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THE VALUE OF A FIRM: ASYMMETRIC INFORMATION IN ECONOMIC VALUE ADDED MEASUREMENT[*]

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Abstract
Subject The value of a firm is an unbiased and reliable measure of operations and strategic performance of an enterprise.
Objectives The study analyzes a combination of approaches based on the book and market values as part of the information asymmetry theory, which points out the comprehensive integrated indicator, such as a firm's value as an unbiased and the most understandable metric for stakeholders, shareholders, would-be investors and managers.
Methods The study is based on methods of induction, deduction and general cognition, methods of logic, statistical and correlation analyses.
Results It is advisable to reduce the information asymmetry for principals and agents by updating the Economic Value Added (EVA) and derivative indicators, such as CFROI, CVA, RCF and EM, which are integrated into consolidated income, earnings before taxes and structure of capital owned by subsidiaries and associates and share of capital invested in the development of property portfolios of corporations. Subsidiaries and associates contribute to the consolidated net income, being financially accountable for the capital involved.
Conclusions and Relevance To forecast the value of a firm, economic-mathematical modeling is advisable, since it will ensure an unbiased evaluation of the firm's position within a three to five year time horizon and help to reduce the information asymmetry, which requires special tools to substantiate the increment in EVA and corporate capitalization. The ultimate objective of research provides for an unbiased integrated value, such as corporate value of a business, which decreases the information asymmetry for principals and agents.

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Contradictions in a Choice of Information Resources and Metrics for Key Groups of Stakeholders

Following fundamental goals of financial management, key users of statistical and financial data, i.e. parties to corporate relationships – agents and principals, determine their economic interests and pursuits [1]. Currently, it is important to justify actions owners (principals)

take to list stocks of the Russian corporations on international stock exchanges. Hence, many Russian corporations intend to enter or have already entered foreign stock exchanges. In such circumstances, reasonable and reliable metrics of financial and business performance becomes hugely relevant. During any financial crisis, in addition to external factors (country of a corporation's origin, its single- or multi-industry design, etc.), quotations are also influenced by the level of corporate relationships (managers – agents) with existing and would-be investors (investor relations (IR)), which mainly stems from the asymmetry of corporate reports. To say it in other words, one should take into consideration the strategic importance of investor relations and particularly liaison with businesses that directly influence the market value of securities, since this helps stock market actors fairly evaluate property portfolios of corporations [2].

In the mean time, the value of property portfolios is an ambiguous and contradictory measure. For example, it can fluctuate almost arbitrarily over time if dominated by external and internal factors. However, as the value changes, cash flows remains constant, with principals (owners) deriving neither economic (financial) benefits from such changes.

Nowadays the financial crisis reveals that the value of property portfolios appears to be inapplicable, since it does give a fair view of the property portfolio value at a certain point of time. Referring to the metric and its trends, it gets rather difficult to choose an entity (corporation) to invest in. In this case, even the information asymmetry does not contribute to the fairness of the value of a property portfolio.

Analyzing the semantics of metrics in question first, we see that it is not the value of a property portfolio that should be increased, but rather the *enterprise value* (EV) for owners (principals) and operations managers (agents).

EV shall mean an integrated metric that includes both current (existing at the moment of time) and possible cash flows, which are reduced to the same point of time through discounting. The current value of a property portfolio shall have a value-based, or monetary, measure. The monetary measure of the current EV requires to evaluate the value of the property portfolio over time to keep principals informed during the analyzable period of time[1].

Conceptually, an EV increase is understood as a change of the property portfolio value after the company settles its accounts with all parties to corporate relationships, i.e. dividends to principals-owners, loans and interests to creditors, taxes to the government, salaries and compensations to operations managers.

Financial statements serve as a source of information for measuring the EV of a property portfolio. Any corporation sets modern mechanisms for data processing, with the accounting system being the basis for this. Besides, any business needs managerial and tax accounting functions because they record all instances of business and financial performance in monetary values. Moreover, there are systems for personnel record-keeping, marketing policy and production logistics and quality control of finished products, etc.

Consolidating all data flows, the entity aggregate the above systems into an integrated dataset. Based on the integrated dataset, the same data are recorded in corresponding subsets. Therefore, the entity can prepare reports that respective groups of internal and external users need at a certain point of time. Nevertheless, an ordinary accounting subset usually includes financial and fiscal accounting in compliance with legislative and regulatory documents (national interests) and management accounting (interests of owners and managers). Furthermore, forms of financial, fiscal and managerial reports serve as final standardized documents respectively.

Principles of financial and fiscal reporting are known to be quite strictly standardized by laws of any country. However, the architecture and form of management accounting are set by principals (owners) or top managers (agents) of a certain corporation or group. Basic management accounting methods are not intended to develop

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[1] *Modelirovanie ekonomicheskikh protsessov* [Modeling of economic processes]. Moscow, YUNITI-DANA Publ., 2013, 543 p.

or outline a strategy, without aiming to evaluate and forecast the future value of a corporation. They do not work for the quantitative comparison of a variance that the scenario-based development of the property portfolio value may demonstrate by group of external and internal factors [3].

Strategic management accounting is a new line of management accounting. It is supposed to reduce the information asymmetry and give an unbiased view of the EV of the property portfolio, outreaching the short-term (prompt) horizon for a choice. The information asymmetry can be decreased for principals and agents by enhancing a widespread and practicable metric, such as the Economic Value Added (EVA) and applying its derivative metrics, such as CFROI (Cash Flow Return on Investment), CVA (Credit Valuation Adjustment), RCF (Retained Cash Flows) and EM (Equity Multiple).

We advice to apply the above metric and actually use it herein because it directly relates to the Net Present Value (NPV) (retained), which is modeled through the factor analysis in some studies[2] [3, 4].

