The Economic Sustainability – Indicator

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Abstract

The Economic Sustainability Indicator measures the long-term financial sustainability of an economy with a single number that is easily understood and compared. 100% on the Indicator scale implies that a group of people (e.g. a generation) over a period of time (e.g. their lifetime) is leaving assets behind that are as valuable as those that it received at the beginning of the period – sustainable behaviour. If a group destroys or consumes assets without re-investing, it behaves unsustainably. The Indicator value would drop below 100%. Historically, the Economic Sustainability Indicator has been registering above 100% since the Industrial Revolution. However, in Germany today, for example, it has been dropping since the end of the baby boom in 1970s and stands today at about 70%.

The Indicator supplies important arguments for policy-making oriented towards the long-term. It communicates these arguments not only within policy circles but also to the broader public.

The Economic Sustainability Indicator is a project of Deutschland Denken! e.V., a think tank based in Frankfurt, Germany.

Political Motivation

Despite general prosperity and peace, anxiety about the future prevails in Europe. Unlike generations before them, today's citizens no longer believe that tomorrow will be better than today. There are many external and internal reasons for this but one of them is the vanishing trust in public institutions and the belief that these will not be able to cope with, in particular, an unfavourable demography that is predicted for nearly all of Europe and described in greater detail elsewhere in this volume.

And it is true, the welfare institutions in the broadest sense, i.e. public pension systems, disability insurance, poverty alimentation, health care but also public education, are products of the 19th and 20th century. They have not been fundamentally changed since their inception and fit today's social reality about as well as a horseshow on a tiger's paw. The most important risks that need social insurance today are no longer poor old age, ill health or accident; they are different: outdated skills, relocation requirements, lack of competitiveness. Nevertheless, rather than adapt, the welfare state has attempted to cover today's risks with the old remedies. Under-skilled or uncompetitive labour has been removed from the labour force and relegated into any one of the social security systems. The result has been the opposite of what most proponents of strong welfare institutions would have hoped for: rather than strengthen human capital in its competition with financial capital, they have weakened it.

This has been very costly. Thus, unless discontinuous assumptions are applied, the fiscal patterns in most advanced economies are not sustainable. The political process – parliamentary budgeting, elections and re-elections, use of fiscal policy as a general policy instrument – is systematically blind to long-range developments that impact the fiscal and indeed the economic health of an economy. Three examples:

A. Demographic change will be putting the social security systems in most advanced economies under a strain that will lead to their destruction – and to considerable disturbance of public and private finances – if they remain as they are today. This applies to old age pensions, health care and other state benefits that are financed in a pay-as-you-go fashion.
B. Rather than react, politicians find themselves constrained by short-term political demands. For example, even faithful adherence to the EU's Stability and Growth Pact would fall well short of preparing member states for the fiscal challenges of demographic change. Nevertheless, and during a period not of recession but of growth, a number of signatories have repeatedly

violated the Pact. Germany, having once provided the original inspiration for the Pact, is likely to do so for the fourth time running in 2005 and to continue to do so for the foreseeable future.

C. Where austerity measures are applied, they often extend to public investment rather than public consumption, aggravating the difficulties in the future which would otherwise have benefited from returns on current investments. The most notable under-investment in many economies is in human capital, as legacy systems are down-sized without regard to the shift of demand for education from changed demographic groups.[1] The challenge is on: to fill the buzz word of "life long learning" with a meaning suitable to the needs of the 21st century.[2]

The short-sightedness of politics today is not the result of poor political leadership, at least not if we accept political leadership of the kind that is otherwise rewarded by existing structures. It is also not the case that the necessary reforms are unknown or even that nothing is being done, though not at the necessary speed. Political short-termism with respect to demographic change is not accidental but structural in three ways:

A. **Perception**: Most citizens are relatively prosperous and do not see demography impacting their individual situation. They believe they have more to lose than to gain from the reform of social security systems, at least in the short term. In planning their individual future, most people implicitly assume stability of the public (fiscal, monetary, social security) environment.

B. **Strategy**: Reform is usually seen in "big bang" imagery and evolutionary changes of the existing system do not satisfy the need for catharsis. But they are the only realistic solution in democratic systems governed by checks and balances. What is missing is a clear road-map of how piecemeal change will lead to a different future and the time frame that is required.

C. **Ideology**: In view of the complexity of the questions even well informed people require the help of ideological reductions. Changes in the social security institutions are typically framed in terms of "liberty and individual responsibility" on the one hand and "solidarity and justice" on the other hand. This sort of debate typically overrides pragmatic concerns about efficiency and sustainability.

