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Bank Millennium SA Capital Group Valuation: An Application of Equity Models

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Master in Finance

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BUSINESS
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Department of Finance

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Abstract

The main purpose of this project is to conclude which valuation model is more appropriate to value Bank Millennium so that it can be used in the future to decide whether invest or not in the bank.

To conclude about which model is more appropriate to value the bank, the difference between the theoretical and market value is computed: the smallest the difference, the more appropriate the model is.

The valuation approaches to be used are FCFE, Residual Income (RI), Bond Pricing and Relative Valuation.

It can be concluded that the most appropriate model to value Bank Millennium is Relative Valuation considering a combination of 2-year forward-looking PBV and PS ratios. Following this model, it can be concluded that Bank Millennium' shares at the end of the year 2020 were slightly undervalued.

The disregard of ESG issues, the assumptions made and the normal market trading may explain the differences obtained between theoretical and market share.

To proceed with the Bank Millennium valuation, the data needed are 2018 up to 2020 Consolidated Financial Statements and Annual Report. To run the DCF valuation, the starting point is the estimation of the next 5 years cash flows, considering several assumptions. To get the final value of the bank, it is needed to estimate the appropriate cost of capital (using CAPM) and then discount the cash flows to get the present value. To pursue Relative Valuation it is needed to decide the peer group and obtain information to compute the multiples.

Key words: Valuation, Banking, Discounted Cash Flow (DCF), Free Cash Flow to Equity (FCFF), Bank Millennium, Residual Income (RI), Bond Pricing, Relative Valuation

JEL: G21; G32

Resumo

O principal objetivo deste projeto é concluir qual é o modelo de avaliação mais adequado para avaliar adequadamente o Bank Millennium, de forma a que esse modelo possa ser utilizado no futuro para investidores decidirem se investem ou não no banco.

Para concluir sobre qual é o modelo mais apropriado para avaliar o banco, analisa-se a diferença entre o valor teórico e de mercado: quanto menor a diferença, melhor é o modelo.

Os modelos de avaliação a serem utilizadas são FCFE, Residual Income (RI), Bond Pricing e Avaliação Relativa.

Conclui-se que o modelo mais apropriado para avaliar o Bank Millennium é a Avaliação Relativa considerando uma combinação dos rácios PBV e PS previstos dos próximos 2 anos. Seguindo este modelo, concluí-se que as ações do Bank Millennium no final do ano de 2020 estão ligeiramente subvalorizadas.

A desconsideração de questões ESG, os pressupostos assumidos e a negociação normal no mercado podem explicar as diferenças obtidas entre o valor teórico e de mercado de cada ação.

Para proceder à avaliação do Bank Millennium, os dados necessários são as Demonstrações Financeiras e o Relatório de Contas consolidadas de 2018 a 2020. O ponto de partida é a estimativa dos cash flows dos próximos 5 anos, considerando vários pressupostos. Para obter o valor final do banco, é necessário estimar o custo de capital adequado (usando o CAPM) e descontar os cash flows para obter o valor atual.

Para seguir a Avaliação Relativa é necessário escolher os pares, recolher informação e calcular os múltiplos.

Palavras-Chave: Avaliação, Banco, Discounted Cash Flow (DCF), Free Cash Flow to Equity (FCFF), Bank Millennium, Residual Income (RI), Bond Pricing, Avaliação Relativa

JEL: G21; G32

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Glossary and Abbreviations

APR – Annual Percentage Rate

AT 1 – Additional Tier 1

ATM – Automated Teller Machine

BCBS – Basel Committee on Banking Supervision

BGF/BFG – Bank Guarantee Fund

BGK – Bank Gospodarstwa Krajowego

BS – Balance Sheet

Capex – Capital Expenditures

CAPM – Capital Asset Pricing Model

CET 1 – Common Tier 1

CHF – Suisse Franc

CJEU – Court of Justice of the European Union

CRD IV – Capital Requirements Directive

CRP – Country Risk Premium

CRR – Capital Requirements Regulation

DCF – Discounted Cash Flow

DDM – Dividend Discount Model

EBA – European Banking Authority

ECB – Europen Central Bank

ECF – Equity Cash Flow

EIB – European Investment Bank

ESG – Environment, Social and Governance

EU – European Union

FCFE – Free Cash Flow for the Equity

FSC/KSF – Financial Stability Committee

FX – Forex

GDP – Gross Domestic Product

GGM – Gordon Growth Model

IMF – International Monetary Fund

IT – Information Technology

KNF – Polish Financial Supervision Authority

LtD – Loans-to-Deposit Ratio

NAV – Net Adjusted Value of Assets

NBP – Narodowy Bank Polski – National Bank of Poland

NPL – Non-Performing Loan Ratio

NPV – Net Present Value

OCI – Other Comprehensive Income

P&L – Profit and Loss/Income Statement

P/Deposits – Price/Deposits Ratio

PBV – Price/Book Value Ratio

PER – Price/Earnings Ratio

PFR – Polski Fundusz Rozwoju/ Polish Development Fund

PFSA/KNF – Polish Financial Supervision Authority

PLN – Zloty

PS – Price/Sales Ratio

RI – Residual Income Model

ROA – Returns on Assets

ROE – Return on Equity

RWA – Risk-Weighted Assets

TCR – Total Capital Ratio

TV – Terminal Value

US – United States of America

WC – Working Capital

WSE – Warsaw Stock Exchange

WIBOR – Warsaw Interbank Offered Rate

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1. Introduction

Valuation is considered the core of Finance by Damodaran (2006). Valuation plays an important role in every area of finance, providing significant information to sustain financial decisions. When thinking about valuing a bank, Copeland *et al.* (2000) states that it is difficult to do so because of the specific characteristics of the banking system.

Despite the difficulties, the importance of valuing a bank is undoubted: as Schildbach (2012) notices, a country's stability strongly depends on banks because of their ability to provide capital for firms and individuals. So that, it is important to identify frameworks that allow valuing a bank properly. However, there is little consensus regarding which model is more appropriate to value a bank which might be problematic to someone who wants to invest in a bank.

This project aims to provide an additional study regarding which model is more suitable to value a bank. The main purpose of this project is to conclude which valuation model is more appropriate to value a bank so that it can be used to decide whether invest or not in the bank.

Notices that this valuation process was performed using data of 2020 which was an uneven year. If a model is capable to capture the bank's value in an abnormal year, it is expected that it continues to be acceptable under a stable scenario. To decide if a model is appropriate, it was compared the average share market price in December of 2020 with the fair value obtained with each valuation model.

The bank to be valued is Bank Millennium SA Capital Group (hereby referred to as Bank Millennium). Bank Millennium is the principal firm of the group (with 99% of consolidated accounting figures).

Bank Millennium is 50,1% owned by Millennium BCP, which means that the results of the bank will affect the biggest private bank in Portugal (and the only publicly traded bank in the Portuguese stock index (PSI-20)). Also, Poland has been demonstrating great growth rates in recent years (around 5% per year) which may attract more investment in the country. These two aspects were considered in the choice of Bank Millennium to pursue the valuation. For this last reason, and believing that more investors will emerge to invest in Poland (and specifically in Bank Millennium), it is important to conclude about which model investors can trust to decide whether to invest in the bank or not.

Bank Millennium is a modern commercial bank that provides several electronic services banking. The bank has around 7% market share in Poland and it is a universal digital bank, which offers its services to all market segments via electronic banking.

This project aims to find the answer to three questions:

1) Which model is more appropriate to reflect the Bank Millennium value per share?
2) Which are the possible reasons to justify the differences between the stock market price and the price obtained with each model?
3) Bank Millennium shares are under, over or fairly price at the end of 2020?

To pursue the valuation process, this project can be split into 6 chapters:

- Literature review: This project starts by understanding the differences between a financial and a non-financial services firm and how these differences impact the valuation process. Then, previous discussions about valuation models and if the models are appropriate to value a bank or not are analysed. Considering previous studies done, it was decided to pursue the valuation using the Free Cash Flow to Equity (FCFE), the Residual Income Model (RI), Bond Pricing Model proposed by Hrdý (2018) and Relative Valuation. Then, the chosen models are presented.
- Polish Environment: The main characteristics of Poland and its financial sector are presented considering the changes and impacts caused by Covid-19, which allow to obtain an overview of the Polish environment during 2020.
- Bank Millennium: An overview of the bank's characteristics and performance is made so that the reader can get a good perception of the bank.
- Methodology: This chapter describes the methodologies to be used to run the valuation of Bank Millennium and the data needed.
- Assumptions: To pursue the valuation process it is needed to establish assumptions to forecast the next 5 years Balance Sheet and Profit and Loss Statement to apply discounted cash-flow models. Assumptions may be based on historical growth rates of the bank, correlation analysis between accounting figures and macroeconomic indicators or estimations.
- Valuation: At this point, valuation models are ready to be applied to access the fair value of Bank Millennium per share. Throughout this chapter is presented possible reasons why a specific model leads to a different value from the observed one in the market.
- Comparison and conclusions: Since it is obtained the fair value of Bank Millennium according to each model, the results can be compared to conclude which one is more appropriate to capture the market value of the bank, i.e, which model should an investor trust to rely on his/her investment decision.

2. Literature review

2.1. Valuation

"Valuation can be considered the heart of Finance", states Damodaran (2006). Valuation plays an important role in every area of finance: i) in corporate finance when the management board wants to identify the value of the firm to make decisions regarding investments, financing and dividends policies, ii) in portfolio management, a robust equity analysis is crucial to find good opportunities to sell/buy assets to make profit in the future, and iii) to analyse whether the market is efficient or not, it can be computed the theoretical value and compare to what is currently observed (Damodaran, 2006).

According to Damodaran (2002), there are three main approaches to pursue a corporate valuation: Discounted Cash Flow (DCF)[1], Relative Valuation and Contingent Claim Valuation. However, these models were mainly designed to value non-financial firms. When it comes to financial services firms, there is less consensus regarding which model is better when thinking about the specifics of the banking sector.

2.2. Differences between Financial and Non-Financial Firms

In fact and according to Damodaran (2009), there are four main characteristics of financial services firms that makes the valuation process more challenging:

1) The regulatory constraints – almost all financial services firms operate under heavy regulatory constraints to protect their clients from excessive risk-taking. These regulations can be related to required capital, may focus on what and how much money these firms can invest and can be linked to barriers for new firms to enter the market.

   These constraints are important when thinking about assumptions regarding growth and reinvestment. Common assumptions made regarding both issues, when applied to financial firms, must be analysed to guarantee that regulatory constraints are not violated.

2) Differences in accounting rules play an important role when valuing a financial services firm. Most financial instruments have an active market, and that is why it is common to record an asset's value using its market value rather than its cost. Due to that, when comparing book value ratios from a financial and non-financial firm, it is needed to be aware of these differences once they may lead to significant differences and misunderstandings.

3) Debt and equity have different meanings. According to the author, debt is something to buy and sell and make a profit from it, and not source of capital. Also, defining what is commonly called "debt" for these types of firms is difficult. The author defends that each analyst can decide what to include and exclude from the definition of "debt" (for example, it can be included all short term, or just long term debt, or both) but he notices that such decision may have a little rationale.

[1] DCF approaches include models such as DDM (Dividend Discounted Model), FCFE, ECF and RI. These models will be presented in this section.

4) The estimation of Cash Flows might be difficult. Let's remind of the previously mentioned constraints regarding what and how much these firms can invest; it leads to difficulties when measuring reinvestments needs (both Working Capital (WC) and Capital Expenditures (Capex)). What is commonly called "Capex", for these kinds of firms, is mostly composed by intangible assets and human resources which are often classified as operating expenses in accounting statements and that is why the cash flow statement reports so little regarding Capex and depreciation. Without WC and Capex, it is difficult to estimate the available cash flow. Some analysts try to use other cash flow estimations such as earnings or dividends to avoid the WC or Capex estimation.

