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THE ANALYSIS OF CASH FLOWS MAXIMIZING THE FIRM VALUE THROUGH THE APPROACH OF SYSTEM DYNAMİCS

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Abstract

In this study, it was practiced to adopt free cash flows to firm which is frequently used in calculating the firm value through the system dynamics model. For the study, a firm traded at Borsa Istanbul 100 Index (BIST-100) was chosen and the firm's cash flow projection was created by analyzing its financial data. Future cash flows of the firm were exercised under certain scenarios via system dynamics model. The results exhibit that the future cash flows of the firm can be predicted successfully through the system dynamics model. It is considered that the system dynamics can be used as an efficient strategic management accounting technique and that it can provide the data which the business executives will require when making the optimal decisions maximizing the firm value.

Keywords: *Firm Value, System Dynamics, Strategic Management Accounting, Cash Flows*

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FİRMA DEĞERİNİ MAKSİMİZE EDECEK NAKİT AKIŞLARIN SİSTEM DİNAMİĞİ YAKLAŞIMIYLA ANALİZİ

Öz

Bu çalışmada, firma değerinin hesaplanmasında sıkça kullanılan firmaya serbest nakit akımları, sistem dinamiği modeliyle belirlenmeye çalışılmıştır. Çalışma için BİST-100 endeksinde işlem gören bir firma seçilmiş ve finansal verileri analiz edilerek firmanın nakit akım projeksiyonu oluşturulmuştur. Sistem dinamiği modeliyle firmanın gelecekteki nakit akımları belirli senaryolar altında çalıştırılmıştır. Sonuçlar, sistem dinamiği modeli ile firmanın gelecekteki nakit akımlarının başarılı bir şekilde tahmin edilebildiğini göstermektedir. Sistem dinamiğinin etkili biri stratejik yönetim muhasebesi tekniği olarak kullanılabileceği ve firma yöneticilerinin firma değerini en yükseğe çıkaracak kararları verirken ihtiyaç duyacakları verileri sağlayabileceği değerlendirilmektedir.

Anahtar Kelimeler: *Firma Değeri, Sistem Dinamiği, Stratejik Yönetim Muhasebesi, Nakit Akışı*

1. INTRODUCTION

Firm value is an economic concept representing the price determined for a good or a service considered for sale. In other words, it is the prediction of the potential price which will be paid for a certain good or service in a certain period of time (Chambers, 2009: 5). As is evident from the definition, the value and the price of an asset can be different from each other. Price is the sum of money paid for the acquisition of a good or service. As for the value, it's the cost of a good or service under the market conditions. Prices can vary in accordance with many economic conditions in the market, supply and demand being in the first place. Therefore, the price can be different from the value of the relevant good or service (Pernsteiner and Sümer, 2004). Accordingly, it is essential to be able to determine the value of a good or service accurately in order to formulate an opinion about the price of a good or service. The process

of determining an asset's value is named valuation. Firms can have different values due to the current economic environment, field of activity, and etc. (School, 2007). In the firm valuation process, it is tried to determine the current value of the relevant firm's assets and resources in a certain period of time (Ercan et al., 2003). Nowadays, there are many factors affecting the firm value and adding value to the firm in real terms. Some of these elements result from general economic factors such as national income, money supply, inflation rate, interest rate, level of employment and exchange rate. As for the other part, some of them result from the sectoral factors such as profitability, the course of the sector, sectoral growth and competition. Economic and sectoral factors constitute the external factors affecting the firm value. Capital structure, cost of capital, financial rates and dividend policies are the internal factors related to the firm which affect firm value. Moreover, elements such as revenue generation potential of the firm, cash flows expected from the investments planned in the future, characteristics of the firm's assets and its research and development activities, firm's marketing power and the ability to hold on the market are essential factors affecting firm value (Pamukçu and Akarçay Öğüz, 2014). Using these factors efficiently in firm valuation enables to determine the firm value more accurately.

In this study, it was practiced to adopt free cash flows to firm which is frequently used in calculating the firm value through the system dynamics model. Within this context, firstly, literature review in this field was examined by including firm valuation methods. Afterward, the financial data regarding ""Pınar Süt Mamulleri Sanayii A.Ş." (PNSUT) traded at Borsa Istanbul 100 Index (BIST-100) were examined and the free cash flows to firm (FCFF) were determined via system dynamics model. Business policies which will maximize FCFF was tested under certain scenarios through the created model.

2. FIRM VALUATION METHODS

According to American Society of Appraisers (ASA), National Association of Certified Valuation Analysts (NACVA) and Institute of Business Appraisers (IBA) who are among the leading institutions in the field of firm valuation, there are three approaches used in the field of valuation in general. These approaches contain different application methods within themselves. These methods in question are book value, "Asset Based Approach" within the scope of liquidation value and net asset value, "Market Value Approach" which is also named as trading multiples method and the "Discounted Cash Flows Method". Discounted Cash Flows Method is the most preferred method by the firms among the valuation methods. The main reason behind this is that it's more realistic and advantageous compared to other valuation methods. Yet, asset values can fall wide of the mark in terms of their current market value since they are recorded by historical cost as of the accounting records in the asset-based approach. On the other hand, there are significant disadvantages in the market value approach since the market data cannot be obtained due to the fact that not all the firms are publicly traded (Demir and Bahadır, 2007).

2.1. Discounted Cash Flows Method

Discounted cash flows are determined by converting the difference between the cash inflow and outflow which is calculated via certain discount rate into the present value. In this method, it's practiced to predict the future cash flows for the upcoming periods by analyzing the firm's date from the previous periods. Cash flows, prediction period and discount rate are the variables used in this method. The projection time to be predicted must be more than 5 years in the discounted cash flows method to be able to determine firm value more accurately. Firms make investments through equity method and borrowing and

generate operating revenue as a result of these investments. Cash flows to be acquired in the future through investments are calculated in two ways as "Free Cash Flows to Equity" and "Free Cash Flows to Firm" (Hatipoğlu and Yener, 2013; Yalçın, 2014).

Free Cash Flows to Equity Method

Free cash flows to equity are the remaining cash amount for the shareholders after the firm had fulfilled its financial obligations and it's calculated as follows (Damodaran, 2001):

$$FCFE = NI - (CAPEX - D) - (\Delta \text{WC}) + (\text{NDI} - \text{DR}) \quad (1)$$

FCFE = Free Cash Flow to Equity

NI = Net Income

CAPEX = Capital Expenditure

D = Depreciation

ΔWC = Change in Working Capital

NDI = New Debt Issued

DR = Debt Repayments

In the free cash flows to equity method, firm's non-operating financial income and costs are predicted (Chambers, 2009: 249).

Free Cash Flows to Firm Method

Free cash flows to firm represents the cash flows to rightful owners. This method is calculated as follows (İvgen, 2003):

$$FCFF = EBIT(1 - TR) + D - CAPEX - \Delta \text{WC} \quad (2)$$

FCFE = Free Cash Flow to Equity

EBIT = Earnings Before Interest and Taxes

TR = Tax Rate

D = Depreciation

CAPEX = Capital Expenditures

ΔWC = Change in Working Capital

Free cash flows to firm method refers to the cash flows to all the rightful creditors of the firm. In this method, weighted average cost of capital (WACC) is used as a discount rate of the cash flows in the calculations. This method is used mostly by the firms which have higher financial leverage and whose debt ratios vary from year to year. Free cash flows to firm gives more detailed information regarding the firm value according to different financing and investment methods (Altan and Karahan, 2016; Chambers, 2009).

