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The Impact of a Young vs. Aging Population on Growth, Welfare and War

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Abstract

This paper underlines the three main long-term effects of an aging population in the 21st century. First, it reduces the factors that contribute to conflicts and war. Second, it increases capital per capita. Third, while it slows the pace of innovation, it does not diminish innovation's impact on economic growth.

We first focus on the relationship between population growth and conflict. We present a new framework in which fertility rates and the probability of conflict are endogenously determined, leading to multiple equilibrium outcomes. The core idea is that high fertility rates increase the likelihood of conflict due to the "youth bulge" phenomenon. Conversely, war and conflict—by causing high mortality among soldiers—motivate families to increase their birth rates. This reciprocal dynamic results in multiple possible equilibria.

As a result, the world faces regional disparities in conflict and population growth. On the one hand, there are countries characterized by low fertility rates, an aging population, and high capital stock, which experience low conflict probabilities. In contrast, there are regions such as parts of Africa and the Middle East, with high fertility rates and younger populations, which are more prone to conflict.

Keywords: aging population, war, conflicts, fertility rates, youth bulge.

JEL classification: D64; D74; J13; J14; O40.

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I. Introduction

The relationship between population and economic growth is central to growth theories. On one hand, the neoclassical model emphasizes that higher fertility rates lead to lower capital stock per capita, a key determinant of development and growth. Countries with low capital per capita tend to have low output per capita. As a result, high population growth - driven by high fertility rates - leads to slower economic growth and lower levels of development.

On the other hand, the new growth theory highlights the importance of population size in driving innovation. As noted in most economic growth textbooks, sustained economic growth is primarily generated through technological progress, which depends on a larger pool of researchers—requiring a sizable global population. As Phelps (1968) observed:

"One can hardly imagine, I think, how poor we would be today were it not for the rapid population growth of the past, to which we owe the enormous number of technological advances… If I could re-do the history of the world, halving population size each year, I would not do it for fear of losing Mozart in the process." (pp. 511-12)

However, one crucial demographic factor has been largely overlooked in economic growth research: the role of conflict and war. Indeed, economic literature has often failed to consider how conflicts impact growth. A review of major economic growth textbooks (Weil, Jones, Barro, and Sala-i-Martin) reveals that terms such as *conflict* or *war* are absent from their indexes.

This omission may stem from the fact that most economic models assume decision-making occurs at the family level. In contrast, decisions to wage war, engage in conflict, or seize territory are made by governments or terrorist organizations rather than individual households.

As a result, economists have traditionally focused on decisions related to consumption and fertility rates while avoiding discussions on war. Even in the case of fertility rates, it was not until Becker introduced the concept of altruism that economic models began incorporating fertility decisions. Until then, the number of children was considered an exogenous factor.

This paper analyzes the connection between fertility rates and conflicts, leading to multiple equilibrium outcomes. The model predicts distinct regions worldwide with varying levels of conflict and population growth. In some countries, low fertility rates and an aging population correspond with low conflict probability. In contrast, regions such as parts of the Middle East experience high fertility rates, a younger population, and a greater likelihood of conflict and war.

The model is built on two key mechanisms. First, fertility rates are influenced by the presence of conflict. When families anticipate a high probability of losing children

to violence, they tend to have more children- similar to how general mortality rates influence fertility decisions.

Second, high fertility rates, in turn, affect the probability of conflict. A high fertility rate lowers the median age of the population and increases the proportion of young people. A substantial body of literature on the *youth bulge* phenomenon suggests that a large cohort of young adults contributes to the emergence and intensity of armed conflicts and insurgencies. Young men, in particular, have been identified as a demographic group that is more easily mobilized for violence (see Urdal, 2006; Cincotta et al., 2003). Empirical data from this literature show a strong correlation between a high proportion of young people and the outbreak of political violence and warfare.

The second element related to low fertility rates is that the aging population increases. Older populations tend to prioritize stability and are less likely to engage in or support violent uprisings. Indeed, aging populations might lead to more conservative and risk-averse policies, as older voters tend to favor stability over radical changes. Consequently, an aging population can decrease the likelihood of internal conflicts and civil wars.[1]

As a result, the probability of conflict is an increasing function of fertility rates, which, in turn, is influenced by the presence of conflict and war—leading to multiple equilibrium outcomes.

The first part of this paper presents empirical data illustrating the interconnectedness of these variables and includes an empirical analysis highlighting the most significant findings.

The second part explores the underlying mechanisms behind these correlations. The theoretical model, drawing from Brezis and Krugman (1997) and Benassy and Brezis (2013), introduces a framework in which fertility rates and conflict probabilities are endogenously determined, resulting in multiple equilibria.

The paper is structured as follows: Section II reviews the relevant literature, Section III presents empirical evidence, Section IV introduces the model, and Section V concludes.

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[1] This can result in more stable governance but might also slow down necessary reforms, potentially leading to political gridlock (see Jackson and Howe, 2008; and Goldstone, 2010). Moreover, countries with rapidly aging populations might face challenges in maintaining their military capabilities. This could alter the balance of power regionally and globally, potentially leading to conflicts as power vacuums or shifts occur (see National Intelligence Council, 2012). However, advancements in AI and robotics will render this possibility largely irrelevant.

