# The Economic Legacy of Gothic Cathedral Building: France and England Compared

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Considerable interest and attention have been given to the gothic cathedral by economists and art historians alike. The idea that a culture and economy popularly viewed as technologically simple could have produced such awe-inspiring and technically complex structures as these cathedrals piques the imagination. These structures represent the solution to engineering and design problems inherent in architecture of such soaring heights supporting a roof structure of such weight. They incorporate art forms of sculpture, stained glass, metalworking, painting, woodcarving, mosaic, and virtually every other known form of the time if one considers both the building and the decoration. Their construction even in modern times would be considered an enormous task and yet they were built in an age with limited construction tools and techniques confined to levers, pulleys, the inclined plane and brute strength. The impact of cathedral building is usually discussed within the context of innovations which led to significant changes in art or technical skills. In the early 1970's, however, a discussion arose over the economic significance of cathedral building to the medieval economy. In examining this literature, it appears that the variation in results depends upon whether the are under consideration is Northern France or Britain.

## Macroeconomic Effects Of Cathedral Building

In "Gothic Cathedral Building as Public Works," Owen argues that cathedral building served the function of public works in modern economies. The discussion is limited to cathedral construction in Northern France between 1137 (when the first cathedral of gothic style was begun at St. Denis) and the first quarter of the fourteenth century. By the time of the papal dispute in 1292, the enthusiasm for undertaking new cathedral projects had waned and the construction boom ended in Northern France. The booming medieval economy of the thirteenth

century also waned with the Hundred Year's War (1337) and the beginning of the plague (1348) usually identified as important reasons for decline. The decline had already begun 25 years earlier, however.

Owen cites three attributes of public works in modern society: size, centralized planning, and the nonvoluntary nature of their finance. (pp. 284-7) All three are shown to be present in the cathedral construction of Northern France.

> "The immensity of the projects is impressive even today. Between 1170 and 1270, 80 cathedrals and nearly 500 churches of cathedral size were constructed in Northern France. Their value in 1840 was estimated to be over one billion dollars." (Owen, p. 285; Thompson, "Economic and Social...," p. 22)

Oldenburg writes,

> "The decision to construct [a cathedral church] meant a more considerable effort than could be entailed in our time by the building of the Aswan Dam, the development of Brasilia, or even the boring of a tunnel under the English Channel." (p. 16)

Cathedral construction was also centrally directed. The first gothic cathedral, St. Denis, was the personal project of Abbot Suger who supervised virtually every detail of the construction. (Bishop, p. 358) At the height of the cathedral construction craze, most construction sites were supervised by a master mason or clerk of the works who exercised both architectural and supervisory duties. (Jones, p. 505)

> "Such men performed within the view of local churchment, whose tastes had to be met. 'Thus the cathedral was a clear expression of the position, pride, and wealth of the bishop, its grandeur and size a measure of his significance.' (Sowards, p. 452)" (Owen, p. 286)

The financing of cathedral construction also fits the model of public works although indirect coercion rather than direct taxation was the method. Prelates....

> "certainly exercised in France a power of action stronger and more pregnant with results than the obscure ministers of a weak, discredited king." (Halphen, p. 133). Although

> officially voluntary and often given out of civic pride, contributions to cathedral projects involved some exploitation of ignorance and fear. When funds were depleted, the working of miracles with a relic from the local church or sale of indulgences could swell the donations. 'The Electors of Saxony piled up a credit of two million years against their time in purgatory." (Thompson, "Economic and Social. . .," p. 12)

Although compulsory taxation was a minimal part of the financing of cathedral building, compulsions was used. As the instrument for salvation in a society obsessed with the subject, requests for contributions in the context of miracles and vivid descriptions of Purgatory and Hell must be considered coercive. (Owen, pp. 286-7). Hence, the analogy of cathedral building to public works in the modern world is complete.