These are the main reasons why models which rely on estimations of WC, Capex and debt may be difficult to estimate (such as FCFF, APV and EVA).

2.3. Previous Discussions

Putting all these differences together, Damodaran (2009) concludes that the best way to value a financial services firm is using equity approaches, such as the Dividend Discount Model (DDM), Free Cash Flow for the Equity (FCFE) and use Relative Valuation to confirm the fundamental analysis. The author believes that Relative Valuation may be useful to "double-check" fundamental valuation, this is, Relative Valuation can be used to evaluate the accuracy of the assumptions made during the valuation process: if assumptions are aligned, it is expected that multiples comparison points to the same direction as DCF models. Nevertheless, if the market is systematically over or under-pricing the entire sector, DCF and Relative Valuation can deviate. The author considers that the most adequate multiples when analysing a bank are equity multiples such as Price/Earnings ratios (PER), Price/Book Value ratios (PBV) and Price/Sales ratios (PS).

Another author, Deev (2011), discussed the three main valuation approaches (mentioned before) regarding their application to a bank. The author tried to understand which one would be more appropriate to capture the banking sector-specific characteristics. The author concludes that both FCFE and DDM are acceptable models to value a bank and Relative Valuation is the simplest way to do so. About Contingent Claim Model[2], Deev (2011) argues that it can capture the characteristics of the banking industry, but it does not take into account the regulatory constraints which banks are obliged to, and its computational application may be problematic. As a final remark, the author states that no model is always better than the others because every model has its pros and cons.

Aggelopoulos (2017) published a study aiming to guide how to conduct a bank's valuation. The author argues that banks can be valued using both the FCFE and the Residual Income Model (RI). The author presents the model and he concluded that, theoretically, both models should lead to the same value.

[2] Contingent Claim Valuation uses option pricing fundamentals to assess the value of assets with similar characteristics to options.

Koller *et al.* (2010) present a suggestion to the standard FCFE model so that it can reflect more the bank's value while capturing the specifics of the sector. The authors defend that considering both other comprehensive income and the variation of book value of equity instead of only considering net income is a good adjustment when valuing a bank (as it will be presented later in this chapter).

Hrdý (2018) studied the application of valuation standard models in commercial banks. The author concludes that two combinations can be recommended to value a bank: i) Relative Valuation plus Bond Pricing Model and ii) DDM or FCFE plus Bond Pricing model or Excess return valuation[3]. The author also presents how Bond Pricing model can be applied in a commercial bank and calls attention to the fact that Bond Pricing Model is a static approach, this is, it does not consider future growth and potential.

Deev (2011) and Hrdý (2018) recognize that the DCF approach advantages are its flexibility to incorporate changes and its capacity to consider future expectations regarding performance and risk. However, both authors argue that the DCF model does not entirely capture the specifics characteristics of a bank and both assume that DCF models need several assumptions and inputs to proceed with the valuation. Assumptions are always subjective and mostly they are based on the analyst expertise, leading to a result that is easily manipulated.

Forte *et al.* (2020) studied the use of Relative Valuation in US and European Union banks. The authors showed that the most used multiple is PER. The authors concluded that forward PER outperforms the historical one and two years forward-looking are even more accurate than just one year. Another popular multiple when valuing a bank is Price/Dividends; the authors defend the usage of this multiple because dividends are the most significant cash flow for shareholders. Finally, Forte *et al.* (2020) consider that the more specific multiple to value a bank is a Price/Deposits ratio (P/Deposits) ratio due to the relevance of deposits in a bank's balance sheet and value creation (deposits from other banks and/or from customers). The authors also concluded that P/Deposits from customers is more accurate to apply in a commercial bank, while P/Deposits from other banks is more suitable for investment banks.

Deev (2011) and Koller *et al.* (2010) notice that the biggest advantages of Relative Valuation are its simplicity to use and a few or even no assumptions are needed (unlike DCF models). However, this valuation approach is a snapshot of a moment meaning that it does not account for growth potential and dynamics, being less reliable when used alone. Another possible issue in the use of this approach is that find comparable firms may be difficult and differences in accounting rules may lead to mismatches when interpreting the multiples.

Taking into account the main conclusions of the literature review, the chosen models to pursue the Bank Millennium SA equity valuation are the FCFE (and the adjustments suggested by the authors), RI, Bond Pricing Model and Relative Valuation. The DDM and the P/Dividends multiple were not selected since Bank Millennium has not been distributing dividends. The selected models will be presented next.

[3] Excess returns are returns achieved above the return of a proxy (usually an index or peer group).

2.4. Free Cash Flow to Equity (FCFE)

The FCFE considers the potential dividends: the total amount that could be distributed to shareholders. Damodaran (2002) presents a measure that captures the cash flow available for equity holders after reinvestment needs and debt payments:

$$FCFE = Net\ Income - (Capex - Depreciation) - Change\ in\ non\ cash\ Working\ Capital + (Net\ Debt\ Issued - Debt\ repayments) \quad (1)$$

However, the standard FCFE approach might be difficult to pursue in a financial firm due to the difficulty of WC, Capex and debt estimation (as previously presented). That is why Damodaran (2009) and Hrdý (2018) suggest considering reinvestment needs as the regulatory capital requirements (which are defined by regulatory authorities and constraints future growth):

$$FCFE_{Financial\ Service\ Firm} = Net\ Income - Reinvestment\ in\ Regulatory\ Capital \quad (2)$$

$$Equity\ Value = \sum_{t=1}^{n} \frac{E(FCFE_t)}{(1+k_e)^t}$$

Being:

$E(FCFE_t)$ the expected free cash flow for the period;

K_e the cost of equity; and

g the stable growth rate.

If the firm will operate through perpetuity, it is not possible to estimate the exact value of each future dividend. Gordon and Shapiro (1956) developed a model (called Gordon Growth Model (GGM)) as an attempted to capture the value of the firm as long as the firm is growing stable, which leads to the commonly called Terminal Value (TV). Damodaran (2002) also calls the Gordon model and presents it as:

$$TV_n = \frac{Expected\ FCFE_{n+1}}{k_e - g} \quad (3)$$

Being:

$FCFE_{n+1}$ the perpetual expected free cash flow to equity;

K_e the required rate of return (or cost of equity); and

g the stable growth rate.

Summing up the projections of each year and the TV, the expected equity value will be:

$$Equity\ Value = \sum_{t=1}^{n} \frac{E(FCFE_t)}{(1+k_e)^t} + \frac{TV_n}{(1+k_e)^n}, \qquad where\ TV_n = \frac{E(FCFE_{n+1})}{k_e - g} \quad (4)$$

Relatively to the previous equation (4), what is new here is TV_n which represents the Terminal Value at the end of year n. The main characteristic of this equation is to allow an understanding of an initial period (until t) which is possible to estimate the DPS and then, from period n onwards, a constant growth rate applies.

2.4.1 Equity Cash Flow (ECF)

Regarding the use of FCFE, Koller *et al.* (2010) present a suggestion to the model so that it can reflect more the bank's value, capturing the specifics of the sector. The authors suggest that the best cash flow estimation for the equity shareholders is:

$$ECF_t = NI_t - \Delta E_t + OCI_t \quad (5)$$

Being:

ECF the equity cash flow,

NI the net income,

ΔE_t is the variation of book value of equity,

OCI is other comprehensive income[4].

Then, following the discounted cash flow methodology, it is just discounting the estimated cash flow at the appropriate discount rate and adding the terminal value to estimate the equity value of the firm:

$$Equity\ Value = \sum_{t=1}^{n} \frac{ECF_t}{(1+k_e)^t} + \frac{TV_n}{(1+k_e)^n}, \qquad where\ TV_n = \frac{E(ECF_{n+1})}{k_e - g} \quad (6)$$

The rationale behind this model is that net income (representing the potential earnings available for shareholders) is not cash flow itself. The authors argue that as the bank grows it will need to increase its equity to fulfil minimum capital requirements and maintain a robust position regarding solvency. That is why the authors claim that equity's variations should be removed from potential earnings (net income) because net income is being used to increase equity rather than distributed to shareholders.

2.5. Residual Income Model

According to the Corporate Finance Institute, the Residual Income Valuation relies on the belief that the value of a stock equals the present value of the future residual income discounted at the appropriate cost of equity. Aggelopoulos (2017: 9) presents this valuation model as "the difference between operating

[4] OCI includes unrealized gains and losses on equity or debt investments (such as bonds and hedging derivatives) which are excluded from net income (because of its unrealized situation). OCI is then a potential future income whose result may change until the time it is sold.

profits after taxes and the cost of equity capital employed". The equity capital employed is the previous year's equity value considering the cost of equity (according to CAPM).

The rationale behind this model is similar to the one described above about the ECF: the residual amount that can be distributed to shareholders will be the net income less the investment done in equity capital. The model is expressed as:

$$Cost\ of\ Equity\ employed_n = Equity\ Capital_{n-1} * Cost\ of\ equity_n \quad (7)$$

$$Residual\ Income_n = Net\ Income_n - Cost\ of\ equity\ employed_n \quad (8)$$

Recalling what was said regarding the cost of equity, growth rate and TV, the equity value is computed as:

$$Equity\ value = \sum_{i=1}^{n} \frac{Residual\ Income_t}{(1+k_e)^t} + \frac{TV_n}{(1+k_e)^n}, where\ TV_n = \frac{Residual\ Income_{n+1}}{k_e - g} \quad (9)$$

Being:

Residual Income the expected residual income of the period;

K_e the required rate of return (or cost of equity); and

g the stable growth rate.

Notice that the author considers the equity capital as being a percentage (Tier 1) of the total RWA. Aggelopoulos (2017) considers the RWA as a percentage of due for banks, loans and securities as follows:

RWA and Regulatory Capital Computation:	
Due for Banks	20%
Loans	75%
Secutiries, Investments and trading assets	100%
Total RWA	**X**
Tier 1	6%
Regulatory Capital	**X*6%**

Exhibit 2.1 - Weights considers in RWA Residual Income

2.6. Bond Pricing Model proposed by Hrdý (2018)

Hrdý (2018) first considered the idea previously presented by Massari *et al.* (2014), where the authors argue that a commercial bank should be valued by splitting its different businesses and then sum up altogether. Departing from this idea and adding fundamentals of Bond Pricing Models, Hrdý (2018) suggests that the best way to value a bank is to use a model such as:

$$Market\ Value\ (MV) = \frac{ROE}{k_e} * NAV \quad (10)$$

Being:

NAV the adjusted net value of assets, which is the market value of assets less market value of liabilities;
K_e the required rate of return (or cost of equity); and
ROE the return on equity.

This model is easy to apply and needs few inputs. However, it does not consider future potential and dynamics: it is a static model. The author argues that this model is mainly suitable for commercial banks. His conclusion is that the best way to value a bank is to mix approaches as stated in the beginning: i) Relative Valuation plus Bond Pricing Model and ii) DDM or FCFE plus Bond Pricing model or Excess return valuation.

2.7. Relative Valuation

All mentioned authors before defend that Relative Valuation is a common, simple, and useful approach when valuing a bank. As stated before, the most used equity multiples are PER, PBV and PS ratios.

This approach determines the bank equity value as a function of a multiple (usually a ratio) and the average market (peers) price: it consists of using market data from the peer group to compare the group with the firm being valued. Notice that the relationship between the ratio and the equity value is crucial to the valuation' accuracy. Relative valuation operates under the assumptions that the stock market is correct (assuming market efficiency), the selected peers are directly comparable and the relationship between multiples and value is linear.

