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Does Biological Assets´ Tangibility Matter from the Profitability and Cost of Debt Perspective for Agricultural Firms?

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Abstract

The research aim is to identify specific production factors (biological assets) and target potential profitability and cost of external debt dependency on these biological assets (as an anticipated essential driving forces) due to relative scarcity of this topic coverage. Underlying unbalanced data set consist of 229 agricultural firms managing their business operations from 2011 till 2019 in the Czech Republic. The paper is innovative based on its combination of several different factors including incorporation of biological assets' variables influencing firm's profitability and by assessing determinants concerning cost of external debt using a panel regression analysis with fixed effects. Biological assets tangibility is relatively low with declining trend. Contrary to it land tangibility experienced exactly opposite development caused by "skyrocket" land price appreciation. It has been proven that cost of debt is depending only on the short/long-term leverage levels, thus primarily the total indebtedness is essential and relevant driving force.

Keywords

Cost of debt, leverage, return on assets, tangibility, variables.

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Introduction

Since profitability is in the epicentrum of the interest from alternative stakeholders' point of view with respect to the effective capital allocation, understanding its determinants is desirable. Understanding of non/essential production factors behaviours (accessibility, availability etc.), as initial inputs for transformation production process, can be viewed in general as an essential part of profitability generation, which is dictated by the efficiency and productivity of their used and has been extensively covered by literature (Setianto et al., 2022). Special attention shall be also paid to the essential production factors, more precisely specific ones that are crucial and possess irreplaceable character (with very limited substation possibility) in production process (agricultural land in crop production etc.). Contrary to it, inadequate and/or inefficient handling of these production factors can detrimentally affect profitability generation and can also lead to higher financial cost (higher risk premium on external debt charged by lenders). Thus, managing these production factors effectively shall lead to profitability as well as cost of external debt enhancement.

The agriculture sector can serve as a good example of industry that is employing and significantly depending on specific production factors possessing unique features due to its natural origin (biological assets) (Mukaila, 2022). The goal of this paper was to identified specific factors of biological character on selected sample of agricultural firms. Consequently, statistical models targeting potential profitability and cost of external debt dependency on biological assets (specific factors) as an anticipated essential driving force were introduced. Apart of these specific production factors also other factors in different effect categories: effects specific to individual firms and macroeconomic effects were utilized.

The authors believe that the paper is innovative in cumulating several factors, namely both types of biological assets (fixed and current assets) and land determining the profitability and cost of senior debt of selected sample of agricultural firms, thus overlapping relative scarcity of this

topic coverage (at least in the context of the Czech Republic). In addition, the underlying dataset comprises predominantly from unlisted firms (mostly SMEs), which typically face information asymmetry resulting in severe resources limitation (excess to external financing etc.), but at the same time represent majority of agricultural entities (family farms). Therefore, this research provides relevant beneficial contribution to academic literature and the results can also serve as guideline for policy makers with respect to agricultural policy, especially public aid policies (subsidies adjustments etc.).

The paper is organized as follows: Section 2 provides an overview of related literature including empirical findings concerning bioassets as potential profitability driver, dataset its adjustments and subsequent descriptive analyses are detailed in Section 3, proposed methodology is explained in Section 4, the results including robustness checks are elaborated in Section 5 and concluding remarks are provided in Section 6.

Literary research

Primary agricultural production contrary to the most other sectors of national economy is employing specific production factors, i.e., assets of biological character that poses unique features due to its natural origin (Du and Li, 2018). The efficient use of assets and the degree of debt financing together with labor productivity create comparative strengths of the agribusinesses in individual countries (Beyer and Hinke, 2020; Bielik et al., 2013; Yakubu et al., 2022). Asset size and leverage as determinants of profitability have been confirmed by many researches conducted in the agricultural sector - for example Mijic and Jaksic (2017) in Eastern Europe, Korneta (2017) in Poland or Pokharel et al. (2019) in the United States. Therefore, the aim of this paper is to test, whether biological assets and their tangibility (as an irreplaceable production factor) play any crucial role in agricultural firms' profitability determination and at the same time influence the cost of external debt (higher biological fixed assets tangibility representing higher level of tangibility that can be used as a collateral). This focus of the article makes it unique, as the authors are not aware of any similar study. A bright spot is only the study of Chinese authors Xie, Wang and Wang (2019). Their paper examines the effect of biological assets, an agricultural characteristic asset on cost of debt capital for Chinese listed agricultural firms over the period 2007 similar to 2016. They find that biological assets have significant positive effect on cost of debt capital.

