CONTINUITY AND CHANGE IN ENGLISH MONETARY HISTORY

c.973–1086

PART 2

D.M.Metcalf

THE VOLUME OF MINT OUTPUT

The figures for mint output tabulated in Appendices IV–VI are estimates which rest in the first instance on two very large collections, namely the systematic collection at Stockholm, as published by Hildebrand in 1881, with the attributions extensively corrected in various articles published in the 1950s and 1960s,[24] and the Copenhagen collection, published by Galster between 1964 and 1975 under the aegis of the British Sylloge Committee. Together these two sources comprise some 17,030 apparently English coins from the period from Eadgar's reform to the Domesday Survey (c. 973–1086), virtually all found in Scandinavia. Both are collections of die-varieties, and there is some duplication between them. In combination (Appendix IV) they give a very large sample which, while it cannot claim to be perfectly random in respect of the proportions of coins from different mints, seems to be substantially so for the period up to c. 1050.

Because some types accumulated in Scandinavia to a greater degree than others, the actual numbers of coins found are not directly comparable as between one type and another. It is more convenient for some purposes to express the output of each mint as a percentage of the total for the type (Appendix V). This allows one to form an impression of the way in which a mint's share of the national output fluctuated, type by type (cf. Appendix III).

The various possibilities of bias in the sample have been discussed elsewhere,[25] and the details need not all be repeated here. There are, very briefly, two sources of bias: first the sample of coins that reached Scandinavia may not have been random; and secondly, the systematic collections may favour scarce mints or varieties. When the hoards from Denmark and Sweden have been fully published, it should be possible to dispose of the second uncertainty almost completely. But for years yet, until the *Corpus nummorum saeculorum IX–XI* has proceeded further than the three fascicles so far in print,[26] the systematic collections taken together will remain incomparably the best sample we have.

Their randomness in respect of the proportions of coins from different mints is of crucial importance, because the second stage of the argument by which we arrive at estimates for the volume of mint output is to use the figures that have been calculated by Lyon for output at the Lincoln mint;[27] in conjunction with the proportion of Lincoln coins among the Scandinavian finds. Thus if in a particular type at Lincoln 175 reverse dies are known and it is estimated that those dies represent 90 per cent of the total output, we may speak of the total in terms of 194 'equivalent reverse dies'. As Lincoln in that type accounted for 13.5 per cent of the finds, the national total may be estimated as 194 x 100 ÷ 13.5, or 1,437. The statistics are

set out in 'equivalent reverse dies', as a measure of output, in Appendix VI.

Comparisons between types are somewhat inexact, because 'equivalent dies' are a variable unit of reckoning. They are, for each type, the average output of the known dies.[28] At Lincoln the known reverse dies usually represent upwards of 70 per cent of the output, but in First Hand, for example, the figure is only 43 per cent. The actual output of individual dies varied very widely, and if a relatively small proportion of the dies in a type are known, the heavily-used dies will colour the result, tending to give a higher value to the 'equivalent die'. It is therefore worth estimating the number of missing dies in the Lincoln material, and assessing the national output for each type on the basis of the total of actual dies originally used, - especially where the proportions of known dies vary widely. We can then compare one type with another on the assumption that the average output of all the dies originally used was much the same in each type. Some alternative estimates of numbers of missing dies at Lincoln are given in Appendix XII.[29]

Average output per die could, of course, have varied significantly from one type to another, and that is something about which we can never recover any information, unless possibly from the variations from type to type in the ratio of obverse to reverse dies. At Lincoln they are mostly about 1:1 or a little higher in the period c. 997-1086, and higher from c. 973-97, but they reveal no clear pattern in relation either to the volume of each type or to its volume in relation to the preceding type. One might conjecture that an increase in activity, in so far as it was unforeseen, would have led the smaller mints in particular to use their dies more heavily. This might not have been true to the same extent of larger mints such as Lincoln, where batches of new dies would in any case be needed frequently. As the estimates in Appendix VI are estimates of output, not of actual dies employed, they should avoid that uncertainty.

A more obvious and a much more serious difficulty is that for the second half of the reign of Edward the Confessor, say from Small Flan onwards, when the accumulation of English coins in Scandinavia seems practically to have ceased, it is demonstrable that the issues of the Lincoln mint are very much over-represented in the few finds from Denmark and Sweden in relation to the issues of other mints. In the Pyramids type, for example, Lincoln used about 23 equivalent dies, and Lincoln coins make up 4 out of 8 coins from Scandinavia. Yet we know that the Northampton mint alone used at least 13 reverse dies,[30] and the national total was therefore obviously far higher than 46.

From Petersson's tables[31] we can deduce alternative estimates, based on all the coins of which he took account. These estimates probably tend to err in the other direction, because the samples are weighted with coins from southern English hoards, in which the Lincoln mint was if anything underrepresented. The discrepancies between the two sets of estimates are sometimes as much as five- or six-fold, as may be seen from Table 3, which offers some guesses at more realistic figures. The element of uncertainty is least for the Small Flan type (2-3 million coins?), which undoubtedly marks the nadir of the late Saxon currency, although a compilation of die-varieties might show that the total was somewhat higher than it has been estimated.

From the middle of the century onwards, then, it is plain that the sample of coins that reached Scandinavia is not random in respect of mints represented in it. There are in principle two ways in which we can test the general validity both of the Scandinavian statistics and of the figures

TABLE 3

Estimated numbers of 'equivalent dies'. c.1048-66

		Scandinavia	*Petersson*	*Best guess*
16	Small Flan (c.1048-50)	199	308	250?
17	Expanding Cross (c.1050-3)	248	249 494	145 290
18	Helmet (c.1053-6)	193	908	500
19	Sovereign (c.1056-9)	320	1412	1000
20	Hammer Cross (c.1059-62)	288	1548	1200
21	Facing Bust (c.1062-5)	463	1016	900
22	Pyramids (c.1065-6)	46	382	200
23	Pax (1066)	-	293	200?

derived from Petersson, by comparing them with purely English evidence. First, we can look at the proportions of the various mints in English hoards. There are astonishingly few of these that are large enough and fully enough recorded to be useful for this purpose, and even with those few, some ingenuity is needed to discount the bias of the local region. The Sedlescombe hoard, for example, contains great numbers of coins from the local mint of Hastings, which it is necessary to disregard. It would seem safest, in fact, to disregard all the nearby Channel ports and to compare the Lincoln coins with those from other regions of England. For the Helmet type, that leaves one with only 7 coins of Lincoln to compare with 68 from elsewhere, and for the Sovereign type with only 3 coins of Lincoln to compare with 43 from elsewhere. Lincoln's share is thus 9 per cent and 6½ per cent respectively, or maybe 8 per cent and 6 per cent if we reintroduce the Channel ports into the equation, whereas the Scandinavian finds give the almost certainly exaggerated proportions of 23 per cent and 20 per cent. But with numbers as small as the hoards provide, the margins of statistical uncertainty are considerable; and as Sedlescombe betrays so much localization anyway, one cannot be sure that Lincoln is fairly represented, even among the non-local coins. Statistics from a whole range of hoards would be required in order to create confidence, and as has been said very few hoards are in fact available. Any figures that one may calculate from the English hoard evidence thus still belong in the realm of intelligent guesswork.

The second and more interesting way in which we can test the general validity of the Scandinavian figures is by checking the die-estimates which they yield against mints other than Lincoln for which a corpus has been published. The estimates of numbers of dies used at the Sussex mints,[32] for example, or at Watchet[33] or at Warwick,[34] can be compared with the total of 'equivalent dies' projected from the Lincoln corpus. For the procedure to have much claim to accuracy, the survival-rate for the types studied has to be high enough for it to be obvious from the corpus that most of the original output is represented by the known dies, i.e. there have to be many duplicates. This is rarely the case except in those types which reached Scandinavia in great quantities. Where the test can be applied the agreement is usually about as good as can be expected with small numbers, although there are some discrepancies (Figures in bold type, in parentheses, in Appendix VI). Several western or west country mints in Quatrefoil, in particular, give exaggerated estimates compared with the numbers of known dies (Axbridge,[35] 6 instead of 3; 'Gothabyrig',[36] 11 instead of 4+; Watchet, 13 instead of 5). The estimate of 47 million pence of the Quatrefoil type is so high that one would be relieved to discover good reasons

for adjusting it downwards. The Chronicle tells of the heavy tribute paid in 1018, amounting to £72,000 plus £10,500[37] from London, equivalent in all to 19.8 million pence. If the geld was collected in Quatrefoil coins it presumably absorbed a very high proportion of the initial recoinage, in which the western mints might be expected to be more prominent than they would have been in the type as a whole. We do not, however, find numerous dies represented by upwards of five specimens in Scandinavia, as we do among the early Long Cross coins. Quatrefoil therefore remains rather problematic. It is of course uncertain how much of the tribute found its way to Denmark, and from there to other Scandinavian countries. But evidence has recently been offered that many millions of Quatrefoil coins accumulated in the currency of the Northern Lands.[38]

In Æthelred's Helmet type, by contrast with Quatrefoil, the Scandinavian material sometimes yields an underestimate of the numbers of dies used (Warwick, 4 instead of 15). There is hardly enough evidence from which to generalize, but one may suspect that when the outflow of English silver to Scandinavia was exceptionally large, as in First Hand, or Crux, or Quatrefoil, westerly mints contributed relatively rather more of it; and when the outflow was a smaller part of the issue, as in Second Hand, or Æthelred's Helmet type, or Jewel Cross, westerly mints contributed less than their average share. It would be useful, as a test of this idea, to have an independent check on the output of the Eastern Danelaw mints in the Crux type. Over-all the discrepancies seem roughly to balance out, so that there is at present no case for applying any general factor of increase or decrease to the Scandinavian statistics.

It is worth emphasizing that the discrepancies in the figures are not a matter of fact, as we are not strictly comparing like with like. The estimated output for every mint in Appendix VI is stated in terms of 'Lincoln equivalent reverse dies', whereas the suggested method of checking its reliability uses either actual dies, or local 'equivalent dies'. It may be that at small mints, where the trouble and expense of a long journey would be incurred to obtain a new pair of dies, the actual output per die would be more variable from type to type according to demand than at a major mint. Sometimes the reverse dies may have been kept in use until they had worn down and become much too short for comfort. Sometimes, where the estimated output is zero, it will suggest (depending on the adequacy of the sample size) that although dies were obtained, there proved to be little work for them. The uncertainties attaching to output per die at the small mints are one reason why we can never hope to dispense with estimates of output based on the Scandinavian statistics, even when we have a corpus for particular small mints.

From 1066 onwards the evidence is too slender to give even tolerably accurate results. There is little or nothing we can do to obtain comparable statistics, except for one type which has had an unusually high survival-rate, namely the Paxs coinage of the later 1080s. *BMC*[39] offers a large collection of die-varieties, which gives us a minimum for the number of dies used at each mint, and an estimated maximum which, because the sample is not random, is very unlikely to have been exceeded (Appendix VII). The much smaller collection at Oxford[40] has been checked against *BMC* for die-duplication, and out of 63 coins, 43 are from reverse dies represented in the British Museum. *BMC* may reflect two-thirds or even three-quarters of the output for the type.

To sum up, the columns on the bar-graph (Fig. 7) representing mint output type by type from c. 973 to 1086 are based on composite evidence, and are subject to distortion through bias and to margins of sampling error.

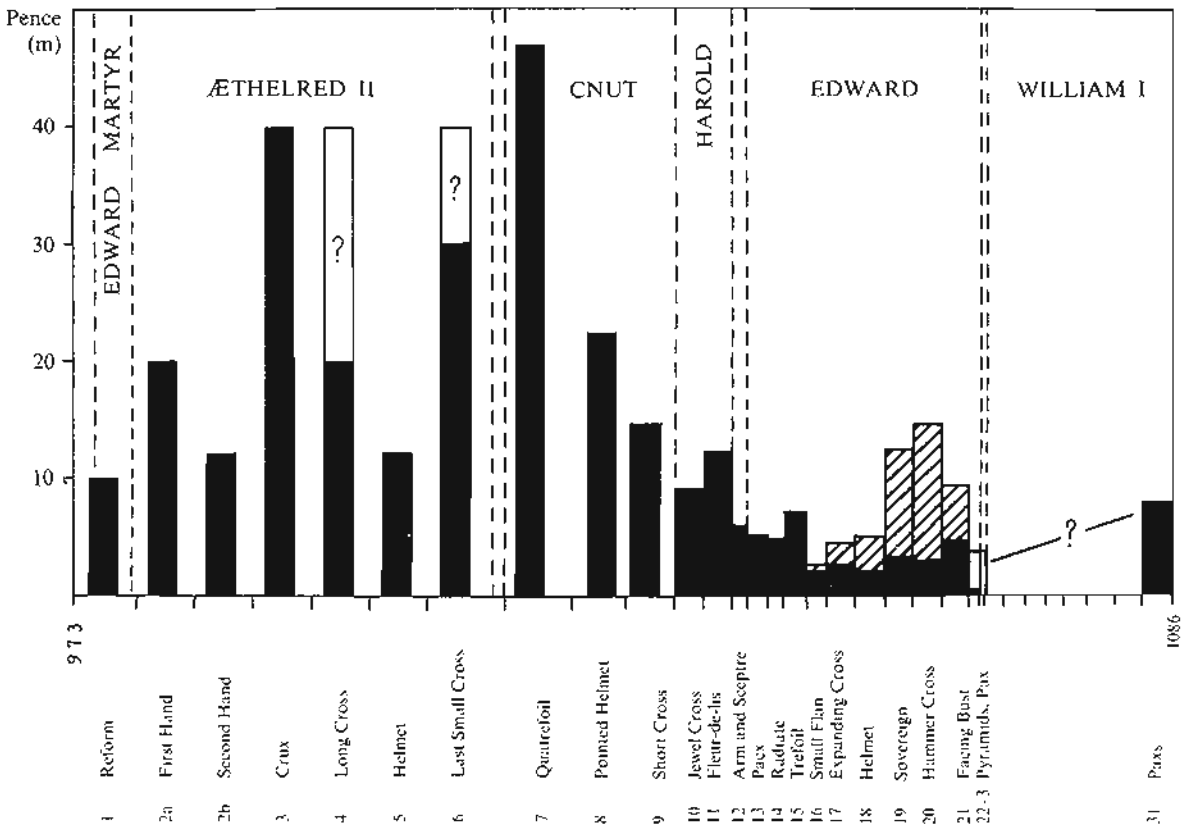

Fig. 7. Bar-graph to show the estimated mint-output for each type (estimated dies x 10,000). The height (*not* the area) of each bar represents the output figure. Alternative estimates for Æthelred II are shown unshaded and marked (?). Best guesses for the period c.1048–66 are shown hatched. (Sources: *Ethelred the Unready*, p.179, Table J; Appendix VI below; Table 3; Appendix VII.)

