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# Determination of the fair value of a multifunctional family farm: a case study

The article analyses the problems of the determination of the fair value of a multifunctional family farm using the method of discounted cash flow, presents a model of determination of the fair value of a multifunctional family farm and tests it for a selected family farm. The specificity of the cash flows in a multifunctional family farm is related to the cash flows from financial support, different value drivers of the earnings before interests and tax and their calculation methodology, and the value of created public goods and externalities. Two types of discount rates are used to determine the value of a family farm: market-based and social discount rate (SDR). It is appropriate to use the SDR to discount the cash flow of investment, the economic and social benefits whereof are distributed among present and future generations. The stages of the determination of the fair value of a farmer's farm include: value drivers' decomposition; differentiation of cash flow and discount rates and measuring value drivers; forecasting cash flow and discount rate value drivers; value drivers' composition; determination of the terminal value; and cash flow discounting.

**Keywords:** fair value, multifunctional family farm, free cash flows, discounting

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## Introduction

Market efficiency means that an existing business organisation is sold, transferred or exchanged at a price that is equal to its fair value. The discounted cash flow (DCF) method is used to determine the fair value of an existing business organisation where only a few transactions are made in the market. The use of this method for the purpose of determining the fair value of a business was studied amongst others by Eccles *et al*. (2001), Damodaran (2002), Kazlauskienė (2005), Mass (2005), Greene (2007), Hill and Zeller (2008) and Lütolf-Carroll and Pirnes (2009). The fair value of a family farm is created not only by the profit earned from the commercial production and provided services but also by the benefits arising from the multifunctionality of agriculture in supplying public goods and ensuring the sustainable development of a family farm. Owing to the above, specific cash flows are created at family farms, the impact whereof on the fair value comes through different discount rates: market-based and social discount rates. The problems encountered in determining the value of such a farm include differentiation and calculation of different nature cash flows as well as fixing market-based and social discount rates.

Family farms are private entities and hence some methods cannot be used to calculate the cost of equity. The selection of a method and its justification remains a scientific problem. The methods of the cost of equity calculation in a private organisation and their application possibilities were studied by Koeplin *et al*. (2000), Bajaj *et al*. (2001), Pratt, (2001), Das *et al*. (2003), Adams *et al*. (2004), McConaughy (2009) and many others. The problems they addressed included not only those of method applicability and measurement of variables but also the possibilities of method modification and adaptation for private organisations.

Another scientific problem that is still unsolved is the social discount rate (SDR), when an organisation incurs expenses related to the creation of public goods and ensuring sustainability but the economic and social benefits are transferred to future generations. Researchers who analyse public goods highlight their diversity, different intended purposes and benefits and emphasise the necessity of a public goods classification or typology and valuation from the macroeconomic perspective (Bateman and Willis, 2002; Randall, 2007; Sydorovych and Wossink, 2008; McVittie *et al*., 2009; Vaznonis, 2009; Hasund *et al*., 2011). As a rule, public goods and their typology are studied from the macroeconomic point of view, however the research related to the supplier's benefit, incurred expenses and their impact on the value of the supplier providing public goods – family farm – is insufficient.

The research problem is how to determine the fair value of a multifunctional family farm, being a private business organisation with specific cash flows, the impact whereof on the fair value comes through different discount rates: market-based and social discount rates. In this paper we conduct a synthesis and analysis of scientific research into the fair value of business organisations and its drivers in order to develop a model of the determination of the fair value of a multifunctional family farm and to test it for a family farm. This work is divided into three tasks: (a) to justify the specificity of the multifunctional family farm cash flows, discount rates and their value drivers; (b) to develop a model of the determination of the fair value of a multifunctional family farm and to justify the methodology; and (c) to test the model of the determination of the fair value for a family farm.

## Value drivers of a multifunctional family farm

The key value drivers in each organisation are free cash flows (FCF) and the discount rate (Eccles *et al*., 2001; Damodaran, 2002; Kazlauskienė, 2005; Mass, 2005; Hill and Zeller, 2008). The FCF of an organisation engaged in traditional agricultural activities depends on such value drivers as the earnings before interests and tax (EBIT), fixed asset depreciation and amortisation expenses, capital investment and additional working capital (Aleknevičienė *et al*., 2012). The marginal profit from the sale of products and provision of services, being the key EBIT driver, is decomposed into three value drivers: the sales volume, the sales price and the unit cost. Using the method of decomposition, all the other EBIT value drivers are reflected in the cash flows according to the statement form prescribed in Business Accounting Standard 3 'Income Statement' for entities, whose typical activities are cultivation of biological assets, production and treatment of agricultural produce, processing of agricultural produce of own and treatment production.

The cash flow statement prescribed for a family farm of the Republic of Lithuania (ŽŪM, 2006) provides that grants related to income shall be reflected in cash flows from operating activities, while grants related to assets shall be included in cash flows from financing activities. In general, the cash flows from financing activity are not included in FCF determining the fair value. An exception is grants related to assets, which are non-repayable and increase the cash flows for the owners. When the FCF are increased by the amount of the received grants for assets, the EBIT is not adjusted by the depreciation expenses of the subsidised fixed assets.

