

The Workings and Measurement of Pre-Industrial 'Organic' Economies: Conjectures on English Agrarian Growth, 1660-1820¹

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This paper considers the appropriate economics for the analysis of pre-industrial economies. In the light of this we demonstrate that those who have estimated the course of agricultural output in England c.1660- c.1820 have applied a totally inappropriate economics and so reached counter-intuitive results. But by applying the appropriate economics we have arrived at more realistic estimates of our own. These estimates are pretty well the reverse of current thinking.

1. Introduction

No issue is more central to an understanding of England's Industrial Revolution than the relationship between agriculture and population growth. One or two agnostics apart, the general consensus now is that agriculture grew at a faster rate between 1660 and 1740 than it did over

¹ The whole of this manuscript, excepting section 8, was completed in September 2000. Section 8 was completed as a note responding to the appearance of a book (see beginning of section 8 for the details) on the assumption that the paper, having been accepted by this journal, would soon appear. And indeed the proofs duly arrived and were returned back. But since then nothing: evidently, between the death of the then editor, and the taking over by the new editors, something got lost on the way. But all was not lost, for this has enabled me to take the note and turn it into an integral part of this version. References to 'recent' literature in the text, however, must be read in this light.

My greatest debts are to Dr Rick Kleer, of the Department of Economics, University of Regina, Saskatchewan, who commented most helpfully and penetratingly on the penultimate version of this; to Professor John Hatcher for his wise counsel; and to Professor Peter Mathias for his timely encouragement and for a crucial piece of advice at a time when prospects of publication were hardly rosy. Useful points were also received from Professor Sir Tony Wrigley and from Dr Bill Sheils while an anonymous referee for the earliest version saved me from a stupid arithmetic error. Technical advice was forthcoming from Professor John Hutton and Dr Berni Stafford. Finally, Stephen Jones must also be thanked for saving a "computerphobe" from innumerable computer glitches (Jason Nice the same).

the years 1740-1790 (when it apparently stalled); only then was growth supposedly resumed and this at a higher rate than ever before. The years 1660-1740 are credited with an overall growth rate of "at least" 4.30 per cent per decade at a time when there was relatively little population growth, whereas the growth for 1740-1790 could only have been "at most" 2.70 per cent per decade at the very time that population growth quickened.² A slightly different chronology suggests growth at 0.60 per cent per annum between 1700 and 1760; virtual stagnation between 1760 and 1780; and growth then stepping up to 0.75 per cent per annum for 1780-1801, and to 1.18 per cent per annum for 1801-31.³ But is all this correct? Did agricultural growth really slow over the years 1740-1790 'just as population growth began to accelerate'?⁴ Was the growth between 1700 and 1740 as great as is presently claimed? And what of the 1790s, the 1800s, and the 1810s? Given that over these three decades there was a striking increase in foodstuff and raw-material imports, reaching some £18,000,000 per annum at current prices by the 1810s,⁵ how does this relate to the performance of home agriculture? In other words, how securely established is an interpretation which, by turns, seems either counter-intuitive relative to population growth, or problematic in other respects?

The three major protagonists of the chronologies sketched above have been N.F.R. Crafts (1985), R.V. Jackson (1985), and more recently R.C. Allen (1999), but all three operate on the same basic assumptions as established by A.H. John (1960, 1961, 1965), and E.L. Jones (1965, 1974), and continued by Joel Mokyr (1977), Ippolito (1975), P.K. O'Brien (1985), and Mark Overton (1996). And it is interpretations derived from these self-same assumptions that, to the extent they accept Jackson's estimates, inform two recent, excellent text-book syntheses of the Industrial Revolution by Hudson (1992) and Daunton (1995). In particular, all analysis is conducted in two-sector terms, "agriculture" on the one side, "industry" on the other; dynamics originate from shifts in the price-terms-of-trade between "industry" and "agriculture"; while the theory

² Jackson (1985), p. 349.

³ Crafts (1985), pp. 41-42.

⁴ Jackson (1985), p. 349.

⁵ Davis (1979), p. 116.

employed is present-day supply and demand analysis. Unfortunately, a consideration of how pre-industrial, "organic" economies actually worked reveals that "modern" supply and demand analysis can have been of but limited application, while in one crucial respect, income-elasticity of demand could hardly have possessed any independent causal agency whatsoever. And when we consider pre-industrial economic structures we discover not two sectors, agriculture on the one side, and industry on the other, but the totality, rather, of one agricultural world. For if we assume a "pure" case of "organic" economy where all primary inputs originate from agriculture, then the whole of "industry" can involve nothing more than merely the processing and/or manufacturing of agriculture's "primary" stocks into the final, and thus "secondary", items required for consumption and use. For example, turning barley into beer, tanning hides into leather, and cobbling leather into boots and shoes. And it is this sort of world that E.A. Wrigley so perceptively portrays in his *Continuity, Chance and Change* (1988), and of which Peter Mathias wrote some fifty years ago as follows:

"To consider such a progression, with that side of the metal industry whose final products also went to serve domestic agriculture, is to emphasize that, before the nineteenth century, agriculture was the only great prime mover of the economy and that most of the nation's industry was processing materials drawn from the harvest of crop, beast, or timber or in some way directly serving these harvests...[this] deserves stress here partly because it is so easy to transfer contemporary assumptions... about the dichotomy of industry as against agriculture back into centuries where a fundamentally different economic structure makes them largely meaningless".⁶

It is the contention of this paper that this is precisely the trap we have fallen into, despite Mathias' eloquent warning against it; and that because of this, the course of agricultural growth over the eighteenth century has been seriously misrepresented. Our task, then, is threefold: first, to

⁶ Mathias (1957/8), p. 40.

establish how a pre-industrial economy actually worked; second, to establish the appropriate theoretical framework for understanding such an economy; and third, to conjecture alternative estimates for agrarian growth between the 1700s and the 1810s. Reliable estimates in any absolute sense are unlikely to be attained, of course, but put together they just might enable us to establish the major phases of growth and, in particular, to adjudicate whether growth was in fact greater over the earlier period 1660-1740, than over 1740-1790 (though in the former respect our analysis is confined mainly to the period 1700-1740, moving back to 1660 only in our conclusion). All the authorities cited above work from the demand-side as we ourselves will also attempt to do, although, before concluding, we shall consider the supply side as well.

2. The “organic” economy of the eighteenth century

For the fundamentals of England's economy during the eighteenth century we need look no further than the opening paragraph of chapter I, Book III, of Adam Smith's *The Wealth of Nations* (the chapter famously entitled “Of the Natural Progress of Opulence”).⁷ In this opening paragraph Smith depicts the relationship between agriculture, with its “rude” produce, and a town. The former “rude” produce comprises the sum total, virtually, of the foodstuffs and raw materials the economy has to work with in annually producing almost the whole of its output; whilst it is in the town that Smith, for purposes of exposition, depicts all processing and manufacturing of the “rude” produce to be located. If we generalise Smith's own terms just a little, as shown by our parentheses in the quote that follows, the essential position becomes clear when he writes: “The country [i.e. the primary, agricultural, sector] supplies the town [i.e. the secondary sector] with the means of subsistence, and the materials for manufacture. The town repays the supply by sending back a part of the manufactured produce to the inhabitants of the country. The town in which there neither is nor can be any reproduction of substance, may very properly be said to gain its whole wealth and subsistence from the country”.⁸

⁷ Smith (1950), I, p. 401

⁸ *Ibid.*, pp. 403-404.

In the latter respect, Smith certainly exaggerates the "passivity" of the secondary sector, since any innovation that made higher output possible there could well then have made it worthwhile for agriculture to produce more. But Smith's emphasis on the centrality of agriculture is clearly correct, though interestingly he was aware of Sheffield, Birmingham and Wolverhampton, and thus of the emergent mineral sectors of the economy.⁹ Accordingly, in the spirit of Smith, we shall assume, for our own illustrative purposes, that all inputs into "industry" originate from the primary/agricultural sector – a "pure" case of "organic" economy, that is. But this is not at all unrealistic for, as late as the 1780s, fully 80 per cent of the income generated in the economy's production of physical output – the basis of everything after all – was earned either in agriculture itself, or in industries wholly dependent on agricultural inputs (e.g., baking and brewing from grain, cloth-making from wool, meat from the slaughtering and butchering of pigs, cattle and sheep, leather and candles from hides and tallow, and so forth).¹⁰ And this has to be the central point: over the eighteenth century and through into the early nineteenth century the economy remained far more agricultural and basic than the image held, almost unconsciously, within the mind-set of those who have applied an agriculture versus industry sectoral-analysis to the eighteenth century. But this kind of analysis only begins to become fully applicable from the mid-nineteenth century onwards. Reaching back to Clapham's

⁹ *Ibid.*, pp. 431.