II. Related Literature

The literature reviewed in this section is extensive. We begin with studies that examine the impact of fertility rates on the economy and society. Next, we focus on research highlighting the relationship between fertility rates, violence, and conflicts. We start by reviewing the literature on the effects of fertility rates on economic growth.

A. Fertility Rates and economic growth -the sibship size effect

The standard economic model on 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 utility of 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".

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. There are two major components that can be distinguished. The first is deteriorating health, which is emphasized in the medical literature, while the second, retarding intellectual development, is mainly emphasized by the sociological literature.

Regarding the medical literature, health externalities constitute an important channel of influence of sibship size. 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". 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 US, 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 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 literature, which focuses on the effects of family size on the emotive and intellectual development of children.

To summarize these various literature in few sentences, we could say that the first direct effect is analyzed 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, and in consequence big families lead to lower intellectual performance.[2] The literature also stresses that there are scale diseconomies in housekeeping, so that the time left for education is a decreasing function of sibship 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, psychological, and sociological literatures do introduce it, and show that the sibship size effect appears when children in large families are, ceteris paribus, less healthy and less developed intellectually.

B. The various theories relating poverty, war and conflicts to fertility rates

There is a vast literature that explores the relationship between higher fertility rates and the probability of conflicts and war. The main literature is what is called 'youth bulge theory'. There is also the Malthusian pressures and resource competition, since high fertility rates can lead to rapid population growth, which in turn increases resource scarcity leading to competition on resources such as land, water, and food, which might contribute to conflict. The third element relating fertility rates to violence and conflicts is that as predicted by the Solow model, higher fertility rates lead to lower capital, lower infrastructure leading to weakened state capacity. We start with the Youth Bulge theory.

C. Fertility rates, Aging and Young population - The Youth Bulge theory of conflicts

A *youth bulge* occurs when a country has a disproportionately large young population due to high fertility rates. As fertility rates rise, the proportion of the aging population declines, while the share of young people aged 15–24 increases.

In sociology, extensive literature links youth bulges to crime and conflict. Youth bulges are typically defined as large cohorts of individuals aged 15–24 relative to the total adult population (15+). One of the leading scholars in this field, Urdal (2006), emphasizes that a youth-heavy population can contribute to political instability, social unrest, and violent conflict.

Urdal conducted econometric analyses on the impact of youth bulges on political violence, finding significant results: youth bulges increase the risk of armed conflict

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[2] 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.

and terrorism. Similarly, empirical research by Brooks et al. (2018) shows that countries with a high proportion of young people are more likely to engage in interstate conflicts than those with smaller youth populations. Their findings indicate that aging societies are the least likely to initiate international conflicts, whereas youth-dominated populations have been linked to civil wars, terrorism, and revolutions, particularly in regions such as Sub-Saharan Africa and the Middle East.

There is an ongoing debate regarding the nature of this relationship—whether it follows a concave or convex pattern. Scholars such as Gunnar Heinsohn and Samuel Huntington argue that when the youth bulge exceeds 40% of the total population, the likelihood of conflict follows a convex trajectory, increasing at an accelerating rate.

What are the key factors highlighted in the literature that explain this relationship? The first set of factors relates to biological and physical attributes, particularly hormones and physical strength. Research suggests that young men are more prone to aggression due to high hormone levels (Goldstein, 2010). At this age, they are also more inclined toward combat. Studies have consistently shown that young males are the primary perpetrators of criminal violence (Neumayer, 2003) as well as political violence (Mesquida & Wiener, 1996).

The second set of factors is socioeconomic in nature. In many countries with high fertility rates, inadequate infrastructure - including the lack of sports and recreational facilities—is a common issue. As emphasized by the Solow model, high fertility rates contribute to lower capital stock, resulting in resource scarcity, poverty, low wages, and high unemployment. This economic hardship makes young populations more vulnerable to frustration and increases their susceptibility to recruitment by militant groups or participation in civil unrest.

Additionally, large youth cohorts facing institutional bottlenecks and unemployment tend to concentrate in urban centers, heightening the risk of political violence (Choucri, 1974). When young people are left with few opportunities beyond poverty and joblessness, joining a rebellion or militant movement can become an attractive alternative source of income.[3] Collier (2000) argues that higher levels of education among men help reduce the risk of political violence by increasing the opportunity cost of rebellion for educated individuals.

The *youth bulge* phenomenon is not unique to the modern world. Goldstone (1991, 2001) demonstrates that youth have played a significant role in political violence throughout history, from the English Revolution to the Revolutions of 1848. He highlights that the presence of a *youth bulge* has historically been linked to periods of political crisis. Similarly, the German historian Möller (1968) attributes the economic

[3] And the more heavily urbanized, the more such countries are likely to experience Dickensian poverty and anarchic violence. In good times, a thriving economy might keep urban residents employed and governments flush with sufficient resources to meet their needs. More often, however, sprawling and impoverished cities are vulnerable to crime lords, gangs, and petty rebellions.

depression in Germany to the emergence of large unemployed youth cohorts, which contributed to the rise of Nazism (pp. 240–244).

Urdal emphasizes that the *youth bulge* has become a widely accepted explanation for political instability in the Arab world. He cites Fareed Zakaria, who suggests that the *youth bulge* was one of the underlying causes of both the September 11, 2001 attacks and the Arab Spring. The high proportion of unemployed young people played a crucial role in fueling uprisings across the Middle East and North Africa.