3. LITERATURE REVIEW

Azeem Qureshi, (2007) has examined the effect of financing and dividend policies on firm value by the system dynamics model. In the study, it was identified that the investments made on productive assets are effective in the maximization of firm value. Furthermore, contrary to literature, it was determined that the capital structure with a relatively low debt ratio does not have any impact upon the maximization of firm value. Another finding obtained in the study was that a consistent dividend policy is the prerequisite for maximizing firm value.

Aksu, (2013) developed a cash budget model based on system dynamics and analyzed the model's response to various scenarios. According to the study, the model enables the determination of the cash situation at any time and provides information about the amount and duration of any cash needs. Additionally, it

was stated that the cash budget model developed can be used for a variety of accounting functions required by management, ranging from cost calculation to cost volume profit analysis.

Martínez-Sola et al., (2013) have examined the relationship between firm value and commercial credit between 2001-2007 for a sample group of firms traded at Spanish Stock Exchange. As a result of the study, it was determined that while there is a positive correlation between firm value and commercial credit on a low level of receivables, there is a negative correlation between firm value and commercial credit on a high level of receivables.

In Aksu et al., (2014)'s studies, a general production business model was developed using a system dynamics approach in order to identify solutions to business problems, and the trend of variables was observed for various scenarios. According to the study, the effects of business decisions made using system dynamics modeling are dynamically displayed on the model, and when compared to other methods, it is stated that it produces very close results to the real situation by considering almost all the variables that can affect business activities.

Özer and Çam, (2016) have researched the role of human capital in firm valuation. For this purpose, “human capital” (HC) was included as “other information” in accordance with the Ohlson Model (OM) and it was practiced to find the reasons behind the difference between the market value and the book value of the firms due to the inadequacies in the accounting standards. The data obtained from the study on industrial corporations registered in Borsa Istanbul (ISE) between 2004-2014 was analyzed by using econometrics models with panel data. As a result of the study, it was specified that OM was able to reveal a significant part of the unexplained difference in the firm value.

In their study; Çetiner and Özöğüt, (2018), the general framework of the discounted cash flows method of the firm valuation methods was introduced, and the method was practiced on an example. Cash flow projections were established as a result of predictions made upon the assumptions and the financial analysis data on the basis of the exemplified firm in the study.

Ünvan, (2019) had performed a firm valuation application for Turkish Airlines operating in the airline transport industry. In the study, discounted free cash flow and similar firm valuation methods were used and the obtained results were compared in terms of consistency. As a result of the study, it was determined that the discounted cash flow method produced significant results for coefficients of firms. Furthermore, it was predicted that the firm is in a positive growth tendency and that its brand value will increase accordingly, and the "Purchasing Decision" would be a healthy decision in favor of investors for Turkish Airlines.

Khan et al., (2021), have analyzed the effect of capital structure policy on firm value via system dynamics approach. In the study conducted for the purpose of maximizing firm value, an institutional planning model was developed for an oil company based on the system dynamics containing operational and financial processes and the model was simulated with various scenarios. It was determined that the increase in the debt ratio of the capital structure increased the firm value. The main reason for this result was indicated as the borrowing costs behind lower than the equity costs.

Aust et al., (2021) have conducted a study examining the relationship between the managerial application of valuation and accounting information. In the study, data was obtained from the firms registered in the stock market in Germany between 2006-2015 and the relationship between valuation and

managerial applications were analyzed. Study findings exhibit that while the relationship of managerial application in regard to valuation/accounting information remained positive for the firms with a high level of free float rate; nevertheless, it did not remain positive for the firms with a low level of free float rate.

Hernawati et al., (2021) have researched the effect of income and earnings method on firm value. Data was obtained from 111 manufacturing companies listed in the Indonesia Stock Exchange (IDX) between 2015-2018 and analyzed. In the study, it was determined that firm value can be increased by transfer of welfare to the shareholders and corporate management as a result of policies toward increasing income.

Bose et al., (2022), have examined the effect of COVID-19 on the changes in the firm value and the regulatory role of sustainability performance at the firm level on this relationship. In the study, it was determined that COVID-19 had less negative impact on firms who have sustainable performance.

4. METHOD AND MODEL STRUCTURE

In the study, financial statements reported by "Pınar Süt Mamulleri Sanayii A.Ş." The main reason for choosing the company from the food sector is that this sector is less affected by the economic crisis. (PNSUT) traded at Borsa Istanbul 100 Index (BIST-100) to the Public Disclosure Platform (PDP) between 2010-2020 were used. With using the data obtained from these financial statements, it was practiced to identify the upcoming 10-year projection of the firm through the model created by Stella software. Figure 1 shows the model of the calculations identifying Free Cash Flow to Firm (FCFF) which is created by the system dynamics approach.

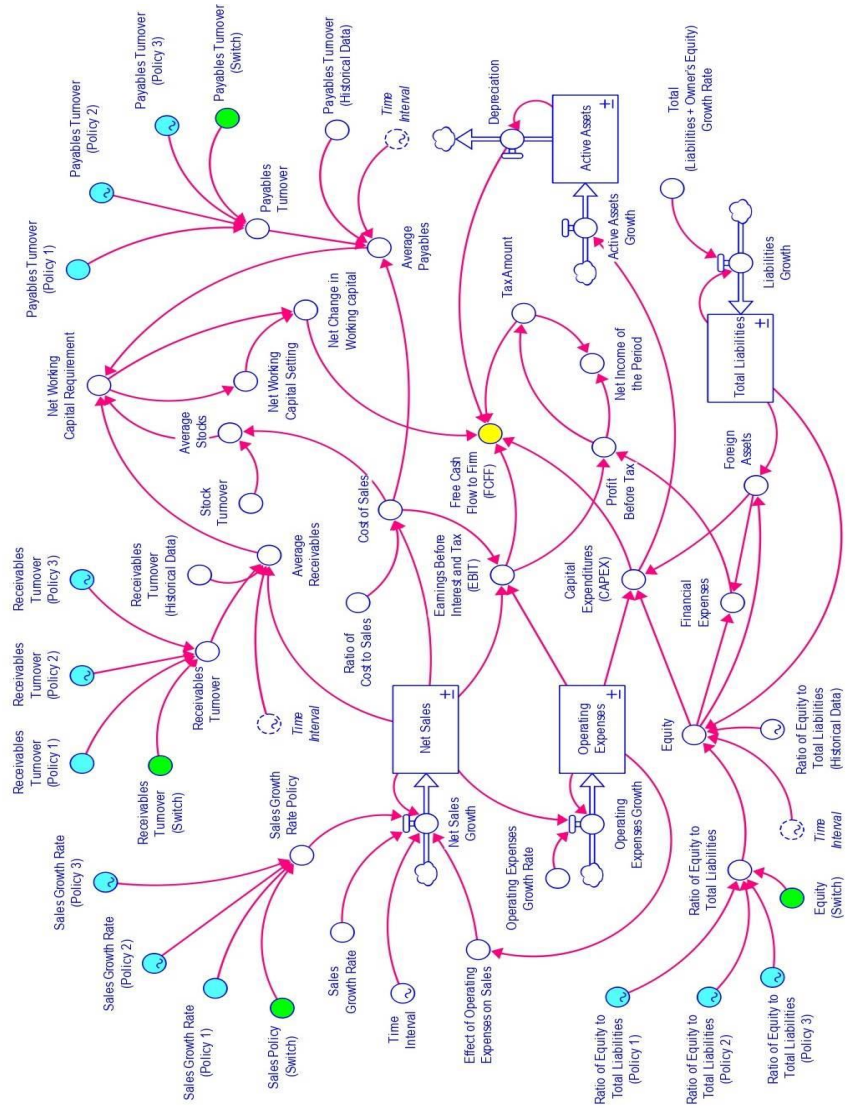

Figure 1. Model Structure

Internal and external factors affecting firm value was used in the model. Some of the factors influencing firm value was not included in the model. Internal and

external factors included in the model as well as the factors not included in the model are shown in Table 1.

