

Population and economic growth: Ancient and modern

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1. Introduction

The New Economic Growth Theory, whose goal is to endogenously explain long-run economic growth, has put an emphasis on demographic factors as an essential element in explaining the dynamics of growth. While in the work of Solow the focus was on the impact of capital on the development of the economy, the New Growth Theory has put back into focus population size, and, especially, the relationship between family size and formation of human capital. More specifically, the Unified Growth Theory has shown that the social and economic dynamics of transformation from an old economic regime (with no growth per capita) to a new economic regime (with a steady growth rate of income per capita) are due to endogenous changes in population growth and the formation of human capital, and, more specifically, due to the trade-off between the quality and quantity of children.¹

Now, in his seminal paper on capital controversies from Ricardo–Malthus to Robinson–Solow, Hicks (1974, p. 307) made the cogent point that in order to deal with the issues involved, he had “to take one particular point. . .and to use it as a means of pulling . . .the story together”. His methodological precept is what guides us here.

This paper focuses on the evolution of the relationship between population and economic growth from Hume to the New Growth Theory, with a special emphasis on the approaches of Hume, Malthus, and Marx. In this paper, we show that there were two main views on this subject. There were

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¹ See Galor (2011) which presents the Unified Growth Theory and the *theoretical* trade-off between the quantity and quality of children. Klemp and Weisdorf (2012), among others, for example, are empirically and *not* theoretically based and will not be discussed here.

those who assumed that the relationship between fertility rate and income was positive, that is, an increase in income would lead, *ceteris paribus*, to an increase in fertility rate. On the other hand, there were those who raised the possibility that this does not occur, and they emphasised that an increase in income did not necessarily lead to having more children.

Why were there divergent views on this relationship? This paper will show that their respective positions on this issue were in fact related to another phenomenon: the sibship size effect. We will show that those who took the view that an increase in income leads to the desire to have more children did not take into consideration the sibship size effect, while those maintaining that there existed a negative relationship introduced into their utility function a sibship size effect. Moreover, we will show that this view was also related to the budget constraint the family faced.

Before explaining why these different positions are interrelated, we should explain what the sibship size effect entails. Sibship is a term used in epidemiology and public health to refer to the siblings in a family, and the sibship size effect is the effect of the number of siblings on the health and intellectual development of a child. In the next section, we will present the literature which emphasises the negative effects of the size of the family on the development and human capital of a child.

Why does the existence of a sibship size effect affect the relationship between income and fertility rate? This is exactly what we will deal with in the last section of the paper, where with the help of a simple model, we show that the sign of the relationship between income and fertility rate is influenced by the sibship size effect, and also by intergenerational transfers.

The intuition is as follows: Today, as in the past, scholars argue that the pauperisation of the poor might lead to an increase in the number of children, and this in opposition to what is viewed as the standard model, that is, a decrease in income leads to having a less number of children. The debate is in fact linked to their belief about the utility function.

On one hand, if one believes that many children have negative effects on their siblings and therefore on the utility of parents, then when the family becomes wealthier, it will reduce the number of children. However, when wages go down, then the family needs more income generated from the children by child labour, and then the number of children increases, despite the negative effect on the siblings.

On the other hand, scholars who do not believe that a sibship size effect exists, and think that a larger family does not negatively affect the health of the siblings, believe that when income increases, this will increase the size of the family, since there is no negative effect of the *quantity* of children.

The model presented in the last section presents these arguments in an analytical way showing that the debate over the sign of the correlation between income and size of the family is related to the existence of a sibship size effect. This paper presents past and present views on the issue, and shows that the questions raised today were already raised, and the divergence of views is similar. Moreover, we show that the debate regarding the sign of the relation between income and fertility rate is related to the sibship size effect, which is part of the overall “family structure”.

The paper is divided in five sections. In Section 2, we present data on population and economic growth at the time the *dramatis personae*, whose views we will present, were writing their essays. We should be aware that the data were not available to them. We also introduce the literature on the sibship size effect.

In Section 3, we present the views on population and economic growth of the Mercantilists, Cantillon and Smith, Hume, Malthus, and Marx, but our focus will be on the views from Hume onwards, and this is because Hume was ostensibly the first to explicitly link population to economic activity, specifying an endogenous relationship between them, as emphasised by Rostow (1990, p. 24).

In Section 4, we present a formal model that enables us to differentiate the respective views and put in perspective the relationship between the income–fertility correlation and the existence of a sibship size effect. Section 5 concludes.

2. Data on population, economic growth, and the sibship size effect

2.1. Data on population and economic growth

This paper focuses mainly on the views of Hume, Malthus, and Marx as they relate to population, economic growth, and family structure, and especially on the relationship between these variables. Each of them lived during different periods, and observed different life events, and they were not fully cognizant of the *actual* population data of their respective periods. We therefore present the data as they are known to us nowadays.

Data on world population estimates are presented in [Table 1](#). The data show us that from the time of the Roman Empire to that of Montesquieu and Hume, the population of Western Europe grew from about 17 million to some 68 million. In [Table 2](#), we present data on income and population for the period from the Greeks to Marx.²

² We thank an anonymous referee for reminding us that great caution should be taken in invoking macro-data related to the pre-1600 period.

