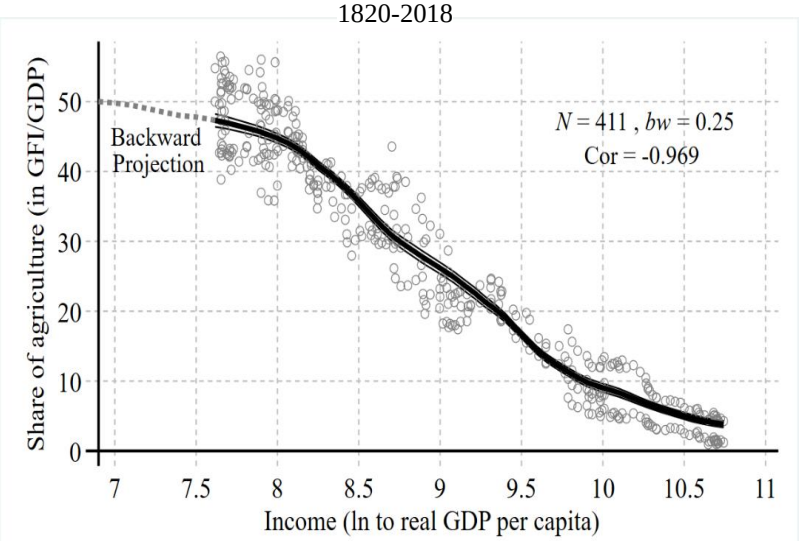
give an unclear picture, but before the curve bends, they support the notion that the traditional share of agriculture is about 45% ± 5%.

Figure 1. The share of agriculture explained by income. 166 countries, 1960-2018



The share of agriculture is 'agriculture, forestry, and fishing, value added (% of GDP)' from the World Bank's WDI. Income is ln(*gdp*) from the Maddison Project. The data are from 1960 to 2018. Only 1% of the data support the curve where it has a positive slope at the start. Here most observations are from African countries under civil war, which makes agriculture difficult. The bold curve is a kernel regression with 95% confidence intervals. The estimate uses the Epanechnikov kernel and bandwidth 0.25. The dashed curve from Figure 2 uses a different definition for the agricultural sector, so it is not fully comparable.

Figure 2. The share of agriculture explained by income. Denmark, 1820-2018



The data in Figure 2 are from Hansen (1972, 1974) – the same data as used by Maddison for the series for Denmark. It is supplemented with data from Statistics Denmark. Two series are used: 'production in agriculture' and 'gross factor income in agriculture and other primary sectors. The shares are reached by division with 'gross factor income', from the same sources. Note that the production data are higher, especially at the high-income end.

In Figure 1, the data points scatter as they include desert countries and city states on the one side, and countries which are the agricultural hinterland to larger neighbors on the other side. Denmark is a net exporter of agricultural products, while many others are net importers, but the average (kernel regression) is well determined. The 95% confidence intervals are so narrow that they are only visible for low incomes where the curve is supported by few observations.

Figure 2 shows the share of agriculture for Denmark from 1820 to 1975 over the same income data. The time-series data show that the Danish share on Figure 2 is higher than the general one from Figure 1 – by about five percentage points, as it should be expected for an agricultural exporter. It also appears likely that the Danish curve is diverging from the steady state level at about 50% at the start in the traditional steady state. Figures 1 and 2 show that the share of agriculture in 1500-1600 in Denmark was 50% $\pm$ 5% of total economic activity. This is probably not controversial, and hence it is a solid foundation for the analysis.

2.3 The shares of the Church in the labor force and in the GDP

Another number we will apply is the net share of income accruing to the landowners when farming is tenured. Danish tenure contracts changed over time and differed regionally. In a comparative perspective, the typical contract allocated about 40% of the product to the landowner; see Binswanger et al. (1995). In addition, farmers were expected to pay 10% in tithe to the Church, as discussed in section 3.1. Farmers were surely heavily "taxed".

