

Malthus Was Right after All: Poor Relief and Birth Rates in Southeastern England

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The payment of child allowances to laborers with large families was widespread in early nineteenth-century England. This paper tests Thomas Malthus's hypothesis that child allowances caused the birth rate to increase. A cross-sectional regression model is estimated to explain variations in birth rates across parishes in 1826-30. Birth rates are found to be related to child allowances, income, and the availability of housing, as Malthus contended. The paper concludes by examining the role played by the adoption of child allowances after 1795 in the fertility increase of the early nineteenth century.

One of the most often heard contemporary criticisms of the Old Poor Law was that the granting of outdoor relief to able-bodied laborers promoted population growth. The aspect of outdoor relief that supposedly had the strongest impact on the rate of population growth was the payment of child allowances to laborers with large families. Like most parts of the traditional critique of the Old Poor Law, the hypothesis that child allowances caused population to increase has been challenged by revisionist historians. In particular, two papers by Huzel (1969, 1980) have led Mokyr (1985a) to conclude that "the demographic argument against [the Poor Law] has been effectively demolished" (p. 11). The judgment is premature. This paper uses

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Huzel's data source to demonstrate that, when other socioeconomic determinants of fertility are accounted for, the payment of child allowances did indeed cause an increase in birth rates. Malthus was right.

The paper will proceed as follows. Section I reviews the historical debate over the role of poor relief in promoting population growth. The administration of child allowance policies and the economic value of child allowances to agricultural laborers are discussed in Section II. A cross-sectional model to explain variations in birth rates across southeastern parishes for 1826-30 is developed in Section III and estimated in Section IV. Some implications for the role played by poor relief in the fertility increase of the early nineteenth century are given in Section V. Section VI presents conclusions.

I. The Historical Debate

Thomas Malthus was by far the most influential contemporary critic of the Old Poor Law. According to him, the Poor Law undermined the "preventive check" to population growth (late marriage and abstention) by artificially reducing the cost of having children. Under the system of child allowances, there was no reason for laborers "to put any sort of restraint upon their inclinations, or exercise any degree of prudence in the affairs of marriage, because the parish is bound to provide for all who are born" ([1872] 1914, 2:66). Indeed, poor relief was administered in such a way as to "afford a direct, constant, and systematic encouragement to marriage" (p. 184). Malthus concluded that, in the long run, the administration of poor relief would create an excess supply of labor and thus, ironically, "increase the poverty and distress of the laboring classes of society" (p. 65).

The 1834 report of the Royal Commission to Investigate the Poor Laws included the Malthusian argument as one of its many criticisms of the administration of outdoor relief. The report maintained that, while the typical unmarried laborer earned a wage close to subsistence, "he has only to marry, and it increases." Moreover, his income increased "on the birth of every child [so that] if his family is numerous, the parish becomes his principal paymaster" (1834, p. 57). Evidence from several parishes was presented to demonstrate that the effect of such allowances was to "encourage early and improvident marriages, with their consequent evils" (pp. 24-31).

Early attempts to empirically test the Malthusian hypothesis reached conflicting conclusions. Griffith (1926) and Blackmore and Mellonie (1927, 1928) found that poor relief had no effect on birth rates over the period 1801-31, while Krause (1958, p. 68) concluded that "the Poor Laws were clearly associated with high fertility" in the

period 1817-21. However, as Huzel (1969, pp. 437-44) has pointed out, the empirical analysis of each of these studies is seriously flawed because (1) they used county-level data, while poor relief was administered by the parish; (2) they somewhat arbitrarily classified counties as either allowance counties or nonallowance counties; and (3) they consisted of simple comparisons of birth rates across allowance and nonallowance counties, ignoring all other socioeconomic determinants of fertility.

The revisionist literature has, until recently, paid little attention to the demographic impact of poor relief. Blaug (1963) quickly disposed of the Malthusian hypothesis in his pathbreaking reinterpretation of the economic impact of the Old Poor Law. While admitting that "most of the Speenhamland counties had fertility ratios above the national average" in the early nineteenth century, he concluded that there was "no persuasive evidence" that outdoor relief caused birth rates to increase (pp. 173-74). On the other hand, he suggested that generous relief might have caused the infant mortality rate to decline (p. 174). Marshall (1968, pp. 38-43) compared county-level data on the administration of poor relief tabulated by Blaug (1964) with rates of population growth and concluded that there was no support for the Malthusian hypothesis. However, his analysis is flawed in ways similar to the earlier papers by Griffith, Blackmore and Mellonie, and Krause.

The latest and most careful empirical analysis of the Malthusian hypothesis was carried out by Huzel (1980). Unlike earlier historians, he used parish-level data to test whether the payment of allowances-in-aid-of-wages or child allowances "led directly to higher birth- and marriage-rates and in turn to population increase" (p. 369).¹ Huzel provided three tests of the Malthusian hypothesis. First, he determined the "impact of the abolition of the allowance system" on birth, marriage, and infant mortality rates for 22 parishes (pp. 369-75). Second, he made a demographic comparison of 11 Kent parishes that paid both allowances-in-aid-of-wages and child allowances with 18 Kent parishes that used neither relief system (pp. 375-78). Finally, he compared demographic indices for 49 Kent parishes divided "into five categories in regard to the payment of child allowances" (pp. 379-80).