Historical Remark. *There is no doubt that EVA was modified from the residual value[3]. It was in 1777–1778 when the English economist R. Hamilton proposed an equal substitute to the relative indicators of the Return on Investment and suggested purifying the profit (numerator) by deducting costs incurred to serve the amount of capital used. At the end of the 19th century Friedrich von Wieser, an economist from the Austrian School of Economics, forged the concept of alternative costs, which currently underlies the computation of capital costs.*

Merging the above views, A. Marshall introduced the theory of entrepreneurial income (residual or net income), which amounts to the balance of revenue from sale net of charge on capital (interests and the insurance cost, i.e. insurance premium) [1, 2]. In the middle of the 20th century, as approaches, which measured the value of property portfolios and used financial

statements as the basis, evolved, the concept of residual income was proved and scientifically substantiated as a basic constituent for measuring the value of corporations. Theoretically speaking, it means that NPV of the property portfolio might be computed on the basis of estimates given in financial statements. The correlation of NPV and the financial element allows to reliably and, consequently, more objectively assess the future business and financial performance of a corporation, thereby increasing the market value of the property portfolio. The way EVA is treated today stems from the theory of B. Stuart stating that Economic Value Added is a measure of economic income net of all taxes and charges on the entire capital invested in the entity.

To make the information asymmetry smoother as per the market and financial approaches, for purposes of measuring the EV of the property portfolio, the semantics of the performance efficiency and good business and financial performance should be formally brought together as much as possible. Traditionally, referring to financial data presented as financial statements (at the governmental level) and management accounting (at the corporate level), operations managers provides owners (principals) with the evidence of the performance efficiency and good business and financial performance. Ultimately, the performance shows the ability of an entity (operations management and the property portfolio) and time it takes to achieve the strategic targets during its dynamic development. Incidentally, the performance efficiency has always been understood as a relative metric comparing the resultant economic effect (economic or financial benefit) and the amount of resources used (tangible, financial or human). There were some attempts to modify the Economic Value Added by integrating the above concepts into it [5, 6].

Enterprise Value as the Integrated Assessment of Operations and Forecasted Results of EVA Modeling

Trying to formalize the above economic ideas that describe the efficiency and performance and objective;y evaluate the EV of the property portfolio, let us focus on two semantically related

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[2] *Modelirovanie ekonomicheskikh protsessov* [Modeling of economic processes]. Moscow, YUNITI-DANA Publ., 2013, 543 p.

[3] Edwards E.O., Bell P.W. The Theory and Measurement of Business Income. Berkeley, CA, University of California Press, 1961.

indicators. First, it goes about the reporting, that is retrospective, net revenue, revenue from sale and net income of subsidiaries and associates. The metric is indicative of their operations and business and financial performance for a specific period of time, i.e. a retrospective indicator of economic and financial results attained for the time being). It underlies consolidated indicators. Second, it goes about the strategic consolidated proceeds of a group of subsidiaries. The consolidated proceeds are forecasted, or, better to say, assessed by modeling scenarios of forecasted reporting (statistical, financial and managerial). It is the metric that describes the future, or hypothetical, results of business and financial operations of a corporation (a group).

There should be an appropriate mechanism (toolkit) to assess and model the EV of the property portfolio. Therefore, the rate of a growth in the market value shall be assessed and taken into consideration. The implementation of the prevailing strategy for the property portfolio development is indispensable without the proper (unbiased) system for reporting (accounting) various amounts and qualities, including economic and financial ones (ratios), which are most objectively representative of production, business and financial operations of a subsidiary both at a certain point of time (report) and in the future (forecast). Economic interests and pursuits of owners and top managers of a corporation are offset in this way. In this case, the corporate economic idea of consolidated financial statements of a group implies to formalize management accounting so that key groups of stakeholders (the State, principals and agents) could agree upon their economic (financial) interests in an unbiased, natural and evolutionary manner. In addition, the organizational and economic development of a corporation should aim at a constant increment in the EV of its property portfolio (a group of subsidiaries) [6, 7].

For purposes of computations and modeling, it is advisable to include reporting and estimated figures, such as:

- consolidated net income;

- operating income before taxation of a certain subsidiary (legal entities only, i.e. subsidiaries and associated joint-stock companies);

- the cost and composition of finance sources (equity, debt and investment);

- Economic Value Added (EVA);

- market value of share capital;

- other additional data.

It is worth mentioning that consolidated net income of a group is assessed with several constituents, which can hardly be used for forecasting. In the mean time, there is a formal probability to formalize the proposed approaches through, for example, economic and mathematical modeling of the tolerable floor consolidated net income of a subsidiary. Doing so will allow to assess cap amounts that can exist during a specific period of economy, including the rate of a growth in the EV of the property portfolio in a given forecast period, thus ultimately creating a greater EVA at a lower entrepreneurship risk. In other words, this will increase the real EV of the property portfolio as an integrated indicator offsetting economic interests of key groups of stakeholders [8].

Any joint-stock company, especially a public one, is known to position itself in he corporate market of mergers and acquisitions at a price which often exceeds its invested capital (property potential) just as much as sales revenue outgrows the weighted average cost of working or production capital. Being a basic constituent of the property portfolio, which is rationally combined with some refinanced net income used for operational and strategic development of the property portfolio, the return on active capital determines the future amount of value added. The proposed approach makes it a prevailing determinant of operational and strategic aspects of the business valuation (as the integrated EV of the property portfolio) [9, 10].

When an integrated indicator is computed, combining the actual and future performance and including the efficiency of corporate operations, a company should tackle quite a strategic task of forecasting how much net income of each subsidiary will be enough to increment the future EV of the property portfolio (in relation to the entire group) within the economic growth interval set by owners (shareholders) per each type of

business operations, on the one hand, and time interval of the analyzable forecast period (one to three years) envisaged to attain them, on the other hand.

The task would better split in two steps. At the first step, the mathematical (simulation) model is formed, which would allow to determine really acceptable rates of a growth in capital of a group and its subsidiaries in a given economic situation and external financial environments (rates of various taxes, cost of credit, information from those regulating the cost of credit, etc.). At the second step, we, first of all, from pair models and them multiple correlation models allowing to determine a correlation of amounts charged on the net icome of a certain subsidiary and remitted to centralized funds of the parent corporation, consolidated net income, and real rates of economic growth in the EV of the property portfolio (corporation's capital). The given statutory financial sustainability of a subsidiary and an entire group (head corporation) serves as a necessary and sufficient constraint. In other words, being applied for forecasting, the simulation model helps plan a withdrawal of reasonable amounts of net income from subsidiaries, thus promoting the most efficient development of their property portfolios and a holding company and incrementing the EV continually [4, 11].