D. Fertility rates – The Malthusian view

Malthus view on population derives from the assumption that human behavior 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" (Malthus, 1970, p. 243). His theory on population is related to the checks as presented by Flew (1970, p. 47): "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. The positive checks are moral restraints, while the preventive checks are war and epidemic.[4] So for Malthus, high fertility rates can lead to war and conflicts through lack of resources.

E. Fertility rates – The Marxian view

Marx was concerned with the Malthusian view on population growth. He wrote that: Malthus's "general laws of nature" as a "sell-out" to the bourgeois. 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).

While 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).

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[4] For Malthus, these checks can be also divided into three different "ideological" categories: the checks of vice, of misery, and of 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).

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).

So why would families have so many children leading to sibship size effect or to conflicts?

For Marx, children were considered a necessity for survival; they were a *production* good. More precisely, the Marxian view suggests that the proletarianization 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: labor power. 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 quoting Laing: "Misery up to the extreme point of famine and pestilence, instead of checking, tends to increase population" (1976, p. 797).

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 bourgeois 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: Child work is a necessity and is the main forces of the society. Marx writes: "Individual workers, millions of workers do not get enough to be able to exist and reproduce themselves" (Marx, 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 rates among the workers is due to a reduction of wages, since the family needs income generated by child labor, even if this leads to more diseases and an overall drop in the quality of life. Child labor is essential for understanding Marx view on fertility rates, wages and conflicts. Indeed, child labor in the nineteenth century amounted to a significant part of the workforce in some British

industries. [5]

Child labor was needed in periods in which the salary of one person was not adequate for subsistence. Hence, children brought about an increase in the family income. Indeed, during the nineteenth century, the share of male factory workers' earnings in the family income went down from 60% in 1800 to 55% in 1820, 42% in 1825 reaching 39% in 1835. This was the period in which wages decreased and fertility rates increased. Therefore men's relative contribution fell suggesting the necessity of getting other households members into the labor force. [6]

III. The Facts (preliminary) [7]

There are four key demographic variables relevant to this analysis.

The first is the *fertility rate*, which represents the average number of children per woman and ranges from 0 to 8. At the lower end, we find countries such as Taiwan and South Korea with a fertility rate of 1.1, and Japan at 1.4. In Europe, Italy and Spain stand at 1.3. At the higher end, Niger has a fertility rate of 6.6, while Chad, the Democratic Republic of Congo, and Somalia each have rates of 6.0. Gaza had a fertility rate of 6.2 from 1990 to 2010, which has since declined to 3.6 from 2020 onward.

The second variable is the *median age* of the population. This ranges from as low as 18 in high-fertility countries such as Nigeria, the Democratic Republic of Congo, and Gaza, to as high as 50 in countries like Italy.

The third variable is the *birth rate*, measured as the number of births per 1,000 people. This varies from 40 in the Democratic Republic of Congo to just 7 in Italy. While the birth rate accounts for the total population, it is also useful to examine the adolescent fertility rate. For instance, in 2022, 37 out of every 1,000 girls aged 15–19 in the West Bank and Gaza gave birth, a typical trend in underdeveloped regions.

The fourth variable is the *youth bulge*, defined as the proportion of the population aged 15–29 relative to the total adult population (15+). This percentage varies significantly, from 50% in countries like the Democratic Republic of Congo to just 15% in many European nations.

Table 1 presents data on the relationships between these four demographic variables. However, the relationships shown in Table 1 are approximations, as a precise analysis would require consideration of mortality rates. Some of these relationships can

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5 In the 1830s, in some regions such as Lancashire and Leeds, 36% of the workforce in the textile industry consisted of children under age 16, and in all England, children under 12 years of age constituted 8% of the labor force in the cotton industry, while children age 13-18 another 10%.

6 As emphasized by Horrell and Humphries (1997: 35-42): "The contributions of women and children may have been crucial to most families during certain stages in the family life cycle … In only a few occupations were men earning enough to buy their families sustenance and to provide the roof over their heads; for most households the earnings of women and children were essential.".

7 The tables and figures are presented in a preliminary format and will be refined for better presentation.

also be visualized using population age structure graphs, which are provided in Figures 1–3.

Demographic patterns vary widely between countries. Some nations exhibit a high youth bulge, high fertility rates, high birth rates, and a low median age, while others display the opposite trend—low youth bulge, low fertility rates, low birth rates, and a high median age.

Table 2 explores the relationship between these demographic variables and the likelihood of conflict.[8] It summarizes findings from Cincotta and other political demographers, showing that countries with younger populations are particularly prone to civil unrest.

The data suggest a strong link between fertility rates and conflict probability. In countries where the average number of children per woman exceeds five, the likelihood of war or conflict is over 50%. However, this is an average probability. If we instead ask, what is the probability that these countries have experienced at least one conflict in the past 20 years?, the answer rises to 90%. In contrast, in countries where women have fewer than three children on average, the probability of war drops to just 5%.

In the following section, we present a model that examines the relationship between demography and conflict.

IV. The multiple equilibria model

There is an extensive literature on multiple equilibria, including an entry in the encyclopedia. In consequence, in this version, I will succinctly expose the theory behind multiple equilibria.

The multiple equilibria model is based on two equations that define the relationship between the two endogenous variables, and their dynamics interactions.

In this paper, the two variables are: the probability of war, $\pi \leq 1$ and n, the number of children per family, also referred as the fertility rate.