With respect to the typology of public goods provided by family farms, the European Union (EU) Common Agricultural Policy (CAP) subsidy measures are classified into three groups: (a) for promoting commercial production development or discontinuation; (b) for indirect promotion of the creation of public goods through the support for the development of commercial production infrastructure; and (c) for the provision of public goods (Vaznonis and Vaznonis, 2011). Some of the subsidies are lump sum or periodic payments, intended to compensate for the income foregone or costs incurred in a family farm. Other subsidies are support to investments the economic benefits whereof can be purely individual or intended for a defined group of individuals. And there are also subsidies that support investments the economic benefits whereof future generations will enjoy. In the valuation of projects with significant environmental impact, the discount rate and the time horizon are the key factors determining the return on social and environmental investment projects (Almansa and Martinez-Paz, 2011). The SDR must reflect the public attitude towards the valuation of the future benefit and costs in comparison with the present benefit and costs (EC, 2008).

To determine the fair value of a multifunctional family farm it is necessary to separate cash flows discounted at a market-based rate and cash flows that are discounted at the SDR. Owing to their nature, cash flows from the sale of farm products and services as well as grants and subsidies for the purpose of efficiency improvement and business diversification in rural areas must be discounted at the weighted average cost of capital (WACC). Cash flows related to investments the economic benefits whereof will enjoy future generations must be discounted at the SDR. Currently under the EU Rural Development policy 2007-2013 such investments include investments into first afforestation of agricultural land, first afforestation of non-agricultural land, actions to restore forestry potential and prevention actions, and non-productive investments linked to forest-investment payments. Both the economic benefits of such investments (income from prepared and sold timber and other income) and public goods (recreation, landscape, biological, historical, cultural and environmental diversity) are fully or partially transferred from the present generation to the future generations since a forest, depending on the trees growing in it, can live 60-120 years or even longer.

The key value drivers of the WACC include the capital structure, the cost of equity and the cost of debt. Plenborg (2002) argues that the WACC should be calculated relying on the target capital structure rather than the actual one based on the information in the balance sheet. The other two drivers of the WACC value are the cost of debt and equity. The drivers of the cost of debt are widely recognised and a single all-purpose methodology is used to determine the cost of capital. On the other hand, there are many different methods for determining the cost of equity. Some of them link the return sought by the owners with the risk, while others do not. Some of them require market information and others do not. Family farms are private organisations and therefore some methods cannot be used to calculate the cost of equity. A farmer does not have a portfolio of financial investment, i.e. his/her investments are not diversified. Therefore the systematic risk is not the only risk assumed by the farmer. The systematic risk arises from macroeconomic factors and therefore it is not diversified. This is the approach followed by Kerins *et al*. (2004), McConaughy (2009) and Pattitoni *et al*. (2012). In their opinion, the cost of equity depends on the following value drivers: risk-free return, return and standard deviation of return on market portfolio, and the standard deviation of return of a private organisation. The cost of equity in a family farm is calculated according to the following formula:

$$r_y = r_f + (\sigma_j / \sigma_m)(r_m - r_f) \tag{1}$$

where $r_y$ is the cost of equity; $r_f$ is the risk-free return; $\sigma_j$ is the standard deviation of return in a family farm; $\sigma_m$ is the standard deviation of return on a market portfolio; and $r_m$ represents the return on a market portfolio.

Pilot studies (Aleknevičienė, 2012) revealed that an equivalent of a market portfolio is the benchmark OMXBB index (www.nasdaqomxbaltic.com). Following the analysis of earlier research (Ismail and Kim, 1989; Nekrasov and Shroff, 2009; Cohen *et al*., 2009), the return on equity (ROE) was used to measure the return in a family farm and companies included in the index. Following the approaches of Ward (1999), Moon and LeBlanc (2008) and Collins and Huang (2011), in the pilot research Aleknevičienė (2012) calculated risk-free return with respect to the investment horizon where the selected bonds of the Government of the Republic of Lithuania were those with the longest maturity in 2003 through 2010.

The value drivers of the social discount rate were analysed by Brukas *et al*. (2001), Groom *et al*. (2005), Hepburn and Koundouri (2007), Voinov and Farley (2007), Price (2010) and Almansa and Martinez-Paz (2011). The conclusion is that the SDR depends on the economic growth rates in the long term, the elasticity of the marginal utility of income, the time horizon of social investment projects and the econometric model of calculation of discount rate declining over time. According to Moore *et al*. (2003) the SDR ranges from 1.5 to 4.5 per cent, where investments are related to one generation only, and from 0 to 3.5 per cent if investments are attributable to several (current and future) generations.

Almansa and Martinez-Paz (2011) argued that in determining the value of high nature value projects with a long-term impact on the future generations, the key factors are the choice of the discount rate and the time horizon. They conducted a *Delphi* survey and found that the discount rates of projects embracing several generations must be declining in time. Brukas *et al*. (2001) argue that the owners of private forests should discount the cash flows from the implementation of forestry investment projects in Lithuania at 2 per cent SDR, with regard to the fact that forests create such non-commercial products as recreation, landscape, biological, historical, cultural and environmental value. Hepburn and Koundouri (2007) maintain that the period of growth of some trees before they become suitable for timber can be about 120 years and therefore the SDR should also be applied for economic benefits derived from timber.

