

Rural Clockmaking in Eighteenth-Century Wales: Samuel Roberts of Llanfair Caereinion, 1755–1774

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With the recent publication of David S. Landes's Revolution in Time (1983) the business of clockmaking has begun to receive the scholarly attention that its historical significance warrants. In this finely etched case study, Mr. Davies draws on a remarkable business record—Samuel Roberts's Register of Clocks—to document a previously obscure chapter in the history of this frequently neglected business: the crafting, sale, and distribution of grandfather clocks in eighteenth-century rural Wales. And if, as Landes contends, "the consumption of timepieces may well be the best proxy measure of modernization," then Davies's study illuminates a key development in the rise of the modern world.

The clock has become the genteelst piece of furniture in almost every cottage.

Universal Magazine, 1747

Samuel Roberts of Llanfair Caereinion, Montgomeryshire, has left us a rare and important business record: the *Register of Clocks* he made between 1755 and 1774.¹ To supplement his income as a tenant farmer—and also perhaps to express an instinct and aptitude for constructing things—Roberts made and assembled all the parts for several hundred simple thirty-hour pull-wind clock movements. His customers were his neighbors and others in the district: artisans, tenant

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¹ The quotation in the précis is from David S. Landes, *Revolution in Time: Clocks and the Making of the Modern World* (Cambridge, Mass., 1983), 325. The epigraph is from Brian Loomes, *Country Clockmakers and their London Origins* (Newton Abbot, 1976).

The original manuscript of Roberts's *Register* is in private possession, but the Welsh Folk Museum, St. Fagans, Cardiff, Wales, has two photographic facsimiles, one made in the 1930s, the other in the 1970s. The Museum's late curator, Iorwerth C. Peate, described the *Register* briefly in "Two Montgomeryshire Craftsmen," *Montgomeryshire Collections* 48 (1943): 3–5, and in *Clocks and Watch Makers in Wales* (Llandysul, 1945; rev. ed. 1975), 21–22, 74, 93. An illustration and some extracts from Peate's account were repeated in Ernest L. Edwardes, *The Grandfather Clock: An Historical and Descriptive Treatise on the English Long Case, with Notes on Some Scottish, Welsh, and Irish Examples* (Altrincham, 1949; 3d ed. 1971), 42–43, Plate 194. See also Loomes, 78–89.

farmers, and laborers. He also made a handful of rather more complicated eight-day movements and a couple of larger clocks, probably for towers. Numbers of surviving clocks from outside the period covered by the *Register* suggest that over forty years Roberts made a total of about six hundred movements; but if he kept comparable notebooks for earlier and later clocks, none have survived.² The extant *Register* gives details of nearly three hundred clocks; individual entries typically contain the clock's number, the customer's name and address (and sometimes occupation), the price, and the date on which the clock was finished.

While nearly complete business records of some large horological firms have survived, most of them cover a later period.³ Records of the work of individual craftsmen are rare. One early example, the *Day Book* of Benjamin Gray, a London watchmaker, describes the watches and clocks he repaired and sold between 1704 and 1726, and gives an indication of receipts and clientele. But Gray was a retailer and repairer, not a maker.⁴ More comparable to Roberts's *Register* is the *Order Book* of John Hoff, which details the 108 clocks Hoff made between 1799 and 1816 for his customers in Lancaster County, Pennsylvania.⁵ Other surviving records of a craftsman's work tend to be fragmentary, though sometimes, in conjunction with evidence from surviving artifacts, they are sufficient to allow a reconstruction of the pattern and volume of output.⁶ The special importance of Roberts's *Register* is its detail and time span. It covers precisely those years that preceded the advent of Birmingham-based firms which, from the mid-1770s, supplied prefabricated clock parts for hand assembly by small town and village clockmakers.⁷ Roberts's clocks also illustrate how widespread the knowledge of elementary clockwork mechanisms had become.

² W. T. R. Pryce, "Samuel Roberts, Farmer Who Made Clocks," *Country Quest* (Feb. 1980): 9–11, notes the discovery of movement number 592, dated 1786, which seems to be the last made and signed by Roberts. Clocks surviving from the late 1770s are sometimes inscribed "Roberts and Son."

³ Notably the business records of Thwaites and Reed, of Clerkenwell and Bowling Green Lane, London, running from 1780 to 1955; and Victor Kullberg, Liverpool Road, London, running from 1868 to 1943. See John Bromley, comp., *The Clockmakers' Library: The Catalogue of the Books and Manuscripts in the Library of the Worshipful Company of Clockmakers* (London, 1977), nos. 1000–1034, 1045–62.

⁴ E. F. Bunt, "An Eighteenth Century Watchmaker and His Day-book," *Antiquarian Horology* 8 (1973): 175–82.

⁵ "John Hoff His Book of New Clocks Made and Sold" is reprinted as an appendix to Stacy B. C. Wood, Jr., "The Hoff Family: Master Clockmakers of Lancaster Borough," *Journal of the Lancaster County Historical Society* 81 (1977): 169–225. See also Stacy B. C. Wood, Jr., and Stephen E. Kramer, *Clockmakers of Lancaster County and Their Clocks, 1750–1850* (New York, 1977), and Fred C. Sweinhart, "Early Pennsylvania Clocks and Their Makers," *Bulletin of the Historical Society of Montgomery County, Pennsylvania* 3 (1941): 48.

⁶ Frank P. Albright, *Johan Ludwig Eberhardt and his Salem Clocks* (Chapel Hill, N. C., 1978), 63–68.

⁷ Brian Loomes, *The White Dial Clocks* (Newton Abbot, 1974).

Above all, the *Register* documents the horological revolution at the bottom end of the market. Much is known of the work of the great horological craftsmen of the eighteenth century, for their masterpieces have inspired considerable antiquarian literature. But Roberts's *Register* belongs to another world. It gives us a rare glimpse into the working life of an eighteenth-century country craftsman.

Samuel Roberts's customers in rural Montgomeryshire belonged to an economy based on pastoral farming supplemented by part-time weaving. Livestock was bred and exported to the English midlands and London; there also flourished, particularly around Llanfair Caereinion, an extensive cottage-based woollen industry organized by the Shrewsbury drapers. The area was one of scattered farms and cottages, and little hamlets and villages surrounding churches.⁸ The parish of Llanfair Caereinion itself measured about six miles by seven miles at its greatest extremities, and when Roberts started making his clocks it had a population of 1,600 to 1,700 in about three hundred households.⁹ The village had two inns (The Goat and The Old Black Lion) and, according to a 1749 inventory, a church with "three very sweet-toned bells" and a clock. The churchyard contained one of two sundials known to have been made by Samuel Roberts, though it is uncertain when it was placed there.¹⁰ (The other was in the churchyard in the nearby village of Llanbryn-mair.) Readings of the sundial gave the time to which the church clock was set, and indicated when the bells were to be tolled to summon the community to worship. The bells also served as time signals for parishioners to set and adjust the clocks they bought from Roberts. He lived about a mile to the north of the village in Pant-y-Tanhouse (so named after a nearby tannery), a small tenancy of the Earls of Powys.¹¹ There, in a workshop adjacent to the farmhouse, and in a rented room above the market hall, Samuel Roberts made his clocks and for twenty years methodically recorded their details in a little notebook.