¹⁰ Our estimates for physical output have been arrived at by combining the estimates of national income provided by W.A. Cole (1981), p. 64 and Deane and Cole (1964), pp. 166-167), with estimates of value-added provided by Crafts (1985), p. 22) for c. 1770, 1801 and 1831, but substituting our own estimates for the cotton industry (see text, section 6). Our estimate for the 1780s has been interpolated. Taking 1801, the breakdown of value-added is as follows: the organic economy = Agriculture (£74.3m) + Wool textiles (£10.1m) + Linen industry (£2.6m) + Brewing (£2.5m) + Leather industry (£8.4m) + Soap-making (£0.8m) + Candle-making (£1.0m) = £99.7 Total. For the cotton-silk/inorganic economy we have the following: Cotton textiles (£16.6m) + Silk textiles (£2.0m) + Building industry (£9.3m) + Iron Industry (£4.0m) + Copper industry (£0.9m) + Coal industry (£2.7m) = £35.5 Total. Hence, total value-added = £135.2m of which 73.7% generated by the organic economy, and 26.3% by the cotton-silk/inorganic economy. We also have estimates for the shipping industry: see note 43 below. But because its involvement as between the organic and inorganic sectors is not easy to sort out, we have not included it as part of the inorganic sector. As noted in the text, the same is true of the transport industry as estimated by Deane and Cole (1964), pp. 166-167.

classic (1926) analysis of the 1851 census returns,¹¹ there is nothing new in any of this – just that the implications for the appropriate economic framework to apply have never been fully confronted. Accordingly, even the most striking “new” economic achievements associated with the Industrial Revolution must be placed firmly within the context of an enduring agricultural totality, whilst all our theoretical presuppositions have to be put on hold for the time being. In this latter respect, it should not be overlooked that the present writer has already shown (D.W. Jones, *War and Economy*, 1988, chapter 4) that though the ‘multiplier’ of modern economics certainly applied when an external, downward disturbance occurred, it could not have applied when an upward movement from “normal” (an export expansion, say) occurred: simply any extra spending would run back into the stocks shortly to be discussed and so lead to rising prices that blocked off any “multiplied” expansionary quantity-effect.

The corollary of all this, of course, is that as late as even the 1780s, (referring back to note 10) a mere 20 per cent of the economy’s physical output came as industrial production not dependent on “home” primary/agricultural inputs. (And were we able to allocate transport, this proportion would be smaller still.) In part, this sector comprises the mineral, inorganic components of the economy – that is coal-mining, iron-making, copper-smelting, together with building and construction (whose bricks clearly were not of agricultural origin). True, building and construction did depend on one important input that was organic, namely timber; but the cycle of timber conservation goes so far beyond the annual cycles of the agricultural year that timber, and so building and construction, must clearly be regarded as separate and distinct from agriculture. Similarly, the cotton and silk industries: for though these, too, were organically based, they also must belong to our “non-home” agricultural sector, for the whole of their raw materials, cotton and raw silk, came from foreign, and not home, sources of supply. Henceforth, all this will be termed “The cotton-silk/inorganic sector”.

Over the latter part of the eighteenth century, and beyond into the

¹¹ Clapham (1930), II, chap. 2.

new century, a growing margin of primary/agricultural inputs – comprising corn, meat, butter, cheese, hides, skins, tallow, and flax and linen yarn (plus the content of both these latter in linen imports) – was also coming in as imports from foreign sources of supply, and thus supplementing home production. But though rising to an equivalent of some 6 per cent of home agriculture by the 1780s, and to some 11 to 13 per cent thereafter until, and including, the 1810s, “home” supply remained much the more preponderant (see below, *Tables 2 and 4*). Of course, this does not exhaust the list of “organic” imports coming in: but just as the Spanish wool imported to make the fine Spanish cloths had thus never competed with home wool supplies, so import was also the source of virtually all hemp supplies.¹² Because these latter imports, therefore, never trenched on home supplies, it is only the imports as mentioned above – corn, meat, flax and linen yarn (plus the latter’s content in linen imports) and so forth – that could, and did, trench on home supplies, which will be relevant when we attempt to derive estimates of home agricultural output-growth from estimates of consumption-growth. (The total of relevant “organic” imports is thus less than the £18,000,000 (at current prices) mentioned at the very beginning, whilst the proportions given above (measured in this case in terms of 1740s prices) already establish the ratio between home-and foreign sources of supply as far as the relevant imports are concerned.)

But to return to the cotton-silk/inorganic sector: income generation here was not dependent on home agricultural inputs (though much the greater part of the income so generated would, of course, still be spent on the products of the “organic” economy). Naturally, as part and parcel of the “Industrial Revolution”, these sectors’ share in national income grew steadily, and our estimating must take account of this in due course. Even so, as late as 1801 and 1831, the proportion of income generated in the production of physical output by sectors of the economy not dependent on “home” agricultural inputs still stood only at some 26 and 38 per cent, respectively. (Whilst, again, these proportions would be smaller still, were we able to allocate transport.) Finally, side by side with

¹² Davis (1979), p. 72.

the cotton-silk/inorganic economy, we shall also supply estimates for freight earned by shipping, this comprising the single most important component of earnings from shipping and foreign trade.

3. The pre-industrial economy: a model

For our model of a pre-industrial economy (see *Table 1*: readers should find it helpful to make xerox copies of all five tables included in the *Appendix* of this work and follow them through in parallel with the text) we turn to Gregory King's analysis – taking account of modern conceptions and revisions¹³ – of the National Income of England and Wales in 1688. (This was a year of peace, we must note, when the government sector was thus quite small.) From King we gather that, of a total national income of some £50,000,000, agriculture amounted to some £20,000,000 (40.00 per cent), and that £7,000,000 (14.00 per cent) was earned by services of various kinds – whether as domestics, as persons in science and the liberal arts, as bishops and clergy, as lawyers, as government ministers and officials, or as officers and men in the armed forces. *Table 1* takes its point of departure from the £20,000,000 earned by agriculture in the supply of the primary inputs as already specified above. (This £20,000,000, commonly accepted as the size of agriculture at this time, includes all purchased inputs, though these could not have been very large. The inter-industry inputs so familiar from the input-output tables of developed economies ran very much out from agriculture, and not the reverse.¹⁴) The next step in our table is the immediate transfer of the agricultural inputs into the secondary sector where they are converted into the final items of consumption and use, as also already specified above. In pre-industrial economies, of course, some of this processing and manufacturing took place within households of the primary sector itself (rural “putting-

¹³ D.W. Jones (1988), pp. 74-75.

¹⁴ Deane and Cole (1964), p. 156, Table 35, n. 1; Horrell *et al.* (1994), pp. 547, 548. In Clark (1999), pp. 231-232, there is an error: the figure given in Table 4.5 of 0.897m for male farm employment in c.1700 relates to farmers as well as farm labourers, and not just the latter, as Clark supposed. Hence the estimate of £38.30 for the size of the agricultural sector c.1700, is much too high.

out" and so forth). Nonetheless, conceptually, the distinction between primary inputs on the one hand, and secondary processing and manufacturing on the other, still holds. Once transferred into the secondary sector, our table assumes that, on average, the value-added in the conversion of the agricultural stocks into the items of final consumption and use amounts to 115 per cent.¹⁵ This makes £23,000,000 in all (i.e., £20,000,000 x 1.15), and when added to agriculture's output of £20,000,000 makes a total physical output of £43,000,000, 86 per cent of national income. At £23,000,000, value-added amounts to 46 per cent of National Income; together with the 14 per cent services' share, the secondary and service sectors together thus amount to 60 per cent of national income.

Set-up in this way, it demonstrates the fundamental character of pre-industrial economics. Dairying apart, agricultural output arrived yearly, yet consumption had to take place daily. Accordingly, pre-industrial economies can be thought of as being dominated by year-long cycles of 'putting-out' last year's stocks into the production of the final items of consumption and use which bridge the production/consumption-gap between harvests. That this was directly the case of agriculture is self-evident from *Table 1*: there we see agriculture receiving back £9,302,320 of its own output, but to which the value of £10,697,680 has been added on its conversion into items of final consumption and use. This makes £20,000,000 in all – though not all of this is in fact returned as physical output. Instead, £2,800,000's worth is returned as services which, in effect, the agricultural sector has purchased in lieu of commodities; correspondingly, these latter commodities have been switched to support the services purchased by the agricultural sector.

¹⁵ Value-added has to have been greater than the value of the primary/agricultural inputs. For had it been just equal, the production of physical output would have been the sum total of economic activity – a state of affairs we know was not the case. Estimates of value-added c.1800, and expressed as multiple percentages of the primary materials involved, are: Bread, c.20 per cent for milling and baking (Peterson 1995, pp. 272-273); beer, c.17 per cent based on a barley output, net of seed corn, worth some £14.25m (Holderness, 1989, p. 145; here, though, price fluctuations make it difficult to establish a representative price for barley, and some went as animal feed, not for brewing); leather (though not including butchering costs), c.425 per cent (Clarkson, 1989, p. 476); Wool textiles, c. 250 per cent (Deane, 1957). We lack an estimate for value-added in slaughtering and butchering, but presumably it was considerably higher than in bread-making and brewing.

But side by side with this, the secondary sector itself is making just as important a contribution to bridging the consumption-gap between harvests, albeit a little more indirectly. For those engaged in adding £10,697,680 of value to provide for the agricultural sector must themselves provide to be able to do so. Hence a further £20,000,000 of physical output, again consisting of £9,302,320 primary agricultural input and £10,697,680 of value-added, and of which £2,800,000 once more goes on services, is generated to provide for the secondary sector itself. Perhaps the easiest way of grasping this is to lump the two tranches of £10,697,680 together, making £21,395,360 in all, and then think of the secondary sector as providing for itself in the mornings so that it can provide for the agricultural sector in the afternoons.