In order to demonstrate the impact of cathedral building on the medieval economy of Northern France, predictions based on a simple Keynesian analysis are made. These are then checked against the limited data available for the period. Although data are not sufficient to identify precise multiplier effects, nevertheless, inferences can be drawn about a boom in employment, prices, mobility, trade and income. The conclusion is that the construction of cathedrals is one explanation of the flowering of the medieval economy in the thirteenth century. (Owen, p. 289)

An alternative view of the importance of cathedral building is presented by H. Thomas Johnson. His work concentrates on building projects in England and is an attempt to determine the man years required to construct the cathedrals and cathedral-like buildings of the late medieval period. Because of the detailed records in the construction of Westminster Abbey, it is possible to estimate the labor input required. Johnson then compares the volume of other ecclesiastical structures in England to that of Westminster Abbey and infers labor input required for them as proportional to the relative sizes. (Johnson, "Cathedral Building...") Subsequent disputes concerned the methodology used to determine labor input to the other ecclesiastical constructions since labor is associated with surface area rather than volume and surface area and volume are not necessarily directly proportional. Johnson redesigned his formulations to account for this and recalculated labor input. The new calculations reduced his original estimates (an average of 1,175 to 1,475 men per year) to "[a]n

average of no more than 1,315 laborers . . . employed annually between 110 and 1400." (Johnson, "Note . . .," p. 110) This amounts to less than a half percent of the estimated adult male population. On this basis he concludes that "It does *not* seem that such building activity, at least in England, was a significant part of gross national investment in the Middle Ages." (Johnson, "Cathedral Building . . .," p. 206) His position lends support to those who place little emphasis on the economic importance of cathedral building or even maintain its counterproductivity to the medieval economy. (Lopez, pp. 433-438)

The Johnson results seem to contradict the Owen conclusions. However appropriate his position is for England, it seems particularly inappropriate for northern France. The surge in gothic cathedral building in France far exceeded that in England. Johnson's estimates are based upon data for 26 cathedrals and "seventy or so other large church structures" which were built during the 300 years between 110 and 1400. (Johnson, p. 204) According to the data cited earlier, 80 cathedrals and nearly 500 abbey churches of cathedral size were built in the 100 years between 1170 and 1270 in northern France. Thus over six times as many ecclesiastical buildings were constructed in France as in England in 1/3 the time. If the size of the church buildings and the labor technology were the same for the two countries this would imply eighteen times as much labor input per year in France as in England.

Published volume data for these cathedrals is scarce but it confirms the size comparability of French and English cathedrals. Hurliman and Bony have estimated Amiens as no less than 260,000 cubic yards in volume. (p. 146)

R. P. Howgrave-Graham confirms this estimate with his own calculations.

(p. 76) Notre Dame de Paris is estimated as containing 285,185 cubic yards by Allan Temko. (p. 114) Crude estimates of interior volume using published dimensions and scale drawings have been made for cathedrals at Chartres, Rheims and Senlis. All this information is summarized in Table 1. To check the accuracy of these estimates, similar estimates were made for Amiens Cathedral and Notre Dame de Paris. These estimates were about 1/2 the figures from published sources. Thus these estimates should be viewed as minimal volumes. The actual volumes may be as much as half again as large. (Table 1)

Table 1: Cubic Volume Estimates of Selected French Gothic Cathedrals

| Cathedral | Date Begun | Volume in Cubic Yards [a] |
|---|---|---|
| Amiens | 1220 | 260,000 to 300,000[b] |
| Chartres | 1194[c] | greater than 300,000 |
| Notre-Dame de Paris | 1163 | 285,185 |
| Rheims | 1211 | 95,130 |
| Senlis | 1191 | 44,770[d] |
| Sainte Chapelle[e] | 1243 | 9,409 |

a. an Interior volume based on published estimates of volumes or published dimensions and scale drawings.

b. Amiens is considered the largest cathedral because of its large floor plan and high nave.

c. Because Chartres burned in 1194, one tower and west front are from the earlier building. Thus less than 300,000 cubic yards were constructed during the time period under consideration.

d. Senlis is considered the smallest cathedral.

e. Sainte Chapelle is not a cathedral but a small chapel built in Paris in 5 years. Building such as this are not included in the data about cathedral building. It is included here for comparison.

