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6 November 2013

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ECONOMICS 301Y1

The Economic History of Later-Medieval and Early-Modern Europe

LECTURE TOPIC NO. 8

V. MANUFACTURING INDUSTRIES: LATE-MEDIEVAL EUROPE

A. The Wool Textile Industries: Woollens and Worsteds

V. MANUFACTURING INDUSTRIES: in LATE-MEDIEVAL EUROPE

A. The Wool-Based Textile Industries: Woollens, Worsteds, Serge (Stuffs)

1. Importance of Woollen Textiles in European Economic History

a) **The two spearheads of modern industrialization, both in England and throughout western Europe** were textiles and metallurgy, but above textiles.

i) **In this term, we will focus on textiles, in particular, the woollen cloth industry;**

ii) **I shall leave metallurgy** for the second term (along with other industries).

iii) **Certainly we cannot understand the nature of the early-modern industrialization, without first understanding the evolution of these industries from the later Middle Ages:** in their technology and industrial organization.

c) **The Leading Textiles in International Trade:** The leading products, in order, were:

(1) wool-based textiles: animal fibres, from sheep

- woollens: semi-luxury to full luxury textiles, very fine qualities:
- worsteds: cheaper and coarser in quality
- stuffs or serges: mixed woollen and worsted fabrics

(2) linens (flax): vegetable 'bast' fibres

(3) fustians: mixture of linen and cotton (both vegetable fibres)

(4) cottons: pure cottons (i.e., not fustians): vegetable fibre

- Asian manufacture, imported into Europe,
- were not manufactured in Europe until the Industrial Revolution.

(5) silks: velvets, satins, damasks, etc.

- insect fibres (silk-worms):
- most expensive of all luxury textile fibres.
- originally Chinese and South Asian: later introduced into Europe — Italy, in the 13th century

d) **The Wool-based Industries: the medieval and early-modern woollen and worsted industries**:

i) **Unquestionably most important were the wool-based industries:**

(1) those producing woollens, worsteds, and mixed worsted-woollen fabrics

(2) important, especially for their 'backward and forward linkages' in the economy: i.e., for their impact on industry, agriculture and foreign trade.

ii) **This Wool-Based industry had two main branches**:

(1) **The woollen industry:** later called the Old Draperies, producing heavy-weight, fairly costly semi-luxury to luxury quality woollens; and,

(2) **The worsted industry:** later (from the Elizabethan era, of the later sixteenth century) called the 'New Draperies', in contrast to the traditional 'Old Draperies' (woollens)

- in fact an old industry resurrected in the sixteenth century, producing much lighter, coarser and cheaper fabrics, known as worsteds,

- or mixed woollen-worsted fabrics, called, serges or stuffs, whose technical properties will be explained in more detail in the second term

b) **Textiles were became very important engines of industrial and commercial development in medieval Europe, and into modern times, because of the following factors**:[1]

(I) Demand Factors:

i) **Their importance in international trade:**

(1) textiles, from the eleventh or twelfth centuries up to the end of the 19th century, constituted the chief and by far the most important manufactured commodity, the chief industrial good, in international trade; i.e., the chief industrial exports:

(2) For England in particular, textile fibres (wool) and then textiles (woollen cloths manufactured from England's own domestic wool supplies; and then worsteds; and later cottons)

- had been a chief employer of labour, in agriculture, industry, and trade, from the 12th to 19th century
- and overwhelmingly England's most lucrative export, accounting for over 90% of her export revenues (in both wool and cloth) to the mid- 17th century (92.5% in 1640)
- ii) **The almost universal, world-wide demand for textiles**: dividing that demand into two categories:

(1) **Textiles as necessities**: as one of the three basic necessities of mankind: FOOD, CLOTHING, AND SHELTER [one might also add SEX, but that will not be considered here!]

- for protection against the elements: against the cold, against the heat, against the rain and snow);
- for physical protection against physical abrasions (to avoid cuts, scratches, other wounds)
- for protection against public shame: reasons of personal modesty, i.e., since nudity has always been unacceptable in most societies.[2]

(2) **Textiles as Luxuries:**

- for personal satisfaction in terms of fashion, dress style, especially involving colours.[3]

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[1] This is the major area of my own research and publications; money, prices, and wages are close second, in my research and publications. For this most recent overview for the medieval era: see the following chapters in David Jenkins, ed., *The Cambridge History of Western Textiles*, 2 vols. (Cambridge and New York: Cambridge University Press, 2003):
a) John Munro, 'Medieval Woollens: Textiles, Textile Technology, and Industrial Organisation, c. 800 - 1500', in Vol. I, chapter 4, pp. 181-227;
b) John Munro, 'Medieval Woollens: The Western European Woollen Industries and their Struggles for International Markets, c.1000 - 1500,' Vol. I, chapter 5, pp. 228-324, 378-86 (bibliography); and also:
c) Herman Van der Wee (in collaboration with John Munro), 'The Western European Woollen Industries, 1500 - 1750', Vol. I, chapter eight, pp. 397- 472. See also the bibliography, posted online separately from this lecture.

[2] Consider the current public debates, in Asia, Europe, and the Americas about the extent of clothing required to meet public demands for modesty, especially for women.

[3] See my recent article: John Munro, 'The Anti-Red Shift – to the Dark Side: Colour Changes in Flemish Luxury Woollens, 1300 - 1550', *Medieval Clothing and Textiles*, 3 (2007), 55-95.

- and for reasons of social status -- the importance of dress in asserting and defending social status.
- but in this respect, for the aristocracy, what may seem to be a luxury might be viewed by them as a necessity

iii) **European Sumptuary Legislation:** acquiring textiles - 'dress' – for such reasons of social prestige and social distinction – is reflected in widespread European *sumptuary* legislation

(1) i.e., laws and decrees by which princes and royal government restricted the wearing of certain types of luxury apparel to the nobility or aristocracy,

(2) prescribing both confiscation and severe penalties to those of the middle (or lower) classes who dared to buy and adorn themselves in such garments. [4]

iv) **These factors involving fashion, social status, and demand for luxuries** may also provide the key reason to explain the importance of textiles in international trade, because of the following point:

(1) While almost every known region in Europe, North Africa, the Middle East and Asia

- could indeed and did produce some textiles from local raw materials -- whether wool, flax (linen), or -- in the tropical zones -- also cotton, or some mixtures of these –
- not every region could specialize in the production of the higher quality textiles demanded for the above reasons in international trade.

(2) Thus some regions specialized in textile production:

- some in one or more types of higher quality textile;
- other regions, in other kinds of textiles;
- and international trade distributed regional surpluses according to needs & demand.

(3) Textiles were and are commodities with a highly favourable weight:value ratio:

- i.e., they are relatively light and compact, with a relatively high value in relation to volume and weight,
- so that unit transport and handling costs are relatively low.
- Question: is it cheaper to transport coal or diamonds -- or silks?

(4) **Optimum values for broad international markets:** i.e.,

- while these textiles had a high enough value to surmount the barriers of transportation and other transaction costs in international trade,
- the majority, throughout European economic history, were still priced low enough to have a fairly broad based regional and international markets.

(5) **The exceptions are, of course,**

- the various silk fabrics (damasks, satins, velvets, and brocades, often with gold or silver threads);
- and certain very high quality woollens, especially those called *scarlets* with the very distinctive

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[4] An issue raised in my recently published essay: John Munro, 'Three Centuries of Luxury Textile Consumption in the Low Countries and England, 1330 - 1570: Trends and Comparisons of Real Values of Woollen Broadcloths (Then and Now)', in Kathrine Vestergård Pedersen and Marie-Louise B. Nosch, eds., *The Medieval Broadcloth: Changing Trends in Fashions, Manufacturing and Consumption*, Ancient Textile Series, vol. 6 (Oxford: Oxbow Books, 2009), pp. 1-73.

bright red dyes (whose name is derived from the textile), which were largely directed to an aristocratic clientele.[5]

(6) For one particular era only, the very late Middle Ages, international trade in textiles did become more restricted to luxury textiles, for reasons that we shall see later.

(7) Many of the necessary ingredients for the textile production -- quality wools, cotton, silk, dyestuffs, and other industrial raw materials -- similarly had to be acquired through international trade.

(II) Supply and Production Factors:

i) **industrial location was not strictly limited to sources of raw materials**:

(1) textiles industries could be located in many various parts of Europe and develop on basis of imported raw materials.

(2) Thus the two leading medieval manufacturers of high quality textiles, the Flemish and Italians, both came to depend on imported English wools, along with many of their dyestuffs and other chemicals.

ii) **industrial development did not require large capital investments,** sophisticated technology, nor highly refined labour skills (i.e., for non-luxury textiles).

(1) The technology was relatively simple, for most of the processes;

(2) question of mechanization, with water power:

- in the woollens industry, only one stage (fulling) was mechanized with water power, from as early as the 10th century (12th century: in England). [6]
- in the silk industry, silk-throwing (equivalent to spinning) was also mechanized: in Italy, from the later 13th century

(3) Much industrial production could be achieved with part-time rural labour

- fitted in well with an agrarian, agricultural economy:
- no strict division between agriculture and the textile industries, in much of late-medieval, early-modern Europe.

2. <u>The Medieval Woollen Industries: Their Nature and Technology</u> [7]

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[5] John Munro, ''The Medieval Scarlet and the Economics of Sartorial Splendour,' in Negley B. Harte and Kenneth G. Ponting, eds., *Cloth and Clothing in Medieval Europe: Essays in Memory of Professor E. M. Carus-Wilson*, Pasold Studies in Textile History No. 2 (London: The Pasold Research Fund and Heinemann Educational Books, 1983), pp. 13-70; reprinted in John Munro, *Textiles, Towns, and Trade: Essays in the Economic History of Late-Medieval England and the Low Countries*, Variorum Collected Studies series CS 442 (Aldershot, Hampshire; and Brookfield, Vermont: Ashgate Publishing Ltd., 1994). See also John Munro, 'The Anti-Red Shift – to the Dark Side: Colour Changes in Flemish Luxury Woollens, 1300 - 1550', *Medieval Clothing and Textiles*, 3 (2007), 55-95.

[6] For the crucial process of fulling woollens, see below: pp. 15-16

[7] A fuller analysis of these processes of woollen cloth production, with illustrations may be found in John H. Munro, 'Textile Technology,' in Joseph Strayer et al, eds., *Dictionary of the Middle Ages*, Vol. 11 (New York, 1988), pp. 693-715; reprinted in John H. Munro, *Textiles, Towns, and Trade: Essays in the Economic History of Late Medieval England and the Low Countries* (London, 1994); and also and John Munro, 'Medieval Woollens: Textiles, Textile Technology, and Industrial Organisation, c. 800 - 1500', in

a) **Woollen Broadcloths: Their Chief Characteristics:**

i) **Semi-luxury to luxury products (as export commodities):**

(1) relatively high priced – from 'affordable' to extremely costly

(2) the highest priced luxury woollens rivalled silks in both value and luxury quality, and aristocratic prestige.

ii) **Very heavy and very durable:**

(1) heavier than a modern woollen overcoat

(2) **The explanations for the latter:** the weight and durability will explain the first on luxury quality and price;

iii) **the changing roles of luxury woollens (i.e. of the Old Draperies):** It is very important to understand the reasons

(1) Why they had been the predominant textile industry in the later Middle Ages;

(2) and then why it was superseded by the so-called New Draperies, from the later sixteenth century (though we will not see that transition until the second term of this course).

iv) **The answers also have to be found to a considerable degree,** in the very wools from which they were woven and in the technology of utilizing those wools.

b) **The wools themselves**: provide the chief reason for their weight, durability, luxury quality and high costs:

i) **The finest woollens manufactured in medieval Europe were woven from English wools,**

(1) or rather the finest quality and thus highest priced wools, which were then the world's finest and best wools,

(2) at least until the sixteenth century, when they were superseded by Spanish merino wools, as noted before, in earlier lectures.[8]

ii) **The very finest of the late-medieval English wools:**

(1) it is argued, came from regions with relatively sparse feeding, especially semi-mountainous terrain, which also had chilly climates

(2) these were regions with very small-sized sheep, whose fleeces were light, with predominantly short curly, fibres

(3) a sheep's fleece or coat has a wide mixture of fibre types

(4) but these conditions promoted, or so it is argued, a predominance of short-fibred wools.

(5) the following regions were populated with sheep that produced the finest wools, as follows:

- the Welsh 'Marches': the west Midland counties of Herefordshire and Shropshire
- and the adjacent Cotswold hill counties: Worcestershire, Gloucestershire, and Oxfordshire, also in the Midlands

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David Jenkins, ed., *The Cambridge History of Western Textiles* (Cambridge and New York: Cambridge University Press, 2003), chapter 4, pp. 181-227. A working-paper version of this chapter may be found on my Home Page, at: http://www.economics.utoronto.ca/ecipa/archive/UT-ECIPA-MUNRO-00-05.html

[8] See John Munro, 'Spanish *Merino* Wools and the *Nouvelles Draperies*: an Industrial Transformation in the Late-Medieval Low Countries', *Economic History Review*, 2nd ser., 58:3 (August 2005), 431-84.