Table 1. Factors That Are Used and Ignored in the Model

Internal Factors	External Factors	Ignored Factors
✓ Net Sales	✓ Interest Rate	✓ Inflation Rate
✓ Operational Expenses	✓ Tax Rate	✓ Activities of the Competitors
✓ Total Foreign Assets	✓ Trade Receivables Turnover	✓ Activities of the Government
✓ Equities	✓ Stock Turnover	✓ Activities of the Other Shareholders
✓ Net Cash Flows	✓ Payables Turnover for Commercial Debts	
✓ Depreciation Expenses	✓ Beta Coefficient	
✓ Fixed Capital Expenditures		
✓ Net Working Capital		

System dynamics model contains internal variables to a great extent in contrast to traditional econometric models based on external variables. Internal factors are the main pillars of model structure, and they guide behaviors of model. On the other hand, external outputs affect internal factors (Sterman, 2000).

4.1. Model Verification and Testing

Sterman, (2000) defines model verification as "the process of building trust toward the model". Nevertheless, it's near to impossible that the models are the same as the real systems since they are the simplified representations of the systems in the real world. However, model testing is an essential step in the process of system dynamics modelling. There are numerous testing methods for testing the reliability of the model. In the study, model was subjected to behavioral test.

In the behavioral test method, it is evaluated as to what extent the model satisfies real system's behavior (As shown in Figure 2, 3, 4, 5, and 6). The compatibility between the simulation data obtained from the model and the

actualized historical data is an essential factor in the model structure's accurate prediction of the correlation between the variables in a short and long period of time and in the interpretation of the simulation data realistically.

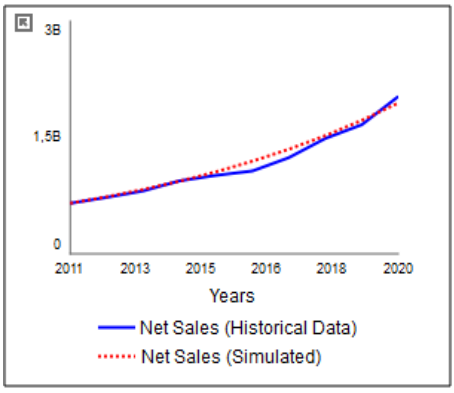

Figure 2. Behavioral Test of Sales

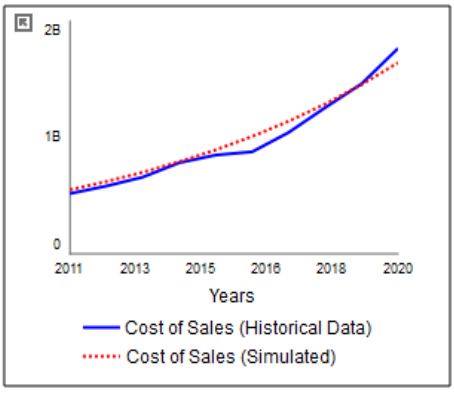

Figure 3. Behavioral Test of Sales Cost

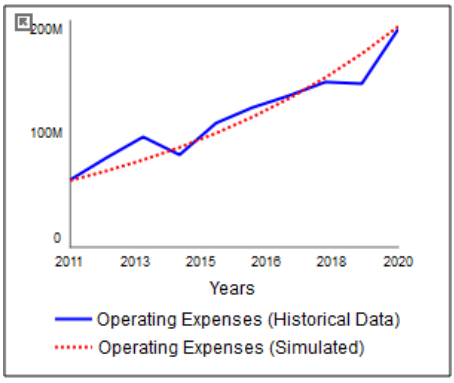

Figure 4.
Behavioral of Operational Expenses

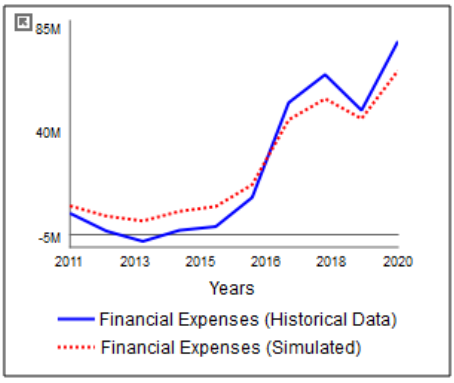

Figure 5.
Behavioral of Financial Expenses

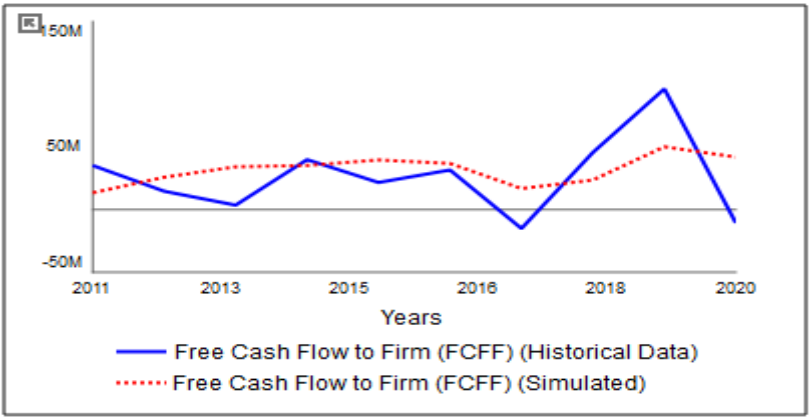

Figure 6. Behavioral Test FCFF

According to the Free Cash Flows to Firm method, it is seen in Figure 2, 3, 4, 5 and 6 that the simulation data used in determining firm value recurs actual data rather successfully.

4.2. Designing Policy

In this study, policies based on growth and capital structure was designed for the firm by taking account of the literature and experimental observations. It was practiced to determine which of these policies would be able to maximize free cash flows to firm by means of scenarios.

Growth Policies

In the model, growth policies consist of three separate policies as sales, receivables turnover and payables turnover. Each policy is divided into three groups within themselves. The first of these is the "Policy 1" which is constituted by utilizing previous data. According to this policy, the latest actualized data remains stable. The second one is the "Policy 2" which is the condition where each growth policy escalate aggressively. The third one is the

"Policy 3" in which the growth policies exhibit a lower performance compared to the present state. In Figure 7, 8 and 9, behavioral patterns regarding the growth policies are shown.

Figure 7. Sales Growth Policies of the Firm

In Figure 7, it was assumed that the growth rate in "Policy 1" of the sales growth policies will progress with the average sales growth rate (0,115) obtained from the firm's data over the last 10 years. It was assumed that the growth rate in "Policy 2" will increase from 0,115 to 0,13 in the next 10 years while the sales growth rate in "Policy 3" will decrease from 0.115 to 0,11.