We start by examining how the probability of war influences fertility rates.

A. The model of fertility rates

In the literature on economic growth and population dynamics, one can find many versions of the canonical model developed by Becker. I present a simple model based on Baland (1999) and Brezis (2003), which makes it easy to add assumption on the effects of war on fertility rates.

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8 Some of the data are our own calculations. Some are based on the literature.

The framework of the model is dynamic in the sense that there is a continuity of generations; each generation of individuals lives two periods: first as children and second as adults. When agents are adults, they work, consume, and raise children.

In the first period of life, agents are children who first live with their parents, work, and consume. They do not take decisions while children. Then, in the next period they get their own income.

The utility function of the parent, W_p is a function of its own consumption, C_p and the utility function of each child, *W*.

$$W_p = U(C_p) + n(1-\pi)\delta W(C_c)\,. \tag{1}$$

where *U* and *W* are both twice continuously differentiable, strictly increasing and strictly concave.

$\delta < 1$ is a parameter measuring the extent to which parents are altruistic, and *n* is the number of children parents have raised. Children when adults can then be affected by war. So while the parents raise n children, the number of children which stayed alive as adult is not n, but $n(1-\pi)$, when π is the probability of war, and casualties. So the simplest way to define children staying alive is by the variable: $n(1-\pi)$.

The budget constraint of the parent is:

$$C_p = A + nwl_c - \sigma n\,. \tag{2}$$

where A is the income earned by the parents; σ is the cost per child; w are the wages earned by children; l_c is the number of hours children are working, and $1-l_c$ is the time children invest into increasing their human capital.[9] An increase in human capital leads to higher productivity in the next period.

Children live two periods as individuals. In the first period, they get σ from their parents, and in the second period, when the child is already an adult, he is independent and gets to keep all his salaries, so that consumption is determined by his income.[10] The income of the child being now an adult is, among other elements, a function of how much his health has been deteriorated during his childhood.

Based on the literature, we take that health deterioration is due to two elements: number of working hours, and the size of the family, due to the sibship effect discussed above, and of course conflicts (see Brezis, 2006).[11] Therefore, income is a positive

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[9] In most models, A is exogenous, since it is based on past decisions.

[10] To keep this framework simple, I assume σ to be exogenous, and not included in total consumption. Moreover, for matter of simplicity, w is constant and I omit the human capital function.

[11] See for instance, Dembe et al. (2005), Sparks et al. (1997), and Spurgeon and al. (1997). About working hours, Dembe et al. (2005) have analyzed the incidence rate as a function of number of hours worked, and

function of the number of children, n and a non-linear function of hours worked, l_c, and consumption equals income, so we get:

$$C_c = I - \lambda n l_c^2 . \quad (3)$$

where λ is an exogenous parameter emphasizing cultural and social elements, as conflicts that influence health deterioration, and is not linked properly to the parameters endogenous to the family. (In this version, we do not include the element of conflict).

Parents have to choose the number of children they have raised, n, and the amount of child labor, l_c which maximize the utility function in equation (4):

$$W_p = U(A + nwl_c - \sigma n) + \delta n(1-\pi)W(I - \lambda n l_c^2) . \quad (4)$$

The two first-order conditions with respect to l_c and n respectively are:

$$U'(C_p)w = 2n\delta\lambda l_c W'(C_c) . \quad (5)$$

and

$$U'(C_p)[wl_c - \sigma] + \delta(1-\pi)W(C_c) = n(1-\pi)\delta\lambda l_c^2 W'(C_c) . \quad (6)$$

How an increase in the probability of war, π is affecting the optimal number of children in a family?

From equation (6), and assuming for simplicity, that utility functions are linear, we get that: [12]

$$n = \frac{\Omega}{(1-\pi)\delta\Lambda} + \frac{I}{\Lambda} . \quad (7)$$

where

$$\Omega = wl_c - \sigma \qquad and \qquad \Lambda = 2\lambda l_c^2 . \quad (8)$$

So:

$$dn/d\pi = \frac{\Omega}{(1-\pi)^2\delta\Lambda} > 0 \quad \text{and} \quad d^2n/d\pi^2 > 0 \quad \text{since} \quad 0 \le \pi \le 1 \quad (9)$$

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have found that the function displays a non-linear relation. About the size of the family, i.e., the "sibship" size, we have presented above the literature.

[12] In case they are not linear, taking the total derivative, we get the same results on the sign of the derivative.

Proposition 1

As the probability of war increases, families tend to have more children, and this effect becomes stronger as the probability of war continues to rise.

In Figure 4, we illustrate the function of n (fertility rate) as a function of the probability of war and conflict.

We now turn to the reverse relationship in the model—how war and conflict are influenced by fertility rates.

B. The model of conflicts

The literature presented in Section II has shown that the increase in the proportion of youth within the adult population leads to higher levels of political violence. In our review of related literature, we explored various explanations for this causality—some focusing on biological factors such as hormones, others on social dynamics. From an economic perspective, the cost of war also plays a role: countries with younger populations can recruit more soldiers at lower costs and more easily mobilize them for conflict.

However, much of the existing literature has primarily emphasized empirical findings. Figure 5, based on the work of Cincotta and Weber, 2021, illustrates this relationship. It shows that as the median age decreases (i.e., as fertility rates rise), the probability of war and conflict increases. However, this relationship is first convex and then concave rather than linear, indicating diminishing returns at higher levels of fertility.

