CHAPTER 6

# CAPITAL FORMATION: CORNWALL'S PARTIAL INDUSTRIALIZATION

In the previous three chapters we saw how Cornwall began to be imagined in new ways in the late eighteenth century. At several points in the creation of the symbolic shape of Cornwall in this period the mining industry has made an appearance. Indeed, we noted that the geography of identity mirrored the geography of mining. The language in which the Cornish identity was asserted, the ideology of 'industrial civilisation' and the institutions of the early nineteenth century did not, therefore, occur in a vacuum. There was a context and the material facts of Cornwall's economic history make up part of that context. Adopting Wahrman's insight, we can state that the economic framework provided a 'space of possibilities' within which representations of Cornwall could be produced and reproduced (Wahrman, 1995, 6 and 8). While Cornwall's mining economy did not determine the way it was imagined it did provide the parameters within which imaginations took root.

This chapter reviews some approaches to Cornwall's economic history in this period before proposing a framework for understanding the economic background to identity formation. We use historical perspectives on proto-industrialisation and industrial regions in order to assist us in discussing aspects of the Cornish economy between 1740 and 1870. And in doing so we also place Cornwall in its wider comparative perspective.

### *Framing the Cornish economy*

Economic historians and regional geographers provide two perspectives on the Cornish economy in this period. These can be summarised as 'Cornwall as pastoralized margin' and 'Cornwall as industrial region'. According to Berg, 'manufacture was by no means new to the eighteenth century; cottage industries were widespread over the Scottish Highlands, west Wales, the Yorkshire Dales, the Derbyshire and Cornish countrysides'. But competition from more efficient industrial areas meant that these rural margins experienced a 'new pastoralization', the destruction of their cottage industries and a pauperisation of the communities dependent on them. This led to a 'long period of resistance to technology in many such communities' (Berg, 1994a, 6). Berg bases her argument on that of Richards who sees Cornwall as a part of the 'margins' of the industrial revolution. Along with such diverse regions as the west and north of Ireland, the Hebrides and Australia, Cornwall was 'drawn into the widening economic network on terms which seemed to be dominated by the more industrial, more populated and more dynamic centres' and 'condemned, at least in the early phase of industrialisation, to a greater dependence on non-industrial output' (Richards, 1993, 204). This view also lies behind Hoppit's explanation of the relatively low bankruptcy rate he discovered in eighteenth century Cornwall. This was because Cornwall was 'on the periphery of the national economy, away from the main flows of internal and external trade' (Hoppit, 1987, 62-63).

There are two major weaknesses in this account of Cornwall as a margin. First, unambiguous empirical evidence for this pastoralization, or de-industrialisation, of the countryside is hard to find, at least for the late eighteenth and early nineteenth

centuries. It may be possible that such de-industrialisation occurred in east Cornwall. Thus Heard's *Gazetteer* remarked that 'before the late war, the clothing business flourished' in Liskeard but had disappeared by the date of publication (Heard, 1817). Similarly, in Michaelstow in north Cornwall the published Census of 1801 claimed that 'the domestic manufacture of spinning obb yarn has been much injured by the introduction of machinery' (BPP, 1801, 47). This hints that some de-industrialisation took place during the Napoleonic war period, although more research is required in order to confirm or deny such a process. But in the west, a process of de-industrialisation of rural cottage industry, if it did take place, occurred much earlier. Lewis's comment in 1907 that the low wages of tinners in west Cornwall in the later seventeenth century were partly because 'no clothing trade existed to serve as a by-employment' (Lewis, 1907, 221) is evidence for this and has been borne out by more recent work.

In west Penwith, an area of early tin mining, Cullum has found that domestic textile production equipment became less common in inventories during the later seventeenth century, indicating a shift from domestic production to the consumption of imports (Cullum, 1993, 279). He concludes that this tin-producing region, although part of a geographical periphery, also saw an early penetration of consumer goods imported through the growing port of Penzance (Cullum, 1993, 293). But any potential de-industrialisation of local craft industries was offset by the parallel expansion of tin mining. What this suggests is a decline of rural textile industry as early as the seventeenth century in the western, mining areas of Cornwall but the avoidance of net de-industrialisation through the concurrent expansion of mining employment. If rural de-industrialisation did take place in the late eighteenth century, it was in the non-mining areas of east Cornwall.

The second weakness of the view of Cornwall as a de-industrialising and poverty-stricken margin is its difficulty in incorporating the mining industry into the picture. Sometimes the contradictions are unresolved. Berg, for example, after describing the Cornish countryside as an arena for new pastoralization, 'major dislocation' and the destruction of cottage industry, at the same time argues that 'early and rapid growth' in Cornwall produced 'the basis for one of the most advanced engineering centres in the world' (Berg, 1994a, 6 and 112). The crucial aspect here is the timing of these two processes –the decline of rural, domestic industry and the expansion of the (also rural) mining industry. Richards allows that Cornwall had been part of an 'older core' but appears to suggest that it became de-industrialised after 1815 when 'rural, low-productivity domestic industries' were swept away by the low-priced goods of modern factory industry (Richards, 1993, 211 and 215). However, as we have seen above, this date is certainly too late for the decline of domestic industry in the mining districts of west Cornwall and possibly too late also for their decline in the non-mining eastern districts. But, as a date for de-industrialisation, it is, as we shall see below, also far too early as it anticipates the peak of mining production by about half a century. In fact, at the very point when, according to Richards, Cornwall was beginning its economic decline, mining, the dominant sector of the Cornish economy, was poised on the brink of 40 years of almost uninterrupted growth.

While classifying late eighteenth and early nineteenth century Cornwall as a pastoralized margin lacks credibility, precisely because of the growth of metal mining, another perspective takes that growth as central and argues that Cornwall was one of Europe's early industrial regions. We have already met this perspective in the converging work of historical geographers and economic historians on the

industrial region (chapter 1). This work is part of a broader critique of the dominant aggregate approach to Britain's industrialisation that argues it was marked by continuity rather than revolution (Crafts, 1985). Maxine Berg and Pat Hudson, in particular, propose a new agenda for the economic history of the industrial revolution which moves beyond this dominant interpretation.

Their approach has obvious attractions to anyone trying to make sense of the details of Cornwall's industrial period. The new revisionism, by emphasising the importance of rebuilding 'the picture of economic and social change from new research at regional and local level' suggests that regional studies have an importance hitherto unrecognised (Berg and Hudson, 1992, 44. See also Lee, 1981 and Evans, 1992).

According to this regional perspective, in the eighteenth century distinct specialised, internally cohesive industrial regions emerged, linked to national and international markets. 'Sectoral specialisation by region' occurred as export trade helped to create integrated transport, commercial and financial links within the industrial region. These in turn rested on dense networks of social, family and business links. Exports went directly from the region rather than through London and regional lobbying or regionally based protest movements indicated growing regional consciousnesses with their epicentres in the larger provincial cities (Langton, 1984; Hudson, 1992, 102-108). We will return to this model of industrial regions below and use some of its concepts to contextualise aspects of Cornwall's economic history. However, before doing this we require a more robust narrative for this history.

### *Narrating Cornwall's economic history*

We can suggest four phases. First, the period to1750 can be seen as one of *transition*, as the foundations of extensive growth were established. Second, the long period from the 1750s to the 1830s contains the classic *growth* phase, when the contours of a specialised industrial region became apparent, but one with striking elements of continuity from the earlier period. Third, the two decades from the 1840s to the 1860s may be viewed as a distinct period of *modernisation*, when structural changes began to set Cornwall on a path of convergence with other more typical industrial regions. However, this trajectory was in turn abruptly arrested in the 1870s, pitching Cornwall into a fourth period of *de-industrialisation*.

*Transition*

Burt (1995) has set out the circumstances in which the non-ferrous metals industries grew from the seventeenth century. New non-recyclable uses led to a widening and deepening of the markets for lead, copper and tin. Early expansion of the firearms industry, stimulating lead production, was followed by a growing market for brass wire in the woollen industry and for tin from the China trade. These produced supply side responses in an institutional context of a tradition of free market exploitation and private property rights in minerals lacking in other parts of Europe. Organisation in Cornwall (and Derbyshire) was small-scale, lower cost, un-proletarianized and therefore more flexible, able 'to slide smoothly back into production, assisted by a continuing "subsidy" to labour costs from the agricultural by-employment of their labour force' (Burt, 1995, 31).

Output of Cornish tin rose during this transitional phase. Burt argues this was achieved through a multiplication of small units of production in the later

seventeenth century, worked by ‘semi-independent part-time miner/farmers, albeit with a greater degree of application of intensity’ (Burt, 1991, 249). As he acknowledges, this picture is reminiscent of the proto-industrial model of the origins of industrialisation (see Clarkson, 1985). Traditionally, this model, focusing on dispersed production in domestic units, has ignored or dismissed mining, seen as organised around centralised plant (Berg et al, 1983, 20; Coleman, 1983, 443). However, if Burt is right then the assumption that metal mining at this period was centralised is itself flawed. Instead the usual unit was the small underground working involving a handful of people, perhaps even families, and with very limited capitalisation, one that was the mining equivalent of the cottage workshop (Burt, 1998).

So does it help to view late seventeenth and early eighteenth century Cornwall as a proto-industrial economy? The poverty of Cornish tinners in the sixteenth and seventeenth centuries has been variously commented upon (Lewis, 1907, 221; Cornwall, 1988, 80) and implies a group of workers who were relatively easily attracted to tinning if required, only to be discarded when the market shrank. For Burt this produced an ‘independent and occupationally mobile society’ (Burt 1991, 267). It was also one where production costs were subsidised by other activities such as farming or fishing. This produced a labour force similar to the kelp, linen and straw-plaiting workers who Schrank identifies as proto-industrial in eighteenth century Orkney. As a result ‘there were few fixed labour costs, a very low remuneration rate for the producers, who were members of a dominated group, and the ready expansibility and contractability of the work force in a widely fluctuating global market’ (Schrank, 1992, 368).