- Lincolnshire, in central north-east England: produced the third best wools, chiefly (so it is argued) from sparse feeding, in the Kesteven and Lindsey districts of Lincolnshire.

iii) **environment vs. breeding (genes)**:

(1) According to the British historian Peter Bowden, medieval England lacked any well defined breeds of sheep, so that wool characteristics and qualities were chiefly determined by the environmental factors listed above.[9]

(2) but also including sheep management, to control disease, ensure proper care and feeding.

(3) No doubt the prevalence of open-field or common-field farming systems in those regions of medieval England producing the best wools – especially the Midlands – made it very difficult to engage in any form of effective sheep-breeding

- chiefly because of the intermingling of peasant sheep flocks on grass and pasture lands and then on post-harvested stubble of the arable fields
- peasants, who certainly produced the bulk of the sheep in medieval England, lacked the capital and ability to invest in breeding rams

(4) However, I have found evidence that in the thirteenth century, some Cistercian monasteries were investing in imported breeding rams for their demesne flocks

- but most of these Cistercian demesnes had been leased to peasants before the Black Death
- even well before, a considerable part of the wools that Cistercian monasteries were selling had come from sheep flocks of dependent tenants

(5) Nevertheless it is difficult to believe that sheep breeding did not have some importance in medieval England.[10]

iii) **These were very fine, short-fibred, curly wools,** with excellent felting properties.

iv) **These wools were first thoroughly washed and scoured to remove their natural oils;**

- they were heavily re-greased with butter, olive oil, or animal fat,
- which was necessary to protect them from damage in the ensuing cloth-making processes: i.e., in combing, carding, spinning, weaving.

b) **Wool-preparation: combing and carding**

i) **Combing:** with a metal instrument containing teeth or prongs that indeed resembled a comb:

(1) Originally these wools were combed, as were all wools;

(2) but combing was awkward, because the short curly fibres so frequently got caught in the teeth

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[9] Bowden, Peter J,. 'The Wool Supply and the Woollen Industry,' *Economic History Review*, 2nd ser. 9 (1956-57), 44-58; Bowden, Peter J., *The Wool Trade in Tudor and Stuart England* (London, 1962), pp. 1-76.

[10] See my publications in note 1; and in the appendix; and also Ryder, Michael, 'The History of Sheep Breeds in Britain,' *Agricultural History Review*, 12 (1964), 1-12, 65-82; Ryder, Michael, 'The Wools of Britain,' in J. Geraint Jenkins, ed., *The Wool Textile Industry in Great Britain* (London, 1972), pp. 51-64; Ryder, Michael, 'British Medieval Sheep and Their Wool Types,' in D. W. Crossley, ed., *Medieval Industry* (London, 1981), pp. 16-28; Ryder, Michael, 'Medieval Sheep and Wool Types,' *Agricultural History Review*, 32 (1984), 14 - 28; Ryder, Michael, *Sheep & Man* (London, 1983).

ii) **Carding:**

(1) From the later thirteenth century: a new instrument, called the card, was introduced into Europe via Muslim Spain and its cotton industry;

(2) shaped much like a hair brush:

- a multitude of wires protruding through a leather-covered wooden base:
- it was much more effective, and certainly economized greatly on labour in processing these short-fibred wools (and short-fibred cotton)

(3) Carding, however, was strongly resisted in most European draperies until the sixteenth century, on the grounds that yarns spun from carded wool were flimsy and weak.

c) **Spinning:** always an exclusively female occupation (generally part-time)

i) **spinning consists of three consecutive processes, which are important to understand:**

(1) **drafting** or drawing the fibres from a 'roving' or mass of carded or combed wools, which were placed on a cleft-stick known as the distaff (often fixed into the spinster's belt

(2) **twisting** the fibres so drafted from the roving of prepared wools

(3) **winding** the twisted yarn onto a spindle

ii) **Two forms of spun yarn for the loom:**

(1) **The warp yarn:** these are the foundation yarns for weaving,

- which are stretched from a roller beam at the bottom of the loom (warp beam) to another roller beam at the head of the loom (cloth beam),
- while passing through suspended loops (called 'heddles') and a comb-like device (to keep them properly straight and aligned).
- because these yarns were subjected to considerable tension and stress on the loom they had to be very strong yarns.

(2) **The weft yarn:** these are much softer and weaker yarns that are woven in between the warps.

- the weft is wound onto a spindle or bobbin inside a wooden casing called a *shuttle*, which unravels from the shuttle as it is passed through the warps.
- More on this when we come to weaving.

iii) **Spinning by the rock or drop-spindle and distaff:** the most ancient method of spinning, for several millennia:

(1) the spinner attached some strands of wool to the top of a weighted and tapered spindle (made of bone, wood, or stone), and then dropped the spindle.

(2) As the spindle descended towards the ground it rotated thus drafting and twisting the fibre.

(3) The spinner then picked up the spindle, wound the yarn on to the tapered end, and repeated the process -- something that she could do while also tending farm or household chores.

iv) **The Spinning Wheel:** introduced in the thirteenth century, along with carding, probably from the cotton industry of Muslim Spain or Sicily; and it used carded wool almost exclusively.

(1) This was simply a mechanization of the spindle, which becomes an axle driven by a looped belt fitted over a large wheel;

(2) the spinner rotates this wheel, by hand or foot-power, thus driving the belt and axle, which thus rotates the spindle at a very high speed.

(3) Attached to the narrow tip of the spindle were strands of carded wool from the roving; and thus, as the spindle rapidly rotated, that process drafted and twisted the fibre

(4) But the spinner periodically had to stop rotating the wheel in order to wind the spun yarn onto the other end of the belt-driven spindle.

(5) The spinning wheel

- vastly increased productivity, perhaps 200-fold,
- but at a cost in quality: for the yarn so spun on the wheel was much weaker than rock-spun yarns,
- and varied in thickness, so that the thinner portions tended to break easily.

v) **As a consequence most late-medieval draperies,** or those producing quality woollens,

(1) permitted the spinning wheel (and carded wools) *only* for the weft yarns,

(2) thus stipulating that the stronger warp yarns had to be spun from combed wools on the rock and distaff.

vi) **The Saxony Wheel:** In the later fifteenth century, carded warp yarns could now be spun by a significant improvement in the spinning wheel, the addition of the Saxon Flyer:

(1) the addition of a separate bobbin, independent of the spindle, which was driven at a different speed by the same belt, but now looped in a figure-eight fashion.

(2) the yarn spun by the rapidly rotating spindle was then automatically wound on to the belt-driven bobbin, without having to stop the wheel, thus permitting a more even a continuous motion, which permitted a stronger and more evenly spun yarn.

d) **Weaving:**

i) **The original and ancient European implement was the vertical, warp-weighted loom:**

(1) This a small, narrow, upright loom, with the warps attached to a top beam and to stone-weights at the bottom (or weights of bone, clay, etc., tied to the bottom of the warp yarns);

(2) The weavers on this loom were exclusively women;

(3) productivity, output, and quality were low.

(4) The cloths woven on this loom, though fairly wide, were necessarily very short -- no longer than the height of the loom.

ii) **The horizontal loom:** appeared sometime in the eleventh century, as the first and perhaps most important technological innovation in the medieval textile industry.

(1) It produced a far longer cloth - up to 30 yards or more long;

- and one that was far more compactly and evenly woven, of much higher quality;
- and it was evidently responsible for producing Europe's first genuine and high-quality woollen cloth. [More on that later].

(2) First described by the Jewish rabbi Rashi of Troyes, ca 1070 AD: possibly eastern in origin.

(3) The new feature was a set of foot-powered treadles operating looped bands, called heddles,

- which alternately raised and separated groups of warps to permit the passage of the weft yarns,
- unravelling from a bobbin placed inside a wooden container called a shuttle.

(4) The original horizontal loom was narrow, narrower than the warp-weighted loom;
(5) but subsequently -- perhaps in the later twelfth or thirteenth century -- this loom was enlarged in width, to about two to three-yards, thus requiring two seated weavers;
(6) accompanying that change was also gender change,

- as weaving became almost predominantly a male occupation
- partly because weavers were the chief industrial entrepreneurs
- and partly because weavers were also part of armed urban guild militias.

iii) **The basic weaving process:** in producing a woollen broadcloth
(1) The warps for this loom were about 30-35 yards long:

- first wound onto pegs on a large board;
- and from there separate bundles of parallel warps were wound onto the warp beam.

(2) the horizontal loom (see images in the appendix, on the lectures web page)

- with the warps wound on to the warp beam at the bottom end,
- passing through looped heddle-harnesses and the comb-like slay,
- to be wound on to the cloth beam at the top.

(3) In the weaving process,

- one male weaver operated a foot-treadle, linked to the leather harnesses,
- attached to which were the aforementioned heddle loops, which opened or pulled apart alternating warps;
- and he then passed the weft-bearing shuttle through the opened warps (called a 'warp shed') to the weaver on the other side of the loom;
- as the shuttle passed through the warps it unravelled the weft yarn from the bobbin within.

(4) The weavers then used a flat wooden blade or 'sword' [weft-beater] to beat the weft up into the fell of the cloth on the cloth boom, then rotating the cloth beam to wind on the woven woollen.
(5) Two weavers could produce in this fashion only about 20 - 25 broadcloths a year: in England, a fully finished broadcloth measured 24 yards in length and 1.75 yards in width.

e) **Fulling and Felting the Woven Woollen Cloth:**

i) **Fulling was a complex, multi-stage process that determined the density,** weight, and luxury quality of the true woollen.

iii) **There were three main components of fulling:**

(1) **Scouring** the woven cloth, to remove all the butter, grease, warp-sizing (a paste added in weaving), and dirt.
(2) **Felting:** -- the same process as producing a felt hat:

- to force the very fine short-fibred wools of the woollen yarns to intermingle, mesh or mat, and interlock, and thus given the cloth its necessary cohesion and strength.
- without such felting, the woollen cloth removed from the loom would soon develop tears and holes, and perhaps fall apart.

(3) **Shrinkage and Compression:** At the same time, fulling not only

- felted the cloth in this fashion,
- but shrunk and compressed the cloth,
- thus promoting greater cohesion,
- and explaining its heavy weight (i.e., its density per sq yard).

(4) **Cloths were normally shrunk** as follows:

- about 30% in length, 35-40% in width,
- and thus up to 60% in surface area (at least 50%).

iii) **Cloth weights and durability:** a function of compression in fulling woollens

(1) a standard English broadcloth (24 yds by 1.75 yds) weighed 60 lb. [=27.25 kg] when finished (or about 1.45 lb. per square yard, vs. about 0.90 lb. per sq yd for today's heaviest woollens).

(2) That cloth was, thanks to the fulling process of felting and compression, so durable that it could last a lifetime or more; and cloths were frequently recorded in wills and bequests for inheritance.

iv) **The Traditional Method: Foot-Fulling**

(1) The woven cloth, directly from the loom, was placed into a large stone or wooden vat, filled with warm water, butter, and a chemical called fullers' earth (kaolin: an aluminum hydroxide);

(2) this chemical combined with the butter to form a cleansing and scouring soap.

(3) two journeymen, supervised and often assisted by a master fuller,

- climbed into this vat and then stomped upon and trampled the cloth,
- alternating the scouring and washing processes
- and then retrampling the cloth during the several days that this process required.

(4) Depending upon the size and quality of the woollen cloth and the season (winter vs. summer), this process, the labour of two full time journeyman and the master part time, could take from three to five days.

iv) **The introduction of the water-powered fulling mill:** to provide the only important powered mechanization of cloth production before the modern industrial revolution.[11]

(1) This topic is discussed below, under the heading of 'Industrial Innovations'

(2) Though first appearing in Italy, in the late tenth century, and thereafter spreading to northern Europe, its use was resisted in the upper-echelon luxury woollen industries,

- especially in the late-medieval Low Countries,
- for fear that it would impair (harm) the luxury quality of these broadcloths made from very fine, delicate wool fibres.

v) **Tentering:** completed the fulling process (by either method):

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[11] See John Munro, 'Industrial Energy from Water-Mills in the European Economy, 5th to 18th Centuries: the Limitations of Power', in Simonetta Cavaciocchi, ed., *Economia ed energia, seccoli XIII - XVIII***,** Atti delle 'Settimane di Studi' e altrie Convegni, Istituto Internazionale di Storia Economica, 'Francesco Datini da Prato', vol. 34 (Florence, Le Monnier: 2003), pp. 223-69; and John Munro, 'Industrial Entrepreneurship in the Late-Medieval Low Countries: Urban Draperies, Fullers, and the Art of Survival,' in Paul Klep and Eddy Van Cauwenberghe, eds., *Entrepreneurship and the Transformation of the Economy (10th - 20th Centuries): Essays in Honour of Herman Van der Wee* (Leuven: Leuven University Press, 1994), pp. 377-88.

(1) The wet fulled-cloth was then stretched on to large open-air frame, by hooks -- tentering hooks -- attached to all four sides of the cloth; and was allowed to dry in the sun.

(2) The stretching removed any wrinkles and folds produced by the fulling process; and also permitted the fullers to repair any minor damages to the cloth.