Table 1 Population of Western Europe, 0–1870 (000)

Year/ Country	0	1000	1500	1600	1700	1820	1870
Austria	500	700	2,000	2,500	2,500	3,369	4,520
Belgium	300	400	1,400	1,600	2,000	3,434	5,096
Denmark	180	360	600	650	700	1,155	1,888
Finland	20	40	300	400	400	1,169	1,754
France	5,000	6,500	15,000	18,500	21,471	31,246	38,440
Germany	3,000	3,500	12,000	16,000	15,000	24,905	39,231
Italy	7,000	5,000	10,500	13,100	13,300	20,176	27,888
Netherlands	200	300	950	1,500	1,900	2,355	3,615
Norway	100	200	300	400	500	970	1,735
Sweden	200	400	550	760	1,260	2,585	4,164
Switzerland	300	300	650	1,000	1,200	1,829	2,664
United Kingdom	800	2,000	3,942	6,170	8,565	21,226	31,393
<i>12 countries' total</i>	<i>17,600</i>	<i>19,700</i>	<i>48,192</i>	<i>62,580</i>	<i>68,796</i>	<i>114,419</i>	<i>162,388</i>
Portugal	500	600	1,000	1,100	2,000	3,297	4,353
Spain	4,500	4,000	6,800	8,240	8,770	12,203	16,201
Other	2,100	1,113	1,276	1,858	1,894	2,969	4,590
<i>Total Western Europe</i>	<i>24,700</i>	<i>25,413</i>	<i>57,268</i>	<i>73,778</i>	<i>81,460</i>	<i>132,888</i>	<i>187,532</i>

Source: Maddison (2001, p. 241).

As the knowledge of *actual* population magnitudes was non-existent, it is not surprising that there was a debate as to whether it increased or decreased. It is interesting to note that Hume intuitively assumed the correct direction of its development. Moreover, there was an ongoing, albeit unresolved debate between supporters of Malthus and those of Marx on the population in the nineteenth century (Petersen 1979; Charbit 2009).³

What is striking is that between the time of Hume and Marx, the population of the Western world almost *doubled* and that in the UK even increased threefold (from some 8.5 million to 21.2 million). This may explain why, from Hume onwards, the population growth had to be considered when analysing factors affecting economic growth, while it was not considered important before him. Indeed, Hume had the intuition that this element

³ There have also been variant interpretations of the population history of the UK and the hypothesis linking means of production with attitudes to reproduction (Laslett, 1969; Smith, 1981; Wrigley and Schofield, 1981). Indeed, the Malthusian demographic system was, according to Smith (1981, p. 615), “most likely in existence” when More’s *Utopia* [1516], as well as *Das Kapital* [1867], appeared.

Table 2 British GDP, population and GDP per capita, 1500–1920

Year	United Kingdom	England, Wales and Scotland	Ireland	Scotland	England and Wales
GDP (million 1990 Geary-Khamis dollars)					
1500	2,815	2,394	421	298	2,096
1600	6,007	5,392	615	566	4,826
1700	10,709	9,332	1,377	1,136	8,196
1801	25,426	21,060	4,366	2,445	18,615
1820	36,232	30,001	6,231		
1870	100,179	90,560	9,619		
1913	224,618	212,727	11,891		
1920	212,938	201,860	11,078		
Population ('000)					
1500	3,942	3,142	800	500	2,642
1600	6,170	5,170	1,000	700	4,470
1700	8,565	6,640	1,925	1,036	5,604
1801	16,103	10,902	5,201	1,625	9,277
1820	21,226	14,142	7,084	2,071	12,071
1870	31,393	25,974	5,419	3,337	22,637
1913	45,649	41,303	4,346	4,728	36,575
1920	46,821	42,460	4,361	4,864	37,596
Per capita GDP (1990 Geary-Khamis dollars)					
1500	714	762	526	596	793
1600	974	1,043	615	809	1,080
1700	1,250	1,405	715	1,096	1,463
1801	1,579	1,931	839	1,505	2,006
1820	1,707	2,121	880		
1870	3,191	3,487	1,775		
1913	4,921	5,150	2,736		
1920	4,568	4,754	2,540		

Source: Maddison (2001, p. 247).

was playing a substantial role in the dynamics of economic growth, as we will see in the next section, in which we present the different viewpoints.

2.2. The theory of sibship size effect

The standard economic model of population introduces the number of children as a positive variable in the utility function. In this section, we present the literature which stresses that there are also negative effects of family size on the family's utility. Indeed, the medical and sociological literature points out the negative effects of family size on the formation of the sibling's human capital, and more specifically on the level attained

once the sibling has become an adult. This effect has been termed the “sibship size effect”. Two major components that impact on this effect can be distinguished. The first is deteriorating health, which is emphasised in the medical literature, while the second, retarding intellectual development, is mainly emphasised by the sociological literature.

Regarding the medical literature, health externalities constitute an important channel of influence of sibship size. Indeed, this literature points out “the negative consequences for health due to crowding and greater exposure to diseases, such as measles, chicken pox and diarrhea” (Desai 1995, p. 198).

Aaby (1988) and Aaby et al. (1984) have shown that in poor countries the addition of a sibling aged less than five years has a statistically negative impact on the child’s height-for-age, which is a good proxy for children’s overall health. Moreover, larger families appear “to increase the child’s risk of contracting the infection and the severity of the infection among those who do become ill”.⁴ Thus, larger families appear to induce adverse long-run effects on health and human capital.

Another reason for such negative effects is mothers’ sickness, indirectly hindering the development of children. Recent research has shown that ultra-orthodox Jewish women in Israel, England, and the USA, who have on average more than seven children, are more often sick, and cannot take care of their children as well as healthy women (Taha et al. 2001; Strauss 2007; Wright et al. 2010).

Independently of this particular source of educational deficiency, a negative influence of family size on the emotive and intellectual development of the children has been pointed out by the psychological and sociological literature. The sociological literature related to sibship size focuses on the effects of family size on the emotive and intellectual development of children.

The first direct effect is analysed by the “resource dilution theory”, which claims that sibship size dilutes family resources, especially psychological and emotional ones, negatively affecting the intellectual growth of children.⁵ Guo and VanWey (1999) show that an increasing number of siblings lowers intellectual performance. They do so by testing the effects of sibship size on cognitive abilities of children, and show that increasing the number of siblings lowers intellectual performance on reading achievement and mathematics tests.

4 Desai (1995, p.198).

5 On the effects of sibship size in terms of the resource dilution theory, see Guo and VanWey (1999), Downey et al. (1999), King (1987), and also Phillips (1999).