Each test yielded the same result. The payment of child allowances and allowances-in-aid-of-wages did not have a significant positive impact on birth or marriage rates or a negative impact on infant mortal-

Allowances-in-aid-of-wages refer to the policy of ensuring workers (whether employed or unemployed) a minimum weekly income, determined by their family size and the price of bread.

ity rates. Indeed, Huzel's results suggest that the Malthusian hypothesis should "be turned on its head"; the allowance system appears to have been associated with relatively low birth and marriage rates and high infant mortality rates (p. 380).

However, there are problems with each of Huzel's tests. The second and third tests, which compare demographic variables across Kent parishes, are open to one of the criticisms used by Huzel against earlier empirical studies, namely, that they consist of simple comparisons of relief policies and birth, marriage, and infant mortality rates, without controlling for other possible determinants of these demographic variables. He has failed to isolate the impact of allowances on birth rates and therefore has not offered a proper test of the Malthusian model.

Huzel's first test gets around this problem to some extent by examining changes in demographic indices within parishes after they abolished the allowance system. However, his finding that birth and marriage rates increased and infant mortality rates decreased in a majority of parishes after abolition raises several questions, none of which Huzel confronts. Why did these parishes abolish allowances to able-bodied laborers? Why did the payment of allowances cause birth and marriage rates to decline?

One possible explanation for Huzel's result is that the parishes stopped paying allowances because they were no longer needed. An increase in nominal wages in agriculture or cottage industry or a decline in food prices might have raised laborers' real incomes by enough to make allowances unnecessary. The increase in real income also would have stimulated marriage rates and birth rates. As before, Huzel's simple comparison of demographic variables with relief policies makes it impossible to determine the cause of the postallowance increase in birth and marriage rates.

II. The Economic Value of Child Allowances

Child allowances were one of the most widespread forms of poor relief granted to able-bodied laborers in the early nineteenth century. Estimates of the extent of child allowance policies can be obtained for 1824 and 1832 from data collected by the Committee on Labourers' Wages and the Royal Poor Law Commission.² Approximately 75 percent of rural parishes granted child allowances in 1824, while only 50

Data for 1824 were obtained from the responses to question 2 of a survey distributed by the Select Committee on Laborers' Wages (Great Britain 1825). Data for 1832 were obtained from the responses to question 24 of the rural queries, distributed by the Royal Poor Law Commission (Great Britain 1834, vol. 31).

percent did so in 1832. Child allowances were particularly widespread in the grain-producing Southeast. More than 90 percent of southeastern parishes used child allowances in 1824, and only 80 percent in 1832.

The administration of child allowance policies differed across parishes. In 1832, 36 percent of southeastern parishes granting child allowances gave relief to families with three children under the age of 10 or 12, 43 percent began relief on the birth of a fourth child, and 21 percent began relief at five or more children. The number of years a laborer received relief depended on the spacing of births as well as the size of his family. If a parish granted relief to laborers with three children under age 10, a laborer with three children born 2 years apart would receive an allowance for 6 years, while a laborer with three children spaced 3 years apart would receive an allowance for 4 years.

The allowance was generally equal to 1.55. per week (£3.9 per year) for each child at and beyond the number at which relief began.³ In other words, a parish that began relief at three children under age 10 would pay 3 $\frac{1}{2}$ s per week to families with four children under age 10 and 4.5s. to families with five children. Annual earnings for an agricultural worker were approximately £28 in 1832; thus a laborer's annual income increased by roughly 14 percent for each child granted an allowance.⁴

The impact of child allowances on fertility depended on the administration of relief and the spacing of births. Suppose that laborers were given a weekly allowance of 1.5s. as long as they had three children under age 10. If births were spaced 2 $\frac{1}{2}$ years apart, a laborer would receive £3.9 a year for 5 years on the birth of a third child. With a 5 percent discount rate, the present value of the child allowance was equal to £17.7, or 63 percent of the annual earnings of an agricultural laborer.⁵ If allowance payments were continued as long as a laborer had three children under age 12, the present value of the child allowance to a laborer with three children spaced 2 $\frac{1}{2}$ years apart

In the counties of Sussex, Kent, Essex, and Norfolk, weekly benefits were equal to 155. in 63 percent of the responding parishes, 15. in 22 percent, and 25. in 11 percent.

Williamson (1982, p. 48) estimated that the average annual earnings of an agricultural laborer were £30 in 1835, assuming that laborers were employed 52 weeks of the year. However, data from the 1832 rural queries suggest that, for England as a whole, the typical agricultural laborer was employed for 48-49 weeks a year. When Williamson's estimate is adjusted to account for unemployment, the average annual earnings of agricultural laborers decline to approximately £28.