The EV of the property portfolio and the rate of its growth are known to influence its market value and depend on corresponding (proportionate) aspects of net cash (financial) flow. EVA Assume an algorithm resolving the issues, which economically (analytically) decomposes the EVA:

$$EVA = (R_{IC} - WACC)\,K_{IC},$$

where R_{IC} is the return on invested capital, relative units;

$WACC$ is the weighted average cost of corporation's capital (group), relative units;

K_{IC} is the amount of invested capital, monetary units.

We believe the proposed information model accommodates for organizational-economic and functional (managerial) relationships. The hierarchical relationships stem from the corporate structure of a holding group, shaping financial and business relations of the heal corporation and subsidiaries, as well as the production scheme of principal, auxiliary and servicing units and functions of each subsidiary. So, the EV represents an estimated book value of the property portfolio multiplied by the current value of the future EVA. As part of the evaluation and estimation of the future property portfolio of a subsidiary and the head corporation, EVA is applied during capital budgeting. As part of operation, it is a measure of the efficiency of production, auxiliary and servicing units of a subsidiary and the entire group. Modified and decomposed, the classical equation of economic value added through the net reatined (consolidated) earnings of a group is expressed as follows:

$$EVA = OI_N - (A \cdot \eta\,),$$

where OI_N is net operating income, monetary units;

A is operating capital, monetary units;

η is the cost of capital, relative units or percent.

EVA transforms key characteristics of the estimated EV of the property portfolio, namely trends in financial indicators of the weighted average cost and return on invested capital, i.e., if possible, combining two above components unto the comprehensive value. Hence, it modified relative indicators into absolute monetary values, which are quite comparable with the future (forecasted) EV. In the mean time, we should remember that the return on invested capital often outgrows its weighted average cost when various scenarios of the property portfolio development are modeled (forecasted). Higher growth rates of the return on invested capital result in a higher EVA, i.e. an absolute growth in estimated EV of the property portfolio of the entire group [11–13].

As afore mentioned, simulation modeling can be used to formalize the forecasting procedure in order to measure the EV, which is rather indicative of innovation in the development of

property portfolios of subsidiaries. It also help strategically assess the expected competitiveness of a subsidiary and a group by quantifying and recording an effect of innovation, which is virtually presented as an amount charged on net income for innovation and ultimately earmarked for increasing the strategic value of a company.

The resultant synergistic effect is supposed to contain an effect of two components, i.e. financial and investment ones [14]. Furthermore, it is advisable to growth rates of consolidated income from subsidiaries for each year of the forecast period separately and compare targets and actual amounts of income earmarked for innovation. The outstripping growth rates of EC may mainly stem from the financial and economic factors of the synergy, which mostly depends on funds earmarked for innovation.

Therefore, forecasting the organizational and economic development of the subsidiary's property portfolio, it is important to reasonably determine how financial and investment synergy will expectedly increase in terms of an increase of the EVA of the subsidiary's property portfolio.

Mathematical and Graphic Interpretation of the Enterprise Value as an Integrated Indicator Representative of Changes in the Efficiency and Performance of a Company

Forming simulation models with reference to consolidated financial statements of a group and each subsidiary, we will trade dependencies that mathematically represent how a set of factors correlation at the level of the group's consolidated financial statements and subsequently transform the outcome, i.e. growth rates of prepaid or working capital of corporations, with regard to expected (forecasted) amounts charged on net income of subsidiaries and associates. Ultimately, we will be able to project the EV in terms of the generation of positive cash flows, which will economically be satisfactory for all groups of stakeholders, whether owners or shareholders – principals, creditors and managers (agents).

Assuming the current development level of complex business corporations (a State-owned holding groups), systemic differences should taken into consideration to measure the EV of property portfolios. Hence, economic interests of

key stakeholders should be presented in a formalized manner, i.e. as a mathematical description of certain subsidiaries' *behavior* through information models which have the adequate design but their positioning depends on a specific composition of estimates. Notwithstanding subsidiaries demonstrate hierarchically diverse behavior among complex entities, which they actually are, grouping and generalization (assumption) of selected indicators should concurrently encompass all cost (value) indicators of each group of stakeholders, which are quite comparable. However, their initial (natural) expression cannot be mathematically formalized and generalized.

To make the analyzable population of aspects logically comparable, we suggest using the uniform (versatile) measure as the main principle of their unity. The entire set of measures must produce the indicator in question whose value and level they ultimately determine. This will allow to compute how much P_r^n has changed due to the variance on the basis of the proposed information model of consolidated net income, which contain the entire set of j factors selected for grouping with regard to the i-subsidiary through the variance of the specific (real) j-factor from the base one (statutory or benchmark set by the parent company) by ΔP_j. The resultant indicator constitutes a conditional measure reflecting the impact of the specific factor. The sum of such measures will make total variance of the cost due to the integrated impact of the entire set of factors, i.e. not only analyzable or formalized ones. The fiscal factor, i.e. total amounts paid by subsidiaries to the State in line with the property they employ for production, are one of the main factors embedded into the proposed analytical scheme to model the consolidated retained (net)earnings of the group.

The model accounts for direct and indirect taxes that make the profitable portion of fiscal revenue at all levels. This refers to the value added tax, property tax. What complicate the matter and requires some abstraction vision for formalization purposes is that the above taxes stem from different tax bases, though having the same ground. Hence, we decide to acceptably simplify and aggregate corresponding indicators, without seriously influencing the variance of theoretical

computations from real data in the analyzable set of entities[4]. For purposes of such computations, multivariate indicia of items should be positive. To formalize our reasoning, we should make some assumptions and assertions[5] [3, 14]:

- proceeding from reinvested amounts of the corporation's consolidated net income, estimated growth rates of its prepaid or working capital are considered as constants in the model;

- the return on capital of the corporation remains unchanged throughout the forecast period;

- the percentage of debt in total finance is constant throughout the forecast period;

- the value of equity and debt is constant throughout the forecast period;

- chargers on consolidated net income reinvested in the property portfolio (group) are made in equal proportions or parts (in current and non-current assets of subsidiaries);

- the percentage of income reinvested in the innovative development of the group is constant in each year of the forecast period.

