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NEW DIMENSION OF THE EFFICIENCY-VERSUS-EQUITY DEBATE

INTRODUCTION

For many years the efficiency-*versus*-equity debate has been an important economic issue. Far from being resolved, nevertheless it led to the conclusion that equity is compromised if efficiency is violated. To some extent both of them can be sought independently. This is reflected in the variety of Bergson-Samuelson social welfare functions. Many conflicting notions of equity are implied by alternative functions such as the utilitarian (Bentham), egalitarian (Rawls) or elitist (Nietzsche) – to quote just three classic examples. And yet it can be proved that any maximum of a Bergson-Samuelson social welfare function is attained in a Pareto optimum (Mas-Collel et al., 1995, p. 825). In other words, even though we may lean towards many different notions of equity, in any case it is impossible to maximize welfare unless the economy achieves efficiency.

A slightly different conclusion is implied by Sen's (1973) proposition to associate social welfare with a combination of average income (reflecting efficiency) and Gini index (reflecting equity). The two concepts are largely independent of each other and both of them are important for our perception of welfare. Until recently the problem seemed to have been solved. However, controversies over climate policy brought to the attention unresolved intergenerational equity issues.

At the first glance, the problem is an old growth theory dilemma: present *versus* future consumption. This issue has been extensively studied by a number of economists over the second half of the 20th century, starting with von Neumann (1945-46), and Dorfman, Samuelson, Solow (1958). Intergenerational equity is

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tackled by using an appropriate discount rate. After Ramsey (1928), future consumption is discounted by a social discount rate given by the formula:

$$\delta = \rho + \mu g,$$

where:
δ – social discount rate,
ρ – pure time preference (human impatience),
μ – elasticity of the marginal utility of income,
g – expected rate of growth of consumption.

In important applications, such as e.g. climate protection, uncertainty regarding appropriate social discount rate invalidates key conclusions. For instance, by applying a very low discount rate (0.1%) Stern (2006) demonstrated that an immediate, aggressive reduction of carbon dioxide emissions is justified in terms of long run global welfare. At the same time, by applying a higher – but declining – discount rate (3% to 1%), Nordhaus (2007) argues that welfare maximization implies a much slower reduction schedule.

Two issues emerge as key controversial questions that are fundamental for long term economic analyses. The first question is about sustainability; the second one – about discounting. Both will be addressed in turns in the remainder of the paper.

SUSTAINABILITY

Sustainability – a catch word reflecting environmental concerns voiced in the so-called Brundtland Report (WCED, 1987) – was in fact introduced by John Hicks much earlier. In his *Value and Capital* (1939), there is a definition of income as a flow which can be continued. In other words, if one owns a house and sells it, then the revenue received is not an income, because it cannot be sustained in the future. In contrast, if one owns a house and rents it, then the rental payment is an income, since it can be enjoyed for ever (of course, subject to certain additional assumptions). According to WCED (1987), sustainability means “to meet the needs of the present without compromising the ability of future generations to meet their own needs”.

It is easy to indicate unsustainable trajectories, but identifying sustainable ones is a controversial issue. A standard dynamic optimization problem refers to maximizing the sum of discounted utilities:

$$W_0 = \sum_{t=0}^{\infty} u_t (1 + \delta)^t,$$

where: u_t denotes the utility enjoyed at time t, and δ denotes a discount rate.

There is an inherent unsustainability implied by this formula with a positive δ. Assuming that utility is an increasing linear function of the consumption of an exhaustible resource, then extracting a unit of this resource one year earlier increases the sum. Likewise, postponing an unavoidable damage one year later increases the sum too.

Having noted that maximization of discounted utility contradicts sustainability, economists started looking for an alternative optimization criterion. Perhaps the best known alternative is the Chichilnisky criterion:

$$W_0 = \alpha \sum_{t=0}^{\infty} u_t/(1+\delta)^t + (1-\alpha)\lim_{t\to\infty} u_t,$$

for some $\alpha \in [0, 1]$.

If a prevailing weight in this combination is attached to the first element (the parameter α is close to 1), the result will be close to the conventional optimum, i.e. a development trajectory that may not be sustainable. If on the other hand a prevailing weight is attached to the second element (parameter α is close to 0), the result will depend on the welfare of distant future generations, and the present will be irrelevant.