From these insights we conclude that the weighted average of the SDR over time suggested by Moore *et al*. (2003) and Almansa and Martinez-Paz (2011) corresponds to the 2 per cent SDR suggested by Brukas *et al*. (2001). With respect to the results of these earlier studies, the following SDR were chosen: 0-40 years: 3.5 per cent; 41-130 years: 2.75 per cent; 131-165 years: 1.75 per cent; 166-250 years: 1.0 per cent; and over 250 years: 0.5 per cent.

In determining the fair value of a family farm using methods based on DCF, the FCF, discount rates and their value drivers must be forecasted. The choice of the forecasting technique depends on the nature of the information. There are two broad categories of forecasting techniques (Naumenkova and Glazun, 2002; Budrevičius, 2007). Quantitative forecasting techniques are applied in a stable economic situation when there is sufficient quantitative information about the phenomena to be forecasted; however, from time to time it is important to check if the conditions are satisfied. When information is limited, qualitative techniques are more practicable (Budrevičius, 2007).

Quantitative techniques are used to analyse actual data from previous periods. Forecasting focuses on the trends of economic activity that are identified through performance analysis (Fedotova, 2009). The choice of a forecasting technique depends on the nature of the time series, i.e. their stationarity. The techniques of moving average, exponential smoothing and simple forecasting are used to forecast stationary indicators while the linear trend is used to predict non-stationary indicators. If historical data are available, the trend projection or regression models are useful, particularly in the case of long-term forecasts. Stutely (2005) noted that analysis and forecasts usually use data for the last 3-5 years. The weakness of the extrapolation method is that it is based on the assumption that all the present conditions will remain relatively constant and the present patterns will continue into the future. If the conditions change, the forecasts must be calibrated on account of internal and external changes. According to Kasnauskienė (2010), the extrapolation horizon should not exceed the number equal to one third of the analysed time series values. The extrapolation method is usually used to forecast the production and stock level (Armstrong, 2000).

In forecasting the FCF, it is essential to build the general forecast structure. Integrated forecasting of the profit and loss statement and the balance sheet followed by FCF calculations is the best way to develop the structure. If there are little historical data available, it is recommended to make the FCF forecasts for five or three years.

When forecasting product sales volumes and sales prices it is feasible to use the trend or averages (depending on the stationarity of the time series). The reliability of the trend function shall be verified by the Mean Absolute Percentage Error (MAPE) and the Root Mean Standard Deviation (RMSE). Forecasting of the production volumes of agricultural products and biological assets shall take into account the agricultural crop areas and the yields of crops. When making forecasts of agricultural crop areas it is appropriate to use averages, particularly if there is no intention to change the land areas, and to take into consideration changes in rotation. The use of agricultural products and biological assets should be forecasted with respect of the planned production volumes and the agricultural product and biological asset consumption for the internal needs of the farm.

The forecasts of variable and fixed costs are attributable to the production and sales volumes. After the structure of variable and fixed costs and the past trends of change were analysed based on the available historical data, forecasts were made for the amounts of each major cost type and all costs of production per hectare of agricultural crop.

Depreciation of fixed assets accounts for a major part of fixed costs. The depreciation was forecasted with respect of the cost of acquisition of the farm assets, their remaining useful life and the depreciation rates. The family farm has grants to assets and therefore the forecasting of the depreciation costs took into consideration the used part of grants related to assets and the depreciation costs were reduced thereby. The used part of grants related to assets was calculated on the basis of the used grant amount in the last analysed year and with regard to the unspent balance of grants at the end of the last analysed period.

Grants related to income were forecasted in the light of the CAP. It is assumed that during the forecast period the CAP that was in force during the last financial year would remain in operation and thus the grants were forecasted by calculating an average grant amount per hectare of crop area with respect of the forecasted crop areas.

The forecasting of the additional working capital relies on changes in stock, crops and amounts payable and receivable excluding loans. It is assumed that the current asset and non-interest bearing liability management policy will remain unchanged. Then those amounts are forecasted in proportion to sales revenue changes (Aleknevičienė, 2009).

Having taken into account the factors generating cash flows and having chosen their forecasting methods, it is necessary to develop the methodology of forecasting the cost of equity. The expected return on market portfolio and risk-free return are forecasted using the trend function or a simple forecasting method. The calculation of the cost of equity is based on historical standard deviations of the market portfolio and the family farm profitability assuming that the risk will remain at the same level.

Usually the *WACC* represents an algebraic manipulation, where the cost of equity ($r_e$) and debt ($r_d$) are mixed so that the components of equity ($w_e$) and debt ($w_d$) represent the capital structure. With respect to the tax ($T$) effect, the WACC is calculated as:

$$WACC = w_e r_e + w_d r_d (1 - T) \tag{2}$$

This formula is used under the assumption that the debt-to-equity ratio in a family farm is constant over time. In fact the debt levels in the capital structure change as the farm value changes and therefore in determining the fair value of a farm it is assumed that the capital structure is rebalanced in infinite term. Then the *WACC* is calculated as (Emery *et al.*, 2004):

$$WACC = r - L r_d T[(1 + r)/(1 + r_d)] \tag{3}$$

here $r$ is the unleveraged cost of equity; $L$ is the target capital structure (debt/equity ratio); $r_d$ is the interest rate; and $T$ is the profit or income tax.