We showcase the proposed approach on the basis of the above assumptions. We assess how much the percentage of charges on the consolidated net income of the group, which are earmarked for the innovative development, and the Economic Value Added given the return on various constituents of capital is constant and their cost is fixed. The cost of some sources of finance shall also remain unchanged throughout the entire period of planning, including the sustainably efficient use of the corporation's assets. The organizational structure of a system (the structural hierarchy of governance) and the existing scale of production should be permanent so as to ensure the unbiased outcome of the forecast. This somewhat (insignificantly) restricts the simulation model we present herein. In the planning (analyzable) period, the organizational structure of the

property portfolio management shall not change, that is, the group of entities shall not be modified or being modified. We also mean that there should not be a merger and (or) division of the property portfolio in subsidiaries and the head corporations, including in-sourcing and outsourcing of any legal entities of the group [15–17].

Therefore, the proposed simulation model describes the subject to be analyzed and evaluation, i.e. a complex vertically integrated structure (a group of subsidiaries lead by the head corporation), which annually sets asides a constant share of its net income for the innovative development of the property portfolio. Economically, total consolidated retained earnings of subsidiaries is now qualified as distributed net income. In the initial period of investment t_0 funds (capital expenditures) as much as P_R^* are reinvested (contributed). Afterward, in the period t_1 the entities receive the return on invested capital (funds). The other scheme applies to sales revenue, which is used to compute a new reasonable amount or income, some part (percentage) of which is put into the innovative development of the corporation. Thus, the funds put into capital investment will amount to P_R^1. The process is assessed step-by-step every year (or within the other time interval, for example, monthly or quarterly) and can reoccur throughout the entire period of planning (one year for tactical purposes, and three to five years for forecasting purposes).

Denotations below were used to construct the simulation model:

- the cost of the group's equity C_{Eq}, relative units or percent;

- the cost of debt (payment for borrowings) C_{Db}, relative units or percent;

- net revenue in the year t – V, thousand monetary units;

- the return of invested capital – R_{IC}, relative units or percent;

- the percentage of income reinvested in capital expenditures (real investment in the property

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[4] Statistical and financial reports of operational holding groups (metallurgy, machine building) were used as real input.

[5] *Modelirovanie ekonomicheskikh protsessov* [Modeling of economic processes]. Moscow, YUNITI-DANA Publ., 2013, 543 p.

portfolio of the group (assets) – P_R, relative units or percent;

- the percentage of borrowings in sources of operations finance – D_{Db}, relative units or percent;

- the cost of capital provided by the Central Bank of Russia to commercial banks, or key interest rate – C_{St}, relative units or percent;

- the rate reflecting the economic interest (economic benefit) of the lending bank that grants funds for operations K_{Cr}, relative units or percent;

- the number of a year in the period of planning tn, лет.

Let us make a formula of the simulation model components step by step:

$t = 0$. $V_0 = 0$; $P_R^0 = P_R^*$;

$t = 1$. $V_1 = P_R^* (1 + R_{IC})$;

$P_R^1 = P_R^* \{[(1 + R_{IC}) (1 - K_{Cr} C_{St} D_{Db}) - 1] [(1 - 0.2) (1 - (C_{Db} - K_{Cr} C_{St}) D_{Db})] [(1 - (1 - D_{Db}) C_{Eq})] + 1\}$;

$t = 2$. $V_2 = P_R^1 (1 + R_{IC}) = P_R^* \{[(1 + R_{IC}) (1 - K_{Cr} C_{St} D_{Db}) - 1] [(1 - 0.2) (1 - (C_{Db} - K_{Cr} C_{St}) D_{Db})] [(1 - (1 - D_{Db}) C_{Eq})] + 1\} (1 + R_{IC})$;

$P_R^2 = P_R^* \{[(1 + R_{IC}) (1 - K_{Cr} C_{St} D_{Db}) - 1] [(1 - 0.2) (1 - (C_{Db} - K_{Cr} C_{St}) D_{Db})] [(1 - (1 - D_{Db}) C_{Eq})] + 1\}^2$;

$t = 3$. $V_3 = P_R^2 (1 + R_{IC}) = P_R^* \{[(1 + R_{IC}) (1 - K_{Cr} C_{St} D_{Db}) - 1] [(1 - 0.2) (1 - (C_{Db} - K_{Cr} C_{St}) D_{Db})] [(1 - (1 - D_{Db}) C_{Eq})] + 1\}^2 (1 + R_{IC})$;

$P_R^3 = P_R^* \{[(1 + R_{IC}) (1 - K_{Cr} C_{St} D_{Db}) - 1] [(1 - 0.2) (1 - (C_{Db} - K_{Cr} C_{St}) D_{Db})] [(1 - (1 - D_{Db}) C_{Eq})] + 1\}^3$;

$t = 4$. $V_4 = P_R^3 (1 + R_{IC}) = P_R^* \{[(1 + R_{IC}) (1 - K_{Cr} C_{St} D_{Db}) - 1] [(1 - 0.2) (1 - (C_{Db} - K_{Cr} C_{St}) D_{Db})] [(1 - (1 - D_{Db}) C_{Eq})] + 1\}^3 (1 + R_{IC})$;

$P_R^4 = P_R^* \{[(1 + R_{IC}) (1 - K_{Cr} C_{St} D_{Db}) - 1] [(1 - 0.2) (1 - (C_{Db} - K_{Cr} C_{St}) D_{Db})] [(1 - (1 - D_{Db}) C_{Eq})] + 1\}^4$;

…

$t = n$. $V_n = P_R^{n-1} (1 + R_{IC}) = P_R^* \{[(1 + R_{IC}) (1 - K_{IC} C_{St} D_{Db}) - 1] [(1 - 0.2) (1 - (C_{Db} - K_{Cr} C_{St}) D_{Db})] [(1 - (1 - D_{Db}) C_{Eq})] + 1\}^{n-1} (1 + R_{IC})$;

$P_R^n = P_R^* \{[(1 + R_{IC}) (1 - K_{Cr} C_{St} D_{Db}) - 1] [(1 - 0.2) (1 - (C_{Db} - K_{Cr} C_{St}) D_{Db})] [(1 - (1 - D_{Db}) C_{Eq})] + 1\}^n$.

To formalize subsequent steps of constructing the required functions, namely growth rates of capital held by each subsidiary and the corporation, within the given time interval of the forecast period, we should assess a correlation of reinvested income derived at the previous steps of computations per each year of the planning period, i.e.:

$T_{ин} = P_R^n / P_R^* = \{[(1 + R_{ин}) (1 - K_{кред} Ц_{гос} D_{зк}) - 1] [(1 - 0.2) (1 - (C_{Db} - K_{Cr} C_{St}) D_{Db})] [(1 - (1 - D_{Db}) C_{Eq})] + 1\}^n$.