They should be sufficiently accurate to support broad conclusions, but they cannot be used to establish small differences. Individual figures could be adjusted as new evidence becomes available, and the publication of the Winchester corpus should provide the opportunity for a thorough revision.

We see, then, that the totals could vary greatly from one type to the next. Under Æthelred II they ranged from about 12 millions to about 40 millions. At the beginning of Cnut's reign mint output reached a peak. But the creation of an Anglo-Danish state, and the ending of the punitively heavy foreign exactions of tribute, were not followed as might have been expected by a recovery in mint output. On the contrary the totals declined type by type during the reigns of Cnut, Harold, and Harthacnut, until they were down to a low point of perhaps 2½ million coins in Small Flan. From then on there was a moderate recovery, until in the years around 1060 mintages were possibly about 10 millions. William's Canopy type may have been the only issue of his reign to reach that level. The Paxs issue, at about the date of Domesday Book, may have amounted to between 7 and 9 million coins. But the mint output figures alone offer a very misleading commentary on monetary affairs.

THE VOLUME OF THE CURRENCY

What one needs to know as a basic statistical series in order to comment on the trends in English monetary history is not the changing volume of mint-output, so much as the changing volume of the currency, which may be a very different matter. On the one hand the currency may have been larger than the scale of the current type, if earlier types remained in circulation, as for example under Edward the Confessor or William I. On the other hand the loss of coin through export may mean that the mint-output figures give a much exaggerated impression of the size of the currency at any particular moment in the six-year or shorter type period.

There are two main reasons to suspect that the flows of bullion into and out of the country were relatively large. First, there is the importance of the east-coast mints. Secondly, the large changes in the volume of minting from one type to the next, particularly during the reigns of Æthelred and Cnut, seem to imply net balance-of-payments changes, either upwards or downwards, which could average £5,000 or sometimes even £10,000 a year. These figures, and the size of the swings into surplus or deficit, need not surprise us if we remember that in 1303-9 foreign bullion in excess of £100,000 a year was being minted, and that in 1324-35 the figure fell to 0.5 per cent as much, namely £500 a year.[43] Where possible merchants evidently made per contra credit arrangements in order to avoid the charges for reminting foreign coin, and the fourteenth-century mint-output figures seem to mirror the balance of payments rather closely. In the late Anglo-Saxon period this was not necessarily so. Indeed it seems inescapable that large inflows and large outflows sometimes took place concurrently. Between Cnut's Quatrefoil and Helmet types, for example, mint output declined from an estimated 47 million coins to 22 millions, and in Short Cross it declined again to 14 millions. (Since the argument rests on the differences between the totals for the types, one should consider whether the output estimates could be seriously inaccurate because of variation in the value of the 'equivalent reverse die'. The estimates in Appendix XII based on actual dies, however, yield national totals of 5,250, 2,640, and 1,540 dies. The differences between the types thus remain very much the same.) Without needing to insist on the accuracy of the estimates, it follows that in order to 'balance the books', we should envisage either the transfer of many tons of silver to non-monetary uses, or a net outflow of at least 15 million coins, and then a further 8 millions, at a time when the mints were very actively dealing with inflows. Even if we postulate that some of the old coins remained in circulation and were not promptly demonetized, the problem does not go away, since there is no large recoinage in the next reign.

If large inflows and large outflows were occurring simultaneously, without per contra arrangements being made, it may have been mainly because payments and receipts were in different directions. England may have been a net exporter of goods, such as wool, to the Low Countries and the lower Rhinelands, and therefore a net importer of silver from those regions, but at the same time a net exporter of silver paid in tribute or to mercenaries, and probably also in commerce, to Scandinavia.

We can gain some idea of the total (not the net) quantities of foreign silver that came into England, because it was strictly required to pass through the mints. Foreign coins were evidently not tolerated to pass from hand to hand in England, and they rarely penetrated far from the port at which they may be presumed to have entered the country. There are in fact a dozen foreign single finds among the 270-odd coins in Appendix 1, and one can see a broad regional pattern among them: they tend to be from the facing countries across the sea. Thus there are two from Lincoln (a

Norwegian and a Danish coin) and one from Thetford (another Norwegian coin); one from Westminster (a German coin); one of uncertain attribution from South Croydon, possibly of Sens; one from Old Sarum (a coin of Utrecht) and another from Salisbury Plain (of Magnus the Good); three Norman deniers, from Alfriston (Sussex), Netherton (Hants), and Winchester; a Spanish dirham (looped) from Cerne Abbas; and a Hiberno-Norse coin from Meols. At just under 5 per cent, these are a small but not negligible proportion of the stray finds. What is surprising, therefore, is the extreme scarcity of peck-marked coins in England. If a few Scandinavian coins managed to escape the net, one would have expected to discover, in the eastern parts of England, distinctly more English coins that had been carried back from Scandinavia. Yet the only examples to which one can point are a pecked Last Small Cross coin from Lincoln, and a similar Long Cross coin from Kingston-on-Thames. Even these rare birds, some would say, may be secondary losses from modern times, or could rest on the confusion of two coins in a modern collection. In any case, the virtual absence of pecked coins from the English currency amounts to a powerful argument that the balance of payments with Scandinavia was very firmly outwards.

The silver that came into England, then, can to some extent be measured, by reference to the output of the English mints. But the corresponding total of silver that went out of the country in the form of English coin has disappeared without leaving us any measurable evidence except as it may be deduced from net changes in the total stock of currency in England. If we were to try to break down the outflow into its component parts, we should encounter numerous technical difficulties. Any English coin that was carried to the Low Countries or to the Rhinelands at this time, for example, would have been reminted there with equal strictness (for we do not find Anglo-Saxon pennies in the hoards), and we might therefore hope to assess the flow of English bullion through the continental mints. The very modest output of the Flemish mints in the late tenth and early eleventh centuries suggests that not much English money can have been crossing the Channel in that direction.[42] Köln was a major mint, but we cannot identify what part, if any, of its output was recoined English silver; and the German coins cannot in any case be dated with quite the degree of precision that would be needed to marry up the English and the German mintage figures.

As evidence of the outflow, we also have the very large numbers of English coins found in Scandinavia and the Baltic regions, especially coins from c.990 to c.1040, which were not required to be reminted there. I have estimated elsewhere that from the time of Eadgar's reform, when there was relatively little English money in Scandinavia, until the early part of the reign of Cnut, a stock of Anglo-Saxon coins was progressively built up in the Northern Lands to an eventual total that was measured in tens of millions. Further, it is demonstrable that the total numbers of Anglo-Saxon coins carried to Scandinavia were far greater than those that remained current there, and it is equally clear that the Scandinavian balance of payments with England was in surplus more or less continuously for half a century. Then from Cnut's reign the English component in the Scandinavian currency seems to have become much more stable in size. There were normally far more Anglo-Saxon coins above-ground in Scandinavia than there were in England.[43]

All this amounts, it may be said, merely to a restatement of the commonsense view that the greatest flow of English money to Scandinavia coincided quite closely with the period of the danegeld and the heregeld. That is broadly true; but it does not necessarily follow that all or most of the

English money of that period found in Scandinavia was carried there as gelds. We are in no position to discuss whether unilateral payments accounted for the bulk of the flow, or whether trade too played a part, until we have described and quantified the currency of Scandinavia.

There are other ways in which silver may have entered or left the English currency than by unilateral payments and foreign trade. Apart from the mining of new metal, which probably contributed only very minor proportions to the sort of totals we are talking about, the most obvious ways are the withdrawal of coin from circulation to be held as treasure or to be converted into jewellery or plate, and conversely its release back into the system. The monastic churches accumulated impressive treasures of silver and gold, as we may judge, for example, from the story of Peterborough Abbey in 1070, when the outlaws made off with 'the diadem all of pure gold from our Lord's head ... the foot-support made entirely of red gold ... the altar-frontal made entirely of gold and silver ... two golden and nine silver shrines, and fifteen great crosses made both of gold and of silver ... riches in money, vestments, or books'.[44] For this sort of wealth we are heavily dependent on written sources. Hinton has argued from the archaeological evidence (which relates on the whole to a different sector of society) that there was relatively little silver other than coin in late Anglo-Saxon England.[45] Nevertheless, one should not underestimate the proportion of the curency held back from active circulation as family treasure, especially when there was a growing stock of cash in the country. But neither should one overestimate the average length of time that particular sums of money would be allowed to lie unused. The demands of a heavy danegeld may have caused many families to dip into their savings, but this process cannot plausibly be invoked over and over again. The savings and spendings from monetary reserves, taken over the whole country, might be expected to a considerable extent to cancel each other out, being governed by the rhythms of family and farming life. They do not provide a convincing explanation of very large mintages in response to demands for geld, and accordingly they should not cast doubt on the arguments about the inflows resulting from foreign trade.

The persistent decline in the numbers of English coins of each new type found in Scandinavia from Quatrefoil, of which there are over 1,500 specimens in the Swedish systematic collection, until the 1060s and later, when each new type is counted in single figures (Fig. 6 in Part 1), is the most conspicuous numerical trend associated with the late Anglo-Saxon coinage. Totals of coins in public collections are not an accurate way of defining it, being unduly influenced by the availability of hoards. Nevertheless, the histogram gives a rough idea of the net quantities of each new type remaining in the Scandinavian currency. The trend which it reveals has often been linked with the abolition of the heregeld in 1051, but one may question whether the evidence is sufficient. The decline begins earlier, and involves a larger reduction than the sums that are likely to have been earned by mercenaries. Moreover, the eventual low totals should not be interpreted simply in terms of the balance of payments. An important reason was the development of national coinages in Denmark and Norway[46] and the consequent reminting of foreign coin – which would presumably have included any English money entering those countries.

We ought not therefore to venture much further, in interpreting what happened in 1051 (or at least at an intermediate date in the Expanding Cross type), than to say that there was a reform of the coinage, involving an over-ambitious increase in the weight of the penny and also the permanent abolition of the use of inferior alloys.[47] Similarly we should hesitate to assert that England during the 1040s ceased being a net exporter of

silver to Scandinavia on any scale. The rising mintages of the later 1050s combined probably with a multi-type currency indicate a recovery in the national stock of bullion, but whether this was because the balance of payments with Scandinavia had swung the other way, or, as is much more probable, it derived from a trading surplus with Germany and the Low Countries, the statistics probably cannot show. Hence the importance of the absence of peck-marked coins.

Our monetary interpretation of the period from the 1040s onwards inevitably depends a good deal on how we think the total mintage in each type was divided between the initial recoinage and the subsequent work of the mints associated with trading flows. If the recoinages were small - and again, this is the period of a multi-type currency - the remainder of the output may have made up, in the two- and three-year validity periods, annual amounts smaller but not very much smaller, except in the years c.1048-56, than those in the at first glance more prolific sexennial periods. If much of the work of the mints consisted, as I have tried to suggest, in reminting foreign silver as it flowed into the country, then we should have to say that mint output, contrary to what the figures for each type might suggest, points to similar levels of trade - or at least similar monetary imbalances resulting presumably from trade - in the years around 1060 as in the 1030s.

There is better evidence pointing in the same direction. If England's overseas trade had dwindled away after the reign of Cnut, there would almost certainly have been a radical decline in the rapidity of circulation throughout the south and east of England, accompanied by noticeable changes in the ranking of the mints. The evidence of the single finds speaks against any such decline. Part of the explanation may be that English coins were reminted when they reached Scandinavia, so that the evidence is not comparable with that from the first half of the century; part may be that England increasingly spent its foreign earnings in France. Concentration of the traffic onto fewer cross-Channel routes may have increased the possibilities of per contra arrangements. In so far as there was a decline in mint output, it may have resulted essentially from trade being broadly in balance, much more than from a decline in the value of goods exported. But the margins of sampling error in the figures from which this view is constructed, plus the elements of conjecture it contains, are such that one would not wish to rest much weight on it if it were unsupported. The wide dispersion of the single finds from the years 1035-86, and better still the continuing rapidity of circulation as shown by Fig. 3, are perhaps our clearest evidence of continuity.

INITIAL RECOINAGES, AND CONTINUED MINTING LATER IN THE VALIDITY-PERIODS

In studying the monetary affairs of Æthelred II's reign I remarked that it would be reasonable to expect that a net inflow of silver into the country would show up in a relatively greater activity at the ports of entry, but that this was conspicuously not the case.[46] Throughout the late Anglo-Saxon period, the ports were surprisingly steady in the share they took, which was between about 60 and 70 per cent of the total in the early eleventh century, declining to between 55 and 65 per cent in the late eleventh century. Presumably not all the bullion minted in the ports was foreign silver coming in. London especially was a wealthy city, and some of its minting might be expected to have been recoinage at the beginning of each new type. Conversely there is no obvious reason why foreign merchants should not have travelled directly to inland centres such as Stamford or

Thetford before changing their money. It is difficult, therefore, to group the output figures for the various mints in such a way as to reveal any differences that there may have been between mints in the share of a type that was minted at the initial recoinage and the share that came later.