³ My choice of a 5 percent discount rate follows Williamson (1985, pp. 36-37). If the discount rate was 0 percent, the present value of the child allowance was £19.5. A discount rate of 10 percent yields a present value of £16.3.

was £23.7, or 85 percent of his annual earnings.⁶ The laborer would receive a similar benefit for each child beyond the third.⁷

The effect of child allowances on birth rates should have been significantly smaller in parishes in which relief began with the birth of a fourth child than in parishes that began relief at three children. Not only did a laborer's family get no allowance on the birth of a third child, but also the duration of allowance payments was shorter if it was necessary to have four children (rather than three) under the age of 10 or 12 in order to collect relief. If weekly allowances were equal to 1.55, the age limit was 10, and births were spaced 2½ years apart, a laborer would receive relief for 2½ years on the birth of a fourth child. The present value of the child allowance was equal to £9.4, or 34 percent of annual earnings.

In parishes in which child allowances were given only to laborers with five children under 10 or 12, a laborer with five children spaced 2½ years apart would not have been eligible for relief if the age limit was 10. If the age limit was 12, he would have received an allowance for 2 years; the present value of the allowance was £7.6. A laborer would receive an allowance for as many as 4 years only if he had five children spaced 2 years apart (or less) and the age limit was 12.

In sum, the effect of child allowances on birth rates should depend on the number of children at which allowances began. Child allowances should have had a strong positive impact on birth rates in parishes in which relief began on the birth of a third (or second) child, a smaller impact on birth rates in parishes in which relief was not obtainable until the birth of a fourth child, and a weak impact in parishes that began relief at five or more children. In the next section, I estimate a cross-section regression in order to test these predictions.

III. An Analysis of the Determinants of Birth Rates

A model to determine the effect of child allowances on birth rates must control for other socioeconomic variables thought to be determinants of fertility. Malthusian models focus on changes in income as the major determinant of movements in both birth rates and death rates. Societies adjust birth rates to changes in income through

The present value of the allowance to a laborer with three children spaced 2 years apart was £26.5. If births were spaced 3 years apart, the present value of the child allowance was £20.8.

If allowances were given to laborers with three children under age 10, a laborer who had four children spaced 2½ years apart would receive a total of £39 in child allowances. The present value of the allowance, measured at the time of birth of the third child, was £33.4, or 119 percent of the laborer's annual earnings.

changes in marital fertility and the age of marriage. Malthusian models are especially useful for the study of preindustrial population movements. For example, Lee (1980, p. 539) found that "both marital fertility and nuptiality were strongly influenced by short-run variations in the real wage" in his study of English demographic trends from 1539 to 1839.

Malthusian models cannot explain the steady decline in fertility rates that occurred along with increasing real wages in late nineteenth-century Europe. According to the "Princeton School" of historical demography, the decline in fertility rates that accompanied industrialization was a result of various social and cultural changes brought about by the process of modernization. The explanatory variables focused on in "transition" models include urbanization, changes in occupational structure, increases in literacy, declining infant mortality rates, and secularization (see, e.g., Lesthaeghe 1977; Teitelbaum 1984).

Economic models of the demographic transition focus on increases in the opportunity cost of mothers' time and the relative pecuniary costs of children, the decline in child labor, and the decline in infant (or child) mortality rates (Schultz 1969; Lindert 1980). Unfortunately, it is difficult to incorporate these hypotheses into an analysis of early nineteenth-century birth rates. There are no good proxies for the opportunity cost of mothers' time. Data on female wage rates exist for only a few parishes, and there are no data on female educational attainment. The existence of cottage industry might be considered a proxy for mothers' opportunity cost, but the fact that cottage industry occurred at home suggests that females' ability to work was not greatly affected by the presence of children.

Similarly, cross-sectional differences in the relative pecuniary costs of children are difficult to measure. Children are food and space intensive, so the demand for children should have been lower in parishes with relatively high food or housing prices, other things equal (Lindert 1980, pp. 53-54). No parish-level price data are available, although the relative price of housing can be proxied by the ratio of families to inhabited houses.

The model developed in this paper includes both Malthusian and demographic transition variables to explain variations in birth rates across parishes. My data set consists of a sample of 214 parishes from 12 counties located in southeastern England.⁸ The sample is not random; all parishes for which data could be obtained were included. I chose to focus on the Southeast because per capita relief expenditures

⁸ T

he counties are Sussex, Kent, Surrey, Essex, Suffolk, Norfolk, Cambridge, Huntingdon, Hertford, Bedford, Buckingham, and Berkshire.

were higher there than in any other region in England throughout the early nineteenth century and because the Royal Poor Law Commission and most critics of the Old Poor Law focused on the region. Moreover, birth rates were higher in the Southeast in 1821 than in any other region except for the industrial counties of Lancashire, Stafford, and the West Riding of Yorkshire.

The data used in the regression analysis were obtained from three sources. Data on the number of births and infant deaths in each parish for the years 1826-30 were obtained from unpublished parish returns for the 1831 census located in the Public Record Office in London.⁹ The published returns for the 1831 census supplied information on population density, the occupational structure of the labor force, and the number of inhabited houses in each parish. The other source of data is the returns to a questionnaire distributed among rural parishes in the summer of 1832 by the Royal Poor Law Commission and printed as appendix B of the 1834 Poor Law Report. The so-called rural queries supplied information on the administration of poor relief, the annual income of agricultural laborers, and the existence of cottage industry and land allotments.