The literature also stresses that there are scale diseconomies in house-keeping, so that the time left for education is a decreasing function of sib-ship size. To conclude, while the standard theory of the family does not introduce a negative effect of the number of children on the well-being of the family, the medical and sociological literature does introduce it, and shows that the sibship size effect appears when children in large families are, *ceteris paribus*, less healthy and less developed intellectually.

3. Population, economic growth, and family structure

This section deals with the different views of the protagonists, putting an emphasis on what they have in common, and especially where they diverge. We present their view on the relationship between economic growth, income, and size of the family. We also present their views on family structure (which incorporates child labour and the existence of a sib-ship size effect). The main protagonists are Hume, Malthus, and Marx. However, we start with the Mercantilists, Cantillon and Smith, in order to present a broader view on the development of the theories of population.

3.1. Mercantilists

A monistic interpretation of mercantilism is not an easy task. Over time, the mercantilist doctrine evolved, and, while writers did not develop a unified position, still, common dogma, assumptions, and assertions ran through all mercantilist writings.

Mercantilism focused on general concepts of society shaped by the will to stimulate production and increase the competitive power of the nation, going beyond the strict theory of trade and money. In consequence, mercantilists focused more on production than on consumption. Heckscher (1955) emphasised that the centrepiece of mercantilist doctrine was the employment of economic forces in increasing the power and the unification of the state.

The main convictions of the mercantilist doctrine linked to population and child labour were the following:

- (i) Frugality should be encouraged among the poor, and idleness discouraged. The mercantilists favoured child labour as a means to decrease idleness, as well as reducing poverty, by increasing family income.
- (ii) An increase in population leads to an increase in the nation's overall power, as the mercantilists believed that there was a certain relationship between a nation's population and its power.

Moreover, according to mercantilists, an increase in population is also beneficial to the economy, since where land is ample and inhabitants are few, there is poverty. Of course, based upon such a view, we cannot infer that they thought poverty leads to a small population (Malthus's idea), or that a small population leads to poverty and low economic growth. In consequence, it is not clear if they thought an increase in income would lead to a large population.

On the matter of sibship size, and the negative effects of large families, the view of the mercantilists is *not* uniform. On one hand, for the sake of a nation state, having a large population is good. This is because the mercantilists put the value of power before individual well-being, and there was a relationship between a nation's population and its power. So, they wanted families to be large.

We should also note that they were aware of what is called today in the growth theory the "externality of population size", since they claimed that an increase in population can lead, through an excess demand for goods, to invention and industrialisation.

Moreover, some mercantilists asserted that a population increase could lead to lower wages, which some mercantilists thought would improve trade. Others believed that lower wages would be an impetus for workers to work more. So there were no negative sibship size effects.

However, with regard to the effect of population size on wages, and the labour market, the views regarding the benefits of low wages were not unanimous. Mercantilists were aware that in comparing England to the Netherlands, the country with higher wages was nonetheless the richest. Some mercantilists also noted that higher wages led to a higher standard of living, and higher worker efficiency.

In conclusion, most mercantilists liked the idea of a large population, and saw its effect on a "nation state" as positive. *However, they were not aware of the effect of income on population.* What is important to recall here is that for mercantilists population, at a given date, was *exogenous*. Perhaps the best example of this is seen in the work of Petty, who in *Political Arithmetik* indeed took population as given (Hull 1899).

3.2. Cantillon and Smith⁶

A relationship between Cantillon and Smith regarding their respective approaches to population growth was suggested by Higgs at the end of the nineteenth century (1892, p. 455). In Chapter 15 of his *Essay on the Nature*

6 We thank an anonymous referee for suggesting us to include a short section on Cantillon and Smith.

of *Commerce in General*”, Cantillon wrote, “Men multiply like mice in a barn if they have unlimited means of subsistence. The English in the colonies will become more numerous, in proportion, in three generations, than they would in thirty in England, because in the colonies, they cultivate new tracts of land from which they expel the savages” (Saucier trans., ed. Thornton 2010, p. 93). Cantillon’s view was taken up, and expanded on, by Smith, who in his *Wealth of Nations* wrote (Canaan edition, 1904, I.11.10):

As men, like all other animals, naturally multiply in proportion to the means of the subsistence, food is always, more-or-less, in demand. It can always purchase or command a greater or smaller quantity of labor, and somebody can always be found who is willing to do something in order to obtain it. The quantity of labour, indeed, which it can purchase, is not always equal to what it could maintain, if managed in the most economical manner, on account of the high wages that are sometimes given to labour. But it can always purchase such a quantity of labor as it can maintain, according to the rate at which that sort of labor is commonly maintained in the neighborhood.

What Higgs did not notice was that a few chapters earlier, in Chapter 8 of *Wealth of Nations*, Smith *expanded* on Cantillon’s view of population increase when he wrote about this, family size, and the economic value of children in England and Europe, North America, and in general. As Smith put it (Canaan edition, 1904, I.8.23):

But though North America is not yet so rich as England, it is much more thriving, and advancing with much greater rapidity to the further acquisition of riches. The most decisive mark of the prosperity of any country is the increase of the number of its inhabitants. In Great Britain, and most other European countries, they are not supposed to double in less than five hundred years. In the British colonies in North America, it has been found, that they double in twenty or five-and-twenty years. Nor in the present times is this increase principally owing to the continual importation of new inhabitants, but to the great multiplication of the species. Those who live to old age, it is said, frequently see there from fifty to a hundred, and sometimes many more, descendants from their own body. Labour is there so well rewarded that a numerous family of children, said of being a burthen is a source of opulence and prosperity to the parents. The labour of each child, before it can leave their house, is computed to be worth one hundred pounds clear gain them. . . . The value of children is the greatest of all encouragements to marriage. We cannot, therefore, wonder that the people in North America should generally marry very young.