In Figure 6, we take one of the curves from Figure 5 and invert the x-axis so that higher median ages and lower fertility rates appear on the left side of the graph.

We now proceed to analyze the complete model.

C. The complete model – Multiple equilibria

In part A, we have shown how probability of war, π affects the fertility rates, n. (Figure 4, represented by the red curve). In Part B, drawing on the literature, we presented the relationship between the probability of war, π, and fertility rates, n (Figure 6, shown by the black curve). Now, we combine these two relationships into a single framework.

Figure 7 illustrates both curves, revealing the existence of three equilibria: green, black and red.

To understand the dynamics of the model, consider a point above the green equilibrium in Figure 8. At π_0, according to the red curve, individuals choose to have n_0 children. However, at n_0, the corresponding probability of war is only π_2. As a result, fertility rates continue to decline, and the system moves leftward- leading to lower fertility rates and a decreasing probability of war.

Now, consider a point to the left of the black equilibrium. At π_3, the red curve suggests that individuals will opt for n_3 children. However, at n_3, which represents a high fertility rate, the corresponding probability of war rises to π_4, which is higher than π_3. Consequently, the system moves rightward - leading to increasing fertility rates and a rising probability of war.

Thus, the model predicts two stable equilibria (green and black) and one unstable equilibrium (red). Over time, each country gravitates toward one of the two stable equilibria: either a state of low fertility rates and low conflict probability or a state of high fertility rates and high conflict probability.

We get the following proposition:

Proposition 2

The model predicts distinct regional patterns in population growth and conflict. Some countries will exhibit low fertility rates and a low probability of conflict, while others will experience high fertility rates alongside a high likelihood of conflict.

The world appears to be divided into distinct regions: parts of Africa and the Middle East are stuck in the unfavorable "black" equilibrium, characterized by high fertility rates, a low aging population, and frequent conflicts. In contrast, Europe and certain Asian countries have reached the "green" equilibrium, marked by low fertility rates, an aging population, and a low probability of war.

V. Conclusion

Historically, demographic perspectives have largely favored population growth. The first blessing given to Abraham was: *"Go forth and multiply,"* and Malthus similarly argued that humans would have as many children as nature allowed them to sustain.

While a larger population has traditionally been seen as beneficial for economic growth, the neo-classical growth models have emphasized the negative effects of population growth due to the quantity-quality tradeoff, and to the necessity of high capital per capita. Indeed, capital accumulation is essential for development, and rapid population growth can dilute both physical and human capital. As a result, population growth negatively impacts economic growth by reducing capital per capita and limiting investments in education.

A notable side effect of low population growth is an aging population. In developed countries, population aging has become the dominant demographic trend, driven by longer life expectancy, declining fertility rates, and the aging of large cohorts. Never before in history have such large numbers of people reached the age of 65 and beyond.

What impact does an aging population have on economic growth? The literature on innovation and robotics suggests that younger populations tend to generate more

creative ideas and drive higher levels of innovation (see Ruiu et al., 2019, 2023; Frosch, 2011). However, declining fertility rates also allow for greater investment in elite universities by increasing capital per capita, which has been shown to enhance innovation through separating equilibrium (see Brezis & Rubin, 2023). Thus, while an aging population—resulting from low fertility rates—may have direct negative effects on innovation, it also has indirect positive effects through increased capital per capita.

This conclusion is without taking into consideration a subject that was completely avoided and ignored by the economic growth literature: War and conflict. This paper stresses that an aging population significantly reduces the probability of conflict.

This study explores the bidirectional relationship between demography and conflict. On one hand, countries with low aging populations and high fertility rates (above four children per woman) have a 53% probability of experiencing conflict. These are the nations with a large youth bulge and a low median age. On the other hand, in countries with high aging populations and fertility rates below two, the probability of conflict falls to less than 5%.

The presence of multiple equilibria in this model suggests that policy interventions can shift a country from an unstable equilibrium to a more stable one. Policies can guide a nation from high fertility rates, high crime, low capital, and weak infrastructure toward a state of low fertility, low crime, and higher investment in education and development. However, since this paper is primarily a research study, identifying specific policies to alter these endogenous dynamics is beyond its scope.

This paper has one main conclusion. Most countries face a choice between two paths: The first one is having big families, low education, low capital, low infrastructure, low aging population, low median age, and in consequence a high probability of conflicts and war.

The second path fosters long life expectancy, small, healthy, and well-educated families, and high infrastructure investment. While an aging population is a natural consequence of low fertility rates, it mitigates the youth bulge effect and reduces the probability of conflict.

I will conclude this paper by raising some questions about past history. Moller, claimed that economic depression in Germany led to unemployed youth cohorts which contributed to the rise of Nazism in Germany. Could the same be said of the French revolution?

It is well-documented that the revolution was a revolt of the poor against the wealth of the nobility and religious elite. But have we overlooked the role of the youth bulge in fueling this upheaval? We know that the *gilded youth* (*jeunesse dorée*) played a significant role in the counter-revolution. Perhaps history has erased the demographic pressures behind the political turmoil of the 18th and 19th centuries.

As a final thought, I conclude with a last question. After reading this paper, would any scholar still lament an aging population, characterized by highly educated and

healthy children, and no conflicts, and instead advocate for societies with youth bulges, low education, and a high probability of war?