Question 24 of the rural queries asked whether privately employed laborers received regular relief "on their own account, or on that of their families; and if on account of their families, at which number of children does it begin." Thus it is possible to determine not only whether parishes used child allowances but also what family size was necessary to receive allowances. In some cases it is even possible to determine the increase in benefits for each additional child, from question 25. However, not enough parishes answered this question to enable me to include generosity of relief in the regression analysis.

Because the 1831 census does not contain data on age distribution, it was not possible to define the birth rate as the number of births per 1,000 women aged 15-49. Instead, the birth rate is defined as the number of births per 100 families residing in the parish. There are obvious problems with this measure of birth rates. Not all families contain women of childbearing age. One cause of variations in the ratio of births to families could simply be differences in the age distribution of married females. Unfortunately, I cannot test for this possibility.

Differential rates of outmigration also might have caused cross-

The census data are classified as Public Record Office, Home Office 71. This is the same data source used by Huzel (1980). The forms on which the data were returned contain a question asking the clergy to estimate the "average number of baptisms, marriages, and burials unentered [per year] due to nonconformity and other factors" (Huzel 1969, p. 447). This information enables one to correct for the problem of possible underregistration of births.

parish variations in the ratio of births to families. If young unmarried persons who migrated otherwise would have formed separate (*solitaire*) households in the parish, then an increase in the rate of out-migration would reduce the number of households and, by definition, raise birth rates. Under the assumption that outmigration tended to be higher from poor, "unpromising" parishes, there would be a spurious relationship between birth rates and measures of parish prosperity, such as wage rates. In addition, if high outmigration and generous child allowances both were associated with poor parishes, there would be a spurious positive correlation between birth rates and child allowances.¹⁰ However, evidence concerning household arrangements reveals that single unmarried persons seldom formed separate households. Laslett (1972, p. 142) found that only 5.7 percent of the households in 100 English parishes contained one person, and many of these *solitaire* households consisted of widows or widowers. Young unmarried adults lived either at home or in the households of others as servants or lodgers (Smith 1981, pp. 600-604).n Because unmarried adults did not form separate households, differential migration rates did not create a spurious correlation between birth rates and income or child allowances.

The specific model to be estimated is

$$\begin{aligned}
 \text{BIRTHRATE} = & p_0 + p_1 \text{INCOME} + p_2 \text{DENSITY} \\
 & + p_3 \text{HOUSING} + p_4 \text{CHILD3} \\
 & + p_5 \text{CHILD4} + p_6 \text{CHILD5} \\
 & + p_7 \text{ALLOTMENT} + p_8 \text{CINDUSTRY} \\
 & + p_9 \text{INFMORT}.
 \end{aligned} \tag{1}$$

The variables are defined in table 1.

The expected impact of each explanatory variable should be briefly noted. Agricultural laborers' annual wage income is included to test

Rosenzweig and Wolpin (1986, pp. 470-80) showed that studies exploiting the cross-sectional variations in centrally allocated program intensities to evaluate programs . . . will produce misleading conclusions about program effectiveness" if there is a "compensatory pattern of program placement." Child allowance policies were set by the parish rather than a central authority, but it is possible that the generosity of allowances was systematically related to parish prosperity. In fact, the generosity of child allowances was negatively related to the level of agricultural laborers' income (see table 3 below). However, the direction of causality is not obvious. Farmers might have reduced laborers' wages in response to the existence of child allowances (Boyer 1986, pp. 128-30).

According to Wall (1984, p. 463), in the late eighteenth and early nineteenth centuries "marriage entail[ed] for most a new household and determine[d], together with service patterns . . . the number of children who remain[ed] with their parents into their twenties."

TABLE 1
DEFINITIONS OF VARIABLES

BIRTHRATE	Number of births per 100 families in parish
INCOME	Annual income of adult male agricultural laborers
DENSITY	Density of population in parish (population/acre)
INFMORT	Number of deaths of infants aged 0-4 per 100 live births
HOUSING	Ratio of families to inhabited houses in parish
CHILD3	Dummy variable equal to one if parish began child allowance payments at three children
CHILD4	Dummy variable equal to one if parish began child allowance payments at four children
CHILD5	Dummy variable equal to one if parish began child allowance payments at five or more children
ALLOTMENT	Dummy variable equal to one if laborers have allotments of farmland
CINDUSTRY	Dummy variable equal to one if cottage industry exists in the parish
PRCNTAG	Percentage of adult males employed in agriculture
LONDON	Distance from London

the Malthusian hypothesis that, other things equal, an increase in income caused birth rates to increase. Density is a measure of "population pressure"; high population density implies a low land/labor ratio (Mokyr 19856, pp. 45-46). I expect density to have a negative impact on birth rates.¹²

The variables CHILD3 through CHILD5 test Malthus's hypothesis that child allowances had a positive effect on birth rates. Results presented above suggest that the impact of allowances will be positive but should decline in magnitude as the number of children at which relief began increases. It is not possible to determine whether child allowances increased birth rates by raising marital fertility or by lowering the age at marriage. Malthus believed that the impact of child allowances on birth rates occurred mainly through changes in nuptiality (see Sec. I above). His hypothesis is supported by the recent work of the Cambridge Group for the History of Population and Social Structure, which found that "marital fertility . . . shows no evidence of significant fluctuation . . . from the sixteenth to the nineteenth centuries. Nuptiality, in contrast, varied substantially over time" (Wrigley 1983, p. 131).¹³

Malthus also believed that birth rates were affected by the availabil-

Studies of the demographic transition have often found birth rates to be negatively related to the proportion of the work force in agriculture. I have not included the proportion of the work force in agriculture as an explanatory variable because it is highly correlated with density.