Sources: Amiens: M. Hurliman and Jean Bony, *French Cathedrals* (New York, 1967), pp. 145-6 and R. P. Howgrave-Graham,*The Cathedrals of France* (New York, 1959), p. 76; Chartres: Estimated from dimensions given by M. Hurliman, *French*....., pp. 55-6; Notre Dame: Allan Temko, *Notre-Dame of Paris* (New York, 1963), p. 114; Rheims: Hurliman, *French...., p. 97 and T. Francis Bumpus, The Cathedrals of France* (New York, 1927), p. 21; Senlis: Howgrave-Graham, *The Cathedrals* ..., p. 135; Sainte Chapelle: Yves Bottineau, *Notre-Dame de Paris and Sainte-Chapelle*(Chicago, 1967) p. 68.

When compared to Johnson's estimates of English cathedrals, these French cathedrals appear larger. No English cathedral exceeds 200,000 cubic yards according to Johnson, yet Amiens, Notre Dame de Paris, and Chartres all exceed 250,000 cubic yards. Even Senlis cathedral, generally acknowledged as the smallest of the French gothic cathedrals, (Howgrave-Graham, p. 135) exceeds seven English cathedrals on Johnson's list. If this estimate is only 2/3 the actual volume as was the case for Amiens and Notre Dame de Paris, then Senlis would rank eleventh in size out of twenty-six English cathedrals. The French ecclesiastical constructions, then, were surely of comparable size on average to the English ones.

The significance of over eighteen times as much labor input to ecclesiastical building per year in France as in England depends upon population comparisons. Obviously France was larger (though the construction was concentrated in northern France) with a significantly larger population. Ideally data would be available for various years during the period 1170 to 1270. Unfortunately, however, the closest years for which estimates are available are 1200 and 1328. J.C. Russell estimates French population in 1200 as 9.2 million. His estimate for France and the Low Countries in 1328 is 13.4 million if family size is assumed to be four and 17 million if family size is assumed to be five. (pp. 9, 105-6, 108) This 1328 estimate is based upon the Great French Survey of Population of 1328 in which hearths were counted. Professor Russell's estimates of English population cited by Johnson are approximately 2.2 million. This figure is for 1377, however, over a century later than the period of examination. Using this figure, nevertheless, one can estimate the French population of 1200 as a little over four times the English population. With similar demographic characteristics, this would make the French adult male labor force a little over four times the English adult male labor force. With eighteen times the labor input being provided by a labor force four times as large, French ecclesiastical building would have employed 2.5 percent of the work force in 1200. This is in contrast to Johnson's estimate of one half percent in England. As population grew, this percent would decline so that the economic significance of ecclesiastical construction would have diminished. Even using the high estimate of 17 million for France and the low countries in 1328, ecclesiastical consideration would still have employed over one percent of the labor force. Furthermore, these calculations assume that labor input to cathedrals was evenly spaced over the century. Construction dates (see Table 1) would indicate a major lumping of this labor input in the first half of the thirteenth

century. The 2.5 percent employment figure no doubt understates th importance of labor input during this period.

The significance of a 2.5 percent employment figure can be deter mined by comparing it to modern public works programs. In 1935, th WPA employed slightly over 2 percent of the civilian labor force of th United States. At no time in its history did it employ over 4.9 percen of the labor force.(1) The CCC employed significantly fewer workers never handling more than .8 percent of the labor force and often hover ing at .6 percent.1 Seen in this context, the 2.5 percent figure fits wel into the pattern of public works programs. Furthermore, even a smal percentage change in national employment statistics can dramatically affect a local economy. Consider as an example the problems o Washington State, especially Seattle, when the Boeing corporation laic off workers in 1969. The economic distress eventually led to nation wide repercussions, yet the initial layoff was less than one tenth per centage point in national statistics. (Moyers, p. 192) Even Johnson's half percent for England would be viewed with alarm by modern stand ards if those workers had not worked in constructing ecclesiastica buildings but had been added to unemployment statistics instead.

In summary, the empirical evidence on cathedral and relatec building in France supports the view of cathedral building as ol economic significance. Although based on rather heroic assumptions, the best estimate is that at least 2.5 percent of the adult male popula tion of northern France was engaged in such building during the first half of the thirteenth century. Such employment must surely have had an expansive effect on the economy.

## Microeconomic Impact Of Cathedral Building

Modern public works expenditures often create microeconomic effects quite apart from their impact on the economy as a whole. The concentration of effort frequently results in a new technology with ramifications on other sectors. The development of transistors and teflon from military expenditures in the US serve as examples. In addition, the expenditures affect the factor markets creating excess demand for some and deficient demand for others. The result is a change in factor rewards. The demand for scientific and engineering personnel in the fifties and early sixties illustrates. Finally, occasionally an administrative innovation results from organizing public expenditure as it did in the development of program budgeting and linear

programming within the US Defense Department. Similar effects occurred during the heyday of cathedral building.

