DE GRUYTER OPEN

ECONOMICS AND CULTURE 13(01), 2016

DOI: 10.1515/jec-2016-0002

COMBINING ENVIRONMENTAL AND SPATIAL DISCOUNT RATES FOR VALUATION OF ASSETS ACCORDING TO INTERNATIONAL FINANCIAL REPORTING STANDARDS

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Abstract. Application of discount rate in finance and accounting is founded on the concept of time value of money. Discounted cash flow model is widely used for asset valuation under the International Financial Reporting Standards (in abbreviation, IFRS). The discount rate applied in valuation models normally is the best rate of return that investors would earn alternative investments. With emergence of ecological economics as a separate branch of economics, the concept of ecological (or in other words, environmental discount rate) has been elaborated. Muller (2013) in his paper 'The Discounting Confusion: an Ecological Economics Perspective', argues that traditional discounting can undermine long-term sustainability of the economy. In his work, Frank G. Muller considered adjusting the traditional discount rate in order to arrive at an environmental discount rate, which would help to ensure the sustainability of the economy. Hannon (2001) and Perrings (2001) in their paper 'An Introduction to Spatial Discounting' consider another variation of the discount rate – spatial discount rate. Spatial discount rate represents the rate at which the diffusion of environmental effects of economic activities is discounted over space. By February 2016, neither the application of environmental nor spatial discount rates under IFRS has been considered. The purpose of this paper is to analyse the implications that environmental and spatial discounting would have for the application of discounted cash flow model according to IFRS. The research methods applied are methods of economic analysis and synthesis.

Keywords: discount rate; assets; valuation; International Financial Reporting Standards.

Type of the paper: Theoretical paper

JEL Classification: M41, Q50

Introduction

The World economy that existed until 20th century can be denoted by term 'empty World economics'. In 'empty World economics,' natural resources were abundant and human-made capital was scarce. For this reason, historically human-made capital was treated as limiting factor in economic decision-making, and economic decisions were made to maximise the productivity of human-made capital as well as to increase its supply (Constanza *et al.*1997). Human-made capital normally is created from natural capital, and the opposite, that is, creation of natural capital from human-made capital, is not feasible. Historically, before 20th century, because of the perceived abundance natural resources, the growth of human-made capital as well as its products was perceived as boundless and limited only by human effort and preferences. High perceived growth rates of human-made capital and its products allowed for the application of high discount rates for valuation of investments.

Starting from 20th century, evolution of the human economy passed from an era, in which human-made capital was the limiting factor in economic development, to an era, in which remaining natural capital has become the limiting factor. This era was named as 'full World economics.' With an advent of 'full World economics', economic policy had to be designed to increase the productivity of natural capital and its total amount rather than to increase the human made capital and its accumulation (Constanza *et al.*1997). With restated aim of economic policy, also the discount rates, which are used for valuation of investments, have to correspond to productivity of natural capital rather than that of human-made capital.

During transition to 'empty World economics' to 'full World economics', a new field of economic science 'ecological economics' emerged. The traditional concept of discount rate was modified to

adapt to postulates of ecological economics; and the concept of environmental or ecological discount rate was elaborated. Furthermore, a concept of spatial discount rate was derived from the environmental discount rate by considering the diffusion of environmental effects across space.

The authority to make decisions regarding allocation of resources, both natural and man-made rests with various economic agents – private investors, lenders and other providers of finance to companies, state and municipal regulators and international organisations. Private initiative of investors is generally recognised in market economies, whilst the government with its legislative authority sets boundaries beyond which it is illegal for private investors to venture. In Latvia and other EU countries, the state legislation also sets limits to the use of natural resources and to infliction of damage on the environment. The environmental protection policies adopted by the state have also been widely studied by academic scientists.

Major information that investors and other providers of finance to companies require for making decisions regarding the allocation of resources is included in financial statements of the companies. All companies that quote their securities in the EU-regulated markets must prepare their consolidated financial statements according to the IFRS. Furthermore, the U.S. securities' market regulator also permits those foreign companies, which list their securities on the U.S.-regulated market to report under IFRS. The IFRS requirements for valuation of assets have a direct influence on reported asset values and ultimately on the resource allocation decisions taken by investors, lenders and other finance providers.