Mendels' original formulation of proto-industrialisation, seen as a stage between pre-industrial and industrial society, emphasises four aspects. First, rural industry grows as an income supplement for peasant farmers who become part-time workers. Second, its products are marketed outside the region. Third, proto-industrial activity stimulates and accompanies the emergence of commercial agriculture. And finally, the towns in the region spawn the merchants who provide the necessary circulating capital (Mendels, 1972, 271; see also Ogilvie and Cerman, 1996, 6). To some extent all these factors apply to seventeenth century Cornwall, with the possible exception of the knock-on effect on agriculture, although even here Burt notes the import of food into Cornwall by the eighteenth century and the demand from the mines for horses for transport (1998, 93-94). Furthermore, both some of the preconditions for proto-industrialisation and some of its implications are applicable to Cornwall. The early disintegration of feudalism, weakness of manorialism and lack of access to common rights that are cited as necessary for proto-industrialisation have all been identified in Cornwall (Hatcher, 1970b). At the same time earlier marriage ages and high rates of population growth seem to be found in the tin-mining districts in the seventeenth century (Cullum, 1993, 272-273; Whetter, 1974, 8-10).

However, there are also problems. Basing his criticism on the implication that proto-industrialisation is also a theory of proletarianisation, Cullum rejects its application to seventeenth century Cornwall on the grounds that the tin-mining farmers of West Penwith were not wage labourers. Instead, they were shareholders 'in a co-operative or a venture capitalist' rather than 'a proto-industrial worker' (Cullum, 1993, 283). To an extent the differences between Burt and Cullum rest on the different versions of the proto-industrial model which they each articulate.

Some versions emphasise proto-industrialisation as producing proletarianisation; others see it as remaining part of a feudal mode of production where surplus labour exists, although not necessarily proletarianised (Ogilvie and Cerman, 1996, 2-5). This suggests more general difficulties with the concept of proto-industrialisation. Its wide applicability as an explanatory device has indeed been criticised by Coleman (1983).

Those using it more recently tacitly accept this, emphasising the importance of proto-industrialisation more broadly in terms of directing our approach to the social context of industrialisation and the relationship between labour organisation, culture and production. If we accept the point of Berg et al. that proto-industrialisation should be placed 'within a broader context of social transformation, which was polymorphic, varying greatly between regions, branches of industry and time' then we have a more modest, more descriptive and more relativist use of the term (Berg at al, 1983, 19). Thus, while pre-eighteenth century Cornwall was not a classic textile proto-industrial region, it did exhibit interesting similarities with those regions. As industrialisation based on greater levels of fixed capital and changes in the family economy evolved in Cornwall, especially with the explosive growth of copper mining after the 1730s, much of the identity of the later industrial region - notably the tradition of the 'independent' tinner - was moulded by this earlier experience of industrialisation, whether or not we bestow the title 'proto' on it.

Therefore, Cornwall before 1750 may fruitfully be seen as a variant of a proto-industrial region. Berg points out how proto-industrial regions 'connected much more significantly to the metropolis, and through this to international markets', than did later industrial regions (Berg, 1994a, 100). The role of London merchants

in the tin market in Cornwall in the early eighteenth century (Rowe 1953, 42), and that of the Duchy and Crown in Cornish tin extraction, illustrates the way Cornwall was locked into metropolitan-dominated circuits before the 1750s. In this way More sees even nineteenth-century Cornwall as an example, along with London, of an older industrial region, distinct from the new industrial regions of the English Midlands and North (More, 1989, 56). And, as we shall see, Cornwall's industrial society, if not its economy, continued to be strongly marked by proto-industrial forms through to the 1840s.

*Growth*

While the legacy of the transitional period was felt throughout the period of growth, for example in continuing traditions of dual employment along with customary attitudes that seemed, in the context of industrialising Britain, conservative, the copper region created in the eighteenth century was qualitatively different from the earlier 'proto-industrial' tin region. The central motif for most narratives of Cornish history in the period 1740-1870 is the expansion of mining. Rowe suggests that, as early as the 1740s, a third of Cornwall's men were affected by the fortunes of its mines and a quarter of its population were directly dependent on the mining sector (Rowe, 1953, 28 and 39). But for Rowe, the 1740s marked the beginning of a 'revolutionary transformation' (see also Deane and Cole, 1962, 56). Large scale organisation and an increasingly sophisticated division of labour in mining required larger injections of capital. Capitalist partnerships were now the norm, replacing the co-operation of the 'free' miners of earlier times. At the same time, a new intermediate managerial group of mine captains and engineers, a technical middle class, began to emerge (Rowe, 1953, 40). This 'revolution' was associated with the

newer exploitation of copper ore reserves, the search for which was vigorously reshaping the mining industry. Copper extraction was ‘extremely volatile. It was exciting, stimulating and always changing and expanding’ (Buckley, 1992a, 16). It was an industry moving to the rhythm of capitalist markets which, during the eighteenth century, were themselves transforming the world. Within a century, metal mining in Cornwall had ‘formed the basis of one of the most advanced engineering centres in the world … and of a complex industrial society exhibiting early development of banking and risk-sharing to deal with the particular needs of local industry’ (Pollard, 1981, 14).

More recent work by Burt has re-emphasised the discontinuity of the eighteenth century although placing its origin earlier. The ‘truly revolutionary changes that began in the last decades of the seventeenth century … culminated around the mid eighteenth century’ (Burt, 1991, 268. And see Burt, 1995, 43). Between the 1660s and the 1680s, Cornish mines doubled their output of tin and, by the end of the seventeenth century, tin mining, according to Whetter, was monopolising capital investment in west Cornwall (Whetter, 1974, 172 and 69). The largest tin mines were already rivalling the collieries of north east England ‘in scale, complexity, the numbers of people they employed and the size of the capital investment they represented’ (Clay, 1984, 59). But, the output of tin metal remained on a plateau in the early eighteenth century with no clear upward trend. During the long eighteenth century, tin production was increasingly overshadowed by the rise of copper, as the mining interest in Cornwall turned their attention to this more lucrative mineral.

Borlase, writing in the 1750s, noted the novelty of copper mining in Cornwall; ‘the richness of our copper-works is not a late discovery, but indeed the application of the Cornish to work them effectually, is not so old as the present generation’

(Borlase, 1758, 205). Demand from a booming brass industry had ‘bump-started the copper industry’ (Burt, 1995, 40). Copper ore extraction in Cornwall, virtually non-existent since brief efforts to mine it at the end of the sixteenth century (Hammersley, 1973, 17-18), grew rapidly. Both Borlase and Pryce were keenly attuned to the revolutionary impact of copper on Cornish mining. For Borlase copper mining was ‘… a happy addition made within these forty or fifty years to the employ and revenue of this county’ while Pryce echoed this two decades later by claiming that the ‘publick is manifestly enriched by the great trade and circulation of money, consequential to this particular business’ (Borlase, 1758, 207; Pryce, 1778, xii). Pryce pointed out the multiplier effects of copper mining:

> The expense of coal, candles, timber, leather, ropes, gunpowder, and various other materials, added to the labour of men, women, children, and horses, occasion such a vast monthly charge, as will not easily be credited by those who are unacquainted with mining (Pryce, 1778, ix).

Table 6.1 illustrates this dynamic growth of copper ore production.

Table 6.1: Annual mean copper production, Cornwall and Devon, 1750s-1850s

| years | Copper ore (tons) | change (%) | copper metal (tons) | change (%) |
|---|---|---|---|---|
| 1755-59 | 15788 | | c1900 | |
| 1775-79 | 28678 | +81.6 | 3443 | +81.2 |
| 1795-99 | 47488 | +65.6 | 5185 | +50.6 |
| 1815-19 | 81846 | +72.4 | 6675 | +28.7 |
| 1835-39 | 147518 | +80.2 | 11743 | +75.9 |
| 1855-59 | 192841 | +30.7 | 12451 | + 6.0 |

*Source*: Hill and MacAlister, 1906, 310-313; Lewis, 1907, 257-258; Morrison, 1980, 373-375.

As Figure 6.1 overleaf illustrates, from the 1750s to the mid-1830s metallic copper production grew steadily with just two breaks. One of these occurred in the 1770s and early 1780s, a period when copper supplies outstripped demand, as a result of the discovery of the more easily exploited ore deposits of Parys Mountain in Anglesey in the late 1760s and the subsequent heightened competition (Rowe, 1953, 69-72). The difficulties of this period eventually led to the formation of the Cornish Metal Company in 1785, in an attempt to control the marketing and therefore the price of copper ore in agreement with Thomas Williams of Anglesey (Rowe, 1953, 81-88; Harris and Roberts, 1962). But, despite a sharp slump in

1788, ore production had already, by 1785, resumed its strong upward trend, and this continued until the second short break in growth in the years around 1810, occasioned by a sudden drop in the price of copper from its wartime peak in 1805 (Hill and MacAlister, 1906, 311).