TABLES

TABLE 1

THE RELATIONSHIP BETWEEN THE VARIOUS DEMOGRAPHIC VARIABLES

Fertility rate	1	2	3	4	5	6+
Birth rate/1,000	15	21	27	33	39	45+
Median age.	55	47	40	31	23	15
Youth bulge %	15	23	28	33	40	45+

Sources: UN.

Note: The data is approximative

TABLE 2

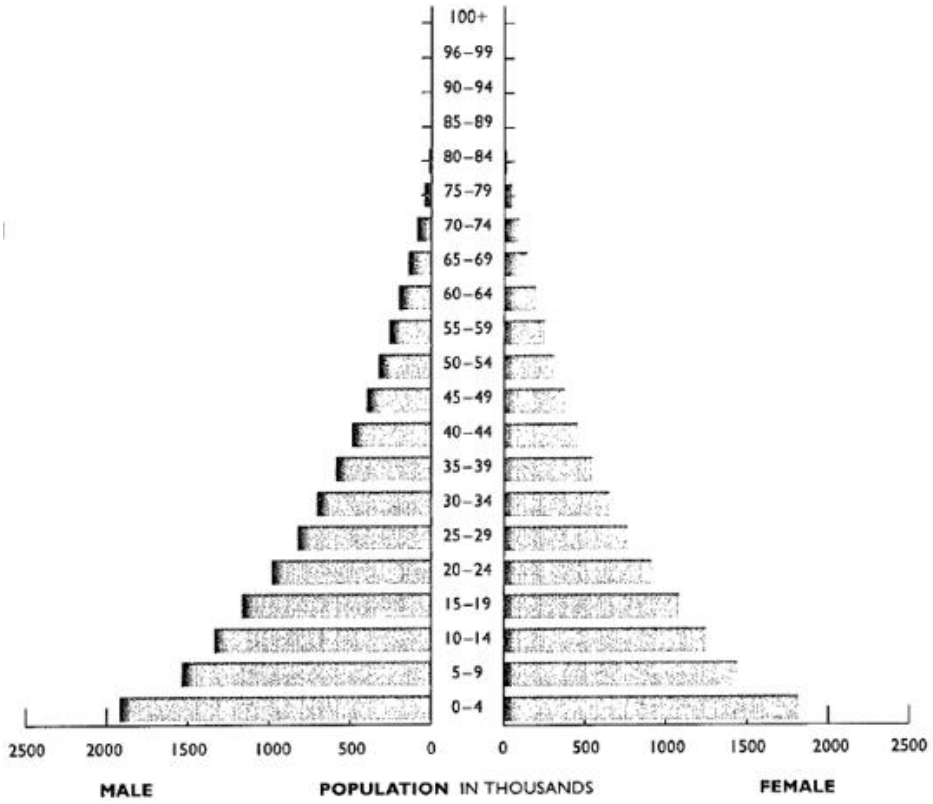
FERTILITY RATES, BIRTH RATES AND PROBABILITY OF CONFLICTS

Birth Rate 1985-1990	Probability of conflict 1990-2000	() Probab. of conflict 1980-1990	() Probability of conflict 1970-1980
45.0 or more	53%	45%	40%
35.0 to 44.9	34%	33%	29%
25.0 to 34.9.	24%	31%	22%
15.0 to 24.9	16%	10%	15%
Less than 15.0	5%	2%	2%

Fertility Rates 2001-2010	2001-2010	# conflicts world	# countries world
5 and more	75%	24	32
4 to 5	45%	10	22
3 to 4	24%	7	29
2 to 3	18%	13	71
0 to 2	8%	6	99
Total		62	253

Sources: own calculations and Cincotta et al., 2003.

Figure 1: Age Structure in Afghanistan in 2000



Source of Fig 1-3: Cincotta et al., 2003.