The discounted cash flow model is required for the estimation of value-in-use of assets that are tested for impairment under IFRS and is an alternative for the estimation of fair values of those financial assets, investment property, property, plant and equipment, biological asset and agricultural produce items that do not have quoted market prices from an active market available. The discount rate applied for the valuation of assets is relevant for choices made by private investors and creditors regarding allocation of natural resources and the resulting productivity of natural capital. Still, even in the era of 'full World economics', there is a lack of research concerning the implications that the choice of discount rate under IFRS would have for the treatment of natural capital. Despite the quite extensive, though mainly theoretical studies on ecological discounting by ecological economists, there is no research on the economic support for the implementation of ecological discount rate in IFRS. The author of this paper has not encountered studies on the implementation of spatial discount rate in IFRS either. Owing to topicality of studies on both ecological and spatial discount rates and because of the lacking research on the economic support for the introduction of these discount rates in IFRS, the author considers the study on the implications of application of combined ecological and spatial discount rates for asset valuation under IFRS to be topical.

The aim of research is to analyse the implications that environmental and spatial discounting would have for the application of discounted cash flow model according to IFRS.

Research hypothesis are formed gathering economic support for the application of combined environmental and spatial discount rates for asset valuation in the financial statements, which have been prepared following the IFRS. According to research hypothesis, the incorporation of environmental discount rate in the discounted cash flow model guaranteed that financial statements do not violate the underlying assumption of going concern and the concept of physical capital maintenance.

Methods of economic analysis and synthesis have been applied.

The research results confirm the hypothesis concerning the incorporation of environmental discount rate in the discounted cash flow model. Adjustment of applied discount rate in order for it to correspond with the environmental rate is crucial for physical capital maintenance. There is no support, however, for use of spatial discount rate for valuation of assets reported in financial statements, which have been prepared according to the IFRS. Spatial discount rate reflects geographical preferences expressed by certain individual or a group of individuals at a certain place of residence and do not represent the preferences of a truly international profile of investors, lenders and

other parties, which may influence and are affected by natural resource allocation decisions made by companies.

Literature Review

In this literature review, the relevant the asset valuation and discount rate requirements set by the IFRS, prominent literature sources on traditional view of discount rate as well as literature on ecological and spatial discounting are summarised.

The concept of discount rate is implicit in the definition of property's value provided by classical American economist Irving Fisher in 1906. According to Irving Fisher, the value of a piece of property is reflected by the present value of the cash flows that are expected to be received from this property in the future and that are discounted at the opportunity cost of capital (Fisher 1906). A notion that value of money decreases over time forms economic support for discounting.

Discounting arises because people value future consumption less than present consumption. To compare future consumption with present consumption, a discount rate is used to convert the value of future consumption to present value. The discount rate is, therefore, a tool for trading goods and services across time (Fisher 1930).

Eckel, Fortin and Fischer (2003) in their paper 'The Choice of Discount Rate for External Reporting Purposes: Considerations for Standard Setting' mentioned the following rates, which may be applied as discount rates:

- risk-free interest rate;
- a sum of risk free rate and a risk premium;
- market rates of individual assets and liabilities;
- rates which are stipulated in the contracts for assets and liabilities;
- rates which are characteristic of particular company – cost of equity, cost of capital, opportunity costs of investments;
- interest rates specified in legislation (if available) (Eckel *et al.* 2003).

The Conceptual Framework for Financial Reporting issued by the International Accounting Standards Board recognises present value as a potential measurement base for assets and liabilities. According to the Framework, assets are carried at the present discounted value of the future net cash inflows that the item is expected to generate in the normal course of business. Liabilities are carried at the present discounted value of the future net cash outflows that are expected to be required to settle the liabilities in the normal course of business (International Accounting Standards Board 2010). To arrive at present values of assets and liabilities, the respective cash flows are commonly discounted at marginal opportunity cost of capital.