Relative Valuation is useful to "double-check" fundamental valuation, this is, if assumptions are aligned, it is expected that multiples point in the same direction as DCF. Also, Relative Valuation is a snapshot of the firm in a specific moment while fundamental valuation considers the dynamics (risk and growth) in the long-run approach. Relative Valuation is an appropriate tool as an auxiliary function to fundamental valuation, but its isolated usage may lead to a poor valuation process.

The steps to carry out the Relative Valuation approach are 1) identification of the peer group or the comparable firm, 2) definition of the multiples to use and 3) adjustment of multiples.

A comparable firm (or peer group if more than one firm) should be one with similar growth rates and risk profile as the firm to be valued (Damodaran, 2006).

The author recognizes the importance of the choice of comparable firms, being such a choice crucial for the assessment. Usually, a comparable firm is one in the same activity sector (since it is expected to have the same risk and growth as the firm being valued). However, some analysts argue that what matters is the comparability and not necessarily belonging to the same sector.

When using a peer group, the author points out the fact that it captures the average of the group, but the accuracy of Relative Valuation may be weaker due to the diversity effect within the group.

Due to the specific characteristics of banking activity, it is common to use specific multiples in this sector (as P/Deposits). However, as Damodaran (2006) states, it is needed to be aware that specific multiples may lead to persistent over or under valuations.

With that said, the chosen multiples to conduct the Bank Millennium SA equity valuation are the PER, PBV, PS and P/Deposits.

When finishing the multiple analysis, it is possible to reach very different values. To avoid such case, Damodaran (2006) defends that using harmonic means gives better estimates for the peer group than arithmetic ones.

Multiples Interpretation:

PER measures the share price of the firm related to its earnings. A firm with a high PER means that the share price is high or investors are expecting that the firm has a high growth rate period. Noticed that PER has no meaning if the firm is losing money.

PBV ratio measures the share price concerning the book value of the firm. This ratio is usually analysed by investors when they want to identify profitable investments. PBV ratio under 1 is considered a good investment within the market analysts.

Analysts consider a PS ratio between one and two as good and below one is considered excellent. A PS ratio below one means that investors are paying less than 1 monetary unit per 1 monetary unit of the company's sales.

P/Deposits ratio is related to the LtD ratio (exists a strong positive correlation of 0,96 between them). LtD measures the bank's liquidity (Rengasamy, 2014) and the ideal LtD ratio is between 80% to 90%, according to the Investopedia website. A LtD ratio of 1 means that the bank is converting 100% of the amount of its deposits into loans.

2.8. Cost of equity - CAPM

The appropriate discount rate to run DCF models is the cost of equity since this project aims to assess the equity value[5]: the cost of equity reflects the financial return that investors who invested in the firm are expecting to receive in the future.

Usually, the cost of equity is computed using the CAPM (Capital Asset Pricing Model) as Aggelopoulos (2017) and Koller *et al.* (2010) state. The required rate of return is computed as:

$$E(R_i) = rf + \beta_i * \left[E(R_m - r_f)\right] + CRP \quad (11)$$

Being:

$E(R_i)$ the Expected Return on asset i;

R_f the risk-free rate;

[5] If the objective was to assess the Enterprise Value, the most accurate discount rate should be one that reflects the cost of capital, usually computed using a WACC approach (Damodaran, 2002).

β_i the Levered beta;

R_m - r_f the equity risk premium; and

CRP the Country risk premium.

The CRP refers to the difference between invest in a more stable country and invest in a country with higher interest rates risk. According to the official website of Damodaran, the CRP can be estimated by considering the difference between the government bonds' yield of a AAA credit rating country and the government bonds's yield of the country being analysed (both have to be expressed in the same currency) as follows:

$$CRP\ (X) = \ AAA\ Country\ Yield - \ \ X\ Country\ Yield \tag{12}$$

Being:

AAA Country yield the government bonds' yield of a AAA credit rating country

X Country yield the government bonds' yield of the country being analysed.

CRP was an adjustment that Koller *et al*. (2010) suggest to better capture the specific risk of the country where the firm being valued belongs.

Damodaran (2002) and Koller *et al.* (2010) suggest using a 10-year government bond (of the country where the firm has most of its operation) as the best proxy for the risk-free rate since it is the most reliable risk-free rate in the market. The equity risk premium (the excess return over the risk-free rate gained when investing in a stock as a compensation for the additional risk) depends upon the return of the market that the company belongs to, which may be difficult to estimate or find an accurate proxy, that is why Koller *et al*. (2010) suggest using historical returns and extrapolate them. According to the same authors, the beta reflects the incremental risk when investing in a specific firm; the beta measures the sensitivity of a company's stock when there are fluctuations in the market. Damodaran (2002) suggests estimating the beta as:

$$\beta = \frac{COV\ (R_e, R_m)}{\sigma^2{}_{R(m)}} \tag{13}$$

Being:

R_e the required return (cost of equity);

R_m the return of the market portfolio; and

$\sigma^2{}_{R(m)}$ the variance of the market portfolio.

As a final remark regarding the cost of equity estimation, Damodaran (2002, 2009) notices that it should be used an average beta when the firm has different businesses to capture the risk of each one; however, when it comes to a large and mature bank, it is usual to assume the beta as one: which means that if the equity risk premium increases by 1%, the cost of equity is expected to increase by 1%, on average.

2.9. Gordon Growth Model (GGM) – Perpetual Growth Rate (g)

Synthesizing what was said about the perpetual growth estimation, Gordon and Shapiro (1956) developed a model to capture the value of the firm as long as the firm is growing stable:

$$Current\ Stock\ Price = \frac{E(DPS_{n+1})}{k_e - g} \quad (14)$$

Being:

$E(DPS_{n+1})$ the expected dividends for the next period;

K_e the cost of equity; and

g the stable growth rate.

Any assumption regarding the perpetuity has a significant impact on the valuation process due to the weight of the TV in the valuation (Damodaran, 2002).

Some critics of DCF's model focus on the weight that TV has in the valuation, as well as the ease of manipulating TV so that the final result is the one that the analyst desires. However, Damodaran (2002) defends his point of view by saying that the TV's significant weight reflects the expectation of the investor in holding the stock for a long period so that he can sell it in the future and get returns from price appreciation. Damodaran (2002) recalls that a stable growth rate should be less or equal to the expected nominal growth rate in the economy in which the firm operates.

2.10. How does a bank create value?

As Damodaran (2009) states "a bank makes money on the spread between the interest it pays to those from whom it raises funds and the interest it charges those who borrow from it, and from other services it offers its depositors and its lenders". Rengasamy (2014) also notes that loans and deposits (and the associated spread) are the primary sources of profitability of a bank.

However, according to the Corporate Finance Institute, a bank can make money from interest, trading and fees/commissions income.

Interest income is generated from the difference between funds from costumer's deposits and funds provided to customers through loans such as mortgages, credit cards and corporate loans. Fees are charged for services such as transaction advisory, managing investment assets, securities brokerage, and many others. Trading income is generated from trading financial instruments such as equity stocks, bonds, foreign exchange and exotic financial products. There is also other income generated from several activities such as insurance, real estate development and others.

3. Sector Analysis-Economic Environment

3.1. World

2020 was heavily affected by the Covid-19 virus. The spread of the virus caused a lot of changes in almost all industries, including the banking sector, around the world. Due to the lockdown, several economic activities were obliged to stop their operation, driven by sanitary restrictions imposed. On other hand, families saw their income reduced as well as their confidence, which led to a reduction in household consumption and investment and the increase in liquidity needs. According to the World Economic Outlook Update of International Monetary Fund (IMF) in January 2021, the Covid-19 pandemic caused the world economy to contract by 3.5% in 2020.

When analysing the Euro Stoxx Europe 600 banks[6], the index decreased 24.6% in 2020. Although both the world stock index and the banking stock index have fallen, the recovery of the banking stock index was slower. This behaviour points to the conclusion previously presented in the study done by Demirguc-Kunt in 2020: the banking system has played a crucial role in absorbing the shock of Covid-19 (by suppling liquidity to the corporate sector and households). Exhibit 3.1 below shows the evolution of the world and banking sector stock index during and after the first impact of Covid-19:

Exhibit 3.1 - World and Banking Stock Index Evolution
Source: 2020 Annual Report of Millennium BCP
Unit: Percentage

3.2. Poland and the European Union

Poland joined the European Union (EU) in 2004 but the country did not join immediately the euro area, maintaining its local currency, the Zloty (PLN). Poland does not have a target date but aims to adopt the euro as soon as possible.

Due to the Covid-19, according to a first estimation made by the ECB (European Central Bank) in the Eurostat News Release Euro Indicators in February 2021, the GDP fell by 6.4% in the EU in 2020. Even during the 2007 Financial Crisis, the GDP was never so low as the one observed in 2020. Comparing the GDP growth rate of 2018 and 2019 of the world, EU and Poland economies it can be concluded that Poland has been growing around 5% per year which is much more than the world or EU growth. Even

[6] Stoxx Europe 600 Banks is an index composed by several European banks. The index's evolution provides an overview of the banking sector behaviour and performance.

in 2020, the fall in Polish GDP was not so significant as first expected: while the EU fell by 6.4%, Poland declined just 2.7%. Exhibit 3.2 below summarizes the GDP growth rates evolution:

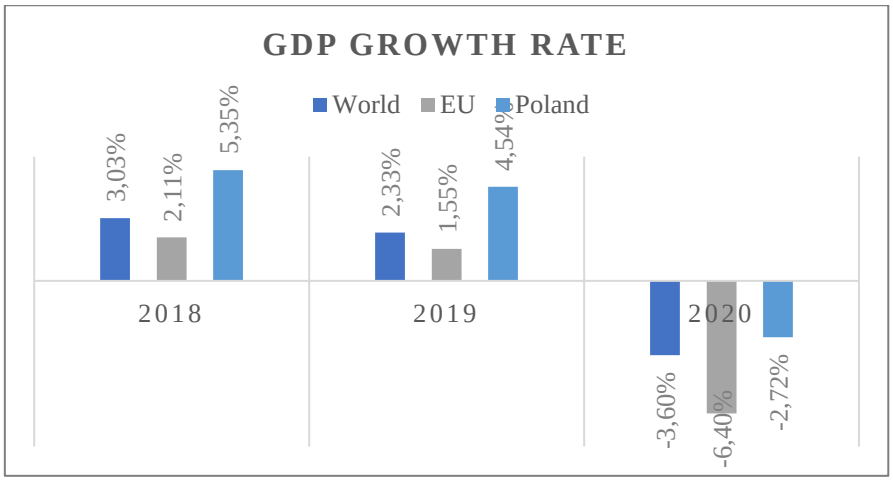

Exhibit 3.2 - World, EU and Poland GDP Growth Rate Comparison
Source: IMF, ECB and World Bank
Unit: Percentage

3.3. Poland Economy

According to the official website of Santander about the Poland Economy (March 2021), Poland is considered the largest economy in central and eastern Europe. The Polish economy has several strengths as its capacity to use resources from the European funds efficiently, its resilient banking system and its strategic position between eastern and western Europe (and Russia). On other hand, Poland has a strict labour law, poor infrastructures and a heavy fiscal framework. Poland has around 38 million people, according to the IMF latest report in April 2021.