There are two types where changes of ruler during the type should enable us to divide the coins into periods with certainty. The Reform/First Small Cross issue was struck in the names of Eadgar, Edward Martyr, and Æthelred, and the coins of Eadgar, obviously, are the early ones. The Oakham and Chester hoards suggest that at some of the larger mints, such as Lincoln, Stamford, and Bedford, upwards of 80 per cent of the output was in the time of Edward and Æthelred, whereas at other mints such as Canterbury and Rochester, and probably many of the smaller mints, at least half of the output was under Eadgar. The Oakham hoard indicates that over all at least 27 per cent of the issue was in Eadgar's name. But this may not be a typical recoinage proportion, for various reasons. It may cover a longer period than was normally required for a recoinage; Eadgar's coins, like those of Edward and Æthelred, are on more than one weight standard; and the 970s are to some extent atypical, for example, in the ranking of the boroughs.[50]

The Jewel Cross type is unfortunately also problematic. It includes early coins in the names of Cnut and Harthacnut for which a date between November 1035 and the spring of 1036 has been proposed, and later coins in the name of Harold, plus coins of Harthacnut with a right-facing bust, both dated between the spring of 1036 and the autumn of 1037.[51] If this chronology were correct, the early coins would correspond in a most convenient manner with the recoinage when the type was changed, and the second phase would reflect continued minting in particular of foreign silver. It is more than likely, however, that coins in Harold's name were struck at many mints in the first few months of the validity-period. The Scandinavian evidence shows that the type behaves with complete regularity as regards the ranking of the mints, and it is hard to believe, for example, that York used the equivalent of one die in the first six months and then the equivalent of 89 dies in the next eighteen months - or that 41 out of the 56 mints represented among the Scandinavian finds should equally have stood idle for the first six months of the type (see Appendix VIII).

The coins of Harthacnut, type Aa (the variety with right-facing bust), are nearly all heavy and on a closely-controlled weight-standard of c.1.12g, presenting a sharp contrast with Harold's coins, which range over several weight-standards.[52] Taking the Jewel Cross type as a whole, the lighter coins are preponderantly from London, Lincoln, York, Stamford, and Thetford. They amount, however, to only about a quarter of the issue, and it seems very unlikely that all the heavier coins belong to the recoinage phase.

If only we could identify the coins within an issue that comprised the recoinage, we should have a most interesting indication of where in England the money was when the type was changed. Its regional distribution was almost certainly different from the geographical pattern of minting. One type for which we can perhaps obtain a rough idea of the distribution is Last Small Cross. If we assume that the heavy coins within that issue are essentially early, and that they make up a proportion of the total equal to or smaller than the recoinage, we can establish percentages based on that phase of the issue alone (Table 4). It is rather unlikely that at the recoinage old coins would be taken all to the nearest mint, and for that reason we cannot say that the heavy coins show us exactly where the accumulated cash was in 1009. But they do serve to establish a contrast with the pattern for the issue as a whole, and therefore probably approximate

TABLE 4

Proportions of heavy coins of Last Small Cross type from each region, compared with the proportions for the type as a whole

		% Heavy coins	All coins
I.	Hampshire Basin	13	13
II.	West Country	13	8
III.	Channel Ports	5	8
IV.	London	9	24
V.	Home Counties	6	1
VI.	Eastern Danelaw	11	14
VII.	Five Boroughs	18	18
VIII.	Western mints	13	5
IX.	York	12	9

Source: Appendices V and X

more closely to the regional distribution of ready money at the beginning of the validity period. They show that there was more money in the west country and the west midlands, and less in London, than the figures for the type as a whole would imply.

Within that regional pattern, discrepancies at a few individual mints attract attention. Bath takes 4.4 per cent of the heavy coins, compared with 0.7 per cent for the type as a whole, and one wonders whether that could be explained by the king's presence there in the year 1009.[53] Oxford and Wallingford take 3.6 and 1.4 per cent respectively, compared with 0.73 and 0.34 per cent - possibly because the sack of Oxford shortly after Christmas 1009[54] resulted in a greater number of the local coins being carried back to Scandinavia (and also, it may be, in the temporary closure of the mints).

One may suspect that the east-west difference is a recurrent pattern in other issues. In First Hand, for example, one can set the specimens of Southern, Midlands, and Northern 'a' style against the later Southern, Midlands, and Northern style 'b' to reveal similar regional discrepancies.[55] Research effort might be well spent in exploring the possibilities, since reliable results would be illuminating for Anglo-Saxon monetary history.

The main point, however, is that one can see how the currency may have been several times smaller than the volume of mint-output. Thus Crux amounted to some 40 million coins; but if, after the initial recoinage had produced let us say 12 million coins, inflows and outflows of bullion as a result of the payment of danegeld and trade in various directions proceeded simultaneously, the size of the currency may never have exceeded the initial figure.[56] In fact it seems likely to have fallen well below it. The stock of currency in the Eastern Danelaw at the beginning of the type might have been about 10 per cent of the national total, say $1\frac{1}{4}$ million pence, and thus if the danegeld of £10,000 or 2.4 million pence in 991 was a local geld in East Anglia, as Dr. Stafford suggests[57] (and assuming that Crux had already been introduced at the time when it was collected), one can see why special minting arrangements might have had to be put in hand.

Finally, therefore, an attempt will be made to construct a simple model of the currency covering the period c.973 to the 1050s to take account of as many as possible of the numerical estimates and relativities that have been assembled in the preceding pages. It involves a good deal of guess-

work, but the guesses seem to fit the evidence better than any of the alternatives. The usefulness of the model, if it has any, is that it should compel one to follow through all the numerical implications of each separate piece of evidence. It is a way of insisting that all the aspects of the coinage must hang together, and make sense in terms of monetary and economic history.

A MODEL OF THE CURRENCY

Let us see how the model (Table 5) is built up step by step. As the first column of figures, we enter the estimates of the numbers of coins minted in each type. Next, we have to decide how to split each total into two parts, representing the recoinage of obsolete English coins, and the subsequent reminting of foreign silver as it was brought in by trade. The large differences in total mintage between one type and the next compel us to envisage relatively small recoinages and large trading flows, and even if we allow for a multi-type currency after 1016, it would not do much to change this constraint. In particular the transition from Last Small Cross to Quatrefoil is difficult unless the initial coinage in Quatrefoil was smaller

TABLE 5

A model of the late Anglo-Saxon currency

	Type	Mintage (million)	Recoinage (%)	Recoinage (million)	Inflow (million)	Outflow: Trade (maximum)	Outflow: Danegeld/Heregeld (minimum)	Outflow: Total	Currency
1	Reform	10	40	4.0	6.0	4.0	-	4.0	4.0 → 6.0
2a	First Hand	20	30	6.0	14.0	11.0	-	11.0	6.0 → 9.0
2b	Second Hand	12	20	2.4	9.6	6.6	2.4	9.0	9.0 → 12.0
3	Crux	40	30	12.0	28.0	30.8	3.8	34.6	12.0 → 5.4
4	Long Cross	18	30	5.4	12.6	5.2	5.8	11.0	5.4 → 7.0
5	Helmet	12	20	2.4	9.6	1.4	8.6	10.0	7.0 → 9.0
6	Last Small Cross	30	30	9.0	21.0	4.0	16.6	20.6	9.0 → 9.4
7	Quatrefoil	47	20	9.4	37.6	34.4	7.0	41.4	9.4 → 6.6
8	Helmet	22	30	6.6	15.4	11.8	6.0	17.8	6.6 → 4.2
9	Short Cross	14	30	4.2	9.8	5.4	5.0	10.4	4.2 → 3.6
10	Jewel Cross	9	40	3.6	5.4	0	3.0	3.0	3.6 → 6.0
11	Fleur-de-lis	12	50	6.0	6.0	7.0	2.0	9.0	6.0 → 3.0
12	Arm and Sceptre	6	50	3.0	3.0	1.5	2.0	3.5	3.0 → 2.5
13	Pacx	5	50	2.5	2.5	0.5	2.0	2.5	2.5
14	Radiate	5	50	2.5	2.5	-0.5	2.0	1.5	2.5 → 3.5
15	Trefoil	7	50	3.5	3.5	3.7	2.0	5.7	3.5 → 1.3
16	Small Flan	2.5	50	1.3	1.2	-1.3	2.0	0.7	1.3 → 1.8
17	Expanding Cross	4.5	40	1.8	2.7	1.5	1.0	2.5	1.8 → 2.0
18	Helmet	5	40	2.0	3.0	1.0	-	1.0	2.0 → 4.0
19	Sovereign	10	40	4.0	6.0	5.2	-	5.2	4.0 → 4.8
20	Hammer Cross	12	40	4.8	7.2				

than seems likely, or unless the geld of 1018 was so severe that it drew large amounts of silver out of 'reservoirs' of family treasure. And the model plainly will not work unless First Hand and Long Cross are assumed to have remained in circulation alongside Second Hand and Helmet respectively. This remains the case if we use the alternative estimates in Appendix XII.

Beyond that we have virtually nothing to guide us on either the proportions or the trend from type to type. Our attempts to find independent evidence for the proportions in the numismatic details of chronology or stylistic variation, in Last Small Cross and Jewel Cross, led to nothing firm; and the grouping of output figures into the ports and the inland mints shows a quite unhelpful regularity. Moreover, there is a loophole in the logic of the argument that the trading flows must have been relatively large: in order to match the estimated output figures against the recorded danegelds, we have to assume an average number of coins minted per die. If this were sometimes higher than the figure of 10,000 that has been used throughout, there would be more room for manoeuvre in the transition, for example, from Last Small Cross to Quatrefoil.

The only statistics that would, so far as one can see, provide a thoroughly secure basis for argument would for that reason be figures for the stock of Anglo-Saxon coins that accumulated in Scandinavia. Preliminary attempts have been made to measure it by way of estimates of the numbers of dies used locally, e.g. for the Sigtuna coinage of Olof Skötkonung, coupled with extrapolated totals derived from the proportions of Sigtuna coins in the hoards. In default of sufficient published hoard-evidence (again, until *CNS* has proceeded further) the results are imprecise. A figure of at least $12\frac{1}{2}$ million Crux coins in the Northern Lands has been proposed.[58] This is a long way short of the $34\frac{1}{2}$ million in the model. For the present one may merely express the view that the Anglo-Saxon coins in Scandinavia by c.1030 were equivalent to the output of several thousand dies, in other words that outflows from England were indeed a substantial fraction of the total mintage, even if we cannot yet say what fraction.

Let us then take an arbitrary figure of 30 per cent for the sexennial recoinages. This is about the upper limit at which the model will work, unless we change some of the other premises on which it is constructed. When the validity-period falls to two or three years, it seems reasonable to assume that the inflows were proportionally less, and the recoinage fraction has accordingly been increased to 40 or 50 per cent respectively. A higher figure would be desirable to correspond with the 30 per cent for the longer validity-periods, but even so this produces impossible negative figures in the column of the table representing outflows as a result of trade.

The estimates of the initial recoinages in each type should be a measure of the volume of the English currency. If three-quarters of the currency in the early years of Second Hand still consisted of First Hand coins, three-quarters of the accidental losses in that phase should still have been of First Hand, and this would conveniently explain the paucity of Second Hand stray finds: similarly with Helmet. But we are still between the devil and the deep blue sea here, unless we can take account of the whole of the evidence, by offering some explanation of how hoards where the Hand coins were predominantly Second Hand came to be put together.[59] Similarly the Penrice hoard, which seems to have been a one-type hoard including Helmet coins from many different mints,[60] is a major obstacle. (The Isleworth hoard is less of a problem.) Faced with a perplexing choice, one may prefer to assume that the hoards in question were put together selectively in some way.

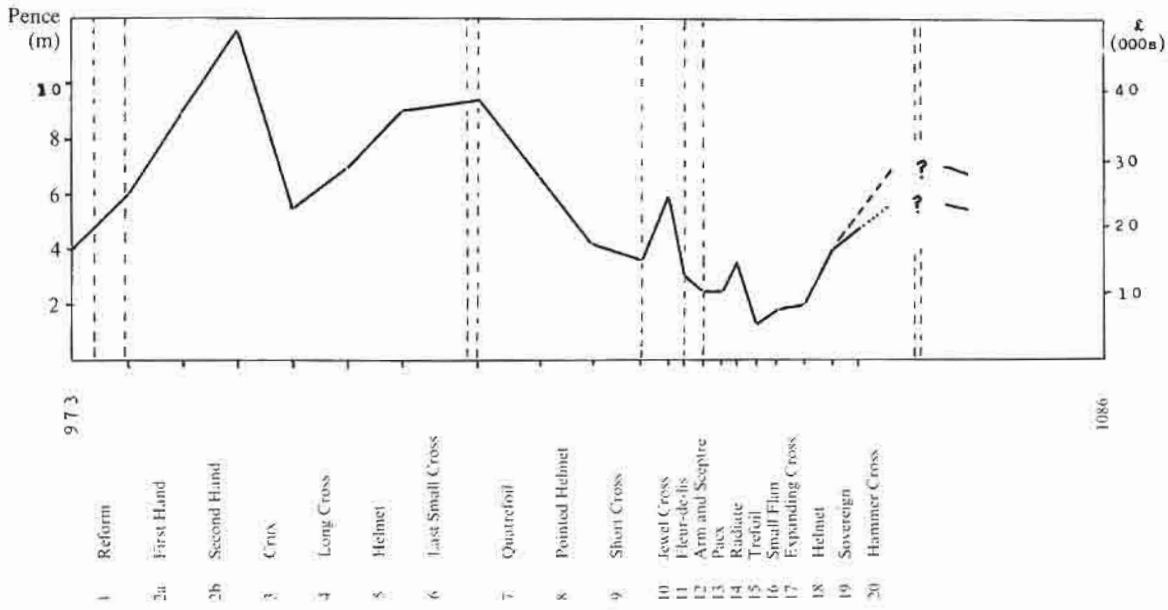

Fig. 8. The volume of the English currency, c.973–c.1059. The broken line represents the addition of obsolete types to the total. (Source: Table 5.)