The IAS 36 'Impairment of Assets' stipulates that for the purpose of asset's value-in-use estimation, the discount rate applied should be a pre-tax rate that reflects

- the time value of money, and
- the risks specific to the asset for which the future cash flow estimates have not been adjusted (International Accounting Standards Board 2001).

Research in ecological economics also encompassed studies of the impact that discounting has on the environment and development of a new concept 'ecological discount rate'. Fisher (1930), Hannon (1973), Muller (2013), Farley (2004), Daly (2004), Carpenter (2005), Brock (2005) and Ludwig (2005) have contributed to the development of the concept and measurement of ecological discount rate (also called 'environmental discount rate').

In 1930, Fisher discovered parallel between economics and biology. The role played by discount rate in economics is analogous to that of the intrinsic rate of natural increase in the computation of reproductive value in population biology (Fisher 1930).

In 1973, Bruce Hannon published 'The Structure of Ecosystems'. He developed an input–output framework for the ecosystem where the net output (the gross domestic product (GDP) of the ecosystem)

was its net exports, inventory change, respiration and new biocapital formation. Respiration is analogous with household and government consumption of the economic definition.

Extending the economic analogy further into ecology, Bruce Hannon showed how an ecological discount rate could be calculated; in a way, this was nature's time preference rate. Under the proper conditions, the natural discount rate of an individual or a species can be approximated by its rate of respiration energy, the rate of heat release per unit of biomass energy. This natural discount rate captures both the idea of inevitable entropy creation of living organisms and the duration of captured energy in their biomass. In this sense, it is a measure of specific unit of biomass has to the ecosystem (Hannon 1973).

Muller (2013) argued that traditional view on discounting is based on presumption that economic growth is feasible. According to him as well as Farley (2004) and Daly (2004), this presumption is likely to be faulty.

If perpetual economic growth is feasible in the World, the use of a rate of discount of zero causes substantial disadvantages for early generations, because according to a growth model that maximises intergenerational utility integral, these early generations are obliged to excessive saving that allows later generations to live in affluence and luxury. Consequently, the concept of utility discounting, considering decreasing marginal utility of income, corrects the alleged injustice and disadvantages of early generations to consume (Hampicke 2000). The presumption that future generations will be more affluent than their predecessors because of the economic growth serves as a justification for discounting. In reality, however, instead of enjoying a life in abundance, they may rather experience environmental disaster, loss of biodiversity and lack of essential natural resources. (Muller 2013).

In reality, however, economic growth might not accede to the marginal opportunity cost of capital, because few natural resource stocks can sustain growth rates equal to this traditional measure of discount rate (Daly, Farley 2004).

Muller (2013) pointed out to the fact that in cases when no sufficient economic growth is feasible in practice, application of inflated discount rates is jeopardising the sustainability of economy. If the underlying assumption of future economic growth turns out to be faulty, the discounting may actually accelerate the process of destroying the livelihood of future generations to support at least their basic needs. (Muller 2013)

Carpenter (2005), Ludwig (2005) and Brock (2005) called for lowered discount rate to maintain sustainability. In their opinion, discounting of future benefits at lower rates improves the sustainability of an economy (Carpenter *et al.* 2005)

In literature, spatial version of discount rate has been studied less extensively than ecological discount rate. During the literature review, the author of this paper has encountered one significant work that lays the foundation to the concept of spatial discount rate – scientific paper by Charles Perrings and Bruce Hannon 'An Introduction to Spatial Discounting', published in 2001.

According to Perrings (2001) and Hannon (2001), research on the valuation of environmental externalities shows that decision makers tend to discount not only over time but across space. Just as time discounting has implications for intergenerational equity, geographical or spatial discounting has implications for intragenerational equity. Similarly, just as positive time discount rates are warranted by positive net rates of growth of the capital stock, positive spatial discount rates may be warranted by the fact that environmental (or other external) effects of economic activity are diffused at positive rates (Perrings, Hannon 2001).