Figure 2: Age Structure in Gaza in 2000

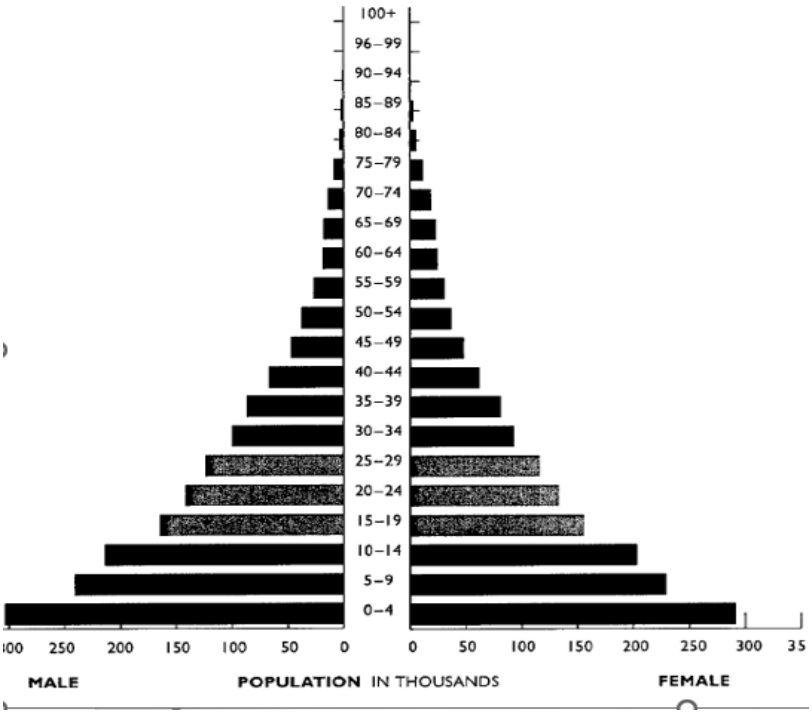


Figure 3: Age Structure in France in 2000

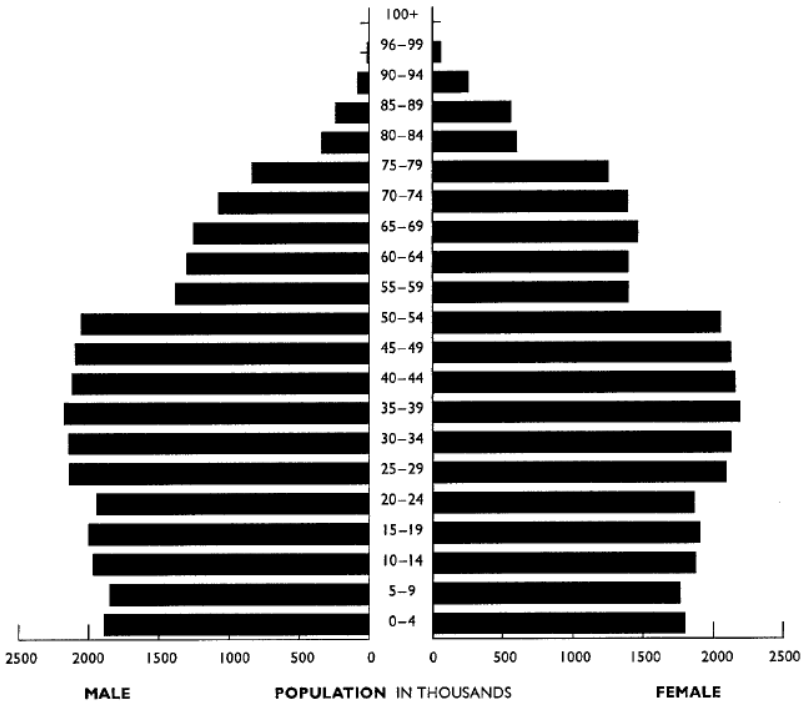


Figure 4: The effects of fertility rates

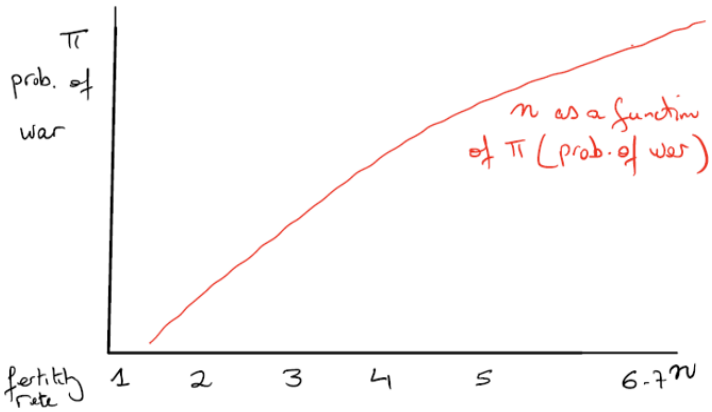
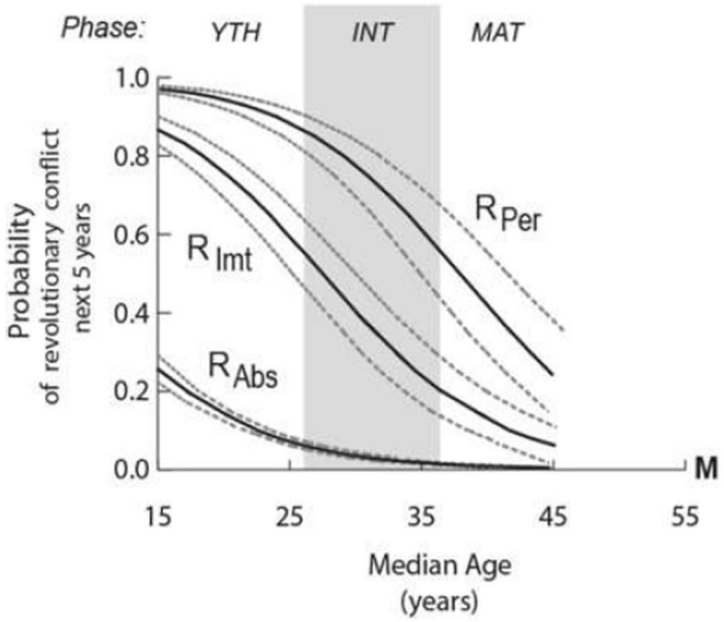


Figure 5: The effects of median age on probability of conflict



Source: Cincotta and Weber, 2003 p. 74, Fig 2.