⁸ Richard J. Colyer, *The Welsh Cattle Drovers* (Cardiff, 1976), 101, 131; J. Geraint Jenkins, *The Welsh Woollen Industry* (Cardiff, 1969), 116ff; and Dorothy Sylvester, *The Rural Landscape of the Welsh Borderland: A Study in Historical Geography* (London, 1969), 447–48.

⁹ Estimates are based on David Williams, "A Note on the Population of Wales, 1536–1801," *Bulletin of the Board of Celtic Studies* 8 (1937): 359–63.

¹⁰ Thomas W. Hancock, "Parochial History of Llanfair Caereinion: Additions," *Montgomeryshire Collections* 18 (1885): 361–62, and Charles H. Humphreys, "Llanfair Caereinion in the Early Nineteenth Century," *Montgomeryshire Collections* 48 (1944): 143.

¹¹ The tithe map and apportionment books of 1842 give the landlord as the Earl of Powys, and the tenant as Samuel Roberts (son of the clockmaker). In 1842 Pant-y-Tanhouse had a total holding of eighty-eight acres, two rods, twenty-three perches, and contained mixed arable land and pastureland. See National Library of Wales, Tithe Map 1842: "A Map of Heniarth . . . in the Parish of Llanfair in the County of Montgomery; Llanfair Parish in Seven Parts; No. 3."

THE REGISTER OF CLOCKS

The *Register of Clocks* is of pocketbook size and contains 140 pages. Most have two or three discrete entries, usually giving the clock's number, price and date of completion, and the customer's name and address. The entries are careful and systematic, running from clock 102 to clock 396. There are a handful of obvious clerical errors. For example, two clocks have the same number (156), and the number for clock 328 is left out. Sometimes the strict sequence is broken, as where 185 appears between 190 and 191, and 383 after 395, probably because Roberts set a clock aside and started and finished others before returning to it. Early in the book is a lacuna, where pages have been torn out and details of eight clocks (numbers 113–20) are missing. Elsewhere there is repetitive scribbling of the name "Margaret Roberts" (his daughter or a member of his family practicing her handwriting?), and following some blank pages at the end of the notebook there are biographical details of the clockmaker's family made after 1890, probably by a descendant. None of these blemishes, ambiguities, and occasional illegibilities seriously detracts from the integrity and veracity of the 287 discrete entries about clocks "made by me, Samuel Roberts." There are some miscellaneous notes, including two lengthy descriptions of clocks in for repair, whose gearing formulae are recorded, no doubt to aid further replication. A typical entry reads: "David Lloyd of Moudog his clock was made and finished March 19th 1758 numbered 131 prize £2.15 Od a Repeating clock with the Minaits upon Made by me Samuel Roberts." Fifty of the first seventy entries, between 1755 and 1761, have brief notes containing technical details such as the ratios of teeth on different wheels and pinions, and the lengths of pendulums. During these years Roberts evidently experimented with different-sized components, trying a dozen pendulum lengths ranging from 2 feet 4¼ inches to 3 feet 10 inches. These variations probably occurred because the beat had to be adjusted to the idiosyncracies of the wheel trains. As Roberts's clocks did not have a second hand—indeed most did not have a minute hand—it is unlikely that anyone would notice an unconventional beat.

Most craftsmen who operated small units of production in the eighteenth century made their products to order. Each of Roberts's clocks was "bespoken," with specifications, extras, and price agreed on beforehand with each customer. The flow of production was steady rather than erratic, as Table 1 shows.

Over the first decade Roberts's output averaged about one clock a month, increasing to a mean of eighteen clocks a year through the second decade. Fewer clocks were completed in the months of January

and February, when short, cold days would probably have reduced the time spent in the workshop, and in September and October, when harvesting obligations limited time available for clockmaking. But the seasonal fluctuations were slight, and the *Register* shows that production was remarkably steady over twenty years. In only 32 of the 216 calendar months covered by the *Register* was a clock not completed. Following blank months Roberts frequently finished two or three clocks in short order. On four occasions two clocks were completed on the same day, and on a further forty-four occasions he completed two clocks within ten days or less of each other, as Table 2 shows.

MARKET CONDITIONS

Although Roberts's method of production was that of a craftsman making an individual article for each customer, he clearly sometimes worked on small batches, or at least prepared some components for future clocks at times when demand was slack. As the tables illustrate, production was normally continuous. Roberts did *not*, however, take the crucial next step, into bulk production ahead of demand. This innovation, made by American clockmakers in the early nineteenth century, was the essential impetus along the road to standardized, interchangeable parts.¹² Roberts's method of production was determined by both demand and supply conditions. His local market was limited, as will be shown later; on the supply side, his was essentially a one-man part-time production unit, in which he was helped by his two sons, Samuel (who died young) and Thomas. Unlike the great London makers who directed large workshops staffed with numerous apprentices, and who employed extensive division of labor and much specialized subcontracting to cater for a luxury market, Roberts made each part of the movement himself. He undertook the final stages of manufacture and assembly only in response to a direct commission.

Such a method was quite adequate for conditions prevailing within Roberts's marketplace. The main constraints limiting output came from demand rather than supply. As time passed and Roberts became more experienced, his craft skills (speed of manufacture and assembly) presumably increased as a result of "learning by doing." Although there is no way of knowing how many man-hours went into the construction of each clock, Table 2 suggests that Roberts could accelerate his rate of production whenever necessary.

¹² J. J. Murphy, "Entrepreneurship in the Establishment of the American Clock Industry," *Journal of Economic History* 26 (1966): 169–86.

TABLE 1**Samuel Roberts's Output of Clocks, by Month, 1755–74**

YEAR	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	TOTAL
1755	—	—	—	—	—	—	—	2	0	1	1	1	5 ^a
1756	1	1	0	1	2	1	—	—	—	—	—	—	6 ^b
1757	—	—	—	2	0	0	3	1	1	1	0	1	9 ^c
1758	2	0	2	1	0	2	1	2	1	1	1	1	14
1759	0	1	1	2	1	2	2	0	2	0	2	1	13 ^d
1760	1	2	0	2	0	2	2	2	0	1	2	0	14
1761	0	2	0	1	1	2	2	2	0	0	1	1	13
1762	1	0	1	1	1	2	1	1	1	0	1	1	11
1763	1	1	0	2	2	0	2	0	0	1	1	2	12
1764	0	2	1	1	0	1	0	2	1	1	1	2	12
1765	1	1	2	1	1	1	2	2	1	1	3	2	18

1766	1	1	2	1	2	1	2	1	0	2	2	1	16
1767	1	1	2	1	3	3	1	2	1	1	2	2	19
1768	1	0	2	0	3	2	2	2	0	2	3	2	19
1769	1	2	2	1	2	3	1	2	2	1	2	3	22
1770	3	1	3	1	1	3	1	2	2	2	0	2	21
1771	1	1	1	1	1	2	1	1	2	0	1	1	13
1772	2	1	2	1	2	3	1	3	2	2	2	2	23
1773	1	1	3	3	1	3	2	1	1	1	4	1	22
1774	1	1	1	2	—	—	—	—	—	—	—	—	5 ^c
TOTAL	19	19	25	25	23	32	26	28	17	18	29	26	

Source: Samuel Roberts, *Register of Clocks*.

^aFive months only. *Register* entries start on 8 August.

^bSix months only. Last entry on 30 June. Records of 8 clocks (numbers 113–20 inclusive) are missing. Five have been allocated to 1756 and 3 to 1757, on the basis of the trend of Roberts's output.