The payment to the landowner was the result of a legal contract, but landowners always found it difficult to extract the full amount due. Through the centuries, farmers have learned to shirk when reporting. In addition, landowners provided some services to the farmers, and there were monitoring and administrative costs. Thus, the net extraction – *the feudal rents* – was probably 'only' 30% of the agricultural production, or

15% of GDP. These numbers also cover the land owned by the King and the Church, which was substantial before the Reformation.

Table 3. The share of the Church in population and GDP, year about 1500

Variable, with subscript C for Church		Church share of population		Assessed
C	Church staff	(1)	$E = pP$	½P
E	Employment, E_C for Church	(2)	$E_C = C/pP$	0.033 Table 4
P	Population	Church share of GDP		
P	Participation ratio	(3)	$f = W/Y$	0.7
f	Factor wage share, f_C for Church	(4)	$f_C = qE_C$	0.05 Section 3
q	Relative wage of Church staff	Residual income of Church 0.06 divided into:		
Y	GDP	Building, education health expenditures		0.03 Section 3
W	Wage sum including imputed	Transfers to the poor and Rome		0.03 Section 3

The income of the Church is also assessed to 0.11 as a share of GDP in section 3. In the 16th century, unemployment was hidden in work with a very low productivity.

In the period considered, the population pyramid did look like a pyramid. Due to the high fertility and mortality, there were many children and few old people. The typical participation rate on the labor market was about 50%, which included self-employed and their spouses. Table 3 covers the mechanics of the calculations used below. It also gives a preview of the results.

2.4 The stability of beliefs and institutions: King, Church, and feudal nobility

The concept of the steady state extends to institutions as well (see Paldam 2021). Many writers have noted that the range of traditional political systems is quite narrow. A well-known first approximation is the *Three Pillars Model*, where the pillars are the hereditary King, the feudal

nobility, and the Church, which was a major landowner before the Reformation.

The kingdom was very stable – since year 800 the Danish kings have been from the same family (broadly defined). However, the power of the King has kept changing. The Reformation caused a large shift of land ownership – and power – from the Church to the King.

Feudal systems were also very stable. (See the major study of traditional agricultural land ownership systems by Binswanger et al. (1995).) In the century after the Reformation, ownership of the old Church land passed from the King to the nobility, consolidating feudalism.

Few countries have had more than one change of religion per millennium. When Denmark changed denomination from Catholic to Lutheran in 1536, it was the first time since the 960s, where Christianity spread and became the national religion.[6]

Coalition theory predicts that coalitions between three parties, where either two can dominate the third, are rather unstable. This was indeed the case – occasionally a (mostly unpredictable) *triggering event* happened to cause an unruly period where the alliance between the three major players shifted. The change of religion was a large triggering event that came from abroad and spread rapidly from below, in the sense that those who imported the new beliefs were farmers, traders and low-level clergy. After only fifteen tumultuous years, the King legalized the change of religion. In the process, his power increased, and the Church became weaker. Seventy-five years later, the Thirty Years' War made the feudal structure much stronger (see section 4.4). Thus, the analysis deals with a key part in a major upheaval leading to two larger shifts in land ownership that caused major shifts in the power structure.[7]

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[6] King Harald Bluetooth {Blåtand} confirmed/legalized the change of religion and made Christianity the national religion in 966. Little is known about the beliefs of the common man at that time.

[7] Land ownership was a crucial instrument of power, as wars were mainly fought with mercenaries, and land was the main collateral for loans paying such soldiers. In addition, tenant farmers had to supply soldiers in times of war. Thus, big landowners could make credible threats.

3. The size of the Church at the end of the Catholic period around 1500

Section 2.3 looked at the production of the Church. Section 3.1 considers its income side, and section 3.2 looks at the expenditure side and the non-religious services the Church provided. Section 3.3 summarizes the wealth and power of the Church and the resentment it created.

3.1 Income of the Church: From production and taxes

The income from production came from three sources:

(1) Land-rent: Most historical sources show that the Church had become a main landowner in the last century before the Reformation, as various entities of the Church owned 30-40% of the land.[8] The largest group of owners was the bishops.