Figure 8, showing the changing volume of the English currency from c.973 to 1086, on the assumption of thorough renewals at each recoinage, raises many questions, and of course the answers it provides are speculative except in so far as it draws attention to estimates which are incompatible with assumptions about mint activity or about what became of the coinage. Some of the uncertainty could be narrowed down by detailed numismatic research, in particular by comprehensive studies of individual mints.

NOTES

(numbered in continuation from Part I)

24 C.S.S.Lyon, G.Van der Meer, and R.H.M.Dolley, 'Some Scandinavian coins ... attributed by Hildebrand to English mints', *BNJ* xxx (1960-1), 235-51; G.Van der Meer, 'Some corrections to and comments on B.E.Hildebrand's catalogue of the Anglo-Saxon coins in the Swedish Royal Coin Cabinet', *Anglo-Saxon Coins*, ed. R.H.M.Dolley (1961), pp.169-87; V.J. Smart, 'Some misread moneyers of London in the reign of Æthelræd II', *BNJ* xxx (1960), 221-6; id., 'A note on two problematical pennies of Æthelræd II', ibid., xxxi (1962), 160; id., 'Moneyers of the late Anglo-Saxon coinage, 973-1016', *Commentationes* ii (1968), 191-276; id., 'Corrections to Hildebrand's corpus of Anglo-Saxon moneyers: from Cnut to Edward the Confessor', *Anglo-Saxon England* iv (1975), 155-70.

25 D.M. Metcalf, 'The ranking of the boroughs: numismatic evidence from the reign of Æthelred II', *Ethelred the Unready. Papers from the Millenary Conference*, ed. D.Hill (British Arch. Reports, British Series, 59. Oxford, 1978), pp.159-212; C.S.S.Lyon, 'The metrology of Æthel-

red's Long Cross type at Lincoln', *Viking-age Coinage in the Northern Lands*, ed. M.A.S.Blackburn and D.M.Metcalf (British Archaeological Reports, International Series, 122. Oxford, 1981), pp.525-31.

26 *CNS* 1.1, 1.2, and 16.1 (Stockholm, 1975, 1977, and 1979).

27 C.S.S.Lyon, 'Analysis of the material', in H.R.Mossop, *The Lincoln Mint, c.890-1279* (Newcastle, 1970), pp.11-19 and Appendices. In Table 4 Lyon gives the approximate percentage of the total output represented by the known dies. He should not be held responsible for the use made by others of these raw statistics. Cf. the following note.

28 This is discussed more fully in M.A.S.Blackburn and D.M.Metcalf, 'Five-finger exercises on the List hoard', *Viking-age Coinage in the Northern Lands*, ed. M.A.S.Blackburn and D.M.Metcalf (British Arch. Reports, International Series, 122. Oxford, 1981), pp.495-524.

29 I am most grateful to Mr. Lyon, who spared himself no trouble in discussing this problem with me, and who has kindly allowed me to print the estimates and explanatory matter in Appendix XII.

30 R.H.M.Dolley, 'The unpublished 1895 find of coins of Edward the Confessor from Harewood', *Yearbook of the British Association of Numismatic Societies* vii (1961), 17-25.

31 H.B.A.Petersson, *Anglo-Saxon Currency* (Lund, 1969), pp.195-232.

32 H.H.King, 'The coins of the Sussex mints', *BNJ* xxviii (1955-7), 60-74, 249-63, 518-36; ibid., xxix (1958-9), 190-1, 415; ibid., xxx (1960-1), 188. Note King's disclaimer (p.60) that not all specimens are listed.

33 M.A.S.Blackburn, 'The mint of Watchet', *BNJ* xliv (1974), 13-38; Addenda, ibid., xlvi (1976), 75-6.

34 N.J.Ebsworth, 'The Anglo-Saxon and Norman mint of Warwick', *BNJ* xxxiv (1965), 53-85.

35 F.Elmore Jones, 'The mint of Axbridge', *BNJ* xxx (1960-1), 61-9.

36 R.H.M.Dolley and F.Elmore Jones, 'The mints "æt Gothabyrig" and "æt Sith(m)estebyrig"', *BNJ* xxviii (1955-7), 270-82.

37 On the figure of £11,000 which some of the sources give, see D.Whitelock, *English Historical Documents*, i (2nd. edn., 1979), 251, s.a.1018.

38 D.M.Metcalf, 'Some twentieth-century runes. Statistical analysis of the Viking-age coin hoards and the interpretation of wastage rates', *Viking-age Coinage in the Northern Lands*, ed. M.A.S.Blackburn and D.M. Metcalf (British Arch. Reports, International Series, 122. Oxford, 1981), pp.329-82.

39 G.C.Brooke, *A Catalogue of English Coins in the British Museum. The Norman Kings* (1916).

40 D.M.Metcalf, *English Coins, 1066-1279* (Sylloge of Coins of the British Isles, Ashmolean Museum Oxford, Part 11. 1969).

41 T.H.Lloyd, 'Overseas trade and the English money supply in the fourteenth century', *Edwardian Monetary Affairs (1279-1344)*, ed. N.J.Mayhew (British Arch. Reports, 36. Oxford, 1977), pp.96-124.

42 D.M.Metcalf, 'Coinage and the rise of the Flemish towns', *Coinage in the Low Countries (880-1500)*. ed. N.J.Mayhew (British Arch. Reports, International Series, 54. Oxford, 1979), pp.1-23.

43 Metcalf, 'Some twentieth-century runes' (note 38 above).

44 *The Anglo-Saxon Chronicle* (trans. G.N.Garmonsway. 1953), p.205.

45 D.A.Hinton, 'Late Saxon treasure and bullion', *Ethelred the Unready* (note 25 above), pp.135-58.

46 In Denmark on a considerable scale already in the 1030s. See C.J. Becker, 'Studies in the Danish coinage at Lund during the period c.1030 1046', *Viking-age Coinage in the Northern Lands*, (note 38 above).

47 Cf. S.Lyon, 'Some problems in interpreting Anglo-Saxon coinage', *Anglo-Saxon England* v (1976), p.204; on the alloy, see D.M.Metcalf, 'Analyses of the metal contents of medieval coins', *Methods of Chemical and Metallurgical Investigation of Ancient Coinage*, ed. E.T.Hall and D.M.Metcalf (1972), pp.410-12.

48 Metcalf, 'The ranking of the boroughs', (note 25 above), p.185.

49 C.E.Blunt and C.S.S.Lyon, 'The Oakham hoard of 1749, deposited c.980', *NC*^{7} xix (1979), 111-21. In the Swedish finds, the proportion for Eadgar is 60 per cent, and in the Chester hoard, 22 per cent. The figures in the English hoards are too low because of wastage during the type, and the Swedish figure is correspondingly too high. The evidence is analogous to that for Long Cross and the List hoard, on which see Blackburn and Metcalf (note 28 above).

50 Cf. Appendix III.

51 R.H.M.Dolley, 'The "Jewel-cross" coinage of Ælfgifu Emma, Harthacnut, and Harold I', *BNJ* xxvii (1952-4), 266-75.

52 Weights are recorded e.g. in G.Galster, *SCBI Copenhagen* iv.

53 P.A.Stafford, 'The reign of Æthelred II. A study in the limitations on royal policy and action', *Ethelred the Unready* (note 25 above), p.20.

54 C.S.S.Lyon, 'The significance of the sack of Oxford in 1009-10 for the chronology of the coinage of Æthelred II', *BNJ* xxxv (1966), 34-7.

55 M.Dolley and T. Talvio, 'The regional pattern of die-cutting exhibited by the *First Hand* pennies of Æthelræd II preserved in the British Museum', *BNJ* xlvii (1977), 53-65.

56 Cf. Table 5 below.

57 P.Stafford, 'Historical implications of the regional production of dies under Æthelred II', *BNJ* xlviii (1978), 46: 'there is no reason to suppose that this geld was not ... local'.

58 Metcalf, 'Some twentieth-century runes' (note 38 above).

59 M.Dolley, 'An introduction to the coinage of Æthelræd II', *Ethelred the Unready* (note 25 above), pp.187-92.

60 R.H.M.Dolley, 'Two unpublished English finds of eleventh-century pence', *NC*^{6} xix (1959), 187-92.

APPENDIX IV. Numbers of coins in Hildebrand (corrected) and *SCBI Copenhagen*

		Æthelred II								Cnut
	Hildebrand	A	B1	B2	C	D	E	A	E	G
		Reform	First Hand	Second Hand	Crux	Long Cross	Helmet	Last Small Cross	Quatrefoil	Helmet
	Stewart	*1*	*2A*	*2B*	*3*	*4*	*5*	*6*	*7*	*8*
	Mint									
12	Axbridge	–	–	–	–	1	–	–	4	1
45	Aylesbury	–	–	–	2	–	–	–	5	–
13	Barnstaple	–	6	5	13	11	4	2	7	3
14	Bath	–	–	1	10	21	9	13	27	28
52	Bedford	2	1	–	9	8	1	8	23	5
81	Bedwyn	–	–	–	–	–	–	–	–	–
82	Berkeley	–	–	–	–	–	–	–	–	–
97	'Brene'	–	–	–	–	–	–	–	–	–
15	Bridport	–	2	4	4	3	–	1	1	2
83	Bristol	–	–	–	–	–	–	2	45	–
16	Bruton	–	–	–	–	–	–	–	10	7
7	'Brygin'	–	1	–	–	–	–	–	–	–
46	Buckingham	1	–	–	2	2	–	–	5	2
53	Bury St. Edmunds	–	–	–	–	–	–	–	–	–
17	Cadbury	–	–	–	–	–	–	10	1	–
71	Caistor?	–	–	–	–	–	–	–	3	–
54	Cambridge	1	1	–	33	18	16	31	94	22
31	Canterbury	6	15	23	49	38	14	43	37	67
80	Chester	5	8	3	10	47	18	46	151	85
32	Chichester	1	2	3	10	10	6	5	19	11
33	Cissbury	–	–	–	–	–	–	6	1	–
55	Colchester	–	–	–	35	15	1	11	37	13
18	Crewkerne	–	–	–	–	3	–	–	9	1
84	Cricklade	–	2	–	4	2	–	7	20	10
72	Derby	–	11	–	1	2	2	4	4	5
56	'Dernt'	–	–	–	–	–	–	–	–	–
2	Dorchester	–	1	–	2	3	2	4	–	4
34	Dover	–	1	–	8	13	9	28	21	55
85	Droitwich	–	–	–	–	–	–	–	–	–
57	'Dyr'	–	–	–	–	–	–	–	–	–
3	'Eanbyrig'	–	–	–	–	–	–	–	2	–
19	Exeter	5	24	28	53	46	28	63	48	63
20	'Fro' (Frome?)	–	–	–	–	–	–	–	–	–

	Harold and Harthacnut							Edward Confessor							Ha
	H	A,A,K	B	B,I	D	A	C	B	E	F	H	G	Ac	l	A
	Short Cross	Jewel Cross	Fleur-de-lis	Arm and Sceptre	Pacx	Radiate	Trefoil	Small Flan	Expanding Cross	Helmet	Sovereign	Hammer Cross	Facing Bust	Pyramids	Pax
	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
12	1	3	–	2	–	–	–	–	–	–	–	–	–	–	–
45	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–
13	3	–	1	–	–	1	–	–	–	–	–	–	–	–	–
14	17	7	6	4	3	3	–	2	–	–	–	–	–	–	–
52	8	1	9	3	3	3	–	2	–	–	–	–	–	–	–
81	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–
82	–	–	–	–	1	–	–	–	–	1	–	–	–	–	–
97	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–
15	1	1	–	1	–	–	–	–	–	–	–	–	–	–	–
83	9	16	20	13	3	4	4	2	–	–	2	–	–	–	–
16	6	1	–	1	2	1	–	–	–	–	–	–	–	–	–
7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
46	1	2	1	1	1	–	1	–	–	–	–	–	–	–	–
53	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
71	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
54	8	5	11	13	1	4	2	1	–	1	–	–	1	–	–
31	51	20	18	7	7	12	12	8	4	1	–	3	–	–	–
80	43	22	27	11	8	12	4	3	3	–	–	1	–	–	–
32	12	3	6	1	–	1	2	1	1	–	1	–	–	–	–
33	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
55	16	7	6	1	2	13	–	2	–	1	–	–	–	1	–
18	3	1	–	–	–	–	–	–	–	–	–	–	–	–	–
84	5	2	3	2	2	1	–	–	–	–	–	–	–	–	–
72	10	12	14	7	3	6	–	1	1	–	–	–	–	–	–
56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2	4	4	8	3	–	–	1	–	–	–	–	–	–	–	–
34	80	20	12	7	3	2	2	–	1	–	–	–	–	–	–
85	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
57	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–
3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
19	32	17	13	16	2	7	1	2	2	–	1	–	–	–	–
20	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–