The Czech financial accounting regulations are distinguishing long-term biological assets (part of fixed assets) and agricultural production (part of current assets) in the form of animals or living plants (Čermáková, 2013). For the purpose of this study, biological assets (excluding land) are considered as items having natural origin and are divided into two group based on their lifetime expectancy (accounting principal), more precisely long-term biological assets (fixed biological assets) and short-term biological assets (current biological assets). Fixed biological assets are formed by breeding livestock and perennials. Current biological assets (agricultural production) are consisting of young animals (Sedláček, 2010).

Biological assets are subject of biological transformation, i.e., process of growth, degeneration, production, and procreation causing qualitative and quantitative changes in living being and generated new assets in the form of agricultural products or additional biological assets of the same type (Bohušová and Svoboda, 2017).

Also, agricultural land can be viewed as a special type of biological production factor due to its natural nature (Simtion, 2020). Therefore, the land is considered as special fixed biological asset playing increasing role at least from the tangibility point of view due to its increasing monetary expression (land prices were in general rather steadily increasing over the period of time and similar path is anticipated in the future) (Zdenek et al., 2019). The land more precisely area of agricultural land may play also important role with the respect to the overall public aid support transfers to farmers (certain subsidies' payments may be in/directly linked to the cultivated farmland area) (Takac et al., 2020).

In order to achieve the above-defined aim, the following hypotheses were defined and will be verified in this study:

H1: Biological assets tangibility positively and significantly influences agricultural firm's profitability.

H2: Profitability of bigger firm tends to have higher dependency on biological assets tangibility (under the assumption that bigger firms tend to have the higher volume and share of biological assets on its balance sheet).

H3: There is a negative relationship between cost of debt and bio assets tangibility.

Materials and methods

Underlying unbalanced data set consist of 229 agricultural firms managing their business operations from 2011 till 2019 in the Czech Republic, thus representing 2.018 observations. Financial figures are derived primarily from publicly accessible resources. Final financial statement (where applicable audited) was used. Following adjustments were imposed on raw data like Bena and Ondko (2012) and Vithessonthi and Tongurai (2015) firms with relatively high indebtedness (short/long term debt to total assets ratio greater than one) and/or firms with negative net worth. No limitation applied from performance (Turnover) point of view to ensure full complexity of the Czech agricultural sector.

To capture profitability and cost of debt determinants (including potential effects of biological assets) following variables were defined and used. Please see Table 1 for comprehensive overview.

Prior to quantitative analysis examination underlying data set was inspected for potential inconsistencies and statistical properties were analysed. Please see Table 2. for descriptive statistics.

The minimum value (equal to zero) of biological assets (both fixed and/or current) represents firms that either farm without own biological assets (crop farming without breeding animals etc.) or are renting them (long term lease of perennials etc.). Also, minimal values equal to zero in the case of land tangibility stands for firms having no own land. Zero debt (without any external debt) firms amount short and/or long-term leverage ratios to zero. Consequently, applied interest rate (in the case of zero debt firms) counts also for zero.

Profitability itself is defined as Return on Assets (ROA). To overcome potential discrepancies resulting from alternative depreciation and amortization scheme earnings before tax and depreciation (EBIT) is employed. The motivation is to capture potential market distortions caused by public policies leading to "non-market" behaviours under the necessity of the subsidy's conditions alignment from producer point of view. To understand, whether the agricultural production is sustainable under the free-market conditions or is in the phase of perilous dependency on public transfers. Since different types of subsidies are relatively common in primarily agricultural production (cash transfers in the favour of firms' cash flow), alternative profitability (ROA_2) is calculated by including also other operating income (OOI), where majority subsidies are booked. From the description, it is obvious that achieved profitability magnitudes differ between ROA and ROA_2 (effect of OOI caused by subsidies). ROA figures are smaller compared to ROA_2 values and even attack negative area (both median and mean values) leading to the conclusion that overall profitability is significantly driven by subsidies.

Interestingly, the observed trend of profitability (both ROA and ROA_2) is decreasing, experiencing relatively significant reduction by -48.1 % and -22.9 % (total average values) for ROA_2 and ROA, respectively. This could lead to assumption (OOI is used as a proxy

	Variables	Abr.	Description
Endogenous variables	Return on Assets	ROA	(EBIT - Other operating income)/Total Assets
	Return on Assets_2	ROA_2	EBIT/Total Assets
	Interest rate (in % p.a.)	IR	Interest expenses/Total bank debt
Exogenous variables	Fixed Bio Assets intensity	Bio.Fix_TA	Fixed Biological Assets/Total Assets
	Current Bio Assets intensity	Bio.Ca_TA	Current Biological Assets/Total Assets
	Land intensity	Land_TA	Land/Total Assets
	Fixed Assets intensity	NCALB_TA	Fixed Assets (excluding Bio Fix Assets & Land)/Total Assets
	Long term leverage	LTBL_TA	Long term financing /Total Assets
	Short term leverage	STBL_TA	Working capital financing/Total Assets
Macroeconomic variables	Inflation (in % p.a.)	CPI	Customer price index
	Price of money (in % p.a.)	3MPRIBOR	3M Pribor at the end of the fiscal year
	GDP growth (in % p.a.)	GDP	Annual GDP growth

Source: own processing

Table 1: The list of used variables.