Assuming that the land of the Church was of average fertility, the rule of thumb in Table 3 means that the agricultural production of the Church-owned land was 0.35·50% = 18% of GDP. The net land-rents received by the Church were 0.3·18% = 5.5% of GDP. Perhaps this is to the high side, but probably by less than 1 pp (percentage point).

(2) The Church also sold candles, medical herbs, letters of indulgence, and a few other items. It is unlikely that this amounted to even 1% of GDP. It means that it is safe to set the estimate of the total production income of the Church to 6% of GDP.

(3) The Church also received user fees from its schools and hospitals, but as argued below these fees must have been rather small.

The main tax of the Church was the tithe levied on agriculture (and fishing). The history of this 'tax' in Denmark is surveyed in Dahlerup (1982). It appears that the tithe was based on production, which is easier to measure than income. If all tithes were paid, it should give the Church a

[8] Both the Church and the king behaved much like other landowners toward their tenant farmers.

tax income of about 0.1·50% = 5% of GDP. The rule was that the tithe was divided in three equal parts: The *church-part* was given to building and maintenance of the churches, the *parish-part* was to cover the salaries of the local church staff, and the *bishop-part* was to finance the top hierarchy of the Church and the tax to Rome. However, the story of the *Peter's pence* is a complex one.

The way the tax was calculated changed frequently, as it was always problematic to collect as much as the Church thought it should receive. The tax was collected locally, and it was a perennial problem to collect the bishop-part. This seems to have been a typical flypaper effect: The local branch of the Church kept most of what they should, and let the higher levels be the residual claimant. Imagine that only 70% was collected net of shirking and administrative costs. Thus, the tithe amounted to a little more than 3.5% of GDP.

The Church also tried to collect money from the rest of the population, and surely got something, notably in the form of inheritance and other gifts. Here little evidence exists, but something was collected, especially by the monasteries. It must have been less than what was collected from agriculture. Thus, the tax-income of the Church was a bit below 5% of GDP.

This gives total incomes of about 6% in taxes plus about 5% in land rent adding to 11±1%, which is my assessment of the size of the Church in the economy. Thus, the Church ran an important sector in the economy.

3.2 Expenditure of the Church: Financing the Church and the three big collective goods

In 1500, there were a total of 2,100 (±20) churches and 100 (±5) monasteries in Denmark.[9] Already at that time, few new churches were built, but one third of the tithe was reserved for the buildings (i.e., about 2-3% of GDP). It covered the costs of maintenance and repair, and a modest building program, which did, however, include the completion of some cathedrals.

[9] The churchdata is from Paldam and Paldam (2017), while the monastery-data is from Kristensen (2013). From about the year 1100, churches were very sturdy buildings of stones and bricks. About 1,600 medieval churches have survived to this day.

Table 4. An assessment of the Church staff in the years 1500 and 1600

	(1)	(2)
Year	1500	1600
Churches	2,100	1,915
Staff per church	4	3
Monasteries	100	0
Staff per monastery	15	0
Staff in total [a)]	10,000	6,000
Population	600,000	650,000
Labor force (50%)	300,000	325,000
Fraction Church staff	3.3%	1.8%

(a). Half the Church staff was probably illiterate lay workers. Section 3.2 discusses column (1), while section 4.3 discusses column (2).

Most of the 2,100 village churches had a conventional format, so they were rather similar. Town churches differed more, and so did the number of staff. I assess that the average staff was a bit above 4 per church, which includes manual workers and the top hierarchy associated with the cathedrals. It gives a total number of 8,400. In addition, there is the staff in the monasteries. They had a skew size distribution, but if the size of the staff in the average monastery were fifteen, that gave a further 1,500 Church staff. Thus, the total Church staff was around 10,000, as given in Table 4.

The population in 1500 was app 600,000, according to Maddison, and with a participation rate of 50%, the labor force was 300,000. Hence, the Church employed 3.3% of the labor force. If the Church staff received the average income, this would give a GDP share of 0.7 *x* 3.3% = 2.3% of GDP.

The priests and monks were committed to a life in austerity, but it is well known that many found it difficult to follow that commitment. Most of the top hierarchy in the Church belonged to the nobility and had networks connecting them to other leading members of the society. This also meant that they were accustomed to a certain lifestyle. In addition, most bishops lived in large residences, looking like the ones of their noble

families. Thus, bishops did live in some luxury, and this luxury had an impact somewhat down the line.