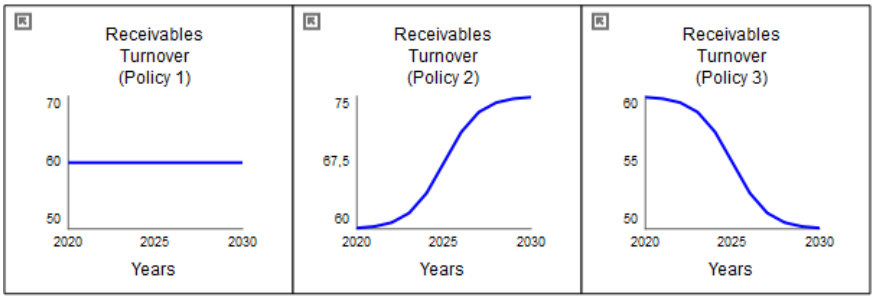

Figure 8. Receivables Turnover Policies

In Figure 8, for the "Policy 1" of the receivables turnover policies, it was assumed that the receivables turnover and the average receivables turnover obtained from the firm's data over the last 10 years will be 60 days. In "Policy

2", it was assumed that receivables turnover will increase from 60 to 75 in the next 10 years while the receivables turnover will decrease from 60 to 50 in "Policy 3".

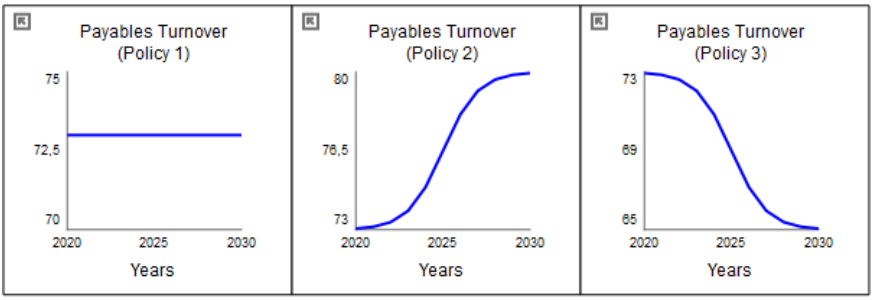

Figure 9. Payables Turnover Policies

In "Policy 1" of the policies in Figure 9, it was assumed that payables turnover will equal to 73 days which is the average payables turnover obtained from the firm's data over the last 10 years. In "Policy 2", it was assumed that payables turnover will increase from 73 to 80 in the next 10 years while the payables turnover will decrease from 73 to 65 in "Policy 3".

Capital Structure Policies

Firms make investments in order to maintain their operations and grow. Investments in question are financed by equity and/or loans. It's an on-going debate in the finance literature as to which ratio should the capital structure which will maximize the firm value have and from which resources it will capitalize on. Optimal capital structure is the one which maintains the balance between the risk arising from using different resources and profitability and increasing firm value to the highest level by minimizing capital cost (Acaravci Kakilli et al., 2018).

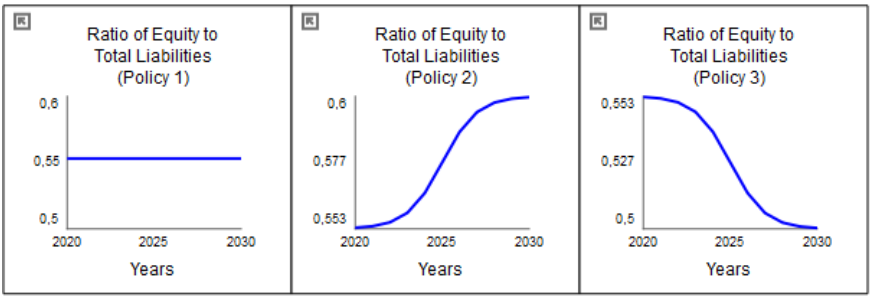

Figure 10: Capital Structure Policies

Firm's capital structure policies are shown in Figure 10. In the first graph, "Policy 1" indicating the condition where the firm progresses with the present equity usage ratio is shown, in the second graph, "Policy 2" is shown which indicates the condition in the event that firm's equity usage ratio is increased from 55% to 60% in the next 10 years and in the third graph, "Policy 3" is displayed which indicates the condition in the event that firm decreases its equity usage ratio gradually from 55% to 50% in the next 10 years.

4.4. The Calculation of Weighted Average Cost of Capital (WACC)

Weighted Average Cost of Capital (WACC) is among the methods which are frequently used in rendering both the investment projects of the firms at the planning stage and the cash flows predicted in the valuation studies into present day conditions. In the method used in our study, Weighted Average Cost of Capital (WACC) was used tor ender cast flows into present day conditions. The reason for using WACC expenditure as a discount method in the firm valuation processes carried out in accordance with free cash flows to firm method is to ensure that the cash flows calculated according to equity is equal to the cash flows to firm (Hatipoğlu and Yener, 2013). Weighted average cost of

capital expenditure represents the lowest rate of return expected by the investor.

$$WACC = [ke * We] + [(kd * (1-t)) * Wd] \quad (3)$$

In the study, as shown in Table 2, the WACC ratio for 2021 was calculated by using the equalization above.

Table 2. The Calculation of Weighted Average Cost of Capital (WACC)

The Calculation of WACC	Year (2021)
Risk-Free Interest Rate	12,50
Market Interest Rate	16,98
Risk Premium (Market Interest Rate-Risk-Free Interest Rate)	4,48
Beta Coefficient	1,96
Cost of Equity **(ke)***	21,28
Weight of Equity **(We)**	55,31
ke* We	**11,77**
Cost of Debt **(kd)**	0,1528
(1-t)	0,78
Weight of Debt **(Wd)**	0,45
kd*(1-t)* Wd	**0,054**
Rate of WACC	**17,17%**

* ke was calculated as [12,50%+(4%,48*1,96)] in accordance with CAPM (Capital Asset Pricing Model).
** t is the corporation tax rate, and this rate is 20% until 2018 and 22% after 2018.

5. FINDINGS

In this study, the cash flows of "Pınar Süt Mamulleri Sanayii A.Ş." (PNSUT) traded at Borsa Istanbul 100 Index (BIST-100) were calculated between 2021-2030 according to the discounted free cash flow method. A simulation was performed to identify which policy components will take the cash flows which are among the most essential variables in determining firm value to the highest level.

Table 3. Overall Presentation of Firm Policies

Description	Capital Structure Policies	Growth Policies		
		Sales Growth Rate	Receivables Turnover	Payables Turnover
Policies Based on Previous Data	Policy 1	Policy 1	Policy 1	Policy 1
Policies Escalating Aggressively	Policy 2	Policy 2	Policy 2	Policy 2
Low-Performance Policies	Policy 3	Policy 3	Policy 3	Policy 3

Policies designed for the firm are shown in Table 3 all together. These policies (3^4) constitute 81 different policy combinations.

Table 4. Scenario Components For FCFF

Scenarios	Capital Structure Policies	Growth Policies		
		Sales Growth Rate	Receivables Turnover	Payables Turnover
Simulated FCFF	Policy 1	Policy 1	Policy 1	Policy 1
Max FCFF	Policy 2	Policy 2	Policy 3	Policy 2
Min FCFF	Policy 3	Policy 3	Policy 2	Policy 3

In Table 4, among all the potential policy combinations of the firm for FCFF, the components of “Simulated FCF” based on the assumption that the existing state will continue, “Max FCFF” maximizing the FCFF and “Min FCFF” minimizing FCFF.