Hence, by whichever route, £21,395,360 gives us the measure of the secondary sector's contribution to bridging the production/consumption-gap between harvests. Whilst adding to this agriculture's £20,000,000 contribution to bridging the gap produces a total of £41,395,360 for the size of the annual consumption-gap within the economy as a whole. This amounts to fully 96 per cent of the total physical output of £43,000,000. Correspondingly, and reflecting the 100/115 ratio of primary units to value-added, we are left with but £3,000,000 of physical output (i.e., £1,395,350 of agricultural input and £1,604,650 value-added) that remains "free" in the sense of being over-and-above what was required to carry the economy from one harvest to the next. But even this was just as dependent on agricultural inputs as the rest, while the same holds for the £7,000,000 earned by the service (tertiary) sector (the details of which can be followed through from *Table 1*, including the £980,000 shown as services swapped within this sector itself). The whole economy, therefore, is pyramided upon agricultural inputs, and clearly we are dealing with a "circulating-capital/wage fund" economy.¹⁶

4. Present-day demand-side estimates

It is within this context that the present-day, demand-side estimates

¹⁶ Blaug (1968), pp. 186-189.

by Crafts, Jackson and Allen, who all work from consumption estimates as a basis for estimating agricultural growth, can be assessed. (And in due course, we also shall conjecturally attempt the same before additionally seeking estimates from the supply-side.) For Crafts, Jackson and Allen their basic model in its simplest form as presented by Jackson,¹⁷ is as follows:

$$\Delta Q = \Delta \text{Pop} + eP + nY$$

where ΔQ is the changing quantity of agricultural goods demanded; ΔPop , population growth; eP the price-elasticity of demand for agricultural goods; and nY the income-elasticity of demand for agricultural goods. Income levels in this latter respect are derived from the real-wages of building workers in the South of England, though Jackson does include a series for building workers in the North. (Jackson's equation is a simplification of Crafts' equation; with Allen, Jackson's equation is merely differently expressed, though additionally including cross-elasticities.)¹⁸

For three reasons, this framework is not theoretically sound. Firstly, given that agriculture, as shown in section 2 and *Table 1*, provides the totality, virtually, of the primary input that the economy has to work with from year to year, applying a price elasticity to this totality is clearly inappropriate: price-elasticity can only relate to price-interrelationships as between commodities (micro-economics), but not to the totality (macro-economics) itself. The basic position was governed, both over periods of time as well as from year to year, by how prices brought the fluctuating quantities of agricultural outputs – and therefore, inputs – into an equality with the income generated in, first, their production, and then their conversion into final items of consumption and use. Lesser quantity,

¹⁷ Jackson (1985), p. 338. Deceptively straightforward though this equation may seem, it is, in fact, of a very strange confection. Subliminally, lying behind it there would appear to be something of Hicks/Schlutsky consumer demand theory whereby, with reference indifference curves and subject to budgetary constraint, the demand function is scholastically split into two in order to separate out own "price effect" from own "income effect". And yet nY would appear also to belong to market demand theory, the demand for a good being determined with reference to Engel curves.

¹⁸ Crafts (1985), p. 39; Allen (1999), p. 212.

proportionately higher prices; and vice versa. To be sure, matters were distorted especially when grain harvests were short (the variable "bounty of nature"), whilst over the longer term, were the population growing faster than agricultural output, then grain (and potato) prices would rise relatively. The composition of output would thus be changed into producing more of the output that provided the greater sustenance, per unit area. Nonetheless, the basic principle of an underlying proportionality had to have applied. For were we to imagine all the agricultural outputs/inputs piled-up in store, sometime during October (say), then no application of a price-elasticity to these inputs, comprising as they do the constitutive totality of the economy as a whole, can make any sense at all. Correspondingly, though, estimating consumption per head becomes, in principle at least, a simple matter. Thus, commencing with an index-base of prices at 100 for a quantity of 100 units: then, were prices over the longer-term to rise to 120, consumption per head has fallen to $100/120$ and thus equals a quotient of 0.833 (or a fall of 16.66 per cent, i.e., 100.00 minus 83.33); and were prices to fall to 80, then consumption per head has risen to $100/80$, and thus equals a quotient of 1.25 (or a 25.00 per cent rise). Then multiply these quotients by a like-based index of population growth (say 130), and we gain an estimate of consumption growth of $130 \times 0.833 = 108.30$ per cent (i.e., an overall growth of 8.30 per cent) in the former case, and of $130 \times 1.25 = 162.5$ (i.e., an overall growth of 62.50 per cent) in the latter case. In practice, though, as we shall shortly see, this method cannot in fact be applied in the former case of prices rising over the longer-term.

Our second difficulty centres on the use made by Crafts, Jackson and Allen of *nY*. Putatively, growth by this term is thought to result from supposed income-growth, coupled with the likelihood of a high income-demand elasticity for food in low-income economies. But quite apart from the revealing slip that the organic economy was dependent on agriculture for far more than just food, there is a hidden assumption behind the use *nY*. Quite simply, it assumes that, 'out there,' from agriculture's point of view, there was an economically autonomous secondary/industrial sector whose incomes could fluctuate – move up and down – quite independently of agriculture: as such, *nY* could indeed have an important 'demand-pull' effect for agricultural output. But this can only be the case

for "modern" multisectoral economies where agriculture takes its place as but one of very many economic sectors; and where the sectors themselves are based on many different sources of wealth creation that are wholly independent of one another. But equally clearly, again as shown in section 2 and *Table 1*, this cannot be the case of a 'pure' organic economy where agriculture dominates as virtually the one and only source of wealth creation and from which 'industry' draws virtually the whole of its inputs. Because "industry" was thus but the creature of agriculture (though this qualified by the "passivity" point made in relation to Adam Smith above), the underlying relationship throughout the economy was merely one of higher agricultural prices (P) leading to proportionately lower real-income (Y), and lower agricultural prices, the opposite. Y is thus wholly dependent on P, and as such just cannot have acted as an independent, dynamic economic variable in its own right. nY has thus been just as much misapplied as eP – though, of course, we shall have to bring back into our picture the cotton silk/inorganic sector which will have exercised an independent effect, but more of this shortly.

The proportionate dependence of Y upon P brings us to our third, and final, difficulty. Given that Y is determined by P, then the application (or misapplication, more accurately) of both eP and nY leads to a double counting. Simply, a substantial part of nY can only be but the product of eP . For example, the quantity-effect of a rising P (as supposedly given by e) leads to a reduction of Q. But this fall is then further amplified by adding to it the quantity effect of a falling Y (as supposedly given by n). Now clearly, since Y is determined by P, and so making both but two manifestations of the same thing, a substantial double-counted fall of Q results; and vice versa in all respects were prices (P) falling. But of course e and n are misapplied anyway, for the reasons already given: nonetheless, even at this early stage, we can improve on the existing analysis. Thus, taking the building workers' real-wages upon which Jackson based his consumption estimates, we remove both eP and the n from Y, and just concentrate on Y (i.e., their real-wages).¹⁹ Now, since

¹⁹ The real-wage data employed here comes from E.H. Phelps-Brown and Sheila V. Hopkins as presented by Wrigley and Schofield (1981), pp. 638-644.

Y has been arrived at by dividing prices into our building workers' money-wages, there is no danger of double counting: P has clearly now been incorporated into Y. And on this basis, we find that, over the period from the 1740s to the 1780s, our building workers' real-wages fell by but 3.7 per cent, or down to a quotient of 0.963 (i.e., 100.00 minus 3.70). So we can multiply our 0.963 quotient by 129.57, our index of actual population growth (see below) to yield an index of 124.57 as our estimate of consumption growth – or a growth in percentage terms of 24.57 per cent. Now this is at least twice anything suggested by Crafts, Jackson and Allen for the period from the 1740s to the 1780s.

In this impasse, then, can we set-up some conjectures that just might help us to resolve these difficulties – at least to the extent of establishing what the major phases of agriculture's growth were? Clearly, we need to be able to measure two things. Firstly, the growth of net-output from agriculture as determined within the "organic" economy; but also, secondly, that growing contribution to income accruing from the economy's cotton-silk/inorganic sectors. For though, as we have seen from the composition of the economy's physical output, these sectors were quite small during most of the eighteenth century, they were growing and their income growth will have been exercising an independent and growing income-demand 'pull' for the organic economy's output (and this to a degree shortly to be established).

Focusing specifically on the period from the 1740s to the 1780s – a time, it will be remembered, of supposedly very little agricultural growth, if any at all – and working from the same consumption-side as Crafts, Jackson and Allen: we devote the next three sections to providing alternative estimates of our own. Thus section 5 attempts to measure, in percentage terms, the growth of agricultural consumption within the organic economy over the period from the 1740s to the 1780s; section 6 then attempts to establish decadal estimates of the size of the cotton-silk/inorganic sector over the period from the 1700s to the 1810s as a whole; while, finally, section 7 takes us back to the 1700s, which then enables us to convert the 1740s-1780s percentage growth-rates of agricultural consumption (as established in section 5) into the quantities our analysis requires. To this we then bring in the relevant estimates for

the cotton-silk/inorganic sector (section 7) while also adding in data for organic exports and imports, and for shipping freight earnings. At this point our demand-side analysis will be complete.