(3) This stretching also restored some of the dimensions lost through compression in fulling.

e) **The Finishing Process: Raising (Teaseling) and Shearing:**

i) **Raising, Napping, or Teaseling:**

(1) The device used for this process was a very prickly plant, called a teasel;

(2) a collection of teasels were packed into a small wooden frame resembling a tennis racket.

(3) The cloth finisher or shearer than pushed this device across the face of the cloth, now dried and hung on a pole.

- Preliminary napping could occur on the tentering frame.
- the object was to raise the nap of the cloth, to lift up all the straggly loose ends of the wool-fibres, to be shorn.

(4) In the fifteenth century, this process also came to be mechanized, with water-powered gig-mills that rotated mechanical burs across the cloth;

- there was widespread opposition to this device: on grounds that it injured the cloth or did an inferior job;
- also on the grounds that it displaced skilled workers, achieving the task in far shorter time.

ii) **Shearing:** the shearer then placed a section of the cloth on a flat but sloping table and cut or cropped this raised nap using razor-sharp shears whose steel blades were about 18 inches long (in a U-shaped steel bowspring).

iii) **This process of napping and shearing was repeated several times:** obviously requiring a very high degree of skill to crop the cloth evenly without damaging it.

iv) **This combination of the felting in fulling, and the napping and shearing in cloth-finishing,**

- therefore totally obliterated any sign of the weave – any that remained after fulling
- and produced a cloth texture that was almost as fine as silk.

e) **Dyeing:**

i) **Dyeing could take place in any of three forms:** dying the wool, dying the yarns, and dying the piece, after the cloth was shorn; and most involved the first and third forms

ii) **The European woad plant (related to indigo) provided a blue dye, as the chief dye:**

(1) it was normally first applied to the prepared wools, because it was the one and only dye that did not require a chemical fixing agent, called a mordant, to fix the dye to the wool fibres

(2) Woad served as the foundation dye for a wide variety of colours: various shades of blues, blacks, browns, purples, greens, and even reds, when the cloth was subsequently redyed in the piece

iii) **Madder, from another European plant, provided the basic red dye;** and usually madder-dyers were separate from woad-dyers.

iv) **Kermes:** the most expensive dye, scarlet, extracted from the eggs of certain Mediterranean insects (shield-

lice) that fed on Mediterranean oaks; the kermes-scarlet dye on the woollen was often worth more than the raw woollen itself.[12]

f) **The historical importance of the heavy, fulled woollen:**

i) **These heavy-weight felted or fulled and shorn woollens were the predominant European textile from the later thirteenth century to about the sixteenth century;** and even after, they remained very important until the eighteenth century.

ii) **A very rapid decline then followed,** certainly from the early 19th century, and they really have not been made (not in this precise fashion) since then: except for the papal curia (cardinals) in Rome, who on ceremonial occasions wear scarlet broadcloth woollens (not silks).

3. **<u>The Medieval and Early-modern Worsted and Worsted-Woollen Industries: the Light Draperies</u> [Topic to be given in the second term]**

a) **Worsteds, and semi-worsted fabrics**: the precursors of the so-called New Draperies.

i) **In the early Middle Ages, at least in northern Europe, worsteds,** including mixed worsted and woollen fabric, had been the predominant wool-based textile, rather than the true woollens.

ii) **The characteristics of worsteds in terms of wool fibres:** in contrast to true woollen fibres:

(1) Much tougher but thinner, coarser, straighter, and generally longer fibres, always combed

(2) These worsted wools contained their own natural animal oils, because the yarns were not thoroughly scoured; and they did not require additional greasing -- i.e., worked 'dry'

iii) **These characteristics permitted the combed worsted-wools to be spun into very strong yarns,** which provided the woven cloth with sufficient cohesion and strength to obviate any necessity to full them -- beyond a cursory fulling purely to cleanse the woven cloth.

iv) **When taken down from the loom,** these worsted fabrics were sufficiently strong and durable to be sold for everyday wear;

(1) but they would not wear for a lifetime,

(2) and thus they were not as durable as a true fulled woollen.

v) **The cloth was indeed finished when woven:** and thus no fulling, napping, or shearing.

vi) **The finished cloth had a very distinguishable weave;**

(1) and part of the fashion design lay in the weave patterns,

(2) often in the form of diamonds or lozenges (twills).

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[12] See further on this question: John Munro, 'The Medieval Scarlet and the Economics of Sartorial Splendour,' in *Cloth and Clothing in Medieval Europe: Essays in Memory of Professor E. M. Carus-Wilson*, ed. Negley B. Harte and Kenneth G. Ponting, Pasold Studies in Textile History No. 2 (London: The Pasold Research Fund and Heinemann Educational Books, 1983), pp. 13-70; reprinted in John Munro, *Textiles, Towns, and Trade: Essays in the Economic History of Late-Medieval England and the Low Countries*, Variorum Collected Studies series CS 442 (Aldershot, 1994). See also John Munro, 'The Anti-Red Shift – to the Dark Side: Colour Changes in Flemish Luxury Woollens, 1300 - 1550', *Medieval Clothing and Textiles*, 3 (2007), 55-95; available on my website for my Working Papers: http://www.economics.utoronto.ca/munro5/Working Papers.htm.

vii) **As a consequence of the fibres themselves and the absence of fulling (i.e., with no shrinkage and compression),** worsteds were much lighter cloths, only about one-quarter to one-third the weight of a fulled woollen cloth.

viii) **They were also generally a much cheaper textile:**

(1) less costly than true woollens because they used much coarser and thus

(2) cheaper wools, a smaller quantity of wools, with much less labour.

b) **Semi-worsted fabrics or worsted-woollen hybrids:** with mixed yarns

i) **They were composed of two different yarns:** a worsted warp and a woollen weft

(1) The warp yarns, for reasons already explained, had to be the stronger yarn;

- worsted yarns were stronger than woollen yarns,
- while the weft would be made from short-stapled woollen yarns

(2) Because of the woollen-weft yarns, which were normally greased, these cloths underwent some fulling, though far less extensive than for true woollens.

ii) **They were about mid-way between true worsteds and true-woollens:** in both weight and quality, and thus in price.

c) **International Trade in Worsteds and Mixed Fabrics:** as cheaper, lighter cloth:[13]

i) **Though the vast majority of these textiles were produced,** in medieval Europe, for domestic and local or regional consumption, nevertheless large quantities of them also entered in international trade.

ii) **During the twelfth, thirteenth, and very early fourteenth century,** they enjoyed quite some considerable prominence in international trade, especially in the Mediterranean basin, during the twelfth and thirteenth centuries: the most popular of these worsted-based textiles were known as says (*sayetteries*).

(1) in particular because the generally warm or hot climate of this region made it more receptive to light

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[13] See further on these issues in: John Munro, 'Industrial Transformations in the North-West European Textile Trades, c. 1290 - c. 1340: Economic Progress or Economic Crisis?' in *Before the Black Death: Studies in the 'Crisis' of the Early Fourteenth Century*, ed. Bruce M. S. Campbell (Manchester and New York: Manchester University Press, 1991), pp. 110 - 48. Reprinted in John Munro, *Textiles, Towns, and Trade: Essays in the Economic History of Late-Medieval England and the Low Countries*, Variorum Collected Studies series CS 442 (Aldershot, 1994); John Munro, 'The Origins of the English 'New Draperies': The Resurrection of an Old Flemish Industry, 1270 - 1570,' in *The New Draperies in the Low Countries and England, 1300 - 1800*, ed. Negley B. Harte, Pasold Studies in Textile History no. 10 (Oxford and New York: Oxford University Press, 1997), pp. 35-127; John Munro, 'Patterns of Trade, Money, and Credit,' in *Handbook of European History in the Later Middle Ages, Renaissance and Reformation, 1400 - 1600*, Vol. I: *Structures and Assertions*, ed. James Tracy, Thomas Brady Jr., and Heiko Oberman (Leiden: E.J. Brill, 1994), pp. 147-95; John Munro, 'The Low Countries' Export Trade in Textiles with the Mediterranean Basin, 1200-1600: A Cost-Benefit Analysis of Comparative Advantages in Overland and Maritime Trade Routes', *The International Journal of Maritime History*, 11:2 (Dec. 1999), 1 - 30; John Munro, 'The "New Institutional Economics" and the Changing Fortunes of Fairs in Medieval and Early Modern Europe: the Textile Trades, Warfare, and Transaction Costs', *Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte*, 88:1 (2001), 1 - 47; John Munro, 'Gold, Guilds, and Government: The Impact of Monetary and Labour Policies on the Flemish Cloth Industry, 1390-1435', *Jaarboek voor middeleeuwsche geschiedenis*, 5 (2002), 153 - 20; John Munro, 'Medieval Woollens: The Western European Woollen Industries and their Struggles for International Markets, c.1000 - 1500,' in David Jenkins, ed., *The Cambridge History of Western Textiles* (Cambridge and New York: Cambridge University Press, 2003), chapter 5, pp. 228-324, 378-86 (bibliography).

textiles.

(2) High population densities and especially urban concentrations provided commercial economies of scale and low transaction costs that made it economic to market cheap textiles.

iii) **During the later Middle Ages fourteenth and fifteenth centuries),** however,

(1) the chronic and debilitating warfare -- the era of the Hundred Years' War -- and especially taxation and commercial embargoes -- along with disruptions and contractions in markets

(2) raised the level of transport and transaction costs to levels that proved to be prohibitive for long-distance trade in cheap textiles, especially from north-west Europe to the Mediterranean basin (to repeat, the chief market for such textiles).

iv) **International trade in textiles was consequently more and more oriented towards luxury woollens and silks:**

(1) For the very high values and thus prices of these luxury textiles allowed them to sustain these increases in transport and transaction costs much more easily than the cheap textiles.

(2) At the same time, a more highly skewed distribution of wealth and incomes may have similarly favoured a relative shift from the cheaper to more costly textiles.

v) **The early-modern revival of the worsted-based cheap textiles:** the *sayetteries*

(1) Not until the very late fifteenth and sixteenth centuries, when greater economic and political stability prevailing, with demographic and economic recovery, did the worsted-based cheaper, lighter textiles regain their former role in western European industrial production and international trade.

(2) Thus the economic and political conditions of international trade in the sixteenth century, provided relatively greater security, a relative fall in transport and transaction costs, and possibly a more favourable income distribution in textile markets.

vi) **The initial revival:** came with and during the recovery and expansion of the aforesaid sayetteries in the Low Countries during the later fifteenth and sixteenth centuries

vii) **With the outbreak of the Revolt of the Netherlands in the 1560s,**

(1) Flemish Protestant refugees, fleeing Spanish Catholic persecutions and the ravage of their homeland,

(2) fled both northward to independent Holland and westward, across the English Channel, to England,

(3) to East Anglia in particular, where they reintroduced these worsted-based industries as the so-called New Draperies.

4. **<u>Industrial Organization: The Putting-Out or Domestic or Cottage System of Production</u>**

a) **This was the predominant form of industrial organization in pre-modern manufacturing industry, and especially in textiles**:

i) **especially,** although not uniquely for rural industries;

ii) **again you cannot understand the importance of the great changes wrought by the Industrial Revolution, by the urban factory system in particular,** unless you understand the pre-modern putting-out system, which was so widespread in late-medieval and early modern western Europe, especially in the textile trades.

iii) **In essence,** it was an amalgam of mercantile capitalism with peasant (or urban) handicraft production.

b) **The Clothier or Draper**: **the merchant draper**

i) **dominated this system,** as the merchant-entrepreneur or merchant capitalist who basically financed the production, while subcontracting the industrial production, and allowing the workers to work in their own homes with their own tools or capital.

ii) **He begins by buying raw wool from the wool merchants (broggers):**

(1) which he gives to his hired employees for preparation: for cleansing and sorting (by staple length).

(2) the short-stapled wools for true woollens would then be greased (butter, oil) to facilitate all the following production processes: to reduce friction and prevent entangling.

iii) **Many of these prepared wools would then be taken to a dyer for blue-dyeing:**

(1) blue (woad, indigo) provided the foundation colour for a wide range of other colours (blacks, browns, purples, greys, greens, etc.), which were subsequently applied after the cloth had been woven and fulled.

(2) Note that dyeing could take place at three different stages:

- for blue dyes (woad, indigo), in particular, in the wool, itself: i.e., after the wool had been cleansed, but before the combing, carding, and spinning processes to produce the yarns (for both warp and weft)
- in the spun yarn: i.e., after spinning, but before weaving
- and in the piece: after the cloth had been woven, fulled, napped, and shorn (sheared), i.e. fully manufactured
- thus cloths, whose wools had first been dyed blue (woad, indigo), were then redyed in various other colours ‘in the piece’, to produce as noted: blacks, browns, purples, greens, etc.

iii) **When the wools had been so prepared,** and if necessary blue-dyed, they were then put-out to various textile workers to be made up into cloth.

(1) Hence the name ‘putting-out’ system.

(2) Alternative names for this system, such as ‘domestic system,’ and ‘cottage system,’ arose from the fact that much of the following stages of production took place in the cottages or homes of textile workers (rural or urban): not in industrial workshops.

c) **The Weavers**: **Or Weaver-drapers**: provide the next and crucial link in the ‘putting-out’ system, as the crucial industrial sub-contractors, working for the merchant-draper.

i) **In so many regions of later-medieval Europe,** weavers came to assume the role of industrial entrepreneurs:

(1) but there is no hard and fast rule, for in certain places at certain times, we can find that it is instead fullers, dyers, shearers, or merchants who undertake this industrial role.

