Demographic Shocks: The View from History. discussion

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I must admit from the onset that I cannot really be very critical of Massimo Livi-Bacci's work, because much if not most of what I know of historical demography I learned from him, and thus if I were overly critical of him, I would be in the position of spitting into the well from which I have drunk. This is a nice and well-argued paper, although for those of us who have been keeping up with Livi-Bacci's books, there is little here that we did not know before or at least were prepared to believe. But his essay, all the same, is so informed and so chock-full of insights that it inspired me to try to formalize and reflect on some of the things that he talks about, and how we should think about demographic shocks and the impact of political and economic events on mortality, fertility, and similar variables.

What are demographic shocks? In a Malthusian framework, we can distinguish between two types of shocks, permanent and transitory. Let me try to explain this using a very simple framework, and then try to make it a bit more sophisticated. To set up a Malthusian model we need to assume as a first approximation that there is no emigration, so that population change is simply births less deaths. Second, we need to assume that this system behaves like a Malthusian model, that is, when income rises, births go up and deaths go down. Third, we need to assume that income is concave in relation to population, as Malthus maintained and almost all economists believe. This leads to the following different cases of "demographic shock" (see Figures 1 to 5).

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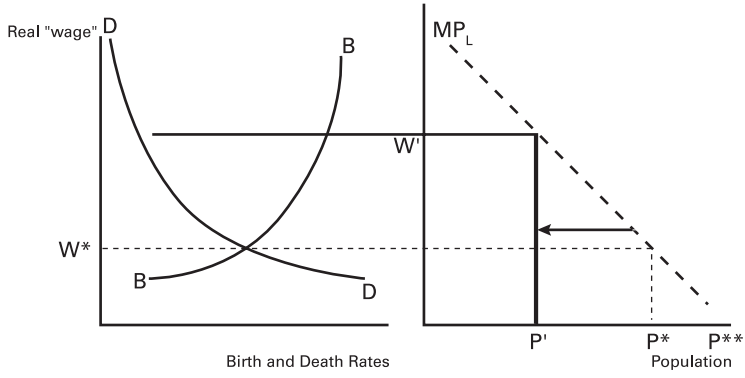
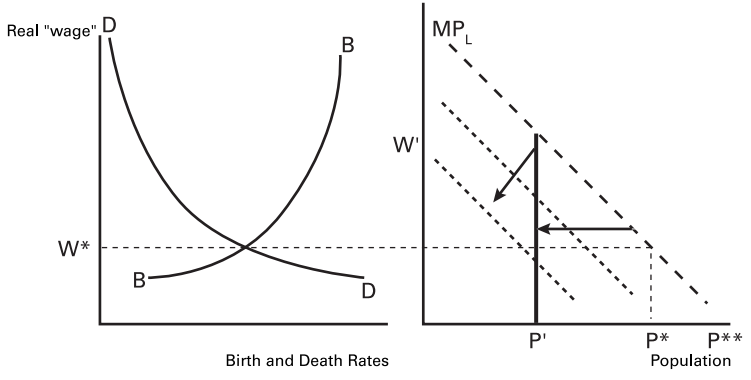
Figure 1



Temporary shock: As the result of an epidemic, population falls from P* to P'. Wages rise to W', at which point B > D, so population starts to recover and eventually gets back to P*.

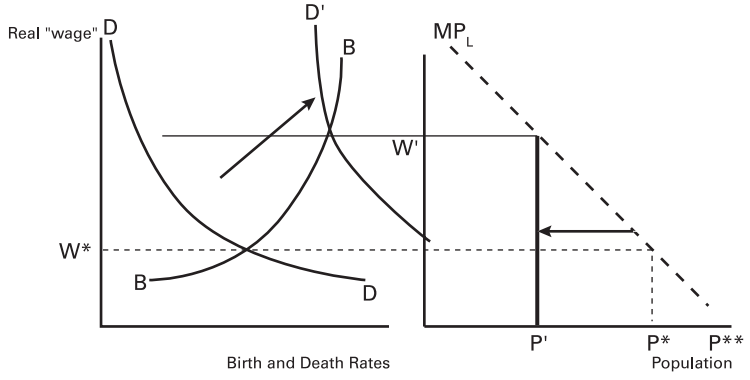
Note: MP$_L$ = marginal product of labor.