5. The growth of agricultural consumption within the organic economy, 1740s-1780s

For the organic economy over these years, we base our procedures upon the (day) money-wages paid to agricultural labourers as provided by Overton's recent work, and which were rising over these years.²⁰ We cannot tell how many days were worked (but this could hardly have been less in the 1780s than in the 1740s). But, subject admittedly to this uncertainty, agricultural workers constituted by far the single largest component of the labour force, while the movement of their money-wages fully equate with what is known of these in the economy more generally.²¹ It also helps that, with population growing over this period, labour earnings, and so their consumption, are likely to have lagged behind the earnings and consumption of everyone else (labour in relatively abundant supply, relative to land and capital): accordingly, we are thus likely to be provided with an underestimate and not an overestimate. (At this point, touching on something we have but briefly mentioned hitherto, the money-wages of labour did rise, though not quite enough, of course, to compensate for rising prices. Hence to this extent a "cost-push" inflation was at work in the economy, depreciating the money of account. And it is the uncertain degree of this that, as already intimated, makes a determination of quantity by a division of price into a quantity index-base of 100 impracticable over this period.)

Before proceeding, two points have to be made concerning the prices we employ in our analysis of the period from the 1740s to the 1780s. First: a glance at Overton's data reveals two categories of priced commodities: (1) mutton and beef which are thus prices for animal products in their final-consumption forms; and (2) prices for wheat, barley

²⁰ Overton (1996), p. 64.

²¹ Williamson (1982), as set out in Mitchell (1988, p. 153).

and wool which are thus prices of the primary inputs entering into bread-making, brewing, distilling, and woollen-manufacturing. But it is the prices of these latter, and not of the primary inputs, that are relevant for consumer demand; and these consumer-prices were bound to have been somewhat lower than the producer-prices of wheat, barley, and wool. For, with money-wage rates rising somewhat less than agricultural prices, as just noted, the costs of turning wheat into bread, barley into beer, and wool into cloth rose somewhat less than did the prices of wheat, barley, and wool themselves. Any lower or constant transport costs plus productivity growth in processing and manufacturing will have had the same effect. On both counts, therefore, consumer demand was cut back to a lesser degree than producer-prices would seem to imply. In our estimates, therefore, we have substituted bread prices in place of wheat, beer prices in place of barley, and textile prices in place of wool; had we prices for hides and skins (but we do not) we would have needed to do the same for leather prices. In this respect, there is thus an unavoidable gap in our analysis, though not a large one.²² (The prices of oats which could be fed to horses or turned into meal for human consumption, and so which belong to both our categories, we have left unchanged).

The second complication is again self-evident from Overton's data. Because of the chronology of population growth, we have had to take the 1740s as our base, since it was then that the population growth commenced. But this means that, along with the 1700s and 1730s, this decade presents us with abnormally low prices because of a freakish run of bountiful seasons (beef and dairy products solely excepted, but this probably reflects the serious outbreaks of rinderpest during the decade).²³ No meaningful comparison is possible, therefore, between the 1740s (when abnormally favourable conditions applied) and the 1780s (when

²² O'Brien (1985), pp. 794-5 for beer and textile prices. Mitchell (1962), pp. 497-8 for (London) bread prices. Something odd appears to be happening to Overton's beef prices between the 1710s and the 1720s. For the years 1700-1750 we have therefore substituted figures drawn from Bowden (1985). Clarkson's estimates (Clarkson (1989), p. 476) suggest that home agriculture's output of hides and skins could not have amounted to more than two per cent of total agricultural output.

²³ Chartres (1990), p. 251.

they did not). For our 1740s base, therefore, we have averaged 1720s prices with 1740s prices (while taking 1730s prices for beef): on this basis, and weighted according to the weights that can be directly or indirectly (i.e. filling-in details from other sources) established from Arthur Young's estimate for 1770, we arrive at a price increase of 26.49 per cent between the 1740s and the 1780s.²⁴

On this basis, then, and as can be followed in *Table 2* (lower half), we proceed as follows. Setting the 1740s as base throughout, we see that population has grown by 29.36 per cent,²⁵ and so stands at an index of 129.36; that prices of the organic economy have risen by 26.49 per cent and so stand at an index of 126.49 (for population we take the mid-decade figure (e.g. 1746 for the 1740s) which has a certain muffling effect for the true amplitude of the population growth); and that (agricultural labourers') money-wages have risen by 22.85 per cent, and so stand at an index of 122.85. Now, dividing the price index into the money-wage index tells us at-one-and-the-same-time both the extent to which rising money-wage rates had clawed back the loss inflicted by the rising organic prices, and the degree to which consumption per caput had nonetheless fallen; all this results in a quotient of 0.971 as shown in the lower part of *Table 2* (or a consumption fall of some 2.90 per cent). Multiplying this by the population index of 129.36 then provides us with a 25.61 per cent estimated consumption-growth between the 1740s and 1780s.

At this point, however, another element intrudes: poor-relief payments during the 1780s were much higher than they had been during the 1740s. By the 1780s these payments were providing an important source of supplementary income for the lowest earners (including any agricultural labourers whose money-wage increases might have been significantly less than the 22.85 per cent average overall). Moreover, these payments were recognised as an important element, pushing-up

²⁴ Arthur Young, as set out in G.E. Mingay (1989), p. 1045; for c.1700, the weights will be based on Gregory King as set out in Thirsk and Cooper (1972), pp. 782-3; for c.1800, on O'Brien (1985), pp. 790-3.

²⁵ Wrigley and Schofield (1981), Table 7.8, pp. 208-9. All our data for population is drawn from this source. We have consistently taken mid-quinquennia years as representative of each decade (e.g., for the 1740s: 1741-50: 1746).

prices further than would otherwise have been the case,²⁶ and they were to grow even more rapidly over the following three decades.²⁷ By how much aggregate demand was increased by poor relief spending, we estimate, first, by deflating in order to establish the real purchasing-power of these payments in terms of current prices; and then by assuming quite conservatively that, on average, some three-quarters of this extra spending was spent on the basics of the organic economy, leaving the rest devoted to house rent and imported sundry groceries and tobacco.²⁸

6. Output estimates of the cotton-silk/inorganic sector, 1700s-1810s

For estimating the growth of the cotton-silk/inorganic sectors, we have taken Crafts' estimates of the value-added by these industries in Great Britain in 1801, and then projected these estimates backwards and forwards using the growth rates that Crafts also supplies.²⁹ Beginning- and end-of-decade estimates were obtained and then averaged to supply estimates for each decade. Allowing for the compounding of growth, this means that the average will apply to the slightly later years of each decade, not its mid-point. But this was thought acceptable, given that we are interested in measuring growth between end-points of time when our procedure of taking mid-decade population totals already muffles this. On this basis (see *Table 3*), we have been able to present estimates at 1801 prices – e.g., £7.736 for the 1740s and £18.166 for the 1780s – for c.1700, for the 1740s and 1780s, and then for the 1790s, the 1800s and the 1810s, respectively.

²⁶ Wrigley (1987), p. 104.

²⁷ A figure for the 1790s has had to be interpolated, and we have only one figure (1803) for the 1800s (but a convincing one).

²⁸ Thus taking Feinstein's (1998, p. 634) estimates of working-class expenditure shares for 1788/92, fully 86 per cent would have involved purchases from the organic economy. Recently, it is true, scholars have been persuasively pushing down estimates of the proportions spent on food and drink, though for us the purchase of woollens and footwear need to be added as additional calls upon the organic economy. See Shammas (1990, pp 123-124); and Clark, Huberman, and Lindert (1995, p.232).

²⁹ Crafts (1985), pp. 22-23.

The only modifications to our estimates based on Crafts' growth rates are that we have removed all iron imports from our estimates for the iron industry, since these are stated to be for gross output really, whilst we have substituted our own estimate for the cotton industry in 1801, Crafts' 1985 estimate being too low. For our own estimate, we have worked from the generally accepted view³⁰ that the value-added in the industry was between three and four times the value of the raw cotton used in production, with all indications pointing to the upper, not the lower, end of this range.³¹ By taking the known volume of retained raw cotton imports and applying to it its current value as supplied by Davis³² for 1794-6 and 1804-6, and then averaging to centre on 1801 (but giving the 1804-6 figure double weighting to reflect the likely upper-end of the three-to-four range), we arrive at an estimate of £16.557m for the size of the British cotton industry in 1801 at the current prices obtaining then. The average price for 1794-6 was £0.999 per thousand pounds of raw cotton; for 1804-6, £0.939: our averaging is thus on a sound footing.

To estimate the actual contribution of the cotton-silk/inorganic sector to the growth of demand for the output of the organic economy – and in this first instance, over the 1740s-1780s period: then, because shortly we will need to allow for how the organic economy's prices rose between the 1740s and 1780s, we must first convert our estimates for the cotton-silk/inorganic sector at 1801 prices into the current prices (base 1740s) prevailing at these respective times (e.g., our £5.788 estimate for the 1740s as shown in *Table 3*). Thanks to O'Brien's data for industrial prices, finding the appropriate prices has been relatively straightforward.³³ But there are two major gaps: we lack prices for silk manufactures, and uncertainty surrounds cotton textile prices. For silk we have got round the difficulty by comparing the so-called 'official' export values of silk exports with the current values as computed by Davis for 1794-6 and 1804-6.³⁴ The point here is that the valuations applied by the customs' authorities c.1700 - at

³⁰ Harley and Crafts (1995), p. 41.

³¹ Chapman (1987), pp. 54-56.

³² Davis (1979), pp. 103-104, 113-114.

³³ O'Brien (1985), pp. 792-5.