The relationship between the standard deviation of return on equity of unleveraged farm ($\sigma_{uj}$) and standard deviation of return on equity of leveraged farm ($\sigma_j$) can be expressed as:

$$\sigma_{uj}/\sigma_m = [(\sigma_j/\sigma_m)(1 - L]/(1 - TL) \tag{4}$$

Then the unleveraged cost of equity is calculated according to the following formula:

$$r = r_f + \left[\frac{(\sigma_j/\sigma_m)(1 - L)}{(1 - TL)}\right](r_m - r_f) \tag{5}$$

The forecasting of unleveraged cost of equity relies on the forecasted risk-free return and return on market portfolio, historical standard deviations of the returns on market portfolio and family farm, and the projected effective income or profit tax rate. The target capital structure is the arithmetic mean of the capital structure. In the *WACC* calculations, the interest rate is forecasted with respect of the average interest rate on loans. If both long-term and short-term loans are to be used to finance the business, it is advisable to use the weighted average interest rate.

In reliance of all the value drivers of the multifunctional family farm, its terminal value is determined by taking into account only the FCF from the sale of farm products and services. Cash flows from the implementation of forestry investment projects are planned for the whole period with respect of the prevailing types of trees and the functional purpose of the forests and therefore the calculations of the terminal value are not made.

Lütolf-Carroll and Pirnes (2009) argued that if the *FCF* growth in infinite term is not estimated, the terminal value is calculated as follows:

$$TV_T = FCF_{T+1}/WACC\infty \tag{6}$$

Then the fair value is:

$$PV = \sum_{t=1}^{T} \frac{FCF_t}{(1 + WACC)^t} + \frac{FCF_{T+1}}{(1 + WACC)^T (WACC\infty)} \tag{7}$$

The zero growth or constant growth rate in infinite term can be used in determining the terminal value. According to Lütolf-Carroll and Pirnes (2009), the fact that the growth rate is increased in determining the terminal value does not create value by itself. They suggested an alternative for determining the terminal value, which corresponds to the growth rate and the assumptions related to the return on long-term investment, which raises the question about the need of capital investments and additional working capital:

$$TV_T = \frac{EBIT(1 - T)\left(1 - \frac{g\infty}{ROCE}\right)}{WACC\infty - g\infty} \tag{8}$$

here *ROCE* is the return on capital employed; and $g$ is the growth rate.

The growth rate $g$ depends on the return on equity (*ROE*) and the weight of reinvested capital ($w$):

$$g = ROE \times w \tag{9}$$

It can also be determined in reliance of the GDP growth rates in the long term considering the correlation between GDP and sales revenues of the farm.

The fair value of a multifunctional family farm is the sum of three values: present value of *FCF* at a definite period, present value of terminal value and present value of cash flows from investment into forests:

$$PV = \sum_{t=1}^{T} \frac{FCF_t}{(1 + WACC)^t} + \frac{TV_{T+1}}{(1 + WACC)^T (WACC\infty)} + \frac{FCF_{ft}}{(1 + SDR)^t} \tag{10}$$

here $FCF_t$ is the free cash flows from forestry investment projects; and *SDR* is the social discount rate.

## Multifunctional family farm valuation model

The logical scheme of the multifunctional family farm valuation model (Figure 1) allows the determination of the fair value of a multifunctional family farm using the DCF method, in accordance with the principles of scientific validity, consistency of valuation, accuracy and objectivity.

In accordance with the principle of *scientific validity*, the value drivers of the multifunctional family farm value are decomposed and composed; the cash flows are differentiated by their impact on the value of the family farm and their value drivers are measured; the discount rates are differentiated and their value drivers are measured; and the terminal value and the fair value of the family farm are determined. The principle of *consistency of valuation* underlies the stages of the determination of the fair value. The principle of *accuracy* requires using scientifically sound methodologies and correct information. The principle of *objectivity* means that there are at least two parties that are interested in the correct fair value and therefore in a transaction one party cannot benefit at the expense of the other. Assumptions used as the basis in forecasting the value drivers and determining the terminal value must satisfy both parties of the transaction.