Figure 2



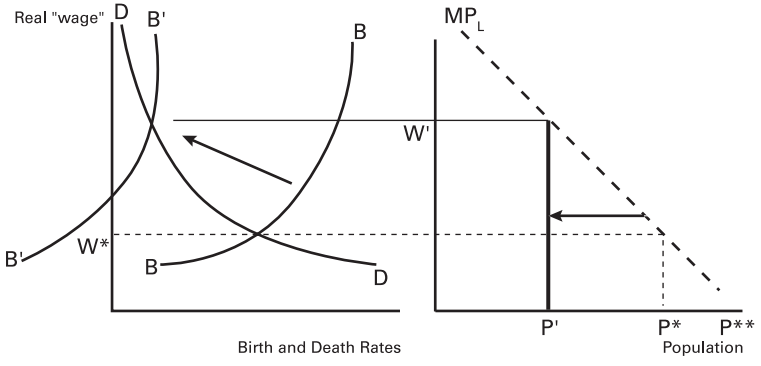
Quasi-permanent shock: Because of a war, population is reduced from P* to P', and the stock of capital is reduced to the point that the marginal product of labor (MP$_L$) shifts to the left. Population is lower, with wages in the medium run at W*. If the capital stock recovers, MP$_L$ shifts back to the right and, in the very long run, population returns to P*.

Figure 3



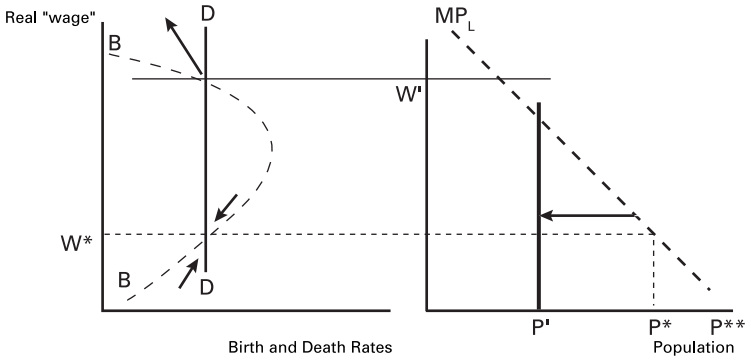
Permanent shock to death-rate regime: As a result, for instance, of the arrival of foreigners carrying new diseases, the DD curve shifts suddenly and permanently to the right. This means a much lower steady-state population, albeit at a higher wage. At the old wage rate, the mortality rate is horrendous. There is no recovery.

Figure 4



Permanent shock to birth-rate regime: The BB curve shifts to the left because of a preference for fewer children. At the old wage W*, the birth rate would be truly low, but declining population raises wages and so people want some children, and we move to a "low-pressure equilibrium" with low rates of births and deaths and high income.

Figure 5



Perverse birth behavior and the end of equilibrium: The BB curve in its lower segment has the normal Malthusian positive slope; however, beyond a certain range it becomes upward-sloping, and if rising incomes in that range cause declining birth rates without a corresponding decline in death rates, we may face continuously declining population and no equilibrium, absent something else happening.

The five figures are based on the simple idea that the BB curve is upward sloping, reflecting the increase in fertility resulting from higher wages (due possibly to higher marriage rates, higher fecundity rates, lower miscarriage rates, and so on). The DD curve reflects lower death rates associated with higher wages. By definition the intersection of the two curves reflects population equilibrium. The curve on the right panel simply reflects a declining marginal product of labor with higher *levels* of population. At a point like W* in Figure 1, population is stable; its level is given by P*.