These quotes, when analysed in light of the sibship size effect, enable us to understand the relation Cantillon and Smith saw between the positive correlation of income and fertility rate, and the fact that an infinite amount of land leads to no resource dilution, and therefore no sibship size effect. These relationships are even clearer in Hume’s writings, which we now turn to discuss.

3.3. Hume

Hume's impact on economic theory has been recognised regarding quantity theory and the price-specie-flow mechanism, and he has been considered, by some, as a precursor of modern approaches, such as the "monetary approach" to the balance of payments. However, Hume's approach to population has not been dealt with by economists interested in economic growth, and this lack of focus on Hume's views regarding population by growth theorists is indeed a conundrum. We now present his views on this subject.

3.3.1. Hume's theory of population and endogenous population growth. In this section, we present Hume's views on population and economic growth, and relate it to his views on "family structure". We will show the following: first, contrary to many observers of his time, Hume intuitively understood that population had increased from the "ancient" period to his own era; second, Hume saw population increase as *endogenous*. His was the first work in which there was an endogenous approach to population; and, third, due to his intuition regarding the increase in population, he stressed that economic and population growth *were not short-run business cycle facts, but part of a long-run growth dynamic*.

We should be aware that thinking in terms of a dynamic path of economic growth, as he did, is not trivial, since before the Industrial Revolution, *there was non-continuous* economic growth. The view held in the eighteenth century about history was in terms of a decline from antiquity to the Middle Ages, followed by recovery. It was not felt that wealth and population were increasing.

In contrast to this, Hume saw the changes in technological progress, output and population increase to be related. In fact, Hume also asserted that many in his time thought that population and output had actually decreased over the centuries. Indeed, contrary to the conventional wisdom of his day, he claimed that the size of the European population circa 1750 was larger than that of Rome at the height of Empire. For instance, he disputed Montesquieu's thesis that the world population had fallen since ancient times, and he wrote in his essay (para XI.91; 1777 edition [1987]), "Our superior skill in mechanics; the discovery of new worlds, by which commerce has been so much enlarged; the establishment of posts; and the use of bills of exchange: These seem all extremely useful to the encouragement of art, industry, and populousness."

Another element should be stressed in the theories of Hume: the relationship between income and population growth. Since population is *endogenous*, he claimed that when income increases, population increases,

and the opposite – when there are bad periods, population decreases. Indeed, Hume who related the population of countries to long-term economic growth was also aware of minor population cycles due to plagues, but which did not have long-run effects. As he put it in his essay (para XI.4; 1777 edition [1987]):

Almost every man who thinks he can maintain a family will have one; and the human species, at this rate of propagation, would more than double every generation. How fast does mankind multiply in every colony or new settlement; where it is an easy matter to provide for a family; and where men are nowise straitened or confined, as in long established governments? History tells us frequently of plagues, which have swept away the third or fourth part of a people: Yet in a generation or two, the destruction was not perceived; and the society had again acquired their former number. The lands which were cultivated, the houses built, the commodities raised, the riches acquired, enabled the people, who escaped, immediately to marry, and to rear families, which supplied the place of those who had perished.

This relationship between population and growth is present throughout his work. Hume's notion of "checks" is evident throughout his *Essays*, such as "Of Money", "Of the Populousness", and "Of Independence of Parliament", albeit with a different focus in each respective case, but all following his view that "The growth of everything, both in arts and nature, at last checks itself" (cited in Rostow 1990, p. 31). Of course, this notion of "checks", such as war and poverty, was taken up by later economists, such as Malthus (Rosen 1970, pp. 40–1; McGee 1989).

3.3.2. Hume on child labour and child rearing. Hume's views on these issues are found in his essay "Of the Populousness" (para XI.14; 1777 edition [1987]). Hume suggests the notion of a sibship size effect but not for all families. He differentiates between poor and rich families, and free children or children of slaves, and especially where they live. While discussing child rearing, Hume makes a clear difference in the price of child rearing if the child is brought up in a place where living costs are low (where land is cheap), or if brought up in London, where living costs are high (since land is expensive):

To rear a child in London, till he could be serviceable, would cost much dearer, than to buy one of the same age from Scotland or Ireland; where he had been bred in a cottage, covered with rags, and fed on oatmeal or potatoes. Those who had slaves, therefore, in all the richer and more populous countries, would discourage the pregnancy of the females, and either prevent or destroy the birth. The human species would perish in those places where it ought to increase the fastest; and a perpetual recruit be wanted from the poorer and more desert provinces. Such a continued drain would tend mightily to depopulate the state, and render great cities ten times

more destructive than with us; where every man is master of himself, and provides for his children from the powerful instinct of nature, not the calculations of sordid interest. (para II, XI, p. 14)

This view is related to the sibship size effect. Hume is aware that having many children in a small place means that they cannot benefit from a good “breeding” period. When children live in a region where land is vast, there is no dilution of income, and each child can have its own place, such that the sibship size effect does not come into being.

We were surprised to find that Hume (as did Smith) was intuitively aware that there could be a sibship size effect, and was also aware of the situation where an increase in income does not necessarily lead to having more children. This is interesting since in the last section of this paper, we show that this intuition can be demonstrated in the context of a model. We turn now to Malthus.

3.4. Malthus

Before describing the views of Malthus, one must recall that his contributions to political economy (1774 [1820]) impacted on many of his contemporaries, such as Ricardo (1811 [1817]), and extended over the next century to Keynes, as was emphasised by, among others, Petersen (1979) and, more recently, by Hollander (1997).

Malthus held what was, in effect, the first Chair of Political Economy in England (at Haileybury), to which he was appointed due to his insights into questions of fertility, mortality, and population increase. His work on the principle of population gave rise to the field of demography. In this paper, we analyse his views on family structure and the sibship size concept, and we link his point of view on wages and the Poor Laws to that of Hume.

