*Appendix: The Components of Agricultural Output*

 Here we compare estimates for some of the non-cereal items that constituted agricultural output, and outline our proposed amendments.

*Beans and Peas*: Stephen Broadberry *et al*.’s (2011a, p. 30) figure for the acreage under beans and peas in 1750 and 1800 is the most conservative of the four (Table 2). However, selecting acreages of 1.3 million for 1750 and 1800, rather than their 0.98 million and 0.83 million, respectively, would add only about 20 calories daily to their total for either date. We adjust accordingly (see Appendix Table 3).

*Potatoes*: Potatoes were not a significant part of the English diet until the late eighteenth century, so the rather different accounts of its calorific contribution in the four estimates do not affect the overall outcome much. Roderick Floud et *al*. (2011,
p. 2011) following the lead of Redcliffe Salaman (1949), reckon calorie supplies from potatoes at a daily average of 53 calories in 1700, 79 calories in 1750, and 154 calories in 1800. Broadberry *et al*. assume that output net of seed rose from 1.27 million bushels in the 1700s to 13.56 million bushels in the 1750s, and 26.7 million bushels in the 1800s. Robert C. Allen, following Brian A. Holderness (1989, p. 145), assumes that gross production, before deducting for seed, rose from 30 million bushels in 1750 to 45 million bushels in 1800. Muldrew (2011, pp. 142‒43) makes no allowance for potatoes. Assuming bushels of 60 lbs. and 23 calories per ounce (Floud *et al*. 2011, p. 221), Broadberry *et al*.’s output totals would have yielded a paltry 14 calories per head in 1700, but 132 calories in 1750 and 175 calories in 1800. Allen’s totals are more generous: deducting one-sixth of his crop estimates for seed would have left nearly 250 calories per diem in 1800, and one-third and two-thirds of that in 1700 and 1750, respectively. But that calculation seems to assume that potatoes were destined for human consumption only, which certainly was not the case (see e.g., Moore-Colyer 1989, p. 358). The incomplete 1801 crop returns include nearly 76,679 acres under potatoes in England and Wales but, as Turner (1981, pp. 294‒95, 297) notes, this is an underestimate for the parishes it covers since the returns exclude potatoes grown in small garden plots. Assuming that this figure represented one-third of the national acreage (compare Turner 1981, p. 301) and a net yield of 5 tons per acre would yield a daily calorie supply of about 230 calories per head c. 1800[[1]](#footnote-1), or closer to Allen’s estimate that those of Floud et *al*. and Broadberry et *al*. We accordingly add 100 calories to Broadberry *et al*.’s 1800 total, and 100 and 230 calories to Muldrew’s estimates for 1750 and 1800, respectively (Appendix Table 3).

*Foreign Trade*: While Muldrew’s estimates are generally on the high side, they are alone in not factoring in the contribution of foreign trade. By the late eighteenth century, England was a net importer of cereals, and Broadberry et *al*. reckon that imports contributed 20 calories per capita daily in the 1750s and 166 calories in the 1800s. By the same token, one minor item omitted by both Muldrew and Broadberry et *al*. is imports of beef, pork, and butter from Ireland. From an Irish perspective, these were not trivial in the late eighteenth century (Cullen 1968, pp. 69‒70; Thomas 1982), although they would not have added much to calories per head in England—perhaps 40‒50 calories c. 1800. As noted earlier, the estimates seem not to allow either for Irish grain exports to Great Britain, which were significant by the1830s and 1840s.

 None of the estimates allows either for imports of live cattle from Scotland. Robert Trow-Smith (1959, p. 226; see too Blackman 1975, p. 60) suggests that as many
as 100,000 animals per year were imported at the end of the eighteenth century. Assuming an average carcass weight of 600 lbs. worth 82.4 calories per oz. (Allen 2005; Floud *et al*. 2011, p. 210) would add a further 20/25 calories or so per head
c. 1800.

 One significant imported item included only by Floud *et al*. is sugar, worth 72 calories in 1750 and 95 calories in 1800. Wine and spirits imports account for an additional 11 calories in 1750 and 17 calories in 1800,and dairy products for 16 kcals in 1800 (Floud *et al*. 2011, pp. 217, 218).

*Fish, Hunting, and Poultry*: Allen (2005, p. 20) is content to exclude calories from poultry, hunting, and fishing, since “it is hard to believe that those sources radically increased food availability.” Still, Broadberry *et al.* allow 200 calories for these items, while Floud *et al*. (2011, p. 167) allow 24 calories for fish in both 1750 and 1800. Muldrew’s allowances under this heading are atypically conservative: nothing for
fish, and about 40 calories for poultry in 1770. In Appendix Table 3, we allow for 100 calories for poultry and fish in our amendments to Muldrew’s totals in 1770 and 1800; and by the same token, we deduct 100 calories from Broadberry *et al*.’s totals under this heading (Muldrew 2011, p. 154).