^cNine months only. *Register* recommences on 30 April. See note b.

^dNumber 150 is for a dial plate only, but there are two clocks numbered 156.

^eFour months only. Entries cease on 15 April.

TABLE 2
Number of Clocks Completed by Samuel Roberts,
by Time Elapsed between Completions

DAYS BETWEEN COMPLETIONS	NUMBER OF CLOCKS COMPLETED			TOTAL	PERCENTAGE ^a
	1755-62	1763-68	1769-74		
0-9	8	16	24	48	17
10-19	20	27	46	93	33
20-29	19	32	19	70	25
30-39	14	13	10	37	13
40-49	9	3	4	16	6
Over 50	8	5	1	14	5
Unclear	7	0	2	9	
TOTAL	85	96	106	287	

Source: Samuel Roberts, *Register of Clocks*.

^aClocks for which the date of completion is unclear have not been included in calculating percentages. Percentages have been rounded off.

Two other features of the pattern of production need to be explained. The first is the overall increase of approximately 50 percent in annual output between the first and second decades spanned by the *Register*. Here the explanation must lie mostly with the geographical extension of Roberts's market. Known sales in the "home market" (within six miles of Llanfair Caereinion) increased from forty-one in the first decade (1755-64) to fifty-five in the second (1765-74), while those in the "distant market" (beyond six miles) nearly doubled, from forty to seventy-five. Over time, Roberts's fame as a clockmaker spread beyond his immediate community, leading to a rise in sales.

Paradoxically, the nature of demand may also explain the plunge in output in 1771, when only thirteen clocks were made. Under prevailing market conditions, there was a very real limit to local demand. Table 3 shows that in the years up to and including 1770, almost half of the customers with known addresses, 86 out of 197, lived within six miles of Llanfair, in the "home market." The very nature of the enterprise implies that a similar (or larger) proportion of the 101 clocks made before the *Register* commenced were probably bought by local customers. By 1770 most of those in the neighborhood who had the purchasing power to buy a clock had probably already done so, and were unlikely to need another. Samuel Roberts's clocks were very durable; they did not become obsolete or wear out rapidly. There was no short-run replacement demand.

The hypothesis that local demand had become saturated is supported by evidence in the *Register* for the years 1772 and 1773, when Roberts increased his annual output again to more than twenty clocks. He was able to do so by extending his market through a clock club. In each of these years eleven clocks (half the annual output) were described as “for ye club,” and were separately numbered as such, in addition to the overall serial numbers. A clock club was an early means of collective hire-purchase.¹³ It operated under very simple rules: club members made regular subscriptions (in this case probably 6*d.* a week for up to two years) to a craftsman who agreed to produce, say, a clock a month. The clocks would be collected *seriatim* as agreed by members, usually after drawing lots. The craftsman gained an assured income and tapped a new market. The customers were committed to saving and acquired an item otherwise beyond immediate reach. Roberts’s club clocks were made at a rate of one a month for eleven months in each year; the most expensive were made first and the cheapest last. It will be argued below that internal clues (the absence of place names) suggest that most of the club demand was local. The innovation of a clock club indicates a significant broadening at the bottom end of an entirely new market.

THE CLOCKS

The overwhelming majority of Roberts’s customers were first-time buyers, new consumers of a new product. Only 3 percent (9 out of 285) of the entries in the *Register* indicate that clocks went to customers who might have bought a clock from another, more expensive clock-maker had Roberts not been able to supply them. Among these special orders were six for clocks costing from £3 10*s.* to £4 1*s.* Two were marked “nine days” (meaning that their movements needed to be wound weekly, not daily); another, for Mr. Rees Pryce, is not numbered, but its entry contains much technical detail about a calendar and a striking mechanism (“to strike upon 3 Bells”), and it cost six guineas. The two most expensive items, for Esq. Lloyd of Trefnant at eight guineas and a “large clock” for Pryce Jones, Esq., of Glanhavren, were probably mechanisms for tower clocks. Apart from these nine items, Roberts’s output consisted of variations or modifications of the same basic movement, which came in two versions: cheap (costing 45*s.*

¹³ E. P. Thompson, “Time, Work-Discipline, and Industrial Capitalism,” *Past and Present* 38 (1967): 70, cites an example in Sussex, where twenty customers clubbed together to pay twenty installments of 5*s.* each, drawing lots for one £5 timepiece. See also C. N. Ponsford, *Time in Exeter* (Exeter, 1978), 128, and Loomes, *Country Clocks*, 88–89.

TABLE 3
The Geographical Extent of Samuel Roberts's Market

	YEAR																			TOTAL	PERCENT- AGE	
	1755	1756	1757	1758	1759	1760	1761	1762	1763	1764	1765	1766	1767	1768	1769	1770	1771	1772	1773			1774
Number of customers*	5	6	9	14	15	15	14	11	12	12	18	16	19	19	22	21	13	23	22	5	291	
Place name not given																						
No information	1	0	1	2	2	2	0	0	1	3	1	2	1	1	3	2	3	6	6	4	41	14
Occupation given, therefore presumed local	0	0	0	0	1	0	1	0	2	1	1	0	1	2	0	0	1	0	0	0	10	3

Place name given																						
Illegible	1	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	6	2
Not located	0	1	0	3	0	3	1	1	1	0	2	1	1	1	2	2	1	2	2	0	24	8
Place name given and located (see map 1)																						
Llanfair, or within 3 mile radius	0	1	1	0	1	2	2	1	1	1	1	3	3	6	1	1	1	2	0	1	29	10
Within 3 to 6 mile radius	1	1	4	7	7	2	1	4	2	2	6	3	2	6	5	4	3	4	2	0	66	23
Within 6 to 9 mile radius	0	2	1	1	1	3	1	2	2	4	3	2	6	1	8	6	2	7	9	0	61	21
Within 9 to 18 mile radius	1	1	2	1	3	2	6	2	2	1	2	1	5	1	2	6	1	0	3	0	42	14
Beyond 18 mile radius	1	0	0	0	1	0	0	0	0	0	1	4	0	1	1	0	1	2	0	0	12	4

Source: Samuel Roberts, *Register of Clocks*.

^aBuyers of clocks, plus miscellaneous items.

TABLE 4

Annual Output of Samuel Roberts's Clocks, by Price, 1755-74

MODEL	PRICE RANGE	YEAR									
		1755	1756	1757	1758	1759	1760	1761	1762	1763	1764
C	70s. +		1	1	1	1			1	1	
B	52s. 6d. to 58s.				1	1		1			
	50s. 6d. to 52s.						1				
	50s.	1		1			5	2		1	6
B or A	48s. to 49s. 6d.				1	1					
	45s. to 47s. 6d.		1	2	1	1	1				
A	45s.	2	3	2	8	5	5	4	7	5	1
	44s. to 44s. 6d.	2	1	1	1		2	5	3	3	5
	40s. to 43s. 6d.			2	1	4		1		2	
	Recorded output:	5	6	9	14	13	14	13	11	12	12
	Annual totals		(11)	(12)							

Source: Samuel Roberts, *Register of Clocks*.

^aFor entries for 1755-57 and 1774, see notes to Table 1.

^bNo price given for clock no. 219.

or less) or expensive (costing between 50s. and 58s.)¹⁴ The former (Model A, in Table 4) had one hand; 61 percent of total output belongs to this category. The latter (Model B, in Table 4) had two hands ("with ye Minnaites upon") and accounted for 21 percent of output.