AgroSector	Mean	Std.De	Min	Median	Max	MAD	IQR	CV
Bio.Ca.TA	0.057	0.040	0.000	0.049	0.435	0.028	0.041	0.695
Bio.Fix.TA	0.030	0.017	0.000	0.028	0.141	0.015	0.021	0.566
CPI	0.017	0.010	0.003	0.019	0.033	0.014	0.018	0.596
GDP	0.025	0.019	-0.008	0.025	0.054	0.010	0.014	0.769
IR	0.048	0.069	0.000	0.040	2.190	0.015	0.020	1.429
LAND_TA	0.118	0.096	0.000	0.095	0.649	0.082	0.115	0.820
LTBL_TA	0.182	0.128	0.000	0.155	0.692	0.118	0.172	0.704
NCALB_TA	0.493	0.136	0.045	0.506	0.830	0.129	0.177	0.275
ROA	-0.103	0.083	-0.561	-0.091	0.263	0.066	0.090	-0.810
ROA2	0.042	0.043	-0.184	0.038	0.353	0.036	0.049	1.042
STBL_TA	0.047	0.056	0.000	0.034	0.469	0.051	0.069	1.175
X3MPRIBOR	0.009	0.007	0.003	0.005	0.022	0.003	0.008	0.800

Source: own processing

Table 2: Statistical properties of used variables.

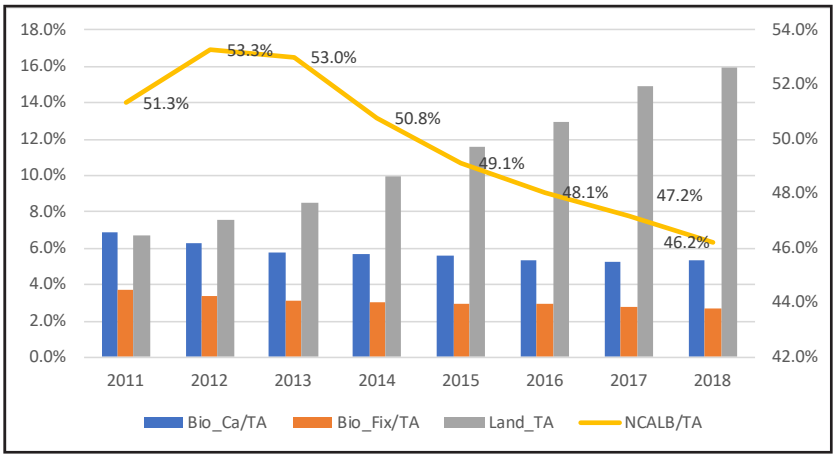
for public transfers level) that slightly less than half of profitability drop is driven by unfavourable market conditions such as uneven margin distribution within the agro-food supply chain (for further detail please see Toušek et al., 2021) and remaining part counts for public aid support level decrease. Regardless of similar trend development, there are differences in magnitudes between selected sub-segments. Where lower subsegment (L) is achieving lower profitability (both ROA and ROA_2) compared to upper subsegment (U), which is higher app. by +28.4 % (average value) for ROA. By comparing development of profitability variables across subsegments it seems that ROA gap (L subsegment lower by app. 46.6 % in average) is narrowed when considering ROA_2 characteristic suggesting higher level of subsidies favouring lower subsegment firms.

To gain further inside into the biological capital tangibility with respect to agricultural firms' size, underlying data set was divided into two subgroups (Lower and Upper) based on the actual firms' performance in the last year of observation (2019). Where median value of turnover adjusted by other operating income (added) was used as a criterion. Thus Upper (U) subsegment represents firms with performance over the median value and Lower (L) stands for remaining part of firms.

Analytic evidence is showing that agricultural firms predominantly prefer long-term financing to short-term financing (in average appr. 3x higher long-term than short-term leverage), regardless relative dramatic increase of working capital leverage (appr. +63.2 % but starting from the significantly lower base) to slightly modest expansion of long-term leverage (app. +5.5 %). With respect to the subsegments' indebtedness ratios (average values) followed similar path of increase namely short-term leverage expanded by app. +53.9 % and appr. +77.8 % for lower and upper subsegment respectively. In the case of long-term leverage diverse trends can be tracked, lower subsegment experienced increase app. +11.9 % contrary to upper subsegment facing slight reduction app. by -0.6 %.