It is not surprising that high spatial discount rates have the potential to prejudice the well-being of distant members of the present generation in the same way that high time discount rates prejudice the well-being of members of future generations. Time discount rates above the warranted rate of regeneration or assimilation imply a myopic approach to the management of environmental resources that is potentially dangerous and is certainly inequitable (in intergenerational terms). In the same way, spatial discount rates above the natural rate of diffusion imply a parochial approach to the management of environmental resources that is equally inequitable (in intragenerational terms).

Nevertheless, high spatial discount rates may be warranted by high rates of diffusion (or decay) of environmental effects (Perrings, Hannon 2001).

Methodology

The main research method applied in arriving at research results in this paper is the method of economic analysis. The economic analysis is performed by comparing the theories developed by authors who have completed studies on discount rate previously and whose research results are presented in section 'Literature Review'. For the purpose of comparing the theories, the concepts and models presented by other authors are disintegrated into distinct elements, if feasible. The construction of logical relationships that synthesise the elements of theories developed by other authors and presumptions made by the author of this paper is used as continuation economic analysis.

Results

The author supports the view of Farley (2004) and Daly (2004) that few natural resource stocks can sustain growth rates equal to this discount rate, if measured by opportunity cost of capital in finance.

In the opinion of the author, the production of natural ecosystems is intended to cover the consumption requirements that are needed for the reproduction of the ecosystems. Thus, without human intervention, except for minor disturbances, natural ecosystems to not grow in their biomass, but reproduce themselves cyclically over time with the amount of biomass remaining about the same.

To draw an analogy with between biology and economics, the biomass can be viewed as capital stock. The products of the plants – seeds, gums and others – are analogous to the products of capital stock in human economics. Furthermore, in natural ecosystems, the biomass of living plants itself becomes a product of these plants required for their reproduction, as plants die and their biomass serves as a humus to the soil. In this respect, natural ecosystems and economic systems do not always resemble, because in economic systems, capital stock does not always becomes an input to the production of goods.

According to Fisher (1930), in biology, discount rate is the intrinsic rate of natural increase in the computation of reproductive value in population biology. Whilst different levels of natural increase are possible in real life depending on the conditions that exist in the ecosystem, there is average, normal level of production by the ecosystem and that is the level of production, which is necessary for the reproduction of the ecosystem. The current author regards the rate of ecosystem's production, which ensures the complete reproduction of the ecosystem, as the ecosystem's discount rate.

The concept of growth in economics has to be elaborated on. The author views economic growth as increase in utility obtained from consumption by future generations over their predecessors. In the opinion of author, it is possible to achieve growth in two ways – as a result of increased quantity of consumption and as a result of improved quality of the products being consumed.

The growth in quantity of production generally is possible at the expense of the natural stock, whilst growth in quality is possible without sacrificing the natural resources, just by creative recombination of the already available production resources. The growth in quality is a merit of inventor's talent. The discount rates that reflect the utility increases because of the recombination of existing resources are not limited; and the author of this paper also favours their implementation in the IFRS.

Another topical issue to consider is the accounting for damage that enterprises inflict on the environment. In the opinion of the author of this paper, the impact that the use of company's assets are expected to have on an environment both in near as well as in distant future should be taken account into account, as the value-in-use of company's assets is determined. Even, if the damage that company's activities inflict on environment cannot be measured in monetary terms, an attempt should be made to incorporate the environmental damage in the model used for the valuation of company's assets. Those assets that are likely to have a negative impact on the environment should be carried at lower values than assets, which pose no threat to the environment.

If the future sustainability of environment is not to be jeopardised, it is important that environmental damage to be observed in distant future is not attributed much less weight than deterioration of the environment that is expected in the near future. This is also a way to guarantee that the well-being of future generations is not sacrificed at the expense of current population. Attribution of similar weights to events occurring in distant and in near-future calls for application of lower discount rate, as assets are measured according to discounted cash flow model following the IFRS. This lower discount rate corresponds to the ecological discount rate.

Though environmental pollution originates at one certain geographic location, it often spreads out to other geographic locations.

Circular, cyclical flow of substances and chemical elements has been observed in the World, and it is driven by Solar energy. Major circulation of substances occurs along with the water cycle that has been depicted in Figure 1.