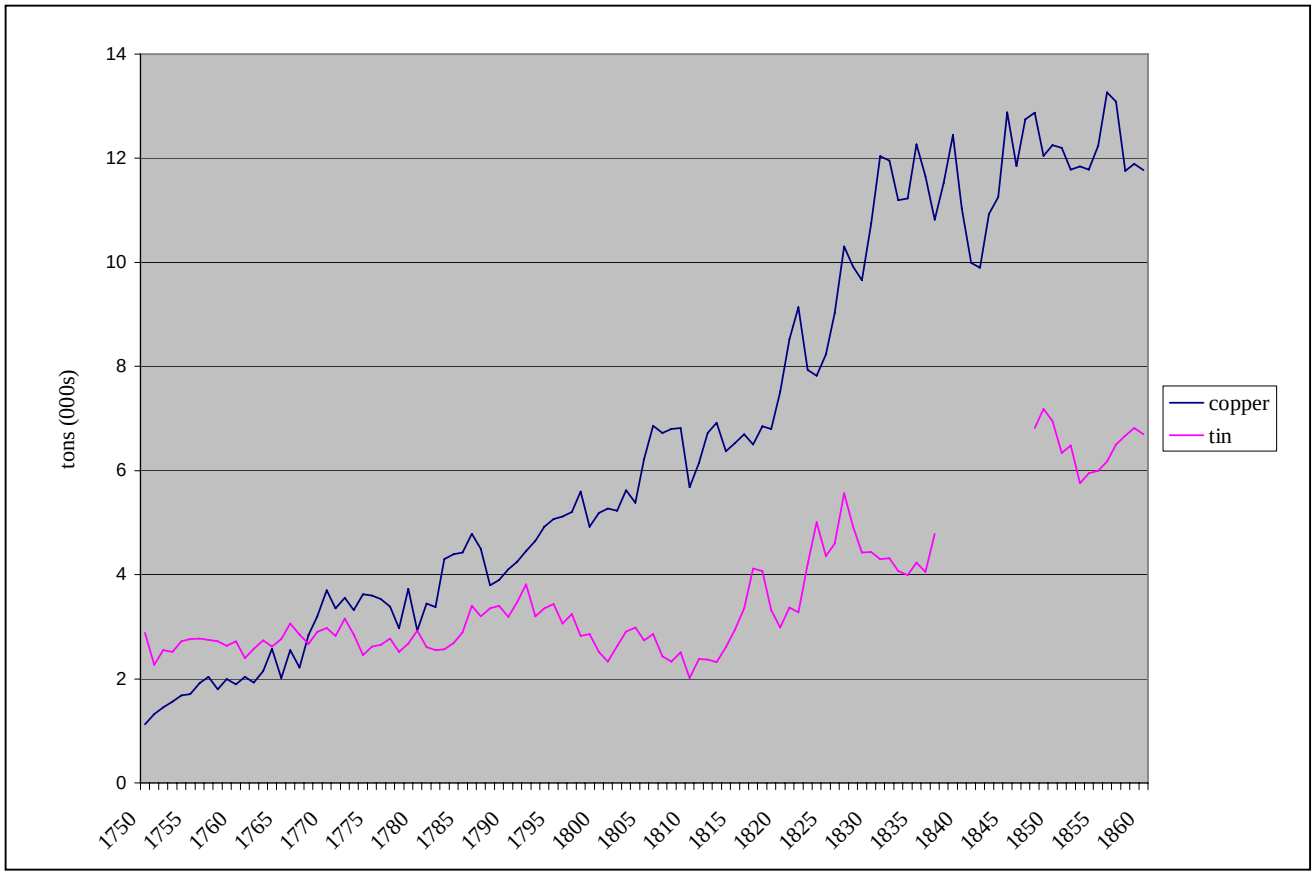


Figure 6.1. Metallic Copper and tin output, Cornwall and Devon, 1750-1860. Based on Hill and MacAlister, 1906, 310-313.

Apart from these two periods, however, copper production grew at more than 2 per cent per annum. Indeed, during the decades of the 1750s, 1760s, 1790s, 1800s

and the 1820s, that rate reached in excess of 4 per cent per annum. After the mid-1830s production slowed down, as production appeared to peak. Growth rates of copper metal usually lagged behind those of ore as the quality of ore generally declined with increasing depth of extraction. An exception occurred in the mid-1840s, when production of metal rose at rates of 3% a year (at a time when ore production was growing at less than 1%). This temporary reversal of the norm reflected the opening of new, shallower and richer ore reserves in east Cornwall and at Devon Great Consols, just across the Tamar in Tavistock.

An expanding output of copper ore in the second half of the eighteenth century was no longer dependent on the multiplication of small production units. While it is possible that, in the eighteenth century copper industry, 'there were great numbers of tiny concerns, most of which were abandoned as soon as ore above adit was exhausted, as the adventurers had not the desire or the capital to install adequate pumps' (Morrison, 1980, 9-10), the increasing scale of some mines also meant an increasing concentration of copper output as compared with the more dispersed tin production. By 1838 Cornish mines were 'altogether larger affairs than contemporary coal mines' (Berg, 1994b, 140). This greater capitalisation and scale of operations was typical of the development of metal mining regions as gradually deepening mining transformed the proto-industrial and small scale organisation of the industry (Burt, 1998, 102-103). Before the end of the eighteenth century, the largest ten mines were producing over 75 per cent of the value of copper output (BPP, 1799, 152-58).

Consolidation of the bulk of output on a relatively few mines had meant a parallel spatial concentration of the copper mining district. Rowe has noted that 'practically the entire copper mining region was within eight miles of the summit of

Carn Brea', midway between the mining towns of Camborne and Redruth (Rowe, 1953, 66). Figure 6.2 illustrates this geographical concentration of Cornish mining in 1795. The rise to dominance of copper mining during the eighteenth century had thus directed income into a relatively small part of Cornwall. As capital congregated in this small area this stimulated 'backward and forward linkages with advanced engineering supply and processing industries (creating) the "critical mass" seen by Pollard as necessary for sustained growth and the emergence of the region as a leading industrial centre' (Burt, 1998, 103). The first part of the general economic upswing of the later

eighteenth century had thus produced, by 1815, in west Cornwall, a concentrated district of industrialism based on deep copper mining as opposed to the more dispersed geography of the tin mining proto-region.

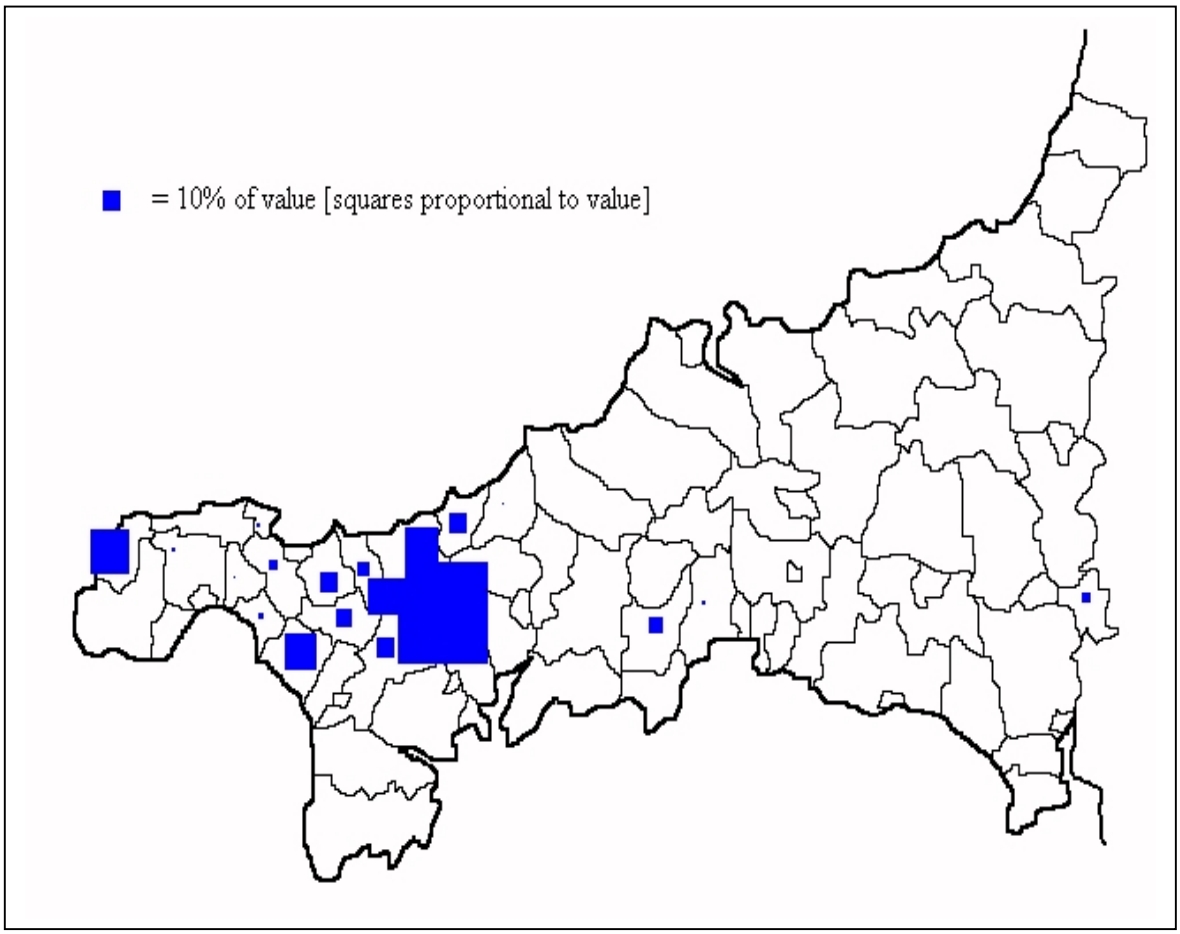

Figure 6.2. Distribution of mining income, 1794-96. Calculated from BPP, 1799, 152-158

As the strong growth in copper mining slowed after 1830, resources shifted back into tin production. The extraction of this metal was no higher in the early 1810s than it was in the early 1750s. For tin, growth rates in excess of 4 per cent per annum marked a later ‘take-off’ in production over the period from 1815 to 1827. According to Rowe, this expansion after 1815 ‘marked the beginning of an era of mechanisation and speculation in Cornish tin mining’ (Rowe, 1953, 188). After a decline in the late 1820s and early 1830s tin production resumed a strong upward trend in the 1840s.

But how did this industrialisation compare with other industrial regions?

Hudson (1992, 102-106) argues that regional sectoral specialisation and factor markets were features of the emerging nineteenth century industrial regions. With this in mind, we can investigate three comparative aspects in more detail: the degree of sectoral specialisation in terms of output and employment; the role of Cornwall in technological change; and the existence of a regional capital market.

### *Sectoral specialisation*

Adopting a comparative perspective reveals that copper mining in Cornwall grew as fast as did coal mining elsewhere in the period from 1750 to 1830.

Table 6.2: Production of coal and copper metal, 1750 - 1830

| year | Coal ('000 tons) | change (%) | Copper in Cornwall and Devon (tons) | change (%) |
|---|---|---|---|---|
| 1750 | 5230 | | c1100 | |
| 1775 | 8850 | + 69 | 3500 | +218 |
| 1800 | 15045 | + 70 | 5250 | + 50 |
| 1815 | 22265 | + 48 | 6600 | + 26 |
| 1830 | 30375 | + 36 | 10860 | + 65 |

Source: coal from Flinn, 1984, 26; copper as Table 6.1.