Assume that the Church staff managed to have salaries of, e.g., 1.5 times the average wage, it yields a sum of 3.5% of GDP. Adding the capital wage of 2%, this gives about 5.5% of GDP. Rome probably managed to extract 0.5%, so the total church expenditures were about 6%. This left 5% to other expenditures.

The *Big Three* collective goods are (i) education, (ii) healthcare and (iii) social protection. In the period discussed, they were provided by the Church. It had about 5% of GDP to spend on the *Big Three*. A guess is that the 5% were allocated as 1.5% to education, 1.5% to health, and 2% to alms to the poor. These numbers are about one third of the numbers for LICs today. As regards (i) education and (ii) health, two adjustments are required: Most of the work was done by staff that is already accounted for, and people paid user costs for schools and hospitals, if they could. However, it is still clear that the total costs of either of these services must have been rather moderate.

Various estimates suggested that literacy rates were low, such as 5%, which included the clerical Church staff and the nobility. As few diseases could be cured, the costs of the hospitals must have been low indeed. A survey of the history of medicine and the modest size of the profession until last century is found in Porter (1997).

3.3 A rich and powerful Church sliding into rent seeking

Thus, the Church controlled about 11% of GDP, and the staff of the Church was around 3.3% of the labor force. So obviously the Church was a wealthy organization. It showed its wealth in the building of churches, including the 10 Danish cathedrals of which most were completed around year 1500, and, as mentioned, the top clergy tended to live with some luxury.

This period saw the Late Renaissance in Rome. The Church spent lavishly on buildings, art and other trappings of power and wealth. The top clergy in Rome did behave much more as rich nobility and not as heads of a Church that preached moral restraint and modest living. Some of the devices used to extract funds, such as the sale of letters of indulgence, were seen as excessive, and in no way supported by the Bible. It was a period of moral decay of the Church. Rumors certainly reached Denmark and created some resentment, and it was a main theme in the propaganda

of the reform movement started by Martin Luther in 1517, which soon became a new denomination. On the other hand, the Counter Reformation that started with Pope Paul III (1534-1549) and the Council of Trent (1545–1563) did not affect Denmark.

4. The size of the Church after the reformation 1550-1650

Section 4.1 gives some facts about the reformation. Section 4.2 considers the path of the church stock. Section 4.3 looks at the loss of income for the Church.

4.1 The Reformation: Fighting the rents

In the years 1517-1536, the Lutheran movement spread rapidly in Denmark, and in 1533 no King could be appointed. From 1534 to 1536, this led to a civil war (the last one in Denmark) between three royal contenders, where two supported one denomination each, and the third headed a changing coalition with parts from both denominations. The Hansa League (notably Lübeck) and Sweden were involved, and several peasant uprisings added to the strife.[10] The Reformation started from below in Denmark. Soon it was taken over by the nobility and by one of the royal contenders, who became King. With all the complex and dramatic events, it is not at all clear that most of the population felt that they had changed religion. However, after the war, the victorious Lutheran side enacted a set of decrees to root out the Catholic Church:

(i) Most of the top Catholic clergy was jailed, as they had supported the losing side in the civil war.[11] All communication between the Church and *Rome* was forbidden.

(ii) The parish priests were given three choices: jail, exile, or to convert to Lutheranism and continue in their old job. The vast majority took the third option.

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[10] The great mass of (tenant) farmers normally played a small role in the politics of the country, but during the war they emerged as a factor, as several peasant armies appeared. However, they did not manage to form a lasting coalition with any other player, and the royal mercenary army defeated and massacred the peasant armies.

[11] A few years later when the Reformation was consolidated, they were set free, often on the condition that they married. The leniency may have been because the bishops belonged to the nobility.

(iii) All churches were converted to Lutheran, and chapels to saints were closed.

(iv) All monasteries were closed. In towns, the churches were converted to Lutheran parish churches. Monasteries in thinly populated parts of the country were used as stone quarries or converted to manor houses. Hospitals, schools, and poor houses often continued as lay institutions, financed by the King.