[1] VBW, Dieter Lenzen, Prognos: „Bildung neu denken: Das Finanzkonzept", Verlag für Sozialwissenschaften, 2005 (transl: Thinking education newly, the financial concept)

[2] Ederer, Schuller, Willms in "Bildung neu denken lernen", in "Weißbuch Bildung", pp. 138-148, Verlag für Sozialwissenschaften, 2004 (transl: Learning to re-think education)

These three structural reasons against long-termism point to a problem of communication. For something fundamental to happen in a democracy not a few but a majority of the voters must recognise the need for it to happen. Expert knowledge must inform not just the *policy process* but also the *political process*. The Economic Sustainability Indicator attempts to do just that: connect expert knowledge to political communication.

The simple information whether a political decision contributes or detracts from the long-term prosperity of society would allow much more effective and relevant communication on social, tax and budgetary policy or constitutional politics. The Indicator makes long-term interests transparent for the citizens; it postulates the long-term goal of economic sustainability and shows the impact of any given policy on this goal; and finally it can differentiate between large and small steps towards economic sustainability.

The Mechanics of the Economic Sustainability Indicator

The methodology of the Economic Sustainability Indicator measures how much net capital is being handed down from the current generations to future generations as a percentage of how much net capital these current generations have inherited. If the ratio is above 100%, then the current generations have increased the stock of capital for future generations and thus increased sustainability, and if it is below 100%, then the reverse has occurred. For that purpose the Indicator defines and measures five sets of capital: real capital, human capital, natural capital, structural capital and intergenerational debt:

1. Real capital comprises the cost of the complete set of production machinery and commercially used real estate buildings that are being employed in a society.
2. Human capital is defined as the number of all people who are employed in the workforce of a society multiplied with the cost of their formal and informal education.
3. Natural capital comprises all natural resources that are being used for the production process.
4. Structural capital arises from all the formal and informal rules and institutions which a society has created for itself in order to organize itself.
5. Intergenerational debt comprises all future promises of payments that current generations expect from future generations, netted with the implicit cash flow embedded in private capital inheritance. In other words, net debt or surplus that the future generations have towards the current generation.

A simplified version of the Sustainability Indicator focussing only on real and human capital as well as state-generated intergenerational cash flows has already been introduced.[3] The more comprehensive version presented here in outline form is the subject of a current interdisciplinary research project involving a multi-national European team of scholars and institutions.

The abstract function of the Economic Sustainability Indicator is:

Net Capital inherited:

$+ \sum$ *(Real C + Human C + Natural C + Structural C – Debt C) per year alive*

Net Capital handed down:

$- \sum$ *(Real C + Human C + Natural C + Structural C – Debt C) per year alive*

Net Capital created or destroyed per generation:

Net Capital handed down / Net capital inherited = economic sustainability index in %

Measuring the five types of capital:

1. Long-term Real Capital Measurement:

All machinery and buildings, private and public, are valued at cost less depreciation. Aggregated nationwide figures for these types of real capital are available through the standard accounting by governmental statistical offices. It is assumed that all available machinery is actually utilized in the production process and thus contributes to the creation of economic welfare. These investment goods experience depreciation, as they wear out or lose their usefulness over time. It is assumed that the officially applied depreciation rates reflect the actual economic value of the assets on average. Thus without replacement investments, the real capital stock would decline towards 0 over the years allowing for depreciation.

However, economies are adding to this dwindling capital stock both replacement and new investments, such that the real capital stock has historically been growing. These investments can be financed either through borrowing (=debt), or through savings (=equity). Since over the medium to long-term, the amount of new debt available in an economy is tied to the amount of equity, and since total new equity is tied to the

[3] Ederer, Schuller, Willms: "Bildung braucht hohe Löhne" in "Human Capital Leadership", pp. 179-192; Murmann Verlag, 2004 (transl: Education requires high salaries)

total aggregate of savings, it can be said that long-term investment is determined by the long-term savings rate of the domestic population. Thus future aggregate investments are determined by future aggregate savings, provided there are no changes in the foreign direct investment levels, no changes in the debt to equity ratios, and no changes in the savings patterns of the population. In this way, with help of the economic theory of life cycle savings, a forecast can be undertaken, whether over the long run real capital investments will be higher, equal to or lower than depreciation. If investment levels will be lower than the depreciation, then this means that the real capital stock will be depleted over time, and vice versa.