From 1775/99 to 1800/1824, the average age at first marriage for females declined from 24.7 to 23.7 years (Wrigley 1981, p. 147).

ity of housing and allotments of land for rural laborers. He claimed that the "principal reason" why poor relief did not cause birth rates to increase "so much as might naturally be expected" was that "the difficulty of procuring habitations" acted as a check to early marriages ([1807] 1970, pp. 39-40). As a test of this hypothesis, I included the ratio of families to inhabited houses as an explanatory variable. A negative coefficient for HOUSING would support Malthus's claim.

Malthus was opposed to the policy of granting allotments to poor able-bodied laborers, adopted by some parishes as a substitute for poor relief. In France and Ireland, the ready availability of small allotments resulted in an increase in population, which was "the specific cause of the poverty and misery of the lower classes" (Malthus 1914, 2:228). Malthus concluded that a policy of guaranteed allotments "would be incomparably more powerful in encouraging a population beyond the demand for labour than our present poor laws" (p. 229). The variable ALLOTMENT is included in the regression to test this hypothesis.

The existence of employment opportunities in cottage industry should have had a positive effect on birth rates. By providing a source of income for females (and for males during slack seasons in agriculture), cottage industry made it easier to begin a household and thus should have caused a reduction in the age of marriage.¹⁴ Cottage industry also provided employment opportunities for children, increasing their economic value to their parents. It should be noted, however, that wage rates in cottage industry were significantly lower in the 1820s than during the eighteenth century, so that the impact of cottage industry on birth rates during 1826-30 might have been relatively small.¹⁵

The infant mortality rate should have a positive effect on the birth rate because a decline in infant mortality reduced the number of births necessary to attain a desired number of surviving children. The infant mortality rate is defined as the number of deaths of children aged 0-4 per 100 births. Because the denominator of INFMORT is the numerator of the dependent variable, if the number of births is measured with error there will be a spurious negative relationship between the birth rate and the infant mortality rate.¹⁶ The obvious way to correct the problem is to instrument infant mortality by some measure of female education or health conditions in the parish, but

Braun (1978) and Almquist (1979) found that cottage industry caused a reduction in females' age at marriage. However, Mokyr (1985b) concluded that the "female propensity to marry" was unaffected by cottage industry.

For more information on the decline of cottage industry in the Southeast, see Pinchbeck (1981, pp. 142-47, 156, 208, 221, 224-25) and Boyer (1985, pp. 140-44).

I thank the editor for pointing out this possibility.

no suitable instruments could be obtained at the parish level of observation. However, if one is willing to assume that the measurement error in number of births is multiplicative, the estimating equation can be rewritten in such a way as to solve the problem. Rewrite equation (1) as

$$\frac{1}{\sigma_g} \frac{\partial \text{BIRTHS} \times e}{\partial \text{FAM}} = \frac{Q_{\text{PAUL}}^{\alpha_1} + Q_{\text{MPI}}^{\alpha_2}}{I^{\alpha_3}} \frac{\partial \text{IDEATHS}}{\partial \text{BIRTHS} \times e} + p_2 \log(X) + u,$$

where e is the measurement error associated with births, FAM is the number of families in the parish, IDEATHS is the number of infant deaths, and Prefers to the other right-hand-side variables. I assume that $\log(e)$ has a mean of zero and that e is uncorrected with the other variables. This equation can in turn be rewritten as

$$\begin{aligned} \log(\text{BIRTHS}) &= -p^{\alpha_1} - \dots - p_j^{\alpha_j} \log(\text{FAM}) \\ &\quad + p^{\alpha_{j+1}} \log(\text{IDEATHS}) \quad (2) \\ &\quad \frac{1}{1 + P_i} \log(X) + [u - \log(e)]. \end{aligned}$$

Equation (2) can be estimated using nonlinear least squares. One can thereby directly estimate p_1 which represents an unbiased estimate of the effect of infant mortality on the birth rate. Note that there is a testable overidentifying restriction in equation (2): the coefficients on $\log(\text{FAM})$ and $\log(\text{IDEATHS})$ are different functions of the same parameter, namely P_j . The restriction can be tested with a standard F-test (Gallant 1987, p. 56).

It is possible that infant mortality was endogenous. Evidence that "probabilities of survival are poorer for births to older women and women of higher parities" (Brass and Barrett 1978, p. 210) suggests that the birth rate had a positive effect on the infant mortality rate. If in addition infant mortality was negatively related to income and child allowances, as one might expect, then assuming that infant mortality was exogenous would lead to an underestimate of the effect of income and child allowances on birth rates. Unfortunately, the lack of instruments for infant mortality mentioned above precludes testing whether infant mortality was endogenous.