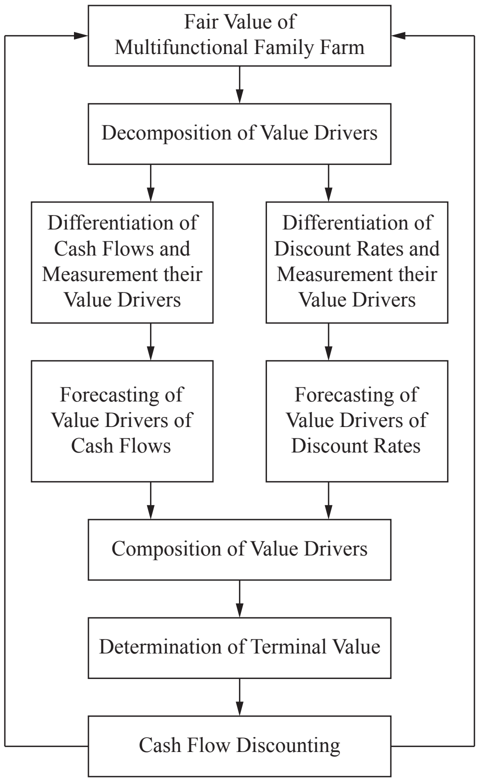


**Figure 1:** The logical scheme of the multifunctional family farm valuation model.

## Testing of the model for a family farm

Here the model of the determination of the fair value is tested for a family farm in Jonava district in the central part of Lithuania,. It is composed of 460 hectares in total; 87 per cent of the arable area is devoted to cereals and oilseed rape, and 16 hectares are covered by woodland. There are no hired employees in this family farm, only the farmer and his wife are engaged in agriculture and forestry.

The determination of the fair value starts with forecasts of the FCF from commercial production and provided services. The FCF calculation is based on certain forecasting assumptions. When the FCF of the family farm are calculated for a period of three years, a stability assumption is made that the weather conditions will be typical and the industrial land plots will not change. The FCF forecasting was made subject to the analysis of the actual data of production (areas, crop, yield), sales (sales prices, sales volumes), costs and expenses (production variable and fixed costs, depreciation costs, operating expenses), grants related to revenue and grants related to assets, and current and fixed assets in 2009-2011. The forecast of the third year was made on the assumption that the forecasted indicators will remain the same as in the second year of forecasting. Insufficient availability of data about the family farm lowers the accuracy of forecasting.

The forecasting of the sales revenue (Table 1) is based on the planned sales volumes and the average sales prices. The sales volumes depend on the agricultural crop areas and the yields. Having taken into account the data of the time series in the analysed period and having identified the trends of changes, the areas of individual agricultural crop were forecasted based on averages, while the agricultural crop yield and the sales prices of agricultural products were forecasted using the trend function. The variable and fixed costs per hectare of agricultural crop were also forecasted using the trend function.

The forecasting of agricultural crop and autumn ploughing balances was made by calculating the averages and taking into account the balances at the beginning of the period, the forecasted production volume, the sales volumes and the consumption in the family farm, while a moving average was used to forecast the agricultural crop and purchased stock balances (Table 2).

Forecasting of the additional working capital is based on the family farm not having trade debtors in the last analysed year and therefore the trade debtors were calculated on the basis of the forecasted sales prices and the average trade debtors in the analysed period. The non-interest bearing liabilities included debts to suppliers and other amounts payable and those debts were forecasted with respect of changes in the sales volumes. Table 3 shows the FCF calculation in the family farm based on forecasted data of the profit and loss statement and the balance sheet.

Once the forecasted FCF from commercial products and provided services is calculated, the cost of equity of the family farm is estimated. The analysed period covers periods of both economic growth and recession and therefore it is assumed that the forecasted values subject to extrapolation of statistical data will correspond to either the trend or the average. In 2011, in comparison to 2003, the ROE of the

**Table 1:** Forecast of the crop production sales revenue, variable and fixed costs in the family farm used in the case study (LTL).

| Indicator | Year the forecast is made for | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Sales revenue | 879,710 | 830,128 | 830,128 |
| Variable costs | 653,156 | 644,569 | 644,569 |
| Fixed costs | 173,702 | 181,144 | 181,144 |
| including depreciation costs | 134,326 | 134,326 | 134,326 |

Source: the forecast is made using family farm financial reports for 2009-2011

**Table 2:** Forecast of the family farm work in progress (autumn ploughing and crops), agricultural output and purchased stock (LTL).

| Indicator | Year the forecast is made for | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Work in progress (autumn ploughing and crops) | 166,534 | 166,834 | 166,834 |
| Agricultural output | 230,561 | 216,465 | 216,465 |
| Purchased stock | 152,350 | 124,504 | 124,504 |

Source: the forecast is made using family farm financial reports for 2009-2011

**Table 3:** Calculation of the free cash flows of the family farm used in the case study (LTL).

| Indicator | Year the forecast is made for | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| EBIT less accrued income tax | 378,993 | 453,815 | 453,815 |
| Depreciation of fixed assets | 134,326 | 134,326 | 134,326 |
| Additional working capital | -226,302 | -43,690 | 0 |
| FCF | 739,621 | 631,831 | 588,141 |

Source: the forecast is made using family farm financial reports for 2009-2011

**Table 4:** Average return on equity (ROE)*, OMXBB and family farm ROE and standard deviations, 2003-2011.

| Indicator | ROE (%) | | | | | | | | | Average ROE (%) | Standard deviation of ROE (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | | |
| OMXBB index | 14.4 | 14.3 | 13.1 | 12.7 | 14.5 | 2.9 | -8.0 | 11.1 | 11.7 | 9.6 | 7.5 |
| Family farm | 19.5 | 26.6 | 27.2 | 25.8 | 38.6 | 33.3 | 7.4 | 19.4 | 19.1 | 24.1 | 9.1 |

*Lithuanian FADN 2003-2008 and family farm financial reports for 2009-2011
Sources: NASDAQ OMX Baltic

**Table 5:** Average return on the Government bonds of the Republic of Lithuania with maturity of 3-11 years, 2003-2011.

| Indicator | Year | | | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | |
| Return (%) | 4.8 | 4.0 | 3.3 | 3.8 | 4.6 | 5.5 | 7.6 | 4.7 | 4.9 | 4.8 |

Source: Bank of Lithuania

OMXBB index decreased by 2.7 percentage points whereas in 2011, as compared to 2009, the ROE of the family farm under investigation increased by 11.7 percentage points. The accuracy of forecasting suffers from insufficient availability of the family farm data as the only available information is the family farm ROE in 2009-2011 and the average ROE of farms engaged in cereal and oilseed rape growing in 2003-2008 (Table 4).