As can be seen from the Figure 1, fixed assets components' tangibility experienced different development. Average share of fixed biological assets as well as other fixed assets are similarly diminishing over the time achieving reduction by -28.5 % and -11.3 % respectively. Contrary to it land tangibility has performed dramatic increase by +157.6 % causing the total fixed assets tangibility reinforcement regardless other fixed asset types opposite development.

Both fixed and current biological assets make up relatively small share of balance sheet (mean as well as median values correspond to the single digit value) contrary to other fixed assets tangibility (NCABL_TA) (excluding biological fixed assets and land to avoid double counting). The other fixed assets significantly outcompeted (by twentyfold times) biological fixed assets on the firms' balance sheet (+89.3 % in average over the respective period, whole sample). Also, from the biological assets (as a whole) perspective, firms' capital is predominantly tied up in biological current assets, which is in average (over the respective period) higher roughly by 89.2 %, thus counting for majority of the whole biological capital. Regarding trend development, biological assets



Source: Authors' own elaboration

Figure 1: Asset tangibility comparison (average annual values).

tangibility is decreasing with more progressive decline in the case of fixed biological assets (-28 %) and biological current assets follow similar path with milder magnitude (-23 %). The analyses revealed that smaller firms (subsegment L) tend to face higher biological assets tangibility compared to bigger ones (subsegment U), in average (over the respective period) both biological fixed and current assets tangibility are higher by appr. 24.2 % and appr. 19.9 % respectively. Also, in the case of land tangibility smaller firms outperformed bigger ones on average by +9.8 %. Opposite situation is in the other fixed capital tangibility (NCABL_TA), where smaller agricultural firms (subsegment L) are achieving lower tangibility ratio in average (over the respective period) by appr. -6.8 % regardless similar trend development. Both subsegments are experiencing comparable dynamics in biological asset tangibility decline (over the respective period), but different in its magnitude. Fixed bio assets tangibility is jointly reduced more significantly by appr. -30.5 % and appr. -25.9 % for lower and upper subsegment respectively compared to the current biological assets, where same trend, but of milder reduction occurred by appr. – 24 % and appr. -22 % for lower and upper subsegment respectively. Opposite dynamics is observed for land, where the land tangibility for smaller firms increased significantly by + 138.6 % and for bigger ones by + 181 %.

The standard panel data analysis was used to explore effect of bio assets on company's balance sheet on its performance as well as cost of external financing. For the former, the following model was estimated:

$$ROA_{it} = Bio\_Fix\_TA_{it} + Bio\_Ca\_TA_{it} + \\ + LAND\_TA_{it} + NCABL\_TA_{it} + STBL\_TA_{it} + \\ + LTBL\_TA_{it} + GDP_t + CPI_t + 3MPRIBOR_t + \\ + \upsilon_i + \varepsilon_{it} \quad (1)$$

where *ROA* refers to return on assets, B*io_Fix_TA* refers to share of fixed bio assets on total assets, *Bio_Ca_Ta* represents share of current bio assets (namely animals) on total assets, *LAND_TA* represents share of land on total assets and *NCABL_TA* represents other than total fixed assets tangibility approximated by share of non-current assets on total balance sheet (excluding biological fixed assets and land). Also leverage-related variables (namely short-term bank loans to assets and long-term bank loans to assets) were included which were found to have negative impact on company's performance (Toušek et al., 2021). Multiple macroeconomic controls variables were also included such as GDP growth (*GDP*), inflation (*CPI*) and 3-month Prague interbank offered rate (*PRIBOR*). The error term includes a company-specific (υ) and a disturbance term (ε).

Due to specifics of agro sector in relation to public subsidies two alternatives of the dependent variable (*ROA*) were inspected. Under Czech accounting regulations, public subsidies which usually represent an instrumental part of profits in agro sector, are booked as other operating income. On one hand, subsidies tend to distort operating efficiency measures, but on the other they form essential source of cash reflected in bank assessments, etc. Therefore, the ROA's nominator as EBIT excluding and including other operating income as *ROA* and *ROA_2* was defined, respectively.

Further, the relationship between share of bio assets on company's balance sheet and cost of its debt were explored. Thus, the following model was estimated:

$$IR_{it} = Bio\_Fix\_TA_{it} + Bio\_Ca\_TA_{it} + \\ + LAND\_TA_{it} + NCABL\_TA_{it} + ROAit + \\ + STBL\_TA_{it} + LTBL\_TA_{it} + GDP_t + CPI_t + \\ + 3MPRIBOR_t + \upsilon_i + \varepsilon_{it} \quad (2)$$

where *IR* refers to cost of debt in terms of interest rate calculated as interest expense over total bank loans on balance sheet. Remaining variables have the same meaning as in the previous model. Also here, the effect of performance measured by return on assets in two modifications – including and excluding other operating income (represented mainly by subsidies) was inspected.