(2) For this model, however, we will stick to the weavers for the sake of simplicity.

ii) **In general, these draper-entrepreneurs received the wools from the clothiers and put them out for production:**

(1) organizing and overseeing the physical processes of cloth manufacture, from wool-carding to fulling (though many clothiers also served as weavers).

(2) thus serving, in a sense, therefore, industrial sub-contractors or lesser industrial entrepreneurs.

iii) **They themselves did not receive any wages but had to earn a profit:** they, bought the wool on credit, incurred production costs (largely wages), and then sold the manufactured cloth to the clothier.

iv) **They put the wool out for production as follows, to various workers, who receive piece-work wages (i.e., according to their output):**

(1) first: the wools were given to workers who further prepared them for spinning:

- i.e., by combing and/or carding -- combing for warp yarns, and carding for weft yarns in many cloths.
- both male and female workers, though predominantly female.

(2) The combed or carded wools were then taken by weaver to the spinners, an entirely female group of workers, using a hand-powered spinning wheel, spinning one yarn at a time.

(3) In the fifteenth century, one weaver generally employed about 8 carders and combers and about 8 spinners.

(4) The Medici woollen workshop accounts of the mid 16th century indicate that :

- the combination of wool preparation, combing/carding, and spinning accounted for two-thirds (67%) of pre-finishing manufacturing costs (i.e., labour value-added costs).
- But these data are somewhat skewed in that fulling + tentering costs, in using water-powered machinery, were only about 5% – compared to about 20% for foot-fulling, in the Low Countries' urban draperies.

(5) The weaver then took back the spun yarns for weaving:

- the warps were wound on warping-pegs and then ends were tightly stretched on the horizontal loom, by warpers;
- and the weft yarns are coiled and placed into the weaver's shuttle, unwinding with the passage of the shuttle back and forth through the warps, from side to side of the loom,
- thus effecting the actual weaving of the cloth.

(6) For luxury quality broadcloths, weavers worked in pairs, with one passing the shuttle to the other, from side to side, about 2.5 to 3 yds.

- In so doing, they worked a series of treadles or pedals to operate the heddles,
- which separate the alternate series of warps, to allow passage of the weft-bearing shuttle (which feeds out the weft yarn as it passes),
- and then close these warps in order to lock the weft in place.

(7) Weaving a full broadcloth (whose finished dimensions were 24 yds by 1.75 yds):

- normally took about two weeks:
- and thus weavers produced about 20 - 25 such woollens a year.

v) **From weaving to fulling:** The woven cloth was then removed from the loom and taken to another important industrial artisan, the fuller, also employed by the fuller for piece-work wages or fees.

d) **Fulling**: commenced the finishing process for true woollens

i) **The Woven cloth was placed in a vat containing water and chemicals,** principally 'fuller's earth'

(kaolin: hydrous silicate of alumina, or aluminum hydroxide), butter (or olive oil in Italy), and human urine (which combined with grease to form a soap): as noted earlier

ii) **As noted above,** the age-old traditional process required two men to trample upon the cloth in this vat for about three days;

iii) **but in England and elsewhere,** foot-fulling was displaced by water-powered fulling mills, which accomplished this task in a matter of hours, or a day at the most.

iv) **Purpose of fulling, as stressed before, was**:

(1) to scour and cleanse the cloth, to eliminate all the grease and dirt; and then

(2) to felt the cloth, by forcing the fine, scaly, curly fibres to interlace and mat together, to given the cloth its necessary cohesion, and strength; and finally,

(3) to shrink and compress the cloth, giving it greater density and weight per square foot (or m^2): fulling shrunk the cloth up to 50% or even more in area.

iv) **From fulling to tentering:**

(1) Once the cloth had been fulled, the fullers and their assistants then stretched the cloth out to dry on a large wooden frame, a tentering frame (held by tenter hooks);

(2) stretched indeed quite severely stretched to remove any wrinkles and restore some of the shrunken, lost dimensions.

(3) During this stage, the fuller and his assistants (burlers) repaired any minor holes, removed knots or burs, shearing off any loose ends (while the cloth was still wet: hence the term 'wet-shearing').

(4) My estimates based on 15th century Flemish and Dutch evidence is that this traditional process of foot-fulling accounted for about 20% of pre-finishing manufacturing costs (value added)

v) **The weaver, after paying the fuller, then sold the fulled woollen in this semi-finished form to the clothier,** who then had the choice of taking it to specialized artisans for finishing, or to the town cloth hall for sale to merchants.

vi) **In England,** cloth merchants frequently exported it to the Low Countries for final finishing.

e) **Cloth Finishing**: Raising, Shearing, and Dyeing: already discussed above

i) **The finishing processes, and especially the dyeing,**

(1) could add 20% to the wholesale price of the fully finished cloth;

(2) or could double the price in the case of scarlet-dyed woollens.[14]

ii) **Note that these cloth finishers were professional artisans who worked for clients,** who could be drapers or cloth merchants; they were not wage-earning industrial craftsmen

iii) **All these finishing/dyeing processes:** were therefore as much commercial as industrial.

f) **Observations on the General Nature of the Putting-Out System**:

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[14] For proof, see my recent publication: John Munro, 'The Anti-Red Shift – to the Dark Side: Changing Colour Patterns of Flemish Luxury Woollens, 1300 - 1550', *Medieval Clothing and Textiles*, 3 (2007), 55-95. This published version is also available online as a pdf file supplied by the publisher, for public distribution. Go to my on line Working Papers website: http://www.chass.utoronto.ca/~munro5/WorkingPapers.htm

i) **Much of the fixed capital costs was borne by the cloth artisans and workers themselves rather than by the clothier:**

(1) almost all of the production processes were carried out in homes of the artisans,

(2) who generally used their own tools: cards, combs, spinning wheels, looms, dyeing vats, shears

ii) **Mechanical Fulling provided one obvious exception:**

(1) these water-powered fulling mills, by which the water wheel converted rotary power into reciprocal power to operate the fulling stocks: two powerful oaken hammers that alternately pounded the cloth: to be discussed in more detail, below

(2) and also, attached to the same water-mills, water-powered gig-mills for raising the nap on the cloth, before shearing,

(3) these mills were often owned or leased by the greater clothiers.

iii) **Furthermore, some clothiers also owned large factory-like workshops for wool preparation;** and many owned several weaving looms, which were operated outside their homes (perhaps in workshops).

iv) **But by and large the average Flemish or English draper or clothier was much more a merchant capitalist than an industrial capitalist;**

v) **and the artisans in this putting-out or domestic system of production were not divorced from their own means of production:** indeed the important point to be noted here is that:

(1) most artisans worked in their own homes or cottages using their own tools (as capital)

(2) in other words, the fixed capital costs were shifted to the artisans themselves

(3) in modern capitalist production, in modern manufacturing industries, labour – e.g., factory workers – do not own their own tools or any other inputs, and work in a factory owned by capitalist

(4) and so, in Marxist terminology, under modern industrial capitalism, labour owns nothing and has nothing to sell but its own labour services

iv) **As noted earlier, much of the labour in this industry was supplied by rural part-time workers:**

(1) especially the wool-workers, carders, combers, and spinners, most of whom were women;

(2) many weavers, generally male, were also part-time, but perhaps many more were full-time skilled artisans, as were fullers, dyers, and shearers.

v) **Since this labour was almost all unsupervised (i.e., working in their own homes):**

(1) wages were paid by output, piece-work (output), rather than by the hour;

(2) it is worth stressing that even with the advent of modern industrialization, textile workers continued to receive piece-work wages (certainly in Great Britain, in the 19th century).

g) **Industrial Scale and Productivity in the Cloth Industry**:

i) **In so far as the cloth industry was oriented towards exports,**

(1) it was characterized by a much more highly refined division of labour: with up to 30 highly specialized and separate industrial workers;

(2) most medieval and early-modern handicraft industries were not so oriented to export markets, and thus experienced a much lesser degree of such ‘division of labour’,

(3) i.e., with specialized tasks, each feeding into the other

ii) **As Adam Smith noted,** the division of labour is determined by the scale of market.

iii) **Nevertheless, extensive division of labour did not make this industry either large-scale or** capitalistic (capital-intensive): it was instead a highly labour-intensive industry (even if raw materials accounted for 65% to 80% of the final wholesale price), in terms of labour value added to costly raw materials.

iv) **The industry in general was very small scale in the form of widely scattered units of production,** rural and urban (with most carding, combing, and spinning rural in location).

v) **Productivity**:

(1) in the textile industry was, as noted earlier, very low: a standard broadcloth (24 yds by 1.75 yds) took over two weeks to be woven, with perhaps another week added for other processes of production.

(2) About 30-35 people needed to produce just one broadcloth: including 2 weavers, 2 warpers, 8 carders, 8 spinners, and others.

(3) And this did not change before the 19th-century Industrial Revolution (according to an 18th-century Parliamentary study on the wool industries).

h) **Innovations and Mechanization:**

i) **As the historical survey of cloth production has indicated,** the medieval woollen textile industry underwent several very significant, productivity-increasing innovations, whose relative impact was comparable to that of the eighteenth century Industrial Revolution in cotton textiles

ii) **the major medieval and early modern innovations in textiles, to summarize them briefly, in chronological order of their appearance:**

(1) water-powered fulling mills, first appearing in Italy in the late tenth century: discussed below as a separate topic.

(2) the horizontal loom, originally a narrow loom: introduced in the eleventh century, to displace the vertical warp-weighted loom

- by the later thirteenth century a broadloom, requiring two weavers, had been devised, to weave cloths that were up 3 yards wide on the loom

(3) water-powered silk-throwing machines, to produce silk yarns: in Italy (Bologna, Lucca), discussed below (later thirteenth century)

(4) cards and carding, for preparing the raw wools for spinning: introduced in the late thirteenth century

(5) the spinning wheel: introduced with carding in the late thirteenth century, but was chiefly reserved for carded wools for weft yarns, while warps, made from combed wools, continued to be spun on the traditional drop-spindle, to provide greater strength

(6) the water-powered gig mill, for raising the nap on cloth for shearing:

- introduced in the fifteenth century, and usually associated with fulling-mills;
- but strenuously resisted even in England.

(7) The Saxony spinning-wheel with the flyer: to permit continuous drafting, twisting, and winding on, with a separately rotated bobbin on which to wind the spun yarn.

(8) The stocking-frame: invented in England by William Lee in the 1590s: to knit hosiery

(9) The Dutch swivel loom: also introduced (from Holland) in the late sixteenth century, to weave ribbons,

twelve of them simultaneously.

iii) **Water-powered fulling-mills:** industrial mechanisation[15]

(1) This is the only important example of industrial mechanisation in textiles, along with silk-throwing machines, to appear in western Europe before the eighteenth-century Industrial Revolution

(2) As noted earlier, mechanized fulling appears around the tenth century, first in Italy, and from there spreading to north-western Europe, or at least to England, by the later twelfth and thirteenth centuries:

(3) **A water-wheel** -- often simply a grain-mill converted into a fulling mill:

- was connected by a camshaft to a drum with two tappets that alternately raised and lowered two heavy wooden hammers, oaken hammers,
- which pounded the cloth up to 40 times a minute.
- Note that this rather complicated device converted the rotary motion of the water-wheel into reciprocal power, to move the fulling hammers up and down.
- This may have been the first industrial application of the water-mill (i.e., apart from grinding grain into flour),
- and also the first use water wheels to convert its essential form of power, rotary power, into reciprocal (up and down) power

(4) Two types of water-mills came into use for fulling: undershot and overshot wheels

- **the undershot-wheel:** the original form of the water-mill: was placed directly into the stream or river, so that wheel rotated by the action of the river-flow against a set of wooden slats or paddles attached to the river, and its power depended on the speed of the flow.
- **the overshot-wheel:** wooden buckets were instead attached to the wheel, to receive the flow of water poured down on the wheel & its buckets from above
- this was a much more capital costly piece of equipment because it required canals, sluice-gates and water troughs to carry the water from the river, upstream, to the mill
- but this provided considerably more power than did the smaller undershot wheels, and could be employed on any slow moving stream

(5) A single fuller operating a mill could produce a fully-fulled cloth in a day or less; and that provided about a 3.3 fold increase in productivity (or a 70% cost saving).

(6) Mechanical fulling came to dominate the English cloth industry by the fourteenth century:

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[15] See: John Munro, 'Industrial Energy from Water-Mills in the European Economy, 5th to 18th Centuries: the Limitations of Power', in Simonetta Cavaciocchi, ed., *Economia ed energia, seccoli XIII - XVIII,* Atti delle 'Settimane di Studi' e altrie Convegni, Istituto Internazionale di Storia Economica, 'Francesco Datini da Prato', vol. 34 (Florence, Le Monnier: 2003), pp. 1-47. Also available on-line, as a Working Paper, at: http://www.economics.utoronto.ca/ecipa/archive/UT-ECIPA-MUNRO-02-01.html**;** and John Munro, 'Industrial Entrepreneurship in the Late-Medieval Low Countries: Urban Draperies, Fullers, and the Art of Survival', in Paul Klep and Eddy Van Cauwenberghe, eds., *Entrepreneurship and the Transformation of the Economy (10th - 20th Centuries): Essays in Honour of Herman Van der Wee* (Leuven: Leuven University Press, 1994), pp. 377-88; and John Munro, 'Gold, Guilds, and Government: The Impact of Monetary and Labour Policies on the Flemish Cloth Industry, 1390-1435', *Jaarboek voor middeleeuwse geschiedenis,* 5 (2002), 153 - 205.