(v) To finance these activities, the King took over the 'bishop-part' of the tithe. This was, in principle, one-third of the tithe, and the part had proven most difficult to extract.

(vi) The King confiscated the Church land, making him the largest landholder in the country. The bishops' land was quickly confiscated, the rest more gradually.

In addition, the Catholic university of Copenhagen was closed for six years and reopened, after a reform, under the direction, which lasted two years, of a close associate of Luther. Its role focused on the education of Lutheran priests. The state took over the nine cathedral schools and renamed them Latin schools. Other schools were run as private business organized by the teachers. There were perhaps 50–100 such schools. (See Appel and Fink-Jensen (2013).).

4.2 The church stock: 1400–1700[12]

Figures 3 and 4 show the number of churches for every fifth year for the period under consideration, and how these numbers changed. Figure 3 includes an index for the sizes of churches.[13] The figures show:

(1) The stock of churches was steadily growing before the Reformation, at least from 1300, where the stock was 1,940. It rose to 2,100 in 1520, which is by 0.75 churches per year. This increase was almost linear.

(2) The Reformation gave a clean break with this growth, and even caused a decrease of 9%. This is the only significant reduction during the

[12] The analysis extends further than the 16th century to show the two trends, so that is becomes clear that the Reformation gives a clear kink in the development of the church stock.

[13] The data compiled cover the church room itself. Village churches rarely changed the church room, though towers and other auxiliary buildings were added. The churches built after 1450 were larger town churches.

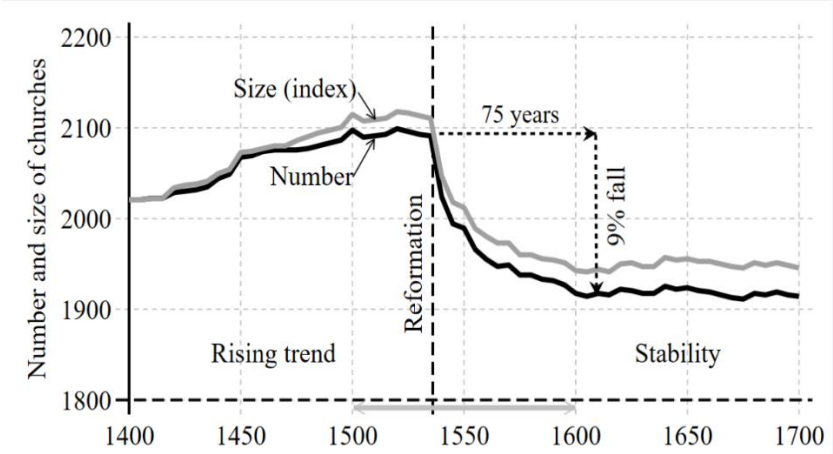
715 years where the data are available.

(3) The decrease took about 75 years to complete. If the fall is understood as an adjustment to a new level, it is substantial in the beginning and then tapers off gradually to the new level, as expected from the capital adjustment model.

(4) From about 1610, the church stock was constant until about 1860. As seen from Figure 3, the number of churches closed and built was small and did not differ very much.

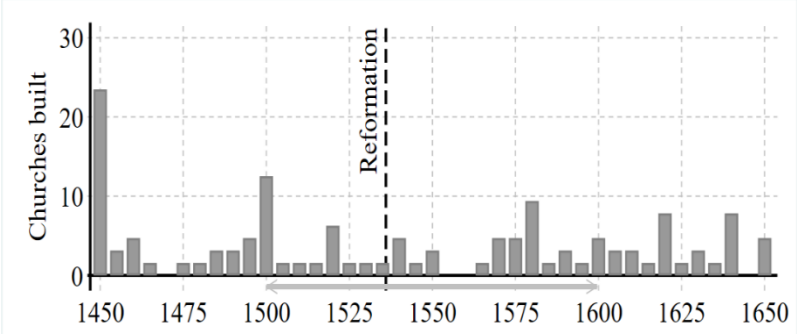
(5) The correction for the size of churches is assessed by normalizing the size weighted stock to be the same as the unweighted stock in 1400. Thus, the gap between the two curves on Figure 3 shows that the relative movement in church size is small.