Poland is self-sufficient in terms of food supply, but agriculture contributes only 2.3% to GDP (according to the World Bank)), while the industrial sector contributes 28.6% to GDP. The tertiary sector represents 57.6% of GDP. The services' sector has been growing in recent years, especially those covering financial services, logistics and information technology. As noticed before, the percentual change of Poland's GDP was around -2.72% compared with the prior year. IMF estimated that the recovery of the Polish GDP will be fast (within 1, 1.5 years) as shown in Exhibit 3.3 below:

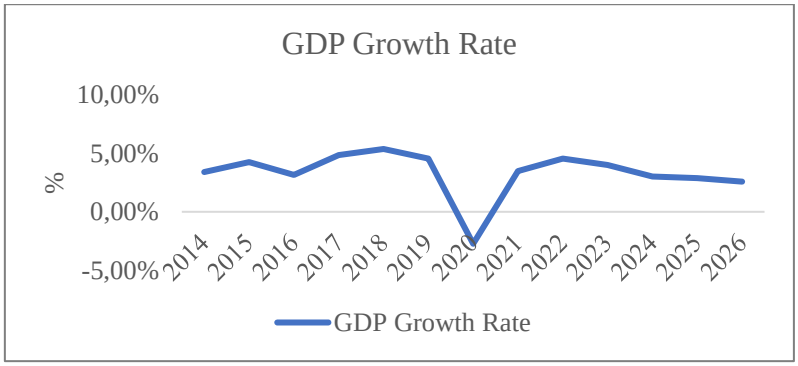

Exhibit 3.3 - Polish GDP Growth rate
Source: IMF
Unit: Percentage

According to the Statista website, the unemployment rate increased from 5.4% to 6.2% in 2020 (compared with 2019). This is clearly an impact of the Covid-19 that causes companies' profits to decrease and loss of capacity to maintain employees. According to the Country Economy website , the national debt increased to around PLN 1.226bn in 2020, more 21,6% when compared with 2019, being now 57.50% of GDP (in 2019 was 45.60% of GDP). According to Trading Economics, the biggest growth of debt was during the first quarter of 2020, when prudential measures were taken to control the Covid-19 spread.

3.3.1 Characteristics of Polish Banking Sector

According to the Law Reviews Website, in Poland, the biggest 5 banks have around 50% of the total assets of the Polish banking sector.

According to the IMF, the ROE of financial firms decreased around 4% during 2020, when compared with the year-end of 2019. If banks distribute less, it means that they retain more, increasing the equity book value. If equity increases, it is expected that ROE decreases. However, according to the NBP (Narodowy Bank Polski - National Bank of Poland), Covid-19 caused approximately a 50% decline in the banking sector's financial results and profitability in 2020 compared to 2019, having a strong negative impact on the ROE.

On other hand, the ROA (Return on Assets) decreased from 0.7% in 2019 to 0.35% in 2020, as expected: the decrease operational result led to a fall in the ROA ratio, as it can be seen in Exhibit 3.4:

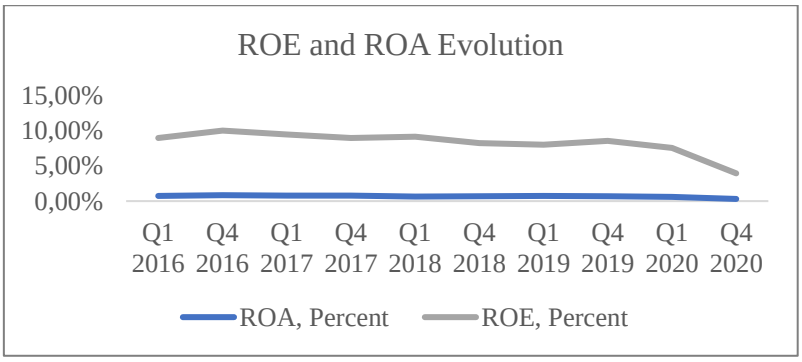

Exhibit 3.4 - ROE and ROA Evolution
Source: IMF
Unit: Percentage

3.3.2 FX Mortgage Loans Swiss Franc (CHF) Issue

Several banks in the Polish financial system (including Bank Millennium) have been reporting provisions to reflect the possible negative outcomes decided in the courts due to the CHF mortgage loans obtained in 2008, according to Econews. The mortgage holders saw their debt climbing due to the appreciation of the Swiss franc against the Zloty. This situation led customers to file lawsuits against the banks alleging that the mortgage contracts contain abusive clauses regarding the nature of indexation, and their primary objective is to annul the mortgage contract or convert the contract into national currency so that they can pay it.

Since 2019, the Court of Justice of the European Union (CJEU) has been ruling in favour of borrowers: CJEU decided that borrowers could ask for the conversion of their loans into national currency. What is missing to close this law battle is the decision of the Poland Supreme Court regarding how this conversion will be done and how clients will be rewarded. The decision has been postponed to May 2021.

With CJEU's decision, banks in Poland started to increase provisions to cover potential future losses due to the conversion or annulment of such loans, resulting in a decrease in net income.

3.4. Narodowy Bank Polski (NBP) – Polish Central Bank

NBP is the central bank of the Republic of Poland. NBP is responsible for the stability of the national currency. According to the official website of NBP, the main objective of NBP is to maintain the inflation rate stable at around 2.5%. The NBP uses several instruments to influence the inflation rate, being the most used the interest rates. The main official interest rates of NBP are the reference rate, the lombard rate and the deposit rate.

The reference rate is the base rate: it is an interest rate benchmark used to set all other interest rates, so that changes in the reference rate will affect others interest rates, being the most relevant interest rate. By changing this rate, the NBP is trying to influence the short-term interest rates in the money market. The lombard rate is the interest rate charged by the central bank when commercial banks borrow from the NBP. The deposit rate reflects the interest that national banks received from the central bank when they constitute deposits.

Analysing the NBP's evolution of the interest rates from 2010 to 2020 (Exhibit 3.5), it can be seen a decrease in the official interest rates since the central bank is trying to targeting an inflation rate of 2.5%: the lower the interest rate, the higher the inflation rate.

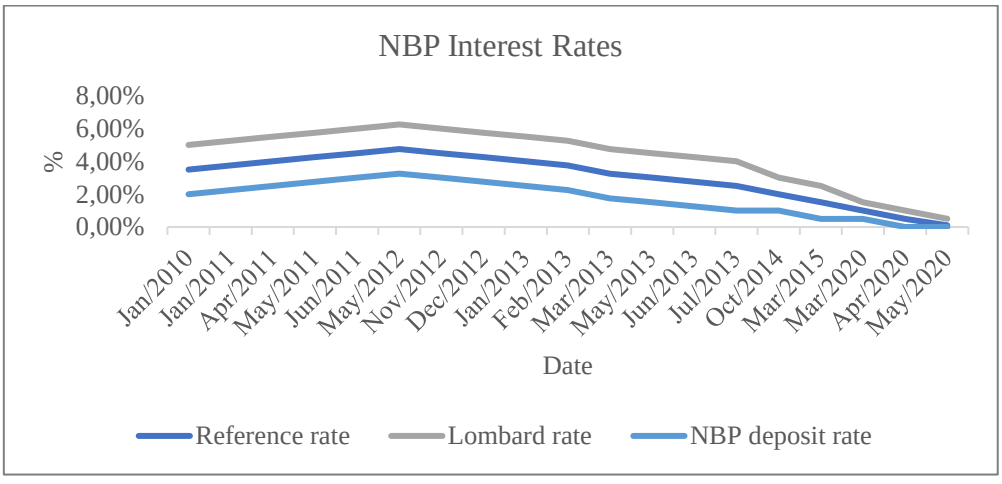

Exhibit 3.5 - NBP Official Interest Rates Evolution
Source: NBP
Unit: Percentage

In general, as interest rates are smaller, more people can borrow more money. The result is that consumers have more money to spend, causing the economy to grow and inflation to increase; and the opposite holds for rising interest rates. Such negative relationship can be seen in Exhibit 3.6 below:

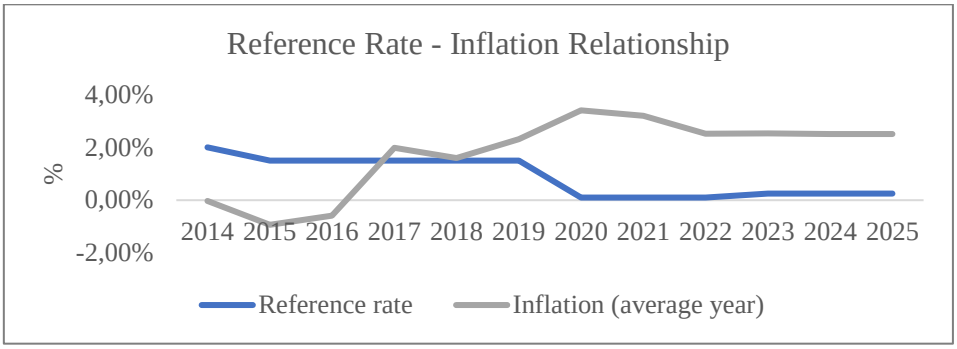

Exhibit 3.6 - Reference and Inflation Rates Relationship
Source: IMF and NBP
Unit: Percentage

In 2020, the inflation rate increased as a result of the decrease in the reference rate by the NBP.

If the central bank charge a higher interest rate, probably banks will borrow from another bank instead of from the central bank. A good measure of how much banks pay for borrowing money is the WIBOR rate (Warsaw Interbank Offered Rate).

WIBOR is based on the interest rates at which a panel of 14 Polish banks (selected by the NBP) borrow funds from one to another. WIBOR is the interest rate benchmark for the majority of zloty-denominated commercial loans and usually customers pay WIBOR rate (often the 1, 3 or 6 months rate) plus a fixed spread, for example, WIBOR+1% (in a floating rate loan contract).

In March 2020, the WIBOR 3 months fell around 1.5%, reaching nearly 0% in July 2020. This means that the interest rates reduction done by the NBP reduced the cost of borrowing from other banks, which was the main objective of NBP: reduce interest rates so that bank's liquidity increases and consequently increase the amount of capital injected into the economy through loans to corporate and individuals.

3.4.1 Regulatory Framework and Polish Banking System

The most important institutions of Poland's Banking System, in addition to NBP, are:

Institution	Name	Polish Name	Responsability
Polish Financial Supervision Authority	PFSA	KNF	State supervision of national financial market
Bank Guarantee Fund	BGF	BFG	Deposit Guarantee and resolution processes
Financial Stability Committee	FSC	KSF	Macro-prudential supervision
Bank Gospodarstwa Krajowego	BGK	BGK	State-owned Bank

Exhibit 3.7 - Polish Banking Sector Institutions
Source: NBP

At the European level, both the PFSA and Polish banks are obliged to follow the guidelines and recommendations of the European Banking Authority (EBA).

3.4.1.1 Regulatory Framework

As Poland is an EU member state, its legal banking system reflects the mandatory regulations within the EU. The Basel II (defined by the Basel Committee on Banking Supervision (BCBS)) was first established in 2007 as a response to the 2007 Global Financial Crisis. The goal was to define regulatory frameworks that can avoid similar effects of the 2007 Crisis.

The Basel III was established in 2010 in response to the 2007 Global Financial Crisis and the subsequent losses in the following years. The main purpose of Basel III was to follow the job initiated in Basel II and improve the capacity of the banking sector to absorbed shocks from a crisis scenario. To do so, Basel III followed the minimum requirements established in Basel II and added a new prudential requirement regarding the capital ratio adequacy – the leverage ratio.

The Basel III were adopted in the EU through a regulation and a directive, respectively the CRR (Capital Requirements Regulation) and CRD IV (Capital Requirements Directive).