- some historians regard the use of such fulling mills as a contributory element to the ultimate victory of the English cloth industry and its export trade.
- but I consider this view to be much exaggerated: many other factors (especially taxation) were more important for that final English victory

(7) As also noted earlier, this innovation was also resisted in many areas:

- in the later-medieval Low Countries especially, after their re-orientation towards the higher-priced more luxury oriented woollens,
- for fear that the process would impair the quality and durability of these delicate cloths.

(8) During the sixteenth century, however, when the structure of the Low Countries' textile industries had again changed, to favour cheaper textiles, fulling-mills did indeed come to be used in the lower-quality draperies of the Low Countries (as they had been in the thirteenth century)

iv) **the fifteenth-century gig mill also used water-power,**

(1) indeed in conjunction with the fulling-mill, its use, as briefly noted above: in napping

- using a water-wheel to rotate or move a box of cards (thistle-like plant) across the face of the cloth,
- in order to raise up the 'nap': the loose ends, loose fibres, to be shorn

(2) but its use was widely resisted on perhaps two grounds

- technological unemployment; but more likely
- quality considerations: that it tended to damage the cloth, much more so than the use of hand-held cars
- and it was thus very slow to spread.

v) **Although all these innovations greatly increased labour-productivity,** only one of them actually improved quality: namely the horizontal loom.

vi) **The later- medieval draperies had perfectly rational reasons for resisting the others,** including the just-discussed fulling-mills, again on the grounds that they impaired quality, and at a time when the international markets favoured higher-quality luxury-oriented textiles (during the fourteenth and fifteenth centuries).

vii) **This is the major difference between the medieval and modern textile innovations:**

(1) most of the medieval innovations impaired quality while the modern ones greatly improved quality.

(2) Thus, in the late-18th century Industrial Revolution in cotton textiles, the steam-powered 'mule' could produce not only much stronger but far finer cotton yarn than any European wheel-spinners.

viii) **The medieval silk industry, however, also developed water-powered machinery:**

(1) as listed above, the water-powered silk-throwing machines, for producing silk yarns: i.e., a device for drawing or drafting silk fibres from the silk cocoons

(2) They are first found at Bologna from 1272;

(3) and thereafter in Lucca, and then elsewhere in Italy and France.

(4) They finally are introduced into England, in 1720

5. <u>The Role of Guilds in Medieval Woollen Textile Industries:</u>

a) **The question of guilds in the textile industries**: how important were they in the medieval woollens industries?

i) **in so far as parts of the industry had or came to have rural locations,** guilds were virtually absent in countryside: i.e., in rural agricultural villages

ii) **but much textile production still remained urban,** where we do find guilds, which remained especially powerful

(1) in the Flemish, Brabantine, and Dutch textile towns, in the Low Countries

(2) In the French cloth industries, especially in the north-west

(3) in the Italian cloth industries.[16]

iii) **In English and Flemish drapery towns there were only four major textile guilds,** all of which were male dominated: weavers, fullers, dyers, and shearers (cloth finishers).

b) **Flemish and English Urban Guilds in the Woollen Cloth Industries:**

i) **weavers guilds**:

(1) they were dominated by the master weavers, who generally also functioned as weaver-drapers,

(2) i.e., as those minor industrial entrepreneurs who organized production and themselves hired labour and whose income was in the form of profit not wages;

(3) but weavers guilds also included those master-weavers who had become hired employees of other drapers, and included also the hired journeymen and weaving assistants.

ii) **fullers**:[17]

(1) the one association or guild that came to resemble a modern labour union, for both the masters and the journeymen;

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[16] This lecture, as will be noted, almost entirely neglects the Italian textile industries, for reasons of space rather than of the professor's personal ignorance. On the contrary, I have recently produced a very lengthy working-paper on the history of the Italian cloth industries, from about 1200 to the 1730s (as part of a book on the history of the West European woollen industries: '*The Rise, Expansion, and Decline of the Italian Wool-Based Textile Industries, 1100 - 1730: a study in international competition, transaction costs, and comparative advantage':* Department of Economics Working Paper no. 440 (2011-10-17), accessible at: http://www.economics.utoronto.ca/index.php/index/research/workingPaperDetails/440. An earlier, shorter version was published (in condensed form) in Italian translation, as: John Munro, 'I panni di lana' in Angelo Colla (editor in chief), *Il Rinascimento italiano et l'Europa*, vol. IV: *Mercanti e cultura mercantile*, ed. by Franco Franceschi, Richard Goldthwaite, and Reinhold Mueller (Fondazione Cassamarca: Treviso, 2007), pp. 105-41. For the later Venetian cloth industry, see John Munro, 'South German Silver, European Textiles, and Venetian Trade with the Levant and Ottoman Empire, c. 1370 to c. 1720: A Non-Mercantilist Approach to the Balance of Payments Problem**',** in Simonetta Cavaciocchi, ed., *Relazioni economiche tra Europa e mondo islamico, secoli XIII - XVIII/ Europe's Economic Relations with the Islamic World, 13th - 18th Centuries*, Fondazione Istituto Internazionale di Storia Economica 'Francesco Datini', Atti delle 'Settimana di Studi' e altri convegni, no. 38 (Florence: Le Monnier, 2007), pp. 907-62.

[17] See John Munro, 'Gold, Guilds, and Government: The Impact of Monetary and Labour Policies on the Flemish Cloth Industry, 1390-1435', *Jaarboek voor middeleeuwsche geschiedenis*, 5 (2002), 153 - 205; and also John Munro, 'Industrial Entrepreneurship in the Late-Medieval Low Countries: Urban Draperies, Fullers, and the Art of Survival,' in *Entrepreneurship and the Transformation of the Economy (10th - 20th Centuries): Essays in Honour of Herman Van der Wee*, ed. Paul Klep and Eddy Van Cauwenberghe (Leuven: Leuven University Press, 1994), pp. 377-88.

(2) for as noted, certainly as far as traditional foot-fulling was concerned, especially in the Low Countries, these fullers all were employed by weaver-drapers for piece-work wages;
(3) and in the Low Countries, these wages came to be determined by the town governments, often dominated by weaver-drapers.
(4) But in Low Countries, weaver-fuller disputes over wages were frequent: and often had to be determined by strikes, by which the fullers left the town (walk-outs).
iii) **shearers and dyers guilds**: the cloth-finishing guilds
(1) these were composed of fully professional artisans, fully independent craftsmen, who worked on commission, for professional fees, for various clients: both drapers and merchants.
(2) They were the aristocracy of skilled labour in the textile industry;
(3) and their organizations were much more akin to modern professional associations: i.e., those for doctors, lawyers, architects, etc.

c) **the role of the textile guilds: positive or negative?**

i) much of the traditional literature on medieval has been highly negative, emphasizing the restrictive role of medieval urban craft guilds: the subject of a major first-term essay topic.[18]

ii) **the chief negative features cited are:**
(1) restrictions on entry, in order to raise wages or professional fees
(2) if not necessarily raising product prices – not when they were market-determined, especially in internationally market-oriented industries, then in raising costs, leading to prices in crafts that became engaged in price-making monopolistic competition
(3) restrictions and other inhibitions discouraging both industrial and commercial innovations: i.e. in both:

- industrial technologies and
- product types

iii) **I myself find the arguments and evidence supporting these negative views to be weak**, for reasons given in my publications, and others listed in the bibliographies for this topic on medieval guilds.

iv) **Instead, I have argued that, especially in the Flemish medieval cloth guilds (and others in the Low Countries), these guilds offered two major benefits:** [19]

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[18] This year, a B-list topic no. 4 (Topic no. 9 on the Master List): Urban Governments, Guilds, and Gender-Related Occupations in Late-Medieval European Towns, 1200 - 1500 . To be found on the course web page, for ECO 301Y.

[19] See in particular: John Munro, 'Industrial Entrepreneurship in the Late-Medieval Low Countries: Urban Draperies, Fullers, and the Art of Survival', in Paul Klep and Eddy Van Cauwenberghe, eds., *Entrepreneurship and the Transformation of the Economy (10th - 20th Centuries): Essays in Honour of Herman Van der Wee* (Leuven: Leuven University Press, 1994), pp. 377-88; John Munro, 'The Symbiosis of Towns and Textiles: Urban Institutions and the Changing Fortunes of Cloth Manufacturing in the Low Countries and England, 1270 - 1570', *The Journal of Early Modern History: Contacts, Comparisons, Contrasts*, 3:1 (February 1999), 1-74; John Munro, 'Gold, Guilds, and Government: The Impact of Monetary and Labour Policies on the Flemish Cloth Industry, 1390-1435', *Jaarboek voor middeleeuwse geschiedenis*, 5 (2002), 153 - 205; John Munro, 'Medieval Woollens: Textiles, Textile Technology, and Industrial Organisation, c. 800 - 1500', in David Jenkins, ed., *The Cambridge History of Western Textiles*, 2 vols.

(1) the imposition and enforcement of quality controls and quality improvement: especially necessary for price-making crafts (i.e., those engaged in monopolistic competition) engaged in luxury-oriented competition in international markets

(2) In providing the education and specific training skills necessary for those quality controls.

6. Industrial Location: Urban and Rural Orientations of the Woollen Industries [20]

a) **The later-medieval shift from urban to rural (village) location**

i) **A major feature of the later-medieval and early-modern textile industries,** in general, as was also true of many other industries, was an increasingly rural location: in small villages, where part or all of the manufacturing was done in the countryside as part of the rural, agrarian economy.

ii) **urban vs rural locations:**

(1) Although much cloth-making remained urban, especially for luxury production, the reasons why so much of the textile industries, collectively speaking, and other industries were rural in location (perhaps 50% of total industrial production) in the later-medieval and early-modern era are very important for understanding the significance of the later, modern Industrial Revolution:

(2) for the Industrial Revolution converted so much rural industry into urban industry, with different technologies and industrial organizations.

iii) **And even where textile manufacturing had retained an urban location,** it was generally still linked with rural industry, generally obtaining its yarn from rural spinners: thus still a mixed rural-urban industry.

b) **Traditional Historical Theories to Explain the Industrial Shift to Rural Locations**

i) **To escape urban restrictions was perhaps an initial reason for some industries**:

(1) Most medieval industries, in most countries or regions up to about the thirteenth century, had been predominantly urban, to escape manorial restrictions and to obtain free, non-servile labour.

(2) England, during the twelfth, thirteenth, and early fourteenth centuries had in fact possessed an export-oriented textile industry that was chiefly urban, rather than rural:

- located chiefly in the eastern lowland towns, from north to south:
- York, Louth, Beverley, Lincoln, Stamford, Northampton, Leicester, Huntingdon, Norwich, Colchester, Oxford, Winchester, and Gloucester in the south-west.

(3) But, according to many historians, much English cloth-making had deserted the towns for rural locations primarily, during the very late thirteenth and early fourteenth centuries, to escape restrictions and impediments imposed by urban craft guilds, enforced by town governments;

(Cambridge and New York: Cambridge University Press, 2003), Vol. I, chapter 4, pp. 181-227.

[20] See an elaboration of these views see again the publications cited in n. 18. Also in David Jenkins, ed., *The Cambridge History of Western Textiles* (Cambridge and New York: Cambridge University Press, 2003), in the same volume, 'Medieval Woollens: The Western European Woollen Industries and their Struggles for International Markets, c.1000 - 1500,'chapter 5, pp. 228-324, 378-86 (bibliography). An on-line version of chapter 4 can be be found at: http://www.economics.utoronto.ca/ecipa/archive/UT-ECIPA-MUNRO-00-05.html

(4) In my view, however, the more important reason for the decay of these urban industries was the same collection of factors that had brought about the contemporaneous destruction of similar textile crafts in the Low Countries and northern France, from the 1290s to the 1330s:

- the fact that most of the textile exported from these eastern towns went to the Mediterranean basin
- and, as with Flanders and northern France, most (if not all) were cheap, light textiles
- and thus this English export trade, especially that in the cheaper textiles, was also plagued by rising transport and transaction costs, as the consequences of the debilitating Mediterranean and European warfare from the 1290s
- as we saw those rising costs were much more serious for the trade in cheap textiles than in the luxury woollens and other fabrics

(5) In any event cloth making that did become established in rural locations were totally free of guilds, government regulations, and of most forms of taxation;

ii) **The supposed attraction of cheaper rural labour:** another reason

(1) But supposedly cheaper rural labour has been cited as another and even more powerful attraction

(2) By the fourteenth century, much rural labour had been free from servile bonds, so that it was much freer to engage in industry.

(3) absence of guilds: to restrict entry and raise wages or impose costly work regulations: a major reason already suggested for deserting the towns.