Cornish copper production grew faster than total coal output before 1775 and then again from 1815 to 1830. If coal output is broken down into its component mining regions we find that only south Wales (Monmouthshire and Glamorganshire) showed a faster growth from 1750 to 1775 and only north Wales grew faster from 1815 to 1830. Over the whole period only Lancashire, south Wales and the east Midlands saw a faster overall rate of growth in mining output (Flinn, 1984, 26).

Indeed, as Table 6.3 shows, except for the troubled 1770s and the 1800s, when the fall in production late in that decade reduced the decadal growth rate, the annual compound rate of growth of copper output was equal to most of the main industrial sectors in every decade before 1830. Before 1770 copper output had even grown faster than cotton.

Table 6.3: Growth of real output in selected industrial sectors (% per annum)

| | cotton | wool | building | iron | beer | Coal | paper | Cornish copper |
|---|---|---|---|---|---|---|---|---|
| 1700-60 | 1.4 | 1.0 | 0.7 | 0.6 | 0.2 | 0.6 | 1.5 | 2.7 |
| 1760-70 | 4.6 | 1.3 | 0.3 | 1.7 | -0.1 | 2.2 | 2.1 | 6.9 |
| 1770-80 | 6.2 | | 4.2 | 4.5 | 1.1 | 2.5 | 0.0 | -2.3 |
| 1780-90 | 12.8 | 0.5 | 3.2 | 3.8 | 0.8 | 2.4 | 5.6 | 3.4 |
| 1790-1801 | 6.7 | | 2.0 | 6.5 | 1.5 | 3.2 | 1.0 | 2.5 |
| 1801-11 | 4.5 | 1.6 | 2.1 | 7.5 | 0.8 | 2.5 | 3.3 | 1.6 |
| 1811-21 | 5.6 | | 3.6 | -0.3 | -0.5 | 2.8 | 1.7 | 3.3 |
| 1821-31 | 6.8 | 2.0 | 3.1 | 6.5 | 0.7 | 3.7 | 2.2 | 3.5 |

*Source*: Hudson, 1992, 43. Cornish copper calculated from Hunt, 1887, 887.

Copper production in Cornwall was one of the fastest growing sectors of the British economy in the second third of the eighteenth century. Moreover, its rate of growth remained well above the average rate of growth of industrial production to the 1800s. Although still continuing to grow at about the same rate after 1800, growth became no faster than industrial production in general (Jackson, 1992, 2, 19)

Copper exploitation provided Cornwall with its specialised export product, the base of an emerging industrial region in its growth phase. The role of mining in the local economy was further boosted in the nineteenth century by expanding tin production and a briefer emergence of lead mining. However, in the absence of estimates for the total production of the nineteenth century Cornish economy, the only way to assess the degree of sectoral specialisation is to identify the proportion of the population directly employed in mining.

Reliable figures for the labour force in mining did not appear until the late 1830s. Sir Charles Lemon calculated the total numbers employed in Cornish mines as at around 28,000 in 1836, obtaining his total by aggregating the numbers employed in each mine (Lemon, 1838, Henwood, 1843 mostly relies on Lemon's statistics). The 28,000 was then around 8.7 per cent of the total population. From 1841 onwards the published census provides totals for the whole mining and quarrying sector (Table 6.4). Comparing the 1841 totals with Lemon's estimates, we might suggest that the Census underestimated slightly the total numbers involved in mining, perhaps failing to enumerate some part-time workers.

Table 6.4: Numbers employed in mining and quarrying

| Year | Number | % of population | % of total employed |
|---|---|---|---|
| 1841 | 27560 | 8.1 | 23.8 |
| 1851 | 36149 | 10.2 | 24.4 |
| 1861 | 38553 | 10.4 | 24.1 |
| 1871 | 29868 | 8.2 | 19.6 |
| 1881 | 18348 | 5.5 | 13.9 |

*Source*: based on Lee, 1979.

This suggests that, at its peak, the mining sector employed almost a quarter of the working population. But these totals include those working in the china clay pits and in granite and slate quarrying. However, the 1881 census figure can be checked against the detailed employment returns in the *Mineral Statistics*, available on an annual basis after 1878, which distinguishes those working in metal mines. This latter source indicates that metal mining still employed 15,241 people in Cornwall in 1881 (calculated from returns in Burt et al., 1987). This implies that the

mines at their peak employed at least 35,000 in 1861, around 9.5 per cent of the total population and 21.8 per cent of the labour force. The 27 per cent or so of men employed in mining in Cornwall in the 1850s meant that the Cornish economy had similar rates of specialisation to those found in south Wales for coal mining (26 per cent of men in 1851) or the North West of England for textiles (27 per cent) (Lee, 1979). At a different spatial level of comparison, of the 200 or so English and Welsh Registration Districts with the highest proportion of men employed in mining in 1861, four were found in Cornwall. In Redruth RD, (covering the area known to contemporaries in Cornwall as the 'central mining district'), over 52 per cent of men were employed directly in mining, second only to the much smaller Reeth RD in North Yorkshire (Gatley, 1996). Even at this late stage Cornwall was still home to almost one in ten of all the miners and quarriers of Great Britain and almost half (46 per cent) of the copper, lead, tin and iron miners (Lee, 1979; Burt, 1984, 200). No doubt, these proportions would have been higher in the late eighteenth century before the rate of growth of employment in the coal mines began to increase (Pollard, 1980).

Specialisation, it is argued, gave rise to regional fragmentation; and regions became, structurally, less like one another as early industrialisation proceeded. One way of quantifying this is by using a simple Index of Dissimilarity, comparing the differences in the occupational structures of various areas. (The Index of Dissimilarity ($I_D$) is calculated by the formula $I_D = \sum (Xi - Yi)/2$ where Xi is the percentage of the workforce in place X in each occupational group and Yi is the percentage of the workforce in place Y in each occupational group (Lewis, in Drake and Finnegan, 1994, 199-200. For a comparative exercise see Kendrick et al.,

1985). Figure 6.3 represents the distance between Cornwall and Great Britain, the counties in the

modern South West Planning Region and other selected industrial regions. Of all these areas, Cornwall's occupational structure differed the most from the British average, and Gloucestershire the least (shown on the vertical axis). When compared with Cornwall the greatest difference was the North West and the smallest was Wales (shown on the horizontal axis). This rather blunt measure does nevertheless suggest that the occupational structure of Cornwall was markedly different both from counties in south west England and industrial regions of the north and Midlands.

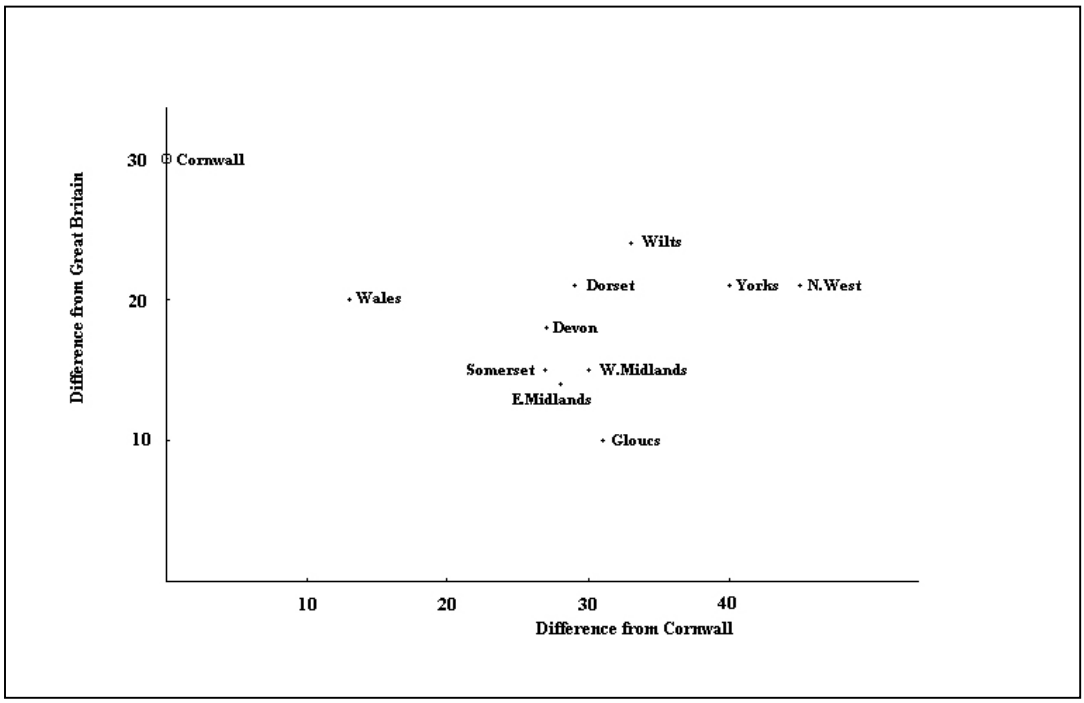


Figure 6.3. Index of dissimilarity, occupational structure: base Great Britain and Cornwall, 1851. Calculated from Lee, 1979.

### *Technology*

According to Hudson (1989, 23) 'successfully expanding regions often came to influence the methods of an entire sector'. In one area of technology – the steam engine – Cornwall played a leading role. Von Tunzelmann concludes that:

> one half of the fuel savings on reciprocating engines and one third of the savings over all, were accounted for by just one county - Cornwall... The significance of the Cornish copper and tin mines in the spread of best-practice technology in the eighteenth century cannot be exaggerated (von Tunzelmann, 1978, 252).

Maintaining levels of labour productivity at the same time as mines were inexorably being deepened meant reducing the costs of draining those mines and hauling the ore to surface. Water power and drainage projects such as the Great County Adit had sufficed in the early years of copper mining (see Buckley, 1992b). But by the

1770s deep mines were becoming dependent on steam power for drainage and hauling. Given Cornwall's lack of coal reserves, attempts to reduce costs had, of necessity, to centre on the efficiency of the steam engine. It was here that striking technological advances took place.

Emphasis has recently focused on the distinction between the classical inventions of the industrial revolution and the small scale mechanical development and improvement that followed. Mokyr proposes that a cluster of 'macro-inventions' in the period from 1765 to 1800 was followed by a series of micro-adaptations in which the initial breakthrough was applied and consolidated (Mokyr, 1994). Berg re-interprets this to suggest that the second stage, of 'learning by doing', was more crucial in the process of technical change (Berg, 1994a, 29). Burt (1991, 253) has already pointed to the importance of this secondary 'sub-invention' stage in changes in metal mining techniques in the early modern period, but this was also the situation in the late eighteenth and early nineteenth centuries.