Until the end of the eighteenth century a single-handed clock indicated time perfectly adequately for most people, as it could show the smallest unit of time commonly referred to, the "half-quarter." To categorize the markets for single- and double-handed clocks as "rural" and "urban" respectively would be to oversimplify the case, for virtually all Roberts's customers were farm or village—not town—dwellers. The choice between models was governed by what people thought they could afford rather than by a felt need for greater precision. For many, minute hands were of less practical use than mechanical calendars, moon phasers (invaluable in the absence of public lighting), and repeaters. The last was a self-powered device connected to an hour bell that, when pulled, repeated the proximate hour; it was useful for telling the time at night.¹⁵ Before 1760 (when the technical notes tail off)

¹⁴ While Roberts offered one basic model in two variations, with some extras, other part-time clock-makers seem rarely to have made two clocks the same. See J. R. M. Setchell, "The Friendship of John Smeaton, F.R.S., with Henry Hindley, Instrument and Clockmaker of York . . .," *Notes and Records, Royal Society of London* 25 (1970): 81.

¹⁵ Edwardes, *Grandfather Clock*, 11-14.

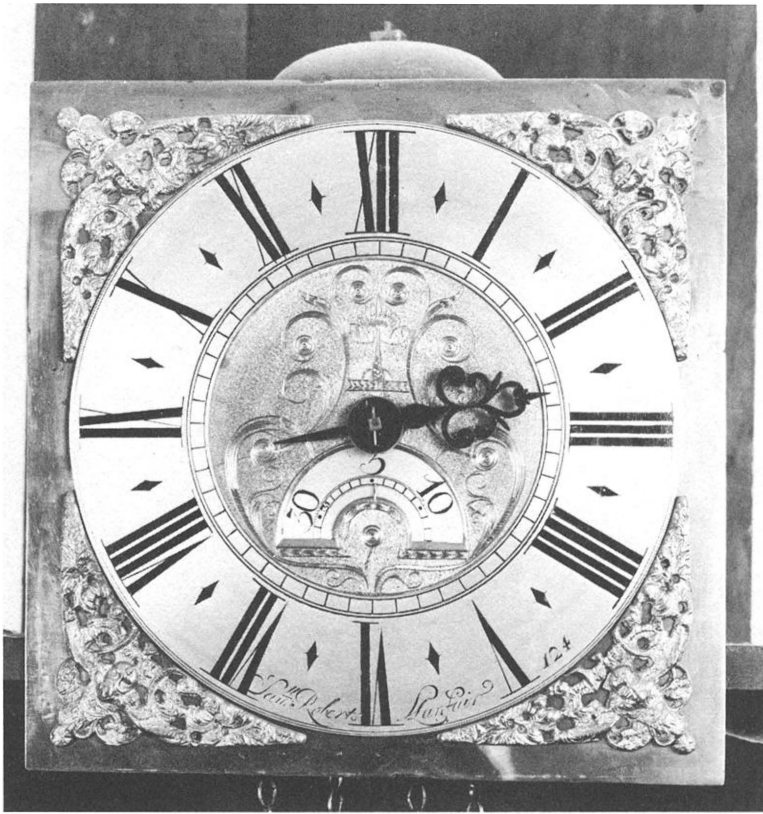
TABLE 4—Continued

YEAR										TOTAL BY CLASS		
1765	1766	1767	1768	1769	1770	1771	1772	1773	1774	TOTAL	NUMBER	PERCENTAGE
					1	1			1	9	9	3
	1	2	1	3	1	2	6	2		21		
		1	1			1	3	3		10	61	21
2	1	2			3	3	1	1	1	30		
	1	1	2	5	1	2	5	4		23		
1	1	1	1		2		2		3	17	50	17
6	11	4	6	7	5	1	4	10		96		
5		7	4	6	4	1				50	176	61
3	1	1	4	1	4	2	2	2		30		
18	16	19	19	22	21	13	23	22	5	287		
(19)										(295)		

Roberts made four clocks, costing between 50s. and 55s., with repeating devices; only two of these were also described as having a minute hand.

Some fifty clocks (17 percent of the total) are difficult to categorize, as they fall into an intermediate price range of between 45s. 6d. and 49s. 6d. Some were expensive versions of Model A; others were cheap versions of Model B. The main difference between the two was the minute hand, which cost 5s. If a price of 47s. 6d. is taken as the dividing line between the two models, then approximately two-thirds of all clocks belonged to the cheap, one-hand category. In 1769 a "Minnit clock and Chaines" (a two-hander with chains) cost 53s. Reasons for minor price variations cannot be determined. Perhaps Roberts charged an extra shilling or two when he could, or knocked off sixpence or so for a friend or near neighbor, or as a discount for advance or prompt payment.

As there seems to be no connection between price differences and the distance a customer lived from Pant-y-Tanhouse, it cannot be established whether the price included a delivery charge. We may assume, however, that Roberts delivered many of the clocks himself, if only to see that the movement was properly mounted and set into its case, and to instruct the owner how to wind and adjust the mechanism. Roberts, of course, made only the movements. It was up to the cus-



CLOCKDIAL (1757)

Samuel Roberts designed this clock for its purchaser, David Hugh of Meifod, and sold it for £2 5s. His entry for it in his register includes the following technical data: "Watch part 78:72:36 . . . Dial 54 by 13." (Photograph courtesy of the Welsh Folk Museum, St. Fagans, Cardiff, Wales.)

tomter either to make his own case or to get a local carpenter to construct one. In rural areas of Wales (and elsewhere) it was "usual for the head of the family to be skilled in every trade . . . as that of carpenter," and most families included someone who could make basic furniture.¹⁶ In the Montgomeryshire borderland cases were sometimes made from pine, but usually from oak, which was especially plentiful in the district.¹⁷ A grandfather clock was a conspicuous adornment, given a place

¹⁶ A. H. Dodd, *The Industrial Revolution in North Wales* (Cardiff, 1933, 3d ed., 1971), 329.

¹⁷ E. Estyn Evans, "Historical Geography of the Shropshire-Montgomeryshire Borderland," *Montgomeryshire Collections* 10 (1929): 1-30.

of honor in every home, and sometimes quite elaborate cases were made.¹⁸ Even without its case, which might weigh up to one hundred pounds, a clock movement with its weight(s) and pendulum was an awkward package. To prevent damage the main components would have to be packed separately and then reassembled into the long case. The market for long-case clocks, as for most bulky items, was essentially local.