Changes in foreign savings in/outflow and debt/equity ratios may represent one way in which current generations impact the welfare of the future generations and should therefore also be considered as one of the variables to be measured, for instance if the current generation accepts foreign capital inflows today, and expects future generations to pay them back either in form of loan repayment or dividends.

Thus, the long-term stock of real capital is defined as:

Cost of capital installed – depreciation + rate of expected reinvestment

Whereas rate of expected reinvestment is defined as

*Domestic savings ratio * debt/equity ratio + foreign savings in/outflow*

2. Long-term Human Capital Measurement:

The research field in Human Capital has generated by now around 40 to 50 different methods of human capital measurement.[4] Broadly speaking these can be separated into the following categories: market value measurements, costing based measurements, indicator based measurements, value added measurements, and investment return based measurements. The Human Capital measurement methodology utilized for the Economic Sustainability Indicator follows closely the logic of the real capital measurement. It measures the cost of all human capital created, deducts from it its various forms of depreciation, and adds to it expected reinvestments under status quo conditions.

[4] Scholz, Stein, Bechtel: "Human Capital Management – Wege aus der Unverbindlichkeit", Luchterhand Verlag 2004.

Thus the human capital stock is defined as:

Cost of human capital creation – depreciation + rate of expected human capital reinvestment.

The above equation is conducted with the methodology developed by the think tank Deutschland Denken! eV.[5] It assumes that there exist four types of human capital that are economically relevant:

1. The cost of formal education received during schooling years
2. The cost of formal education received during tertiary, professional or vocational training at universities, professional and vocational schools
3. The cost of informal education received from parents (measured implicitly by their opportunity cost of time)
4. The cost of informal education generated during adulthood (again measured implicitly by the opportunity cost of time).

The human capital stock thus aggregated needs to be depreciated to accurately reflect its economic earning power. There are three types of depreciation that need to be accounted for:

1. education received, but over time forgotten
2. education received, but over time rendered useless (e.g. a secretary's education for stenographic writing)
3. education received, but not utilized in the work place (a lawyer who works as a taxi driver)

Finally, the rates of reinvestment must be forecasted. In case of human capital this is determined by four factors:

1. the birth rate, which determines how many people can be invested into
2. the education rate, which determines how much education each person receives
3. the immigration rate, which determines the net in/outflow of human capital
4. the cost of repairs invested in maintaining human capital healthy and productive, in other words spending for health aimed at increasing the amount of human capital available to the labour market.

[5] Ederer, Schuller, Willms, Deutschland Denken!eV: „Wieviel Bildung brauchen Wir ? Humankapital in Deutschland und seine Erträge", Alfred Herrhausen Gesellschaft 2002 (transl: How much education do we need? Human Capital in Germany and its returns)

3. Long-term Structural Capital Measurement:

Besides real and human capital, over time societies develop institutions that govern the interaction between real and human capital. Most explicitly these institutions are in the form of laws, rules and regulations, that are being enforced by direct or indirect government actions. Implicitly, these institutions also manifest themselves as informal rules: cultural habits and social norms. All taken together, they form the institutional environment in which economic activity takes place. The more net capital is invested in these institutions, the higher the economic output can be expected to be. The field of "New Institutional Economics", is beginning to be able to quantify the contribution of the institutional environment to economic output.

One way to measure long-term structural capital would be to apply the same logic as with real and human capital. Thus one would accumulate the costs of all public investments in building up institutions, which is mostly financed through taxes, add all the privately motivated institution building, and attempt to quantify the costs of cultural investments, both formal and informal (the latter to be measured by opportunity costs of time). From this total one would then deduct the depreciation of structural capital, measured as the rate at which institutions become inadequate over time, the degree to which they contradict and therefore neutralize each other, and the degree to which they are being ignored. However, there is to date little consensus on how to measure these aspects of structural capital.

Therefore, pending further progress in the research of New Institutional Economics, the Economic Sustainability Indicator will instead measure structural capital in an indirect fashion, i.e. as the risk factor that is applied to expected returns on investment achieved on human and real capital. The higher this risk factor, the lower is the net structural capital that is available in that society. From this equation it can be traced backwards how much structural capital is implicitly available.

This risk factor, while qualitative, will be calibrated so that it does not subsume the differentiation of the other capitals. In practical application, the values for structural capital turn out to be far lower than the real and human capital items of the equation. A material differentiation of intergenerational transfer of capital will therefore hardly be the result of changes in the structural capital account.