The technology of gothic cathedrals is astounding, and represents an advance over the preceding romanesque style. In point of engineering and technique Gothic was almost immeasurably an advance upon Romanesque. The whole development of Gothic architecture depended upon flexible employment of its most conspicuous feature, the pointed arch.

The radical change affected by Gothic was the ability to vault any space of any height by means of the pointed arch, a solution which eliminated the use of heavy pillars or columns in the interior and at the same time enabled making the walls thin by supporting them with external buttresses, instead of the walls holding their own by their own massiveness and weight. In the principle of independent ribs carrying vaulting reduced to a minimum of weight lay not only a new element of architecture, but also a new method of building which did not hamper or restrict the creative imagination of the architect. (Bishop, p. 373)

The techniques spread to other building so that in the late Middle Ages. They were applied to town halls, guild halls, market crosses, college buildings, monasteries, castles, and fortifications all over western Europe. (Thompson, "The Middle . . .," p. 848) As a result of this technology in building, " ..the ratio of the area of floor space to the cross-sectional area of supporting walls increased from four to eight during the middle ages,...." (Osborne, p. 492) The heights achieved by this technology were not exceeded until the use of steel in the 19th century. Actual construction methods were also perfected. William of Sens, the 12th century architect, constructed devices for the hauling of stones and cement and for the unloading of ships. (Mason, p. 109) To the extent that sea transport was stimulated by the importing of heavy construction materials, innovations such as the sternpost rudder, compass, and astrolabe along with maps and harbor charts may be part of the legacy of cathedral building. (Bishop, p. 163)

In addition to significant contributions to the technology of construction and design, the cathedral building also had a profound effect upon the labor force. It stimulated specialization and division of labor and created a mobile work force of dimensions unknown before. Mason concludes as follows. With such refinements in technique came a differentiation of the crafts. Engineers and instrument makers separated off from the mill-wrights and blacksmiths, sculptors and artists from the stone masons and the decorators. The more skilled of

the specialist craftsmen became literate, and recorded the experience of their art, whilst later such men assimilated some of the learning of the scholarly tradition, and contributed towards the development of modern science. (Bishop, p. 163)

The extent of the differentiation is indicated in the variety of wage rates paid to stone masons in medieval accounts. One abbey employed 131 masons at eighteen different wage rates in 1278-80. (Bishop, p. 1663) In addition, there were many other trades represented -- carpenters, glaziers, metal workers, painters, mortarmen, barrowmen, and hod carriers. (Jones, p. 511) The supervisor of construction was normally paid three or four times the amount of ordinary masons (Bishop, p. 358) and sometimes, especially early in the period, was given canon status with the sponsoring religious order. (Judd, p. 199) The impetus to differentiation of labor and the creation of a labor force dependent upon wage earnings as a result of cathedral building should not be overlooked.

Another microeconomic effect of cathedral building also concerns the labor force--its mobility and the spreading of skills implicit in that mobility. One of the distinguishing features of the medieval building labor from their contemporaries in other industries was that mobility. "In any event, the erection of the great castles and cathedrals of medieval Europe was possible only gathering hundreds of craftsmen from a wide district." (Jones, p. 505) Even in the planning of St. Denis, Italian glaziers were hired since French glaziers didn't work in stained glass. (Bishop, p. 163) "...(French influence) has been noted in the cathedrals of Burgos and Toledo, of Cologne, Bamberg and Naumberg, and even in Upsala and Cyprus; and, in some cases at least, the explanation is known to have been the emigration ofFrench architects and workmen." (Jones, p. 499)

The mobility of these construction workers was so great that if cathedral projects faced financial difficulties, they "...left for more profitable locations the day their pay stopped." (Oldenburg) This mobility resulted in the formation of lodges or loose associations at each building site within which all members of the craft were welcome. No doubt this contributed to a more rapid adoption of new techniques and at the same time established the forerunner of the labor union. The cosmopolitan nature of these lodges is evidenced by the records at Xanten which indicate that it contained at various times masons from Dounai, Holland (Utrecht, Kranenberg), Antwerp, Brussels, Westphalia (Borken, Munster), the Rhineland (Dusseldorf, Cologne,

Mainz, Trier) and even Nuremburg. (Jones, p. 519) The social and economic consequences of such mobility seem obvious.