The standard procedures for selection of the appropriate estimation method based on panel dataset were performed. In our dataset the evidence of presence of fixed individual effects as F-test based on results of pooled ordinary least squares and fixed effects estimation yields p-value lower than 0.001 was found. Further, the consistency of random effects and fixed effects estimation using Hausman test was inspected. As zero hypothesis was rejected at p-value < 0.001, random effects estimation might generate inconsistent estimates and thus the individual fixed effects ordinary least squares were employed. In general, fixed effects models account for individual-specific characteristics by introducing a fixed effect (dummy variable) for each cross-sectional unit in the dataset, such as companies in Agro sector in our case. These fixed effects capture time-invariant heterogeneity, allowing to control for unobserved individual differences, making them useful for addressing endogeneity and omitted variable bias. However, fixed effects models alone do not explicitly address for example cross-sectional dependence, arising from correlations or interdependencies between these individual units over time. In panel data, especially when dealing with a small time dimension and a large cross-sectional dimension (which is our case), the error terms may exhibit correlation within individual units or clusters (cross-sectional dependence) and non-constant variance over time, which was also detected in our analysis (based on Pesaran CD test for cross-sectional dependance). As panel-corrected standard errors (PCSE) introduced by Beck and Katz (1995) provides a way to adjust the standard errors to accommodate these issues, we apply these in our final analysis (in all cases).

Finally, the potential multicollinearity among variables was tested using variation inflation factor (VIF) test on the pooled model. In the case of all variables VIF values remained safely below 3 being considered in the literature to be a conservative rule-of-thumb threshold implying no strong correlation among explanatory variables (maximum VIF value 1.82).

Results and discussion

This section sets forth estimation results of the models specified above using R statistical software. First, the attention was focused on determinants of agricultural firm's performance taking into consideration impacts of public subsidies often transforming operating loss to profit. Also a closer look was taken on how the situation changes if the distinction on the smaller and the larger companies in the sample was considered. Second, the hypothesis that cost of debt of agricultural companies might be impacted by bio assets tangibility (i.e., share of biological assets on company's balance sheet) was explored. This section concludes with final discussion of robustness of the results and potential limitations.

Effect of biological assets tangibility on agricultural firm´s profitability

Table 3 summarizes determinants of return on assets excluding other operating income largely represented by subsidies in agricultural sector. In entire sample was found significantly (with at least 95 % confidence) that fixed biological assets (i.e., mainly breeding livestock and perennials) tangibility has a negative impact on company's operating performance caused by overall total fixed assets tangibility increase similar to empirical finding of Boadi, Antwi and Lartey (2013), Pratheepan (2014) and Vintila and Nenu (2015), etc. Other tangibility-related variables remain silent in case of full sample as observed alternatively also by other authors, such as Kotsina and Hazak (2012), Okwo et al. (2012), and Derbali (2014). Interestingly, was found significantly positive impact of long-term leverage on agricultural companies operating performance. Finally, macro control variables indicate that companies in data sample exhibit rather countercyclical patterns in their return on assets. It seems that applied public

aid policies behaved as a "safety net" in the form of economic transfers independent on the national economy development. Alternatively, profitability measures of agricultural production (essential food production) are not primarily driven by general economic development (GDP), but rather other forces such as agro-food supply chain organization (internal margin redistribution) and inflationary pressure (captured by CPI) etc. Since leverage ratios are (both short/long-term) increasing over the time than associated financial burden (interest paid) out of which essential part is price of money (3M PRIBOR) lead to negative sign.

Determinants	All	Lower	Upper
Bio.Fix.TA	**-0.429** *	**-0.405** °	-0.235
	(0.191)	(0.245)	(0.371)
Bio.Ca.TA	-0.054	-0.127	**0.429** *
	(0.110)	(0.146)	(0.186)
LAND_TA	-0.052	0.037	**-0.173** **
	(0.044)	(0.065)	(0.056)
NCALB_TA	0.001	0.050	**-0.097** *
	(0.034)	(0.050)	(0.044)
STBL_TA	-0.014	-0.031	0.057
	(0.045)	(0.071)	(0.052)
LTBL_TA	**0.079** **	0.059	**0.139** ***
	(0.025)	(0.039)	(0.034)
GDP	**-0.360** ***	**-0.399** ***	-0.265 **
	(0.070)	(0.115)	(0.083)
CPI	**0.299** *	-0.066	**0.671** ***
	(0.127)	(0.199)	(0.152)
X3MPRIBOR	**-0.358** °	-0.281	-0.311
	(0.188)	(0.305)	(0.214)
Adjusted R2	68.6 %	68.1 %	55.4 %

Note: *** p < 0.001; ** p < 0.01; * p < 0.05; ° p < 0.1
Source: Authors' own elaboration

Table 3: Determinants of return on assets (excluding other operating income).