(4) lower cost of living in rural regions meant lower wages: since both the cost of farm-supplied food and housing was obviously much cheaper; workers in particular could grow and supply their own food cheaply; and absence of so many taxes found in towns also kept cost of living lower.

(5) that so much employment in textiles was part-time, supplementary: i.e., supplementary to basically agricultural employment.

(6) Since most rural workers were not totally dependent on industry, especially the female workers, they would offer their services at much lower wage-rates.

(7) Much of this rural industrial labour came from the cottager (or cottar) class of peasants, whom you have already seen in discussion of Enclosures: they had some strips of arable in the open fields, and common-field grazing rights for their livestock, but not enough land to support themselves fully.

- So in cottager families, some or all had to work at least part of the year elsewhere for wages, especially in rural industry: women in combing and spinning, men in weaving and fulling;
- and, given seasonal nature of agriculture, many above subsistence margin still welcomed extra income from industrial bye-employments in off seasons.

iii) **Access to Water and especially Water-Power**: cheaper, cleaner water, for the following requirements:

(1) water for cleansing the wools, for dyeing wools and cloths,

(2) water-power especially for fulling, which, in England, had become water-powered from about the thirteenth century, as previously noted (several times now).

iv) **But why was a rural location more desirable in using water?**

(1) because rural areas would more likely have had more free, unused water sites than would towns, with so

many competing demands for water; hence the opportunity costs of rural sites would be far lower than in urban locations.

(2) rivers flowing through countryside would be much cleaner than those portions passing through towns, with heavy pollution (or conversely dyeing would pollute water for other town uses).

(3) in England, streams and rivers in the upland or hilly rural areas:

- flowed more swiftly than in coastal lowland regions, where traditional urban cloth industries had been located;
- faster-flowing water permits more efficient, cheaper water-mills, using undershot wheels.

(4) Many manorial lords had already constructed water-mills which could be cheaply converted into fulling mills for textiles (especially with slump in grain agriculture in later Middle Ages).

(5) Nevertheless, even in England, we can find many examples of urban cloth industries, even in the lowland areas of East Anglia, utilising fulling-mills, possibly with overshot wheels, on nearby river cites, though generally outside towns walls.

v) **Cheaper Access to Raw Materials**: Wools and Dyestuffs

(1) close access to raw materials produced in the countryside, with savings on transport costs, is often given as an important reason for rural location.

(2) This is certainly true of metallurgy; but less true of textiles, where transport of raw materials was relatively cheaper, because of the higher unit value of the commodity.

(3) However, as the map on the screen suggests, the wool-supply was often a locational factor of some importance:

(4) The most important area for producing fine or luxury quality woollens was the West Country: and it was adjacent to England's very finest wools, in the Cotswolds (Oxfordshire, Gloucestershire, Worcestershire) and the two counties of the so-called Welsh Marches (Shropshire and Herefordshire).

(5) Medium quality woollens were produced in East Anglia, adjacent to medium quality wools in that region and East Midlands;

(6) but the Dorset-Devon area producing medium-quality woollens was in fact a region of very poor quality, very coarse wools.

(7) Coarse woollens were produced in Yorkshire, which was also an area of coarse quality wools.

c) **The Problems with such arguments about rural industrial orientations:**

i) **First and foremost, in England, but also in the Low Countries and Italy,**

(1) a great deal of textile production remained urban -- if we may still class small towns as urban -- until well into the early-modern era: most especially for export-oriented woollen cloth production.

(2) In the Low Countries, Flanders especially, urban and village cloth production co-existed over very long periods;

(3) and many so-called village or small-town draperies evolved into urban draperies -- especially by the sixteenth century;

(4) in England, the industrial shift to the countryside was very slow and piecemeal: and more a later fifteenth century than a fourteenth or even a thirteenth century phenomenon.

(5) By the 1470s, almost all of the English cloth trade was being channelled through London and exported to Antwerp (Brabant Fairs): a phenomenon, to be explained further in the section on international trade, that undermined the economies and mercantile fortunes in most other port towns, and consequently their ability to finance cloth production in the provincial towns.

(6) English cloth merchants, associated with the Merchants Adventurers, sought to increase their inventories by dealing directly with newer cloth producers in smaller towns and villages, i.e., bypassing the more traditional provincial cloth towns.[21]

ii) **In terms of water-power, while there are many theoretical arguments to favour locations in rural uplands with fast flowing streams and low opportunity costs,** the facts are clear:

(1) as noted earlier, many urban industries within England were able to use water-powered fulling mills: Worcester, Winchester, Gloucester, Bristol, London, Colchester, Leicester, York, etc.;

(2) at least into the fifteenth century, when possibly other factors did raise the opportunity costs of urban-sited fulling mills.

iii) **Historians have too often overlooked the symbiosis between rural and urban production:** [22]

(1) with some of the preliminary processes in combing, carding, and spinning undertaken in the countryside,

(2) but weaving, fulling, and cloth-finishing continuing as urban processes.

iv) **Rural labour may indeed have been cheaper for relatively unskilled occupations,** such as combing, carding, and spinning -- though we have no evidence to substantiate this view;

v) **For more skilled tasks in cloth making,** lower rural wages may have been offset by less refined skills, lower productivity, and lower quality work: in other words, lower wages do not necessarily mean lower labour costs; and subsequent arguments will consider the urban advantages.

vi) **The prime advantages of an urban location, especially for export markets are:**

(1) A better supply of skilled and specialised and disciplined labour;

(2) savings on transaction and bookkeeping costs in supervising congregated labour; and certainly better conditions for monitoring labour

(3) Similarly, more effective machinery for imposing and ensuring quality controls (lead seals for inspection).

(4) better access to credit and marketing facilities

vii) **Finally, the arguments that urban craft guilds were an impediment to industrial innovation and efficient production simply does not hold water,** so to speak, in England, the Low Countries, or Italy: largely a figment of the 19th-century liberal imagination.

(1) No evidence from a close examination of guild regulations and documents that they thwarted productive innovations, regulated production, or set prices, as so many textbooks suggest

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[21] See my recent publications cited in the previous notes; and, in this lecture, the Appendix on the English cloth industry.

[22] See John Munro, 'The Symbiosis of Towns and Textiles: Urban Institutions and the Changing Fortunes of Cloth Manufacturing in the Low Countries and England, 1270 - 1570', *The Journal of Early Modern History: Contacts, Comparisons, Contrasts*, 3:1 (February 1999), 1-74.

(2) On balance their role was much more positive in providing and enforcing the quality controls that are necessary for those engaged in monopolistic competition with differentiated products, as was true of the later-medieval orientation towards more luxury quality woollens.
(3) See further in the lectures on late-medieval international trade.

7. **The Woollen Industry in Late-Medieval and Tudor England**: **Its Victory Over Continental Rivals in the Fifteenth Century:** [23]

a) **The Importance of the Cloth Industry in the Late-Medieval and Early-Modern English Economy**
i) **Industrial Manufacturing:** The woollen cloth industry, with both urban and rural locations, became England's chief and most important single manufacturing industry by the fifteenth century
ii) **The Foreign Trade Sector**:
(1) The growth of the English cloth trade, eventually to become Europe's leading exporter and supplier of high quality woollens, effectively began in the mid-fourteenth century; and from about the mid-fifteenth century, woollens constituted England's chief export: the commodity producing the most revenue in English foreign trade, about 85% of total export revenues.
(2) As just noted, England added this newly revived industry and export trade in the cheaper and lighter worsted textiles (usually worsted-woollen fabrics); and these textile together, woollens and worsteds, continued to dominate the export sector, still supplying over 80% of total export revenues, until about the 1650s.
(3) Thus woollen and worsted textiles served as one of the chief agencies of English overseas commercial expansion, in seeking out new markets, in the early-modern era.
(4) On the input side, that commercial expansion also assisted the cloth industry in securing new sources of imported dyestuffs from Asia and the Americas.
iii) **The Agricultural Sector**: in supplying industrial inputs
(1) Thus, as I previously insisted, the first and perhaps major wave of Enclosures from the 1460s to the 1540s was strongly oriented towards pastoral farming: sheep raising to provide more wool for the domestic cloth industry (though also to provide more meat for urban markets)
(2) Later, in the second term, we shall see how the Tudor Stuart Enclosures were partly responsible, almost accidentally,

- for altering the quality of English wools, and thus
- partly responsible for the development of so-called New Draperies,
- insofar as enclosures -- both in terms of breeding and management -- converted English sheep from small, scrawny sheep with short-fine wools to much bigger sheep, with far heavier fleeces, that produced longer-stapled wools.

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[23] This section does not form part of the verbally delivered lecture, because parts of it were already given, in the previous topic on the origins of the Tudor Enclosures; and most of it will be repeated in the subsequent lecture on English trade. Nevertheless, it obviously fits in with this current topic on textile manufacturing, and should be read in conjunction with the rest of this lecture topic.

(3) Other important industrial inputs, besides wool: dyestuffs, fullers earth, teasels, etc., and above labour from the industrial sector. Note that much of the necessary industrial labour in textiles was part-time or supplementary labour from agriculture.

(4) Furthermore, note that these textile industries constituted the largest single source of manufacturing employment, in both rural and urban areas. [See industrial organization later.]

b) **England and International Competition in the European Cloth Industries in the fourteenth century:**

i) **When this course begins, around 1300, the leading European manufacturers of woollen textiles were to be found:**

(1) in the Low Countries: in the towns of Flanders and Brabant; and, from the 1360s, in Holland;

(2) and the next most important were in Italy, especially Florence in Tuscany.

ii) **England, in the early fourteenth century, was still primarily an exporter of raw wools -- which,** to repeat, were still included by far the world's finest wools, for which the cloth industries in the Low Countries, northern France, and Italy provided a continuously voracious demand.

iii) **England's own cloth industry was small and uncompetitive;** it was an urban industry, located principally in eastern coastal towns, which formed an arc running from York in the north (Yorkshire) to London in the south.

iv) **This English urban industry began to suffer a severe decline from about the 1290s:**[24]

(1) Indeed, it may have declined for reasons related to the decline or virtual extinction of the cheaper-line, lighter-weight textile industries in the Low Countries

(2) For this urban-based English cloth industry seems also to have been largely based upon the production of similar cheap textiles for export as well to the Mediterranean basin;

(3) Thus again the spreading stain of Mediterranean and European warfare and the related rise in transport and transactions may also have rendered uneconomic, unprofitable, such an export trade in cheaper fabrics to such far distant markets.

v) **The decline of the English urban industry may also have been related to the high costs of an urban location:** especially with rising taxes and guild restrictions -- though that may be disputed.

vi) **There is some evidence for a relative shift to rural locations,** in search of lower cost labour; and the subsequent growth of a true woollens industry in England became more and more rural (though perhaps half of the cloths produced for export in the 1390s came from urban centres).

vii) **The late Prof. Carus-Wilson argued that the chief reason was the spread of the fulling-mill:**

(1) She argued that this process 'revolutionized' the production of English textiles, and provided England with its primary advantage over its rivals in the Low Countries;

(2) While she greatly exaggerated its importance, especially for luxury textiles, there is some merit to her views;

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[24] On this issue, see further in: John Munro, 'The 'Industrial Crisis' of the English Textile Towns, 1290 - 1330,' *Thirteenth-Century England*: VII, ed. Michael Prestwich, Richard Britnell, and Robin Frame (Woodbridge, UK: Boydell Academic Press, 1999), pp. 103-41.

(3) in particular the arguments, both explicit and implied, that fulling mills could operate more effectively and more cheaply:

- in the hilly terrain of western England, with swift flowing streams;
- and in rural areas, with lower opportunity costs in location
- i.e., without other competing uses for fixed river sites

(4) nevertheless, I have found that in the later-medieval era, urban-based English cloth industries were able to utilize fulling mills, either within or just outside the towns.[25]

c) **The Rise of the English Cloth Trade in the fourteenth Century[26]**

The reasons for the initial rise of the English cloth trade have already been suggested, in large part, in our discussion of wool in English agriculture, in terms of the fall of the wool trade and the rise of the cloth trade. The following is simply of reminder of the chief arguments, with some additional and necessary closing arguments:

i) **Wools:** ultimately, the English supremacy was based upon their own domestic wools: on virtual monopoly control over Europe's finest wools in very abundant supply, a monopoly unchallenged until the significant improvement in Spanish merino wools by the later fifteenth century

ii) **In medieval Europe, without any competitive substitutes,** England had reaped huge monopoly gains -- i.e., rents -- by exporting these wools to continental draperies, especially in the Low Countries: about 35,000 sacks a year in the early fourteenth century: i.e., , about 5.8 metric tons of wool annually from approximately 8 million sheep, with an average of 1.5 lb. wool per fleece, and thus about 240 fleeces in a 364 lb sack.

iii) **Royal taxation and late-medieval fiscal policies:** With seemingly captive markets, English kings thought that they could extract lucrative fiscal revenues from taxing the wool-export trade:

(1) thus, with the onset of the Hundred Years' War in 1337 (to 1453), they began raising the export taxes on the wool trade (increasing the tax sixfold, from 6s 8d per sack to 40s and more per sack).