The original breakthroughs of Newcomen, Smeaton and Watt in the eighteenth century only paved the way for even more rapid technical advance and increases of efficiency in the early nineteenth century. By 1840, steam engines in Cornwall were 'three to four times as efficient thermodynamically speaking as Watt's own engines' (von Tunzelmann, 1978, 256). As a result 'most authorities regarded the Cornish engine as the highest level of technological accomplishment in its field between, say 1815 and 1840' (von Tunzelmann, 1978, 263). This had occurred, argues vonTunzelmann, through a series of on-the-job 'disembodied' developments, needing no major changes to the engine but improving the way it was operated. Such small scale changes were then rapidly diffused through what was still a geographically bounded industrial region.

Empirical tinkering (the phrase is from Mokyr, 1994, 35) on such a successful scale was, by the 1810s, embedded in a culture which had been experiencing two generations of technological change. In the 1780s and 1790s William Murdoch, James Watt's engineer was experimenting with steam locomotives and first used gas for lighting purposes at Redruth (Griffiths, 1992, particularly 86-237). Murdoch was just one of a number of engineers and inventors active in Cornwall in those years, men such as Jonathan Hornblower and his brothers, Edward Bull, Richard Trevithick and the young Arthur Woolf (see Rowe, 1953, 96-113). Rivalries and competition between these men and the mines that employed them helped to establish a critical mass of ingenuity that in turn enabled the culture of empirical tinkering to flourish after the 1810s.

The central symbolic role of the steam engine in Cornish culture by this date is well illustrated by the publication of the *Engine Reporter* by the Lean family from 1811. This listed the performance of pumping engines at Cornish mines, including the 'duty', or weight of water raised per unit of coal consumed. Described as a 'symptom of and a stimulus to the competitive spirit prevailing between rival engineers over duty' (von Tunzelmann, 1978, 254), the publication also helped to establish a wider interest in steam engine performance among shareholders and educated opinion locally, reinforcing the iconic status of the steam engine as a measure of the prosperity and progress of the Cornish economy. By the 1830s the cultural role of the steam engine was thus firmly established and Cornwall's role in its development was seen as a cause for much local pride. An anonymous writer in the *Quarterly Mining Review* summed this up in words, which, when read from a vantage point that encompasses the wreckage and desolation of de-industrialisation, are both prophetic and deeply poignant:

> It is farther (*sic*) the boast of this district, that the steam engine, a machine which has influenced the destinies of nations, and will probably continue to so beyond the power of the human mind to foresee, was here first encouraged, and has been matured to its present highest power and greatest perfection; a circumstance which will attract the attention of future generations, when, perhaps, after a lapse of centuries, the mines of Cornwall shall have become exhausted, the population dispersed, and the surface more barren and desolate than ever (anon, 1832, 255).

However, in 1832 such intimations of doom were mere journalistic insight. For most contemporaries, looking to the recent past rather than an unpredictable future, what was most impressive was Cornwall's early role in steam engine technology. The relatively early growth of copper mining and its growing drainage requirements had resulted in Cornwall becoming, by the 1780s, one of the main locations for the new steam engine. In the period 1734-80 only the north eastern coalfield saw more engines erected (calculated from Kanefsky and Robey, 1980, 176-77). In terms of absolute numbers Cornwall was overshadowed in the last two decades of the eighteenth century by the spread of steam engines to general manufacturing processes elsewhere, although if horsepower is compared, rather than the number of engines, Cornwall probably came first as late as 1800 (von Tunzelmann, 1986, 76).

### *Factor markets*

Another element in the industrial regions model is the emergence of regional labour and capital markets. We will focus here on the capital market. Did Cornwall have a coherent and independent capital market of its own or was capital for the mining industry imported from elsewhere?

Banks appeared relatively early in Cornwall (c.f. Neal, 1994, 165-69). It is significant that in the first and most important banks the emerging Cornish merchant- bourgeoisie, together with some of the landed class, were very closely involved (Shearme, n.d.). These same groups were crucial in the financing of metal mining. Here the organisational breakthrough in the eighteenth century was the institutionalisation and formalisation of the cost book system of financing and its application to the new copper mining ventures. This was no innovation. Indeed, Hatcher suggests that cost book financing can be found as early as the fourteenth century (Hatcher, 1973, 60-61). In the cost book system a number of investors (known in Cornwall as ‘adventurers’) would share the start-up costs of a mine. If it proved successful then the profits made were divided amongst the adventurers at regular intervals. If not profitable, then calls for extra capital would be made to those same shareholders. Burt explains how cost-book companies (a cross between extended partnerships and joint stock companies) were designed to give shareholders, all with little capital, the stability, consistency and regular organisation of the more opulent coal mining companies. He goes on to argue convincingly that, whatever their long-term disadvantages, such a form of financial organisation, with its ‘qualified form of limited liability’ encouraged the investment required by the increasingly capitalised mines (Burt, 1984, 79 and 72. See also Burt and Kudo, 1983). This judgement is echoed by Rule who points to the success of the cost-book system in mobilising capital for an ‘expanding but speculative industry’ (Rule, 1992a, 172). Capital from a host of small shareholders could be raised (Rowe, 1953, 65 estimates there were approximately 500 to 1,000 shareholders in copper mines by 1775), but these always supplemented the larger holdings of the merchant-bourgeoisie and landowners.

In 1799, it was estimated that around a third or a quarter of adventurers had a direct interest in supplying the mines that received their investment (BPP, 1799). John Taylor, the mines manager and owner, was critical of this practice, writing in 1814 that 'the concerns are often supplied by a part of the adventurers who are dealers in the articles required and who therefore have a consuming interest in allowing exorbitant prices and an unlimited consumption' (Burt, 1969, 26). As Newell points out, the role of merchants in mines investment 'demonstrates how closely mining was related to merchanting, transport, ancillary industries and landownership in the county' (Newell, 1988, 56). This reminds us of the strategic role the mining industry played within a web of networks and economic relationships by the early nineteenth century. Even before this, sufficient profits had certainly been generated, whether from within mining itself, from supplying the mines, from advancing money to the mines or from smelting and exporting the products of the mines, for the local merchant-bourgeoisie and landowners to find the capital to finance the Cornish Metal Company in 1785, 'one of the most heavily capitalised enterprises in the whole of the eighteenth century economy' (Rule, 1992a, 178. See also Pollard, 1981, 14).

The above implies that little capital was needed or sought from outside the region in the eighteenth century. This is what we might expect from the industrial regions model which proposes that, because labour and capital markets were not yet fully 'national', specialised industrial regions possessed, for a period, largely internally integrated intra-regional flows of labour and capital (Gregory, 1988; Langton, 1988). This remained the case, according to Hudson, at least as late as the 1830s and 1840s (Hudson, 1989, 15).

Most writers on Cornish mining present a relatively simple picture of initial local financing of mining followed by a gradually increased involvement of outside capital. The implication in the literature is that Cornwall was progressively drawn into a wider capital market. Thus Morrison argues that the 'need for heavier investment and the rising commercial power of London and the Midlands made them vital sources of capital' (Morrison, 1980, 16). Others broadly follow suit and differ only in their timing of this process (Rule, 1992a, 172; Clay, 1984, 76; Payton, 1992a, 80; Johansson, 1974, 98).

Burt, who suggests that metal mining in Britain went through three phases, provides the most comprehensive descriptive model of this process. In the first phase, in the early eighteenth century, metal mines were small scale and locally financed. In the second phase, from the mid-eighteenth to the early nineteenth century, mines were regionally financed and in the third phase metal mining was financed by a national capital market (Burt, 1984, 57). Applying this to Cornwall, he argues that for most of the second half of the eighteenth century, Cornish mines were 'clearly in the second stage of development', part of a regional capital market, with the leading adventurers being 'smelters, local landowners ... tradesmen, professional classes and farmers'. While there was some investment by outside adventurers like Boulton and Watt in the late eighteenth century, in 1800 most Cornish mines still derived most of their capital from within Cornwall. (For investment by Boulton and Watt after 1785 see Rowe, 1953, 82). According to Burt, the change to a national capital market in metal mining was pioneered by the Cornish mines and began in the 1820s, when 'large scale, nationally financed mining began to develop'. By the 1850s Cornish mining was attracting 'large quantities of outside capital, particularly from the London area' and had moved

towards a dependence on ‘anonymous and speculative capital’ (Burt, 1984, 70 and 82-83).

This model, however, requires some qualification both in its chronology and in its assumptions of a progressive, stage process from local to regional to national capital markets. To begin with, it appears that distant adventurers had been active in tin mining as early as the seventeenth century (Buckley, 1992a, 11). Yet it seems that this outside investment declined in importance as the end of that century neared. Whetter points out how local merchant capital supplanted the London pewterers in the later seventeenth century and Burke reinforces this by arguing that Cornishmen were buying out the London tin dealers in the seventeenth century, so much so that by the eighteenth century a ‘small all-Cornish group’ tightly controlled the smelting, financing and purchasing of tin (Whetter, 1974, 172; Burke, 1981, 37). This was formalised by 1780 in meetings of the Association of the Proprietors of Tin, which met regularly to fix the price of that metal until 1818 (Rowe, 1953, 166).

Whereas tin mining was increasingly financed regionally, the early investment in deep copper mines again drew on adventurers from outside Cornwall - this time from Bristol industrialists and businessmen with interests in the brass industry. Outsiders became prominent shareholders in a few mines in the early eighteenth century, in Gwinear and Illogan for example (Buckley, 1992a, 14). Yet, again, the early involvement of outside capitalists soon ended. Cornish capital seems to have supplanted it and became dominant in the development of copper mining in the second and third quarters of the eighteenth century. Despite the involvement of Watt and Boulton in Cornish mining from the early 1770s no fundamental change occurred in the regionally capitalised industry in that century.