The approach implies that there should be a multivariate information model, which specifically focuses on the accuracy of a relationship description and presents a behavioral mechanism (formalization) of the analyzable phenomenon. The relationship mechanism is described as a factor, though in rather a generalized manner, through a strictly determinant multivariate model, including a correlation-regression one. Such models are recommendable to make a mathematical description and formalize the way the factors influence decisions of subsidiaries' top management as part of holding groups. Afterwards, making the model more and more sophisticated, we will arrive at the integrated effect of the factors on top consolidated indicators, i.e. the cost of the property portfolio of a holding company (group), thus quantifying the EV of the property portfolio.

In multi-tiered organisms, such a sector, national economy, industry, corporation (group), etc., each element constitutes the general system, meanwhile being quite autonomous and isolated. The fact dictates two approaches to the appraisal of the corporate management efficiency and, ultimately, change of trends in the EV of the property portfolio.

The first approach resonates with governmental interests, which translate into some financial

flows (resources) that are remitted to respective budgets (fiscal revenue, levies, payments), planning of economic growth rates and inflation reduction.

The second approach does not contradict to the first one, provided it complies with governmental interests and economic interests of shareholders (in some cases the State is a shareholder). At this level, the main strategy is to increase the EV of the property portfolio of a holding company as much as possible and, concurrently, reduce the overall consumption of production resources, which would be technologically acceptable.

To examine the dependence of boundary charges on net income of subsidiaries as related entities of the group to centralized (consolidated) monetary funds and reserves of the head corporation, we make a simulation model, which provides for growth rates of capital held by subsidiaries as economically related entities of the group (the holding company), in addition to the above aspects of financial management. For convenience purposes, we prepare a graphical representation of the dependence (*Fig. 1*) concerning groups of the different number of subsidiaries (from three to seven) by the value added (VA) within the group. Relying upon the dependencies, we leverage the current tax payments of each entities and increase the retained earnings of the corporation as much as possible.

The model reflects really acceptable growth rates of capital (the property portfolio) of the head corporation and subsidiaries in the specific economic situation given actual or known parameters (indicators) of financial management, i.e. the structure of capital, share and cost of debt financing, refinance rate, etc. *Fig. 1* shows scenarios of the simulation model depending on changes in some specific factors of the corporation's financial management.

The use of the model allows to study the behavior of complex economic systems in rapidly changing circumstances (for example, the developing financial environment) during the organizational restructuring.

What imposes a basic constraint is the withdrawal of an acceptable part of net income, i.e. a share

not affecting the financial sustainability and existing growth pace of each subsidary. Stemming from decisions of the board of directors (owners), the constraint shall be supported by the management board of the corporation. As a rule, economic interests of principals and agents completely coincide in this case.

The simulation model accommodate for organizational, economic and financial distinctions of subsidiaries in a formalized way. Therefore, it includes the difference of the cost of capital, composition of sources of finance, share and cost of debt financing, etc. To express the model mathematically, we introduce a new parameter of financial management – the conditional hierarchical level of a legal entity S_{chrg}. It is a measure of the boundary percentage of charges on the subsidiary's net income to the centralized financial reserve of the head corporation (group), which does not affect the financial sustainability throughout the forecast period of strategic planning. Upon some iterations, we arrive at the final expression:

$$S_{chrg} = (\sqrt[n]{T_{IC}} - 1) / 0.8 [(1 + R_{IC}) (1 - K_{Cr} C_{St} D_{Db}) - 1] [(1 - (C_{Db} - C_{Db} - K_{Cr} C_{St}) D_{Db})] [(1 - (1 - D_{Db}) C_{Eq})] - 1,$$

where T_{IC} stands for given growth rates of the subsidiary's capital, relative units or percent.

If $S_{chrg} = 0$, a member company holds 100 percent of net income or 80 percent of taxable income.

Referring to research into production, business and financial operations of the Russian industrial corporations (KAMAZ, Magnitogorsk Iron & Steel Works, Aviastar SP), we can give general recommendations for setting statutory values of savings subsidiaries and the head (parent) corporation should make in order to ensure the objective EV of their property portfolio.

The simulation model herein is capable of working inversely. So to say, given growth rates of capital, it can determine the time of their attainment, required parameters of financial management in each subsidiary. Concurrently, it balanced economic interests (economic benefits) and eliminates the information asymmetry for

owners (principals), top managers of subsidiaries (agents), including common corporate economic interests of shareholders, investors, creditors and production management [18, 19].

The model herein takes into consideration the strategic financial and investment aspect of the EV and pursues a reduction in the information asymmetry in computing the economic value added. This is done in accordance with the following steps of logic reasoning.

At the first step, we make a mathematical model reflecting the way the economic assessment of operational efficiency and performance of subsidiaries and the groups depend on each other. While modeling, we determine and make a mathematical description of the dependence of consolidated retained earnings of vertically integrated holding entities on the cost structure, namely the effect of operational leverage, value added, continuous appreciation of basis (or typical) corporate types of the holding company's products, provided they are sold within the corporation or the group, and the number of technologically related subsidiaries.

At the second step, we carry out economic and mathematical modeling of the dependence of investment in subsidiaries' sustainable development and the entire holding company. Economic Value Added forms the basis of this procedure. Ultimately, modeling expressed the highest tolerable amount of charges on retained earnings of the group that depends on basic parameters (reasonable factors) of the holding company's financial management, namely the mix of financial sources of operations and property portfolio development (the equity to debt ratio), i.e. the effect of financial leverage, differential, key interest rate, return on assets and investment, cost of capital of each subsidiary and the entire group, etc. [20, 21].

The dependence of boundary charges on subsidiaries' net income to centralized monetary funds and reserves of the corporation is finally modeled at the third step. The amount of charges should meet the floor limit to ensure (preserve) the financial sustainability of subsidiaries and planned (expected) rates of the innovative development of each subsidiary and holding company.