Looking closer at the smaller 50% of the sample, can be observed slightly weaker evidence of negative impact of fixed biological assets tangibility on ROA. Apart from strongly negative impact of GDP control variable, the remaining explanatory variables remain silent with respect to their significance. As expected, more is revealed in case of larger companies. Contrary to all sample and lower sub-sample result, was found significantly positive impact of young animals' tangibility on operating performance in case of larger companies and on the other hand no significance of the fixed biological assets tangibility. However, negative effect of fixed assets tangibility in general was detected. Unsurprisingly, stronger positive impact of long-term leverage was found as compared to the all-sample result suggesting that despite very similar long-term leverage in both subsamples, larger companies probably use the leverage for more value-accretive investments. The assumption of non-linear (e.g., the inverse "U" shape form) relationship between operating performance and leverage observed by Vithessonthi and Tongurai (2015) and Coricelli et al. (2012) etc. was not confirmed in the underlying sample. Therefore, other forces such as public state support in the form of interest rate subsidies (compensation of interest paid on granted senior bank lending to buy selected non-biological assets) could play the key role is the forming of this relationship. As far as macroeconomic variables are concerned, the results in case of larger companies are similar to all-sample results except for consumer prices inflation where larger companies are more successful in reflecting inflation to output prices and at the same time limiting these impacts on cost side.

Further, intention was to demonstrate how the inclusion of other operating income distorts return on assets as a measure of company's operating efficiency. As subsidies in agricultural sector are partly related to biological assets deployed on firm's business, a potential reverse causality issue was mitigated by including lagged variables related to biological assets tangibility. Estimation results are set forth in Table 4.

Determinants	All	Lower	Upper
Bio.Fix.TA	0.055	0.109	-0.134
	(0.132)	(0.178)	(0.228)
Bio.Ca.TA	-0.101	-0.098	-0.012
	(0.073)	(0.101)	(0.116)
LAND_TA	**-0.060 °**	-0.043	**-0.107 ****
	(0.032)	(0.049)	(0.037)
NCALB_TA	**-0.124 *****	**-0.128 *****	**-0.115 *****
	(0.023)	(0.037)	(0.027)
STBL_TA	**-0.085 ***	**-0.117 ***	-0.028
	(0.034)	(0.054)	(0.036)
LTBL_TA	-0.009	0.023	**-0.043 °**
	(0.019)	(0.030)	(0.022)
GDP	**-0.372 *****	**-0.533 *****	**-0.204 *****
	(0.058)	(0.102)	(0.053)
CPI	**-0.231 ***	**-0.444 ****	-0.007
	(0.096)	(0.154)	(0.110)
X3MPRIBOR	**-0.427 ***	-0.318	*-0.459 **
	(0.184)	(0.305)	(0.201)
Adjusted R2	34.8 %	32.7 %	40.7 %

Note: *** p < 0.001; ** p < 0.01; * p < 0.05; ° p < 0.1
Source: Authors' own elaboration

Table 4: Determinants of return on assets (including other operating income).

It was detected that both variables related to biological asset tangibility are insignificant for operating performance once other operating income to the returns was included, which is in line with nature of these subsidies. Consistently across all subsamples negative impact of general fixed assets tangibility was found which is also not surprising as these do not have an immediate compensating element in other operating income as in the case of biological assets. In contrast to the former analysis excluding subsidies from ROA, negative impact of short-term leverage for all and lower subsample and of long-term leverage in case of larger companies was found. Again, negative impact of GDP growth was confirmed. However, in case of inflation a negative impact of CPI in case of all sample and smaller companies' subsample was detected. This could be attributable to non-indexed nature of subsidies and lower market strength of smaller companies to translate general price increases to their output prices. This is also in line with the fact that CPI was detected insignificant in case of larger companies which are supposedly more successful in passing on the inflation to their customers as suggested by results of the former analysis (see Table 3).

As a robustness check lagged variables were included also in the case for the model explaining ROA excluding other operating income. The results for all sample are summarized in Table 5.