BASEL III

The minimum capital ratios under Basel III are summarized in Exhibit 3.8:

Tier 1 (going concern)	Common Equity Tier 1 (CET1)	Sum of common shares (equivalent for non-joint stock companies') and stock surplus, retained earnings, other comprehensive income, qualifying minority interest and regulatory adjustments	CET1 >4.5%
	Additional Tier 1 (AT1)	Sum of capital instruments meeting the criteria for AT1 and related surplus, additional qualifying minority interest and regulatory adjustments	CET1 + AT1 >6%
Tier 2 (gone concern)		Sum of capital instruments meeting the criteria for Tier 2 and related surplus, additional qualifying minority interest, qualifying loan loss provisions and regulatory adjustments	CET1 + AT1 + Tier 2 >8%

Exhibit 3.8 – Capital Ratios Under Basel III Regulation
Source: Executive Summary of BIS (Bank for International Statements) – Basel III

Under Basel III, banks are required to maintain the following minimum required levels: the CET1 should be at least 4.5%, the Tier 1 should be at least 6% and the TCR should be at least 8% (percentages of RWA). CET1 is the kind of capital that absorb losses immediately when they occur (such as retained earnings and other comprehensive income). AT1 also absorbs losses but AT1 instruments (as minority interests) do not meet all criteria of CET1. Tier 2 instruments absorb losses before depositors and general creditors do. Then, the total regulatory capital is the sum of Tier 1 (CET1 + AT1) and Tier 2 Capital.

Additionally, PFSA has made some recommendations to maintain additional funds to cover possible negative outcomes resulting from FX mortgage loans granted to households synthesized in the Pillar II RRE FX buffer. The buffer was set as 3.35% for TCR, 2.52% for Tier 1 and 1.88% for CET 1.

One of the most used indicators to analyse the solvency position of a financial firm is Tier 1: it measures the capital adequacy which ultimately determines the degree of robustness of financial institutions.

According to IMF, Tier 1 ratio has been increasing since 2016, on average, due to the prudential rules implemented under Basel regulation. Exhibit 3.9 presents the ratio for the EU and Poland:

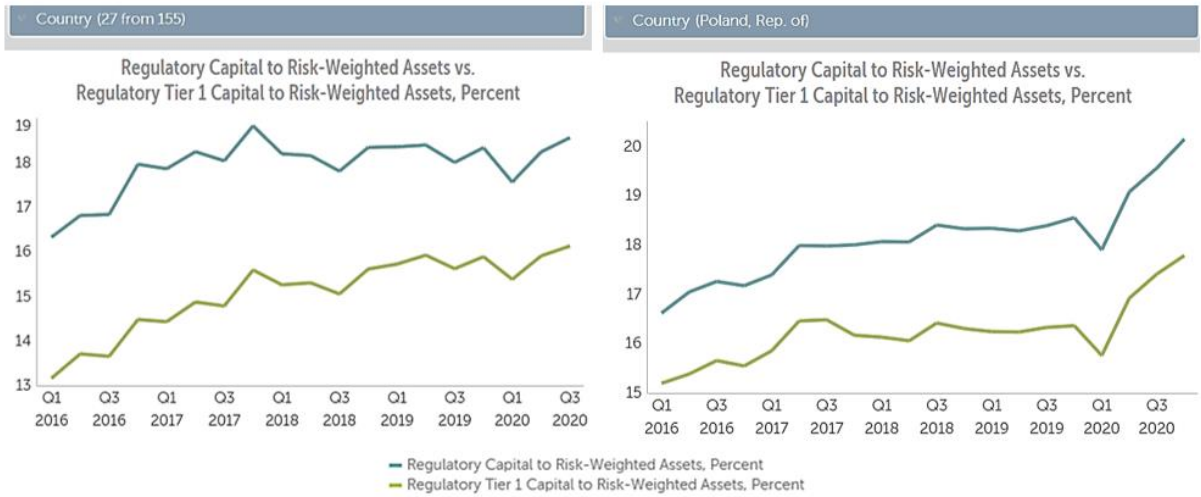

Exhibit 3.9 - Tier 1 Evolution in Poland and EU
Source: IMF

Remind that under CRR the Tier 1 should be at least 6%, and Polish banks have, on average, around 17%. Despite the actual pandemic scenario, due to the prudential rules implemented in the last decade, Polish banks seem better prepared to respond to crises since even in 2020 the Tier 1 ratio was 15.5% (around 9.5% above the minimum ratio).

3.5. Polish measures in response to Covid-19

The NBP and Polish Government responses to Covid-19 focused on helping the economy to absorb the shock of the crisis, keeping borrowing affordable and increasing banks' lending capacity to provide liquidity for firms and families. According to the Our World in Data wesbite, at the end of 2020, Poland registered 1.3 million cases and around 28 thousand deaths (in 2020 the population was approximately 38 million). The spread of the virus was first noticed in October 2020. However, the economy's impact started before with fewer exports, tourism, and transactions with other countries.

Interest Rates' Cut

One of the first measures taken by the NBP was the reduction of the required reserve ratio for banks to 0.5% (less 3% than before) and the increase of the interest rate on this reserve. The objective was to increase the banks' liquidity.

The NBP decided to cut interest rates: the deposit rate became 0% in 2020 (being 0.5% since 2015). The goal was to encourage the increase of loans and advances to customers (instead of deposits in the central bank) to consequently increase the liquidity of the economy. The same rationale applies to the liabilities side: the lombard rate decreased to 0.5% in 2020 (being 2.5% since 2015). If the interest rate paid to the central bank decrease it encourages banks to fund more resources from the central bank. This was the

goal of NBP: makes it cheaper to lend from NBP, so that banks can provide capital to the economy. Exhibit 3.10, summarizes the changes in interest rates:

Date	2020	2015
Reference rate	0,1%	1,5%
Lombard rate	0,5%	2,5%
Deposit rate	0,0%	0,5%

Exhibit 3.10 - Interest Rates change in 2020
Source: NBP

Dividends

The PFSA expressed a recommendation regarding dividends distribution: it recommended to not pay dividends in the first half of 2021 without its authorization, due to the macroeconomic uncertainty caused by Covid-19.

Economic stimulus measures

According to a study done by KPMG about the measures taken due to the Covid-19, another relevant economic measure was related to loans. Consumers were permitted to suspend the repayment of principal and interest instalments of a loan (commonly called moratorium regime) with no interest or other fees charged in respect of the suspension period. The period of the moratorium regime could last up to 3 months. The moratorium regime harmed the profitability of banks, reducing their income.

The access to credit lines and public loans were facilitated to the non-financial sector, to maintain the normal activity of the company, protecting jobs and income. The State will guarantee up to 80% of the credits requested by companies.

The Non-Performing Loan ratio[7] (NPL) in Poland increased, on average, during 2020 because of the uncertainty times due to the Covid-19 virus, as it can be seen in Exhibit 3.11:

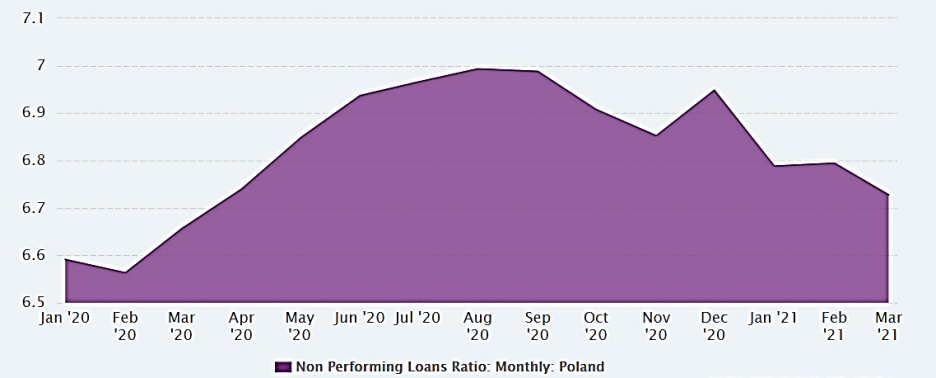

Exhibit 3.11 - NPL Ratio Evolution
Source: CEIC Data. Unit: Percentage

At the beginning of 2020, the ratio was around 6.5% and at year-end, the ratio reached around 7%. Despite the measures taken by the Government to relieve pressure from families and firms (such as the

[7] A loan becomes "non-performing" when there are expectations that the borrower is unlikely to repay the loan or if more than 90 days have passed without the payment of the agreed instalments.

moratorium regime), it is important to recognize that they are increasing their indebtedness and increasing their financial vulnerability in a context of great uncertainty.

4. Bank Millennium

BIG SA (Bank Inicjatyw Gospodarczych) was founded in 1989[8], being one of the first private commercial banks in Poland. In 1992, BIG SA was listed on Warsaw Stock Exchange (WSE). In 2000, Banco Comercial Português (BCP) became the strategic investor of BIG SA and three years later BIG SA changes its name to Bank Millennium. Nowadays, BCP owns 50.1% of Bank Millennium capital. Since 2003, the bank is led by João Brás Jorge, being the actual chairman of the Management Board.

In 2019, Bank Millennium acquired the Euro Bank for approximately PLN 1.8bn. Euro Bank reported PLN 64bn of assets in the 3rd quarter of 2019[9] (comparing with PLN 97bn of Bank Millennium in the same period).

The legal deal took place on 1 October and it was fully completed on 11 November. The acquisition boosted Bank Millennium, allowing a stronger and more competitive position. The number of active retail customers increased from 1.2 million to 2.6 million due to the operation.

In 2020, the number of active retail clients exceeded 2.6 million, of which approximately 2.05 million customers (more 12% than 2019) were using electronic banking actively. The bank has around 700 branches and 7600 employees.

Bank Millennium has been receiving several accolated, recognizing its relevancy in the Polish market. In 2020, it was considered as the Best Digital Bank for Individuals Clients in Poland and one of the TOP10 Most Digitally Advanced Banks in Europe.

Currently and according to the official website, Bank Millennium is "a nationwide modern bank, which offers its services to all market segments via a network of branches, a network of relationship managers as well as electronic banking." Bank Millennium is a universal bank and has around 7% of market share in Poland.

The bank's priority is to make clients' everyday lives easier by offering financial services such as current accounts, investment and saving products, payment cards, loans, and other services such as brokerage, financial advice and leasing.

Bank Millennium is the most important firm of the Bank Millennium SA Capital Group (having 99% of the consolidated asset's value). This project aims to value the group's share price - when referring to just "Bank Millennium" or just "the bank" it is always considered the group. Nowadays, the group is

[8] According to the official website of Bank Millennium. Available at: https://www.bankmillennium.pl/en/about-the-bank/about-the-bank/history

[9] According to an announcement made by Bank Millennium and Euro Bank 9M2019 Results. Available at: https://raportroczny.bankmillennium.pl/2019/en/consolidated/acquisition-of-shares-and-merger-with-euro-bank-s-a/ and https://www.eurobankholdings.gr/-/media/holding/omilos/grafeio-tupou/etairikes-anakoinoseis/2019/3q-2019/3q2019-results-presentation.pdf

composed by several entities, each one specialized in a particular service to offer the best possible service to customers, as it can be seen in Exhibit 4.1:

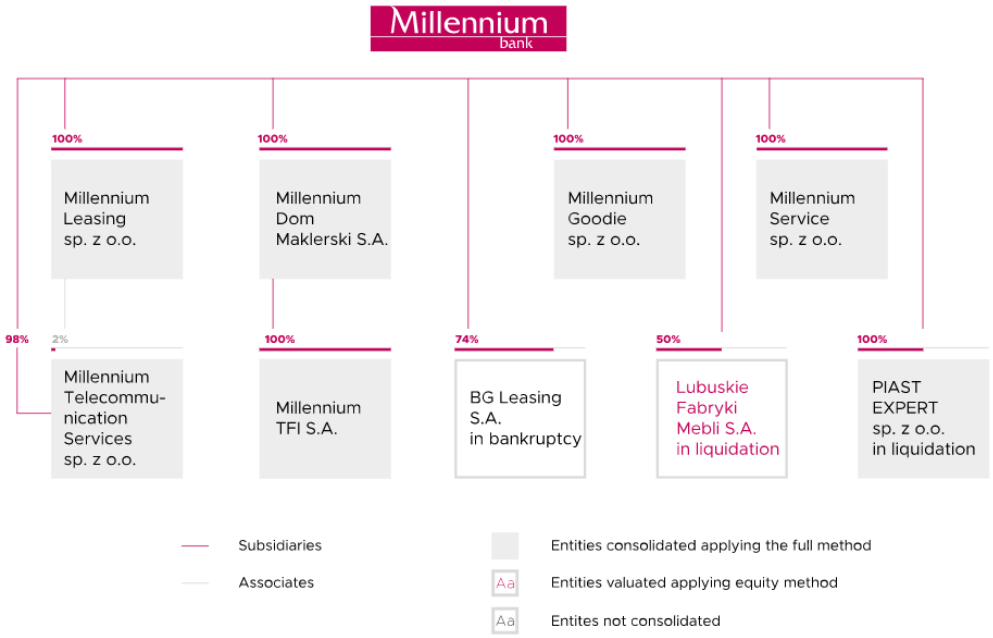

Exhibit 4.1 - Organizational chart of the Bank Millennium Group
Source: Bank Millennium Website

Share Price

Bank Millennium is listed in Warsaw Stock Exchange (WSE) and it is included in several Polish indices (such as WIG, WIG30, mWIG40) and in FTSE4Good Emerging Index FTSE (a member of the London Stock Exchange).