 Holderness (1989, p. 149) reminds us that “the quantity of meat…from rabbits was not negligible, and should not be ignored simply because we have no statistics.”[[2]](#footnote-2) Yet on his reckoning that the annual output of rabbit warrens before 1800 was no higher than two or three million animals, and that the average rabbit yielded 1.5 lbs. of meat, farmed rabbits would have added only about three calories daily per head at most
in 1750‒1800. Wild rabbits cannot have added more than a few more calories.
Other wild animals and birds must have contributed even less to aggregate calorie availability.

*Conversion Rates*: A feature of Floud *et al*.’s estimate (2011, p. 154) is their use of coefficients generated by U.S. output estimates to calculate the proportions of English crop outputs not entering human consumption. They also employ U.S. conversion ratios to correct for milling losses and distributional losses. The relevant ratios are given in Appendix Table 1. Given that crop yield ratios were about 10:1 in England and Wales at this time, Floud *et al*.’s assumed proportions of wheat, barley, and rye entering gross production in column 1 seem on the low side. Similarly, comparing columns 2 and 3 suggests that the assumed losses from processing and distribution may be too high except, perhaps, in the case of barley.

 Although in general Muldrew’s estimates seem overgenerous, Appendix Table 2 suggests that his calorie conversion rates are conservative. The rates used by Broadberry *et al*. and Floud *et al*. tally with those in Robert A. McCance and Elsie
M. Widdowson (1960).

 Appendix Table 3 summarizes the amendments suggested above to the estimates
of Broadberry *et al*. for 1750 and 1800 and of Muldrew for 1770 and 1800.
Gaps between the implied revised aggregates remain but they are now much smaller
than before and, as explained in the main text above, consistent with a common interpretation of conditions on the eve of the Industrial Revolution.

Appendix Table 1

CROP CONVERSION RATIOS c. 1700‒1800

|  |  |  |  |
| --- | --- | --- | --- |
|  | Floud *et al*. |  | Overton and Campbell |
| Crop | (1) ProportionEntering Gross Product | (2) Proportion Net of Milling and Distribution Losses |  | (3)Proportion Net of Storage and Food Conversion Losses |
| Wheat | 0.855 | 0.6189 |  | 0.70 |
| Rye | 0.737 | 0.5345 |  | 0.70 |
| Barley | 0.850 | 0.4000 |  | 0.68/0.30 |
| Oats | 0.280 | 0.4263 |  | 0.56 |

*Sources*: Floud *et al.* (2011, table D2); Overton and Campbell (1996) as reported in Apostolides *et al*. (2008, table 20).

Appendix Table 2

KCAL/OZ. ESTIMATES

|  |  |  |  |
| --- | --- | --- | --- |
|  | Muldrew | Floud *et al*. | Broadberry *et al*. |
| Wheat | 82.8 | 95 | 95 |
| Rye | 87.2 | 95 | 95 |
| Barley | 75.4 | 102 | 91 |
| Oats | 87.9 | 114 | 105 |
| Beans/Peas | 74.6 | 73/78 |  |

*Sources*: Muldrew (2011, p. 143); Floud *et al*. (2011, pp. 205‒09); Campbell *et al*. (1993, table 3, p. 41).

Appendix Table 3

SUGGESTED AMENDMENTS TO THE ESTIMATES OF MULDREW AND BROADBERRY *ET AL*.

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Muldrew |  | Broadberry *et al.* |
|  | *1770* | *1800* |  | *1750* | *1800* |
| Wheat | ‒750 | ‒400 |  |  |  |
| Rye | ‒165 |  |  | +250 |  +50 |
| Oats | ‒250 | ‒600 |  |  |  |
| Barley | ‒550 | ‒400 |  |  |  |
| Peas/Beans |  |  |  |  +20 |  +20 |
| Potatoes | +100 | +230 |  |  |  +50 |
| Garden plots and orchards |  |  |  | +20/+50 | +20/+50 |
|  |  |  |  |  |  |
| Milk/Meat | ‒329 | ‒142 |  | +414 | +304 |
| Fish and poultry |  +60 |  +60 |  | ‒100 | ‒100 |
| Lard |  +53 |  +46 |  |  +53 |  +46 |
|  |  |  |  |  |  |
| Sugar/Wine |  +90 | +110 |  |  +90 | +110 |
| Irish/Scottish imports | +20/+25 | +60/+75 |  | +20/+25 | +60/+75 |
|  |  |  |  |  |  |
| Total | ‒1716/‒1721 | ‒1021/‒1036 |  | +767/+802 | +560/+605 |

*Source*: See the text.

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1. Using Floud *et al*.’s 23 calories per oz. [↑](#footnote-ref-1)
2. On wild rabbits, see Sheail (1971). [↑](#footnote-ref-2)