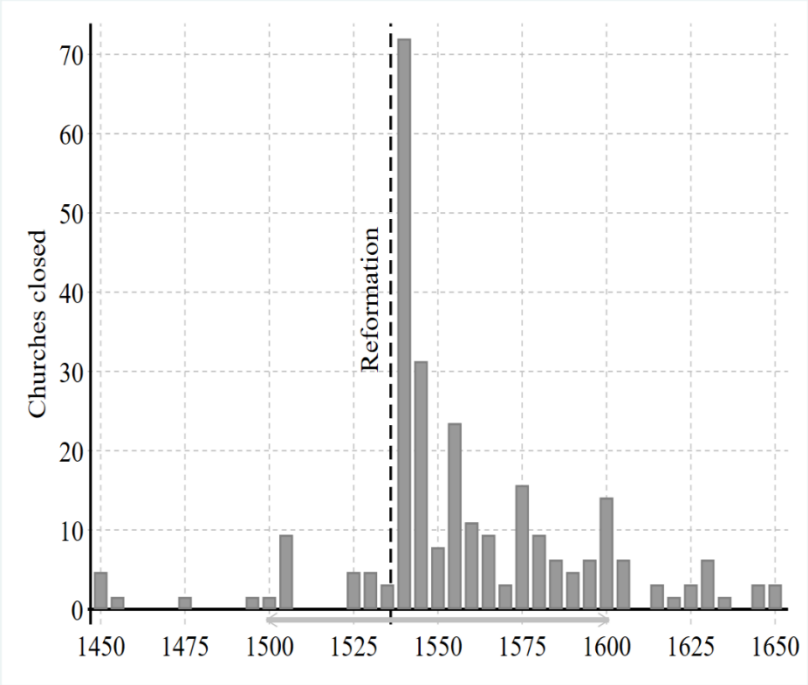
Figure 3. The church stock, 1400 to 1700



Source (also to Figure 4): Paldam and Paldam (2017). The size index is done by church types as explained in the source. Village churches were made in a rather fixed format, and the main room rarely changed.

Figure 4. The changes in the church stock 1450-1650





4.3 Lost and retained income of the Church

The loss of the income from the Church lands was 4% of GDP, or 40% of the incomes of the Church. When the King took over the bishops' third of the tithe, this was a further loss. The additional loss was probably about 2% of GDP. Thus, it appears that the income of the Church fell from about 11% of GDP to 5%. Consequently, the Church had to be downsized. Fortunately, Luther stressed that personal belief was much more important than the worldly trappings and power of the Church. This argued for a large reduction in the expenditures of the Church. Notably, Luther argued against saints that acted as middlemen between the individual and God. This theology also caused a downsizing of the Church.

Part of the reduction was automatic: The monasteries and chapels to saints were closed, the top clergy was sacked, and the subsidies for *Rome* ceased. It appears that these reductions were smaller than the decrease in incomes. The Church was further downsized by the 9% reduction in the stock of churches. Also, the staff per church must have been reduced.

Thus, there are two straightforward explanations for the downsizing of

the Church after the reformation: (i) The loss of funds, and (ii) the change in theology from the church intensive Catholic beliefs to the less church intensive Lutheran beliefs. By abolishing the saints, the number of services needed was sharply reduced.

It is difficult to know what weight to put on the two explanations, and it is possible that the Lutheran Church made a virtue out of financial necessity, stressing that it was the belief of the individual that counted and that one church service per week was enough. Table 4 (section 3.2 above) assessed the size of the Church staff. Column (1) contains the numbers from section 3.3. Column (2) assumes that the number of services is smaller than it used to be, and that schools and hospitals employed more lay people.

With the reduction in churches and in Church staff, which was particularly strong in the top hierarchy, it was probably possible to reduce the costs of Church staff to 2.5% of GDP, and by a reduction in church building, it might have been possible to reduce the Church expenditures to 5% of GDP, leaving a smaller sum for alms. Thus, Table 4 suggested how the decrease in Church incomes could have been accommodated.