(2) But, by the later fourteenth century they had severely overtaxed the wool trade; for as noted before, the demand for wool was derived from the demand for woollen textiles, which was in fact quite elastic. There were always substitutes for fine Flemish and Italian woollens.

(3) In late fourteenth century, English wool exports fell by over one half, to about 14,000 sacks

iv) **Differential Export Taxes: Rise of the English Cloth Trade**

(1) As was noted earlier, while export taxes on wools amounted to almost 50% of the wholesale export value by the 1390s, the export taxes on English woollens amounted to only about 2% of the mean export prices (About 1s on a cloth worth 40s.0d)

(2) Consequently, that tax differential acted as an implicit export subsidy for woollen cloth -- i.e., it was more economic to export the wool in the form of manufactured cloth than in raw woolsacks; and English cloth exports began to climb from the 1360s.

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[25] See my publications in the two previous notes.

[26] This section may be omitted and considered instead under the topic on International Trade.

(3) But English woollens were still regarded as inferior in quality to the Flemish and Italian; and the English cloth trade also encountered severe rebuffs in Baltic and German markets, for reasons to be seen in foreign trade.

d) **English fiscal policies in the fifteenth century and the final ruination of the English wool trade:**

i) **In the late 1420s, came the final and most injurious folly in English fiscal policy,** known as the Calais Staple Bullion Laws.[27]

ii) **The crown, having seen its mint-outputs fall drastically in the 1420s,** from foreign (and chiefly Burgundian-Flemish debasements), and concerned about coin shortages -- especially a concern about having enough coin to pay its military garrison at Calais -- sought to extort the needed coin from the wool trade.

iii) **By several statutes, the crown**:

(1) forbade the sale of any wool on credit,

(2) demanded full and immediate payment for all wool in good English coin and bullion (to be minted at Calais).

(3) allowed a small clique of leading Staplers to monopolize the trade, and then urged it to raise wool prices, to get more coin and bullion;

(4) and that provision was chiefly to secure their support in enforcing the other measures..

iv) **The burden in the form of increased wool costs was just too great for the traditional urban cloth industries in the Low Countries;** and the results can be seen in the graphs on the screen: as wool exports plummeted again by more than a half, and as all the cloth-production indices fall for the Low Countries' draperies.

v) **Another consequence was to encourage the smaller village draperies, principally in Flanders,** who had been producing cheaper imitations of the urban woollens, to switch from English to Spanish merino wools, which, though still inferior, were nevertheless now an acceptable substitute (at least for second-quality cloth production). But they were still a minority.

vi) **From the 1460s, as the graph shows, the English cloth trade,** now buttressed by those forces rapidly expanding the Antwerp market, engaged in a tremendous boom that swept away most of its continental rivals (at least in the Low Countries).

B. <u>Other Manufacturing Industries in Late-Medieval Europe</u>

For independent reading: see outline of the lectures, with suggested readings.

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[27] See John Munro, *Wool, Cloth and Gold: The Struggle for Bullion in Anglo-Burgundian Trade, ca. 1340-1478* (Brussels: Editions de l'université de Bruxelles; and Toronto: University of Toronto Press, 1973); and the various essays published in *Bullion Flows and Monetary Policies in England and the Low Countries, 1350 - 1500*, Variorum Collected Studies series CS 355 (Aldershot, 1992); and John Munro, *Textiles, Towns, and Trade: Essays in the Economic History of Late-Medieval England and the Low Countries*, Variorum Collected Studies series CS 442 (Aldershot, 1994).

Appendix: The English Woollens Industry in the later fifteenth century and the shift of manufacturing to smaller towns and villages:

Extracted from: John Munro, 'The Symbiosis of Towns and Textiles: Urban Institutions and the Changing Fortunes of Cloth Manufacturing in the Low Countries and England, 1270 -1570', *The Journal of Early Modern History: Contacts, Comparisons, Contrasts*, 3:1 (February: 1999), 1-74.

Thus, even if this study has supported Bridbury's contention that the late-medieval English cloth industry had remained substantially more urban, certainly for export-oriented production, than has been commonly assumed, until well into the fifteenth century, nevertheless a subsequent shift of cloth-manufacturing from the larger provincial towns to much smaller ones, indeed to quasi-villages may certainly be detected.

Thus, Heather Swanson, in an exhaustive regional study, has demonstrated that York still remained a major textile-producing city until the early 1460s, by which time cloth exports from Hull, Ipswich, Boston, and other north-eastern ports had suffered a dramatic and permanent decline, after English defeats in ruinous conflicts with the Hanseatic League and Denmark, and thus with the final losses of Baltic, Scandinavian, and Prussian markets.[1] Other cloth-producing towns, notably Bristol, suffered from England's final defeat in the Hundred Years War, and the loss of Gascony, by 1453; and others from conflicts, trade bans, and even sporadic war with the Burgundian Low Countries (1433- 67).[2] Indeed, for other reasons as well, primarily demographic, monetary, and financial, the years from the mid-1440s to the mid-1460s were ones of extremely harsh agrarian, industrial, and commercial depression, during which aggregate English cloth exports fell 45.4 percent, from an annual mean of 57,056 broadcloths in 1440-44 to one of just 31,161 cloths in 1460-64.[3] Thereafter, as noted earlier, the combination of the South German silver-copper mining boom, the dramatic expansion of the overland continental trades linking Italy, South Germany, and the Low Countries, and the consequent flourishing of the Brabant Fairs promoted an eighty-year long boom in the English cloth trade, expanding exports 3.75 fold, to reach an annual mean of 117,345 broadcloths in 1540-44.[4] But, the traditional

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[1] Swanson, *Medieval Artisans*, 26-43; Lloyd, *England and the German Hanse*, 173-234. He points out, however, that the decline in cloth exports to the Baltic had set in by 1410 (pp. 170-72); see n. 94.

[2] E.M. Carus-Wilson, 'The Overseas Trade of Bristol in the Fifteenth Century,' in *Studies in English Trade in the Fifteenth Century*, ed. Eileen Power and Michael Postan (London, 1933), 183-246, reprinted in her *Medieval Merchant Venturers*, 1-97; Munro, *Wool, Cloth, and Gold*, 93-179; Munro, 'Bruges and the Abortive Staple,' 1137-59.

[3] See Table 1; and Nightingale, 'England and the European Depression,' 631-56; Nightingale, *Medieval Merchant Community*, 432-89; Hatcher, 'The Great Slump,' 237-92; Munro, 'Economic Depression and the Arts' and other studies in *Textiles, Towns, and Trade* (1994); and John Munro, 'Crisis and Change in the Later Medieval English Economy,' *Journal of Economic History*, 58:1 (March 1998): 215-19. See n. 131 above.

[4] See Table 1; and Van der Wee, *Antwerp Market*, 2: 67-142; John Munro, 'The Central European Mining Boom, Mint Outputs, and Prices in the Low Countries and England, 1450 - 1550,' *Money, Coins, and Commerce: Essays in the Monetary History of Asia and Europe (From Antiquity to Modern Times)*, ed. Eddy H.G. Van Cauwenberghe (Leuven 1991),119-83; John Munro, 'Anglo-Flemish Competition,' 37-60. As noted in these studies, Edward's IV silver-coinage debasement of 25% effectively reduced English cloth prices on the Antwerp market, in 1464-65; and the subsequent Burgundian debasement of 1466 dramatically altered

provincial ports and the major cloth towns that they had long served did not share in this dramatic cloth-export boom, which was almost entirely canalised upon the Antwerp market, as the virtually sole gateway to continental markets, so that London's share of total cloth exports rose from 42.5 percent in 1430-34 to 68.5 percent in 1495-99 (and to 84.9 percent in 1540-44).[5]

In Swanson's view, York's cloth industry experienced a rapid decay from the 1460s chiefly because of the drastic fall in exports from the nearby northeastern ports, which thereby undermined the ability of merchants in those ports and in York itself to finance further cloth production. Cloth manufacturing therefore deserted the town of York for various smaller towns and quasi-villages in surrounding areas of Yorkshire's West Riding: not to escape any urban or guild restrictions, not to seek lower-wage rural labour, but principally to secure the now much more accessible, abundant and cheaper capital supplied by many prosperous landowners and sheep-farmers in this region, with the concomitant growth in the Tudor enclosure movement. Furthermore, during this same era, local clothiers from Halifax, Leeds, Ripon, Wakefield, Bradford, Doncaster, and other small Yorkshire towns bypassed York to establish their own direct connections with London-based merchants.[6]

More recently, Pamela Nightingale has offered substantial evidence to support a similar thesis for the contemporary industrial declines of Coventry, Winchester, Colchester, Leicester, with shifts of cloth-manufacturing to neighbouring small towns and villages. She demonstrates in particular the disastrous effects that the severe contractions in the money supply, as well as in overseas commerce, had upon traditional sources of urban credit, during this mid-century depression, but far more so in the provincial towns than in London, whose urban economy experienced relative growth over the entire century. In the countryside that surrounded the formerly prominent provincial cloth-towns, she also found that some relatively prosperous landowners and yeomen farmers readily supplied abundant credit on much easier terms than urban merchants, many of whom indeed were forced to vacate this financial field entirely (except in London). She also analysed the contemporary rise of rural chapmen, as itinerant pedlar-broker merchants, operating on very low overheads, who also assisted in financing production in the newer clothmaking centres, often providing barter arrangements to secure more woollens for direct transport to London. They also co-operated with the now

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the gold:silver mint ratio; together they provided major catalysts to attract German merchants with their silver to Antwerp where they purchased English woollens as their major return cargo to southern Germany and central Europe.

[5] See the sources for Table 1; and those cited in nn. 155-58.

[6] Swanson, *Medieval Artisans*, 29-33, 142-49; Swanson, 'Craft Guilds,' 29-48; Bartlett, 'Decline of York,' 17-33; Jennifer Kermode, 'Urban Decline? The Flight from Office in Late-Medieval York,' *Economic History Review*, 2nd ser. 35 (May1982): 179-98; Jennifer Kermode, 'Merchants, Overseas Trade, and Urban Decline: York, Beverley, and Hull, c.1380-1500,' *Northern History* 23 (1987): 51-73; and Jennifer Kermode, 'Money and Credit in the Fifteenth Century: Some Lessons from Yorkshire,' *Business History Review* 65 (Autumn 1989): 475-501; Heaton, *Yorkshire Woollen and Worsted Industries*, 46-84, 89-101. Though Heaton paints the traditional picture of excessive urban regulations, guild restrictions, high taxes, etc., within York, nevertheless his statistics extracted from the aulnage accounts show that this city itself was still in the lead, for 46 weeks of cloth production in 1468-69 (p. 75): York, 1596 cloths; Ripon, 888; Halifax, 853; Wakefield, 231; Leeds, 177; Almondbury, 160; Hull, 148; Bradford, 89; Doncaster, 36 cloths.

expanding London-based merchants, who sought out many more industrial clients throughout the small country towns of East Anglia, the Midlands, Yorkshire, and the West Country, to meet the ever more voracious demands for woollens in London's Blackwell Hall, i.e., for re-export to the rapidly expanding Brabant Fairs.[7]

[7] Nightingale, *Medieval Mercantile Community*, 365-67, 483-89; Nightingale, 'England and the European Depression,' 631-56; Nightingale, 'Growth of London,' 89-106; Pamela Nightingale, 'Monetary Contraction and Mercantile Credit in Later Medieval England,' *Economic History Review*, 2nd ser., 43 (November 1990): 560 - 75; Keene, *Medieval Winchester*, 1: 295-327, 517-20; Britnell, *Colchester*, 163-89, estimating a peak production in the 1440s, but relative prosperity to the 1460s. See also Charles Pythian-Adams, *Desolation of a City: Coventry and the Urban Crisis of the Late Middle Ages* (Cambridge, 1979), 33-52, showing a city 'still flourishing in 1450,' but suffering severe crisis by '1518-25;' for the cloth industry and other crafts, see pp. 99-124. See also Peter Clark and Paul Slack, *English Towns in Transition, 1500 - 1700* (Oxford, 1976), 46-61, 97-110; and Margaret Spufford, *The Great Reclothing of Rural England: Petty Chapmen and their Wares in the Seventeenth Century* (London, 1984), 1-32, 69-84. For the monetary aspects, see also the several studies in John Munro, *Bullion Flows and Monetary Policies in England and the Low Countries, 1350 - 1500*, Variorum Collected Studies series CS 355 (London/Aldershot, 1992).