Figure 1

Dynamics of consolidated (retained) profit: *a* – **for three subsidiaries and affiliates (value added = 20%);** *b* – **for five subsidiaries and affiliates (value added = 20%);** *c* 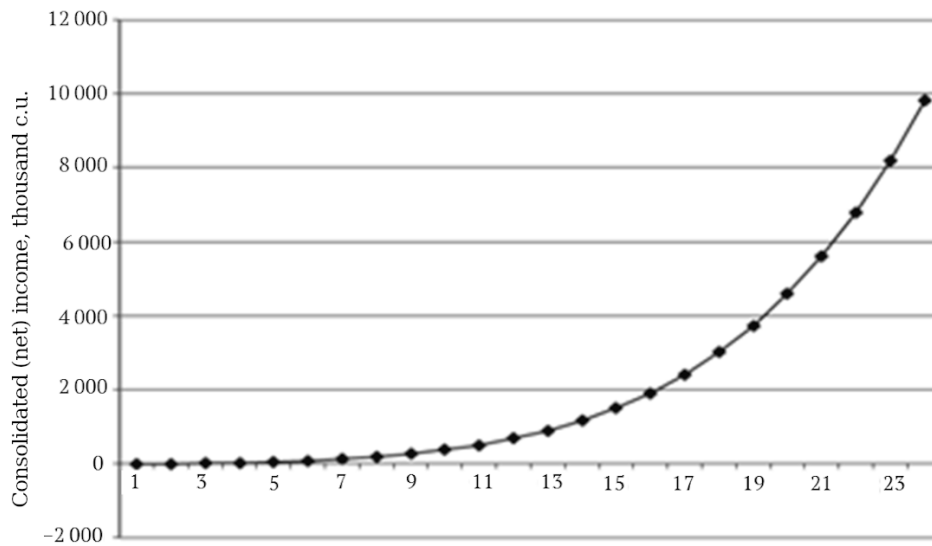– **for seven subsidiaries and affiliates (value added = 20%);** *d* – **for three subsidiaries and affiliates (value added = 40%);** *e* – **for five subsidiaries and affiliates (value added = 40%);** *f* – **for seven subsidiaries and affiliates (value added = 40%)**
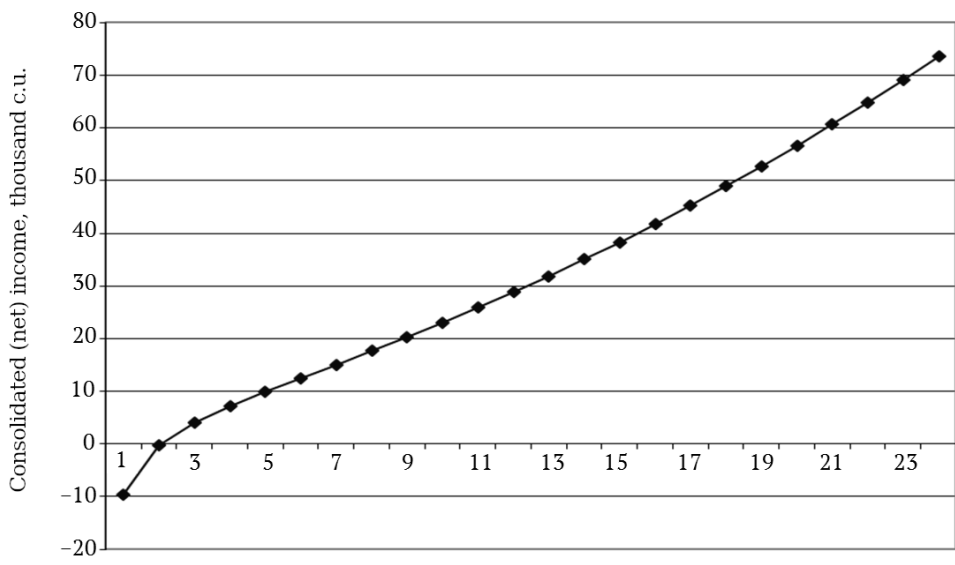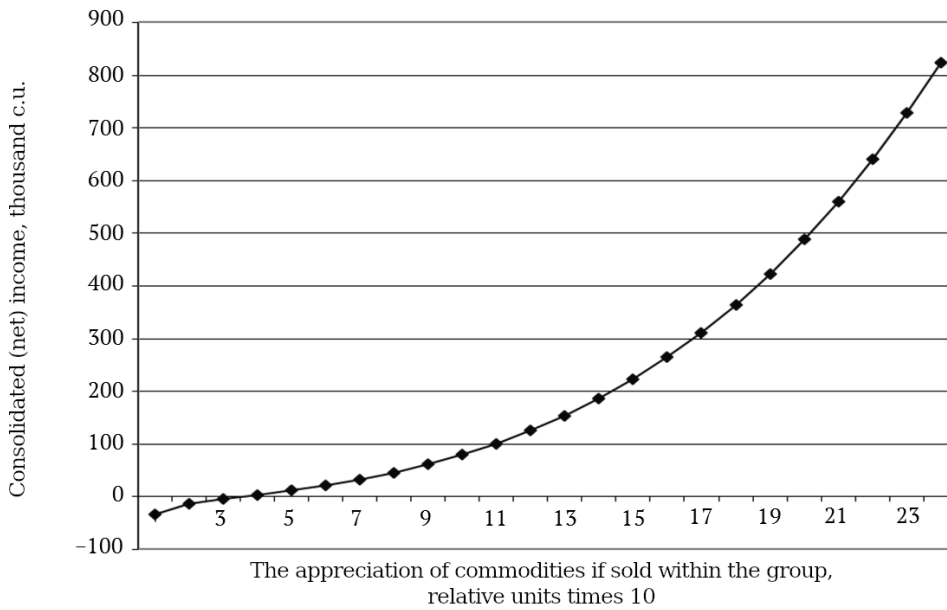