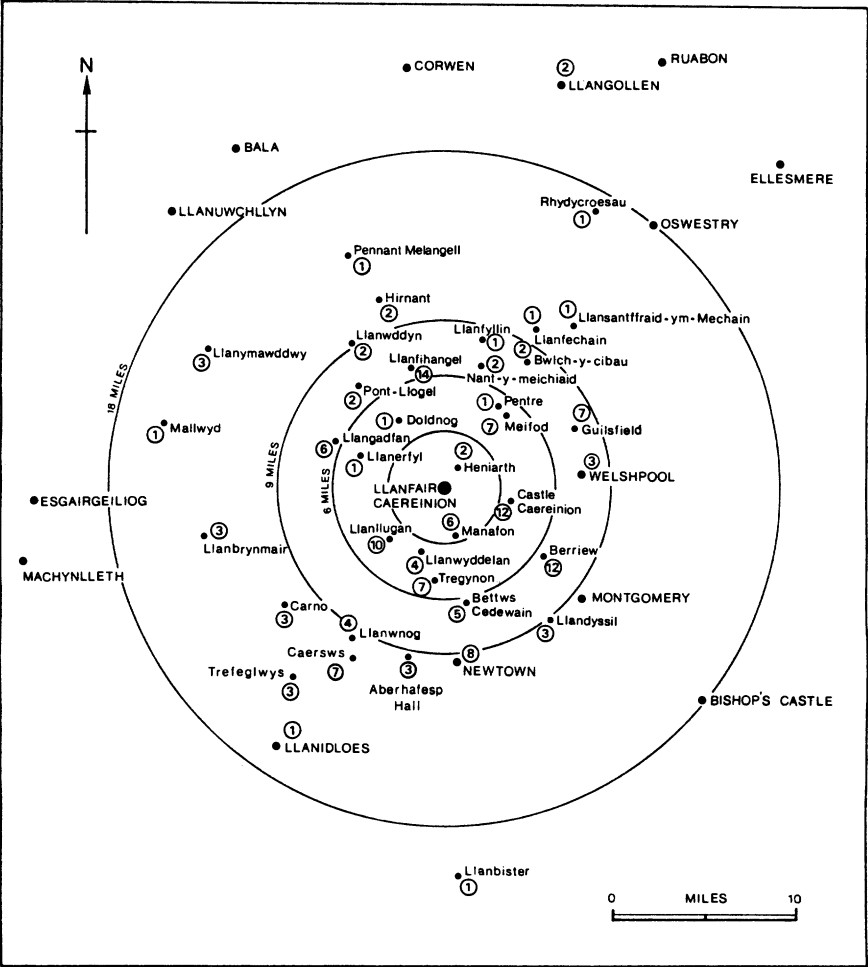
Whether Roberts delivered or the customer collected, most clocks found homes within a few miles of Pant-y-Tanhouse. Place names are given for some 240 of the 291 names in the *Register* (buyers of the 287 clocks, plus names mentioned in miscellaneous entries). Six are illegible, and another twenty-four cannot be identified with confidence. The remainder—210 place names—have been located with reasonable certainty. Map 1 shows, and Table 3 summarizes, information about the geographical extent of Roberts's market.¹⁹

THE CUSTOMERS

Twenty-nine known customers lived in the village, in nearby farmhouses, and in the neighboring hamlets of Llangyniw, Ystrad, and Heniarth. Farther out, between three and six miles radius, are another sixty-six known customers, with particular concentrations in Meifod, Castle Caereinion, Llanwyddelan, and Llanllugan. Extending the radius another three miles, to nine miles, reveals the locations of sixty-one further customers, including thirty-four in the villages of Guildsfield, Bettws Cedewain, Llangadfan, and Llanfihangel. Beyond this distance customers were fewer, for obvious geographical and commercial reasons. To the hilly west and northwest, population was sparse and villages smaller and less frequent; in the more densely populated lowlands to the northeast, east, and south, Roberts's potential customers were also within easy access of rural clockmakers in Oswestry, Welshpool, Wrexham, and even Shrewsbury. Few of Roberts's customers lived far from Llanfair Caereinion; indeed the *Register* records

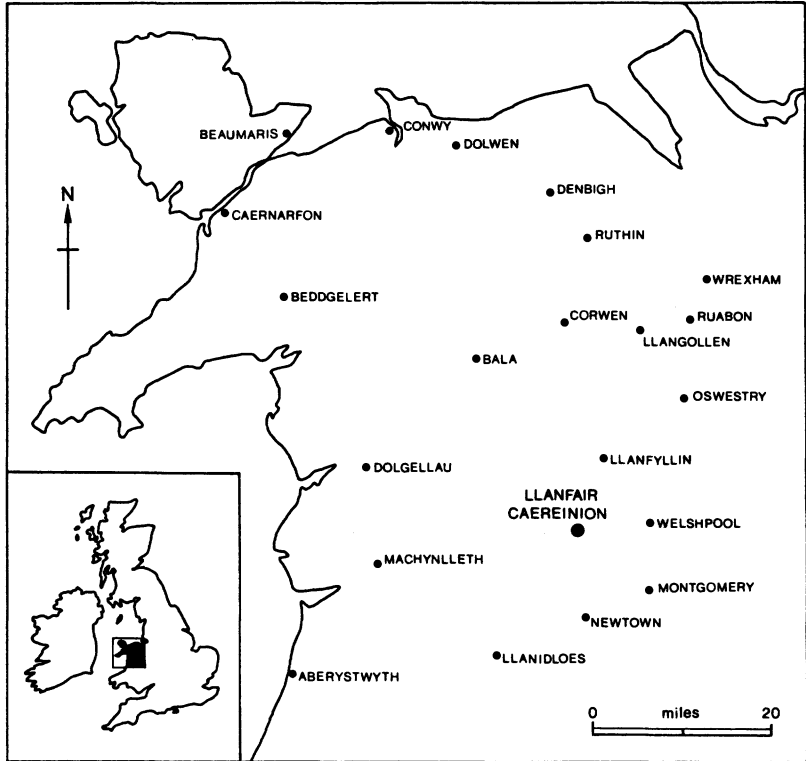
¹⁸ The modest two-hander, number 265, which Roberts made for 54s. in 1767, has an oak case with an elaborate marquetry of inlaid holly and bog oak. See Plate 5 (a) of Peate, *Clock and Watch Makers in Wales*, and Plate 194 of Edwardes, *Grandfather Clock*.

¹⁹ Map 1 and Table 3 were compiled by locating place names on the following Ordnance Survey Sheets: (i) 125, 126, 136; 1:50,000, first series; (ii) S.J. 00, 01, 10, 11; scale 2½ inches to 1 mile (1952); Sheet 40: Montgomery: Scale 1 inch to 1 mile (David and Charles facsimile, 1970 reprint of survey started in early 1800s and completed in 1830). See also Elwyn Davies, ed., *A Gazetteer of Welsh Place Names* (Cardiff, 1957), and Thomas Morgan, *The Place Names of Wales* (2d rev. ed., 1912), 224–35. It is impossible to be precise about some places, either because the entry is incomplete ("Pant-y-") or because some place names (Pentre, Bwlch, Cwm, Bryn, Allt, etc.) are common to most Welsh localities, often as informal local abbreviations. Where it seems reasonable to allocate these to places in the neighborhood of Llanfair Caereinion, this has been done.



MAP 1

The Market for Samuel Roberts's Clocks



MAP 2

**Towns in North and Mid Wales with at Least One Clockmaker,
1750-1800**

that only a dozen came from farther than eighteen miles. Of these, some lived in the Radnorshire villages of Llanbwloch and Llangynidr, while others were from Dolgellau, Machynlleth, and Llangollen. Without comparable information on the models and prices of other makers, it cannot be determined if Roberts's occasional long-distance sales were made because his prices were very competitive. A more likely explanation is that these customers knew Roberts personally or had relatives in and around Llanfair Caereinion who knew him. A long-case clock, for example, made an attractive and enduring wedding gift.