4. Long-term Natural Capital Measurement:

A society can improve its current well being by selling or using up non-renewable natural resources that are available in its territory. An obvious example are oil-producing nations, where every barrel of oil sold today is one barrel less available to

future generations. In this way, selling these barrels of oil implies running down a stock of capital, that cannot be replenished or only so at enormous costs. Trying to evaluate this stock of natural capital requires putting a price on it reflecting what it would be worth to future generations. This valuation methodology is fraught with numerous methodological issues, primarily around how to estimate future value. If Saudi Arabia today has twice as much oil available as it will have tomorrow, then this decrease would not matter to tomorrow's generations, if the price for that oil would double in the meantime. The value of the remaining stock would then stay the same as it is today. Theoretically that same calculation could be continued into the future forever, until the last drop of future oil has the same value as all the oil available today. In reality, at some point in the future a substitute product would appear, thus capping the value of the dwindling stock of oil, and thus ultimately depriving future Saudi generations of that source of income.

Applying the same concept to European countries, we must acknowledge that most industrial European countries barely utilize, much less deplete domestic non-renewable resources, though some may have been depleted by previous generations. In Germany, it is practically only coal that is being depleted as a natural resource, and even that only at negative returns. With so little depletion or even economic utilization of domestic non-renewables occurring, natural capital will have only a marginal impact on economic sustainability.

In recent years, questions have arisen in terms of whether the current level of CO_2 emissions is depleting the atmospheric resource of climate stability, on which in turn much economic activity depends. To the extent that this is true, such a resource depletion would have to be captured by the Economic Sustainability Indicator . The same applies as well to other such resources such as biodiversity or water supply. The depletion of these natural resources is only relevant to the Economic Sustainability Indicator, however, if they have an economic impact. It may very well be that depletion of such resources has cultural or moral implications that represent other types of losses to society, however, the measurement of these types of losses is outside the scope of the Economic Sustainability Indicator .

Likewise, the impact of environmental conditions on human health is not being captured with the measurement of natural capitals. In so far as such deterioration or improvement are taking place, these are measured in terms of availability of human capital to the employment markets, and the cost it requires to maintain that human capital. Thus this factor is captured under the heading of human capital.

5. Intergenerational Debt Measurement:

In addition to these above four types of capital which are handed down from one generation to the next, debts that are being incurred for future generations must also be measured. Conceivably the current generation might be handing down an increased capital stock, but only with the attached promise to be paid certain amounts of money in the future, implying that future generations also inherit debts to the current generations. In a typical advanced economy, this type of debt would normally come in three varieties: governmentally guaranteed or quasi-guaranteed retirement benefits, governmentally guaranteed or quasi-guaranteed health benefits beyond working life, or privately guaranteed retirement and health benefits (e.g. from life insurances or through private company retirement schemes, etc.).

The governmental guaranteed or quasi-guaranteed pension and health care benefits can be measured with the generational accounting methodology developed by Auerbach and Kotlikoff in the US,[6] and Raffelhüschen in Germany and Europe.[7] The result of these generational accounts are so-called implicit generational debts (or surpluses) if current intergenerational transfer practices are maintained into the future. For most of the advanced economies, these intergenerational transfers turn out to be debt caused by a combination of unfunded overgenerous public benefit schemes on the one side and declining populations on the other side.

A similar accounting will also be undertaken for the privately guaranteed future benefits, if they are not already netted with real capital invested. This is particularly so for unfunded pension schemes. It can currently be observed in the United States in cases such as United Airlines, General Motors or Ford, that company guaranteed future payment promises are also a liability on future generations, even if it is not primarily conducted through the government. In the case of United Airlines, its pension scheme had to be taken over by the quasi-governmental "Pension Benefit Guaranty Corporation", when the company went into bankruptcy. PBGC estimates that around $ 450 billion worth of the 80.000 different company pension schemes it insures, are unfunded and therefore ultimately a risk to the American tax payer.[8]

Even if these private pension guarantees do not fall on the American tax payer, they are still a debt to the future generations. At the car companies GM and Ford, retirement benefits already cost the equivalent of $ 1,500 per car, which is due to rise to $ 5,000 over time per car if current conditions and agreements prevail. That means

[6] Auerbach, Kotlikoff und Gokhale, 1991, 1992, 1994; Auerbach und Kotlikoff 1987; Kotlikoff 1989, 1992
[7] Raffelhüschen, Bernd; Freiburg University, since 1998 in various papers and books
[8] Various studies conducted and published by the US Pension Benefit Guaranty Corporation

that a today's generation car purchaser has to pay $ 1,500 per car in order to pay the debt that the car company has to previous generations of workers. If these $1,500 would not have to be paid to the previous workers, then they would instead be available to either the current purchaser in form of a lower purchase price, or the current workers in form of higher wages, or the current stock owners in terms of higher investment returns. Thus either one of these ways, the private car company pension benefit promise, is a debt that is being placed on a future generation.