3.4.1. Malthus’s view of the principle of population. Malthus’s demographic theory regarding the relationship between economic growth and the fertility rate is based on his basic philosophy regarding human beings, which he termed “the general laws of nature”. His view on population derives from the assumption that human behaviour is driven by nature, and men will have as many children as nature gives them the possibility of sustaining. Malthus maintained that “There is no reason whatever to suppose that anything besides the difficulty of procuring in adequate plenty the necessaries of life should either indispose this greater number of persons to marry early or disable them from rearing in health the largest families” (1970,

p. 243). His theory on population is related to the checks as presented by Flew (1970, p. 47):

Since population tends to press to the limit of available subsistence; since the power of production is beyond all comparison weaker than the power of reproduction; and since the equilibrium between population and resources can be maintained only by the constant operation of various checks, all of which are kind of either vice or misery, then population will always grow until there is enough misery or enough vice or more likely a sufficient mixture of both to achieve equilibrium.

In other words, since population, if not “checked”, will increase by more than food production, disequilibrium will arise. When the population of a nation reaches the limit of its food production possibilities, there are only two ways to maintain equilibrium: positive checks or preventive checks, or both.

For Malthus, these checks can be also divided into three different “ideological” categories: the checks of *vice*, of *misery*, and of *moral restraint*. The positive checks are of two ideological categories, either of misery (war, epidemic) or of vice (abortion, infanticide, and birth control, since Malthus was opposed to it and saw birth control as a vice), while the preventive checks are either through vice or through moral restraint, that is, postponing marriage.

However, we cannot disregard the fact that Malthus’s views contain, on the one hand, a side that is purely theory-based, yet concomitantly, on the other hand, a view based on his own moral values. For Malthus, the only way of keeping population in equilibrium with the means of subsistence, and which is perfectly consistent with virtue and happiness, is “moral restraint”. As he put it: “Moral restraint is the only mode of keeping population on a level with the means of subsistence which is perfectly consistent with virtue and happiness” (Malthus 1970, p. 250).

3.4.2. Malthus’s views on family structure and the sibship size concept. As a corollary to his views on moral restraint for the workers, i.e. “the poor”, Malthus presented a theory regarding the labour market and the family structure that has as its basis not only the “iron laws of wages”, but also an ostensibly negative view of the poor that is evident in his stated view against higher real wages. His position was that an increase in the real wages of workers (or in transfers) would not be beneficial for the following reasons:

- (i) It would reduce their supply of labour, since higher real wages would permit them to attain a subsistence level with less work. This, in his view, would lead to idleness.

- (ii) It would increase the demand for food, leading to a price increase, but not to an increase in the quantity purchased or supplied. As he put it (Malthus 1970, pp. 94–98):

Suppose that by a subscription of the rich, the 18 pence a day which men earn now was made up 5 shillings, it might be imagined that they would than be able to live comfortably and have a piece of meat every day for their dinners. But this would be a false conclusion. . . The transfer of 3 shillings and 6 pence a day would not increase the quantity of meat in the country. . . It would make every man able to indulge himself in many hours or days of leisure. . . and in a short time not only the nation would be poorer but the lower classes themselves would be much more distressed than when they received only 18 pence a day. . . I feel no doubt whatever that the parish laws of England have contributed to raise the price of provision and to lower the real price of labour.

- (iii) It would increase the fertility rate and encourage marriage. As Malthus put it, the “laws of nature” dictate that workers will have as many children as possible, and higher real wages will lead to an increase in population. Therefore, Malthus claimed that “The poor laws of England tend to depress the general conditions of the poor. . . Their first tendency is to increase population without increasing the food for its support. A poor man may marry with little or no prospect of being able to support a family” (1970, p. 97).

Malthus’s overall theory led him to express strong political opinions regarding the Poor Laws: “The evil is perhaps gone too far to be remedied, but I feel little doubt in my own mind that if the Poor Laws had never existed. . . the aggregate mass of happiness among the common people would have been much greater than it is at present” (1970, p. 101).

3.4.3. Similarity and dissimilarity in the views of Hume and Malthus. As is well known – and even acknowledged by Malthus himself – Hume’s ideas influenced him (*Essay*, I, iii: Rosen 1970, pp. 40–1). Still, the differences are quite large. Both understood that high wages will lead to higher fertility rates, but while Hume supported high wage rates, arguing that ample remuneration was the best incentive for diligence and ingenuity, Malthus opposed it, and thought that poor people will work less, which will lead to idleness.

Hume thought that higher income brought more happiness to the poor, than to the rich, and that high wages provided an incentive to industry and thus furthered the development of human capabilities. Hume saw too great an income disparity as leading to an overconcentration of power, the further impoverishment of the poor, and the discouragement of all industry. For him, significant income inequality weakened the state and

made the poor less able to resist the economically strong (Hume, “Of Commerce”, 1777 edition [1987], 265; Marshall 1998, pp. 311–315).

Malthus – who lived at a period when capital was already concentrated in the hand of the entrepreneurs – saw workers as suppliers of labour; this, at a time when there was the need for a large supply of labour, in order to efficiently employ this capital, and increase output. This difference in their views on wages also influenced their views on population.

Hume saw an increase in population which resulted as a consequence of an increase in output and income as a *good* thing. Malthus was afraid that increase in population is not sustainable and should be stopped. Moreover, their analysis of data was itself influenced by their own position. Whereas Hume regarded encouragements to marriage as signs of large populations, Malthus saw these as evidence of small populations which were increasing; and while Hume reasoned that societies with a large number of unmarried people had small populations, Malthus believed this represented large populations which were at a standstill. According to Rosen (1970, p. 44):

Thus, encouragements to marriage represented for Hume the policies of a government large and thriving, but for Malthus, those of a government anxious to become large. And while large numbers of unmarried people represented few births and a small population for Hume; for Malthus, this could be evidence of a large society, existing without increasing subsistence, and forcing substantial numbers of its inhabitants to remain unmarried so that others would be able to feed their own children. . . . The evidence used by Hume to determine population size could be interpreted in a different manner.