TEXTILES IN EUROPEAN TRADE: 12th to 16th Centuries

TEXTILES	RAW MATERIALS: animal, insects, or vegetable fibres
WOOL-BASED TEXTILES	Wool: from sheep (animal fibre)
■ Woollens (England: the Old Draperies)	Wool: fine, short-stapled
■ Worsteds	Wool: coarse, long-stapled
■ Serges or Stuffs (England: the New Draperies)	Worsted warps (long-stapled wool) &Woollen wefts (short-stapled wool)
LINENS	Flax (fibres): vegetable
FUSTIANS	Flax-based linen warps and cotton-based wefts (vegetable)
COTTON TEXTILES: Asian ■ Calicoes (fine textiles) ■ muslins (coarser textiles)	Cotton fibres (vegetable)
SILKS: Asian and Italian Velvets, satins, damasks	Silkworms (insects), feeding on mulberry leaves

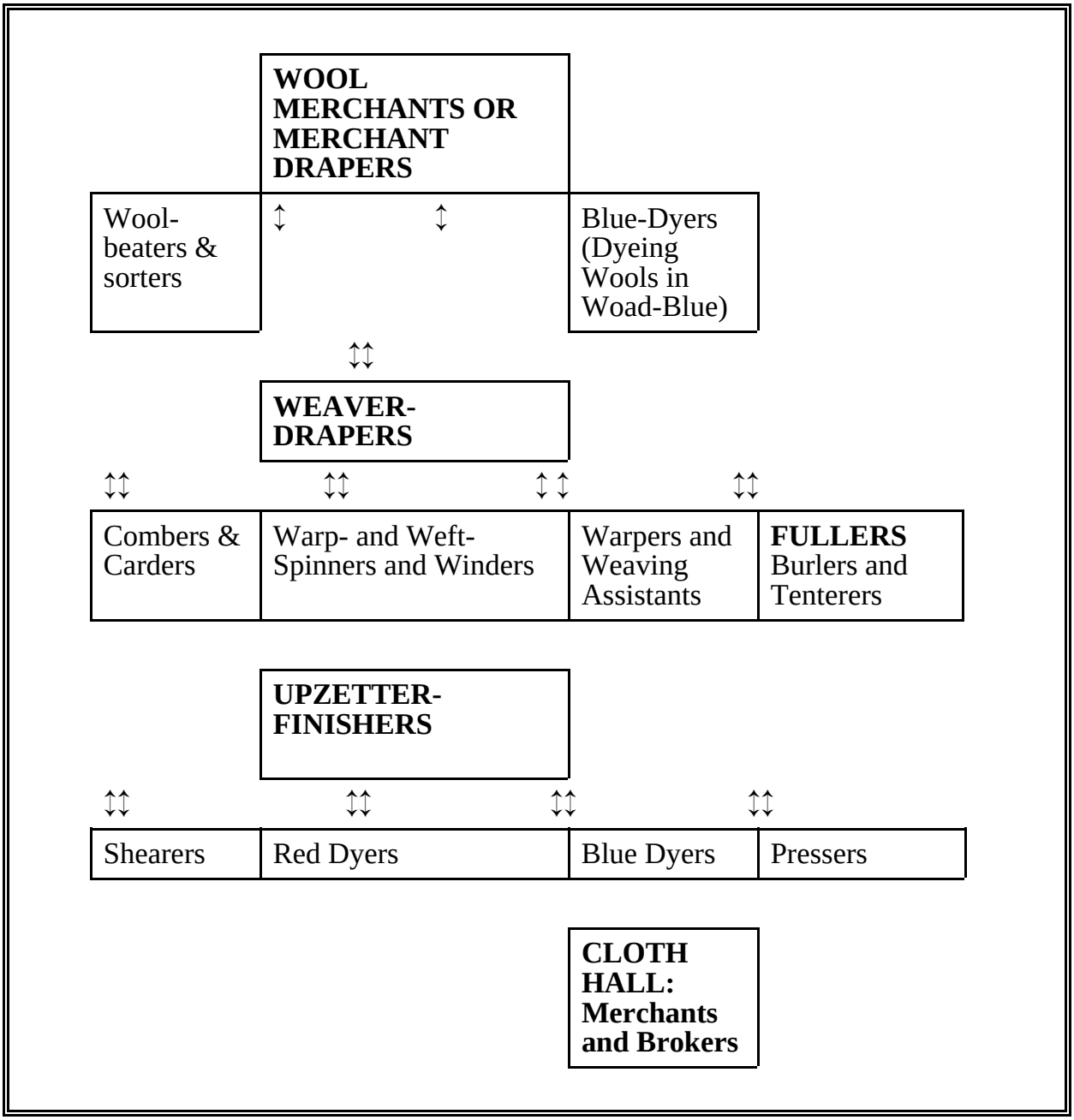
THE WOOL-BASED TEXTILE INDUSTRIES IN ENGLAND

Features	THE OLD DRAPERIES: WOOLLENS	THE NEW DRAPERIES: WORSTEDS AND STUFFS
Wools for Warps and Wefts	Short-stapled, very fine, curly, scaly, soft wools: very costly. Originally English: Shropshire, Herefordshire, Cotswolds, Lincs.; later, with Spanish merino wools	Long-stapled, straight-fibred, coarse wools: relatively cheap; but in some hybrid or mixed fabrics, short-stapled wools were used for the weft. Some interwoven with goat's hair, silk, etc.
Wool preparation	After initial scouring, wools were oiled or greased (olive oil, butter)	Wools were left dry, ungreased, after scouring; but if short-stapled wools were used for the weft, they were oiled
Yarn preparation	wools were carded, warp and weft (though combed in medieval era)	wools were combed, at least for the warp; if short-stapled wools used for the weft, they were also carded
Spinning	carded wools were spun on the spinning wheel; in medieval era, combed warps were spun on the distaff or 'rock'; Saxony wheel with flyer in use by 16th century	combed wools originally spun with the distaff; but by the 16th century, the Saxony wheel was used for both warp and weft
Weaving	warp and weft yarns were woven on a broadloom with two weavers	yarns were more commonly woven on a single-weaver narrow loom
Fulling	When woven, the broadcloths were intensively fulled [usually at a water-powered fulling mill] to degrease the cloth, to felt and shrink the cloth by about half	Pure worsteds were not fulled (i.e., with dry worsted yarns for warp and weft); but hybrid fabrics with greased carded wefts were partially fulled, if only to degrease the cloth
Finishing	Fulled woollens were stretched on a tentering frame and subjected to preliminary napping; when dried renapped and shorn several times with large shears; and then dyed with costly dyes	No napping or shearing; woven cloths were subjected to simple bleaching and/or dyeing; and then calendared (pressed with steam irons); inexpensive dyes
Names	West Country, Suffolk, Essex broadcloths; later: Spanish medleys with Spanish merino wools	Worsteds, says, bays, serges, stuffs, bombazines, perpetuanas, honscots, ostades, etc. Mixed 'stuffs' with combed worsted warps and carded woollen wefts

warps: the foundation yarns stretched between the warp and cloth-beam rollers on the loom

wefts: the yarn, carried by a wooden shuttle, that is inserted between (above and below) groups of warps to effect the weaving.

INDUSTRIAL ORGANIZATION AND 'PUTTING OUT' IN THE LATE-MEDIEVAL FLEMISH CLOTH INDUSTRY



Composition, Dimensions, and Weights of Woollens and Worsteds:
Products of the Traditional Luxury Woollen Draperies, the *Nouvelles Draperies*, *Sayetteries*, and 'New Draperies':
in the Low Countries and England, 15th and 16th Centuries

Drapery:	**Name of**	**Dates of the**	**Wools**	**Warp**	**Weight in kg**
Town	**Textile**	**Ordinances**	**Used**	**Count**	**on Loom**
A. Traditional Old Draperies:					
Woollens					
Ghent	Dickedinnen 5 Seal	1456-62; 1546	English: Fine March, Cotswolds, Berkshire	2066	38.179
Leuven	Oppersten Zegel	1519	English: Middle March, Cotswolds, Berkshire	2400	42.090
Mechelen	Gulden Aeren	1544	English: Leominster (Herefordshire)	3120	n.s
Suffolk, Essex	Suffolk Short Cloths	1552	English: short-stapled	n.s	n.s
B. Nouvelles Draperies:					
Woollens					
Armentières	Oultreffin	1510; 1546	Spanish (2/3) + English: Cotswolds, Lindsay, Berks.	1800	40.823
Diksmuide	Grooten Claus	1523; 1546	Spanish, English, Scottish, Rhenish, Flemish	1968	38.968
Haubourdin	Oultreffin	1539	Spanish (2/3) + English	1800	38.040
Bruges	Dobbel Leeuwen	1544	Spanish merino exclusively	2010	n.s

Composition, Dimensions, and Weights of Woollens and Worsteds:
Products of the Traditional Luxury Woollen Draperies, the *Nouvelles Draperies*, *Sayetteries*, and 'New Draperies':
in the Low Countries and England, 15th and 16th Centuries

Drapery:	**Name of**	**Dates of the**	**Wools**	**Warp**	**Weight in kg**
Town	**Textile**	**Ordinances**	**Used**	**Count**	**on Loom**
C. Draperies Légères:					
Worsteds, Says, Stuffs					
Bergues-St.-Winoc	Fine narrow say	1537	Flemish, Artesian	1400	n.s
Hondshoote	Small double say	1571; 1576	Flemish, Scottish, Frisian, Kempen	1800	n.s
Colchester (Essex)	Single bays	1579	English long (warp) & short (weft)-stapled	n.s	n.s
Essex	Broad says	1579	English long stapled (warp); wefts n.s.	n.s	n.s

Drapery:								
Town	**Length**	**Width on**	**Final Length**	**Final Width**	**Area in**	**Warps**	**Weight**	**Weight**
	on Loom in m.	**Loom in m.**	**Metres**	**Metres**	**m2**	**per cm**	**in kg.**	**g/m2**
A. Traditional Old Draperies:								
Woollens								
Ghent	29.750	2.5375	21.0000	1.663	34.913	12.43	22.126	633.77
Leuven	29.885	2.7800	20.8500	1.738	36.227	13.81	25.254	697.11
Mechelen	33.072	2.7560	20.6700	1.723	35.604	18.11	27.217	764.42
Suffolk, Essex	n.s	n.s	22.5552	1.645	37.095	n.s	29.030	782.58
B. Nouvelles Draperies:								
Woollens								
Armentières	29.400	2.1000	21.0000	1.400	29.400	12.86	24.123	820.50
Diksmuide	28.700	2.5375	21.0000	1.488	31.238	13.23	23.195	742.54
Haubourdin	29.400	2.1000	21.0000	1.488	31.238	12.10	22.267	712.84
Bruges	30.800	2.4500	21.0000	1.488	31.238	13.51	22.267	712.84
C. Draperies Légères:								
Worsteds, Says, Stuffs								
Bergues-St.-Winoc	n.s	n.s	28.0000	0.700	19.600	20.00	5.103	260.35
Hondshoote	28.000	1.006	25.7250	0.875	22.509	20.57	7.257	322.42
Colchester (Essex)	n.s	n.s	31.9532	0.940	30.030	n.s	9.979	332.31
Essex	n.s	n.s	9.3984	0.940	8.833	n.s	1.247	141.19

Prices of Ghent Dickedinnen Woollens, Mechelen Rooslaken Woollens, and Hondschoote Says, and the Daily Wages for an Antwerp Mason, 1535 - 1544: in pence and pounds groot Flemish

Year	Ghent Dicke-dinnen in £ groot	Mechelen Black Rooslaken in £ groot	Hond-schoote Single Says in £ groot	Hond-schoote Double Says in £ groot	No. Days of Mason's Wages to buy one Ghent Dicke-dinnen	No. Days of a Mason's Wages to buy one Hond-schoote Single Say	Antwerp Master Mason's Daily Wage in d groot	Value of Ghent Dicke-dinnen in Antwerp consumer-baskets	Value of Hond-shoote Single Says in Antwerp consumer-baskets	Value of Antwerp Basket of Consumables in d. groot Flemish
1535	14.150	10.667			328.660		10.333	12.637		268.730
1536	14.250	10.667			310.910		11.000	11.497		297.470
1537	14.500	11.333			298.280		11.667	13.683		254.330
1538	14.500	11.333	0.967	2.278	274.730	18.320	12.667	11.775	0.785	295.530
1539	15.000	11.333	0.945	2.184	284.200	17.900	12.667	11.984	0.755	300.400
1540	15.000	11.333	0.835	1.961	284.200	15.820	12.667	12.365	0.688	291.130
1541	15.500	11.333	0.879	2.015	293.680	16.650	12.667	13.381	0.759	278.000
1542	14.500	11.333	0.838	2.005	274.730	15.880	12.667	11.853	0.685	293.600
1543	14.000	11.333	0.783	1.775	240.000	13.420	14.000	10.364	0.580	324.200
1544	14.000	11.333	0.908	1.942	240.000	15.570	14.000	9.571	0.621	351.070

Sources: Stadsarchief Gent, Stadsrekeningen 1534/5-1544/5, Reeks 400: nos.46-52; Stadsarchief Mechelen, Stadsrekeningen 1534/5-1544/5, nos.209-19; Herman Van der Wee, *Growth of the Antwerp Market and the European Economy, 14th to 16th Centuries*, 3 vols. (The Hague, 1963), 1:457-68 (Appendix 39); sources cited in Tables 1 and 2.

Notes:

a. Converted from Brabant *groten:* 1.5d Brabant groot = 1.0d Flemish groot (gros)
b. Ghent woollens (dickedinnen): 30 ells by 9.5 quarter ells (made from English March and Cotswolds wools).
c. Mechelen woollens (Rooslaken): 30 ells by 10 quarter ells (March wools), prices converted from *pond groot* Brabant into *pond groot* Flemish
d. Hondschoote single says: 18 ells by 5 quarter ells: Hondschoote price.
e. Hondschoote double says: 36.75 ells by 5 quarter ells: Antwerp price.