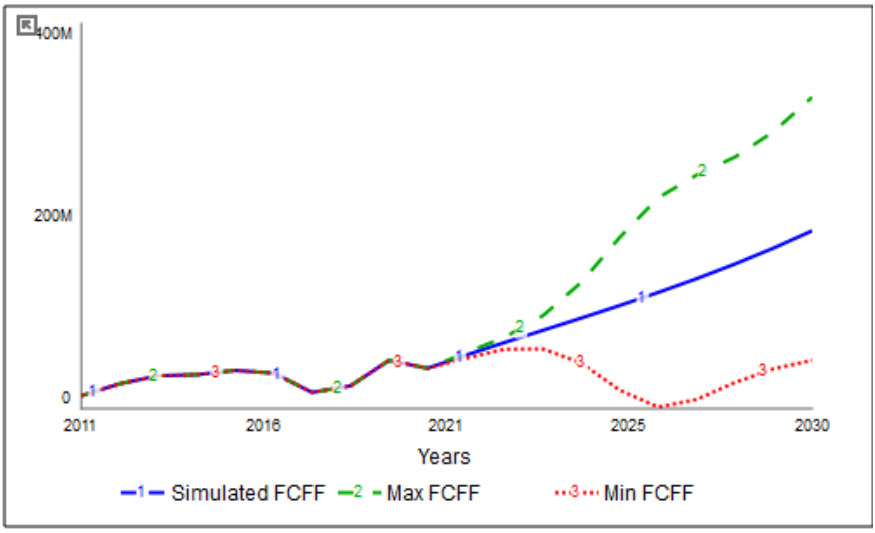

Figure 11. Scenario Components For FCFF

According to the scenarios of "Simulated FCFF", "Max FCFF" and "Min FCFF" shown in Figure 11, firm's net cash flow can vary between 372.095.657,30 TL and 1.872.229.046,00 TL. According to the scenario for Max FCFF, it is observed that in the next 10 years, the firm will be able to gradually increase its total amount of net cash flows to 1.872.229.046,00 TL apart from the terminal value under the assumptions that the equity usage ratio will increase from 0,5531 to 0,60, sales growth ratio will increase from 0,115 to 0,13, receivables turnover will decrease from 60 days to 50 days and payables turnover will increase from 73 days to 80 days. This state is the highest level within the existing scenarios in which the firm can carry its net cash flows to the highest level.

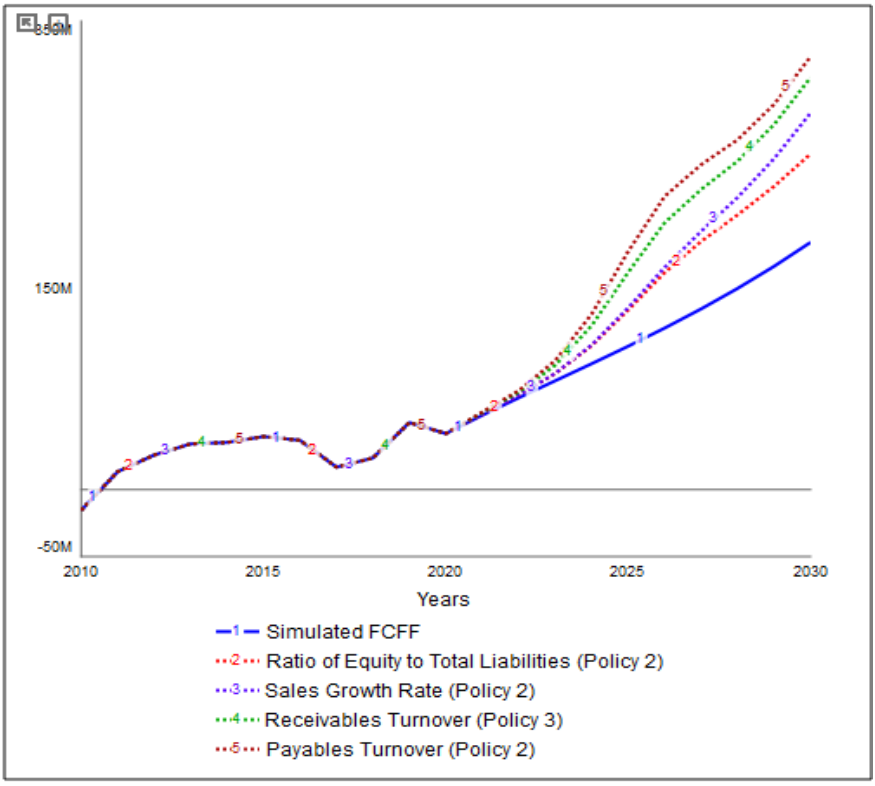

Figure 12. Scenario Components for Max FCFF

In Figure 12, the contributions of the scenario components for "Max FCFF" to FCFF are displayed separately. Upon the scenario of Simulated FCFF determined in accordance with the firm's previous data, total cash flow of 1.164.114.823,00 TL was achieved. This total cash flow amount can reach up to 1.872.229.046,00 TL via the scenario of Max FCFF. With this increase, the graphical display of the contribution level of the scenario components for Max FCFF is exhibited in Figure 12. Furthermore, total amount of contribution and the contribution rate regarding each scenario component was indicated in Table 5.

Table 5. Contribution Rates of the Scenario Components of Max FCFF

Scenario Components	Amount of FCFF	Amount of FCFF (Net Present Value)	Contribution Rate (%)
Simulated FCFF	1.164.114.823	536.908.106	66
Ratio of Equity to Total Liabilities (Policy 2)	321.184.348	118.261.290	15
Sales Growth Rate (Policy 2)	78.293.710	23.652.513	3
Receivables Turnover (Policy 3)	193.927.845	80.156.452	10
Payables Turnover (Policy 2)	114.708.320	47.412.541	6
Total	**1.872.229.046**	**806.390.905**	**100**

The scenario of Max FCFF which will maximize firm value is evaluated separately in Table 5. Accordingly, firm's discounted net cash flows increase by 118.261.290,70 TL (15%) in the event that the equity usage ratio is increased gradually from 0,5531 to 0,60 in the next 10 years (2021-2030). Firm's discounted net cash flows increase by 23.652.513,19 TL (3%) in the event that their sales growth rate is increased from 0,115 to 0,13, by 80.156.452,77 TL (10%) in the event that receivables turnover is decreased from 60 days to 50 days and by 47.412.541,81 TL (6%) in the event that payables turnover is increased from 73 days to 80 days. In examination of the scenario components of Max FCFF as a whole, it is observed that firm's discounted net cash flows increase by 269.482.798,50 TL (34%). It was determined that cash flows were affected mostly by the equity usage ratio.

6. CONCLUSIONS AND DISCUSSION

It's an essential factor for the potential investors to know the cash flows of the firms within the scope of their future plans and strategies in determining firm value. It is of vital importance to know the fair value of the firm in cases of

acquisition, merging, division and transfer whether they are traded at the stock exchange or not. Therefore, firm valuation studies play a significant role in determining the fair value of the firm. Although there are many firm valuation methods nowadays, discounted cash flows methods are the ones that are used primarily. In this method, it is essential to predict the firm's future cash flows accurately.

In this study, for the firm value, the FCFF (Free Cash Flows to Firm) projection of "Pınar Süt Mamulleri Sanayii A.Ş." (PNSUT) traded at Borsa Istanbul 100 Index (BIST-100) was determined by using firm's conclusive financial data between 2010-2020. The firm's future projection was analyzed under different scenarios with the established model.