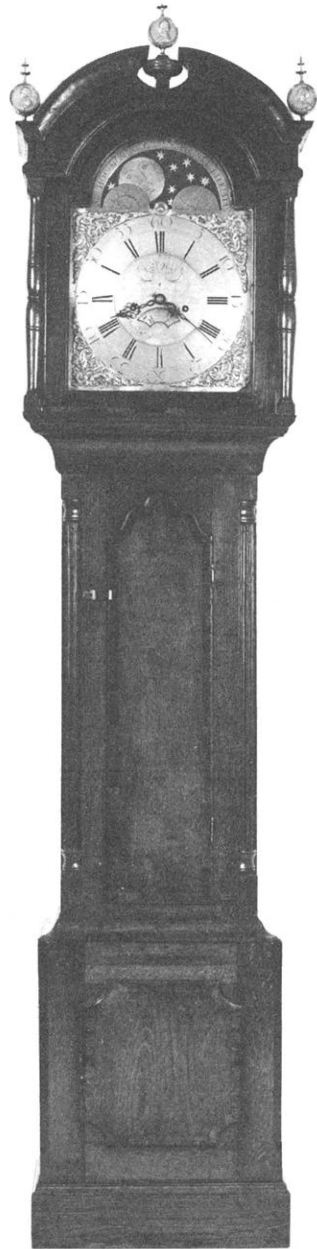
The intensely local nature of Roberts's market is understated by the map and Table 3, for it is highly probable that most if not all of the fifty-one customers without place names were local. When Roberts left an address out, it almost certainly meant that he knew the customer personally. He needed to note the names and addresses only of strangers from distant villages. For twenty years the entries in the *Register* are so systematic and methodical that the omission of an address seems deliberate rather than accidental. For those whom he knew well, the name alone sufficed. Of the fifty-one clocks without a location, ten give indications of the customer's craft or trade, such as "Evan Davies Glover." In rural Wales, then as now, such an appellation indicates personal and local familiarity.²¹

In all, fourteen entries describe occupations. They include two clergymen (Mr. Owen, vicar of Lanfair, and Rev. Mr. Jones of Llanegryn), three "coopars," and a smith, a miller, a "harpar," a weaver, and "joyner." A customer from "the Peace Office" may have been a constable. Not surprisingly—for this was a cattle-rearing area with a village that was a center of crafts and trades connected with leather—there were two glovers and three tanners.²² Thirteen, including the clergymen, had the title "Mr.," indicating some social or professional standing, and there were the two gentlemen graced with the title "Esquire," for whom Roberts made his most expensive clocks. Two entries describe customers as "widow" or "Mrs.," and there are some female baptismal names without a title, probably indicating spinsters. But only eleven names in all belong to women. Negotiation for such an unusual and expensive transaction as the purchase of a clock was almost invariably a masculine prerogative.

²¹ The addition of a trade or place name to a surname helps to discriminate among the handful of well-established classic Welsh surnames; the *Register* contains twenty-one customers by the name of Davies, twenty-three Evanses, twelve Lloyds, sixteen Morrisises, twenty-one Thomases, and fully thirty-eight Joneses. See also T. E. Morris, "Welsh Surnames in the Border Counties of Wales," *Y Cymmrodor* 43 (1932): 93ff.

²² Charles H. Humphreys, "The Trade and Industries of Llanfair Caereinion a Hundred Years Ago," *Montgomeryshire Collections* 46 (1940): 107–10.

UNNUMBERED CLOCK (1776)
Roberts made this clock for his own family. The poem engraved on the dial reads:
I labour hear with all my might
to show thy Hours both Day & night
Therefore warning take by mee
and serve thou God as I serve thee
(*Photograph courtesy of the Welsh Folk Museum, St. Fagans, Cardiff, Wales.*)



THE ECONOMICS OF RURAL CLOCKMAKING

The inclusion of a price for each entry allows a measurement of Roberts's annual receipts, summarized in Table 5. It is not easy, however, to calculate Roberts's income from clockmaking. We do not know his precise capital costs, his running expenses and costs of raw materials, or even whether the price included delivery. Receipts rose from an average daily level of 1s. 6d. to 2s. over the first decade, and to 3s. by the end of the second. Income presumably increased as well. Of course, Roberts's earnings from clockmaking were supplementary to his general subsistence derived from the farm tenancy. He almost certainly earned more from clockmaking than he could have earned from the most widely available local alternative, handloom weaving. Roberts's mean daily receipts were two or three times the shilling a day, or less, earned by agricultural laborers in North Wales at this time. We do not know how Roberts disposed his income during his working and later life. But his earning power as a part-time clockmaker helped him to accumulate sufficient wealth to make a cash bequest in his will of £30 to his daughter Martha, a sum equivalent to well over a year's budget for a laborer's family.²³

Clockmaking, then, was reasonably remunerative, as well as a thoroughly satisfying craft activity. Yet Roberts did not abandon his farm and set up a workshop in one of the nearby large towns. That he chose to keep two strings to his bow may be less an indication of entrepreneurial nervousness than of his contentment with his lot in a closely knit Welsh rural community. For every village clockmaker like John Harrison, who reached for fame and fortune in the world of luxury markets and contemporary high technology, there were scores of Samuel Robertses who stayed at home.

THE DUAL REVOLUTION

Samuel Roberts's clocks illustrate one aspect of the dual revolution in British horology that had begun during the second half of the seventeenth century. The luxury end of the industry flourished. Centered in London and supplied with components made by armies of outworkers in Liverpool and Coventry, it produced exquisite watches and clocks for the wealthy and, ultimately, prodigiously accurate chronometers for Britain's navy and mercantile marine. Superlative craftsman-

²³ National Library of Wales, Aberystwyth: Will of Samuel Roberts, 1 February 1800, proved before the Ecclesiastical Court of the Diocese of St. Asaph, 17 June 1801. Unfortunately the will does not have an inventory attached; it simply declared that "my working tools in the Shop" were to go to one of Roberts's sons, Lewis. For annual budgets, see Dodd, *Industrial Revolution in North Wales*, 335-36.

TABLE 5
Samuel Roberts's Annual Output and Gross Receipts from
Clockmaking, 1755-74

YEAR	NUMBER OF CLOCKS PRODUCED	RECEIPTS	MEAN PRICE PER CLOCK ^a	AVERAGE RECEIPTS PER DAY
1755 ^b	5	£11.8.0	45s. 6d.	18.2d.
1756 ^c	6 (11)	£15.6.6	51s.	20.4d.
1757 ^d	9 (12)	£21.19.4	49s.	19.5d.
1758	14	£36.0.6	51s.	23.7d.
1759	13	£31.9.0	48s. 6d.	20.7d.
1760	14	£33.0.6	47s.	21.7d.
1761	13	£29.14.6	46s.	19.6d.
1762	11	£30.15.0	56s.	20.2d.
1763	12	£34.3.0	57s.	22.5d.
1764	12	£28.5.0	47s.	18.6d.
1765 ^e	18 (19)	£38.4.0	42s. 6d.	26.5d.
1766	16	£37.2.0	46s. 6d.	24.3d.
1767	19	£44.5.0	46s. 6d.	29.1d.
1768	19	£42.15.6	45s.	28.1d.
1769	22	£51.1.0	46s. 6d.	33.6d.
1770	21	£49.11.6	47s.	32.6d.
1771	13	£33.0.0	51s.	21.7d.
1772	23	£55.16.6	48s. 6d.	36.7d.
1773	22	£51.16.6	47s.	34.1d.
1774 ^f	5	£12.19.0	52s.	25.9d.
TOTAL	287 (295)	£689.13.4	48s.	25.2d.