³⁴ Davis (1979), pp. 94, 96.

which point they were supposed to reflect market values – were applied virtually unchanged thereafter. Given that there was relative price stability between c.1700 and the 1740s, official values should still be close to actual market values for the latter decade. To reach the current price of silks in 1801, it is much as before with raw cotton imports. We have simply divided Davis' current-price estimates for 1794-6 and 1804-6 by the known quantities of silks exported to arrive at two values expressed per pound weight. By averaging the two results, we thus arrive at an estimate at current values centering on c.1801 – and hence a basis for deflating back to the 1740s. This still leaves the problem of what prices to apply to the 1780s: we have just assumed that a third of the indicated price rise (100 per cent) between the 1740s and 1801 had taken place by the 1780s. Cotton textile prices are very contentious matters.³⁵ Fortunately, the more recent work of the two protagonists, Harley and Cuenca Esteban, has produced a fair measure of agreement as to how prices moved from 1801 back to the later years of the 1780s. Thus using Harley's prices³⁶ produces an estimate of £6,324 for 1786-89 inclusive whereas using Cuenca Esteban's prices³⁷ yields an estimate of £6,590. Thus we have simply averaged these (£6,457) and taken this in *Table 3* as our estimate for the cotton industry during the 1780s (again, the muffling effect of taking mid-decade population figures can be invoked to justify our use of an end-of-decade estimate). For the 1790s, we have assumed that 1801 prices applied (though given the vagaries of war this is probably a little too high); for the 1800s and 1810s we have simply averaged Harley's and Cuenca Esteban's prices which are very close for the former decade, though they do diverge markedly in the 1810s. For the period between the 1740s and 1780s, in the light of the general debate, we have estimated that cotton textile prices fell by 30 per cent between these dates; fortunately, during the 1740s the size of the industry is not such as to make this estimate of any decisive significance. In any case, the consequence of any error in any of our estimates for the cotton-silk/inorganic sectors (including our

³⁵ Cuenca Esteban (1994 and 1995); Crafts and Harley (1995).

³⁶ Harley (1998), p. 79.

³⁷ Cuenca Esteban (1999), p. 755.

silk manufactures) will be damped, given how, throughout, a ratio of but a third (roughly: see below) is applied to estimate demand-growth for the products of the organic economy.

The final total for the size of the cotton-silk/inorganic sector during the 1780s works out at £16.507 at the current prices obtaining then. All our subsequent operations on this figure can be followed by returning to *Table 2*. First, we do indeed adjust this estimate to allow for how the organic economy's prices had risen between the 1740s and the 1780s. From the resulting £12,826 we then deduct 5 per cent to allow for Scotland's share of these industries. (5 per cent has been chosen on the basis that, although Scotland accounted for some 15 per cent of Great Britain's national income in 1801, Scotland was as yet not so 'industrial' as England. In our estimates for the 1790s, the 1800s and the 1810s as set out in *Table 4* below, we shall be deducting 10, 15 and 20 per cent, respectively, under this head to allow for how quickly Scotland caught up.)³⁸ From the resulting £12.185 we then deduct our £5,778 estimate of the size of the cotton-silk/inorganic sector during the 1740s – and so arrive at an estimate of £6.397 as the growth that had occurred between the 1740s and the 1780s. Now the 'agricultural content' of each extra pound generated and spent by the cotton silk/inorganic sectors will have been the same as in any other tranche of total spending. Accordingly, we finally apply to our £6.397 estimate the proportion of agriculture's share in total national income, and arrive at £1.983 as our measure of the extra demand created by the cotton-silk/inorganic sector for agriculture's output. (Agriculture's share of national income commences at some 40.00 per cent at the start of the eighteenth century, and hovers around a third in the second half, before tapering down to some 28 per cent by the 1810s.³⁹) Our procedures are essentially the same for the shipping industry, where we are able to use tonnage statistics combined with R.C. Nash's (1997) recent work to estimate this

³⁸ Deane and Cole (1964), pp. 161-7; Cole (1981), p. 64; Smout (1970), pp. 247-57.

³⁹ The basis of all this is provided by Deane and Cole (1964), pp. 166-167, and by Cole (1981), p. 64). We have taken Cole's estimates for national income, but substituted our own estimates for agricultural output (see *Tables 2* and *4*). Cole's data are basically the original Deane and Cole estimates (1964), p. 78, but following Crafts (1976), reworked for the first half of the eighteenth century. The old estimates for the second half of the eighteenth century appear to have been grafted unchanged on to the reworked 1700-1750 estimates.

sector's income growth.⁴⁰ To this we apply the same proportions on the same grounds as above.

To leave matters thus, however, would be seriously begging the question: for did agriculture actually meet the extra demand generated by the cotton-silk/inorganic sectors? Fortunately, there is a solution to this problem: the extent to which it might not have done will have been communicated as rising prices, and is thus taken care of by the "prices" side of our prices/money-wages estimations.

7. Estimated agricultural growth, 1700s-1740s; 1740s-1780s.

Hitherto, our discussion of the organic economy's growth has been in percentage terms exclusively. Clearly, before we can put the picture together, we must first convert these percentages into quantities. To do this we now take the period between the 1700s and the 1740s (upper part of *Table 2*) and repeat the operations carried out for the period from the 1740s to the 1780s to get us back to 1700 – and thus to that one generally agreed datum that agriculture was of the order of £20.00m at that time. (This procedure would have been hazardous, of course, had there not been price stability over these years.)

Hence, using trade data⁴¹ to exclude what went out as exports and

⁴⁰ We have taken Nash's (1997) estimates for c.1700 (and which are thus more or less equivalent to 1740s prices) and applied to them multipliers for the growth of the shipping industry as supplied by ship-tonnage statistics. The method is, of course, crude, but applying it to c.1770, for which Nash provides an estimate, his estimate of £2.143m compares with our estimate of £2.043m. Once the registration of ships begins in 1788, a higher tonnage of shipping is returned than can be reconciled with the total supplied for 1786 by our source down to this date (Davis, (1962), pp. 27, 404-6); moreover, from 1789 onwards, the registration statistics are only readily available for the United Kingdom (Mitchell (1962, p. 217). We have therefore bridged these discontinuities first by subtracting from our post-1788 tonnages the difference between 1788 and 1786; and, secondly by subtracting the difference between the English and United Kingdom tonnages in 1788. This is a case where leaving out an (imperfect) estimate would do more harm than leaving it in.

⁴¹ Our trade data are as follows. For c.1700 our figures come from Davis, (1962), pp. 301-303 and A.H. John (1976, pp. 65-67 (grain exports). Mitchell (1982), pp. 293-294) and Schumpeter (1960, Tables VII, VIII, X, XII, XV and XVI) supply the figures for the 1740s. (A figure for skins and hides has had to be 'borrowed' from Davis' (1962) figures for 1754-6.) Details of linen imports have been compiled from Public Record Office London, CUST 3/44-5. For the 1780s, 1790s, 1800s, and 1810s our figures come from Mitchell

include what came in as imports, this enables us to estimate that total home "organic" consumption amounted to some £19.150 in c.1700. Between then and the 1740s, prices (that is our 1720s/40s prices once more) were a little higher, and the population had grown by 8.66 per cent. By multiplying as before, therefore, but operating now with our datum of £19.150 as base, we find that, because of the interplay of prices and population growth, home organic consumption has grown by £1.367. Though at this point we must note that money-wages are not brought into our analysis as they were for the 1740s-1780s period, since over the earlier period it was rising money-wages, not prices, that contributed most to rising real-wages: and this, therefore must have been largely redistributive, leaving total demand for the output of the organic economy unchanged (unless lowered, that is, had labour opted for more leisure). Lest it be thought that in this we are coming perilously close to estimating agricultural growth circularly from population growth, as before it must be emphasised that the price-component of our analysis does break this circularity. Admittedly, this is the case of prices that, for our own estimating purposes, have been adjusted (i.e. the 1720s/1740s average), but we have done this to provide a better basis for comparison with the 1780s.

All that now remains, as can be followed through in the upper half now of *Table 2*, is to deduct £0.123 for higher imports (i.e. for imports that did trench on home supplies as already specified in section 1 above), and to add an extra £0.347 for the extra demand generated for agricultural commodities by higher grain exports; an extra £0.297 for the same generated by the wool content of higher wool-textile exports; an extra £0.032 generated by higher linen exports; an extra £0.504 generated by the cotton-silk/inorganic sectors; an extra £0.109 generated by higher

(1962), p. 295 and Schumpeter (1960), Tables IX, XI, XV, XVI and XVIII); figures for the import of provisions, tallow, hides and skins have been compiled from PRO CUST 5/3-5, 11/5-7, 17/8-10, 16-18 and 26-28. Two complications must be mentioned. The import of provisions began during the 1780s when the customs' valuations applied to them reflected prices at that time; accordingly, we have deflated back to 1740s-prices. Similarly, when grain began to be imported, a higher valuation was applied than when it had been exported earlier in the century; accordingly, we have revalued grain imports back to their original export valuations.

poor relief payments; and finally an extra £0.118 generated by higher shipping earnings. Adding all this amounts to a net growth of £2.651, and so yields an estimate of £22.651 as the size of agriculture during the 1740s: this represents a growth of some 13.25 per cent between the 1700s and the 1740s.