The same logic applies also to private life insurance companies who collect savings today in return for promises tomorrow. These savings today are being invested in real capital and therefore increase the capital stock being handed down to future generations (and are accounted for in the Indicator's real capital account). However, at some point in the future, these savers will demand their money back – and this demand needs to be accounted for as future debt. Finally the same logic also applies to health insurers, if they do not apply age-adjusted premiums, but instead subsidize older members' payouts from younger members' premiums. If the latter is the case, then there would be an implicit promise towards today's younger members to subsidise them in the same way once they get older, and thus another implicit intergenerational debt transfer will be concluded.

There are intergenerational capital transfers in the other direction that must be similarly taken into account: inheritance or other gifts of private capital for the consumption of future generations, the most typical of which are private homes that represent an implicit cash flow stream for the inheriting generation. These private inheritances are not captured by the Indicator's real capital account which only measures productive assets.

Thus the sum of intergenerational debt is:

Explicit Government Debt + Implicit Government Debt + Life Insurance assets + Intergenerational Health Insurance promises + Intergenerational unfunded private company pension benefits – intergenerational private wealth inheritances and gifts

How the Economic Sustainability Indicator measures economic sustainability

The basic assumption of the methodology is that total economic output is a linear function of the input of the four types of capital specified, real, human, structural and natural capital. The more of these types of capital are being employed, the more economic output can and will be created. So, if the future availability of each type of

capital can be forecast, then this will also be an indicator of future economic output. If there will be less capital available in the future than today, then economic output will be reduced and not sustained at today's levels. If there will be more capital available in the future, then economic output will be higher, growing beyond today's levels. In this way the measurement and forecast of each type of capital can provide an indication about the long-term economic sustainability of a society. Thus, if the inherited capital surpasses the debts that future generations are to pay back, then positive value has been created for the future generations, and vice versa.

The economic background of this methodology rests on the logic of the Cobb-Douglas production function developed in 1928, which in itself was based on work by Alfred Marshall in 1881, Johann Heinrich von Thünen in 1863 and David Ricardo in 1817. Since then the Cobb-Douglas production functions have been continuously refined and proven to explain economic output beyond any reasonable doubt: any economic output necessitates a set of capital inputs with which to create the production. These inputs have typically been defined as financial capital, labour input and land.[9]

The key insight from the definition of the production function in the early 20th century had been that it can explain how the marginal units of these principal inputs determine both volume and price of total economic output. On the other hand, one of the main frustration with these production functions since the early 20th century has been that they fail to adequately explain economic growth. If the last marginal input explains the total output created, then economic growth could only be created with additional inputs. However, empirically, economic growth has nearly always been faster than the growth of inputs. The higher growth is due to the productivity growth, which is not adequately captured by the production functions typically in use.

This weakness of the production function is also a weakness of the Economic Sustainability Indicator. However, with the advances in structural capital and human capital measurement, the gap between theoretically explainable (and therefore forecastable) growth and observed economic growth is closing.

The issue of per capita economic sustainability

The Economic Sustainability Indicator measures whether an economy is sustainable for given periods into the future. Stated more concretely for the case of Germany, the Indicator measures what levels of productivity growth, saving rates, foreign

[9] For an overview of production functions see, Humphrey, Thomas: „Algebraic Production Functions and Their Uses Before Cobb-Douglas", in Economic Quarterly, Volume 83/1 Winter 1997

investments rates, population growths, or structural capital improvements would be necessary to balance the impact of the decline in the reproduction rate of the German population. If current conditions concerning these factors would not change in the future, then the total capital stock in the economy would be declining, and with it the possible economic output. If the current rate of decline would continue, then this would mean that the German economic output would disappear after about 12 generations (i.e. sometime around the 24th century). However, by this time, the German population would also have disappeared.

Economic sustainability is therefore most appropriately measured on a per capita basis. As long as every living individual has the same or an increasing amount of capital available, then his personal economic output (and commensurate possible consumption) could stay the same or even grow. In that case there would be personal economic sustainability. That individual may experience the gradual disappearance of the society around him as a cultural loss, but at least he or she would not be economically impaired by it.