IV. Regression Results

The results obtained from estimating equations (1) and (2) are given in table 2. The value of the F-test statistic implies that the overiden-

TABLE 2
DETERMINANTS OF BIRTH RATES

	ORDINARY LEAST SQUARES DOUBLE-LOG SPECIFICATION			NONLINEAR LEAST SQUARES		
	P	t Statistic	Prob > $ t $	P	t Statistic	Prob > hi
CONSTANT	1.12	2.06	.041	-2.81	4.28	.0001
INCOME	.45	2.95	.004	.44	2.40	.017
DENSITY	-.09	2.70	.007	-.10	2.52	.013
INFMORT	-.06	1.17	.242	.38	5.82	.0001
CHILD3	.13	2.24	.026	.25	3.67	.0003
CHILD4	.11	2.15	.033	.17	2.64	.009
CHILD5	.09	1.50	.124	.17	2.25	.025
HOUSINC	-.19	1.62	.106	-.28	1.94	.054
ALLOTMENT	.001	.03	.981	.01	.21	.838
CINDUSTRY	.04	.76	.446	-.06	.91	.364
tf		.124				
Number of observations	214			214		

tifying restriction in equation (2) cannot be rejected at the 5 percent confidence level.¹⁷ The major difference between the two regressions lies in the behavior of infant mortality. The coefficient of INFMORT is negative, although not significant, in equation (1) and positive and significantly different from zero in equation (2). This result suggests that there may be a spurious negative relationship between the birth rate and the infant mortality rate due to measurement error, as discussed above. The results for the other variables are qualitatively similar between the two regressions. Therefore, I will focus on equation (2) in my discussion of the results.

The provision of child allowances had a positive effect on birth rates, suggesting that parents did indeed take economic factors into account when making decisions concerning family size. The quantitative impact of child allowances is large. Parishes that began allowances at three children experienced birth rates 25 percent greater than those of parishes without allowances, other things equal. The impact of allowances was smaller in parishes that began relief at four or more children. Birth rates were 17 percent higher in parishes that began relief at four children than in parishes without child allowances. Surprisingly, the effect of child allowances was as large in parishes that began allowances at five (or more) children as in parishes that began allowances at four children.

¹⁷ The value of the F-statistic is 3.625, while the 5 percent critical value for $F(4, 200)$ is 3.89.

The large impact of allowances that began at five or more children is difficult to reconcile with the analysis in Section II. Two possible explanations for the result come to mind. First, the age of children at which relief stopped might have been positively correlated with the number of children at which relief began. Parishes that began allowances at five children might have continued relief as long as the eldest child remained under age 13 or 14 rather than 10 or 12. Second, the average spacing of births could have been affected by the administration of child allowances. In order to obtain relief for longer periods, families might have reduced birth intervals, perhaps by a reduction in the length of time children were breast-fed.¹⁸ Unfortunately, data do not exist to test either of these hypotheses.

Three other Malthusian hypotheses are supported by the data. First, agricultural laborers' annual income had a positive effect on fertility: birth rates increased by 4.4 percent in response to a 10 percent increase in income, other things equal. Second, birth rates were checked by the unavailability of housing. A 10 percent increase in the ratio of families to inhabited houses resulted in a 2.8 percent decline in the birth rate.¹⁹ Third, density had a negative impact on birth rates: a 10 percent increase in density resulted in a 1.0 percent decline in the birth rate.

There is no support for Malthus's contention that birth rates increased in response to the availability of allotments. However, it should be pointed out that Malthus's comments concerning the impact of allotments were directed against Arthur Young's (1800, p. 77) plan to grant each rural laborer with three children "half an acre of land for potatoes; and grass enough to feed one or two cows." Responses from southeastern parishes to the rural queries suggest that the typical laborer's allotment was smaller than a quarter acre. Thus one could argue that allotments were simply too small to have a significant impact on birth rates.

Cottage industry did not have a significant effect on birth rates. It was mentioned above that wage rates in cottage industry had been declining since the late eighteenth century. The insignificance of CINDUSTRY suggests that the employment opportunities in cottage

Evidence from nineteenth-century Europe and currently developing countries shows that "the practice of nursing increases the length of [birth] intervals by an estimated 15-33 percent" (Van Ginneken 1974, p. 201). Suppose that allowances were given to families with five children under age 12. A reduction in birth intervals from 30 to 21 months would increase the present value of an allowance to a laborer with five children from £7.6 to £17.7.

This result can also be interpreted as support for Linden's (1980) hypothesis that the demand for children is negatively related to the price of housing since children are a space-intensive commodity.

industry available to children were too small by the late 1820s to affect parents' decisions concerning family size.

Up to this point I have ignored an important question (as did Malthus): Why did some parishes adopt child allowance policies while others did not, and why did the generosity of relief differ across parishes granting allowances? In particular, was the adoption of child allowances an endogenous response to changing demographic patterns? It is possible that Malthus had the causation backward, that child allowances were a response to high birth rates.