In order to calculate the cost of equity, it is necessary to determine the expected ROE of the OMXBB index. The SPSS software is used to forecast the ROE of the OMXBB index and the reliability of the trend function is verified. The value of the forecasted indicator is 10.7 per cent. As regards the main reliability measures, MAPE = 71 and RMSE = 7.7 per cent mean that the forecasted indicator value is not reliable. In such situation a simple forecasting method is used:

$$\bar{\Delta} = \frac{11.7 - 14.4}{8} = -\ 0.34$$

$$r_t = 14.4 + (-\ 0.34) \times 9 = 11.3$$

The calculations show that the forecasted ROE of the OMXBB index is 11.3 per cent.

Table 5 shows the return on the Government bonds of the Republic of Lithuania with maturity of 3-11 years in 2003-2011. The average of maturity of risk-free asset during the analysed period was 6.4 years. The returns on the government bonds of the Republic of Lithuania changed depending on the macroeconomic situation: they increased during the period of economic growth and decreased during the period of economic recession.

The forecasted risk-free return based on the trend function is 4.9 per cent. MAPE = 18 and RMSE = 1.3 per cent mean that the forecasted indicator value is correct.

The cost of farmer's equity is 12.7 per cent.

$$r_{yu} = 4.9 + (9.1/7.5)(11.3 - 4.9) = 12.7$$

To calculate the WACC it is necessary to know the cost of equity of unleveraged family farm, the target capital structure, the effective rate of personal income tax and the forecasted interest rate on loans. The target capital structure is estimated as the arithmetic mean of the historical capital structures. Table 6 shows historical capital structures of the family farm, expressed as the ratio of financial debts to financial debts plus equity.

**Table 6:** Capital structure of the family farm used in the case study.

| Indicator | Year | | | Average |
|---|---|---|---|---|
| | 2009 | 2010 | 2011 | |
| Capital structure (interest bearing debts/equity) | 0.142 | 0.053 | 0.108 | 0.101 |

Source: family farm financial reports for 2009-2011

**Table 7:** Interest rate on loans in LTL to non-financial corporations and households in Lithuania, 2004-2011.

| Indicator | Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
| Short-term loan interest rate (%) | 5.7 | 5.6 | 5.5 | 6.5 | 7.8 | 8.8 | 6.3 | 5.4 |
| Long-term loan interest rate (%) | 4.9 | 4.6 | 4.6 | 6.0 | 7.2 | 8.4 | 5.1 | 4.2 |

Source: Bank of Lithuania.

During the last two years the family farm was paying income tax. The effective personal income tax rate was 1 per cent. The cost of equity of unleveraged family farm is 11.9 per cent:

$$r = 4.9 + \left[\frac{(9.1/7.5)(1 - 0.101)}{(1 - 0.01 \times 0.101)}\right](11.3 - 4.9) = 11.9$$

On the assumption that over the projection period of three years the family farm will be subsidised just like it was during the period of analysis, the taxable result is profit. The tax advantage derived by the farmer from the non-taxable interest is very small and therefore it does not affect the fair value of the farm. Both long-term and short-term loans are used to finance the business of the family farm (Table 7).

Based on the trend function, the forecasted interest rate on short-term loans is 3.3 per cent. MAPE = 0.19 and RMSE = 1.9 per cent mean that the forecasted indicator value is very accurate although the probable value error is 1.9 per cent. Similarly, the forecasted interest rate on long-term loans is 4.2 per cent. MAPE = 18 and RMSE = 1.5 per cent mean that the forecasted indicator value is accurate and the probable value error is 1.5 per cent. On average, the weight of the family farm short-term loans in the total loans in the analysed period accounted for 0.691 and consequently the weighted average of interest rates is 3.6 per cent $(0.691\times3.3)+(1-0.691)\times4.2))$.