The scenario displaying the cashflows tested by the model and which will maximize firm value was determined. According to this scenario, in the next 10 years, the firm can increase its discounted net cash flows from 536.908.106,50 TL to 806.390.905,00 TL (34%) in the event that it gradually increases its equity usage ratio from 0,5531 to 0,60, sales growth rate from 0,115 to 0,13 and payables turnover from 73 days to 80 days and decreases its receivables turnover from 60 days to 50 days (exclusive of the terminal value). In examination of the scenario components of Max FCFF separately, it is observed that discounted net cash flows are increased by the equity usage ratio increases at the rate of 15%, by the sales growth rate at 3%, by the receivables turnover at the rate of 10% and by the payables turnover in the ratio of 6%. Accordingly, it is observed that firm value increases significantly as the equity usage rate increases. This situation signifies that the liabilities costs are higher than the equity costs for the examined firm. This is also supported by the literature. because interest rates and loan costs can be effective in determining the capital

structure. Khan et al., (2021), stated in his study that as the ratio of foreign resources in the capital structure increases, the value of the firm increases. He stated that the main reason for this is that debt is less costly than tax rates. This result revealed for the examined firm is an information produced via system dynamics model. Therefore, specific to the examined firm, it is considered that the established model will provide essential information to the business executives as to what extent and from which variables cash flows are affected by. This information allows business executives to design their firm policies which will maximize the firm value.

Nowadays, it has become difficult to provide the kind of information business executives require by traditional management accounting techniques. In this study, it is envisioned that the used system dynamics model can be implemented as an efficient strategic management accounting technique. Yet, the model provides information that can help business executives in their fast-paced, predictable and dynamic decision-making processes.

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GENİŞLETİLMİŞ ÖZET

Giriş

Firma değeri; satışı düşünülen bir mal veya hizmet için belirlenen fiyatı temsil eden ekonomik bir kavramdır. Bir diğer ifade ile, belirli bir zamanda belirli bir mal ve hizmet için ödenecek olası fiyatın tahminidir (Chambers, 2009: 5). Tanımdan da anlaşılacağı üzere bir varlığın değeri ile fiyatı birbirinden farklı olabilir. Fiyatlar başta arz ve talep olmak üzere piyasadaki birçok ekonomik koşula göre farklılık gösterebilir. Bu nedenle fiyat, söz konusu mal ya da hizmetin değerinden farklı olabilmektedir (Aydın, 2004: 194). Dolayısıyla, bir mal veya hizmetin fiyatı hakkında fikir yürütebilmek için o mal veya hizmetin değerinin doğru tespit edilebilmesi önem arzetmektedir. Bir varlığın değerinin

tespit edilmesi sürecine değerleme denilmektedir. Firmalar, içerisinde bulundukları ekonomik ortam, faaliyet alanı ve benzeri birçok değişkenlerden dolayı farklı değerlere sahip olabilirler (Fernandez, 2007: 5).

Günümüzde firma değerini etkileyen ve firmaya gerçek manada değer kazandıran birçok unsur bulunmaktadır. Bu unsurların bir kısmı; milli gelir, para arzı, enflasyon oranı, faiz oranı, istihdam düzeyi ve döviz kuru gibi genel ekonomik faktörlerden kaynaklanmaktadır. Bir kısmı ise; karlılık, sektörün seyri, sektörel büyüme ve rekabet gibi sektörel faktörlerden kaynaklanmaktadır. Ekonomik ve sektörel faktörler firma değerini etkileyen dış faktörleri oluşturmaktadır. Firmanın; sermaye yapısı, sermaye maliyeti, finansal oranlar ve kar dağıtım politikaları, firma değerini etkileyen firma ile ilgili iç faktörlerdir. Ayrıca, firmanın gelecekteki gelir getirme potansiyeli, gelecekte yapılması planlanan yatırımlardan beklenen nakit akımları, firmanın varlıklarının özellikleri ve araştırma geliştirme faaliyetleri, firmanın pazarlama gücü ve piyasada tutunma becerisi gibi unsurlar firma değerine etki eden önemli faktörlerdir (Pamukçu ve Öğüz, 2014: 79). Bu faktörlerin firma değerlemede etkin kullanılması firma değerinin daha doğru bir şekilde belirlenmesine yardımcı olmaktadır.

Bu çalışmada, firma değerinin hesaplanmasında sıkça kullanılan firmaya serbest nakit akımları, sistem dinamiği modeliyle belirlenmeye çalışılmıştır. Bu kapsamda, öncelikle firma değerleme yöntemlerine yer verilerek bu alandaki literatür taraması incelenmiştir. Ardından Borsa İstanbul (BİST-100) piyasasında işlem gören Pınar Süt Mamulleri Sanayii A.Ş. (PNSUT) firmasına ait finansal veriler incelenmiş ve firmaya serbest nakit akımları (Free Cash Flows to Firm) FCFF, sistem dinamiği modeliyle belirlenmiştir. Oluşturulan model ile, FCFF'yi maksimize edecek işletme politikaları belirli senaryolar altında test edilmiştir.

Yöntem

Çalışmada, Borsa İstanbul (BİST-100) piyasasında işlem gören Pınar Süt Mamulleri Sanayii A.Ş. (PNSUT) firmasının Kamuyu Aydınlatma Platformu (KAP) 'na 2010-2020 yılları arasında bildirdiği finansal tablolar kullanılmıştır. Bu finansal tablolardan elde edilen veriler kullanılarak, firmanın gelecek on yıllık projeksiyonu Stella yazılım programıyla oluşturulan model ile tespit edilmeye çalışılmıştır. Sistem dinamiği modeli, dışsal değişkenlere dayanan geleneksel ekonometrik modellerin aksine büyük ölçüde içsel değişkenleri kapsar. İçsel faktörler, model yapısının temel direkleridir ve model davranışını yönlendirir. Dışsal girdiler ise içsel faktörleri etkilemektedir (Sterman, 2000: 95).

Bulgular

Bu çalışmada firma değerinin tespit edilmesinde en önemli değişkenlerden biri olan nakit akımlarını, hangi politika bileşenlerinin en yükseğe çıkaracağı simüle edilmiştir. Firma için tasarlanan politikalar (3^4) 81 farklı politika kombinasyonu oluşturmaktadır. Bu politika kombinasyonlarının her biri bir senaryo olarak değerlendirilebilir. "Simulated FCFF", "Max FCFF" ve "Min FCFF" senaryolarına göre firmanın net nakit akımları toplamı 372.095.657,30 TL ile 1.872.229.046,00 TL arasında değişebilmektedir. Max FCFF senaryosuna göre, gelecek 10 yılda kademeli olarak, öz sermaye kullanım oranının 0,5531'den 0,60'a yükseleceği, satış büyüme oranının 0,115'ten 0,13'e yükseleceği, alacak devir süresinin 60 günden 50 güne düşeceği ve borç devir süresinin 73 günden 80 güne yükseleceği varsayımı altında firmanın net nakit akımları toplamını terminal değer haricinde 1.872.229.046,00 TL'ye yükseltebileceği görülmektedir. Bu durum, firmanın mevcut senaryolar içerisinde net nakit akımlarını taşıyabileceği en yüksek seviyedir. Firmanın geçmiş verilerine göre belirlenen Simulated FCFF senaryosu ile toplamda 1.164.114.823,00 TL nakit akımı elde edilmektedir. Max FCFF senaryosu ile bu toplam nakit akımı tutarı, 1.872.229.046,00 TL'ye ulaşabilmektedir.