The hypothesis that child allowances were not exogenous in the model above can be tested using a technique developed by Durbin and Wu (Nakamura and Nakamura 1981). The test consists of two parts. First, a model is estimated to explain cross-parish variations in child allowance policies, using as right-hand-side variables all the other explanatory variables from the model above plus one or more instruments. The model to explain birth rates is then reestimated with the predicted values for child allowances, CALLOWHAT (obtained from the previous regression), included as a right-hand-side variable along with the original child allowance variable. If the coefficient of CALLOWHAT is significantly different from zero, then the null hypothesis that child allowance policy is exogenous is rejected.

It is useful to combine the child allowance dummies into one variable in order to perform the Durbin-Wu test. The variable CALLOW is equal to 0 if the parish did not use child allowances, 1 if allowances began at five or more children, 2 if allowances began at four children, and 3 if allowances began at three children. I used the proportion of the work force in agriculture and the parish's distance from London as instruments. The demand for child allowances should be positively related to the proportion of the work force in agriculture because of the seasonality of demand for labor in grain production. Distance from London is a proxy for cost of migration. As distance from London increased, the cost to farmers of maintaining an adequate peak season labor force declined (Boyer 1986, pp. 125, 130). Thus parishes' willingness to supply child allowances should be negatively related to distance from London.

The results of the test are given in table 3. Columns 1-3 contain the estimated equation to explain variations in child allowance policies across parishes. The instruments behave as expected, although the coefficient of LONDON is not significantly different from zero. The original regression to explain variations in birth rates is given in columns 4-6, while the regression including the predicted values for child allowances is given in columns 7-9. The coefficient of CALLOWHAT is not significantly different from zero, and its inclusion in

TABLE 3
TEST FOR EXOGENEITY OF CHILD ALLOWANCES

	DEPENDENT VARIABLE			DEPENDENT VARIABLE: BIRTH RATE			DEPENDENT VARIABLE: BIRTH RATE		
	CHILD ALLOWANCE								
	<i>a</i>	<i>t</i> Statistic	Prob > hi	P	<i>t</i> Statistic	Prob > <i>l/l</i>	P (V)	<i>t</i> Statistic	Prob > <i>III</i>
	(1)	(2)	(3)	(4)	(5)	(6)		(8)	(9)
CONSTANT	8.26	3.67	.0003		1.19	2.22	.028	.99	1.33
INCOME	-1.09	1.88	.062		.43	2.87	.005	.47	2.64
DENSITY	-.05	.30	.766		-.09	2.75	.007	.08	2.19
INFMORT	-.58	3.48	.001		-.05	1.20	.231	.04	.62
HOUSING	.53	1.16	.248		-.19	1.61	.110	.20	1.64
ALLOTMENT	-.19	1.26	.208		-.001	.02	.982	.003	.07
CINDUSTRY	.06	.30	.767		.04	.79	.430	.04	.78
PRCNTAG	.86	3.05	.003						
LONDON	-.21	1.13	.262						
CALLOW					.04	2.20	.029	.04	2.06
CALLOWHAT								.03	.38
<i>R</i> ²		.134			.119			.119	
Number of observations		214			214			214	

the model has no effect on the coefficient of CALLOW. Child allowance policy is exogenous, as Malthus, and I, assumed.²⁰

V. Implications for the Long-Term Increase in Birth Rates

Fertility increased sharply in England during the early nineteenth century. The crude birth rate (CBR) for the years 1799/1803-1829/33 was 10.8 percent higher than in 1749/53-1789/93 (Wrigley and Schofield 1981, p. 529). The fertility increase occurred even though real wages of blue-collar workers remained roughly stable during 1755-1819 (Lindert and Williamson 1983, p. 13). Moreover, employment opportunities in cottage industry and the availability of allotments for rural laborers declined throughout the period 1760-1830 (Boyer 1985, pp. 133-44).

The results above suggest that the early nineteenth-century increase in fertility was partly a result of the increased generosity of poor relief and, in particular, the widespread adoption of child allowance policies. The overall impact of child allowances on birth rates can be estimated using the regression coefficients for CHILD3 through CHILD5 from table 2 and data on the administration of child allowances from the 1832 rural queries. Specifically, the increase in the birth rate is given by

$$\text{ABIRTHRATE} = \sum_i \left(a_i [M^o] + MM + P * fo + pMl \right)$$

where i refers to region; a_i is the proportion of England's population contained in region i ; p_{jy} , p_2 , and $p\$$ are the proportion of parishes beginning allowances at three, four, and five or more children; p_y is the proportion of parishes without child allowances; and b_1 , b_2 , and $b\$$ give the percentage increase in the birth rate resulting from allowances beginning at three, four, and five or more children.²¹ The model suggests that the birth rate in 1832 was 8.7 percent higher than it would have been without child allowances.

The Durbin-Wu test was also performed with the unemployment rate included as an additional instrument in the equation to explain cross-parish differences in child allowance policies. The demand for child allowances should be positively related to the unemployment rate. Unemployment data were obtained from question 6 of the 1832 rural queries. Unfortunately, they were available for only 165 of the 214 parishes included in the sample. The coefficient for unemployment is positive and significantly different from zero at the 2 percent level. However, the addition of the unemployment rate as an instrument does not improve the performance of CALLOWWHAT in the equation to explain variations in birth rates. The coefficient of CALLOWWHAT remains insignificant, and its inclusion has no effect on the coefficient of CALLOW.