The WACC amounts to 11.9 per cent:

$$WACC = 0.119 - 0.101(0.036)(0.01)\left[\frac{(1 + 0.119)}{(1 + 0.036)}\right] = 0.119$$

**Table 8:** Afforestation and maintenance expenses incurred by the family farm in the case study.

| Year | Type of expenses | Amount (LTL) | Year | Type of expenses | Amount (LTL) |
|---|---|---|---|---|---|
| 1 | Afforestation and maintenance per year | 47,016 | 15 | Pre-commercial thinning | 2,828 |
| 2 | Maintenance | 3,703 | 25 | Commercial thinning | 7,708 |
| 3 | Maintenance | 4,254 | 35 | Commercial thinning | 9,635 |
| 4 | Maintenance | 4,254 | 45 | Routine commercial thinning | 12,526 |
| 5 | Maintenance | 3,276 | 60 | Routine commercial thinning | 15,417 |
| 6 | Maintenance | 3,276 | 80 | Non-intensive routine/sanitary thinning | 7,708 |
| 7 | Maintenance | 3,276 | 100 | Main thinning | 69,375 |
| 8 | Pre-commercial thinning | 2,626 | | | |

Source: 'Medstata' project data

**Table 9:** Revenue from the commercial forest production of the family farm in the case study.

| Revenue year | Revenue type | Total (LTL) |
|---|---|---|
| 25 | Revenue from the sales of fuel wood | 13,574 |
| 35 | Revenue from the sales of timber and fuel wood | 24,644 |
| 45 | Revenue from the sales of timber and fuel wood | 33,875 |
| 60 | Revenue from the sales of timber and fuel wood | 41,693 |
| 80 | Revenue from the sales of timber and fuel wood | 24,563 |
| 100 | Revenue from the sales of timber and fuel wood | 221,069 |

Source: 'Medstata' project data

The WACC equals the cost of equity of unleveraged family farm as the tax advantage from the non-taxable interest is very small and does not affect the fair value of the farm.

The analysed family farm is implementing an investment project of afforestation, therefore when determining the fair value of the family farm it is necessary to take into account the FCF of the investment project and to discount them at the SDR. The FCF of the forest investment project were predicted on the basis of the forecasting assumptions given below. The afforestation project was prepared for an area of 4.04 ha. Given the dominating type of trees (European larch, *Larix decidua*) and the functional purpose of the forest (forest group 4, commercial forests), the planned turnover of the forest is 100 years, and thus the project cash flows, the social and environmental benefits were estimated for this period.

The project prepared by the firm 'Medstata' includes afforestation and plant maintenance works over a period of five years. Pursuant to the Forest Regeneration and Afforestation Regulations, the plant maintenance works will also have to continue in years 6 and 7 after afforestation.

The new forest thinning was designed pursuant to the *Rules of Forest Felling* that provide for pre-commercial thinning in trees under 20 years old, thinning in coniferous stands from 21 to 40 years old, and routine thinning from 40 years old. With respect of the yields of the growth location and the composition of the planted forest species, two pre-commercial thinning sessions are provided in 8 year old and 15 year old trees along with intensive commercial thinning and routine thinning. The *Rules of Forest Felling* provide for non-intensive routine thinning or, as the case may be, sanitary felling at the age of 80. The costs of pre-commercial and commercial thinning were forecasted on the basis of the average forest work costs in the state forest sector over the last three years while the timber prices were based on the average wood sortiments prices (www.gmu.lt).

The dynamics of the planted forest volume was forecasted based on the normal forest stand growth tables for II bonitet pine stands (Repšys *et al*., 1983) as the European larch growth course in Lithuanian conditions has not yet been researched. It was assumed that at maturity the stand stocking level will amount to 0.8. The afforestation and maintenance expenses of the family farm are incurred in different years during the period from 1 to 100 years (Table 8) and are estimated at LTL 196,878 in total.

Forest thinning and felling produces fuel wood and timber, the sales whereof generate income for the family farm (Table 9). The family farm plans that the sales revenue will amount to LTL 359,418. On the assumption that the buyers will pay for the sold products the same year, the cash inflows equal to the sales revenue.

The analysed non-timber forest functions included $CO_2$ accumulation; landscape/recreation, water protection; biodiversity and hunted animals. The $CO_2$ accumulation function was appraised with regard to the change in timber volume, the $CO_2$ emissions from the wood pulp, and the average market carbon price in 2012 (LTL 24.47 per tonne). The $CO_2$ accumulation function of the planted forest is greater than that of the existing forests due to a relatively lower change in volume. The values of these functions were calculated on the basis of average values for Lithuanian forests per year (LTL 6.95 and LTL 7.05 per ha respectively) established by Mizaras *et al*. (2012). The value of the $CO_2$ accumulation function in the planned period falls from LTL 595 in the first year to LTL 264 in the last year.

The recreation/landscape and biodiversity conservation functions were appraised with regard to the net losses in using the timber that are calculated using the opportunity costs approach. The water protection function was appraised with regard to the formation of clean water flow, water protection against pollution, increase of water flow and surface flow infiltration into groundwater. The value of hunted animals was determined with regard to the costs related to hunted animal care and hunting arrangements and the net revenue from hunting. According to Mizaras *et al*. (2012), the values of recreation and environment, water protection functions, biodiversity conservation and hunted animals are LTL 28.08, 28.48, 43.91 and 13.82 respectively. Those values remain the same throughout the planned period, except the recreation and landscape value which is not created before year 20.

Since the species composition of the planned stand is uncharacteristic of Lithuanian forests, it is not possible to assess the potential yield of mushrooms, berries and medicinal plants and therefore the value of those forest products was not calculated.