Analysing the evolution of Bank Millennium share's price in WSE between 2018 and the middle of 2019, it can be noticed that the price was relatively stable, around PLN 9. Due to the acquisition of Euro Bank, the share price decrease to approximately PLN 6 in 2019 (due to the premium paid to Euro Bank with internal means of the bank, decreasing the liquidity of the bank and increasing risk which is reflected in the share price), and, in March 2020, the Covid-19 impact was noticed on the share price of the bank. Exhibit 4.2 shows the evolution of the share price:

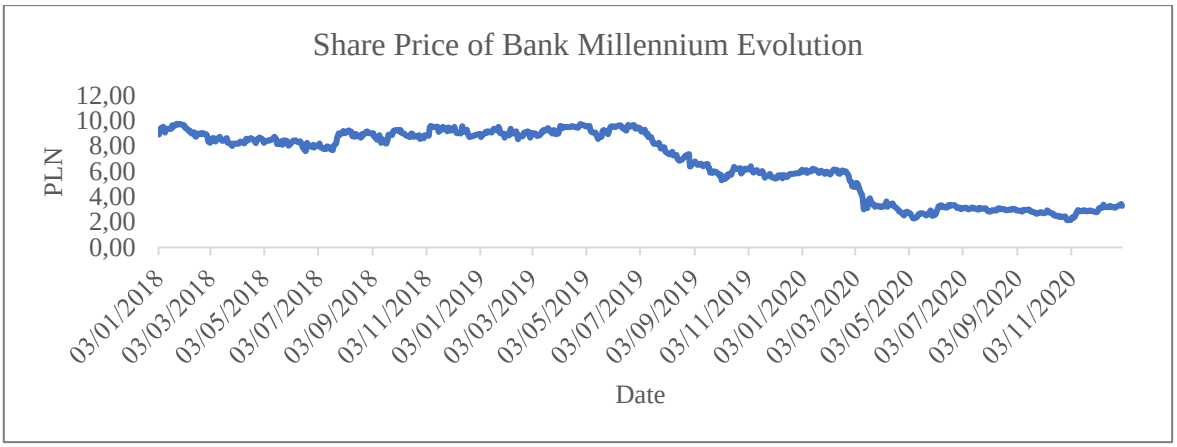

Exhibit 4.2 - Share Price of Bank Millennium Evolution
Source: Bloomberg

2020 was a year strongly influenced by Covid-19 increasing uncertainty and risk. Remind that the main objective of this project is to understand which valuation model better captures the value per share of Bank Millennium. Therefore, the reference share price to be compared with each output from the valuation models is crucial, so it is necessary to have some security about the price to pursue the comparison, this is, that the reference share price was not an accidental value on a given day and that it is the fair value of the share. Accordingly, it was considered that the best share price to be considered should be the average price during December 2020, since the average price of December was quite stable. The average share price of Bank Millennium in December 2020 was approximately PLN 3,15. The share price during December 2020 is in Exhibit 4.3:

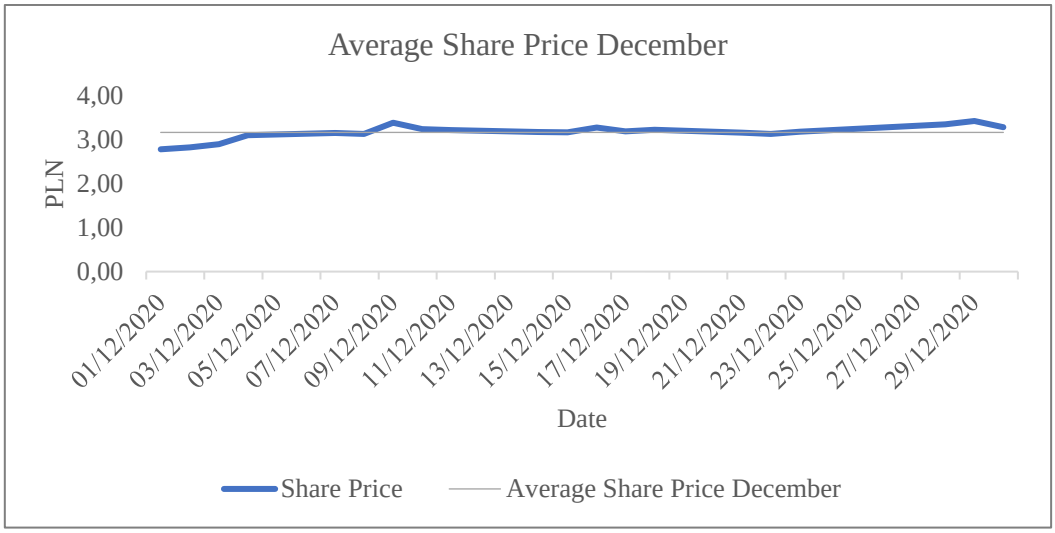

Exhibit 4.3 - Share Price of Bank Millennium December 2020
Source: Bloomberg

Shareholder Structure

The share capital of the Bank Millennium is equal to the Group's share capital and corresponds to PLN 1 213 166 777 divided into 1 213 166 777 shares of PLN 1 par value each.

As previously mentioned, BCP is the principal shareholder, holding 50,1% of the share capital of the bank. Other 3 relevant shareholders hold around 22,45% of Bank Millennium together. Notice that the remaining free-float (shares of a company that can be publicly traded) is 27.45%, being higher than the peers (21.07%[10]).

According to the Corporate Finance Institute, stocks with high free-float are preferred to invest in because such stocks usually show a smaller bid-ask spread, lower volatility and more liquidity due to the availability of shares in the market.

The shareholder structure of the bank can be synthetized in Exhibit 4.4:

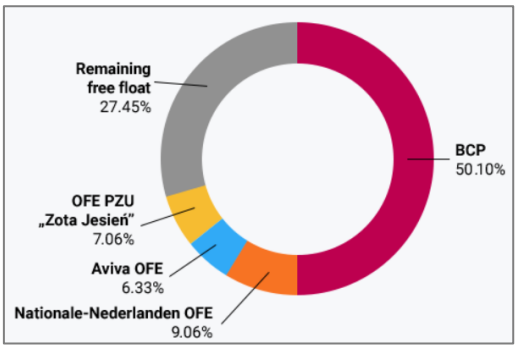

Exhibit 4.4 - Shareholder Structure of Bank Millennium
Source: Bank Millennium Website

Turnover

Share turnover reflects the liquidity of the share: the higher the turnover, the greatest the liquidity. As it can be seen in Exhibit 4.5, in the last 3 years the turnover of the bank shares was approximately 0.11%, on average. During 2020, the turnover was around 0.18%, and, in December, the turnover was around 0.16%. It can be concluded that the turnover did not change significantly.

2018-2020 Average	
Average Price Per Share (PLN)	6,69
Average Volume (Nº Shares)	1 324 221
Nº Shares	1 213 116 777
Share Turnover (%)	0,11%

2020 Average	
Average Price Per Share (PLN)	3,47
Average Volume (Nº Shares)	2 244 265
Nº Shares	1 213 116 777
Share Turnover (%)	0,18%

December 2020 Average	
Average Price Per Share (PLN)	3,15
Average Volume (Nº Shares)	1 945 396
Nº Shares	1 213 116 777
Share Turnover (%)	0,16%

Exhibit 4.5 – Share Turnover Analysis
Source: Bloomberg

[10] In accordance with Alior Bank, BNP Paribas, Bank Handlowy and mBank official websites.

Financial Analysis

The bank has been reporting an annual growth on assets of around 12% in the last 3 years. The main activity of the bank is in Poland and the main source of income is interest income, as it can be noticed in Exhibit 4.6:

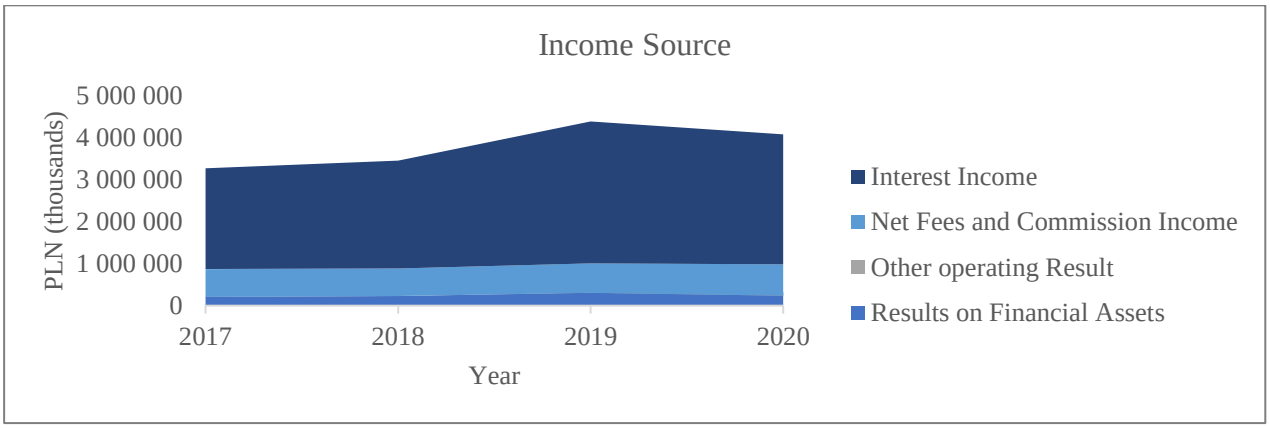

Exhibit 4.6 - Income Sources of Bank Millennium
Source: Annual Reports of Bank Millennium

In 2020, the net income fell around 96% comparing with 2019, reaching approximately PLN 23bn. This result was mainly due to the creation of provisions to face possible negative outcomes from the issue of the FX Loans Mortgage indexed to CHF, as it can be seen in Exhibit 4.7:

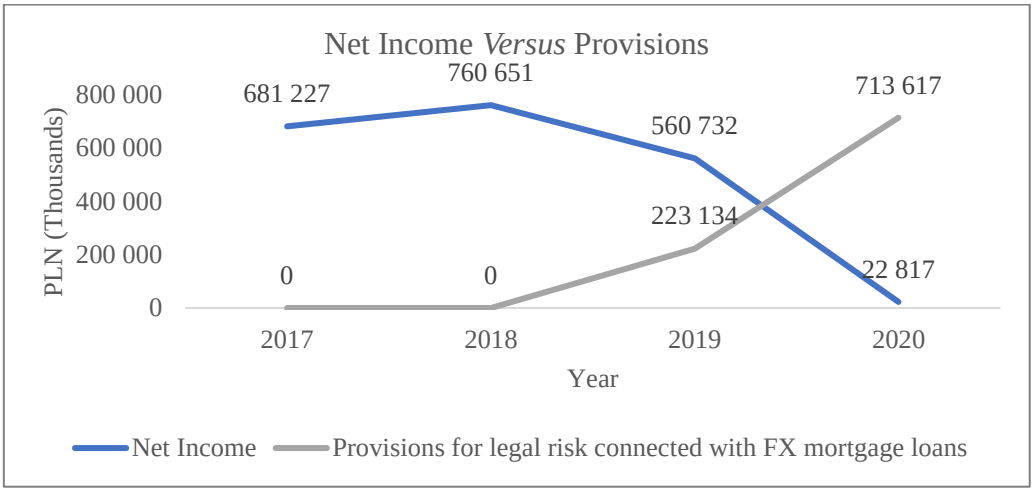

Exhibit 4.7 - Net Income and Provisions Amounts Comparison
Source: Annual Reports of Bank Millennium

<u>Main ratios</u>

It can be concluded that Bank Millennium has a solid financial position and an historical ROE of around 7% (excepting the year 2020). However, the LtD ratio increased significantly in 2020 which means that the bank is increasing its risk. According to the Moody's Rating, Bank Millennium Credit Rating is

classified as A3 (upper-medium grade, being a good bank to invest in). See Exhibit 4.8 below for further details.