From this figure we proceed forward to the 1780s in exactly the same way as we moved forward from the 1700s to the 1740s. On this basis, home "organic" consumption grew some £5.254 by the 1780s, but of this £1.301 was met by higher imports, and £0.637 by the switching (in effect) of the grain exports of the first half of the century into home consumption. (In respect of these grain exports we have excluded the wholly exceptional exports of 1748 and 1749 for much of these could only have come about either by diversion from the home market and/or out of stocks, not current production.) On the credit side, on the other hand, an extra £1.983 comes from the growth of the cotton-silk/inorganic sectors; an extra £0.766 from higher poor relief; and £0.270 from higher shipping earnings. The net effect of all this leaves us with a total growth between the 1740s and the 1780s of some £6.335; this amounts to a growth of some 27.96 per cent since the 1740s, and makes £28.968 the total for home agriculture during the 1780s. Moreover, given the availability of the material, this latter percentage growth is for only four decades, not the five of the earlier period from the 1700s to the 1740s. To make matters comparable we should apply $\frac{4}{5}$ to the 13.25 per cent, and end up with 10.6 per cent (it is on this that the rest of our discussion will be based). And all this over a period when climatic conditions were far less favourable than they had been over the first half of the century. It should also be noted here that the prices of the cheapest years during the 1740s, with the sole exception of wool, were no lower than the cheapest years of the first decade of the century (taking the cheapest years as a crude way of controlling for the varying "bounty of nature").¹² Had growth over the first half of the eighteenth century been as great as has been claimed, then we would have expected 1740s prices to have been significantly lower. There was agricultural growth over this period,

¹² Based on Bowden (1985) who supplies data which are extraordinarily complete.

but it came, as just specified above, from growing grain exports assisted by export bounties, and from growing wool textile exports that boosted home-demand for wool.

Limitations of space preclude any detailed discussion of our estimates for the 1790s, the 1800s and the 1810s (see *Table 4*). The results suggest relative stagnation during the 1790s, but then followed by greater growth than ever before during the 1800s and the 1810s. Over these decades, agriculture was taken to stand at 46.49 and 66.00 per cent higher, respectively, than it had amounted to during the 1740s though it has to be recognized that the further forward we move beyond the 1780s on the basis of 1740s prices and valuations, then the less realistic our estimates become.

8. The supply side

From the supply side there would appear to be a fundamental objection to our estimates thus far – namely the engaging *Farm Production in England 1700-1914*, by M. E. Turner, assisted by M.V. Becket and B. Alford (Oxford University Press, 2001) and which unambiguously appears to demonstrate that productivity, as measured by bushel-yields per acre, remained flat over the course of the century as far as wheat, rye, barley and vetches were concerned. Only oats showed some increase while carcass weights appear to have risen in most (though not all) categories of livestock.¹³

For our own estimates, as set out in *Table 5*, we have turned first to Gregory King's *Natural and Political Observations* of 1696 to establish as our base for c. 1700 the size of the different branches of the agricultural economy.¹⁴ Unfortunately, his estimates for livestock numbers are hopelessly too low, but fortunately an alternative, and more realistic estimate is to be found in the so-called 'Burn's Journal' compiled by King at roughly the same time: it is these estimates that we have employed.¹⁵ (This entails a higher estimate for agriculture – £22.108m – than "of the

¹³ Turner (2001) pp. 129, 131, 152-153, 157-158, 163-165, 166-169, 171.

¹⁴ King in Thirsk and Cooper (1972), pp.782-4

¹⁵ King in Thirsk and Cooper (1972), p. 767, n.5

order of £20.00m" we adopted for the demand-side analysis. Quite simply, when working on the latter, King's alternative statistics for livestock numbers had just not been taken on board.) Other problems are: while we can tell from King how much barley went as malting barley to be brewed into beer (much the greater part) as against what entered human and animal consumption, with rye we have no basis for distinguishing between these two, beyond knowing that over the century the consumption of wheaten bread grew steadily at the expense of rye bread.⁶ The case is similar with oats: we have simply had to assume that half entered human consumption, leaving the rest to go either as provender for horse or to provide straw-feed for cattle overwintering in byres. (As with rye, the oats fed to livestock forms an intermediate goods and so should only be accounted for as embodied in livestock: to do otherwise would be to double count). Finally, where King supplies an estimate of one million pounds for "hemp, flax, saffron, dying weeds etc", we have had to assume that hemp and flax accounted for two-thirds of this.

For the growth rates we have to admit immediately that no estimate is possible either for wheat or rye throughout, nor for swine over the first half of the century and after the 1780s. (As with cattle and sheep, Turner *et al*'s data, not their fault, are just not internally consistent, periods of higher carcass weights being followed by periods of much lower weights which is inherently implausible.) But we do include these in parentheses in *Table 5*, and as also in our totals: this way we can at least get some notion of the size of the problem (not as great, perhaps, as we might think). For the rest our techniques vary. Thus for oats throughout, and for swine between the 1740s and the 1780s, we have taken Turner *et al*'s estimate of higher yields per acre for oats, and of higher carcass weights for swine. But it is Crafts, once more, who is the major source, though taking this time his growth estimates for the "organic" industries – namely, brewing, leather, linen and wool textiles.⁷ Now with these we reasoned as follows: as value-added in brewing grew, then by the same rate so

⁶ Orbell in Feinstein (1998), p143.

⁷ Crafts (1985), p.23

must the barley input have grown; the same with linen and its linen yarn (flax and hemp) input. More extendedly: the more that value-added in the wool textile industry grew, then by the same rate so must not only the wool input have grown (more sheep and/or heavier fleeces) but so also sheep numbers and/or heavier carcass weights that increased mutton supplies. Whilst most extendedly of all: the more that value-added in the leather industry grew, then by the same rate so must not only the input of hides and skins have grown, but so also the number/carcass weight of beasts, and hence higher supplies not only of beef, but also dairy products. All that then remains is to subtract what came in as imports.

There is only one of Crafts' estimates that we cannot accept – namely his estimate that the wool textile industry was growing at a compounding rate of 0.97 per cent per annum over the years 1700-1760. One minor point is that we have preferred Deane's own summary of her results (the source of Crafts' estimates) where this rate is put at 0.80 per cent per annum.⁴⁸ Even so, at least until 1740, even this estimate is impossibly high. For domestically the wool textile industry was a long-established, mature industry for which in pre-industrial terms, and in the absence of much population growth, a compounding rate of 0.80 per cent per annum would have been an impossibility. The wool content of woollen textile exports did grow at precisely this rate,⁴⁹ but it is inherently implausible that these two rates should have been the same, given that export growth was starting from a much lower base. (The case of the home linen industry is the same: it too grew precipitously, but again from a lower base.) Fortunately, Crafts' growth estimate for the leather industry over this period, standing at 0.25 per cent per annum, offers a means of escape. Boots and shoes were made out of leather, and the demand for these must have been closely related to the market for apparel (with wool textiles predominating) more generally. Combining this rate with the export rate on a weighted basis yields a rate of 0.45 per cent per annum until 1740. For the two subsequent decades we have applied the 0.80 rate, given renewed population growth and buoyant trade, plus the

⁴⁸ Deane and Cole (1964), p. 68.

⁴⁹ See *Table 2*.

dissemination of the flying shuttle in weaving from the late 1730s onwards. (Our uncertainty about these rates plus the heroic character of King's livestock estimates means that our supply side estimates are far less certain than on the demand side).

The results are set out in *Table 5* in parallel with the demand-side estimates, while now we see that it has been possible this time to start with the 1710s to supply us with four decades on either side of the 1740s (and not the five to four of our demand-side estimates). The results would appear to indicate a somewhat lower growth between the 1740s and the 1780s (21.01 per cent) than suggested by the demand-side approach (27.96 per cent), but better than this we have no right to expect, whilst what matters is that growth estimated from the supply-side is certainly greater after 1740 than before.

9. Conclusion

What to conclude rather depends on the view we take of conjectures. In the present instance, it is not just a case of basing conclusions on data that are insufficient, but also on procedures that are inherently uncertain. Estimates of value-added and growth-rates can be no more than heroic "best" 'guesstimates'. Small differences in the multipliers applied in the demand-side analysis can have large aggregate effects just as on the supply-side but small errors in the compounding growth rates also have very large aggregate effects when projected back or forward over any appreciable span of time. Nonetheless, thanks to the consistency of our procedures and the manner in which we have consistently applied them, our efforts do possess a certain legitimacy. What we have done, in fact, is to set up a controlled conjectural test for the internal consistency of present-day conclusions (about agricultural growth) in the light of present-day 'best' guesses about growth in the economy as a whole. And we find that matters are not consistent, and particularly so with reference to Crafts' sectoral growth rates. Further, it would appear very difficult to squeeze out more growth for the period from the 1700s to the 1740s, just as it would take very large downward revisions indeed to squeeze down

the higher growth that seems apparent for the period from the 1740s to the 1780s. We can be certain, therefore, that, at the very least, agricultural growth proceeded steadily over the whole of the eighteenth century, and that very probably, at least until the 1790s, and *pace* Crafts, Jackson and Allen, the pace quickened over the second half of the century. Our 27.96 per cent (demand side) and 21.01 per cent (supply side) estimated growth between the 1740s and 1780s, after all, is more than double our estimated 10.60/11.34 per cent growth over the preceding period. Thereafter, over the 1800s and the 1810s, growth appears to move up to an altogether higher plane.