The essence of this approach is contained in the theorem (Chichilnisky, 1996), that any development paths satisfying any reasonable definition of sustainability can be derived from the Chichilnisky criterion, after having fixed certain weights α and $1-\alpha$, but the discount rate δ cannot be constant over time; it should converge to zero. Hence, on the grounds of economic analysis intergenerational equity can be derived only as a very special case of an optimum resource allocation subject to certain arbitrary assumptions.

The constancy of discount rates will be addressed in the next section. Here we will concentrate on the logic of taking an infinite series of utilities (whether discounted or not). The logic extrapolates decision making of an individual who makes an intertemporal allocation of his/her resources. In both formulae above, one assumes that society behaves like an infinitely living individual.

This is questionable. Lionel Robbins (1932) convinced economists that economics is "the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses". There is also no doubt that people do discount when they make choices. What is questionable, however, is the extrapolation of this behaviour on the society, which lives longer than any discounting individual. Some people argue that this extrapolation is not justified (Roemer, 2011). Moreover discounting the future suggests that upcoming generations are assigned lower weights than the present one which offends ethical convictions of many people.

On the other hand, Partha Dasgupta (2011) argues convincingly that assigning equal weights to different generations even if their production opportunities (technologies) are clearly not the same would be unreasonable. Therefore more theoretical analyses need to be carried out in order to see whether individual decision-making can serve as a prototype for intergenerational choices. Unfortunately, the issue cannot be resolved empirically, as long-term economic growth trajectories cannot be manipulated by researchers. In addition, sustainability is a fuzzy concept, since it cannot be applied unambiguously at non-global scales, i.e. when one sector (or region) free rides on another one.

DISCOUNTING

Consciously or not, economists used some sort of discounting in order to derive intertemporal aggregates even in the 17th century. William Petty (1662) argued that the price of land is equal to 21 annual rental payments, since this is – on average – how long a man can cultivate a field while his son and his father are living together; a somewhat strange argument, but effectively it implies a discount rate of 4.76% (a capital of X gives an annual rental payment of $R = X\delta$ which means that $X=R/\delta$, and $1/21 \approx 0.0476$). Later on, discount rates were linked to rates of growth, as explained by the Ramsey formula. Joseph Schumpeter (1912) was perhaps the first economist to argue that the discount rate corresponds to the long run rate of growth of economy (in the Ramsey formula, this requires that $\rho = 0$ and $\mu = 1$). Several generations later this was a prevailing argument behind numerous economists' conviction that a "justified" discount rate should be on the order of 3% or 4% (Weitzman 2001).

While it is empirically clear that people discount the future in their decisions, the exact rate depends on various circumstances. Typically in rich economies, where all basic needs are satisfied, the social rate of discount is low, i.e. 3% or less. In contrast, in poor economies, where many basic needs are not satisfied, the social discount rate is much higher: saving for the future must appear very attractive if one is to postpone the consumption. The World Bank and other international financial institutions recommend to adopt a discount rate of at least 8% in order to assess investment projects in developing countries adequately.

An essential question economists need to answer about discounting is whether δ may change over time. Standard economic theory understood that for a given problem the social discount rate must be constant. This has been embedded in the so-called "time consistency" principle. The principle states that preferences with respect to an outcome do not change, whether they are stated now or in the future. Constant discount rate illustrates the time consistency rule, since $(X/(1 + r)^K)/(1 + r)^N = X/(1 + r)^{K + N}$. In other words, the present value of X $K + N$ years from now can be calculated as the present value of X K years from now and then as the present value of this intermediate result $(K + N)$ – K remaining years (i.e. N years) from the intermediate moment. Of course, the formula does not work if there are different discount rates applied to the periods $K + N$ and K.

Dasgupta and Maskin (2005) explained why it is perfectly "rational" to apply different rates to time periods of different lengths. Moreover, the longer the time horizon of the analysis, the lower the discount rate is likely to be appropriate. The mechanism refers to the value of information. Let us assume that a 50-year problem is to be analyzed in two "instalments" 25-year long each. Is it reasonable to apply, say, 3% discount rates for each of the halves, and, say, 1% for the entire period? It clearly violates the time consistency principle that economists are used to.

Nevertheless the positive answer has an easy intuitive interpretation. Namely, dividing the long period (of 50 years) into the shorter halves (25 years each) implies that a decision can be taken in "instalments". By doing so, the decision maker buys time, and in the middle of the period benefits from additional information that was not available at the beginning of the period. Thus a rational decision with respect to the entire period does not have to be a simple sum of what emerges as rational decisions for both of the smaller parts.