However, this scenario is unlikely. Human beings are less productive in old age than when younger, and furthermore, even while the population might be shrinking overall, people live longer. A shrinking society combined with ever longer lives, mean that the ratio of working to non-working population continues to shrink as well. Therefore, not only is the total amount of capital shrinking, but also the per capita available pool of capital. Personal welfare will be impaired. It is therefore possible to arrive at different conclusions concerning economic sustainability for the economy as a whole and personal economic sustainability. The primary concern of the Economic Sustainability Indicator is to measure overall sustainability, however it can also be used to measure individual economic sustainability.

Particularities for calculating the Economic Sustainability Indicator

Typically, economic forecasts of cash flows into the future require the application of a discount rate to those future cash flows. The application of the discount rate represents the time value of money, and indicates that even adjusted for inflation, future cash flows are less valuable tomorrow than they are today.

However, the calculations for the Economic Sustainability Indicator do not rely on discounting future cash-flows. There are several reasons for this, economic, legal-political, mathematical and conceptual.

1. Economic considerations:

In the context of the ecological sustainability debate as well as economics more generally, the question of a suitable "social" discount rate has been raised. Hampicke supplies a good systematic overview on this subject.[10] Also, students of economic growth such as Solow, Ramsey, Harrod, E.F. Schumacher, Arrow or Sen, all make clear that there are considerable doubts around the methodology of discounting. [11]

In principle there is a production-oriented and consumption-oriented explanation for why discounting is necessary. The production-oriented theory maintains the concept of a “rich future”. According to this theory there is a constant advance of progress and with it an accompanying growth of consumption potential. If in absolute terms, a payment in the future is regarded as equally valuable than today, then in relative terms it will be regarded less worthy due to the generally higher prosperity in the future. In order to account for this relative equivalence, a payment occurring in the future should be discounted. For instance, in absolute, inflation-adjusted terms, an automobile cost about the same in the year 1910 as today. If one adds the inferior quality of the car of the past, a car was less valuable than it is today. Nevertheless the owner of this car in 1910 was considerably richer than the typical car owner today, because car ownership today is much more wide-spread. A given amount of wealth today would have been more valuable yesterday, and will be less valuable tomorrow = i.e. the concept of the rich future.

The consumption-oriented theory of discounting is based on the individual and collectively observed preference for consumption today versus risks of tomorrow. This social time preference creates an impatience towards the future. The most frequently observed expression of this impatience is the fact that people generally charge interest for money lent, because it forces them to postpone their own consumption into the future. Since the future has not happened yet, this incurs risks to the possibility of this consumption, for which the lender wants to be reimbursed. Likewise, the borrower appears to be willing for the same reason to consume today instead of tomorrow and pay a higher price for that. Thus a market rate for lending money develops.[12]

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[10] Hampicke, Ulrich: „Neoklassik und Zeitpräferenz: der Diskontierungsnebel“, in Frank Beckenbach (Hrsg.), Die ökologische Herausforderung für die ökonomische Theorie, Metropolis Verlag, Marburg, 1991, Seiten 127 - 150

[11] Listing of appropriate sources in the journal " Generationengerechtigkeit 2-2003, Stiftung der Rechte zukünftiger Generationen, page 21.

[12] Overview on discounting theories provided by Dr. Reimund Schwarze, scientific researcher at the DIW Berlin

However at closer inspection, neither the production nor the consumption oriented explanation of "time value" holds up. Even if some scholars find that the production-oriented theory of discounting provides the "deepest economic justification, quasi its intuitive argument"[13], the scientific literature has not yet reached consensus on the actual nature of "time value", leaving open a vast field for further research.

Most of the open questions concerning the time value concept revolve around the fact that people apply different discount rates to different circumstances. Famously, the field of behavioural finances has uncovered that people apply widely diverging values of riskiness to probabilities that are technically identical, but emotionally different. The classical example of this is to give people a choice between 500 Euro of immediate payment and a 50% chance of 1000 Euro later. A large majority of the people will prefer the 500 Euro. However, given a choice between an immediate punishment of 500 Euro and a 50% a chance of a 1000 Euro punishment later, a large majority of the people will opt for the latter.[14] Although in both cases, the mathematical values are the same, people behave drastically differently. The picture becomes even more complicated because the behaviour also depends on the absolute size of the amounts involved. The same experiment leads to divergent results, if the amount is 50 cent, 50 Euro or 5000 Euro in play. There are also the so-called lottery or gaming effects that change the behaviour drastically with different likelihoods applied to these calculations. Most times, people are willing to accept even negative discount values on the future potential payment, if only the potential is large enough (even if very unlikely).