Two observations arise from this. First, if the chronology for the eighteenth century is accepted, then attention is focused back on a question rather neglected of late. England's Industrial Revolution was achieved spontaneously (i.e. there were no 'guiding hands' at work save Smith's 'invisible hand'.) Hence, for Habakkuk (1955-6), Deane & Cole (1964) chapter 2 section 5, M.W. Flinn (1966) and J.D. Chambers (1972), this spontaneity, at least implicitly, raised an important question: for by what dynamic sequences were the actions of a whole host of otherwise independent economic agents concerted to achieve what was achieved? Now if agriculture grew more rapidly over the second half of the eighteenth century, we could then say that population growth communicated a set of price signals that were far more conducive for growth than in the earlier period. The conundrum for England's agriculture at this time, non-mechanised and lacking automotive power (and as indeed for all pre-industrial agricultures of this character), was of being capable of producing more with the same labour force, but not the same with a smaller labour force (short of land going out of production, that is, but this appears not to have happened). Now, once any agricultural innovations – those of the seventeenth century in particular – had been achieved, the labour involved in achieving them would then certainly have been freed for other things, and particularly so over the second half of the seventeenth century.

Now, this latter period (1650s to c.1700) possesses three interesting aspects, and this at a time when no 'cost-push' inflation is present to complicate our analysis of prices. Firstly (1), it was over these years

that the real-wages of waged-labour recovered, its consumption index having fallen to some 75 (or by 25.00 per cent) between the 1560s and the 1650s. Hence, taking waged-labour's roughly one-third share⁵⁰ of national income in relation to an agricultural sector of some £20.00m, or so, implies an increased consumption (and hence of output) of some 9 per cent, and since much the greater part of this was down to falling prices rather than increases in money wages,⁵¹ this growth, *pace* the period from the 1700s to the 1740s, must have been actual, and not merely redistributinal. The second point of interest is that (2): comparing prices in the 1650s with their average over the 1670s and 1680s, we find that the prices of grains, field crops, dairy products, mutton and wool fell by a weighted average of some 16.72 per cent (or down to an index of 83), thus implying a consumption growth of some 20.00 per cent (i.e., $100/83 = 120.0$).⁵² Then finally (3): it was between the 1650s and c.1700 that beef and pork prices 'crossed-over' when, on a weighted basis between them, their prices rose by some 12.18 per cent while all other prices were falling by some 16.72 per cent, as just noted. (In harmony with this, cattle and pig prices rose, sheep prices stagnated.) Clearly, what was happening was that more and more resources went into beef and pork production now that the fall in the prices of grains, field crops, dairying, mutton and wool enabled consumers to buy more beef and pork. Accordingly, with the price of real resources falling by 16.72 per cent (i.e. down to 83), and with the price of beef and pork rising by 12.18 per cent, then $112/83$ gives us an estimate of some 35 per cent for how much these two sectors were absorbing real resources and thus growing over these years. Weighting all this according to King's estimates we used in the supply-side of our analysis leaves us with a measure of some 23.50 per cent for the growth of agriculture 1650s-c.1700, as implied by price movements. Adding to this some 5 per cent that can be estimated to have come from shipping and trade, and from the cotton-silk/inorganic

⁵⁰ Taking in King's estimates for "Labouring People and Outservants" plus "Artisans and Handicrafts" in Thirsk and Cooper (1972), p.780.

⁵¹ Wrigley and Schofield (1981), p. 640; Overton (1996), p.64.

⁵² For this analysis we are again using Bowden (1985) especially Tables XXIII and XXVII

sector⁵³ and we end up with an estimated overall growth of some 28.53 per cent, or by fully 40 per cent of what this percentage implies for the size of the agricultural sector c. 1650/60. Now, we have to allow that our estimate must be somewhat too high, since it has not been possible this time to substitute wool textile prices for wool and beer prices for barley (labour costs in their secondary "finishing" now not falling as much as primary input prices where from the 1740s to the 1780s and beyond, the reverse had held). Quite simply we lack data for the 1650s.

Nonetheless, growth must have been substantial and achieved by the 1680s, which makes the period 1650s-1680's one of very significant growth indeed. The fruits of the important agricultural innovations of the seventeenth century were clearly coming on stream. At the same time the growth of London was a major stimulus. However, by about 1700, all this was at an end, though the "London" factor is unclear, the (flawed) demographic data suggesting stagnation where coal imports suggest continued growth.⁵⁴ In fact, beef and pork prices appear to have continued their rise during the 1710s, but this impression rests solely on the record prices of the near-disaster year for beef and pork over the harvest year 1710-11. By c.1700, therefore, it appears that returns from the agricultural innovation of the seventeenth century were at an end. But if so, that release of labour posited once innovations had been achieved could have been no more than a one-off phenomenon; thereafter, agriculture could not release labour, or at least other than by that steady, but slow economizing of labour as farms tended to get larger. Beyond a certain point, after all, and in the absence of population growth, all that (a non-mechanised, non-automotive power) agriculture, as the motor of the organic economy, could do was to innovate itself into a slump, as clearly occurred during the 1730s and 1740s when virtually all agricultural commodity prices either slumped, or where they rose as was the case of hay and straw

⁵³ For trade estimates, D.W. Jones (1988), pp. 314-315; for the cotton-silk/inorganic sector we have projected back the growth rate of 1700-1740s.

⁵⁴ Deane and Cole (1964), pp.101, 103; M.W. Flinn (1984), p. 217 Hatcher (1993) pp41, 501-2

only to increase farming costs. Dairying and beef prices also rose, but this time only because of the rinderpest. From about 1700 onwards, therefore, agriculture was being held back until such time as the population started to grow from the 1740s onwards. And once this happened, prices recovered and agriculture was then able and encouraged to resume applying the innovations of the former century (and especially the switch of worn-out arable land to pasture, the extension of convertible husbandry, and renewed enclosure).⁵⁵ Now most of these were, in fact, land-saving (i.e., raising the productivity of each acre), and not labour-saving. But many of the innovations required extra labour only at what had previously been the slack times of the agricultural year; more horses augmented man-power; the trend towards larger farms and thus the more efficient use of labour accelerated; while the labour-saving resulting from the Rotherham plough, introduced from the 1730s onwards, was considerable. But apart from this latter (relatively cheap), all the rest were such costly investments that they could hardly have been contemplated at times of agricultural stagnation, let alone of slump.

Hence, from the 1750s onwards, the inability of agriculture to release labour was overcome once population growth created the labour force that home agriculture could more or less provide for, but which it could not itself have released. It was around 1700 that agriculture stalled, and not over the 1740s to the 1780s period. But the potential was there by 1700 rather as if, like a car, the economy was in gear, but frustratingly the clutch was still out. (Significantly, removing the 8 per cent population growth that did occur between the 1700s and 1740s more than halves our growth estimate of 10.60 per cent for these years.) Certainly, the agricultural legacy of the seventeenth century cannot be denied: thus, between the 1580s and 1620s (both decades of average prices) a population growth of some 913,843 arising from an initial population of 3,805,851 was accompanied by a fall of some 25 per cent in the real-wages of agricultural and building labourers. Yet between the 1740s and 1780s a population growth of some 1,654,000 arising from an initial

⁵⁵ Overton (1996), pp.121-128, 162-167

population of 5,635,000 was accompanied by a fall of less than four per cent in both cases.⁵⁶

The second, and final, observation that arises from our analysis is conceptual: having undermined that "sectoral" approach that had placed agriculture on the one side, "industry" on the other, suggests that something still remains to be understood about the nature of the "transition" when an economy with one prime mover changed into one with many.

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⁵⁶ The major phases of the movement of real-wages (though the data for agricultural wages are not quite complete), and with each phase presented by discrete linear trend lines, are as follows: first, a trend of falling real-wages from the 1570s onwards, reaching its nadir during the 1610s; second, real-wages bumping along the floor between the 1620s and the 1640s; third, a strong recovery beginning during the 1650s and proceeding down to the 1710s; fourth, a high plateau between the 1720s and the 1780s; and fifth, a fall over the three succeeding decades (though this fall for the building workers was delayed until the first decade of the new century). Now granted this underlying pattern, moving averages should not be employed in presenting the data, for in doing so the 'floor' of the 1620s to 1640s period is converted into a non-existent trough, just as the 'plateau' of the 1720s to 1780s period is converted into a non-existent peak.