Firma değerini en yükseğe çıkaracak olan Max FCFF senaryosuna göre; gelecek 10 yılda (2021-2030) kademeli olarak öz sermaye kullanım oranı 0,5531'den 0,60'a çıkarıldığında, firmanın indirgenmiş net nakit akımları 118.261.290,70 TL (%15) artmaktadır. Firmanın indirgenmiş net nakit akımları, satış büyüme oranı 0,115'ten 0,13'e çıkarıldığında 23.652.513,19 TL (%3), alacak devir süresi 60 günden 50 güne düşürüldüğünde 80.156.452,77 TL (%10) ve borç devir süresi 73 günden 80 güne yükseltildiğinde 47.412.541,81 TL (%6) artmaktadır. Max FCFF senaryosunun bileşenleri bir bütün olarak değerlendirildiğinde ise firmanın indirgenmiş net nakit akımlarının 269.482.798,50 TL (%34) arttığı görülmektedir. Nakit akımların en fazla öz sermaye kullanım oranından etkilendiği tespit edilmiştir.

Sonuç ve Tartışma

Potansiyel yatırımcılar için firmaların gelecek plan ve stratejileri çerçevesinde elde edecekleri nakit akımlarını bilmek, firmanın değerini belirlemede önemli bir unsurdur. İster borsada işlem görsün ister görmesin, firmaların satın alma, birleşme, bölünme ve devir durumlarında gerçeğe yakın değerinin bilinmesi çok önemlidir. Dolayısıyla firma değerleme çalışmaları, firmanın gerçeğe uygun değerinin tespitinde önemli rol oynamaktadır. Günümüzde birçok firma değerleme yöntemi bulunmasına karşın, en çok kullanılan yöntemlerin başında indirgenmiş nakit akımları yöntemi gelmektedir.

Bu çalışmada, firma değeri için Borsa İstanbul (BİST-100) piyasasında işlem gören Pınar Süt Mamulleri Sanayii A.Ş. (PNSUT) firmasına ait 2010-2020 tarihleri arasındaki kesinleşmiş finansal veriler kullanılarak, firmanın 2020-2030 yılları arasındaki firmaya serbest nakit akım (Free Cash Flows to Firm) FCFF projeksiyonu belirlenmiştir. Firmanın gelecek projeksiyonu, oluşturulan model ile farklı senaryolar altında analiz edilmiştir.

Bu senaryoya göre; firma gelecek 10 yılda, kademeli olarak öz sermaye kullanım oranını 0,5531'den 0,60'a, satış büyüme oranını 0,115'ten 0,13'e ve borç devir süresini 73 günden 80 güne yükseltirse, ayrıca alacak devir süresini 60 günden 50 güne düşürürse (terminal değer hariç) indirgenmiş net nakit akımlarını 536.908.106,50 TL'den 806.390.905,00 TL'ye (%34) yükseltebilmektedir. Max FCFF senaryosu bileşenleri itibarıyla ayrı ayrı değerlendirildiğinde, öz sermaye kullanım oranının %15, satış büyüme oranının %3, alacak devir süresinin %10 ve borç devir süresinin %6 oranında indirgenmiş net nakit akımlarını arttırdığı görülmektedir. Buna göre öz sermaye kullanım oranının artmasıyla firma değerinin önemli ölçüde arttığı görülmektedir. Bu durum, incelenen firma için yabancı kaynak maliyetlerinin öz kaynak maliyetlerinden daha yüksek olduğu anlamına gelmektedir. İncelenen firma için ortaya çıkan bu sonuç, sistem dinamiği modeli yardımıyla üretilen bir bilgidir. Dolayısıyla oluşturulan modelin, incelenen firma özelinde nakit akımların hangi değişkenlerden hangi oranlarda etkilendiği konusunda işletme yöneticilerine önemli bilgiler sağlayacağı değerlendirilmektedir.

Günümüzde, geleneksel yönetim muhasebesi teknikleri ile firma yöneticilerinin gereksinim duyduğu niteliklerdeki bilgiyi sağlamak güçleşmiştir. Bu çalışmada, kullanılan sistem dinamiği modelinin etkili bir stratejik yönetim muhasebesi tekniği olarak kullanılabileceği düşünülmektedir. Zira model, firma yöneticilerinin hızlı, öngörülebilir ve dinamik karar alma süreçlerine yardımcı olabilecek bilgileri sunmaktadır.

APPENDIX

Table A1: Formula of Variable in Stock-flow Diagram

Variabel	Formula
Active_Assets(t)	Active_Assets (t- dt) + (Active_Assets_Growth- Depreciation) * dt
Net_Sales(t)	Net_Sales (t- dt) + (Net_Sales_Growth) * dt
Operating_Expenses(t)	Operating_Expenses (t- dt) + (Operating_Expenses_Growth) * dt
Total_Liabilities(t)	Total_Liabilities (t - dt) + (Liabilities_Growth) * dt
Active_Assets_Growth	"Capital_Expenditures_(CAPEX)"
Depreciation	Active_Assets/5
Liabilities_Growth	"Total_(Liabilities_+_Owner's_Equity)

	_Growth_Rate"*Total_Liabilities
Net_Sales_Growth	IF Time_Interval<2021 THEN (Sales_Growth_Rate*Net_Sales) +Effect_of_Operating_Expenses_on_Sales ELSE (Sales_Growth_Rate_Policy*Net_Sales) +Effect_of_Operating_Expenses_on_Sales
Operating_Expenses_Growth	(Operating_Expenses_Growth_Rate*Operating_Expenses) +(Net_Sales*0,004)
Average_Payables	IF Time_Interval<2021 THEN ("Payables_Turnover_(Historical_Data)"/360) *Cost_of_Sales ELSE (Payables_Turnover/360) *Cost_of_Sales
Average_Receivables	IF Time_Interval<2021 THEN ("Receivables_Turnover_(Historical_Data)"/360) *Net_Sales ELSE (Receivables_Turnover/360) *Net_Sales
Average_Stocks	(Stock_Turnover/360) *Cost_of_Sales
"Capital_Expenditures_(CAPEX)"	83904246,83+(0,836*Operating_Expenses) +(0,176*Foreign_Assets) -(0,316*Equity)
Cost_of_Sales	Ratio_of_Cost_to_Sales*Net_Sales
"Earnings_Before_Interest_and_Tax_(EBIT)"	Net_Sales-(Cost_of_Sales+Operating_Expenses)
Effect_of_Operating_Expenses_on_Sales	Operating_Expenses*0,15
Equity	IF Time_Interval<2021 THEN ("Ratio_of_Equity_to_Total_Liabilities_(Historical_Data)"*Total_Liabilities) ELSE (Ratio_of_Equity_to_Total_Liabilities*Total_Liabilities)
"Equity_(Switch)"	2
Financial_Expenses	32639794,84-(0,142*Equity) +(0,216*Foreign_Assets)
Foreign_Assets	Total_Liabilities-Equity
"Free_Cash_Flow_to_Firm_(FCFF)"	"Earnings_Before_Interest_and_Tax_(EBIT)"- Tax_Amount+Depreciation-Net_Change_in_Working_capital- "Capital_Expenditures_(CAPEX)"
Net_Change_in_Working_capital	Net_Working_Capital_Requirement- Net_Working_Capital_Setting
Net_Income_of_the_Period	Profit_Before_Tax-Tax_Amount
Net_Working_Capital_Requirement	Average_Receivables+Average_Stocks-Average_Payables
Net_Working_Capital_Setting	DELAY (Net_Working_Capital_Requirement; 1; Net_Working_Capital_Requirement/2)
Operating_Expenses_Growth_Rate	0,1
Payables_Turnover	IF "Payables_Turnover_(Switch)"=1 THEN "Payables_Turnover_(Policy_1)" ELSE IF "Payables_Turnover_(Switch)"=2 THEN "Payables_Turnover_(Policy_2)" ELSE "Payables_Turnover_(Policy_3)"
"Payables_Turnover_(Historical_Data)"	73
"Payables_Turnover_(Policy_1)"	73
"Payables_Turnover_(Policy_2)"	GRAPH(TIME) Points: (2020,00, 73,0468499565), (2021,00, 73,1259034697), (2022,00, 73,3319811122), (2023,00, 73,8344204542), (2024,00, 74,8825899496), (2025,00,