	Stewart	*1*	*2A*	*2B*	*3*	*4*	*5*	*6*	*7*	*8*
	Mint									
86	Gloucester	1	3	1	7	15	4	11	38	31
21	'Gothaburh'	–	–	–	–	3	5	3	7	–
47	Guildford	–	–	1	1.	5	–	–	3	–
35	Hastings	–	–	1	3	4	7	4	8	30
87	Hereford	1	4	–	7	17	4	7	26	25
58	Hertford	–	–	–	26	3	2	1	35	3
73	Horncastle	–	–	–	–	–	–	–	–	–
59	Horndon	–	–	–	–	–	–	–	–	–
60	Huntingdon	–	4	–	6	21	11	17	25	33
36	Hythe	–	–	–	–	–	–	–	–	–
22	Ilchester	1	5	7	26	8	3	–	75	12
61	Ipswich	2	7	3	11	7	7	26	44	24
23	Langport	–	–	–	–	–	–	–	5	2
24	Launceston	–	–	–	–	–	–	–	–	–
74	Leicester	4	5	3	7	11	5	9	21	16
37	Lewes	3	9	2	16	21	8	41	29	20
70	Lincoln	6	14	–	63	139	59	224	236	271
43	London	8	83	127	227	278	191	425	645	917
75	Louth?	–	–	–	–	–	–	–	–	–
25	Lydford	–	3	2	8	9	3	34	13	3
38	Lympne	6	3	3	7	3	–	–	2	1
63	Maldon	1	1	–	18	1	2	1	23	14
88	Malmesbury	–	–	1	4	4	1	1	7	7
26	Milborne Port	–	–	–	–	2	–	–	–	1
76	Newark	–	–	–	–	–	–	1	–	4
48	Newport	–	–	–	–	–	–	–	–	–
6	'Niwan'	–	1	–	–	–	–	–	–	–
64	Northampton	4	3	2	20	23	4	14	32	10
65	Norwich	5	10	8	26	25	16	58	82	51
77	Nottingham	–	1	1	3	–	1	3	7	12
49	Oxford	4	1	2	21	25	13	13	56	38
89	Pershore	–	–	–	–	–	–	–	–	–
66	Peterborough	–	–	–	–	–	–	–	–	–
27	Petherton	–	–	–	–	–	–	–	–	–
50	Reading	–	–	–	–	–	–	–	–	–
39	Rochester	2	5	9	20	12	1	13	10	7
40	Romney	–	–	–	–	5	4	4	7	10
4	Salisbury	–	–	–	–	–	6	21	23	33
41	Sandwich	–	–	–	–	–	–	–	–	–
5	Shaftesbury	1	5	4	6	12	8	15	24	19
90	Shrewsbury	2	3	–	6	17	4	5	40	23
8	Southampton	–	7	1	4	2	1	3	22	–
44	Southwark	–	–	–	107	9	2	9	72	30
91	Stafford	1	–	–	3	4	1	2	3	4
78	Stamford	9	14	7	16	37	18	82	77	105
62	'Stes' (Ipswich?)	–	–	–	–	–	–	–	–	–
42	Steyning	–	–	1	–	–	–	–	–	4
67	Sudbury	–	–	–	–	–	–	4	11	–
92	Tamworth	1	–	3	6	1	1	1	–	–
28	Taunton	–	–	–	–	2	–	1	18	–
68	Thetford	1	12	8	48	28	31	76	93	71
79	Torksey	–	–	1	–	1	–	3	1	1
29	Totnes	–	8	7	16	7	4	5	11	16

	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
86	15	7	12	15	3	2	2	3	3	1	–	–	–	–	–
21	–	1	2	4	–	–	–	–	–	–	–	–	–	–	–
47	13	1	1	–	–	–	–	–	–	–	–	–	–	–	–
35	25	8	7	3	–	2	1	–	1	–	–	–	–	–	–
87	15	17	12	9	4	3	3	2	–	–	1	1	–	–	–
58	19	1	13	1	8	11	1	2	–	–	1	–	–	–	–
73	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
60	9	3	5	5	3	5	–	1	–	–	1	–	–	–	–
36	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
22	6	3	1	2	2	–	–	–	–	–	–	–	–	–	–
61	7	8	8	5	2	8	2	1	4	–	–	1	–	–	–
23	1	6	–	1	–	–	–	–	1	–	–	–	–	–	–
24	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
74	4	4	13	7	1	1	5	2	–	–	–	–	–	–	–
37	17	7	6	11	3	2	2	3	1	–	–	–	–	–	–
70	262	120	87	64	49	54	25	24	24	11	5	4	1	4	–
43	482	194	242	89	80	86	48	54	21	7	4	3	1	–	4
75	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
25	2	1	1	2	–	1	–	1	–	–	–	–	–	–	–
38	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–
63	–	1	–	–	–	1	–	1	–	–	–	–	–	–	–
88	2	2	2	3	–	–	1	1	–	–	–	–	–	–	–
26	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
48	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
64	7	5	15	3	4	7	–	1	1	1	–	1	–	1	–
65	34	21	25	18	9	14	2	1	5	4	1	–	–	–	–
77	14	6	7	5	4	3	1	–	–	–	–	–	–	–	–
49	32	18	24	13	5	12	6	4	1	2	–	–	–	–	–
89	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
66	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
27	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–
50	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
39	13	3	–	–	–	1	–	–	–	–	–	–	–	–	–
40	6	1	3	–	1	–	–	–	–	–	–	–	–	–	–
4	25	11	16	6	2	4	1	3	–	–	–	–	–	–	–
41	–	–	–	–	2	2	1	1	–	–	–	–	–	–	–
5	18	4	3	2	1	6	–	2	–	–	–	–	–	–	–
90	16	11	7	8	1	7	3	2	–	–	–	–	–	–	–
8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
44	6	10	–	8	1	5	1	–	–	–	–	–	–	–	–
91	–	–	4	–	–	–	–	–	–	–	–	–	–	1	–
78	137	43	48	34	14	15	13	8	2	1	–	–	2	–	–
62	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
42	7	–	3	–	2	–	–	–	1	–	1	–	–	–	–
67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
92	1	–	2	–	–	–	–	–	–	–	–	–	–	–	–
28	–	–	1	2	1	–	1	–	–	–	–	–	–	–	–
68	49	24	32	21	13	16	6	11	3	–	1	1	2	–	1
79	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
29	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–

	Stewart	*1*	*2A*	*2B*	*3*	*4*	*5*	*6*	*7*	*8*
	Mint									
51	Wallingford	–	1	3	33	18	6	6	20	19
9	Wareham	1	3	3	13	6	2	2	1	–
10	Warminster	–	–	–	–	3	–	2	–	1
93	Warwick	–	–	–	4	12	2	7	9	11
30	Watchet	–	2	1	1	4	1	1	8	2
11	Wilton	4	4	1	25	16	–	1	4	6
69	'Wilton'	–	–	–	–	–	–	1	–	–
94	Winchcombe	–	–	–	2	3	2	–	5	4
1	Winchester	15	43	20	101	51	36	176	186	121
95	Worcester	1	3	–	10	12	6	4	17	24
96	York	10	29	–	122	102	85	153	251	331
	Total	115	371	300	1295	1231	677	1774	2906	2751

APPENDIX V. Estimated mint-output as a percentage of the total output for each type

	Hildebrand	A	B1	B2	C	D	E	A
		Reform	First Hand	Second Hand	Crux	Long Cross	Helmet	Last Small Cross
	Stewart	*1*	*2A*	*2B*	*3*	*4*	*5*	*6*
	I. Hampshire Basin							
1	Winchester	13.04	11.59	6.67	7.80	4.14	5.32	9.92
2	Dorchester	–	0.27	–	0.15	0.24	0.30	0.23
3	'Eanbyrig'	–	–	–	–	–	–	–
4	Salisbury	–	–	–	–	–	0.89	1.18
5	Shaftesbury	0.87	1.35	1.33	0.46	0.97	1.18	0.85
6	'Niwan'	–	0.27	–	–	–	–	–
7	'Brygin'	–	0.27	–	–	–	–	–
8	Southampton	–	1.89	0.33	0.31	0.16	0.15	0.17
9	Wareham	0.87	0.81	1.00	1.00	0.49	0.30	0.11
10	Warminster	–	–	–	–	0.24	–	0.11
11	Wilton	3.48	1.08	0.33	1.93	1.30	–	0.06
	SUB-TOTAL	18.26	17.53	9.66	11.65	7.54	8.14	12.63

	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
51	15	6	19	12	–	2	1	1	1	1	–	–	–	–	–
9	1	–	2	1	2	–	–	–	–	–	–	–	–	–	–
10	3	1	–	–	–	–	–	–	–	–	–	–	–	–	–
93	7	6	6	4	3	2	2	1	1	–	–	–	–	–	–
30	3	2	2	–	–	1	–	2	–	–	–	–	–	–	–
11	6	2	6	3	–	4	2	3	2	–	1	–	–	1	3
69	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
94	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–
1	99	38	37	33	16	22	7	15	2	–	–	1	–	–	–
95	7	6	9	4	1	1	2	1	2	–	–	–	–	–	1
96	241	85	81	42	29	43	28	11	12	5	2	1	4	–	–
	1944	832	919	535	309	419	198	189	101	38	22	17	11	8	9

	E	G	H	A,A,K	B	B,I	D	A	C	B	
	Quatrefoil	Helmet	Short Cross	Jewel Cross	Fleur-de-lis	Arm and sceptre	Pacx	Radiate	Trefoil	Small Flan	c. 1053-66
	7	8	9	10	11	12	13	14	15	16	17-23
1	6.40	4.40	5.09	4.57	4.03	6.17	5.18	5.25	3.54	7.94	1.46
2	–	0.15	0.21	0.48	0.87	0.56	–	–	0.51	–	–
3	0.07	–	–	–	–	–	–	–	–	–	–
4	0.79	1.20	1.29	1.32	1.74	1.12	0.65	0.95	0.51	1.59	–
5	0.83	0.69	0.93	0.48	0.33	0.37	0.32	1.43	–	1.06	–
6	–	–	–	–	–	–	–	–	–	–	–
7	–	–	–	–	–	–	–	–	–	–	–
8	0.76	–	–	–	–	–	–	–	–	–	–
9	0.03	–	0.05	–	0.22	0.19	0.65	–	–	–	–
10	–	0.04	0.15	0.12	–	–	–	–	–	–	–
11	0.14	0.22	0.31	0.24	0.65	0.56	–	0.95	1.01	1.59	3.40
	9.02	6.70	8.03	7.21	7.84	8.97	6.80	8.58	5.57	12.18	4.86

	Stewart	*1*	*2A*	*2B*	*3*	*4*	*5*	*6*
	II. West Country							
12	Axbridge	–	–	–	–	0.08	–	–
13	Barnstaple	–	1.62	1.67	1.00	0.89	0.59	0.11
14	Bath	–	–	0.33	0.77	1.71	1.33	0.73
15	Bridport	–	0.54	1.33	0.31	0.24	–	0.06
16	Bruton	–	–	–	–	–	–	–
17	Cadbury	–	–	–	–	–	–	0.56
18	Crewkerne	–	–	–	–	0.24	–	–
19	Exeter	4.35	6.47	9.33	4.09	3.74	4.14	3.55
20	'Fro' (Frome?)	–	–	–	–	–	–	–
21	'Gothaburh'	–	–	–	–	0.24	0.74	0.17
22	Ilchester	0.87	1.35	2.33	2.01	0.65	0.44	–
23	Langport	–	–	–	–	–	–	–
24	Launceston	–	–	–	–	–	–	–
25	Lydford	–	0.81	0.67	0.62	0.73	0.44	1.92
26	Milborne Port	–	–	–	–	0.16	–	–
27	Petherton	–	–	–	–	–	–	–
28	Taunton	–	–	–	–	0.16	–	0.06
29	Totnes	–	2.16	2.33	1.24	0.57	0.59	0.28
30	Watchet	–	0.54	0.33	0.08	0.32	0.15	0.06
	SUB-TOTAL	5.22	13.49	18.32	10.12	9.73	8.42	7.50
	III. Channel Ports							
31	Canterbury	5.22	4.04	7.67	3.78	3.09	2.07	2.42
32	Chichester	0.87	0.54	1.00	0.77	0.81	0.89	0.28
33	Cissbury	–	–	–	–	–	–	0.34
34	Dover	–	0.27	–	0.62	1.06	1.33	1.58
35	Hastings	–	–	0.33	0.24	0.32	1.03	0.23
36	Hythe	–	–	–	–	–	–	–
37	Lewes	2.61	2.43	0.67	1.24	1.71	1.18	2.31
38	Lympne	5.22	0.81	1.00	0.54	0.24	–	–
39	Rochester	1.74	1.35	3.00	1.54	0.97	1.15	0.73
40	Romney	–	–	–	–	0.41	0.59	0.23
41	Sandwich	–	–	–	–	–	–	–
42	Steyning	–	–	0.33	–	–	–	–
	SUB-TOTAL	15.66	9.44	14.00	8.73	8.61	7.24	8.12
	IV. London							
43	London	6.96	22.37	42.33	17.53	22.58	28.21	23.96
44	Southwark	–	–	–	8.26	0.73	0.30	0.51
	SUB-TOTAL	6.96	22.37	42.33	25.79	23.31	28.51	24.47
	V. Home Counties							
45	Aylesbury	–	–	–	0.15	–	–	–
46	Buckingham	0.87	–	–	0.15	0.16	–	–
47	Guildford	–	–	0.33	0.08	0.41	–	–
48	Newport (Pagnell?)	–	–	–	–	–	–	–
49	Oxford	3.48	0.27	0.67	1.62	2.03	1.92	0.73
50	Reading	–	–	–	–	–	–	–
51	Wallingford	–	0.27	1.00	2.55	1.46	0.89	0.34
	SUB-TOTAL	4.35	0.54	2.00	4.55	4.06	2.81	1.07