Simultaneously with the vast expenditures organized the Church, there developed the banking industry and accounting practices which have continued to this day. (deRoover, p. 74) Many factors no doubt contributed to these developments, but Church financial dealings must have played their part. The letter of credit was developed specifically by Italian bankers for the convenience of the papacy so that the transportation of gold across the Alps would be minimized. (Bishop, p. 128) Durant even ascribes the end of French cathedral building to the accumulated debts to bankers of the French cathedrals and abbeys. (p. 767) Some influence on the administrative innovations of the 13th and later centuries must be attributed to the immense undertakings of the cathedral builders.

## Conclusion

The accomplishments of the Gothic cathedral builders are immense. They are usually examined in terms of technical and artistic achievement, however, This seems shortsighted in view of their economic ramifications. The legacy of these works can be seen in technology, specialization and mobility of labor, and procedures in accounting. They thus served as a vehicle for the transformation of feudal society to the early capitalism which generated our modern world.

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## References

Bishop, Morris, *Middle Ages*. New York: American Heritage Publishing Company, Inc., 1968, p. 37.

deRoover, R., "The Organization of Trade," M.M. Poston, E.E. Rich, and Edward Miller, eds., *Cambridge Economic History* Cambridge: The University Press, 1963, p. 74.

Durant, Will, *The Age of Faith*. New York: Simon & Schuster, 1950, pp. 296, 556.

Halphen, Louis, "France in the Eleventh Century," *Cambridge Medieval History,* III, H.M. Gwatkin, J.P. Whitney, J.B. Tan, and

C.W. Previte-Orion, editors Cambridge: The University Pres 1964, p. 133.

Howgrave-Graham, P., *The Cathedrals of France.* New York, 1959, p 76.

Hurliman, Martin and Boney, Jean, *French Cathedrals* New York 1967.

Johnson, H. Thomas, "Cathedral Building and the Medieva Economy," *Explorations in Entrepreneurial History* Second Series Vol. 5, No. 1 (1967), pp. 191-210.

_____, "Note: Relation of Building Volume and Construction In puts," *Explorations in Entrepreneurial History* Second Series, 5, (1967), pp. 108-10.

Jones, Gwilym Peredur, "Building in Stone in Medieval Western Europe," *Cambridge Economic History of Europe,* Vol. II, M. Postan and E.E. Rich, editors Cambridge: The University Press 1952, p. 505.

Judd, Denis, *A History of Civilization.* New York: The Macmillan Company, 1963, p. 199.

Lopez, Robert S., "Economie et architecture medievales cela aurrait il tue ceci?" *Annales; Economies, Societes, Civilisations,* 7 (1952), pp. 433-438.

Mason, Steven F., *History of the Sciences* (New York: Collier Books, 1962, pp. 103-5.

Moyers, Bill, *Listening to America* (New York, 1971), p. 192.

Oldenburg, Zoe, "With Stone and Faith," *Great Cathedrals.* New York: American Heritage Publishing Company, Inc., 1968, p. 19.

Osborne, Harold, ed., *The Oxford Companion to Art.* New York: Oxford University Press, 1970, p. 492.

Owen, Virginia Lee, "Gothic Cathedral Building as Public Works," in*Essays in Economic and Business History* edited by James H. Soltow East Lansing: Michigan State University Press, 1979, pp. 283-292.

Russell, J.C., "Late Ancient and Medieval Population," *Transactions of the American Philosophical Society* (Philadelphia, June 1958).

Sowards, Jesse Kelley, *Western Civilization to 1660.* New York, 1964, p. 452.

Temko, Allan, *Notre-Dame of Paris* (New York, 1963), p. 114.

Thompson, James Westfall, *Economic and Social History of Europe in the Later Middle Ages 1300-1500* New York: The Century Co., 1931, pp. 5-6.

_____, *The Middle Ages 300-1500.* New York: Alfred A. Knopf, 1931, pp. 734-5.