When the FCF of forest investment projects is calculated, the cash flows from financing activities should be taken into account as the government grant is non-repayable and increases the FCF in the family farm. The support for afforestation and forest maintenance to be given to the family farm is LTL 47,016 in year 1, LTL 3,703 in year 2, LTL 4,254 in year 3, LTL 4,254 in year 4 and LTL 3,276 in year 5.

The FCF of the forest investment project were calculated by deducting the expenses of afforestation and maintenance from the revenue from the commercial forest production and by adding the government grant and the value of non-timber resources that includes the value of recreation and environment, water protection functions, biodiversity conservation and hunted animals. The FCF are discounted at the SDR, which is justified in part two of the paper: 0-40 years: 3.5 per cent; 41-130 years: 2.75 per cent. The discounted FCF amount to LTL 40.2 thousand:

$$PV = \sum_{t=1}^{n=40} \frac{FCF_{ft}}{(1+0.035)} + \sum_{t=1}^{n=41,42\ldots100} \frac{FCF_{ft}}{(1+0.0275)^{t}} = 40159$$

Each year the forecasted FCF are different and therefore they are excluded from the formula and only the overall calculated result is presented.

The terminal value of the family farm is determined on the assumption that the FCF growth rate in infinite term will equal zero since in the analysed period from 2009 through 2011 the farmer used more profit for personal needs than earned the net profit. The use of net profit for personal needs over the forecasted period of three years is planned to be 100 per cent. The terminal value of the family farm is LTL 4942.4 thousand:

$$TV_T = \frac{588141}{0.119} = 4942361$$

With respect of the CFC of the investment project, the fair value of the family farm is calculated to be LTL 5154.3 thousand.

$$PV = \frac{739621}{1.119^1} + \frac{631831}{1.119^2} + \frac{588141}{1.119^3} + \frac{4942361}{1.119^3} + 40159 = 5152783$$

The fair value is calculated for the capital employed. To determine the total fair value of the family farm, non-interest bearing liabilities (debts to suppliers and other accounts payable) shall be added to the fair value of the capital employed. In the last financial year, 2011, it amounted to LTL 142,133 and consequently the fair value of the family farm is LTL 5294.9 thousand. The fair value of the family farm is significantly higher than its book value (LTL 3088.6 thousand). To determine the value at which the family farm can be sold, the debt in the last financial year, i.e. 2011, shall be deducted from the fair value of the capital employed.

## Discussion

The DCF method is the only way to determine the fair value of an existing business organisation where only a few transactions are made in the market. When using the DCF method for determining the fair value of any business organisation, two key value drivers must be estimated: free cash flows and the discount rate. The research novelty of this paper lies on the logical scheme of the multifunctional family farm valuation model in which the differentiation of cash flows and discount rates is the main stage.

The specificity of the cash flows in a multifunctional family farm is related to the cash flows from financial support, different value drivers of the EBIT and their calculation methodology, and the value of public goods and externalities.

In general, the cash flows from financing activity are not included in FCF determining the fair value. An exception is grants related to assets, which are non-repayable and increase the cash flows for the owners. When the FCF are increased by the amount of the received grants for assets, the EBIT is not adjusted by the depreciation expenses of the subsidised fixed assets.

The marginal profit from the sale of products and provision of services, being the key EBIT driver, is decomposed into three value drivers: the sales volume, the sales price and the unit cost. Using the method of decomposition, all the other EBIT value drivers are reflected in the cash flows according to the statement form prescribed in Business Accounting Standard 3 'Income Statement' for entities, whose typical activities are cultivation of biological assets, production and treatment of agricultural produce, processing of agricultural produce of own and treatment production.

Cash flows related to investments the economic benefits whereof that future generations will enjoy must be discounted at the SDR. Currently under the EU's Rural Development policy 2007-2013 such investments include investments into first afforestation of agricultural land, first afforestation of non-agricultural land, actions to restore forestry potential and prevention actions, an non-productive investments linked to forest-investment payments.

Family farms are private organisations and therefore some methods cannot be used to calculate the cost of equity. The investments of the farmers are not diversified, so they assume total, not only systematic risk, and this is the approach followed by Kerins *et al*. (2004), McConaughy (2009) and Pattitoni *et al*. (2012). That is why the cost of equity is calculated using a modified capital asset pricing model (CAPM) and includes total, not only systematic, risk. However, previous researchers do not answer the question: what accounting information shall be used in CAPM? The WACC is calculated under the assumption that capital structure is rebalanced to target capital structure and the SDRs used decline over time.

Being a key method, DCF has some limitations considering both techniques of value drivers' measurement and forecasting. Firstly, several difficulties arise in the measurement of public goods and externalities in monetary terms, because some of them are non-measurable. Secondly, all value drivers are uncertain, so the assumptions related to the techniques of value drivers' measurement and forecasting depend not only on the reliability of methods, but also on the expectations of purchaser and seller of family farm. Thirdly, the fair value is a dynamic concept, and it changes over time in response to macroeconomic and microeconomic factors.

The question "Can the 'fairer' value for the farm be determined?" remains open. It can be 'fairer' only in the light of consensus of two interested parties: purchaser and seller. The purpose of this paper was to present the possible techniques for determining the fair value of a multifunctional family farm, and thus to help to solve problems that arise when calculating and forecasting free cash flows, and determining market based and social discount rates.

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