In conclusion, despite many differences between Malthus and Hume, it is clear that both claimed that an increase in income leads to higher fertility rates, and in countries with ample land, there is no income dilution and sibship size effect. We turn now to analyse Marx’s view on these issues.

3.5. Marx

In this section, we present Marx’s view on population, on the relationship between income and fertility rate, and on the family structure, emphasising the difference with Malthus’s and Hume’s views.⁷

3.5.1. Marx’s views on the general principle of population. Marx took a diametrically opposite view regarding population to that of Malthus, albeit attaching both an ideological perspective and personal attack. He viewed

⁷ Indeed, we would like to emphasise that Marx had a divergence of views with Hume. It should be recalled that Marx and Engels criticised Hume in the context of their critique of Dühring, especially regarding the *originality* of Hume’s monetary thought (Krause, 2002, p. 356). In this paper, we will focus on the subject of population.

Malthus's "general laws of nature" as a "sell-out" to the bourgeoisie. As he put it: "This baboon [Malthus] thereby implies that the *increase of humanity* is a purely natural process, which requires *external restraints, checks* to prevent it from proceeding in geometrical progression" (Marx 1973, p. 606).

In order to understand the differences in their conceptions of demographic development, one must focus on the difference between the Marxian and the Malthusian concepts of human nature. As stated above, the main assumption of Malthus's theory is that the decisions of men are driven by nature. This was not the case for Marx and Engels: "Marx and Engels did not contend that human reproduction was simply a function of the sex drive, and the high birth rate of the laboring class was due to their inability to control this passion" (Wiltgen 1981, p. 111). For Marx, man *controls* nature: "Man therefore is able to control nature consciously and make his own history. It is this ability that allows him to produce beyond subsistence and which guarantees that he will not have subjected to the dilemma that Malthus has described. . . According to Marx and Engels, man was the only form of life which could master nature" (Wiltgen 1981, p. 109).

3.5.2. *Marx's view on income and fertility rate.* For Marx, children were considered a necessity for survival; they were a *production* good. More precisely, the Marxian view suggests that the proletarianisation of the workforce brings on a fertility increase, since the working masses attempt to accumulate the one factor of production over which they do have control: labour power.

Indeed, the approach of Marx regarding income and fertility is diametrically opposite to the one of Hume and Malthus. Marx wrote that the relationship between the size of the family and the level of real wages can be the inverse of that denoted by Malthus. Marx claimed that family size is inversely related to real wages. As he wrote, "In fact. . . the absolute size of the families stands in inverse proportion to the height of wages" (Marx 1976, pp. 796–7), and in the footnote on this sentence, Marx quoted Laing: "Misery up to the extreme point of famine and pestilence, instead of checking, tends to increase population" (1976, p. 797).

Indeed, Marx rejected the demand-driven Malthusian and Ricardian "iron law of wages" – a term coined by Lassalle (1863 [1919]) – which held that an increase in population must drive real wages to a subsistence minimum regardless of the form of social organisation.⁸ Marx instead was asserting that the problem originated on the supply side.⁹

8 An increase in population was in the interest of the elite, as it reverses the "reserve army" of labour, and thus pushed down wages.

9 We thank Sam Hollander for pointing this out to us.

3.5.3. *Marx's view on family structure.* In the view of Marx and Engels, decisions about fertility are related to the modes of production: "In fact every special historic mode of production has its own special laws of population, historically valid within its limits alone" (Marx 1976, p. 784). Since the decisions about fertility are related to the modes of production, there should be a difference in the family structure between the social classes – the bourgeoisie and the proletariat.

Regarding the bourgeoisie, children are a means for continuing the family business. The capitalistic orientation of the bourgeoisie will determine the optimal number of children that are the legal heirs of the business.

For the proletariat, the relationship is completely different: "...his [the worker's] relation to his wife and children has no longer anything to do with bourgeois family relations" (Marx and Engels 1955, p. 21). Instead, it is formed by the dependence of all on the family's wage labour. Indeed, "Individual workers, millions of workers do not get enough to be able to exist and reproduce themselves" (Marx and Engels 1978, p. 206). There is a need for the work of children in order to ensure the family's survival: "All family ties among the proletarians are torn asunder, and their children transformed into simple articles of commerce and instruments of labour" (Marx and Engels 1955, p. 28). As expressed by Marx, "In order that the family may live, four people must now not only labour, but expend surplus labor for the capitalist...Previously, the workman sold his own labor power, which he disposed of nominally as a free agent. Now he sells wife and child. He has become a slave dealer" (Marx 1967, p. 395).

So the increase in fertility rate among the workers is due to a reduction of wages, since the family needs income generated by child labour, even if this leads to more diseases and an overall drop in the quality of life.

3.6. *Hume and Malthus vs. Marx*

The views presented in this paper permit us to analyse the common elements and also the divergence among the different views. In summary, we could conclude that from Hume on it becomes clear that the population increases and that it is endogenously affected by income.

On the sign of the relationship between income and fertility rate, we have shown that for Hume, and Malthus, an increase in income leads to an increase in fertility rate, and during bad periods, when income decreases, fertility rates decrease. In Marx's writings, we get the opposite result: when income decreases, the fertility rate increases.

About family structure, Hume emphasised that where there was a plenty of room, there was no income dilution. Malthus and Hume did not believe

in income dilution and the existence of a sibship size effect. This is not the case for Marx: he emphasises the worsening of life at this time, and the need for child labour and child income. He was aware of income dilution, and, in consequence, of the sibship size effect (we should remember that in his time, in cities, urban life was characterised by a lack of sanitation, and more children meant more sickness).

Below, we present a model emphasising that it is not surprising that on both subjects their views are opposite, since there is a relationship between income, fertility rate and the sibship size effect.