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Appendix

The Workings and Measurement
of Pre-Industrial 'Organic' Economies:
Conjectures on English Agrarian Growth c.1660 - c.1820

TABLE 1. The structure and workings of an organic economy (In £'s)			
OUTPUT			
AGRICULTURE	SECONDARY VALUE-ADDED SECTOR	TOTAL PHYSICAL OUTPUT	SERVICES
20,000,000 (Ag)	23,000,000 (SVA)	43,000,000 (Ps0)	7,000,000(SVC)
TOTAL OUTPUT = 50,000,000			
SPENDING			
AGRICULTURAL SECTOR: SPENDING			
9,302,320 Ag (x 1.15) = 10,697,680 SVA = 20,000,000 Ps0 (x 0.14) = 2,800,000 SVC			
SECONDARY VALUE-ADDED SECTOR: SPENDING (1)			
9,302,320 Ag (x 1.15) = 10,697,680 SVA = 20,000,000 Ps0 (x 0.14) = 2,800,000 SVC			
[20,000,000 Ag + 21,395,360 SVA = 41,397,360]			
SECONDARY VALUE-ADDED SECTOR: SPENDING (2)			
1,395,530 Ag (x 1.15) = 1,604,650 SVA = 3,000,000 Ps0 (x 0.14) = 420,000 SVC			
SERVICE SECTOR: SPENDING			
2,800,000 Ps0 + 2,800,000 Ps0 + 420,000 Ps0 = 6,020,000 Ps0			
7,000,000 SVC (x 0.14) = 980,000 SVC			
SPENDING SUMMARY			
	AGRICULTURAL SECTOR	SECONDARY VALUE-ADDED SECTOR	SERVICES
Physical Output	17,200,000	19,780,000	6,020,000
Services	2,800,000	3,220,000	980,000
TOTAL	20,000,000	23,000,000	7,000,000
TOTAL SPENDING = 50,000,000			

TABLE 2. Growth of Agricultural consumption and net-output: 1740s (base) back to c. 1700 and forward from 1740s (base) to 1780s (in £M's)	
POSITION c.1700 (1740s BASE)	
Home Agriculture: £20.000 . Organic Exports: £0.290 (Grain); £0.781 (wool content of wool-textile export). Organic Imports: £0.221 .	
∴ Total Home Organic Consumption = £20.000 + £0.221 - (£0.290 + £0.781) = £19.150 .	
Cotton-silk/inorganic sectors: £4.347	
1740s BACK TO c.1700 (1740s BASE)	
Δ Population: = 108.66	
Prices: 1740s/1700s = 0.986%	
∴ Δ Home Organic Consumption = 0.986 x 108.66 = 107.14; 7.14% x £19.150 = + £1.367	
Δ Organic imports = £0.344 - £0.221	= - £0.123
Δ Organic exports (Grain): £0.637 - £0.290	= + £0.347
Δ Organic exports (Wool content, extra wool-textile export)	= + £0.297
Δ Organic exports (Linens)	= + £0.032
Δ Cotton-silk/inorganic sectors = £5.778 - £4.347 = + £1.441 :	
∴ Δ contribution to demand = £1.441 x 0.35	= + £0.504
Δ Poor relief expenditure, contribution to demand	= + £0.109
Δ Shipping earnings, contribution to demand	= + £0.118
GROWTH = + £2.651 = + 13.25% FROM c.1700s TO 1740s	
TOTAL HOME AGRICULTURE 1740s = £22.651	
THE 1740s FORWARD TO 1780s (1740s BASE)	
Home agriculture: £22.651 . Organic Imports: £0.344	
∴ Total Organic Consumption = £20.517 . Cotton-silk/inorganic sec. = £5.788 .	
Δ Population: 129.36	
Money Wages/prices 1740s to 1780s = 122.851/126.49 = 0.971	
∴ Δ Home Organic Consumption = 0.971 x 129.36 = 125.61; 25.61% x £20.517	
= + £5.254	
Δ Organic imports = £1.645 - £0.344	= - £1.301
Export switch (Grain)	= - £0.637
Δ Linen exports	-
Δ Cotton-silk/inorganic sectors = £16.507 x 0.777 = £12.826 - 5% =	
£12.185 - £5.788 = £6.397	
∴ Δ contribution to demand = £6.397 x 0.31	= + £1.983
D Poor relief expenditure, contribution to demand	= + £0.766
D Shipping earnings, contribution to demand	= + £0.270
GROWTH = + £6.335 = + 27.96% FROM 1740s TO 1780s	
TOTAL HOME AGRICULTURE 1780s = £28.968	

TABLE 3. The cotton-silk/Inorganic sectors (in 000's £ At 1801 Prices)

	c. 1700	1740s	1780s	1790s	1800s	1810s
Cotton	£0.402	£0.743	£5.615	£12.594	£21.185	£34.962
Coal	£0.741	£0.988	£1.730	£2.334	£3.088	£4.008
Iron	£0.564	£0.738	£1.804	£3.067	£6.103	£8.087
Copper	£0.127	£0.166	£0.405	£0.690	£1.373	£1.820
Building	£2.475	£3.241	£6.587	£8.461	£10.346	£13.816
Silk	£1.377	£1.860	£2.025	£2.069	£2.179	£3.295
	£5.686	£7.736	£18.166	£29.215	£44.274	£65.988
At Current Prices (base 1740s)						
Cotton	£0.573	£0.955	£6.457*	£12.594	£16.428	£22.233
Coal	£0.537	£0.704	£1.406	£2.260	£3.753	£5.009
Iron	£0.470	£0.593	£1.340	£2.629	£6.651	£9.029
Copper	£0.106	£0.133	£0.313	£0.614	£1.495	£2.032
Building	£1.997	£2.473	£5.778	£9.641	£15.736	£24.417
Silk	£0.688	£0.930	£1.213	£2.069	£2.179	£3.295
	£4.347	£5.788	£16.507	£29.807	£46.243	£66.015
* For the years 1786-1789 inclusive.						
Sources and methods: see text.						

TABLE 4. Estimated agricultural consumption and net output for 1790s, 1800s and 1810s (base 1740s), in £M's	
THE 1740s	
Home agriculture:	£22.651
Organic Imports:	£0.344
Total organic consumption =	£20.517
Cotton-silk/inorganic sectors:	£5.788
THE 1740s FORWARD TO THE 1790s	
Δ Population =	+ 45.497%
Money wages/prices =	136/164.97 = 0.826
∴ Home organic consumption =	0.826 x 145.497 = 120.122
	20.12% x £20.517 = + £4.128
Δ Organic imports =	£3.122 - £0.344 = - £2.778
Export switch (grain)	= - £0.837
Δ Organic exports (woollens)	= + £0.800
Δ Organic exports (linens)	= + £0.277
Δ Cotton-silk/inorganic sectors =	£29.807 x 0.606 = £18.063 - 10%
	= £16.257 - £5.788 = £10.469 x 0.335 = + £3.507
Δ Poor relief expenditure, contribution to demand	= + £1.050
Δ Shipping earnings, contribution to demand	= + £0.309
Growth =	+ £6.456 = + 28.62%
TOTAL HOME AGRICULTURE 1790s = £29.107	
THE 1740s FORWARD TO 1800s	
Δ Population =	+ 64.471%
Money wages/prices =	199/237.5 = 0.838
∴ Home organic consumption =	0.838 x 164.47 = 137.70
	37.70% x £20.517 = + £7.735
Δ Organic imports =	£4.254 - £0.344 = - £3.910
Export switch (grain)	= - £0.637
Δ Organic exports (woollens)	= + £0.902
Δ Organic exports (linens)	= + £0.220
Δ Cotton-silk/inorganic sectors =	£46.243 x 0.421 = £19.468 - 15%
	= £16.548 - £5.788 = £10.760 x 0.35 = + £3.766
Δ Poor relief expenditure, contribution to demand =	+ £1.129
Δ Shipping earnings, contribution to demand =	+ £1.365
Growth =	+ £10.570 = + 46.49%
TOTAL HOME AGRICULTURE = £33.181	
THE 1740s FORWARD TO 1810s	
Δ Population =	+ 89%
Money wages/prices =	199/244.54 = 0.814
∴ Home organic consumption =	0.814 x 189 = 153.8
	53.8% x £20.517 = + £10.554
Δ Organic imports £4.074 - £0.344	= - £3.730
Export switch (grain)	= - £0.637
Δ Organic exports (woollens)	= + £0.706
Δ Organic exports (linens)	= + £0.204
Δ Cotton-silk/inorganic sectors =	£66.014 x 0.409 = £27.000 - 20%
	= £21.600 - £5.788 = £15.812 x 0.28 = + £3.636
Δ Poor relief expenditure, contribution to demand	= + £2.428
Δ Shipping earnings, contribution to demand	= + £1.756
Growth =	+ £14.917 = + 66.00%
TOTAL HOME AGRICULTURE = £37.568	
Sources and methods: See text	

TABLE 5. English agrarian growth 1710s-1810s: the supply side

	Wheat	Rye	Barley	Oats	Flax & Hemp	Beef	Hides	Dairying	Wool	Mutton	Swine	£Ms	
1700	2.100	1.000	2.275	0.600	0.666	5.700	0.600	2.500	2.000	3.300	1.367	22.108	
	3.100					8.800			5.300				
1710s	(3.100)		2.347	0.609	0.803		9.134		5.665		(1.367)	23.025	
1740s	(3.100)		2.506	0.695	1.236		10.095		6.754		(1.367)	25.753	
1780s	(3.100)		2.931	0.895	1.691		11.935		9.986		1.777	32.315	
1790s	(3.100)		3.305	1.044	1.663		12.918		10.531		(1.777)	34.339	
1800s	(3.100)		3.702	1.222	1.671		13.756		12.083		(1.777)	37.397	
1810s	(3.100)		3.760	1.258	2.217		13.556		14.532		(1.777)	40.199	
Summary: Agrarian Growth (base 1740s) for 1710s, 1740s and 1780s, plus 1790s, 1800s, 1810s													
	Supply Side						Demand Side						
	Base 1740s						Base 1740s						
1710s	23.025 minus Δ organic imports c. 50.000 (?) =						23.020						
1740s	25.753 minus Δ organic imports 123.000 =						25.630 + 11.34 %						+10.60%
1780s	32.315 minus Δ organic imports 1.301.000 =						31.014 + 21.01 %						+27.89%
1790s	34.339 minus Δ organic imports 2.788.000 =						31.610 + 23.33%						+28.62%
1800s	37.397 minus Δ organic imports 3.910.000 =						33.486 + 30.67%						+46.49%
1810s	40.199 minus Δ organic imports 3.730.000 =						36.469 + 42.29%						+66.00%
<i>Source and methods: See Text.</i>													

reviews of books