I assume that the estimates of $\&i$ through $o3$ obtained from the regression analysis hold for all regions.

The only other source of data on the use of child allowances is an 1824 questionnaire drawn up by the Select Committee on Labourers' Wages. Child allowances were more widespread in 1824 than in 1832 in all regions, but especially in the North, Northwest, and Midlands. Under the assumption that the values of b_1 through b_7 and the relative number of parishes beginning relief at three, four, and five or more children remained constant from 1824 to 1832, the existence of child allowances caused birth rates to increase by 14.2 percent in 1824, other things equal.

What role did child allowances play in the fertility increase of the early nineteenth century? Elasticities obtained from the regression model can be used to estimate what would have happened to birth rates in the absence of child allowances. According to Wrigley and Schofield (1981, p. 529), the CBR increased by 14.4 percent from 1779/83 to 1819/23. Linden's (1983, p. 145) revision of the Wrigley-Schofield data suggests an increase in the CBR of 6.4 percent over this period. Our model's estimate of the change in the CBR is

$$\begin{aligned} \text{ABIRTHRATE} = & \wedge(\text{AINCOME}) + e_2(\text{ADENSITY}) \\ & + \wedge(\text{AHOUSING}) + \wedge(\text{ACHILDALLOW}) \\ & + \wedge(\text{AINFMORT}), \end{aligned}$$

where A represents the percentage change in a variable from 1781 to 1821, e_i is the elasticity of the birth rate with respect to variable i , and $\wedge(\text{ACHILDALLOW})$ represents the overall impact of child allowances on the birth rate. Real wages for blue-collar workers increased by approximately 14 percent, density increased by 63 percent, and infant mortality declined by 9 percent during this period.²² I assume that no child allowances existed in 1779/83, that the impact of child allowances on birth rates in 1819/23 was equal to its estimated impact in 1824, and that the ratio of families to inhabited houses increased by 10-20 percent from 1781 to 1821.²³ Given these assumptions, the

Real wage data were obtained from Lindert and Williamson (1983, p. 7; 1985, p. 148). An estimate of the infant mortality rate in the 1780s was obtained from Wrigley (1977, p. 310). I assume that the infant mortality rate for 1819/23 was equal to the rate for 1839/42, the earliest years for which data are available from the registrar general's office.

According to Ashton (1963, pp. 41-49), there was a serious housing shortage in the years following the Napoleonic wars. Rapid population growth and urbanization during the previous decades had resulted in a large increase in the demand for housing, while the rate of construction of new houses had been slowed down by "a quarter of a century of war" and by the inordinately high level of building costs in the 1820s. The evidence presented by Ashton suggests that the ratio of families to inhabited houses increased sharply from 1779/83 to 1819/23.

model estimates that the CBR increased by 5.0-7.8 percent from 1779/83 to 1819/23. If child allowance policies had not been adopted, the model predicts that the CBR would have declined by 6.4-9.2 percent, other things equal.²⁴

Thus if the Wrigley-Schofield numbers are correct, the adoption of child allowance policies after 1795 accounts for 60.2-68.3 percent of the gap between the actual change in birth rates and the model's predicted change (assuming child allowances were not adopted). If Linden's estimates are correct, child allowances account for 91.0-110.9 percent of the gap. The conclusion to be reached is clear: whether one believes Wrigley and Schofield or Lindert, the early nineteenth-century increase in birth rates cannot be understood without taking child allowance policies into account.

VI. Concluding Comments

There are two important conclusions to be drawn from this paper. First, Malthus's hypothesis that the use of child allowances had a positive impact on birth rates is correct. This result runs strongly counter to Huzel's conclusion that "the Malthusian proposition should ... be turned on its head." Huzel based his conclusion on simple comparisons of birth rates and child allowance policies, without controlling for other determinants of fertility. But the regression analysis has shown that income, infant mortality, crowding, and density had a statistically significant impact on birth rates and thus that Huzel's empirical work does not yield an accurate measure of the effects of child allowances.

Second, the widespread adoption of child allowances after 1795 appears to have been a major cause of the increase in birth rates during the first two decades of the nineteenth century. The seeming anomaly of increasing birth rates during a period of stable or falling real income largely disappears when Poor Law policy is brought into the analysis.

The estimates above do not take account of another possible effect of child allowances on the labor market. Farmers might have responded to the existence of child allowances by reducing their wage payments to laborers to a level just high enough to support a family of two or three children. In a recent paper (Boyer 1986, p. 128), I determined that the existence of child allowances caused a reduction of £1.28 in agricultural laborers' annual income. Given my estimate that 73 percent of English parishes used child allowances in 1824, the typical laborer's income would have increased by £0.93 in the absence of child allowances. According to the model, the increase in income would have resulted in a 0.6 percent increase in the CBR. With the inclusion of allowances' impact on income, the model predicts that the CBR would have declined by 5.8-8.6 percent from 1779/83 to 1819/23 in the absence of child allowances.

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