



Real wages and the family: Adjusting real wages to changing demography in pre-modern England

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ABSTRACT

This paper uses demographic data drawn from Wrigley et al.'s (1997) family reconstitutions of 26 English parishes to adjust Allen's (2001) real wages to the changing demography of early modern England. Using parity progression ratios (a fertility measure) and age specific mortality for children and parents, model families are predicted in two reference periods 1650–1700 and 1750–1800. These models yield two levels of interesting results. At the individual family level, we can measure how different families' real wages changed over the family life cycle as additional children were born. At the aggregate level, we can predict thousands of families using Monte Carlo simulation, creating a realistic distribution of median family real wages in the economy. There are two main findings. First, pregnancy and lactation do not create cyclical effects in the family's income. Instead, most families' welfare ratios decline steadily across the family life cycle until children begin to leave the household, increasing the welfare ratios. Second, Allen's real wages understate or match the median of the predicted demography-adjusted distributions.

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1. Introduction

The flurry of scholarship in the last decade reconstructing historical real wages around the world has fundamentally changed the way economic historians understand the Great Divergence debate. By comparing nearly identical consumer price baskets and labourers' wages, first Allen and then his collaborators were able to construct comparable real wages for most parts of the world including North America, Latin America, Europe, Africa, India, and China (Allen, 2001; Allen et al., 2011; Allen et al., forthcoming). These papers have generally refuted the California school position that parts of China and India were just as developed as Europe in the eighteenth century. Real wages were quite low around the world from the sixteenth century onwards with notable exceptions in Britain and the Netherlands.

This scholarship has been tremendously helpful in reconstructing the economic history of the world, but in order to make international comparisons, Allen and his co-authors made certain assumptions about family size and composition over time and across countries. Allen based his family size assumptions on an English gardener from Ealing, who had a wife and four small children, described by Sir Frederick Eden in *The State of the Poor* in the 1790s. Therefore, Allen assumed that the average family size and composition around the world was similar and consisted of the equivalent energy needs of three adult males (Allen, 2009, p. 29).

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Humphries has recently criticized Allen's constant family size as being too low for England, thus making his English real wage estimates too high. There is therefore room in the literature for a careful reworking of the relationship between family size and real wages.

In general Allen's family size assumption may be justifiable because of the paucity of detailed demographic information that would allow historians to precisely vary family size over time for many countries. Family size is also difficult to proxy with other demographic variables because it depends not only on fertility measures but also on the mortality of children. However, there is good demographic data for England from which we can attempt to understand how changing family size influenced real wages over time. This paper will use demographic data drawn from Wrigley et al.'s (1997) family reconstitutions of 26 English parishes to adjust Allen's real wages to the changing demography of early modern England. Using parity progression ratios (a fertility measure explained later) and age specific mortality for children and parents, model families are predicted for two reference periods, 1650–1700 and 1750–1800. We can then study how the changing size and composition of an individual family affected its 'welfare ratio'¹ over the family life cycle. The welfare ratio is the wage earned by the father divided by the consumption requirements of the family in any given year. In addition, Monte Carlo simulation can be employed to predict thousands of families in each reference period, providing a realistic distribution of welfare ratios based on the different families possible. These distributions can then be compared with Allen's original figures to measure the influence of changing family size and structure on real wages.

2. Previous attempts

There have been two previous attempts to account for family size in real wage calculations. First, in their paper on real wages and the industrious revolution, Allen and Weisdorf (2011) attempted to account for fluctuations in family size by using the net reproduction rate and the dependency ratio of the population to recalculate the size of the household in different years. The net reproduction rate is the average number of daughters surviving to reproductive age that would be born to a female if she conformed to the age-specific fertility and mortality rates throughout her lifetime. The dependency ratio is the number of people aged 15 and under and aged 60 and older divided by the people in the population aged 16–59. To calculate family size from these proxies, Allen and Weisdorf held that family size would be equal to two adults plus the net reproduction rate, and they used the dependency ratio as an index to calculate family size.

Allen and Weisdorf's use of these proxies was a good first attempt to understand the effect of changing family size on household consumption requirements, but it is insufficient for several reasons. First, they did not adjust the net reproduction rate to account for males that might have been born in the household. Two adults plus the net reproduction rate would be the father, mother, and the daughters born to the household but would not include sons. Therefore, a better measure might have been two plus the net reproduction rate times two, assuming that the same number of sons and daughters were born. They also do not allow children at different ages to influence the family's consumption differently. Teens needed many more calories than new-borns, and counting them the same clearly would influence their results. In addition, the dependency ratio is not a very good proxy because it is a measure of the cost of those not of working age on those of working age; it thus spreads the burden of those not working across the entire population instead of measuring the burden of dependents on families in society. These problems clearly limit the usefulness of the adjustment in the Allen–Weisdorf paper.

Humphries (forthcoming, p. 11–14) has also attempted to account for changing family sizes on real wages in her paper criticizing Allen's method. She argued that the Ealing gardener's family was not representative of the English population, where larger family sizes were more common. To support this argument, she presented completed family size and sibling group size figures computed from the Cambridge group reconstitutions, which were much larger than Allen's model family. However, these figures are also problematic. In the context of the Wrigley et al. family reconstitutions, a completed family is one where the mother survived to age 50. Thus, using these figures alone would overestimate family size since many women died before the age of 50. Likewise, with high infant and childhood mortality rates, many children would have died before adding substantially to the household's consumption requirements. Finally, although women may have had many children, it is doubtful that all of them were a burden on the household at the same time because birth spacing was quite wide. Clearly, previous attempts to understand how family size influenced real wages have provided an interesting starting point for discussion, but a more complex method that incorporates both fertility and mortality is necessary to truly understand what the influence might be.

3. Real wages, consumption, and family income

Before describing the predictive model in detail, it is first necessary to describe how family consumption and the family's welfare ratio over the family life cycle has been calculated in this paper. The family's consumption was determined by the number of people needing to be fed, clothed and housed and by the additional consumption requirements of pregnancy and lactation. In order to measure this level of consumption uniformly, it was necessary to convert the consumption of children and adults of both sexes and at different ages into consuming units, the equivalent consumption of an adult male (Allen, 2001; Floud et al., 2011, pp. 43–6). Fortunately, the Food and Agriculture Organization (FAO) has published recommended guidelines of caloric consumption for male and female children and adults, which allow these conversions to be calculated.

I have followed Floud et al.'s (2011, pp. 46, 166) conventions for converting older men and adult women to consuming units. However, Floud et al.'s categorization of children into five-year age groups is too broad to usefully capture the increasing burden of a child on a family as it grows. Therefore, I have used the FAO recommended calorie requirements of male and female children and adolescents, provided in Table 1. These energy requirements are based on the average weight of children at each age and on their

¹ Throughout the paper, real wage will be used to refer to inflation adjusted male wages. Welfare ratio will be used to denote the family size and inflation adjusted male wage, i.e. the purchasing power of a family with certain demographic characteristics.

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