Figure 6: The Effects of fertility rates on the probability of war

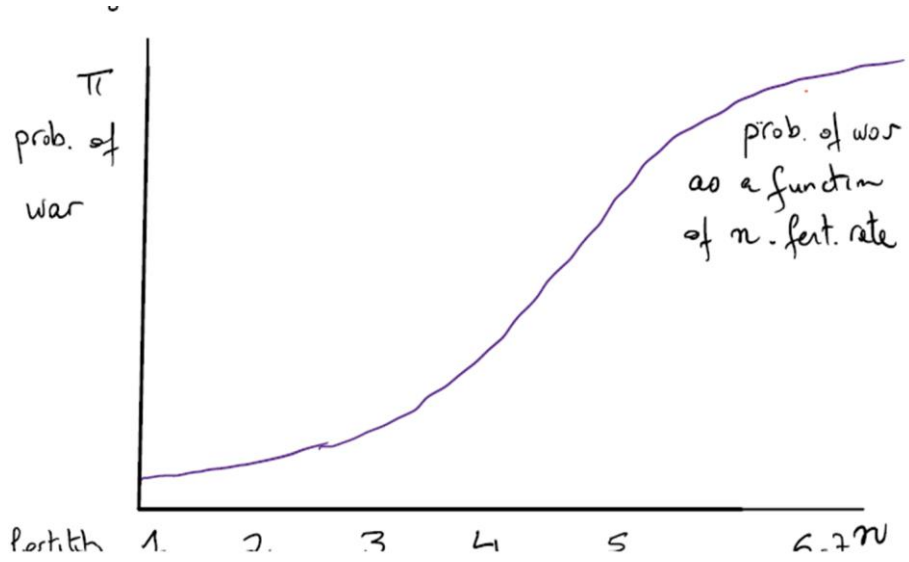


Figure 7: Multiple equilibria

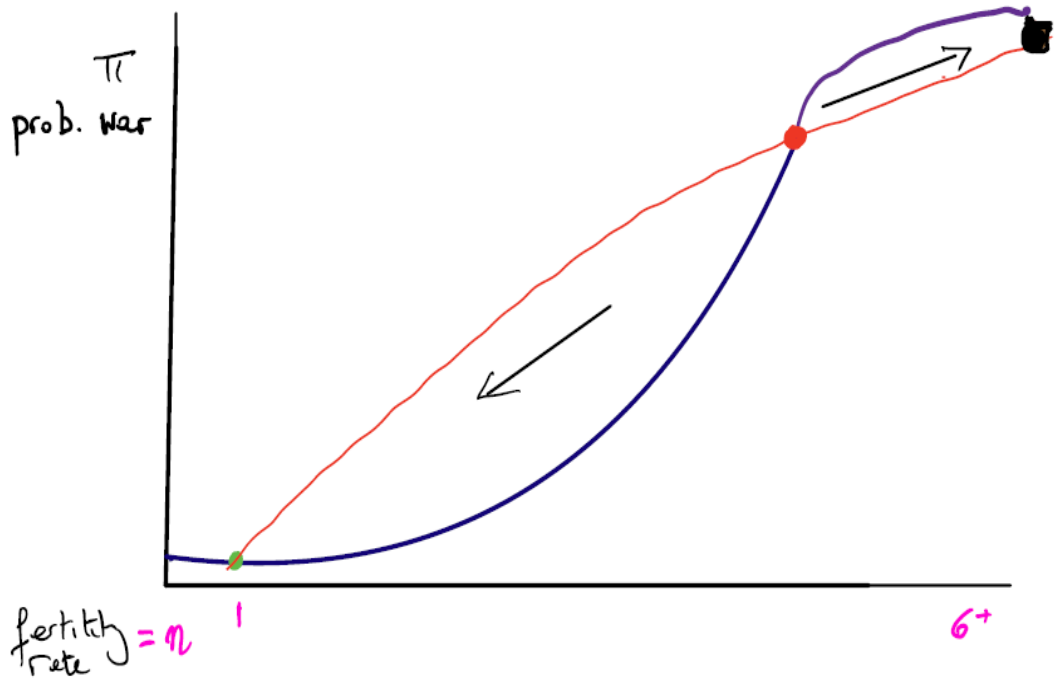
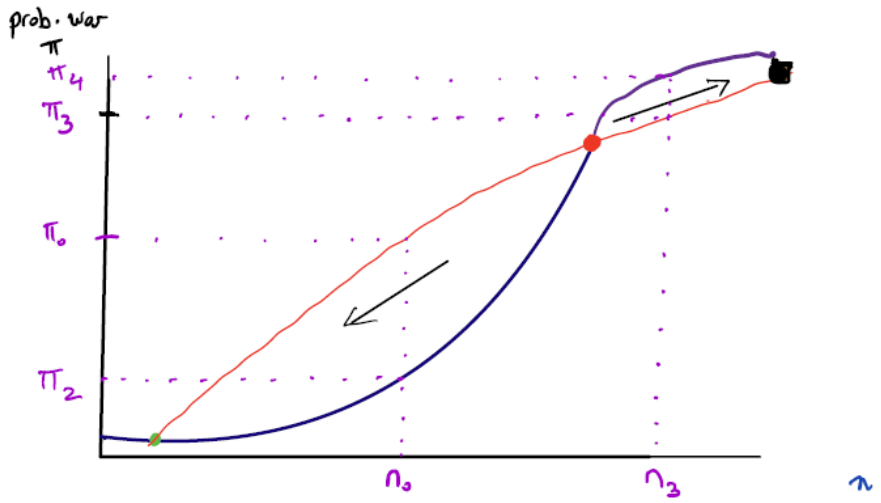


Figure 8: The Dynamics towards an equilibrium



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