4. Humean, Malthusian, and Marxian models of family and fertility

In the previous section, we have shown that Malthus and Hume claimed that the relationship between fertility rate and income is positive, while Marx took the opposite view. Moreover, we have shown that Malthus and Hume did not stress the possibility of a sibship size effect, while for Marx, this was part of the reality he was describing.

The model we present in this section will explain why their divergence of views on these two subjects is in fact related. We will show that when the utility function takes into account a sibship size effect, then the relation between income and fertility rate is negative (we call it the *Marxian* view). However, when the utility function does not take into account a sibship size effect, then the relation between income and fertility rate is positive (the *Humean–Malthusian* view). Moreover, we will show that this view was also related to the budget constraint the family faced.

In other words, this model will permit us to pinpoint the assumptions which lead to the diametrically opposite views between Hume and Malthus, on one hand, and Marx, on the other hand. We will first present the model and then explain the difference between a Hume–Malthus model and a Marx model.

In a previous paper (Brezis and Young 2003), we emphasised that altruism was the reason Malthus and Marx held different views of the relationship. Here, the utility function is the standard function assuming altruism, albeit with the introduction of a sibship size effect. We show that the main reason for the difference in their respective viewpoints is actually the introduction of a *sibship* size effect, of which Marx speaks (as we have discussed in the previous section), while this was not considered by Hume and Malthus. The reason for this is quite obvious: *the fertility rates changed significantly over the nineteenth century*, while this relationship *did not exist* at the time of Hume or Malthus.

We start by presenting the model, and then the results. We first formulate the parent's utility maximising problem.

4.1. The parent's optimisation problem

Our model includes a standard Beckerian utility function of the family. We consider the decisions taken by a representative adult in an economy with identical individuals living for two periods, childhood and adulthood. The parent's utility W_p depends on his own consumption, C_p , and on the consumption of each child when grown into an adult, C_c :

$$W_p = U(C_p) + \delta nW(C_c). \quad (1)$$

Both the subutility functions U and W are twice continuously differentiable, strictly increasing and strictly concave.¹⁰ The parameter $\delta \in (0, 1)$ measures the extent to which parents are altruistic, and the variable n is the number of children.

Following some models in the literature on household behaviour, we simplify the intertemporal structure of the parent's problem by ignoring a dynastic structure. Thus, the child's expected income is supposed to be entirely allocated to consumption, so that

$$C_c = wH, \quad (2)$$

where H is the human capital obtained by the child at adulthood, and the wage w is the expected future wage (assumed identical to the current wage) per efficiency unit of labour.

In the family economics literature, and following Becker, human capital, H , is an increasing function of the time devoted to education. Denoting $l \in [0, 1]$ as the fraction of each child's time to be allocated to work, and assuming that the total amount of time is 1, we obtain that the time devoted to education is equal to $1-l$, and therefore human capital H is a decreasing function of the time devoted to work, l .

The new element we add, and which is based on the literature presented in Section 3, is the sibship size effect. The size of the family, n , affects the human capital of children. So, the amount of human capital takes the form

$$H = H(l, n), \text{ and } H_l < 0, H_n < 0, H_{ll} < 0, H_{nn} < 0. \quad (3)$$

10 Of course, we could use only one subutility function U , such that $W = U$. Since in the literature many models take two different utility functions, we follow this assumption. The utility of the child's consumption, while being a child, is omitted in many papers, and we follow this form of modelling.

The function H is assumed to be a twice continuously differentiable function of the time l allocated to work and of the family size n .

The parent's expenses consist of the consumption of the parents, and also of the net costs of raising children, expressed in real terms. The revenues of the family consist of A , the parent's income, which depends on past decisions, and is therefore taken as exogenous. It also includes the income earned by the children, when w is the wage earned by each child. Therefore, the budget constraint is

$$C_p + (\sigma - wl)n \leq A, \quad (4)$$

where σ is the cost of raising a child and C_p is the consumption of parents.

The second element of the budget constraint can take two forms: either

$$\sigma - wl > 0 \quad \text{Form A} \quad (5)$$

or

$$\sigma - wl \leq 0 \quad \text{Form B.} \quad (6)$$

Form A means that children cost more than they earn, or, in other words, intergenerational transfers are from parents to children, while Form B is just the opposite. In the next section, we show that the form of the H function is not independent of the budget constraint, or, more specifically, the intergenerational relationship.

4.1. Human capital formation and sibship size

4.1.1. *The utility maximising solution.* Substituting the budget constraint into the utility function, we get

$$W_p = U[A + (wl - \sigma)n] + \delta n W[wH(l, n)]. \quad (7)$$

To simplify notation, we denote

$$V(l, n) = W(wH(l, n)).$$

The parent's decisions concern the fraction l of each child's time to be allocated to work, and the desired number n of children which maximises the utility function, such that the two first-order conditions (FOC) for

interior solutions in l and n can, respectively, be written as

$$U'(C_p)w = -\delta V'_l(l, n) \tag{8}$$

and

$$U'(C_p)(\sigma - wl) = \delta \left(V(l, n) + nV'_n(l, n) \right). \tag{9}$$

We divide both sides of Equation (9) by the corresponding sides of Equation (8) to obtain

$$\frac{\sigma - wl}{wl} = \frac{1 + \varepsilon_{V,n}}{-\varepsilon_{V,l}}, \text{ where } \varepsilon_{V,n} = \frac{V'_n(l, n)n}{V(l, n)} \text{ and } \varepsilon_{V,l} = \frac{V'_l(l, n)l}{V(l, n)}. \tag{10}$$

4.1.2. *The Humean–Malthusian view: the case with no sibship size effect*

This case is what we call the Humean–Malthusian view, since as we have shown in the previous section, Hume, as well as Malthus, did not assume that large families have a negative effect on children. In a model of family economics, in which the sibship size n is not an argument of the function H itself, while education is, we get the following effects:

$$\begin{aligned} H(l, n) &= h(1 - l), \\ V(l, n) &= W(wh(1 - l)), \text{ and } \varepsilon_{V,n} = 0. \end{aligned} \tag{11}$$

As a consequence, we see from Equation (10) that a necessary condition for an interior solution is $\sigma - wl > 0$, i.e. intergenerational transfers are from parents to children.