4.4 Some further developments[14]

The story until now contains a big downsizing of the Church, greatly reducing its economic power, and entailing a corresponding increase in the economic power of the King. Two additional economic factors came into play, both related to war financing.

The first reformed king, Christian III, had to finance the costs of the civil war that on the winner's side was largely fought with expensive mercenaries. With the great increase in the king's income from the former Church lands, the financial consolidation was probably accomplished within his time in power. Once the finances of the King were consolidated, the extra incomes of the King allowed him to undertake great projects.

The King who excelled in such endeavors was Christian IV. His many expensive buildings are still national treasure. However, he did also

[14] This section exceeds the 16th century, but only as regards the direct consequences of the Reformation. The Thirty Years' War started as a war between the two denominations, and the Danish and Swedish kings did join the war as defenders of the Lutheran faith.

participate in the Thirty Years' War 1618-48, with disastrous results.[15] This caused a big decline in the royal assets, so the King lost most of the land acquired from the Church at the Reformation. The winners were the nobility, making Denmark an unusually feudal country. Nearly all European countries had Feudalism around year 1600. It appears that the fraction of the land under freeholders was unusually low in Denmark. Hansen (1972) found that in 1700 only 1,700 of 60,000 farmers owned their land.

In Catholic time, the Church owned most churches. It had adequate funds to maintain the existing churches and to build new ones at a slow, but steady pace. After the big reduction in the income of the Church due to the Reformation and the later reduction in the incomes of the king, the ownership of most churches and hereby the church-part of the tithe went to the landowners. In practice, most churches became private property.

The income from owning a church barely covered the costs, and the churches often occupied well-situated land, which represented considerable opportunity costs. Thus, a private owner had a clear interest in closing 'superfluous' churches. A Royal permit was necessary to close a church, but the fact that most church owners were members of the aristocracy helped with the bureaucracy. A total of 520 churches were closed between 1300 and 2015. Of these, 180 were due to the Reformation, and about 300 were closed in the period where the churches were private property. However, in this period a similar number of new churches were built.

5. Conclusion

The vastly simplified *Three Pillars Model* sees the hereditary King, the feudal nobility, and the Church as the main players of traditional society. In this model, the Reformation was a successful power grab by the first two players for the resources of the third one.[16] The *triggering event* that

[15] The lost war left the royal finances in a bad state. The nobility obtained land from the crown in two ways: Some crownland was bought, while other was obtained as forfeit collateral for non-performing royal loans. In addition, some foreign moneylenders became Danish landowners, and after some time they joined the nobility. But there was the Torstenson-Hannibal war of 1643-45 which was very costly to the Danes…losing a large piece of land to the Swedes.

[16] Paldam (2021, 2023) uses the three pillars model to explain the democratic

allowed the grab was the religious turmoil that came from abroad and spread rapidly from the lower ranks. This led to a complex process of conflicts that lasted fifteen turbulent years.

The outcome of the process was a reduction of the share of the Church in the GDP to less than half. This turned the Church from being a large sector in the economy to becoming a moderately sized one. In addition, the large decrease in the top hierarchy of the Church reduced the links between the nobility and the Church, and the network at the top of the society came to include much fewer Church dignitaries.

The severance of the link to the Pope and his administration removed the possibility of the Church for calling for outside help when disagreements occurred between the Church and the state (i.e., the King). Thus, both the economic and political balance between the Church and the State shifted to the advantage of the latter.

The Church became much weaker in the national distribution of power. Furthermore, the closing of the monasteries started the secularization of education and healthcare. Just after the Reformation, the professional staff in schools and hospitals was the same as before, as there was nobody else. Thus, the secularization of these sectors took time, but it did happen.