	7	8	9	10	11	12	13	14	15	16	17–23
12	0.14	0.04	0.05	0.36	–	0.37	–	–	–	–	–
13	0.24	0.11	0.15	–	0.11	–	–	0.24	–	–	–
14	0.93	1.02	0.87	0.84	0.65	0.75	0.97	0.72	–	1.06	–
15	0.03	0.07	0.05	0.12	–	0.19	–	–	–	–	–
16	0.34	0.25	0.31	0.12	–	0.19	0.65	0.24	–	–	–
17	0.03	–	–	–	–	–	–	–	–	–	–
18	0.31	0.04	0.15	0.12	–	–	–	–	–	–	–
19	1.65	2.29	1.65	2.04	1.41	2.99	0.65	1.67	0.51	1.06	1.46
20	–	–	0.05	–	–	–	0.32	–	–	–	–
21	0.24	–	–	0.12	0.22	0.75	–	–	–	–	–
22	2.58	0.44	0.31	0.36	0.11	0.37	0.65	–	–	–	–
23	0.17	0.07	0.05	0.72	–	0.19	–	–	–	–	0.49
24	–	–	–	–	–	–	–	–	–	–	–
25	0.45	0.11	0.10	0.12	0.11	0.37	–	0.24	–	0.53	–
26	–	0.04	0.10	–	–	–	–	–	–	–	–
27	–	–	–	–	–	–	–	0.24	0.51	–	–
28	0.62	–	–	–	0.11	0.37	0.32	–	0.51	–	–
29	0.37	0.58	–	0.12	–	0.19	–	–	–	–	–
30	0.27	0.07	0.15	0.24	0.22	–	–	0.24	–	1.06	–
	8.37	5.13	3.99	5.28	2.94	6.73	3.56	3.59	1.53	3.71	1.95
31	1.27	2.44	2.62	2.40	1.96	1.31	2.27	2.86	6.06	4.23	3.88
32	0.65	0.40	0.62	0.36	0.65	0.19	–	0.24	1.01	0.53	0.97
33	0.03	–	–	–	–	–	–	–	–	–	–
34	0.72	2.00	4.12	2.40	1.31	1.31	0.97	0.48	1.01	–	0.49
35	0.28	1.09	1.29	0.96	0.76	0.56	–	0.48	0.51	–	0.49
36	–	–	–	–	–	–	–	0.24	–	–	–
37	1.00	0.73	0.87	0.84	0.65	2.06	0.97	0.48	1.01	1.59	0.49
38	0.07	0.04	0.26	–	–	–	–	–	–	–	–
39	0.34	0.25	0.67	0.36	–	–	–	0.24	–	–	–
40	0.24	0.36	0.31	0.12	0.33	–	0.32	–	–	–	–
41	–	–	–	–	–	–	0.65	0.48	0.51	0.53	–
42	–	0.15	0.36	–	0.33	–	0.65	–	–	–	0.97
	4.60	7.46	11.12	7.44	5.99	5.43	5.83	5.50	10.11	6.88	7.29
43	22.20	33.33	24.80	23.32	26.33	16.64	25.89	20.53	24.24	28.57	19.42
44	2.48	1.09	0.31	1.20	–	1.50	0.32	1.19	0.51	–	–
	24.68	34.42	25.11	24.52	26.33	18.14	26.21	21.72	24.75	28.57	19.42
45	0.17	–	–	–	–	–	–	0.72	–	–	–
46	0.17	0.07	0.05	0.24	0.11	0.19	0.32	–	0.51	–	–
47	0.10	–	0.68	0.12	0.11	–	–	–	–	–	–
48	–	–	–	–	–	–	–	–	–	–	–
49	1.93	1.38	1.65	2.16	2.61	2.43	1.62	2.86	3.03	2.12	1.46
50	–	–	–	–	–	–	–	–	0.51	–	–
51	0.69	0.69	0.77	0.72	2.07	2.24	–	0.48	0.51	0.53	0.97
	3.06	2.14	3.15	3.24	4.90	4.86	1.94	4.06	4.56	2.65	2.43

	Stewart	*1*	*2A*	*2B*	*3*	*4*	*5*	*6*
	VI. Eastern Danelaw							
52	Bedford	1.74	0.27	–	0.69	0.65	0.15	0.45
53	Bury St. Edmunds	–	–	–	–	–	–	–
54	Cambridge	0.87	0.27	–	2.55	1.46	2.36	1.75
55	Colchester	–	–	–	2.70	1.22	0.15	0.62
56	'Dernt'	–	–	–	–	–	–	–
57	'Dyr'	–	–	–	–	–	–	–
58	Hertford	–	–	–	2.01	0.24	0.30	0.06
59	Horndon	–	–	–	–	–	–	–
60	Huntingdon	–	1.08	–	0.46	1.71	1.62	0.96
61	Ipswich	1.74	1.89	1.00	0.85	0.57	1.03	1.47
62	'Stes'	–	–	–	–	–	–	–
63	Maldon	0.87	0.27	–	1.39	0.08	0.30	0.06
64	Northampton	3.48	0.81	0.67	1.54	1.87	0.59	0.79
65	Norwich	4.35	2.70	2.67	2.01	2.03	2.36	3.27
66	Peterborough	–	–	–	–	–	–	–
67	Sudbury	–	–	–	–	–	–	0.23
68	Thetford	0.87	3.23	2.67	3.71	2.27	4.58	4.28
69	'Wilton'	–	–	–	–	–	–	0.06
	SUB-TOTAL	13.92	10.52	7.01	17.91	12.10	13.44	14.00
	VII. The Five Boroughs							
70	Lincoln	5.22	3.77	–	4.86	11.29	8.71	12.63
71	Caistor?	–	–	–	–	–	–	–
72	Derby	–	2.96	–	0.08	0.16	0.30	0.23
73	Horncastle	–	–	–	–	–	–	–
74	Leicester	3.48	1.35	1.00	0.54	0.89	0.74	0.51
75	Louth?	–	–	–	–	–	–	–
76	Newark	–	–	–	–	–	–	0.17
77	Nottingham	–	0.27	0.33	0.23	–	0.15	0.17
78	Stamford	7.83	3.77	2.33	1.24	3.01	2.66	4.62
79	Torksey	–	–	0.33	–	0.08	–	0.06
	SUB-TOTAL	16.53	12.12	3.99	6.95	15.43	12.56	18.39
	VIII. Western Mints							
80	Chester	4.35	2.16	1.00	0.77	3.82	2.66	2.59
81	Bedwyn	–	–	–	–	–	–	–
82	Berkeley	–	–	–	–	–	–	–
83	Bristol	–	–	–	–	–	–	0.11
84	Cricklade	–	0.54	–	0.31	0.16	–	0.39
85	Droitwich	–	–	–	–	–	–	–
86	Gloucester	0.87	0.81	0.33	0.54	1.22	0.59	0.62
87	Hereford	0.87	1.08	–	0.54	1.38	0.59	0.39
88	Malmesbury	–	–	0.33	0.31	0.32	0.15	0.06
89	Pershore	–	–	–	–	–	–	–
90	Shrewsbury	1.74	1.08	–	0.46	1.38	0.59	0.28
91	Stafford	0.87	–	–	0.23	0.32	0.15	0.11
92	Tamworth	0.87	–	1.00	0.46	0.08	0.15	0.06
93	Warwick	–	–	–	0.31	0.97	0.30	0.39
94	Winchcombe	–	–	–	0.15	0.24	0.30	–
95	Worcester	0.87	0.81	–	0.77	0.97	0.89	0.23
	SUB-TOTAL	10.44	6.48	2.66	4.84	10.86	6.37	5.23

	7	8	9	10	11	12	13	14	15	16	17-23
52	0.79	0.18	0.41	0.12	0.98	0.56	0.97	0.72	–	1.06	–
53	–	–	–	–	–	–	–	–	–	–	0.49
54	3.23	0.80	0.41	0.60	1.20	2.43	0.32	0.96	1.01	0.53	0.97
55	1.27	0.47	0.82	0.84	0.65	0.19	0.65	3.10	–	1.06	0.97
56	–	–	–	–	–	–	–	–	–	–	–
57	–	–	–	–	–	–	0.32	–	–	–	–
58	1.20	0.11	0.98	0.12	1.41	0.19	2.59	2.63	0.51	1.06	0.49
59	–	–	–	–	–	–	–	–	–	–	–
60	0.86	1.20	0.46	0.36	0.54	0.93	0.97	1.19	–	0.53	0.49
61	1.51	0.87	0.36	0.96	0.87	0.93	0.65	1.91	1.01	0.53	2.43
62	–	–	–	–	–	–	–	0.24	–	–	–
63	0.79	0.51	–	0.12	–	–	–	0.24	–	0.53	–
64	1.10	0.36	0.36	0.60	1.63	0.56	1.29	1.67	–	0.53	1.94
65	2.82	1.85	1.75	2.52	2.72	3.36	2.91	3.34	1.01	0.53	4.85
66	–	–	–	–	–	–	–	–	–	–	–
67	0.38	–	–	–	–	–	–	–	–	–	–
68	3.20	2.58	2.52	2.88	3.48	3.93	4.22	3.82	3.03	5.82	3.88
69	–	–	–	–	–	–	–	–	–	–	–
	17.15	8.93	8.07	9.12	13.48	13.08	14.89	19.58	6.57	12.18	16.51
70	8.12	9.85	13.48	14.43	9.47	11.96	15.86	12.89	12.63	12.70	23.79
71	0.10	–	–	–	–	–	–	–	–	–	–
72	0.14	0.18	0.51	1.44	1.52	1.31	0.97	1.43	–	0.53	0.49
73	–	–	–	–	–	–	–	–	–	–	–
74	0.72	0.58	0.21	0.48	1.41	1.31	0.32	0.24	2.53	1.06	–
75	–	–	–	–	–	–	–	–	–	–	–
76	–	0.15	–	–	–	–	–	–	–	–	–
77	0.24	0.44	0.72	0.72	0.76	0.93	1.29	0.72	0.51	–	–
78	2.65	3.82	7.05	5.17	5.22	6.36	4.53	3.58	6.57	4.23	2.43
79	0.03	0.04	–	–	–	–	–	–	–	–	–
	12.00	15.06	21.97	22.24	18.38	21.87	22.97	18.86	22.24	18.52	26.71
80	5.20	3.10	2.21	2.64	2.94	2.06	2.59	2.86	2.02	1.59	1.94
81	–	–	–	–	–	–	–	–	–	1.06	–
82	–	–	–	–	–	–	0.32	–	–	–	0.49
83	1.55	–	0.46	1.92	2.18	2.43	0.97	0.95	2.02	1.06	0.97
84	0.69	0.36	0.26	0.24	0.32	0.37	0.65	0.24	–	–	–
85	–	–	–	–	–	–	–	–	–	–	–
86	1.31	1.13	0.77	0.84	1.31	2.80	0.97	0.48	1.01	1.59	1.94
87	0.89	0.91	0.77	2.04	1.31	1.68	1.29	0.72	1.52	1.06	0.97
88	0.24	0.25	0.10	0.24	0.22	0.56	–	–	0.51	0.53	–
89	–	–	–	–	–	–	–	–	–	–	–
90	1.38	0.84	0.82	1.32	0.76	1.50	0.32	1.67	1.52	1.06	–
91	0.10	0.15	–	–	0.43	–	–	–	–	–	0.49
92	–	–	0.05	–	0.22	–	–	–	–	–	–
93	0.31	0.40	0.36	0.72	0.65	0.75	0.97	0.48	1.01	0.53	0.49
94	0.17	0.15	–	–	–	0.19	–	–	–	0.53	–
95	0.58	0.87	0.36	0.72	0.98	0.75	0.32	0.24	1.01	0.53	1.46
	12.42	8.16	6.16	10.68	11.32	13.09	8.40	7.64	10.62	9.54	8.75

	Stewart	*1*	*2A*	*2B*	*3*	*4*	*5*	*6*
	IX. York							
96	York	8.70	7.82	-	9.42	8.29	12.56	8.62
	Uncertain							
97	'Brene'	-	-	-	-	-	-	-

APPENDIX VI. Estimated mint-output in (Lincoln) "equivalent reverse dies".