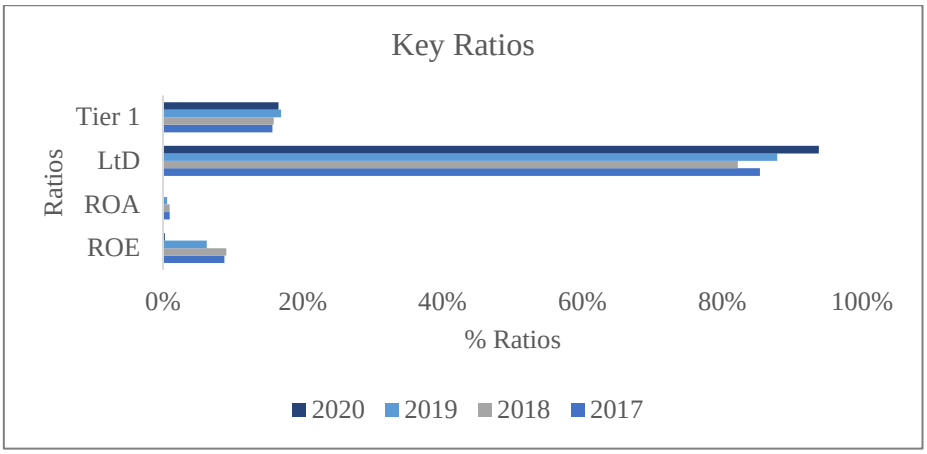

Exhibit 4.8 - Key Ratios of Bank Millennium
Source: Annual Reports of Bank Millennium

Tier 1 minimum required ratio is 6% and Bank Millennium has been reporting around 16% in the last years (even during 2020 which could be expected a higher decreased in the ratio), meaning that the bank has a solid position about solvency. The LtD ratio has been around 85% in the last three years. In 2020, the LtD ratio reached 0.94. Remind that a higher LtD ratio means more risk, which would be expected due to the macroeconomic scenario in 2020.

The ROA of the banking system decreased from 0.7% in 2019 to 0.35% in 2020 and Bank Millennium's ROA decreased from 0.57% in 2019 to 0.02% in 2020, following the pattern of the sector.

The ROE of Bank Millennium decreased from 6.27% in 2019 to 0.25% in 2020 (recall that Covid-19 caused approximately a 50% decline in the banking sector's profitability in 2020 compared to 2019, having a strong negative impact on the ROE, according to the NBP).

5. Methodology

To run the equity analysis of Bank Millennium Group, it is needed to forecast the Balance Sheet and Income Statement for the period under analysis (the next 5 years, until 2025) to apply DCF models.

The first thing to do is collect historical data. It was considered that 4 historical years (from 2017 to 2020) should be enough to capture trends that might be helpful to forecast the next years. To do so, the Annual Consolidated Reports of the Bank Millennium S.A Capital Group from 2017 until 2020 were collected and they can be easily accessed on the official website of the bank (remind that when referring to "Bank Millennium" it is being considered the whole group, since 99% of the accounting figures are due to the bank). Then, it was decided to model both the Balance Sheet and Income Statement, i.e., if the BS and P&L statement are harmonized and simplified to capture the most important issues it might facilitate the valuation process.

It was decided to follow the Bank & Financial Institution Modelling suggested by Breaking Into Wall Street ™ (see Appendix W – Bank & Financial Institution Model). It is a training platform that seeks to provide the trainee with knowledge about financial models so that they can conclude about their investments. This platform is recognized by financial institutions as JPMorganChase, Bank of American, Barclays or Credit Suisse, where BIWS is in use.

After collecting the data and model both BS and P&L statements, the next step is to analyse accounting figures and conclude about drivers, trends and correlations that may exist to help in the forecasting process.

Notice that the last 2 years were years of change in Bank Millennium. In 2019, the acquisition of Euro Bank was concluded and 2020 was strongly affected by the Covid-19 virus and provisions created to face the FX mortgage issue. Due to these significant impacts, when analysing historical data to estimate future expectations it needs to be careful and analyse case by case if any of these variables have a significant impact.

Having the BS and P&L modelled, the next step is to make assumptions (based on correlation analysis, estimations or growth rates) to forecast the BS ad P&L for the next years. Then, it is needed to compute the cost of equity and apply the DCF models presented in the Literature Review chapter.

To pursue the Relative Valuation, it is needed to collect the data from the peers (in their official websites) and compute the multiples for them. The last step is to compare all the results from each valuation model and conclude which is the most accurate model to value Bank Millennium (based on the difference between the model's result and the average market value in December).

6. General Assumptions

To estimate the BS and P&L for the upcoming years it was considered some macroeconomic indicators such as real GDP, Inflation rate, Total Investment, Average Wages and Total Employment. See

Appendix C – Macroeconomic Indicators where it is presented the compiled data considered (collected from the IMF's country report of April 2021 and Trading Economics).

6.1. Balance Sheet Assumptions

Loans and Advances to Customers

Loans and Advances to Customers (or just "loans") is the most relevant asset in the BS statement of Bank Millennium. Loans are the main source of value for the bank and that is why assumptions about them are so important. Notice that the objective is to forecast the gross amount of loans and then allowances for loans losses will be estimated.

The first thing to do is analyse the different exposure that the bank has historically and understand which macroeconomic indicators might be a suitable driver for future estimations. The main categories of credit exposure, according to the category of customers are financial intermediation, industry and construction, wholesale and retail business, transport and communication, public sector, mortgage loans, consumer loans and other sectors.

A historical correlation analysis (of the last 4 years, this is, from 2017 until 2020) between reported exposure to each category and each macroeconomic indicator was made to conclude which macroeconomic indicator is more correlated with each credit segment. To do so, the correlation is computed as:

$$Correlation\ Coefficient\ (x,y) = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2 \sum(y-\bar{y})^2}} \quad (15)$$

Where x and y are the values of the variables and $\bar{x}$ and $\bar{y}$ are the simple average of the values. This is the covariance between the variables divided by the standard deviation of each variable.

Appendix D - Correlation Coefficient Between Credit Segments and Macroeconomic Indicators summarizes the results of the correlation coefficients. The objective is to identify strong linear correlations between variables. Exhibit 6.1 summarizes the conclusions of which macroeconomic indicator is more suitable to forecast each credit segment:

Credit Segment	Criteria to forecast	Corr. Coefficient
Financial intermediation	GDP Growth Rate	0,96
Industry and Construction	Total Investment Growth Rate	0,96
Wholesale and retail business	Average Wages Growth Rate	0,95
Transport and communication	Total Investment Growth Rate	0,92
Public Sector	Average Wages Growth Rate	1,00
Mortgage Loans	Inflation Growth Rate	0,98
Consumer loans	Average Wages Growth Rate	0,94
Others sector	Average Wages Growth Rate	1,00

Exhibit 6.1 - Correlation Coefficient between Credit Segments and Macroeconomic Indicators
Source: Author

It can be concluded that, on average, mortgage loans has a strong positive correlation with inflation levels (with a correlation coefficient of 0,98) which means that if the price level increases it is expected that mortgage loans also increase, and so it is expected that mortgage loans follow the expected growth rate of inflation. The public sector segment has, on average, a perfect negative correlation with average wages. This means that if average wages increase by 1-unit, the public sector segment decreases by 1 unit. Similar conclusions can be done for the others credit segments. See Appendix E – Expected Loan Portfolio to see the expected amounts for each credit segment.

Since the gross amount of loans are estimated for the next upcoming years, it is needed to estimate the allowance for loans losses (impairment losses). To do so, the historical percentage of allowance for credit losses were analysed; on average, Bank Millennium consider 3% of the loan's gross amount to be enough to be protected against credit default. For the next 5 years, the same percentage was considered to estimate allowance's amounts. Notice that even during 2020 (where a higher amount of allowances could be expected) the percentage remains quite constant and that is why the average of the last 4 years was considered as accurate to estimate allowances for loans losses.

Securities

Securities are the major type of assets right after loans in the BS. Securities include mostly non-trading assets, derivatives and financial assets (essentially debt securities) being the last the most significant ones. Debt securities mainly include bonds issued by the State Treasury. A correlation analysis between macroeconomic indicators and securities (as previously done to the loan portfolio) was made. See Appendix F – Expected Securities Amount for the correlation analysis for further details. The conclusion is that the best macroeconomic indicator to estimate securities is the total investment (it has a correlation coefficient of 0.92) and so securities should follow the expected growth rate of total investment.

Tangible and Intangible Assets

Bank Millennium has buildings, equipment and machines (fixed assets) as well as intangible assets as goodwill, patents, licenses and software programs. Bank Millennium had a Strategic Plan covering the period 2018 to 2020. However, due to the Covid-19 impacts in its activity, the Group decided to reformulate the plan and set up a new target period of 2022-2024, being 2021 a year to recover from the pandemic crisis and incorporate the changes that have been taking place in the country and its effects on bank's activity.

The Bank Millennium Group's main objectives are to increase operational efficiency and increase customers in the online segment. In 2020, Bank Millennium registered an increase of 2% in retail clients, reaching 2.63 million clients of which more than 2 million uses the digital services provided by the

bank[11]. The objective of the bank comprises the increase of digital clients to 80% in 2021 (being 76% in 2020). If digital clients increase as expected, it is also expected that investments in software capacity and fixed assets (such as computers and cooling towers) will be necessary. Considering personal judgement and taking into consideration the increase in clients and the desired growth of 10% in total investments (according to Strategic Plan 2022-2024), it was considered that tangible and intangible assets should grow at a 2% stage in the next 5 years.

Liabilities to Customers (Deposits)

On the liabilities' side, the most significant amount concerns deposits to customers: without deposits from firms and individuals the bank has not liquidity to invest in financial assets or provide loans (there is a strong correlation of 98% between loans and deposits). For this reason, the deposits will be estimated through loans.