Source: Samuel Roberts, *Register of Clocks*.

^aTo nearest 6d.

^bFive months' production.

^cSix months' production.

^dNine months' production.

^eNo price entered for clock 219.

^fFour months' production.

ship went hand in hand with the highest reaches of contemporary technology.²⁴ Simultaneously, another aspect of the same revolution was the countrywide diffusion of the basic horological skills that resulted in the thirty-hour pull-wind clock.²⁵ Knowledge of the mechanics of simple clock movements meant that every small town had its clockmaker, and every village church added a clock to its steeple. In Wales alone more than two hundred clockmakers have been identified as hav-

²⁴ David S. Landes, "Watchmaking: A Case Study in Enterprise and Change," *Business History Review* 53 (spring 1979): 1-39, esp. 5-12; Alun C. Davies, "The Life and Death of a Scientific Instrument: The Marine Chronometer, 1770-1920," *Annals of Science* 35 (1978): 509-25.

²⁵ Loomes, *Country Clocks*, 54ff.

ing practiced the craft during the eighteenth century, and the number for the rest of the British Isles ran into thousands. At least fifty country clockmakers operated at one time or another, between 1750 and 1800, in the two dozen largest villages and towns of North Wales, a sparsely peopled, generally poor agricultural region (see Map 2). Dolgellau boasted four, Caernarvon five, while Wrexham, some thirty miles to the northeast of Llanfair Caereinion, was a veritable provincial horological capital, with ten known makers in this period.²⁶ None left a *Register* like Roberts's, so little is known of the range, price, and quantity of their output. Yet the very existence of these craftsmen, with their new skills and new products, suggests the profound consequences of two crucial technical developments in late-seventeenth-century horology.

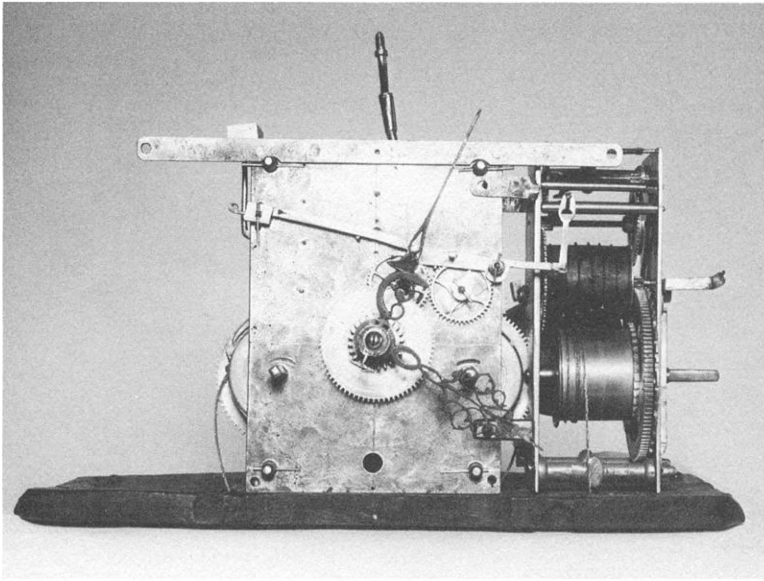
The first of these developments was the invention of the pendulum, attributed to Christiaan Huygens in 1658. It was a device that might be applied equally to small domestic and large public clocks, such as turret clocks in church towers. A pendulum permitted much greater accuracy than the foliot, the device that preceded it, not only because it might be finely adjusted, but also because even when used with a verge escapement its beat was more independent of the wheel train. An early conversion by Huygens at Scheveningen, for example, reduced timekeeping error from about a quarter of an hour to about a minute a day, well within the normal needs of a society in which local timekeeping was crudely determined by sundials. The dramatic improvement effected by the pendulum was widely and rapidly diffused. The typical domestic clock of the time—a lantern clock mounted on brackets with its weights hanging freely below—could easily be modified to incorporate a pendulum.²⁷

The second crucial development was also easily adopted and could equally be applied to existing turret and domestic clocks. This was the anchor (or recoil) escapement. While credit for its invention is disputed, its development during the 1670s owed much to the great experimental physicist Robert Hooke. The anchor escapement contracted the pendulum's arc of swing and interfered less with its free motion than had its predecessor, the verge escapement.²⁸ By the early eighteenth century both the pendulum and anchor escapement were

²⁶ Compiled from list in Peate, *Clock and Watch Makers in Wales*, 31–89.

²⁷ See Ronald A. Lee, "Early Pendulum Clocks," *Antiquarian Horology* 11 (1978): 146ff, and Michael S. Mahoney, "Christiaan Huygens: The Measurement of Time and of Longitude at Sea," in *Studies on Christiaan Huygens*, ed. H. J. M. Bos et al. (Lisse, Holland, 1980), 236–38.

²⁸ J. Hartley, "The Thirty-Hour Key Wound Long Case Clock," *Antiquarian Horology* 11 (1978): 33–34. For Hooke's contribution see R. W. Symonds, *Thomas Tompion: His Life and Work* (London, 1951), 14, 112–13, and R. T. Gunther, *The Life and Work of Robert Hooke* (Oxford, 1930), 69.



CLOCK MOVEMENT (1776)

This photograph shows the clock movement—including the quarter strike mechanism—for the previously illustrated clock that Roberts made for his own family. (Photograph courtesy of the Welsh Folk Museum, St. Fagans, Cardiff, Wales.)

well-understood features of precision clockwork and were widely adopted. Indeed, more than half a century later, as Roberts's *Register* testifies, conversions were still being made, for a note at the end of entries for 1760 reads "clock turned to long pendulum. . . . Pendulum of common length."²⁹ Village blacksmiths and country clockmakers who had served apprenticeships with London makers knew how to modify turret clocks. They found it not too difficult to take the next step, namely the replication of the movements in miniature, using brass and steel instead of iron and wood.

The raw materials for clockmaking—brass, copper, zinc, lead, and iron—were either readily available or could be easily acquired in most parts of the British Isles. Roberts's small village of Llanfair Caereinion was not isolated; it was at the hub of five roads connecting Machynlleth, Dolgellau, and Aberystwyth to England. Welshpool and Montgomery, nine and seven miles distant, were destinations on major trade routes. Lead was mined locally, and Anglesey copper was abun-

²⁹ Noted between entries for clocks 170 and 171 in the *Register*.

dant; indeed, its price was falling throughout this period.³⁰ In any event the cost of raw materials was a modest portion of the total cost of a completed clock. Roberts could either have bought the metals in the form of rough plates or bars or, with a small furnace, used old metal as scrap for recasting and reworking. He must have had basic blacksmith's equipment, including bellows and anvil, to work the iron and forge the steel for hands and pinions, and a furnace to cast brass for the face and spandrels (the decorations filling the four corners of a square dial). By the mid-eighteenth century, as T. S. Willan has shown, shopkeepers such as Abraham Dent could supply rural clockmakers (like Roberts) not merely with a wide range of components and tools but even with ready-made rough brass plates and castings.³¹ Roberts, however, seems to have been highly self-sufficient, and evidence from surviving clocks shows that he cast his own spandrels from a mold, filed them, and secured them to a dial plate. The dials show that he did his own crude engraving. His workbench, consequently, must have contained vices, a lathe, grindstones to sharpen the tools, and an "engine."