	Hildebrand	A	B1	B2	C	D	E	A
		Reform	First Hand	Second Hand	Crux	Long Cross	Helmet	Last Small Cross
	Stewart	*1*	*2A*	*2B*	*3*	*4*	*5*	*6*
	I. Hampshire Basin							
1	Winchester	130	237	80	317	76	64	291
2	Dorchester	-	6	-	6	4	4	7
3	'Eanbyrig'	-	-	-	-	-	-	-
4	Salisbury	-	-	-	-	-	11	35
5	Shaftesbury	9	28	16	19	18	14	25
6	'Niwan'	-	6	-	-	-	-	-
7	'Brygin'	-	6	-	-	-	-	-
8	Southampton	-	39	4	13	3	2	5
9	Wareham	9	17	12	41	9	4	3
10	Warminster	-	-	-	-	4	-	3
11	Wilton	35	22	4	79	24	-	2
	SUB-TOTAL	183	361	116	475	138	99	371
	II. West Country							
12	Axbridge	-	-	-	-	1	-	-
13	Barnstaple	-	33	20	41	16	8	3
14	Bath	-	-	4	31	31	16	21
15	Bridport	-	11	16	13	4	-	2
16	Bruton	-	-	-	-	-	-	-
17	Cadbury	-	-	-	-	-	-	17
18	Crewkerne	-	-	-	-	4	-	-
19	Exeter	43	132	112	167	70	50	104

	7	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17–23*
96	8.64	12.03	12.40	10.22	8.81	7.85	9.38	10.26	14.14	5.82	11.65
97	–	–	–	–	–	–	–	–	–	–	–

	E	G	H	A,A,K	B	B,I	D	A	C	B	
	Quatrefoil	Helmet	Short Cross	Jewel Cross	Fleur-de-lis	Arm and sceptre	Pacx	Radiate	Trefoil	Small Flan	Paxs
	7	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*31*
1	298	98	73	40	49	37	26	25	25	16	63–113
2	–	3	3	4	11	3	–	–	4	–	4+
3	3	–	–	–	–	–	–	–	–	–	–
4	37	27	19	12	21	7	3	5	4	3	18–41
5	38	15	13	4	4	2	2	7	–	2	15+
6	–	–	–	–	–	–	–	–	–	–	–
7	–	–	–	–	–	–	–	–	–	–	–
8	35	–	–	–	–	–	–	–	–	–	5–9
9	2	–	1	–	3	1	3	–	–	–	11+
10	–	1	2	1	–	–	–	–	–	–	–
11	6	5	4	2	8	3	–	5	7	3	6–8
	419	149	115	63	96	53	34	42	40	24	122–201
12	6 (3)	1 (2+)	1 (2+)	3 (4+)	– –	2 (1+)	– –	– –	– –	– –	– –
13	11	2	2	–	1	–	–	1	–	–	2+
14	43	23	13	7	8	5	5	3	–	2	4+
15	2	2	1	1	–	1	–	–	–	–	–
16	16	6	4	1	–	1	3	1	–	–	–
17	2 (2+)	–	–	–	–	–	–	–	–	–	–
18	14	1	2	1	–	–	–	–	–	–	–
19	77	51	24	18	17	18	3	8	4	2	18–38

	Stewart	*1*	*2A*	*2B*	*3*	*4*	*5*	*6*
20	'Fro' (Frome)	–	–	–	–	–	–	–
21	'Gothaburh'	–	–	–	–	4 (1)	9 (3)	5 (3)
22	Ilchester	9	28	28	82	12	6	–
23	Langport	–	–	–	–	–	–	–
24	Launceston	–	–	–	–	–	–	–
25	Lydford	–	17	8	25	13	6	56
26	Milborne Port	–	–	–	–	3 (2)	–	–
27	Petherton	–	–	–	–	–	–	–
28	Taunton	–	–	–	–	3	–	2
29	Totnes	–	44	28	50	10	8	8
30	Watchet	–	11 (4)	4 (2)	3 (1)	6 (7)	2 (2+)	2 (2)
	SUB-TOTAL	52	276	220	412	177	105	220
	III. Channel Ports							
31	Canterbury	52	83	92	154	57	25	71
32	Chichester	9 (3+)	11 (3+)	12 (5+)	31 (12+)	15 (13+)	11 (6+)	8 (7+)
33	Cissbury	–	–	–	–	–	–	10 (3)
34	Dover	–	6	–	25	19	16	46
35	Hastings	–	–	4 (1+)	9 (2+)	6 (3+)	12 (7+)	7 (5+)
36	Hythe	–	–	–	–	–	–	–
37	Lewes	26 (7+)	50 (8+)	8 (5+)	50 (13+)	31 (14+)	14 (11+)	68 (41+)
38	Lympne	52	17	12	22	4	–	–
38A	Pevensey	–	–	–	–	–	–	–
39	Rochester	17	28	36	66	18	2	21
40	Romney	–	–	–	–	7	8	7
41	Sandwich	–	–	–	–	–	–	–
42	Steyning	–	–	4	–	–	–	–
	SUB-TOTAL	156	195	168	357	157	88	238
	IV. London							
43	London	70	457	508	713	416	340	702
44	Southwark	–	–	–	336	13	4	15
	SUB-TOTAL	70	457	508	1049	429	344	717
	V. Home Counties							
45	Aylesbury	–	–	–	6	–	–	–
46	Buckingham	9 (1)	–	–	6 (3)	3 (1)	–	–
47	Guildford	–	–	4	3	7	–	–
48	Newport (Pagnell)	–	–	–	–	–	–	–
49	Oxford	35	6	8	66	37	23	21
50	Reading	–	–	–	–	–	–	–
51	Wallingford	–	6	12	104	27	11	10
	SUB-TOTAL	44	12	24	185	74	34	31

	7	8	9	10	11	12	13	14	15	16	31
20	–	–	1 (1+)	– (1+)	–	–	2 (1+)	–	– (1+)	–	–
21	11 (4+)	–	–	1 (1+)	3 (2+)	5 (2+)	–	–	–	–	–
22	120	10	4	3	1	2	3	–	–	–	2+
23	8	2	1	6	–	1	–	–	–	–	–
24	–	–	–	–	–	–	–	–	–	–	–
25	21	2	1	1	1	2	–	1	–	1	–
26	–	1 (1)	1 (1+)	–	–	–	–	–	–	–	–
27	–	–	–	–	–	–	–	1	4	–	–
28	29	–	–	–	1	2	2	–	4	–	2+
29	18	13	–	1	–	1	–	–	–	–	–
30	13 (5)	2 (1)	2 (2)	2 (2)	3 (1)	– (1)	– (1+)	1 (1+)	– (1+)	2 (2)	1+ (2)
	391	116	57	45	35	40	18	16	12	7	32–53
31	59	54	38	21	24	8	12	14	42	8	41–125
32	30 (17)	9 (8)	9 (5)	3 (6)	8 (9)	1 (1+)	– –	1 (1+)	7 (4+)	1 (2+)	11–14 (12)
33	2 (1+)	–	–	–	–	–	–	–	–	–	–
34	34	44	59	21	16	8	5	2	7	–	17–45
35	13 (14+)	24 (17)	19 (18)	8 (8)	9 (6)	3 (3+)	– –	2 (4+)	4 (5+)	– (1+)	6–16 (7)
36	–	–	–	–	–	–	–	1	–	–	4+
37	46 (65)	16 (22)	13 (16)	7 (7+)	8 (7+)	12 (4+)	5 (5+)	2 (3+)	7 (9+)	3 (8+)	11–36 (15)
38	3	1	4	–	–	–	–	–	–	–	–
38A	–	–	–	–	–	–	–	–	–	–	1 (1)
39	16	6	10	3	–	–	–	1	–	–	3+
40	11	8	4	1	4	–	2	–	–	–	7+
41	–	–	–	–	–	–	3	2	4	1	4+
42	–	4	5	–	4	–	3	–	–	–	5–9 (7)
	214	166	161	64	73	32	30	25	71	13	110–230
43	1033	741	357	204	323	100	132	99	169	56	49–106
44	115	24	4	11	–	9	2	6	4	–	29–92
	1148	765	361	214	323	109	134	105	173	56	78–198
45	8	–	–	–	–	–	–	3	–	–	–
46	8 (7+)	2 (1+)	1 (1+)	2 (1+)	1 (1+)	1 (1+)	2 (1+)	– (1+)	4 (1+)	–	–
47	5	–	10	1	1	–	–	–	–	–	1
48	–	–	–	–	–	–	–	–	–	–	–
49	90	31	24	19	32	15	8	14	21	4	16–28
50	–	–	–	–	–	–	–	–	4	–	–
51	32	15	11	6	25	14	–	2	4	1	13–25
	143	48	46	28	59	30	10	19	33	5	30–54

	Stewart	*1*	*2A*	*2B*	*3*	*4*	*5*	*6*
	VI. Eastern Danelaw							
52	Bedford	17	6	–	28	12	2	13
53	Bury St. Edmunds	–	–	–	–	–	–	–
54	Cambridge	9	6	–	104	27	28	51
55	Colchester	–	–	–	110	22	2	18
56	'Dernt'	–	–	–	–	–	–	–
57	'Dyr'	–	–	–	–	–	–	–
58	Hertford	–	–	–	82	4	4	2
59	Horndon	–	–	–	–	–	–	–
60	Huntingdon	–	22	–	19	31	20	28
61	Ipswich	17	39	12	35	10	12	43
62	'Stes'	–	–	–	–	–	–	–
63	Maldon	9	6	–	57	1	4	2
64	Northampton	35	17	8	63	34	8	23
65	Norwich	43	55	32	82	37	28	96
66	Peterborough	–	–	–	–	–	–	–
67	Sudbury	–	–	–	–	–	–	7
68	Thetford	9	66	32	151	42	55	126
69	'Wilton'	–	–	–	–	–	–	2
	SUB-TOTAL	139	217	84	731	220	163	411
	VII. The Five Boroughs							
70	Lincoln	82	77	–	198	208	105	370
71	Caistor?	–	–	–	–	–	–	–
72	Derby	–	61	–	3	3	4	7
73	Horncastle	–	–	–	–	–	–	–
74	Leicester	35	28	12	22	16	9	15
75	Louth?	–	–	–	–	–	–	–
76	Newark	–	–	–	–	–	–	2
77	Nottingham	–	6	4	9	–	2	5
78	Stamford	78	77	28	50	55	32	135
79	Torksey	–	–	4	–	1	–	5
	SUB-TOTAL	195	249	48	282	283	152	539
	VII. Western Mints							
80	Chester	43	44	12	31	70	32	76
81	Bedwyn	–	–	–	–	–	–	–
82	Berkeley	–	–	–	–	–	–	–
83	Bristol	–	–	–	–	–	–	3
84	Cricklade	–	11	–	13	3	–	12
85	Droitwich	–	–	–	–	–	–	–
86	Gloucester	9	17	4	22	21	8	18
87	Hereford	9	22	–	22	25	8	12
88	Malmesbury	–	–	4	13	6	2	2
89	Pershore	–	–	–	–	–	–	–
90	Shrewsbury	17	17	–	19	25	8	8
91	Stafford	9	–	–	9	6	2	3
92	Tamworth	9	–	12	19	1	2	2
93	Warwick	–	–	–	13	18	4	12
		(2+)	(3)		(12)	(12)	(15)	(6)
94	Winchcombe	–	–	–	6	4	4	–
95	Worcester	9	17	–	31	18	11	7
	SUB-TOTAL	105	128	32	198	197	81	155

	7	8	9	10	11	12	13	14	15	16	31
52	37	19	6	1	12	3	5	3	–	2	3+
53	–	–	–	–	–	–	–	–	–	–	–
54	150	18	6	5	15	15	2	5	7	1	1+
55	59	11	12	7	8	1	3	15	–	2	7+
56	–	–	–	–	–	–	–	–	–	–	–
57	–	–	–	–	–	–	2	–	–	–	–
58	56	2	14	1	17	1	13	13	4	2	2+
59	–	–	–	–	–	–	–	–	–	–	–
60	40	27	7	3	7	6	5	6	–	1	1+
61	70	19	5	8	11	6	3	9	7	1	12–c.30
62	–	–	–	–	–	–	–	1	–	–	–
63	37	11	–	1	–	–	–	1	–	1	3+
64	51	8	5	5	20	3	7	8	–	1	–
65	131	41	25	22	33	20	15	16	7	1	25–c.50
66	–	–	–	–	–	–	–	–	–	–	–
67	18	–	–	–	–	–	–	–	–	–	5+
68	149	57	36	25	43	24	21	18	21	11	15–c.30
69	–	–	–	–	–	–	–	–	–	–	–
	798	213	116	78	166	79	76	95	46	23	74–130
70	378	219	194	126	116	72	81	62	88	25	9–25 (18)
71	5	–	–	–	–	–	–	–	–	–	–
72	6	4	7	13	19	8	5	7	–	1	3+
73	–	–	–	–	–	–	–	–	–	–	–
74	34	13	3	4	17	8	2	1	18	2	2+
75	–	–	–	–	–	–	–	–	–	–	–
76	–	3	–	–	–	–	–	–	–	–	–
77	11	10	10	6	9	6	7	3	4	–	5+
78	123	85	101	45	64	38	23	17	46	8	4+
79	2	1	–	–	–	–	–	–	–	–	–
	559	335	315	194	225	132	118	90	156	36	23–39
80	242	69	32	23	36	12	13	14	14	3	13–c.40
81	–	–	–	–	–	–	–	–	–	2	–
82	–	–	–	–	–	–	2	–	–	–	–
83	72	–	7	17	27	15	5	5	14	2	19–c.40
84	32	8	4	2	4	2	3	1	–	–	1+
85	–	–	–	–	–	–	–	–	–	–	–
86	61	25	11	7	16	17	5	2	7	3	13–c.40
87	42	20	11	18	16	10	7	3	11	2	6–12
88	11	6	1	2	3	3	–	–	4	1	4+
89	–	–	–	–	–	–	–	–	–	–	–
90	64	18	12	12	9	9	2	8	11	2	6–9
91	5	3	–	–	5	–	–	–	–	–	2+
92	–	–	1	–	3	–	–	–	–	–	2+
93	14	9	5	6	8	5	5	2	7	1	9–33
	(14)	(6)	(7)	(8)	(5)	(9)	(4)	(8)	(2+)	(2+)	
94	8	3	–	–	–	1	–	–	–	1	2+
95	27	19	5	6	12	5	2	1	7	1	6–12
	578	180	89	93	139	79	44	36	75	18	83–190

	Stewart	1	2A	2B	3	4	5	6
	IX. York							
96	York	87	160	–	383	153	151	253
	Uncertain							
97	'Brene'	–	–	–	–	–	–	–

APPENDIX VII. Estimated mint output for the Paxs type, c.1084-7, in 'equivalent reverse dies'.