This simple set-up can be used to show the effects of different shocks, as explained in the five diagrams. As always, there is a difference between deviations from equilibrium that lead to temporary shocks and a return to equilibrium (as shown in Figure 1) and shifts of the relationships denoted in the curves. In Figure 2, some events such as war shift the marginal product of labor to the left. In Figures 3 and 4, the DD and BB curves shift out permanently, thus administering permanent shocks, resulting in different equilibrium levels of wage and population. Finally, in Figure 5 there is a different order of shock: The system changes from an equilibrium to a disequilibrium system if the BB curve becomes positively sloped and may face permanently declining population at higher and higher wages.

Why would BB be positively sloped? The answer is that if people have high incomes, they can consume a lot. But consumption of many

things, from ski vacations to elaborately cooked dinners, takes time, and so do children. Under certain reasonable assumptions about the nature of children, it can be shown that people will "consume" fewer of them as income goes up. If that is the case, the BB curve may rotate and acquire a negative slope (Figure 5). It is hard to think of this situation, which Livi-Bacci describes in detail, as a "shock" or a "crisis." Instead, what we have is a behavior that in purely Darwinian terms is somewhat perverse but by now must be acknowledged to be a reasonable approximation to what is happening in much of the Western world. As income per capita rises and the time-intensity of the consumption packet increases, people reduce the number of children. All other things equal, this will cause income to rise even faster, and that will exacerbate the trend. It is possible that a move to the left of the DD curve will weaken this trend: Fewer people are born, but they live longer. This will help, but unless the perverse BB curve's slope turns to zero, this will not reverse the trend.

This model will take us only that far. It explains some historical events such as the Black Death and the Irish Famine that Livi-Bacci describes, but it has a hard time analyzing a great deal of the variability in modern demographic history. The framework applies most fruitfully to what I regard as the greatest shock to demographic history, one that Livi-Bacci does not quite address as much as I would have liked him to, namely the decline in infectious diseases in the Industrialized West after 1870 or so. The fall in infectious diseases relentlessly drove down mortality rates, so that when effective cures appeared after 1945, the demographic impact of these diseases had already been attenuated. This historical phenomenon underlines the need for a field of study that I will call somewhat lugubriously "the economics of death." It is based on the idea that people do not choose to die, normally, but their life expectancy depends on economic decisions such as consumption and the allocation of resources within the household. In a nutshell, the goods and services that people consume and the way they spend their time affect their health, often as a by-product of other utility-producing activities. The idea of "goods" here should be taken broadly: Health is influenced not only by diet, doctor's visits, exercise, and lifestyle, but also by residential location and occupational choice. It is also a function of how much time people are willing to spend on health-enhancing housework such as cleaning, cooking, and child care.

I propose a general framework in which life expectancy (or its obverse, "death") depends on three sets of constraints: income, relative prices, and knowledge. Income should be rather obvious: When income goes up, all goods with positive income elasticity go up in quantity. That, normally, will enhance health unless people have an especially high income elasticity for health-reducing goods such as narcotics or motorcycles. Changing relative prices are, of course, very pervasive. Much institutional change manifests itself as changes in relative prices. For

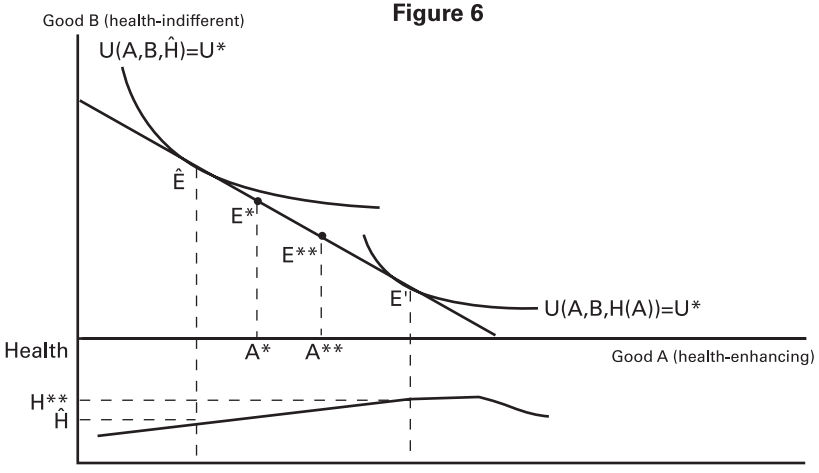
instance, the crumbling of the medical infrastructure in the post-Soviet Russian Republic has raised the *relative* price of goods that affect health positively relative to other goods; as a result, health has declined more than the fall in income alone would have predicted. On the other hand, the improved public health services in many less developed countries after 1950 increased life expectancy more than income growth would have suggested, because it reduced the relative price of health-enhancing goods.