Thus, for families for whom the utility function takes the standard specification, it is necessary to assume that even if children work, intergenerational transfers are from parents to children.

It should be noted that as a further consequence of the *absence* of a sibship size effect, we get the following Lemma.

Lemma: *In a Humean–Malthusian framework, in which there is no sibship size effect, we get that when income increases, the fertility rate also increases:*

$$\partial n / \partial A > 0 \text{ and } \partial l / \partial A = 0. \tag{12}$$

Equation (12) implies that an increase in income always leads to an increase in the fertility rate; moreover, child labour is unaffected by changes in parent’s income.

Proof: The proof takes the following form. Since when n is not an argument of V , Equation (10) completely determines its sole unknown l ,

independently of the parent's income A . Hence, $\partial l/\partial A = 0$ and, given l , the parent's consumption C_p is determined by any one of conditions (8) or (9), also independently of A . Finally, by Equation (4) and as $\sigma - \omega l > 0$, n and A must move in the same direction. \square

This lemma reflects the Humean–Malthusian view, that is, when income increases, the fertility rate also increases. We now turn to analyse the case with a sibship size effect.

4.1.3. The Marxian view: the model including a sibship size effect. As we have shown in Section 3, the Marxian view assumes a sibship size effect and the necessity of child labour. Therefore, in this framework, we incorporate that the human capital of children is a negative function of l and n . In the next proposition, we present the consequences of this relationship, and we include the results of the previous lemma.

Proposition: *When there is existence of a sibship size effect, we get that $\partial n/\partial A < 0$, which is the Marxian view.*

When there is no existence of a sibship size effect, we get that $\partial n/\partial A > 0$, which is the Hume–Malthus view.

Proof: The second part has already been presented in the above lemma. Regarding the first part, we see that in cases with a sufficiently strong sibship size effect, such that $\varepsilon_{V,n} < -1$, the budget constraint has to take the form $\sigma - \omega l_c < 0$ (Form B) and transfers are always from children to parents. In other words, the work of children is a necessity, which is an important element of Marx's view on wages of the proletariat. \square

Let us present a specific form of the utility function such that we get an elasticity smaller than 1. Let us assume the following specific forms:

$$H(l, n) = h(1 - l)n^{-\alpha}, \quad \alpha > 0, \quad (13)$$

and the function h is such that $h' > 0$ and $h'' > 0$.

We further assume that the child's utility function W is of class CRRA (Constant Relative Risk Aversion), with constant elasticity β thus satisfying $0 < \beta < 1 < \alpha\beta$. So

$$W(C_c) = C_c^\beta. \quad (14)$$

Notice that we thus obtain by the chain rule $\varepsilon_{V,n} = -\alpha\beta < -1$.

It is easy to show that the child's labour l is independent of the parent's income A , so $\partial l/\partial A = 0$. Taking the total derivative of the FOC relative to

n , we then get by strict concavity of U'' and W_p

$$\frac{\partial n}{\partial A} = -\frac{\partial^2 W_p / \partial A \partial n}{\partial^2 W_p / \partial n^2} = \frac{(wl - \sigma)U''}{-\partial^2 W_p / \partial n^2} < 0. \quad (15)$$

So, we obtain $\partial n / \partial A < 0$. *This reflects the Marxian view.*

5. Conclusion

The New Growth Theory has emphasised the importance of population dynamics as one of the main elements of economic growth. Interestingly enough, this subject has also been emphasised in the past, especially by Hume, Malthus, and Marx, and also by the Mercantilists, Smith and Cantillon. This paper has presented their views on the relation between economic and population growth.

The main point of this paper is that their views on this subject cannot be disentangled from another subject – the sibship size effect. This paper has shown that scholars, who had stressed a positive relationship between income and fertility rate, did not raise the possibility of a sibship size effect. However, Marx, who was aware that child labour and fertility rates have increased due to a reduction of wages, saw the family relationship turn upside down and the reduction in standard of living, which is part of the sibship size effect. Moreover, it is quite obvious that the sibship size effect *did not exist* at the time of Hume or Malthus, but *was extant* at the time of Marx. Therefore, they had two different types of models in mind, and obtained diametrically opposite effects regarding the relationship between income and fertility rate.

This debate then is not without policy implications today. While it is clear that in developed countries the sibship size effect is non-existent and concomitantly, child labour is not necessary, this is not usually the case in developing countries, where child labour is a necessity and high fertility rates lead to dilution of income, and to the existence of a sibship size effect.

Thus, the debate between the *Humean–Malthusian* view and the *Marxian* view, which was probably the result of the difference in the periods during which the protagonists lived, can now be linked to the differing modes of family structure in developed, as against developing countries, and, in consequence, may account for the differences in the relationship between incomes and fertility rate they face.

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Abstract

This paper focuses on the evolution of the relationship between population and economic growth from Hume to New Growth Theory. In this paper, we show that there were two main views on the subject. There were those who assumed that the relationship between fertility rate and income was positive. On the other hand, there were those who raised the

possibility that this linkage did not occur, and they emphasised that an increase in income did not necessarily lead to having more children. Following from Hicks' methodological precept, *the paper will show that their position on the issue was related to a socio-economic fact: the sibship size effect*. We show that those who took the view that an increase in income leads to the desire to have more children did not take into consideration the sibship size effect, while those maintaining that there existed a negative relationship introduced into their utility function a sibship size effect.

Keywords

Population, economic growth, sibship size effect, children, fertility rates

JEL Classifications: B10, D10, J13