		Non-singletons	Sample	Known dies	Estimate
I. Hampshire Basin					
1	Winchester	53	95	63	63–113
2	Dorchester	–	–	–	4+
4	Salisbury	10	23	18	18–41
5	Shaftesbury	2	16	15	15+
8	Southampton	4	7	5	5–9
9	Wareham	4	13	11	11+
11	Wilton	8	10	6	6–8
					122–201
II. West Country					
13	Barnstaple	–	–	–	2+
14	Bath	–	–	–	4+
15	Bridport	–	–	–	3+
19	Exeter	12	25	18	18–38
22	Ilchester	–	–	–	2+
28	Taunton	–	–	–	2+
30	Watchet	–	–	–	1+(2)
					32–53
III. Channel Ports					
31	Canterbury	16	49	41	41–125
32	Chichester	15	19	11	11–14(12)
34	Dover	8	21	17	17–45
35	Hastings	3	8	6	6–16(7)
36	Hythe	–	–	–	4+
37	Lewes	4	13	11	11–36(15)
38A	Pevensey	–	–	–	1(1)
39	Rochester	–	–	–	3+
40	Romney	–	–	–	7+
41	Sandwich	–	–	–	4+
42	Steyning	4	7	5	5–9(7)
					110–230
IV. London					
43	London	30	65	49	49–106
44	Southwark	11	35	29	29–92
					78–198
V. Home Counties					
47	Guildford	–	–	–	1
49	Oxford	13	23	16	16–28
51	Wallingford	10	19	13	13–25
					30–54

	7	8	9	10	11	12	13	14	15	16	31
96	402	267	178	89	108	47	48	49	99	11	5+
97	–	–	–	–	–	–	–	–	–	–	–

APPENDIX VII (continued)

		Non-singletons	Sample	Known dies	Estimate
VI. Eastern Danelaw					
52	Bedford	–	–	–	3+
54	Cambridge	–	–	–	1+
55	Colchester	–	–	–	7+
58	Hertford	–	–	–	2+
60	Huntingdon	–	–	–	1+
61	Ipswich	2	13	12	12–c.30
63	Maldon	–	–	–	3+
65	Norwich	12	31	25	25–c.50
67	Sudbury	–	–	–	5+
68	Thetford	6	18	15	15–c.30
					74–130
VII. The Five Boroughs					
70	Lincoln	4	11	9	9–25(18)
72	Derby	–	–	–	3+
74	Leicester	–	–	–	2+
77	Nottingham	–	–	–	5+
78	Stamford	–	–	–	4+
					23–39

		Non-singletons	Sample	Known dies	Estimate
VIII. Western Mints					
80	Chester	2	14	13	13–c.40
83	Bristol	8	23	19	19–c.40
84	Cricklade	–	–	–	1+
86	Gloucester	4	15	13	13–c.40
87	Hereford	4	8	6	6–12
88	Malmesbury	–	–	–	4+
90	Shrewsbury	6	9	6	6–9
91	Stafford	–	–	–	2+
92	Tamworth	–	–	–	2+
93	Warwick	4	11	9	9–33
94	Winchcombe	–	–	–	2+
95	Worcester	4	8	6	6–12
					83–190
IX. York					
96	York	–	–	–	5+
	Total				550–1100
	'Best guess'				880

APPENDIX VIII. Issues within the Jewel Cross Type

		"Early"		"Late"	
		Cnut K, H/K	Harthacnut A	Harthacnut Aa	Harold A
I. Hampshire Basin					
1	Winchester	–	4	11	23
2	Dorchester	–	–	1	3
4	Salisbury	1	–	1	9
5	Shaftesbury	2	–	1	1
10	Warminster	–	–	–	1
11	Wilton	–	–	–	2
	Sub-total	3	4	14	39
II. West Country					
12	Axbridge	–	–	3	–
14	Bath	–	1	1	5
15	Bridport	–	–	1	–
16	Bruton	–	–	1	–
18	Crewkerne	–	–	–	1
19	Exeter	1	3	3	10
21	'Gothaburh'	–	–	–	1
22	Ilchester	–	–	3	–
23	Langport	–	1	3	2
25	Lydford	–	–	–	1
29	Totnes	1	–	–	–
30	Watchet	–	–	1	1
	Sub-total	2	5	16	21
III. Channel Ports					
31	Canterbury	–	–	4	16
32	Chichester	–	–	1	2
34	Dover	3	2	2	13
35	Hastings	–	–	2	6
37	Lewes	–	–	2	5
39	Rochester	–	–	2	1
40	Romney	–	–	–	1
	Sub-total	3	2	13	44
IV. London					
43	London	9	9	6	170
44	Southwark	1	–	2	7
	Sub-total	10	9	8	177
V. Home Counties					
46	Buckingham	1	–	–	1
47	Guildford	–	–	1	–
49	Oxford	–	–	7	11
51	Wallingford	2	1	–	3
	Sub-Total	3	1	8	15
VI. Southern Danelaw					
52	Bedford	–	–	–	1
54	Cambridge	–	–	–	5
55	Colchester	–	–	–	7
58	Hertford	–	–	–	1
60	Huntingdon	–	–	–	3
61	Ipswich	–	–	–	8
63	Maldon	–	–	–	1
64	Northampton	–	–	–	5
65	Norwich	1	–	–	20
68	Thetford	–	–	–	24
	Sub-total	1	–	–	75
VII. The Five Boroughs					
70	Lincoln	–	–	1	119
72	Derby	–	–	1	11
74	Leicester	–	–	–	4
77	Nottingham	–	–	–	6
78	Stamford	–	–	2	41
	Sub-total	–	–	4	181
VIII. Western mints					
80	Chester	–	–	–	22
83	Bristol	3	1	1	11
84	Cricklade	–	–	1	1
86	Gloucester	–	–	6	–
87	Hereford	–	–	–	17
88	Malmesbury	–	–	1	1
90	Shrewsbury	–	–	–	11
93	Warwick	–	–	3	3
95	Worcester	–	–	1	5
	Sub-total	3	1	13	71
IX. York					
96	York	1	–	1	83

APPENDIX IX. Estimated mint output (in 'equivalent reverse dies'), grouped according to economic categories of mint

The groups, lettered as on Fig. 5, are as follows:

a) London and the Channel Ports (IV plus III omitting Cissbury, Lewes, and Steyning)

b) Small inland mints: all except a), c)-f): includes Winchester

c) Larger inland mints: Oxford, Wallingford; Cambridge, Northampton, Norwich, Thetford; Derby, Leicester, Stamford.

d) East-coast ports (York, Lincoln, Ipswich, Colchester, Maldon)

e) Western ports (Southampton, Wareham, Bridport, Exeter, Totnes, Barnstaple, Watchet, Bristol)

f) Chester

Type		a	b	c	d	e	f
1	Reform	200	297	244	195	52	43
2a	First Hand	602	518	322	281	287	44
2b	Second Hand	664	184	132	12	196	12
3	Crux	1356	929	645	783	328	31
4	Long Cross	555	409	278	394	118	70
5	Helmet	418	229	190	274	74	32
6	Last Small Cross	887	675	484	686	127	76
7	Quatrefoil	1314	1157	766	946	230	242
8	Helmet	911	384	272	527	70	69
9	Short Cross	504	259	218	389	37	32
10	Jewel Cross	271	168	142	231	39	23
11	Fleur-de-lis	384	253	258	243	51	36
12	Arm and Sceptre	129	154	145	126	36	12
13	Pacx	156	113	83	135	11	13
14	Radiate	128	100	88	136	15	14
15	Trefoil	237	109	124	194	19	14
31	Paxs	345	284	98	48	80	25

APPENDIX X. A sample of heavy coins of Last Small Cross type

The coins in Table 4, weighing 1.5 g or more (23.1 gr. or more) are from the following sources. I am indebted to Mr.Lyon for the weights of the heavy coins in Hildebrand. At Winchester in particular there is a weight standard close to 1.5 g, with the result that there are many coins with weights just below that figure.

Hildebrand Barnstaple, Bath (8), Bedford (2), Bridport, Bristol, Cadbury, Cambridge (4), Canterbury (3), Chester (8), Chichester (3), Cissbury (2), Cricklade (3), Derby, Dorchester, Dover, Exeter (12), Gloucester (5), 'Gothaburh', Hastings, Hereford (2), Huntingdon (4), Ipswich (3), Leicester, Lewes (4), Lincoln (31), London (22), Malmesbury, Newark, Northampton (1 or 2), Norwich (3), Oxford (12), Rochester, Salisbury (4), Shaftesbury, Shrewsbury (4), Stafford, Stamford (14), Tamworth, Thetford (12), Totnes, Wallingford (6), Warwick (4), Winchester (29), Worcester (3), York (37).

BMC Bath, Chester, Lewes, Lincoln, London, Stamford (2), Totnes, York (2)

SCBI Cambridge, omitting Cambridge coins Exeter

SCBI Hunter. Lincoln, Oxford, Wallingford

SCBI Copenhagen Bath (4), Bedford, Bristol, Cadbury (4), Chester (3), Chichester, Cissbury, Dorchester, Exeter (6), Gloucester, Hereford (2), Huntingdon (2), Ipswich, Leicester, Lincoln (4), London (10), Norwich (2), Salisbury (2), Stamford (5), Thetford (2), Totnes, Warwick, Winchester (6), Worcester, York (6)

SCBI Oxford, omitting Oxford coins Bath, Gloucester, Lincoln

SCBI Midlands Chester, Derby, Shrewsbury, Warwick

SCBI Mack Exeter, Winchester (2)

SCBI Yorks Lincoln

SCBI West Country Bath (2), Cadbury, Exeter

APPENDIX XI. Mints represented in the Swedish and Danish finds, by types

1. Reform	32	*8.* Helmet	61	*16.* Small Flan	40
2a. First Hand	44	*9.* Short Cross	60	*17.* Expanding Cross	26
2b. Second Hand	36	*10.* Jewel Cross	56	*18.* Helmet	14
3. Crux	55	*11.* Fleur-de-lis	52	*19.* Sovereign	13
4. Long Cross	61	*12.* Arm and Sceptre	52	*20.* Hammer Cross	10
5. Helmet	51	*13.* Pacx	45	*21.* Facing Bust	6
6. Last Small Cross	61	*14.* Radiate	49	*22.* Pyramids	5
7. Quatrefoil	68	*15.* Trefoil	37	*23.* Pax	4

(Source: Appendix IV.)

APPENDIX XII. Alternative estimates of the numbers of dies employed at Lincoln, by C.S.S.Lyon

Given that the samples are biassed, the most reliable way to judge the total numbers of dies employed (omitting, of course, those that broke very early in their life and cannot really be detected by any method) is to estimate the missing dies using information about the numbers of dies known from 1, 2, and 3 specimens respectively. Although the methods used are based on the assumptions of equal output per die and lack of bias, these assumptions are probably less critical when one is concentrating on two or three terms of the distribution. The methods almost invariably produce higher numbers than the estimation of output in terms of 'equivalent dies'. They are nevertheless still likely to be underestimates rather than overestimates.

The problem is to estimate d_0, the number of dies represented by zero specimens, from a formula of the form

$$d_0 \doteq k \cdot d_1$$

where d_1 is the number of dies represented by a single specimen and k conveys the theoretical relationship between the *expected values* of d_0 and d_1.

In Formula (1),

$$k = \frac{d}{c - d_1},$$

where d is the total of known dies and c is the number of known coins. Rearranged, this gives the formula discussed in Mossop's *Lincoln Mint* and adopted in the text above to estimate 'equivalent dies'. Although apparently using the full information (namely the values of d and c) this formula is suitable only for estimating the relative importance of d_0 in terms of output, and then only if it can be assumed that the surviving coins are an unbiassed sample - which they are manifestly not in the case of Long Cross, for example. If it were used as a measure of the actual number of missing dies it would be liable to give a serious underestimate because of the effect of unequal die output.

In Formula (2),

$$k = \frac{d_1}{2d_2},$$

where d_2 is the number of dies known from exactly two specimens. This value of k may be expected to be less affected either by bias or by unequal output; but where d_2 is small it is obvious that k is very sensitive to the actual figure for d_2. But in such a situation (as, for example, First Hand) any estimate of d_0 will be subject to wide margins of error.

Formula (3), in which

$$k = \frac{d_1}{3d_2} + \frac{d_2}{9d_3}$$

is one of a large number of formulae that could be constructed to involve d_3 as well as d_1 and d_2. There is a risk, however, of d_3 being too much affected by bias to be useful in estimating d_0. It will be seen from the table that the chosen formula tends to bring out lower estimates of d_0 than Formula (2).

	Type	No. of coins	Known dies	Dies known from: 1 spec.	2 specs.	3 specs.	Estimates of missing dies: Formula (1)	Formula (2)	Formula (3)
1	Reform	68	46	30	11	4	36	41	37
2a	First Hand	46	33	26	3	3	43	113	78
3	Crux	224	127	80	22	11	70	146	114
4	Long Cross	642	183	76	33	19	24	87	73
5	Helmet	169	80	41	19	8	25	44	40
6	Last Small Cross	595	277	149	56	29	92	198	164
7	Quatrefoil	523	276	143	68	34	104	150	132
8	Helmet	508	186	77	40	18	33	74	69
9	Short Cross	496	175	52	42	32	20	32	29
10	Jewel Cross	166	91	46	25	13	35	42	38
11	Fleur-de-lis	156	81	47	15	12	35	74	55
12	Arm and sceptre	100	51	29	10	7	21	42	33
13	Pacx	89	52	33	9	2	31	60	57
14	Radiate	96	51	19	18	11	13	10	10
15	Trefoil – Quadrilateral	101	59	33	17	3	29	32	42
16	Small Flan	47	21	8	5	5	4	6	5
17	Expanding Cross:								
	– Light	41	25	11	12	2	9	5	11
	– Heavy	96	36	13	8	5	6	11	9
18	Helmet	57	34	22	4	6	21	60	42
19	Sovereign	30	24	20	2	2	48	100	69
20	Hammer Cross	74	44	26	8	9	24	42	31
21	Facing bust	37	24	16	6	–	18	21	–
22	Pyramids	20	14	8	6	–	9	5	–
23	Pax	30	14	4	7	1	2	1	4
31	Paxs	72	17	2	2	4	1	1	1