This argument explains why discount rates may decline over time; reduced uncertainty makes people less impatient with respect to distant future consumption – they do not support short run projects unless these provide them with high returns, but they are willing to support long run projects which provide them with lower returns. This mechanism was implemented by Nordhaus (2007) in order to check the efficiency of climate protection measures whose effectiveness can be appreciated by future generations. There are many patterns of declining discount rates. For mathematical reasons, it is convenient to assume that they decline like in a hyperbolic function $f(x) = 1/x$. Consequently, "hyperbolic discounting" was analyzed by Dasgupta and Maskin (2005) as a special case of human behaviour consistent with the hypothesis which links people's impatience to the time interval involved in decision making.

SUMMARY AND CONCLUSIONS

Climate change debates have revived the old efficiency-*versus*-equity controversy. The issue seemed to have been discussed thoroughly, pointing to the conclusion that a preference assigned either to efficiency or to equity cannot be justified on scientific grounds. It merely reflects the political preference of discussants: some insist that efficiency is of paramount importance as inefficient solutions compromise equity; others emphasize that without a sense of equity people refuse to work so that efficiency is compromised. Debating climate protection measures introduced an extremely long time horizon. In the past, analyzing intergenerational allocation of resources was considered of academic interest only. The global climate debate revealed that intergenerational equity is of political importance.

There is a paramount distinction between intragenerational and intergenerational equity. Both are important and difficult to address. Nevertheless the former can be addressed in the framework of functioning democratic systems, at least in principle. In contrast, there are no known democratic systems to address the latter. For obvious reasons, future generations cannot have true representation even in a democratic system. Experimenting with children votes or environmental "ombudsmen" cannot change this in a meaningful way. The well-being of future generations depends on the mercy of the present generation.

The only difference people who are exceptionally sensitive can make is enhancing the awareness of intergenerational equity in economic analyses. The last decades of the development of economic theory put two new concepts in spotlight: sustainability and hyperbolic discounting. Both of them revive the efficiency-*versus*-equity debate.

Sustainability demonstrated that some development patterns considered feasible in fact violate a criterion that many people take as indispensable. It would be difficult to argue whether sustainability is a factor of efficiency or equity. Sustainability probably affects both. Unsustainable paths of development are likely to waste resources thus compromising efficiency. On the other hand, unsustainable paths of development may violate intergenerational equity which is a special case of equity in general.

Discounting is a method of comparing costs or benefits that appear in different moments of time. As it is a technique of analyzing intergenerational distribution, it obviously affects equity. At the same time, it helps to identify projects that improve rather than impair efficiency. Hyperbolic discounting takes into account availability of information. The fact that it assumes low discount rates for long time horizons – much longer than what can be revealed by studying human behaviour – partially incorporates empirical findings and partially reflects theoretical considerations related to the availability of information.

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NOWY WYMIAR W DYSKUSJI NAD EFEKTYWNOŚCIĄ I SPRAWIEDLIWOŚCIĄ

STRESZCZENIE

Trwająca od dawna dyskusja na temat efektywności i sprawiedliwości uzyskała nowy wymiar w trakcie ostatniej dekady. Okazało się bowiem, że niektóre spośród problemów globalnych – takich jak zmiany klimatyczne – potrzebują wyjątkowo długiego horyzontu czasu, co wymaga nowego spojrzenia na sprawiedliwość międzypokoleniową. Wywołało to potrzebę nowego spojrzenia na analizę ekonomicznych kosztów i korzyści. W artykule podjęto dwa problemy wymagające szczególnego zainteresowania: kryteria dobrobytu dla długookresowych ścieżek rozwoju oraz stopy społecznego dyskonta.

Słowa kluczowe: sprawiedliwość międzypokoleniowa, trwałość rozwoju, dyskontowanie.

ABSTRACT

The old efficiency-versus-equity debate acquired a new dimension during the last decade. It turned out that some of the global problems – including climate change – imply a very long time horizon which puts intergenerational equity at the core. This called for a totally new approach to cost-and-benefit analysis. The paper looks at two issues that require careful scrutiny: welfare criteria for long time trajectories and social discount rates.

Keywords: intergenerational equity, sustainability, discounting.

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