The framework I delineated above serves well to explain this event. The rise in income, as McKeown and others have steadfastly maintained, increased the consumption of goods that improved health: fresh fruits and vegetables, high-protein foods, home-heating, hot water, cleaning materials, and so on. At the same time, growing government intervention and public health measures reduced the relative price of clean and safe water, the price of waste disposal and of protection against insects, and the costs of verifying the safety of food and drink. Not all changes in relative prices were the result of public health measures: Technological change in a variety of areas contributed as well. Filtration and chlorination of drinking water, refrigerated ships, pasteurization techniques, electrical home-heating, all reduced the price of health-enhancing goods.

Yet, as I have argued in a string of papers as well in my forthcoming book, this is not enough. What matters is what consumers *believed* about their health and how they adapted their consumption to maximize simultaneously their health and their direct utility from consumption. This is a hard issue, since we cannot readily measure consumer belief. Yet it stands to reason that the average consumer in large parts of the world in 1914 knew a great deal more than the consumer of 1860, and that it is unthinkable that he or she would not have adjusted behavior accordingly. By 1914, a large proportion of the population knew that water could be dangerous even if it looked, tasted, and smelled clean; they knew that lice transmitted typhus and mosquitoes malaria and yellow fever; they knew that certain diseases could be transmitted directly by air and others through food only; and that by boiling water and thoroughly cleaning baby bottles, the likelihood of diarrhea could be reduced. All this meant major changes in household behavior on many fronts. It is this "shock," more perhaps than even the two world wars, that has created the demographic structures of the modern world.

The three factors at play here can be readily illustrated in a simple diagram. Assume for simplicity that there are only two goods; one of them (A) is health-enhancing ("grapefruits") and the other (B) is health-neutral ("videocassettes"). The consumer likes both goods, but the demand for A, in addition to its direct utility, also enhances health and to the extent that the consumer knows this and takes it into account, she will normally consume more of the good than the primitive utility-maximizing quantity. The question is: How much does the consumer know?

Figure 6



Extreme cases:
E': "fully informed" consumer. Consumption takes the indirect effect of A fully into account.
E: "primitive" consumer. Consumer entirely neglects health-enhancing effects of A.
Intermediate cases:
Consumer knows "something" (E*) and then learns more (E). So health goes up as a result of learning. Of course, the same increase in A from A* to A** could have been attained by an increase in income or a change in the relative price of A.**

Figure 6 demonstrates this idea. The extreme possibilities are the totally uninformed ("primitive") consumer who entirely fails to take account of the indirect effect of good A on her health (at $\hat{E}$) and the fully informed consumer who has full knowledge of this effect and optimizes consumption at E′. In between, there are partially informed consumers. The shock that the new bacteriology and nutrition science that emerged between 1880 and 1940 administered to the system was a move from something like E* to E**, leading to a rise in health (measured, for example, by life expectancy) from $\hat{H}$ to H**. This change would be equivalent to a shift of the DD curve to the left, which in a Malthusian regime would have meant lower wages. By the twentieth century, of course, the Malthusian model no longer applied. The greatest demographic shocks in modern history, then, must be the regime change and the knowledge revolution, which created an entirely new demographic world that Professor Livi-Bacci rightly regards as the great challenge to his profession.