In addition, actually observed market rates for interest are impacted by more such "behavioural" effects, such as the herd effect, the panic tendency, the winner's curse, the status quo bias, and many others. Under these circumstances, it is a bit of a folly to claim that there is an observed "objective" rate of interest that can be used to discount future cash-flows. Robert, Shiller, a sobered empirical economist therefore concludes:

> *"In the 1990's, a lot of focus of academic discussion shifted away from these econometric analyses of time series on prices, dividends and earnings toward developing models of human psychology as it relates to financial markets. The field of behavioural finance developed. Researchers had seen too many anomalies, too little inspiration that our theoretical models captured important fluctuations."* [15]

[13] ibid
[14] Overview to experiments in Behavioural Finance in: "Behavioural Finance and Technical analysis", Mc Graw Hill, Cahpter 19, pp. 650 - 655
[15] Shiller, Robert J.: "From Efficient Markets Theory to Behavioural Finance" in Journal of Economic of Perspectives volume of 17, Nr.1-Winter 2003, page 90, 91

2. Legal-political considerations:

The majority of economic flows between generations is passed through the state. Discounting these economic flows that are conducted via the state (e.g. public pension systems) assumes that the state is an economic actor to whom economic "laws" apply.

Legally speaking that is not the case. The state is subject to a set of politically created laws, of which the constitution of any given state has the highest validity. It is typically the constitution, that grants the other political institutions their power. Any conduct of the state must ultimately be in agreement with the provisions of the constitution.

Taking the German constitution as an example to study whether it recognizes the "time value" of money, or in fact whether it even recognizes the concept of "time periods", and thereby legitimizes the practice of discounting of future payments made or received by the state. A summary of such an analysis and in particular of Article 14 in the German constitution is provided briefly below and it shows that there is only very little direct evidence for the recognition of time value of public cash flows.[16] One of very few explicit statements on this subject had been made by the constitutional scholar and current justice of the Constitutional Court, Hans-Jürgen Papier, who argues that a negative net yield on contributions to the public pension system would be legally seen as disproportionate.[17]

The issue centers around the nature of property according to the German constitution (and in fact most modern democratic constitutions). Article 14 clearly mandates the protection of property. If protection were understood as economic protection of value, then a relatively easy argument could be derived from the constitution that the value of an economic good included not only current value but also future value, and that therefore the state has an obligation to protect both current and future value – hence has to recognize the time value of future payments.

Alas, the historical origin – and current interpretation by Germany's Federal Constitutional Court – of Art. 14 is not economical but political: the protection of property must be seen as a specific case of protecting individual freedoms against an activist state. Art. 14 follows the constitutional tradition of assuming a strong

[16] for a more detailed analysis see Ederer, Peer: "Lebensbilanzen – Die finanzielle Beziehung zwischen Einwohner und Staat, pp. 65-91 doctoral dissertation at University of Witten/Herdecke, 2003 (transl: Life Accounting – the financial relationship between inhabitant and the German state)

[17] Papier, Hans-Jürgen: „Alterssicherung und Eigentumsschutz", in Freiheit und Eigentum, Festschrift für Walter Leisner, 1999 page 741 (transl: social security and protection of property)

interdependence between liberty and property.[18] As long as the individual exercise of freedom is not impaired by the state's impacting the individual's property, then the state has neither obligation nor constitutional basis for redressing this damage. This interpretation applies even to current alteration of economic value, such as when the state builds a road that reduces the value of adjacent properties[19] – and it most certainly applies also to payments that the state promises to generations in the future. So the state has no obligation to adjust the economic value of these cash flows to the time period of when they will be paid. To quote Papier again:

> *"the complementarities of liberty and property, as seen correctly in the German constitution, may not be misunderstood as a simple warranty of the material-economic basis of the free individual development."* [20]

This constitutional interpretation has been challenged several times in the context of the public pension system. In various rulings since 1980, the Constitutional Court's response amounted to a protection of the pension as such, but neither of its economic current value, nor its future value. [21]

Most German citizens who base their financial retirement plans at least in part on the German public pension system, would probably be surprised to find out how little legal protection the German constitution affords them. A similar investigation published in the 2003 Handbook of Intergenerational Justice, studying the constitution across a broader spectrum of intergenerational transfers of value (including for instance ecological values) also reaches the conclusion that such intergenerational transfers are essentially not protected by the German constitution.[22] The political discourse of recent years, both among experts and among citizens, has assumed far greater legal and constitutional security of the pension systems. In the medium to long term this requires either a change in the constitution or a change to the political debate.