Determinants	All	Excluding OOI	Including OOI
Bio.Fix.TA	0.055	-0.336 °	0.055
	(0.132)	(0.177)	(0.132)
Bio.Ca.TA	-0.101	0.171 °	-0.101
	(0.073)	(0.098)	(0.073)
LAND_TA	**-0.060 °**	0.115 **	**-0.060 °**
	(0.032)	(0.042)	(0.032)
NCALB_TA	**-0.124 *****	**0.032**	**-0.124 *****
	(0.023)	(0.030)	(0.023)
STBL_TA	**-0.085 ***	**0.038**	-0.085 *
	(0.034)	(0.045)	(0.034)
LTBL_TA	-0.009	0.105 ***	**-0.009**
	(0.019)	(0.026)	(0.019)
GDP	**-0.372 *****	**-0.366 *****	**-0.372 *****
	(0.058)	(0.069)	(0.058)
CPI	**-0.231 ***	**0.408 ****	-0.231 *
	(0.096)	(0.129)	(0.096)
X3MPRIBOR	**-0.427 ***	-1.016 ***	*-0.427 **
	(0.184)	(0.217)	(0.184)
Adjusted R2	34.8 %	71.3 %	34.8 %

Note: *** p < 0.001; ** p < 0.01; * p < 0.05; ° p < 0.1
Source: Authors' own elaboration

Table 5. Determinants of return on assets in relation to subsidies.

The findings still hold (except for significance level of biological fixed assets tangibility decreasing to 90%) even with lagged variables employed suggesting that the reverse causality issue persists in case of ROA including subsidies only. Finally, it can be pointed out that goodness of fit in terms of adjusted R2 is dramatically lower as compared to the former analysis illustrating the necessity of controlling for subsidies when examining ROA as operating performance measure of agricultural companies.

Since majority of authors with respect to the biological assets focused their attention to the reporting techniques (differences caused by alternative accounting standards applications) and the related impact of disclosure of this information, there is rather limited source of literature regarding biological assets tangibility implication on agricultural firms' profitability. As showed the biological assets tangibility level (both fixed and current assets) influence the profitability in mixed way and is relatively small in its magnitudes. This may be caused by their relatively small share on the total balance sheet on agricultural firms (low tangibility). Which is even reduced by diminishing trend (in average app. -27.03% and -23.19% over period for fixed and current biological assets, respectively).

Alternatively, the insufficient differentiation of agricultural activities by Czech accounting legislation may result in the omission of critical aspects of biological transformation. Consequently, this may hinder the accurate reflection of associated economic benefits in the financial statements of agricultural entities (Hinke and Stárová, 2014).

Surprisingly biological assets (both fixed and current) as irreplaceable production factors play insignificant role in profitability formation under scenario with subsidies paid out. Contrary to it under alternative scenario (no subsidies considered) biological asset tangibility become significant profitability driver (but relatively low significance). With negative relationship to the profitability in the case of fixed biological assets tangibility suggesting that relatively high associated costs/investments and relatively long depreciation period ties up significant level of firms' own capital. It is assumed that possibility of external debts financing (such as bank loans) is rather limited due to its natural character (meaning higher vulnerability and inconvenience as a stable collateral). A limited positive relationship to profitability is observed for current biological assets tangibility (only for upper sub-segment). Therefore, proposed hypothesis 1 shall be rejected.

As empirical evidence revealed, the biological assets tangibility (both fixed and current assets) is higher rather for smaller firms (lower sub-segment) than for bigger ones (upper sub-segment). Please see text above. Also, based on the calculations there are no clear records proving that bigger firms' profitability (upper sub-segment) is more significantly driven by biological assets tangibility than smaller ones (lower sub-segment). Only one parameter (current biological assets tangibility) seems to be significant for bigger firms under scenario without subsidies paid out. Therefore, the hypothesis 2 shall be also rejected.

Effect of biological assets tangibility on agricultural firm´s cost of debt

Also, the issue whether biological assets tangibility do have any impact on company's cost of debt was explored. Interestingly, there is no evidence of biological nor fixed assets in general tangibility having an effect on cost of debt. Unsurprisingly, negative impacts of both short- and long-term leverage with comparable effects in term of size and significance across all (sub)samples were observed.