John Vivian's evidence to the parliamentary committee enquiring into the state of the copper trade of 1799 allows us to identify the major shareholders in nine copper mines in that year. These mines included five of the fifteen most productive of that year. Just over 100 separate adventurers are noted, but as Table 6.5 indicates, a quarter (25.8 per cent) of the shares were in the hands of just five individuals and companies and almost 42 per cent were held by just ten individuals and companies. Merchants, bankers and smelters held over a quarter of the shares, with landowners and the clerical gentry possessing about another fifth, These two groups combined owned over 40 per cent of the shares in these major copper mines. Boulton and Watt were the only major non-Cornish investors.

Table 6.5: Principal shareholders in nine Cornish copper mines, 1799

| Adventurer | number of mines in which shares held | share of total ownership (%) |
|---|---|---|
| *Merchants, bankers, smelters* | | |
| G.C.Fox and sons, merchants | 5 | 6.78 |
| John Williams and sons, adventurers and mine captains | 4 | 5.33 |
| John and M.Vivian, mine adventurers | 5 | 4.33 |
| Philip Richards, banker | 2 | 4.33 |
| Thos Reed and William Carne, merchants, bankers and smelters | 3 | 4.11 |
| R.A.Daniell, merchant, banker and smelter | 1 | 1.89 |
| John Edwards, merchant | 2 | 1.44 |
| total | | 28.21 |
| *Landowners and clergy* | | |
| Francis Rodd | 3 | 5.00 |
| Reverend John Vivian, clergyman | 3 | 3.44 |
| Reverend Henry Hawkins Tremayne | 3 | 3.00 |
| John Rogers | 1 | 1.78 |
| Basset family | 1 | 1.44 |
| Reverend Mr Walker, clergyman | 1 | 1.44 |
| Robert L.Gwatkin, landowner | 1 | 1.44 |
| total | | 17.54 |
| *Others and unidentified* | | |
| Mr.Hole ?? | 4 | 3.11 |
| Mr.Wallis, solicitor | 2 | 2.33 |
| Boulton and Watt, engineers, Birmingham | 2 | 2.11 |
| Thomas and James Kevill | 2 | 1.78 |
| total | | 9.33 |

*Source*: BPP, 1799, 160-163; Boase and Courtney, 1890.

Buckley suggests that it was only after 1805, when copper mining expanded, that outside capital was drawn in (Buckley, 1992a, 14). The most active non-local adventurer was John Taylor, originally from Norwich, who launched the Consolidated Mines at Gwennap in 1818, with a capital of £15,000 provided by himself and 'other investors, mainly from the London area'. John Taylor himself suggested in 1814 that 'shares in these undertakings are now frequently bought and sold at a distance from the districts in which they are situate' (in Burt, 1969, 28). By the 1840s and 1850s, evidence for the involvement of outside capital mounts up. Thus, Bartlett points out how London investors were active in the new lead mines of Menheniot in east Cornwall in the 1840s (Bartlett, 1994, 24 and 14). Further east, the phenomenally rich copper mine of Devon Great Consols was initially financed in 1844 with the help of five London stockbrokers as a joint stock company, divided into 1024 £1 shares (Richardson, 1974, 98). A few years later, in 1850, it was being reported that 'a gentleman from Manchester, who is a large holder in (Phoenix mine, in the Caradon district) has been the means of keeping the mine going to the present time' (*Mining Journal*, 6 July, 1850, 316).

However, it is significant that the weight of this evidence for growing involvement relates to mining districts in east Cornwall and west Devon in the 1840s and later. Further west, the Taylor family's involvement in at least thirty mines in the 40 years after 1818 (Burt et al., 1987, xix) might have been the exception rather than a new rule. Buckley suggests that the influence of John Taylor has been exaggerated and argues that 'at times (Taylor) matched the Williams (family of Gwennap) for forward thinking and scientific planning but he never bettered them; so far as Cornwall was concerned, they remained throughout

the nineteenth century the most successful mine operators' (Buckley, 1992a, 24). While it is claimed that 'many' of the principal adventurers in Tresavean, Consolidated and other mines in 1835 had no Cornish connections, there is also ample evidence that other mines were solidly financed by local capital. For example, at Wheal Vor at least 74 per cent of the shareholders in 1820-22 were Cornish (Burt, 1984, 91, citing *Quarterly Mining Review* of 1835; Barton, 1967, 50). At around the same time, in 1815-16, Cornish capitalists still held at least 81 per cent of the shares in the Pembroke mine in the new copper mining district east of St.Austell while local tin smelters had 75 per cent of the interest in Ding Dong tin mine near Penzance. Similarly, at least 72 per cent of the shares in Cooks Kitchen in 1808 and 66 per cent of those at East Crofty in 1835, both in Illogan, were held by Cornish adventurers (calculated by present author from cost books at CRO, X363/2, TEM 156). And although London capital was active in the Menheniot district in the 1840s, in the same decade at the older lead mine of East Wheal Rose (then the richest lead mine in Cornwall and Devon) various Cornish merchant families held over 50 per cent of the shares (calculated from Douch, 1964, 38-39).

Table 6.6 shows a more detailed breakdown for another three mines later in the nineteenth century. Wheal Tryphena was an unsuccessful venture in Camborne while West Great Work at Breage and West Seton at Camborne saw periods as profitable tin mines.

Table 6.6: Shareholding by place of residence; selected Cornish mines (% of shares held)

| | Locality | Other west Cornwall | east Cornwall | Devon | London | other |
|---|---|---|---|---|---|---|
| Tryphena, 1853 | 46.2 | 39.5 | 0.0 | 6.1 | 4.9 | 3.4 |
| West Gt. Work, 1862 | 14.3 | 49.3 | 6.0 | 0.6 | 16.4 | 13.4 |
| West Seton, 1877 | 37.7 | 22.7 | 3.1 | 0.5 | 12.5 | 23.5 |

*Sources*: based on CRO PD.152; PD.1; TEM.270/1.

Therefore, even quite late in these particular mines, Cornish capital remained dominant. There is some indication here that share dealing by outside capitalists had become a feature of Cornish mining by the 1860s but the striking impression is how much these ventures relied on local capital from the area west of Truro. The majority of adventurers were still living in the towns of Penzance, Helston, Falmouth and Truro or in the mining and industrial district from Hayle to Redruth. It is not difficult to find other examples. For instance, Dolcoath mine, one of Cornwall's richest and most productive, remained firmly in Cornish hands (Harris, 1974). And as late as 1872 79 per cent of the adventurers in Levant mine lived in Cornwall (Burke, 1984, 48). Barton suggests that in the nineteenth century ‘there was not a tin mine of any consequence ... in which smelters (who were predominantly Cornish) did not hold an important, and in many cases, a majority share’ (Barton, 1967, 110). Evidence for local domination of tin mining seems

clearer than for copper in the 1850s and more pronounced in west than in east Cornwall.

In fact, Cornish capital was being exported for use elsewhere by the first two decades of the nineteenth century. After the crisis of the 1780s had been overcome, Cornish capitalists had moved after 1800 to:

> eradicate once and for all the dominance of outside (copper) smelters, be they Gloucestershire or Welsh. The great Cornish families took control of their own destinies during the early decades of the nineteenth century by moving their money into Welsh smelting, of which they retained control for most of the century (Buckley, 1992a, 24).

The Fox family, too, had moved into Welsh coal and iron mines in the same period and Burt notes the important role of Cornish capital in the revival of the north and central Wales lead mining industry after 1815 (Vale, 1966, 51; Burt, 1984, 82). Meanwhile, the copper smelting firm of Williams, Foster and Co, financed mainly by Cornish capitalists, was by the 1830s beginning to invest on a large scale outside Cornwall (Boase, 1890, cols. 1251-1254). It was not only mining and smelting that received the export of Cornish capital. William Praed, the Truro banker, was an important investor in the Grand Union Canal in the Midlands (Freeman and Aldcroft, 1983, xx).

This survey suggests there was no simple linear progression from local to national capital investment in Cornish mining. If anything, there seems to be an ebb and flow, with the early involvement of outside capital being replaced by a vigorous regional capital market, one boosted by the late eighteenth century development of banking in the west Cornish towns. Cornish mining was financed predominantly by a regional, Cornish capital market in the later eighteenth century and through to the 1840s. There is then evidence for a growing involvement of

outside capital. This pattern – of initial outside investment replaced by the dominance of local capital – was also seen in the infant china clay industry (Barton, 1966, 59).

The second theme suggested by this overview is that, while some outside capitalists began to invest in Cornish mining from the late 1810s and 1820s, Cornish capitalists were themselves at the same time investing in other regions and overseas. What was happening was a generally more vigorous and wider circulation of capital. An economic region had emerged by the late eighteenth century, largely financed through its own regional capital market. As industrialisation proceeded that industrial region became part of a growing inter-regional capital market, rather than the end point of a flow of capital.

Two further points need to be made about this regional capital market. Even when the proportion of extra-regional capital grew this might not necessarily entail a loss of local control. Thus, Burt concludes that, despite increased penetration by outside adventurers, ‘most Cornish mines’ in the 1850s were ‘still dominated by local in-adventurers’ (Burt, 1984, 91). Problems of distance meant that day to day management remained local. Furthermore, local investors were in a far better position in terms of quality of information. Barton claims that the failures of tin mining investment in the 1850s were predominantly ‘London-owned ventures’ and goes further, to argue that a ‘considerable proportion of the mines at mid-century were run for (the merchants’) prime benefit, unknown to the world at large’ (Barton, 1967, 110 and 121. See also Burke, 1984, 48-49 and Burt, 1984, 80). Whereas outside investment was no doubt growing in scale by the 1840s, ownership did not necessarily mean control and the evidence suggests that the

balance of power (and information) in Cornish mining remained with local adventurers rather than outsiders throughout the industrial period.