[18] Papier, Hans-Jürgen: „Staatliche Eigentumsgarantie und die Sozialbindung des Eigentums", page 92 (transl: public protection of property and the social duty of property)
[19] Maunz Duerig: "Kommentierung des Grundgesetzes 1994, Article 14", paragraph 164
[20] Papier, Hans-Jürgen: „Staatliche Eigentumsgarantie und die Sozialbindung des Eigentums", page 99 (transl: public protection of property and the social duty of property)
[21] Papier, Hans-Jürgen: „Alterssicherung und Eigentumsschutz", in Freiheit und Eigentum, Festschrift für Walter Leisner, 1999 page 723 (transl: social security and protection of property)
[22] Lux-Wesener, Christina in SRzG: "Handbuch Generationengerechtigkeit", Oekom Verlag 2003, pages 405 – 441 (transl: A manual for generational justice)

3. Mathematical considerations:

Its ubiquity notwithstanding, it is often overlooked that the mathematics of discounting work only under three conditions that must be fulfilled for the result to be mathematically correct:

1. all future payments are discounted to the same reference date, which usually is today, but could also be any other day of the past or in the future
2. all future payments are discounted at the same rate.
3. all future payments are fungible with each other, (meaning that these cash flows are describing interchangeable circumstances)

Mathematically speaking, stating that any given cash flow in the future has a net present value of 1 Euro, is not complete unless it also specifies which discount rate has been used. Using a different discount rate would lead to a different present value. It is therefore essentially impossible to reflect the fact that discount rates might be changing over time, or that different recipients of the cash flows may have different discount rates. Since both of these facts are usually true, however, the discounting indirectly violates condition #2.

More specifically to comparing future generational cash flows, the cash-flows apply to different stages in the life-cycle of the generations compared, so they are not fungible with each other. In 2030, the 1960 cohort is 70 years old, while the 1961 cohort is only 69 years old. This difference in life-cycle makes their cash flows not fungible if discounted to today, for instance. The two sets of cash-flows would only be fungible if they referred to the same stages in their individuals' life-cycle, for instance at their respective births, or their respectively being 20 years old, etc. This is a violation of condition #3.

However, if in order to maintain fungibility, the cash flows are discounted to the same stages in life, then the discounting would be violating the requirement to discount to the same reference date, i.e. condition #1. It is therefore mathematically impossible to apply discounting when comparing life cycle sensitive cash flows of different generations.[23]

[23] For a more detailed explanation and simulation of the mathematical effects, please refer to Ederer, Peer: "Lebensbilanzen – Die finanzielle Beziehung zwischen Einwohner und Staat, pp. 65-91 doctoral dissertation at University of Witten/Herdecke, 2003 (transl: Life Accounting – the financial relationship between inhabitant and the German state)

4. Conceptual considerations:

Finally as a last consideration, the value of the Economic Sustainability Indicator is expressed in terms of a ratio. The methodology calculates for every given generation in any given year the ratio between how much capital it is inheriting and how much it is handing down. This ratio is then weighted with the amount of capital transferred per year and can thus be aggregated into a lifetime ratio. If at all, a discount value would have to be applied to the weightings assigned in each year, before averaging the ratios, however in this application, the effect of discounting would be much diminished.

Conclusion

Intergenerational flows of economic value are a growing concern of policy makers in Germany and elsewhere, triggered by foreseeable changes of the demographic composition of the population and a deepening crisis of the current welfare state that is increasingly unable to live up to the public's expectations of economic security.

In order to provide economic policies that address these concerns, policy makers as well as citizens require instruments that can communicate the impact of policies on their own economic position as well as on their own future economic position and that of their descendants. No such tool exists so far.

The Economic Sustainability Indicator developed by Deutschland Denken! e.V. provides the outline of such a tool, by measuring the long-term impact of policies on all types of capital that are utilized in the process for creating economic wealth. It can therefore make this long-term impact transparent and aid the policy creation process.

The Economic Sustainability Indicator measures how much capital any given generation is handing down to future generations, in terms of how much capital it has inherited from its parent generation. This tool goes beyond similar tools available today and encompasses all spheres of economic activity. It can furthermore not only be applied to generational cohorts but also to shorter time frames, such as election cycles. It is applicable not only to the economy as a whole but also to individuals or individual interest groups within it.

Whether a generation is therefore creating value and contributing to the sustainability of all kinds of economic activity, especially including the distributive mechanisms of the welfare state, or whether it is destroying value and making economic activity unsustainable is apparent at a single glance.

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