Determinants	All	Lower	Upper
Bio.Fix.TA	0.158	0.059	-0.352
	(0.192)	(0.150)	(0.433)
Bio.Ca.TA	-0.022	0.028	-0.064
	(0.099)	(0.090)	(0.235)
LAND_TA	0.030	-0.003	0.053
	(0.041)	(0.039)	(0.059)
NCALB_TA	0.018	0.038	**0.095** °
	(0.034)	(0.031)	(0.053)
ROA	-0.026	-0.041	0.043
	(0.031)	(0.027)	(0.055)
STBL_TA	**-0.246** ***	**-0.228** ***	**-0.264** ***
	(0.044)	(0.044)	(0.068)
LTBL_TA	**-0.171** ***	**-0.185** ***	**-0.190** ***
	(0.025)	(0.024)	(0.043)
GDP	**-0.184** °	**-0.332** ***	-0.099
	(0.095)	(0.063)	(0.122)
CPI	0.122	-0.023	-0.039
	(0.149)	(0.135)	(0.138)
X3MPRIBOR	**-0.581** *	-0.106	-0.634
	(0.262)	(0.172)	(0.430)
Adjusted R2	37.5 %	40.2 %	41.4 %

Note: *** p < 0.001; ** p < 0.01; * p < 0.05; ° p < 0.1
Source: Authors' own elaboration

Table 6. Determinants of cost of debt (controlling for ROA excluding other operating income).

As mentioned above, the biological assets tangibility has no significant influence on the cost of debt. Suggesting that external debt providers (typically banks) do not consider biological assets (especially fixed biological assets) as relevant tangible assets for loan collateralization, thus promoting lower applied interest rates and potentially increase in leverage itself. Also, other fixed assets type tangibility seems not to influence cost of debt (exception of NCALB_TA in upper sub-segment). Our finding does not support the conclusions of other authors, such as Lyandres and Palazzo (2016), who posited that firms with relatively high asset tangibility generally tend to have lower external financing costs. Conversely, firms with relatively fewer tangible assets are more likely to face difficulties in raising external capital and may be financially constrained, thereby missing investment opportunities (Almeida and Campello, 2007).

Simultaneously, it seems that both profitability measures (ROA and ROA_2) are not influencing the overall cost of debt significantly. Alternative scenario for ROA_2 (with exception of whole data set) shows no significance as well as. It is

leading to conclusion that public aid policies have rather limit (if any) direct impact on the cost of debt (with exception of direct interest rate subsidies program). Interestingly, both leverages are having negative sign (caused by interest rate decline over the respective period with exception of two last years). In contrast to other authors, such as Kiyotaki (2011) and Bernanke, Gertler and Gilchrist (1999), who demonstrated that an increase in corporate leverage results in higher costs of external financing due to elevated default probabilities, which can ultimately result in a significant economic slowdown. Short-term leverage had stronger impact (expressed in the parameter magnitude) contrary to the long-term leverage probably due to the associated interest rate subsidies (public compensation scheme for paid interest margin associated with selected non-biological assets' purchases) and relatively low mortgage rates associated with agricultural land purchase (applied mortgage interest rates are typically significantly lower compared to "conventional" long-term loans' rates). Therefore, the hypothesis 3 must be rejected.

Conclusion

The aim of this paper was to elaborate on potential importance of biological assets tangibility (both fixed and current) including land from profitability and the cost of debt generation point of view due to relative scarcity of this topic coverage. The analysis revealed that biological assets tangibility is relatively low with declining trend for both sub-segments and almost twentyfold compared to NCABL_TA regardless their irreplaceable character in production process. Contrary to it land tangibility experienced exactly opposite development caused by "skyrocket" land price appreciation. Nevertheless, it showed that biological assets (including land) tangibility regardless their development influence profitability in the mixed way from sub-segments as well as their lifetime expectancy point of view.

Alternative models for different profitability distinguishing existence of public policies in the form of subsidies are suggesting market distortion leading to "non-market" behaviours under the necessity of the subsidy's conditions alignment from producer point of view (ROA negative and ROA_2 positive average figures). Thus, commonly expected economic rules (under the free market assumptions) are not in the place. Obtained findings are suggesting that public aid policies served rather as a "safety net" for agricultural firms to compensate insufficient profitability generation (in the most cases) than promoter of unbiased free market behaviours.

It seems that cost of debt is depending only on the short/long-term leverage levels, thus primarily the total indebtedness is essential and relevant driving force. Which may be also influenced either by public aid (interest margin paid compensation) and type of debt instruments employed (mortgage loan typically having lower interest rate compared to "conventional" long-term loans). Surprisingly profitability (ROA) itself is not significant variable (contrary to other sectors) suggesting that subsidies level (OOI) is other driving force. Interestingly, fixed assets tangibility both non/biological ones do not contribute to the cost of debt level (not significant parameters) as potential instruments of collateralization promoting lower applied interest rates (due to higher security level for external debt provider).

Regional scope limited to the Czech Republic caused by the necessity of the completeness and the consistency of underlying data may be viewed as a limitation. Also, certain level and structure of public aid policies (subsidies) uniqueness on the national level shall be distinguished and acknowledged. Nevertheless, obtained findings can be applicable to other countries in broader sense.

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