If the pendulum and the anchor escapement lowered technical barriers, the wheel-cutting engine was the greatest practical help to rural clockmakers. Invented in the late seventeenth century, the engine greatly simplified and standardized the method of cutting out wheels and pinions. The wheel blank was placed on it, the number of teeth to be cut was selected, and their spacing and measuring then automatically followed. Various simplified formulas determined the layout of the trains and wheels. Samuel Roberts knew these, probably because he had been shown them. Early on, in 1755, he noted the individual variations of his movements by notes such as "Watch part ye Body is $78 \times 66 . . . 36$. Dial wheel is 54 by 13. Pendulum is 3 ft 10 inch from Top to Bottom." Over the next few years, apart from special-order clocks, he abbreviated entries, simply giving the various ratios: "78 72 40. Dial 48 by 14." Clock 171 (February 1761) has the note "with the same number as the others made before," and thereafter the technical data is very infrequent. It was the engine that permitted Roberts and his contemporary clockmakers to manufacture movements simply, reliably, and relatively rapidly. As Dr. Pearson explained in his celebrated entries on clockmaking for Abraham Rees's *Cyclopaedia*: "The clockmakers of the present day have greatly the advantage of those who laboured in the art in the infancy of clockmaking, in that they have the

³⁰ Dodd, *Industrial Revolution in North Wales*, 158, 169, 185, 309; W. J. Lewis, "Lead Mining in Eastern Montgomeryshire in 1751," *Montgomeryshire Collections*, 58 (1963-64): 114-24.

³¹ T. S. Willan, *Abraham Dent: An Eighteenth Century Shopkeeper* (1970), 36-37.

most difficult operations in theory, such as dividing and cutting the wheels . . . done by engines not only in less than one-hundredth part of the time, but with infinitely more accuracy than they could be performed by hand with manual tools."³² The teeth left by the wheel cutter had to be rounded up at the top by a hand file. Roberts, like all craftsmen who worked with metal, would have had an array of files, and it was in the use of these tools that a clockmaker's skills were crucial: "It is not easy," T.S. Ashton noted, "for the layman of today to appreciate the part played by the file in the manufacturing processes of earlier generations."³³

IMPLICATIONS

Compared with the elegant designs and technical sophistication of the great contemporary London makers' products, Roberts's clocks were crude and simple. Yet their significance was considerable. They were among the first large and comparatively expensive consumer durables bought by farmers and artisans in the middle of the eighteenth century. At around 50s. a clock was one of the most expensive single items bought by Montgomeryshire farmers in their lifetimes, costing as much as their most important purchase, a handloom.³⁴ A loom was a desirable capital investment. A clock was one of those "decencies, half-way between luxuries and necessities" whose appearance and spread among "the rising part of the population" has been identified by David Eversley as one of the key elements in the changing patterns of consumption in Britain's domestic mass market between 1750 and 1780.³⁵

If expensive compared with a handloom, a clock was nevertheless cheaper than any alternative timepiece such as a metal or silver watch.

³² See "A Thirty Hours Clock, with a Larum and Count-Wheel Striking Work," s.v. "Clock" in vol. 8 (1819) and the illustration, s.v. "Horology" in vol. 2 (plates) (1820), of Abraham Rees, *Cyclopaedia*. The articles describe tools and methods similar to those used by Roberts; they were originally published in 1807-8; see N. B. Harte, "Rees' Clocks, Watches, Chronometers and Naval Architecture: A Note," *Maritime History* 3 (1973): 92-95. For the development of wheel-cutting engines and their spread in the late eighteenth century, see Leonard Weiss, *Watchmaking in England, 1760-1820* (London, 1982), 153-75.

³³ T. S. Ashton, *An Eighteenth Century Industrialist: Peter Stubs of Warrington, 1756-1806* (Manchester, 1939), 60. See also F. Mercer, "The Manufacture of Files, 1773-1935," *Horological Journal* 77 (1935): 136-41.

³⁴ The cheapest handloom in Montgomeryshire in the eighteenth century was £2. See J. G. Jenkins, "The Woollen Industry," in *Wales in the Eighteenth Century*, ed. Donald Moore (Swansea, 1976), 97.

³⁵ D. E. C. Eversley, "The Home Market and Economic Growth in England, 1750-80," in *Land, Labour and Population in the Industrial Revolution: Essays Presented to J. D. Chambers*, ed. E. L. Jones and G. E. Mingay (London, 1967), 212. See also Neil McKendrick, "The Consumer Revolution of Eighteenth Century England," in *The Birth of a Consumer Society: The Commercialization of Eighteenth Century England*, ed. Neil McKendrick, et al. (London, 1982), 26-27.

Cheap watches were notoriously unreliable. Although they cost as much as, or more than, the cheapest of Roberts's clocks, they were likely to involve their owner in frequent and probably expensive repairs. A thirty-hour pull-wind grandfather clock, on the other hand, was virtually foolproof. It was a durable, conspicuously attractive piece of furniture to be admired by visitors, a domestic accoutrement whose possession combined function and prestige. Few comparable consumer goods were available to Roberts's customers, and it is easy to see why his clocks were so popular. They satisfied the kind of demand that in later eras (when margins of disposable income were higher) found expression in the purchase of cottage pianos, gramophones, and radios. But the diffusion of clocks at this level had a significance greater than that normally accorded to the introduction of a new consumer good. The spread of Roberts's clocks, and of those of hundreds of similar craftsmen in other rural parts of Britain, represented a fundamental shift in people's consciousness about time measurement.

The introduction of domestic clocks marked a crucial move from a primitive to a relatively complex state of time consciousness. E.P. Thompson has noted the difference between the "task-orientation" characteristic of clockless societies, and the general diffusion of timepieces "occurring (as one would expect) at the exact moment when the industrial revolution demanded a greater synchronization of labour."³⁶ Societies with and without domestic clocks had very different *mentalités*. The purchase of even a one-handed clock, with its rough approximation of time, was an irrevocable step. Henceforth its owner—and other members of the household—became accustomed to time measured by a clockwork mechanism and not by a moving shadow. The most immediate and frequent *need* for knowing the time was for attending meetings, especially religious ones. But once a relatively precise degree of time measurement became a normal feature of domestic life, it enabled one to apportion or to measure hours devoted to competing activities. For many of Roberts's customers this meant being able to measure the time spent on farming and on weaving; clocks no doubt enabled them also to make crude comparisons of returns to different kinds of labor. In the eighteenth century as today, the demand for timepieces accompanied "the adoption of all the values that we commonly associate with modern living [including] a whole bundle of new work and life requirements. . . . [U]se of timepieces [grows] fast-

³⁶ E. P. Thompson, "Time, Work-Discipline, and Industrial Capitalism," 60. "When any group of workers passed into a phase of improving living standards, the acquisition of timepieces was one of the first things noticed by observers" (*ibid.*, 70).

est in those countries . . . on the steepest part of the development curve."³⁷ Although firm information on this point is lacking, it is likely that few other rural areas in Europe—with the possible exception of Holland—experienced a comparable permeation of clock ownership at this level during the second half of the eighteenth century. Hence the spread of clocks in and around Llanfair Caereinion—a comparatively backward, semicommercialized area of rural Wales—reflected the growing complexity and sophistication of British society in general.

³⁷ Landes, *Revolution in Time*, 325–26.