Finally, the relationship between Cornish and non-Cornish investors was often a wary one, tinged with suspicion and hostility. Several commentators have noted how Cornish mining interests were quick to blame ‘foreign’ interests during short term crises in the later eighteenth century and before (see for example Rowe, 1953, 68). Indeed, it was the reaction of Cornish mining interests against the domination of foreign smelters and capitalists in copper refining that had led to the creation of another ‘unique’ institution of Cornish mining in 1725, the practice of regular ticketing, which attempted (though largely unsuccessfully) to guarantee a free market in copper ores and reduce collusion by the buyers (Buckley, 1992a, 15; Rowe, 1953, 21-22; Newell, 1988, 115-133). The brittle relations between Cornish adventurers and others in the period from the 1820s to the 1850s, with the occasional outright fraudulent practices designed to part ‘foreign’ investors from their money as quickly as possible, is further, later, evidence of conflicts between Cornish and ‘foreign’ interests. In 1840, letters in the *Mining Journal* illustrate the ‘information deficit’ felt by outside investors. A ‘severe sufferer in Cornish mines’ wrote from London that Cornish mines were ‘ruinous to those who have been gulled by the insidious statements of some who ought long since to have been brought up at the Old Bailey’ (*Mining Journal*, 12 September 1840). Clearly cultural factors were here interacting with more ‘purely’ economic factors in the generation of such frictions. In this sense the creation of a self-conscious economic region clarified interests that were perceived as being in opposition to those of other sectors and regions despite similar class positions. This, in turn, reinforced feelings of regional identity and echoes Langton’s point about the fragmented regional economy of

early nineteenth century Britain accompanying a rising consciousness of regional differences (Langton, 1984).

Of course, while Cornwall can be viewed as an integrated capital market in the early nineteenth century, it was at the same time linked to other regions, particularly perhaps to London, by other inter-regional flows. Notable among these were circuits of political and market information, via the press (see Gregory, 1987). Early nineteenth century Cornwall is thus perhaps best seen, not as a periphery opposed to a metropolitan centre at this time, but as a node in a more general regional circulation, a circulation that was both creating regions and reproducing them. The rise of copper mining had thus grafted newer links, in particular to the coal mining region of south Wales, onto older ones with the metropolis (for the Welsh links see Jaggard, 2000, xxxiv-xxxv).

But it had done more than create new inter-regional links and a new place for Cornwall as one of Britain's early industrial regions. It had also become the pole around which a new form of Cornish identity was cohering. As Hudson (1989) points out, the emergence of recognisable industrial regions was accompanied by a growing identification of 'all social groups with the economic, social and political interests of their region'. As chapters 3 and 4 have suggested, by the 1820s the Cornish identity was crystallising around the icons and fortunes of the mining industry. For those in the heartlands of mining this was only to be expected; thus 'the paramount influence in nineteenth century west Cornwall was the peculiar history of the mining region' (Brayshay, 1977, 116). But in all spheres there was a clearer articulation of a regional identity by the second quarter of the nineteenth century. And this was an articulation that did not hesitate to unite the artefacts of an industrial age with the local sense of place. For example, the first railway

locomotive built by the Sandys, Carne and Vivian works at Hayle in 1838 was promptly named the ‘Cornishman’ (Rowe, 1953, 149).

*Modernisation*

Growth continued into the 1850s. We have already seen how copper provided the basis for the eighteenth century expansion of the mining industry. After 1815 tin production also began to grow rapidly. But these were not, despite the impression portrayed by local mining historiography, separate industries. Many mines, such as Dolcoath, shifted from one metal to another during their working lives while other mines produced both copper and tin together over long periods (Harris, 1974; Noall, 1970). Morrison, in a percipient comment, has stated that he finds it ‘impossible to view separately metals which were hoisted through the same shafts’ and Burt and Timbrell agree that ‘it clearly makes little sense to try to write separate histories of copper and tin mining’ (Morrison, 1980, 17; Burt and Timbrell, 1987, 53). Therefore, in order to gain a more holistic picture of the fortunes of the whole Cornish mining industry the value of its total output must first be assessed. The sources available allow us to do this for copper and tin 1770 with the only gaps for copper production occurring in the early 1790s and in tin production from 1837 to 1848.

The estimated value of lead mining cannot be calculated before 1845 but its contribution was small before the 1840s, a period that saw the expansion of the major lead producing mine of East Wheal Rose and the opening up the new lead mining district near Menheniot (Douch, 1964, 37; Bartlett, 1994). Fewer than ten years before this Henry de la Beche had found that ‘at present little (lead) is produced’ (de la Beche, 1839, 610. See also Taylor, 1837, 36). He claimed that manganese was at that time a more important mineral, contributing around

£40,000 a year to the value of mining. Yet even this amount was only around 11 per cent of the value of tin output and a mere 4 per cent of that of copper.

However, prices fluctuated considerably over this period: that of copper went from a low of £40 a ton at the mine in 1788 to a wartime high of £138 in 1805 and was only £60 a ton again in 1849. Tin prices also rose from a low of £52/10 for a ton of metal in 1774 to £157 at their peak in 1810. They had drifted back to £72 by 1842, only to rise again to just over £136 in 1860 (Hill and MacAlister, 1906, 311-312). To compensate for this the real value of mining has also been calculated, based on 1851 prices, and related to the cost of living indices of Lindert and Williamson and Bowley (Mitchell, 1988, 737-738). From the graph on the next page we can see that the total real income of Cornish mining rose from the 1770s to peak in 1805. There was then a sharp fall to a low in 1812. Growth then resumed to reach a plateau in the later 1850s and early 1860s, with the periods 1815-1835 and 1848-56 being ones of particularly strong growth.

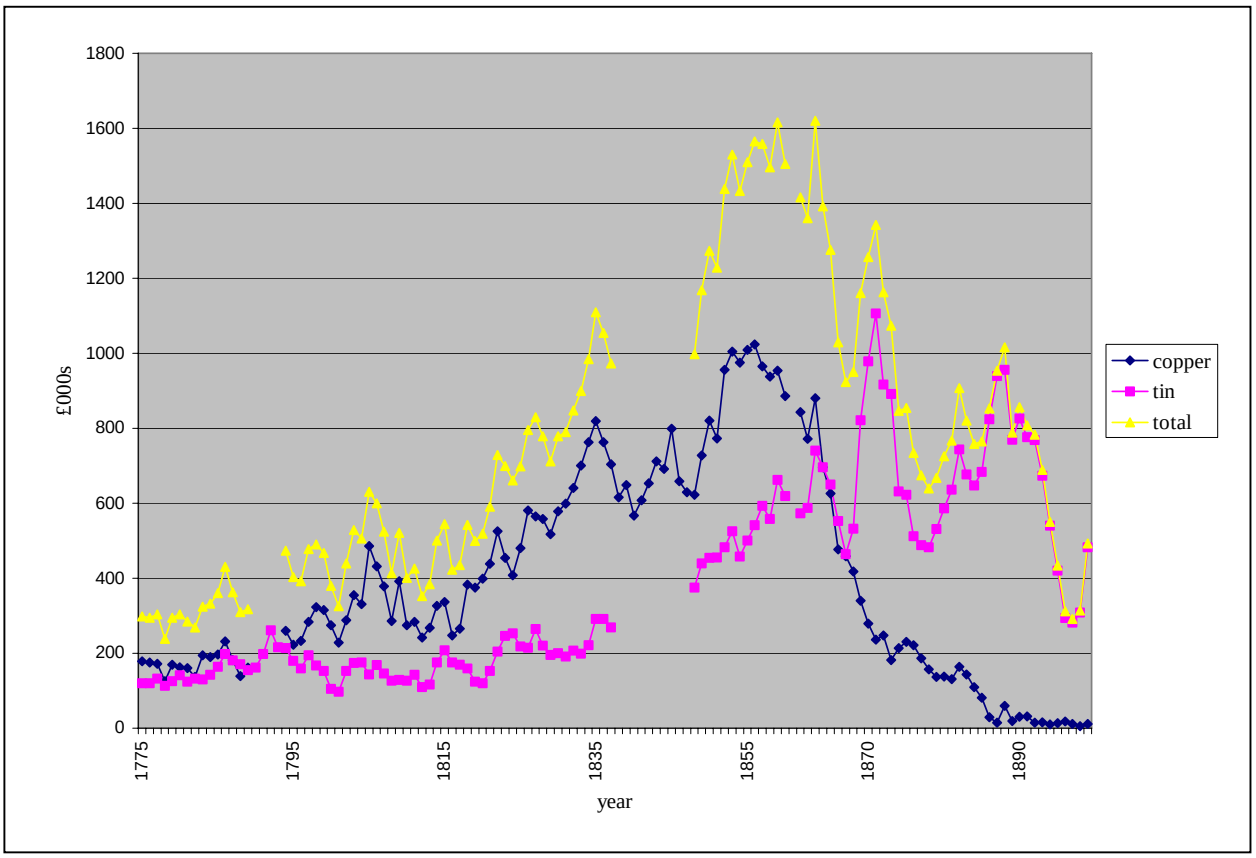


Figure 6.4. Real value of Cornish mining, 1775-1895. Calculated from production database built up from Burt et al., 1987; Burt et al., 1984; Hill and MacAlister, 1906310-313; *TRGSC* 1, 1818, 256-261; 2, 1822, 428-441; 3, 1827, 342-355; 4, 1832, 492-497; BPP, 1799, 152-158; *Quarterly Mining Review*, May 1836, appendix, iii and Feb 1837, appendix, ii; *Mining Journal*, 1841, 372 and cost of living index from Mitchell, 1988, 737-738.

The production plateau of the 1850s has been long noted by other writers (Burt et al., 1987, xxi-xxii; Morrison, 1980, 17; Payton, 1992a, 99-100; Rowe, 1953, 305-310). But these statistics of the real income of Cornish mining suggest something insufficiently emphasised previously: the total income of mining rose at

a rapid rate from the late 1840s to the mid-1850s, with growth rates as high as any achieved in its previous history. The regional economy, by this time dominated by mining, thus remained remarkably buoyant into the 1850s. But this late growth has often been over-shadowed in the literature by the portents of decline, as historians, focusing on copper production and the beginnings of mass emigration, tend to view these years with a hindsight dominated by the disastrous crises and long term restructuring of the years after the mid 1860s. For example, Goodridge, in his descriptive study of the historical geography of the industry, includes a section entitled ‘Decline: actual and potential’ when discussing the period from 1830-56 (Goodridge, 1967, 94). Rowe also saw the 1850s as ‘but the brief and illusory Indian Summer of the Cornish copper mining industry’ (Rowe, 1953, 164). However, contemporaries still saw the prospects of continued profits in metal mining as late as the mid-1860s (see Spargo, 1865).