	76,500), (2026,00, 78,1174100504), (2027,00, 79,1655795458), (2028,00, 79,6680188878), (2029,00, 79,8740965303), (2030,00, 79,9531500435)
"Payables_Turnover_(Policy_3)"	GRAPH(TIME) Points: (2020,00, 72,9464571926), (2021,00, 72,8561103203), (2022,00, 72,6205930146), (2023,00, 72,0463766238), (2024,00, 70,848468629), (2025,00, 69,000), (2026,00, 67,151531371), (2027,00, 65,9536233762), (2028,00, 65,3794069854), (2029,00, 65,1438896797), (2030,00, 65,0535428074)
"Payables_Turnover_(Switch)"	2
Profit_Before_Tax	"Earnings_Before_Interest_and_Tax_(EBIT)"-Financial_Expenses
Ratio_of_Cost_to_Sales	0,845
Ratio_of_Equity_to_Total_Liabilities	IF "Equity_(Switch)"=1 THEN "Ratio_of_Equity_to_Total_Liabilities_(Policy_1)" ELSE IF "Equity_(Switch)"=2 THEN "Ratio_of_Equity_to_Total_Liabilities_(Policy_2)" ELSE "Ratio_of_Equity_to_Total_Liabilities_(Policy_3)"
"Ratio_of_Equity_to_Total_Liabilities_(Historical_Data)"	GRAPH(TIME) Points: (2010,00, 0,7225), (2011,00, 0,7017), (2012,00, 0,7071), (2013,00, 0,7022), (2014,00, 0,6786), (2015,00, 0,6644), (2016,00, 0,6355), (2017,00, 0,5744), (2018,00, 0,5612), (2019,00, 0,5799), (2020,00, 0,5531)
"Ratio_of_Equity_to_Total_Liabilities_(Policy_1)"	GRAPH(TIME) Points: (2020,00, 0,5531), (2021,00, 0,5531), (2022,00, 0,5531), (2023,00, 0,5531), (2024,00, 0,5531), (2025,00, 0,5531), (2026,00, 0,5531), (2027,00, 0,5531), (2028,00, 0,5531), (2029,00, 0,5531), (2030,00, 0,5531)
"Ratio_of_Equity_to_Total_Liabilities_(Policy_2)"	GRAPH(TIME) Points: (2020,00, 0,553413894708), (2021,00, 0,553943553247), (2022,00, 0,555324273452), (2023,00, 0,558690617043), (2024,00, 0,565713352662), (2025,00, 0,57655), (2026,00, 0,587386647338), (2027,00, 0,594409382957), (2028,00, 0,597775726548), (2029,00, 0,599156446753), (2030,00, 0,599686105292)
"Ratio_of_Equity_to_Total_Liabilities_(Policy_3)"	GRAPH(TIME) Points: (2020,00, 0,552744609616), (2021,00, 0,552144932251), (2022,00, 0,550581686134), (2023,00, 0,546770324841), (2024,00, 0,538819210525), (2025,00, 0,52655), (2026,00, 0,514280789475), (2027,00, 0,506329675159), (2028,00, 0,502518313866), (2029,00, 0,500955067749), (2030,00, 0,500355390384)
Receivables_Turnover	IF "Receivables_Turnover_(Switch)"=1 THEN "Receivables_Turnover_(Policy_1)" ELSE IF "Receivables_Turnover_(Switch)"=2 THEN "Receivables_Turnover_(Policy_2)" ELSE "Receivables_Turnover_(Policy_3)"
"Receivables_Turnover_(Historical_Data)"	60
"Receivables_Turnover_(Policy_1)"	60
"Receivables_Turnover_(Policy_2)"	GRAPH(TIME) Points: (2020,00, 60,1003927639), (2021,00, 60,2697931494), (2022,00, 60,7113880977), (2023,00, 61,7880438303), (2024,00, 64,0341213205), (2025,00, 67,50), (2026,00, 70,9658786795), (2027,00, 73,2119561697), (2028,00, 74,2886119023), (2029,00, 74,7302068506), (2030,00, 74,8996072361)

"Receivables_Turnover_(Policy_3)"	GRAPH(TIME) Points: (2020,00, 59,9330714908), (2021,00, 59,8201379004), (2022,00, 59,5257412682), (2023,00, 58,8079707798), (2024,00, 57,3105857863), (2025,00, 55,00), (2026,00, 52,6894142137), (2027,00, 51,1920292202), (2028,00, 50,4742587318), (2029,00, 50,1798620996), (2030,00, 50,0669285092)
"Receivables_Turnover_(Switch)"	3
Sales_Growth_Rate	0,115
"Sales_Growth_Rate_(Policy_1)"	0,115
"Sales_Growth_Rate_(Policy_2)"	GRAPH(TIME) Points: (2020,00, 0,115100392764), (2021,00, 0,115440900129), (2022,00, 0,116267838044), (2023,00, 0,117766808554), (2024,00, 0,119927764304), (2025,00, 0,1225), (2026,00, 0,125072235696), (2027,00, 0,127233191446), (2028,00, 0,128732161956), (2029,00, 0,129559099871), (2030,00, 0,129899607236)
"Sales_Growth_Rate_(Policy_3)"	GRAPH(TIME) Points: (2020,00, 0,114899607236), (2021,00, 0,114730206851), (2022,00, 0,114288611902), (2023,00, 0,11321195617), (2024,00, 0,110965878679), (2025,00, 0,1075), (2026,00, 0,104034121321), (2027,00, 0,10178804383), (2028,00, 0,100711388098), (2029,00, 0,100269793149), (2030,00, 0,100100392764)
Sales_Growth_Rate_Policy	IF "Sales_Policy_(Switch)"=1 THEN "Sales_Growth_Rate_(Policy_1)" ELSE IF "Sales_Policy_(Switch)"=2 THEN "Sales_Growth_Rate_(Policy_2)" ELSE "Sales_Growth_Rate_(Policy_3)"
"Sales_Policy_(Switch)"	2
Stock_Turnover	45
Tax_Amount	Profit_Before_Tax*0,22
Time_Interval	GRAPH(TIME) Points: (2010,00, 2010,00), (2011,00, 2011,00), (2012,00, 2012,00), (2013,00, 2013,00), (2014,00, 2014,00), (2015,00, 2015,00), (2016,00, 2016,00), (2017,00, 2017,00), (2018,00, 2018,00), (2019,00, 2019,00), (2020,00, 2020,00), (2021,00, 2021,00), (2022,00, 2022,00), (2023,00, 2023,00), (2024,00, 2024,00), (2025,00, 2025,00), (2026,00, 2026,00), (2027,00, 2027,00), (2028,00, 2028,00), (2029,00, 2029,00), (2030,00, 2030,00)
"Total_(Liabilities_+_Owner's_Equity) _Growth_Rate"	0,13