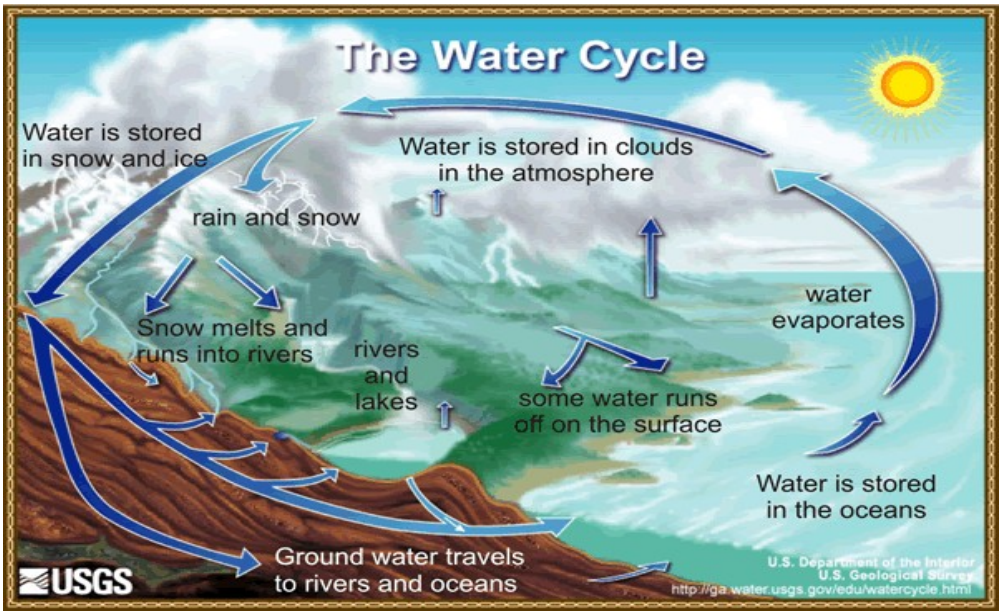

Fig. 1. The cycle of water circulation in an ecosystem (Source: U.S. Department of the Inferior, 2016)

Some pollution, if originated in the water, may spread along with water cycle, as depicted in Figure 1. Air pollutants may diffuse along with movement of air masses. The diffusion of pollution because of circulation of substances forms the theoretical support for spatial discount rate.

The spatial discount rate represents geographical preference that concerned parties have for consumption and receiving economic benefits in one geographic location over another. Clean environment, in this respect, may also be viewed as an economic benefit, to which utility is attached. Thus, the spatial discount rate may represent the preference that economic agents express on enjoying clean environment in one geographic location over another.

In practice, in modern-day international corporate relations, spatial discount rate may matter for assessment of environmental pollution. The author of this paper would expect that the investors who represent the developed countries of their residence, when assessing the value of companies' assets, would place a lower weight on environmental pollution occurring in developing countries in Asia where the production actually takes place than to the same pollution, if that would occur in their developed countries of residence. This leads to sacrifice of environmental quality in China and in other Asian developing countries, which specialise on the production of goods, at the expense of environmental quality in the United States, which is the major residence of corporate investors.

Over time, however, the effects of pollution tend to diffuse all over the World. Therefore, if environmental quality to be enjoyed by future generations is not placed much less weight than that of present generations, the impact that spatial discount rate has on valuation of assets should be eliminated. Furthermore, the IFRS are intended for a global profile of investors, lenders and other providers of finance without emphasis to any particular country or region where these providers of finance may take residence and without preference for clean environment in one geographic location over another. In this respect, spatial discount rate should be irrelevant for the valuation of assets under IFRS.

Conclusions

In order to maintain the sustainability of environment, the incorporation of environmental discount rate in the discounted cash flow model is necessary. There is no support, however, for the use of spatial discount rate for the valuation of assets reported in financial statements, which have been prepared according to the IFRS. Spatial discount rate reflects geographical preferences expressed by certain individual or a group of individuals at a certain place of residence and do not represent the preferences of a truly international profile of investors, lenders and other parties, which may influence and are affected by natural resource allocation decisions made by companies.

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