a
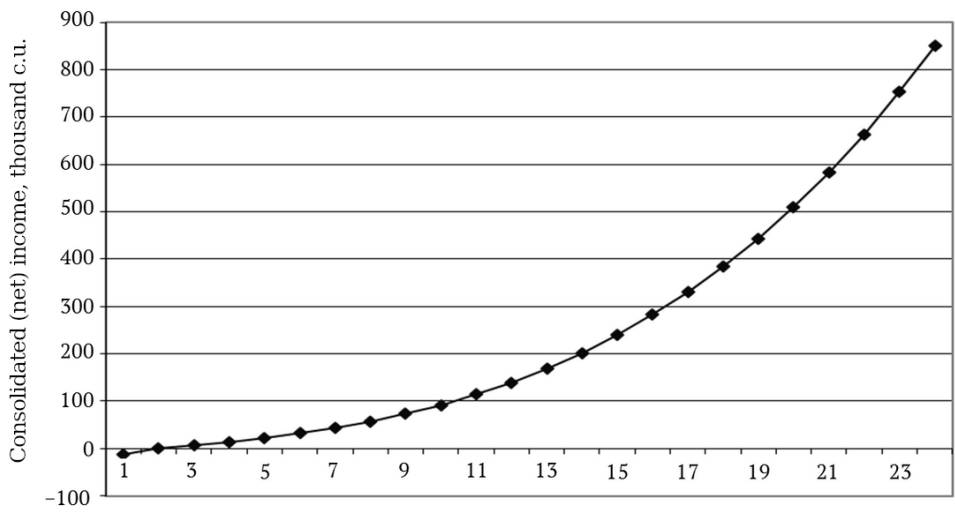
b

The appreciation of commodities if sold within the group,
relative units times 10

c
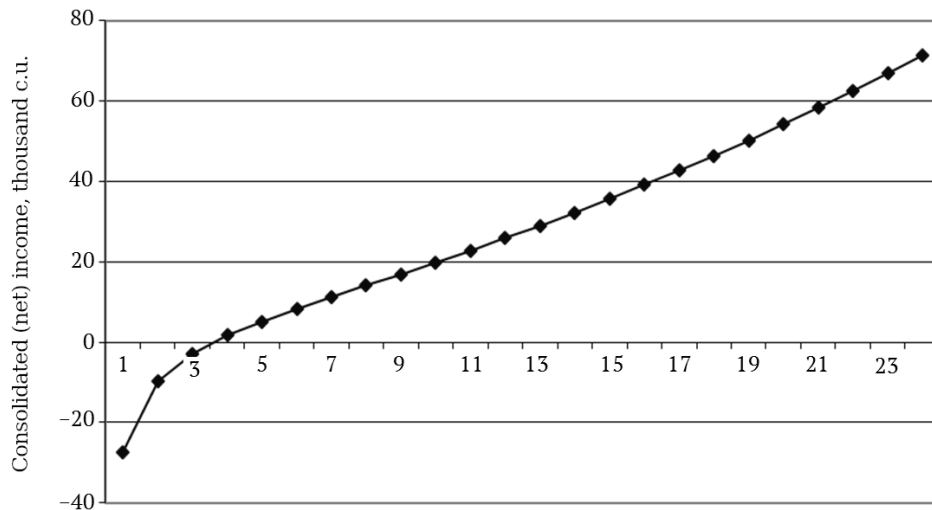
The appreciation of commodities if sold within the group,
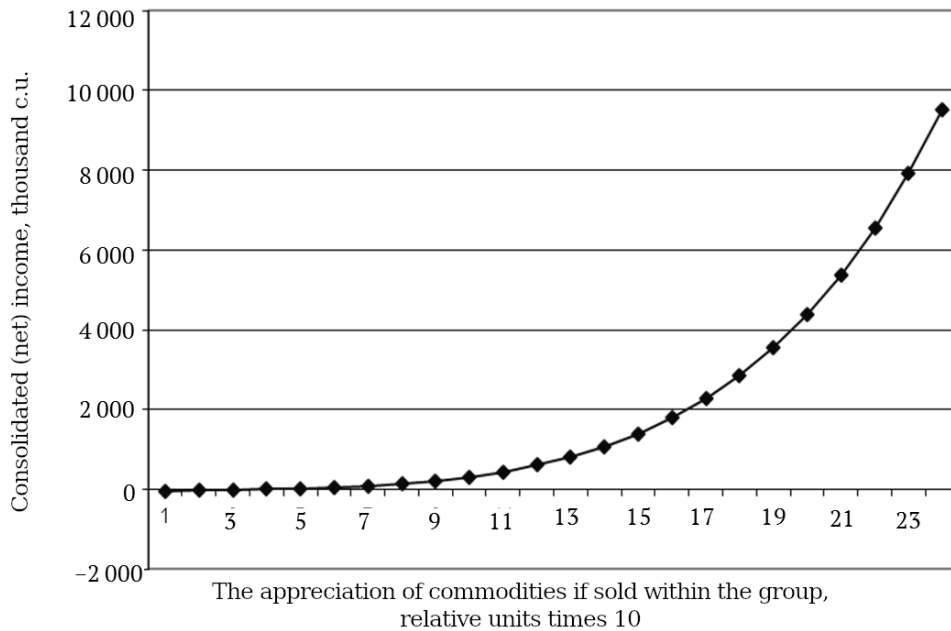relative units times 10

d

e

f

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References

1. Van Horne J.C., Wachowicz J.M. Jr. Fundamentals of Financial Management. 13th edition. Pearson Education, Prentice-Hall, 2008, 744 p.

2. Brealey R., Myers S., Allen F. Principles of Corporate Finance. 12th edition. McGraw-Hill Education, 2016, 976 p.

3. Kleiner G.B. [System Management and System Optimization of an Enterprise]. *Sovremennaya konkurentsiya = Journal of Modern Competition*, 2018, vol. 12, no. 1, pp. 104–113. URL: http://beta.moderncompetition.ru/general/upload/articles/p104-113.pdf (In Russ.)

4. Fedorovich V.O., Fedorovich T.V. [Management of finance of large State corporations: sources of financing of innovations]. *Finansy i kredit = Finance and Credit*, 2012, vol. 18, iss. 40, pp. 47–55. URL: https://cyberleninka.ru/article/n/upravlenie-finansami-krupnyh-gosudarstvennyh-korporatsiy-istochniki-finansirovaniya-innovatsiy (In Russ.)

5. Kontsipko N.V. [Development of conceptual approaches to depreciation policy as the source of corporate financing]. *Vestnik Tomskogo gosudarstvennogo universiteta. Ekonomika = Tomsk State University Journal of Economics*, 2017, no. 37, pp. 153–168. (In Russ.) URL: https://doi.org/10.17223/19988648/37/11

6. Postupinskii I.A. [Improving the mechanism of debt financing of investment activities of metallurgical companies]. *Innovatsii i investitsii = Innovation and Investment*, 2016, no. 4, pp. 24–30. URL: https://readera.ru/sovershenstvovanie-mehanizma-zaemnogo-finansirovanija-investicionnoj-dejatelnosti-142164198 (In Russ.)