Appendix: Data for gdp and pop 1500 and 1600

The *gdp* is the GDP per capita in fixed PPP-prices, while *pop* is the population in millions. Table A1 shows *gdp* and *pop* data from the MPD 2020 version of the Maddison project, which updates Maddison's original data. [17] The data reported are for the years 1000, 1500, 1600 and in 1820, for the countries where national accounts exist. Maddison claimed that the growth rate was zero the first millennium, and 0.14% on average over the 820 years from 1000 to 1820. Note that the gdp numbers in italics are not updated in MPD 2020. Here the last data given are used after a change of

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transition in the last two centuries. The agricultural transition (from Figures 1 and 2) undermined the feudal pillar, and the religious transition undermined the Church. A well-educated middle class in the towns replaced the two old sectors. This led to democracy. The process consists of spells of stability and jumps caused by exogenous triggering events.

[17] Maddison (1926-2010) updated his data until 2010 one month before he passed away. A group of economic historians has continued his project.

the price index to give the $2011 prices.[18]

Table A1. Some assessments of historic *gdp* and *pop* from the Maddison project

Year	1000	[*g*% pa]	1500	[*g*% pa]	1600	[*g*% pa]	1820
Part A. Gross domestic product per capita in 2011 international Geary-Khamis $							
Denmark	*1,000*	[0.11]	*1,700*	[0.16]	*2,000*	[0.02]	2,104
France	*1,100*	[0.09]	1,694	[-0.05]	1,610	[0.05]	1,809
Italy	*1,200*	[0.16]	2,703	[-0.12]	2,404	[0.05]	2,665
Netherlands	*1,100*	[0.15]	2,332	[0.61]	4,270	[-0.16]	3,006
China	1,225	[0.00]	1,207	[0.01]	1,217	[-0.15]	882
India	*1,200*	[0.03]	1,400	[-0.11]	1,254	[-0.13]	937
Part B. Population in thousands, *pop*							
Denmark	360	[0.10]	600	[0.08]	650	[0.26]	1,155
France	6,500	[0.17]	15,000	[0.21]	18,500	[0.24]	31,250
Italy	5,000	[0.15]	10,500	[0.22]	13,100	[0.20]	20,176
Netherlands	300	[0.23]	950	[0.46]	1,500	[0.20]	2,333
China	59,000	[0.11]	103,000	[0.44]	160,000	[0.40]	381,000
India	75,000	[0.08]	110,000	[0.21]	135,000	[0.20]	209,000

The annual growth rates, *g*, in the []-brackets are calculated for the years to either side. The data are in constant $2011. The gdp numbers in italics are projected (to $2011 prices) from the last time they were updated.

Consider x_t and x_{t+N} for a variable, such as the *gdp* or *pop*, in the two years t and $t+N$. The average annual growth rate, g, follows from the mathematics of compound interest rates:

$$(1)\ x_{t+N} = (1 + g)^N x_t, \text{ so that } g = (x_{t+N}/x_t)^{1/N} - 1$$

[18] The source for the data is Maddison (2003) and the Maddison project (since 2012). The data reported are from the MPD 2020 version that covers 169 countries to 2018. The *gdp* is measured in fixed PPP-prices, which is 2011 international $. Note the small differences between the *gdp* levels in the countries listed at the start. Even in 1820, Denmark had only twice the *gdp* of China.

Table A2. Illustrating the robustness of long-run growth rates

From year 1000 to 2010			From year 1000 to 1820		
gdp_{2010}	gdp_{1000}	g	gdp_{1820}	gdp_{1000}	g
42,932	500	0.44	**2,104**	500	0.18
42,932	1000	0.37	**2,104**	1000	0.09
42,932	1500	0.33	**2,104**	2000	0.04

Note: The bolded estimates are the ones of the Maddison Project. They are in constant $2010.

If N is large, (1) gives a narrow range for the assessments of g as shown in Table A2. The Danish standard of living 1000 years ago was probably so low that only a handful of countries have a lower standard of living today. Maddison claimed that $gdp_{1000} \approx 1{,}000$ $.

Table A2 shows how little it matters for the size of the growth rate if the *gdp* was $500 – more or less of that.

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[19] Danmarkshistorien is a large semi-popular project of the Department of History at Aarhus University, with participation of most faculty. It brings texts, sources, and many illustrations. It keeps growing, and it has a large section on the Reformation, with links to more material.

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