Nevertheless, structural shifts were starkly visible by the 1840s. New mining districts were being developed near Liskeard and Tavistock in east Cornwall and west Devon, extending the boundaries of the industrial region eastwards. In transport, early railway developments in and after the 1810s had replaced the traditional reliance on mules for carrying ore and coal between the ports and the mines. New foundries were being established in the 1840s, as at St.Austell and Charlestown (McGuiness, 1942, 91). These met the needs of the small clay works that mushroomed after the 1830s, to cope with a rising demand from the pottery, textile and paper industries (Barton, 1966, 54). Moreover, the granite quarrying industry was growing fast in the 1840s in the Penryn and Caradon districts (Stanier, 1985) and Cornish firms were beginning their domination of the market for safety fuse (Newell, 1988, 60; Earl, 1978). More generally, the 1840s appear to have

marked shifts in both the source of capital and in the intensity of information flows. The *West Briton* remarked of 1846 that ‘a new era began in the magnitude of mining operations, in investment, and especially in the spread of information’ (*WB*, 15 January 1847).

But, also, consolidation was occurring in cultural terms. The small town middle classes were gaining in confidence and beginning to assert themselves after the political reforms of the 1830s freed their boroughs (or at least some of them), from the deferential ties of landlordism (Jaggard, 1999). In these places by mid-century a vigorous Liberalism had emerged to challenge the older political establishment. At the same time the religious practice of these Cornish towns was becoming markedly more respectable, deliberately distancing itself from rural small chapel Methodism (Luker, 1986). We shall consider these socio-cultural changes below but at this stage we can note that the urbanisation of the central mining district was proceeding apace, despite a slow down in population growth generally in Cornwall from the late 1830s. In the two decades from 1841, while the population of Cornwall only grew at 8 per cent, that of the urbanising parishes of Camborne, Redruth and Illogan grew by almost 30 per cent (Census Reports, 1841-1861). By 1861 the population of these three parishes was over 35,000. The central mining district appeared to be on the way to creating an unambiguous central place for Cornwall, as the newer industrial towns moved into a position of parity with long established marketing and merchant centres.

*De-industrialisation*

But this was not to be. The partial diversification, geographical spread and urbanisation of the industrial region halted and contracted, and Camborne and

Redruth remained embryonic regional centres, lacking a full range of central place functions. As the world economy entered a downswing, Cornwall was one of those regional economies that became ‘easy prey to the acute backwash effects of downswing’ (Hudson, 1989, 35). Indeed, in Cornwall the proportion of men employed in agriculture and fishing rose from 29.5 per cent in 1861 to 34.5 per cent in 1881, indicating de-industrialisation from the 1860s to the 1880s, with the 1870s, when the proportion rose from 30.1 per cent to 34.5 per cent, being the decade in which change was most abrupt (calculated from Lee, 1979)

The proponents of the industrial regions perspective have pointed to the importance of interdependent diversity and critical mass in enabling regions to establish a base for sustaining their economic leadership (Hudson, 1989, 28-29). Interdependent diversity involved the growth of backward and forward integration, linking service trades to the manufacturing specialisation and markets to suppliers. As this diversity emerges and grows, ‘economics of conglomeration’ take effect and at some point a critical performance mass of industrial activity is reached (Berg, 1994a, 114). Successful regions can then be host to a sequence of industries as one takes over the reins of regional leadership from another, as in the north east of England, where coal gave way to glass and chemicals, then iron and steel, shipbuilding and engineering (Evans, 1989). Regions that failed to reach this elusive ‘critical mass’ fell by the wayside.

One reason why Cornwall’s economy declined so rapidly after the 1860s was already foreshadowed in its demographic history after the 1830s. From 1801 to 1841 Cornwall’s population growth was broadly in line with that of England and Wales. However, a marked slowdown set in from 1841, the population growing just 8 per cent in the following 20 years, compared with a 26.4 per cent growth in

England and 21.9 per cent in Wales. Despite the continued absolute and relative expansion of the mining industry in the period of modernisation, Cornwall's population growth was slower even than that of Devon from 1841 to 1861, reversing the situation of the earlier four decades. The gap in terms of population size between Cornwall, already smaller than the other industrial regions, then began to widen even more rapidly, as Table 6.7 shows.

Table 6.7: Cornwall's population in context, 1801-61 ('000s)

| | Popn 1801 | Popn 1841 | Popn 1861 | As % of England/Wales 1801 | 1841 | 1861 |
|---|---|---|---|---|---|---|
| Cornwall | 192 | 342 | 369 | 2.15 | 2.15 | 1.84 |
| Lancs./Cheshire | 866 | 2063 | 2935 | 9.73 | 12.96 | 14.63 |
| West Riding | 572 | 1164 | 1508 | 6.43 | 7.31 | 7.52 |
| North East | 317 | 574 | 852 | 3.56 | 3.61 | 4.25 |
| Mon/Glamorgan | 116 | 306 | 492 | 1.30 | 1.92 | 2.45 |
| Devon | 340 | 533 | 584 | 3.82 | 3.35 | 2.91 |
| Shropshire | 169 | 226 | 241 | 1.90 | 1.42 | 1.20 |
| England/Wales | 8896 | 15914 | 20066 | | | |

*Source*: calculated from 1861 Census; Summary Tables, xiv.

In addition, the growing population of the eighteenth and first third of the nineteenth century had not been associated with major urbanisation. If we adopt a crude measure of urbanisation as the proportion of the total population living in

parishes with more than two persons to the acre then, as Table 6.8 shows, numbers living in ‘urban’ parishes grew only slightly faster than those in rural ones. Indeed, before the 1840s the rural population grew faster in terms of absolute numbers.

Table 6.8: Proportions of Cornish population in urban and rural parishes, 1801-1831

| | urban | Rural |
|---|---|---|
| 1801 | 20236 (10.5%) | 172045 (89.5%) |
| 1831 | 43275 (14.4%) | 258031 (85.6%) |

*Source:* calculated from published Census Reports, 1801 and 1831.

The impact of urbanisation was effectively diluted across a number of small towns, rather than being concentrated in one or two central places. The largest town in Cornwall by 1861, Truro, only had a population of just over 11,000. Two other places, Penzance and Falmouth, had populations between 9 and 10,000 whilst the twin mining centres of Redruth and Camborne each had populations between 7 and 8,000. If we apply a log-normal model to this, one that tests the degree of centralisation by ranking settlements and then seeing how far they conform to a log-normal distribution (i.e. the sequence 1, 1/2, 1/3, 1/4, 1/5 etc) we can see that Cornish settlements were clearly below any log-normal line. Truro, the largest town, was only marginally larger than the next two, and the fifth largest, Camborne, was still 64 per cent the size of Truro, instead of the expected 20 per cent.

What this means is that Cornwall's settlement network had a strongly decentralised pattern. This was in marked contrast to the larger industrial regions with their dominating cities and contrasts with Devon, where Plymouth, with around 127,000 people in 1861 was almost four times the size of the next largest town, Exeter, which, at 34,000, was almost three times as big as the next towns, Torquay and Tiverton (Hoskins, 1954). While mid-nineteenth century Cornwall displayed a decentralised settlement pattern, Devon had the strongly centralised settlement structure much more typical of England, both industrial and agricultural.

Cornwall's slowdown in population growth after the 1830s and its dispersed settlement pattern might be connected. Baines suggests that, in nineteenth century Europe, emigration rates from areas surrounding small towns would be higher than those near large towns (Baines, 1994, 538). Cornwall's lack of the latter may have been one factor making emigration an attractive opportunity for the rural population. And it was, of course, the growing propensity to emigrate that explains the slow down of population growth after the 1830s. (The process of emigration is analysed further in the next chapter). Emigration and a slowing down of population growth in turn helped to guarantee that local markets for consumer goods remained small and fragmented. As a consequence, the industrial towns of Camborne, Redruth and St.Austell competed with the older market towns of Penzance, Falmouth and Truro, but never became dominant. The result was not just a dispersed population geography but a tendency to cultural and political fragmentation and localism that existed in tension with the notions of Cornwall that were crystallising at the same time.

Critical mass had clearly not been attained, in that no central place had emerged comparable in functional status to those great provincial cities such as Manchester,

Leeds or Birmingham which all provided a leadership role for their respective hinterlands. Such cities were also a reservoir for the specialised demands and skills required for further industrial diversification. While Cornwall had achieved sufficient critical mass in eighteenth-century conditions to enable the emergence of a concentrated industrial region based on metal mining, its scale of development was insufficient to enable the region to take the next step, towards diversification. The lack of a major urban centre and the small absolute size of the region meant that such diversification was unlikely to occur in Cornwall and it was here that the region differed most profoundly from other major industrial regions in the mid-nineteenth century.

### *Conclusion*

Cornwall's industrial history was important in two ways. It supplied the symbols for the territory's 'symbolic shape' and the parameters for its 'space of possibilities'. Early industrialisation produced some unique institutions, for instance cost book financing and wage systems that enabled links to be maintained with older traditions of a free tinning population. The intensely concentrated industrial region produced by copper mining in the eighteenth century led to both a regional pride in the achievements of mining and a culture of empirical tinkering. Among other things, these established an iconic status for the steam engine in local representations of place. Furthermore, the way the mining industry had become intertwined with the territorial identity by the 1850s may itself have been a factor in the de-industrialisation that followed the 1860s.

Hudson suggests that the long term economic survival of regions was related to a variety of factors, which were cultural and political as much as economic. She

suggests that ‘flexible, cheap labour’, which had ‘little strong institutionalised attachment to earlier methods of working’, may be one of these factors (Hudson, 1996, 60. And see Hudson, 1989, 30-33). From this perspective we might propose that the centrality of the mining industry in Cornish people’s representations of themselves by the 1860s had itself become counter-productive, closing off alternative representations and making the option of emigration in order to continue to work within the mining industry more rational than that of staying put and taking up opportunities in the non-mining sector.

Cornwall’s industrial experience, despite its ultimate restrictions, was therefore a crucial element in the history of Cornish communities in the century from 1750. But this was an experience that was not shared equally in all parts of Cornwall. To restore a sense of heterogeneity we now need to delve into some intra-Cornish differences to see if they shed light on the form and intensity of the Cornish sense of place at different locations within Cornwall.