7. Fedorova E.A., Khrustova L.E., Chekrizov D.V. [Industry characteristics of bankruptcy prediction models appliance]. *Strategicheskie resheniya i risk-menedzhment = Strategic Decisions and Risk Management*, 2018, no. 1, pp. 64–71. URL: https://cyberleninka.ru/article/n/otraslevye-osobennosti-primeneniya-modeley-prognozirovaniya-bankrotstva-redpriyatiya (In Russ.)

8. Ushaeva S.N. [Facets of optimization of capital structure in conditions of crisis]. *Vestnik Chelyabinskogo gosudarstvennogo universiteta = CSU Bulletin*, 2010, no. 5, pp. 173–179. URL: https://cyberleninka.ru/article/n/grani-optimizatsii-struktury-kapitala-v-usloviyah-krizisa (In Russ.)

9. Teplova T.V. [Borrowed capital-based work: Company's optimal leverage: from theoretical concepts to practical model justifications (part 1)]. *Upravlenie korporativnymi finansami = Corporate Finance Management*, 2013, no. 4, pp. 198–208. URL: https://docplayer.ru/48124473-Rabota-na-zaemnom-kapitale-optimum-dolgovoy-nagruzki-kompanii-ot-teoreticheskih-koncepciy-k-prakticheskim-modelnym-obosnovaniyam-chast-1.html (In Russ.)

10. Teplova T.V., Getalova A.A. [Borrowed capital-based work: Company's optimal leverage: from theoretical concepts to practical model justifications (part 2)]. *Upravlenie korporativnymi finansami = Corporate Finance Management*, 2013, no. 5, pp. 262—279. URL: https://fmlab.hse.ru/data/2013/11/15/1334099794/%D0%A2%D0%B5%D0%BF%D0%BB%D0%BE%D0%B2%D0%B0%20%D0%93%D0%B5%D1%82%D0%B0%D0%BB%D0%BE%D0%B2%D0%B0%205%202013.pdf (In Russ.)

11. Postupinskii I.A. [The economic essence of an effective borrowing company policy]. *Ekonomika i predprinimatel'stvo = Journal of Economy and Entrepreneurship*, 2016, no. 3, part 1, pp. 1124–1127. URL: http://www.intereconom.com/archive/325.html (In Russ.)

12. Rusanova E.T. [Development of the capital structure theory after Modigliani and Miller]. *Finansy i kredit = Finance and Credit*, 2011, vol. 17, iss. 9, pp. 60–67.
URL: https://cyberleninka.ru/article/n/razvitie-teorii-struktury-kapitala-posle-modilyani-i-millera (In Russ.)

13. Syroezhin A.S. [Management of the company's capital structure]. *Vestnik Rostovskogo gosudarstvennogo ekonomicheskogo universiteta (RINKh) = Vestnik of Rostov State University of Economics*, 2009, no. 29, pp. 172–179. URL: https://cyberleninka.ru/article/n/upravlenie-strukturoy-kapitala-kompanii (In Russ.)

14. Fedorovich V.O. [Rational capital structure of a corporation as a base for the growth of the innovative value of its property complex]. *Sibirskaya finansovaya shkola = Siberian Financial School*, 2012, no. 3, pp. 91–97. URL: http://journal.safbd.ru/ru/content/racionalnaya-struktura-kapitala-korporacii-kak-baza-rosta-innovacionnoy-stoimosti-ee (In Russ.)

15. Chernysheva T.Yu., Ozhogova O.V. [Expert assessment of forms of borrowed funds of the enterprise]. *Ekonomika i predprinimatel'stvo = Journal of Economy and Entrepreneurship*, 2013, no. 7, pp. 301–304. URL: http://www.intereconom.com/archive/234.html (In Russ.)

16. Obukhova A.S., Anisimov A.Yu. [The influence of various factors on the choice of sources of financing of the enterprise in the conditions of stagnation]. *Ekonomika v promyshlennosti = Russian Journal of Industrial Economics*, 2015, no. 2, pp. 92–97. (In Russ.)
URL: https://doi.org/10.17073/2072-1633-2015-2-92-97

17. Fedorovich V.O. [Criterion of efficiency of rational structure of the capital of the corporation]. *Problemy ucheta i finansov = Problems of Accounting and Finance*, 2012, no. 2, pp. 17–25.
URL: http://journals.tsu.ru/uploads/import/964/files/06-017.pdf (In Russ.)

18. Shchetinin E.Yu. [The production process in the food industry: the relationship of investment in fixed assets and technical efficiency]. *Prikladnaya ekonometrika = Applied Econometrics*, 2012, no. 4, pp. 63–84. URL: https://cyberleninka.ru/article/v/proizvodstvennyy-protsess-v-pischevoy-promyshlennosti-vzaimosvyaz-investitsiy-v-osnovnoy-kapital-i-tehnicheskoy-effektivnosti (In Russ.)

19. Sharikova O.V. [Determination of the optimal capital structure of Russian organizations]. *Korporativnye finansy = Journal of Corporate Finance Research*, 2013, no. 1, pp. 33–43.
(In Russ.) URL: https://cyberleninka.ru/article/n/opredelenie-optimalnoy-struktury-kapitala-rossiyskih-organizatsiy

20. Shuklov L.V. [Effective capital structure as a key for successful business growth]. *Finansovaya analitika: problemy i resheniya = Financial Analytics: Science and Experience*, 2010, vol. 3, iss. 16, pp. 55–61. URL: https://cyberleninka.ru/article/n/effektivnaya-struktura-kapitala-kak-klyuch-k-uspeshnomu-razvitiyu-biznesa (In Russ.)

21. Ebrati M.R., Emadi F., Balasang R.S., Safari G. The Impact of Capital Structure of Firm Performance: Evidence from Tehran Stock Exchange. *Australian Journal of Basic and Applied Sciences*, 2013, vol. 7(4), pp. 1–8. URL: http://ajbasweb.com/old/ajbas/2013/March/1-8.pdf

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We, the authors of this article, bindingly and explicitly declare of the partial and total lack of actual or potential conflict of interest with any other third party whatsoever, which may arise as a result of the publication of this article. This statement relates to the study, data collection and interpretation, writing and preparation of the article, and the decision to submit the manuscript for publication.