Analysing the historical Loans-to-Deposit ratio (LtD) of the last 3 years, the LtD ratio has been increasing (0,85 on average). This ratio measures the bank's liquidity and its profitability (Rengasamy, 2014) and it measures how the bank is converting deposits into loans. A ratio of 0,85 means that 85% of the deposit's amount had been converted to loans. A higher ratio means that the bank is converting a great part of its deposit funds into loans which leads to an increase in income (due to the interest rate paid by customers in loan contracts). But a higher LtD ratio means a higher risk due to the increase of exposure to credit and failure in repayment of the loan by the customers.

The ratio has been increasing, reaching its higher value of 0,94 in 2020. Remind that a higher LtD ratio means more risk, which would be expected due to the macroeconomic scenario in 2020. For the next upcoming years, it is expected that uncertainty remains in the economic environment. For this reason, it was considered the LtD ratio of 2020 for the next years to estimate the amount of the deposits (conservative consideration). See Appendix G – Expected Liabilities to Customers (Deposits) for further details.

Long Term Debt

Long term debt includes sale and repurchase agreements, debt securities issued, subordinated debt and derivatives (hedging), being the most significant the subordinated debt (bonds issued). All the debt securities mentioned are very different from each other and that is why it was decided to run a correlation analysis as previously done in loans to customers. See Appendix H – Expected Long Term Debt to have more details and estimated amounts.

The summary of results is presented in exhibit 6.2 below:

[11] According to an announcement done by Millennium BCP, the holding company, on February 2, 2021: https://web3.cmvm.pt/sdi/emitentes/docs/FR78149.pdf

Debt Segment:	Criteria	Corr. Coefficient
Sale and repurchase agreements	Inflation (average of year)	0,98
Debt securities issued	Inflation (average of year)	-0,66
Subordinated debt	Average Wages Growth Rate	0,90
Derivatives - Hedge accounting	Inflation (average of year)	0,98

Exhibit 6.2 - Correlation Coefficient between Debt Segments and Macroeconomic Indicators
Source: Author

It can be concluded that the best estimators for Long Term debt are the average wages growth rate for subordinated debt and the inflation growth rate for the remaining debt segments.

Provisions

Provisions themselves are already a challenge to measure. Provisions are an amount set aside to cover a probable future expense, which exact value is undefined and uncertain. Estimate future provisions are even more blurry and cloudy.

Remind the FX Mortgage Loans in CHF currency issue. Since 2019, CJEU has been deciding in favour of borrowers (allowing them to convert CHF mortgage loans into local currency). CJEU's decisions alarmed the Polish banking system (including Bank Millennium), leading to the creation of more provisions for potential losses.

The rationale to estimate provisions was: if Bank Millennium has 16% of total CHF loans in the banking system under this issue, it will have 16% of total expected costs.

According to a Bloomberg article, the total amount of loans indexed to CHF is around PLN 92bn. The total expected costs that may result to the banking system as a result of the conversion or annulment of such loans is around PLN 34.5bn, according to S&P Global Market Intelligence (March 2021).

The total amount of CHF currency loans in Bank Millennium is around PLN 14.3bn (2020 Annual Report), which corresponds to around 16% of total CHF loans in the banking system. Then, it is expected that Bank Millennium "hold" 16% of the costs, which is around PLN 5.4bn.

Notice that the distribution per year was not equal and different percentage growth rates were considered following a subjective personal judgement. It is expected that in 2021 even more provisions will be created due to the increase of CJEU's decisions in favour of clients. For that reason, it was considered that in 2021 Bank Millennium should increase its provisions by 150%, and +20% in 2022. By 2023, it is expected that this issue will be solved and provisions are expected to return to normal levels. It was considered a decrease of 15%, 60% and 60% in 2023, 2024 and 2025 respectively. See Appendix I – Expected Provisions for further details. Notice that the sum of the expected provisions' amount computed through the expected growth rates leads to a close amount of the total possible provision.

Equity

The shareholder's equity comprises the share capital, common stock, other comprehensive income and retained earnings, being the latter the most significant one. Share capital and common stock will remain

unchanged until 2025. Retained earnings comprise the net income of the last year that was not distributed to shareholders less the reinvestment in regulatory capital made in the year. To get more details about solvency ratios and investments done in regulatory capital see Chapter 6.3 Assumptions on Minimum Requirements Regulation/Solvency.

In the last four years, Bank Millennium has not been paying dividends. It was assumed that in the next upcoming years such decision will be maintained. Other comprehensive income (OCI) includes gains and losses from non-operational activities such as debt securities, actuarial and hedge account gains/losses. OCI includes several and different components and that is why it was considered to estimate OCI following the inverse expected growth rate of GDP (since OCI and GDP as a correlation of -0,84). Notice that Retained Earnings were used to square the BS. See Appendix J – Expected Equity for more details about the estimated amounts.

Central Bank Funds and Deposits

In 2020, both the deposit rate and the lombard rate decreased (as explained before in the Polish measures due Covid-19 chapter). However, since the inflation rate is increasing due to the fall in interest rates, it is expected that the reference rate will increase (to cause a fall in the inflation rate). Lukasz Hardt, a Polish rate-setter, thinks that interest rates should remain until the end of 2022, but he expects that in 2023 the reference rate increase by 0,15%. [12]

Considering the evolution of the inflation rate and the rate-setter judgment, it was considered that up to 2022 the funds to receive from the central bank will grow inversely to the GDP, while central bank resources will follow the GDP projections.

For instance, if GDP grows positively, customers will have more confidence leading to a greater willingness to invest, which may result in a constitution of a loan in the bank. If banks have more loans in their balance sheet, banks may need more resources from the central bank to finance the loans (increasing the resources from the central bank).

By 2023, which is the year of "returning to normal" the relationship inverts: assets will grow at GDP growth expected rate and resources from the central bank will decrease at GDP growth rate, caused by the expected increase in the reference rate.

As a final remark, for estimation purposes, the central bank's accounts (assets and liabilities), deposits with other banks and retained earnings were used to square the balance sheet.

See Appendix A – Historical and Expected Balance Sheet (BS) to analyse final estimations as well as other accounting figures estimations that were not presented here.

[12] Polish central bank should consider 15 bp rate hike, on Reuters on 13 April, 2021. Source: https://www.reuters.com/article/poland-rates-hardt-idUKL8N2M622A

6.2. Income Statement Assumptions

Net interest income (financial margin)

Interest income represents the interest received on loans and mortgages given to customers and funds placed in the central bank. Bank Millennium commonly presents the actual cost of a loan or mortgage contract by expressing the APR (annual percentage rate) instead of the interest rate. APR includes the interest rate, fees, and other possible charges.

When analysing the Bank's website and the annual report, it can be concluded that, on average, APR is 1% more than interest rates. An average of the loans and mortgages APR was done (since they represent the major part of advances to customers) and, to get the interest rate 1% was subtracted. The interest rate received from the central bank fund in 2020 was 0%.

Interest expenses respect interest amounts to be paid to customers and central banks due to deposits on the bank. The average interest rate on client's deposits is around 0.44% and the interest rate paid to the central bank is 0,5%.

By 2023 an increase of 0,15% was considered in all interest rates, remaining until 2025. See Appendix K – Expected Net Interest Income for more details about the interest rates considered.

Net Fees and Commission Income

Net Fees and Commissions result complies commissions paid and received from banking services, insurance activity, brokerage services and asset management. Since banking activity is the most relevant business segment of the Group, it was considered that fees and commissions will be related to the core activity of the Group; that is why it was decided to estimate fees and commissions as a percentage of loans and deposits together. Also, if a simple correlation analysis is performed, it can be concluded that both deposits and loans have a strong positive correlation between net fees and commissions, 0,83 and 0,92 respectively. The historical weight of net fees and commissions over deposits plus loans was computed. Then, the average weight will be maintained for the next years. See Appendix L – Expected Net Fees and Commissions Income for more details.

Provisions Created

It is expected that in 2021 more provisions will be created due to the increase of CJEU's decision and by 2023 this issue is expected to be solved. Until 2022, provisions follow the variation of the provisions considered on the liabilities side of BS.

By 2023 it is expected that the creation of provisions regarding this issue decrease since it is expected to be solved in the meantime. For that reason, it was considered that by 2023 the provisions should decrease around 67% (which was an increase from the previous year) and after that should follow an inverse growth pattern of GDP (if the economic environment is positive, it is expected that fewer

problems arising from the normal activity appear, leading to a decrease in provisions created). See Appendix M – Expected Provisions Created.

Impairment Losses on Financial and Non-Financial Assets

Impairment losses on financial assets represent the losses on loans and securities, while losses on non-financial assets respect to other assets.

To estimate impairment losses on securities, the historical weight of impairment losses on financial and non-financial assets on securities was considered. Then, it was assumed that the average weight of the last 4 years will remain until 2025. To estimate impairment losses on loans it was analysed the historical weight of total impairments over allowance for loan losses. The average weight of the last 4 years was assumed as constant until 2025. See Appendix N – Expected Impairment Losses on Financial and Non-Financial Assets for further details about the computation.

Operating Costs

Operating costs include administrative expenses such as staff costs, advertising costs, IT and communications costs, maintenance of building and ATM costs, legal advisory and others. Operating costs varies in price, dimension and relevance. Due to this variety, it was considered that operating costs should reflect the evolution of prices in the country, this is, should follow the inflation growth rate. Operating costs and inflation correlate 0,89 (positive, strong). See Appendix O – Expected Operating Costs for further details about the computation.

Depreciation and Amortization

Depreciation and amortization costs depend upon investment in fixed and intangible assets. As mentioned before, the business strategy for the next years of the Group was accounted. As expected, the correlation between tangible and intangible assets and depreciation/amortization costs are very strong (+0,98). Depending on the asset class, the depreciation/amortization rate is different. For this reason, to estimate depreciation and amortization cost it was considered the historical weight of these costs in the total amount of tangible and intangible assets. See Appendix P – Expected Depreciation Costs for further details.

Taxes

To estimate taxes, it was considered the average effective tax rate. The effective tax rate is calculated by dividing the tax amount by the Pre-Tax Income. The average historical effective tax rate is 28%.

See Appendix B – Historical and Expected Profit and Loss (P&L) to analysed final as well as other accounting figures estimations that were not presented here.

6.3. Assumptions on Minimum Requirements Regulation/Solvency

As Poland is an EU member state, its legal banking system reflects the Basel III framework. However, due to the issue related to the CHF-indexed mortgage loans, some additional buffers were recommended by KNF being 3.35%, 2.52% and 1.88% respectively for TCR, Tier 1 ratio and CET1 ratio. Pillar II regarding the FX Buffer is expected to decrease as the problem is solved along in the courts. For that reason, it was considered that by 2023 the Pillar II RRE FX Buffer capital minimal requirements will decrease 1% per year until it gets to zero. See Appendix Q1 - Mandatory Capital Ratios to analyse all minimal capital requirements.

To estimate future expectations regarding capital adequacy some assumptions were made.

RWA – Risk-Weighted Assets

First, it was analysed the historical RWA over total assets and its respective growth rate. In 2019 the acquisition of Euro Bank was concluded (which affected the total RWA) and in 2020 the economic uncertainty increased significantly the RWA/Total assets ratios (from 2% to 6%). Taking this into consideration, it was defined that this ratio should follow an inverse GDP growth rate pattern. The rationale behind this assumption is that if the GDP falls (what was experienced in 2020) it is expected that the level of risky assets will increase (due to the inherent market uncertainty). If a simple correlation analysis is performed, it can be stated that the correlation coefficient between GDP and RWA/Assets is -0,98, giving more robustness to the rationale. See Appendix Q2 – RWA Estimation for further details about the calculation.

CET 1, Tier 1 and Total Capital Ratios

To estimate required ratios, the first thing done was to analyse the historical differences between reported ratios and the minimum rate required by Basel III. In 2020 the differences between the reported and required ratios decrease, as a result of an increase in RWA ten times bigger than the increase in CET1 capital. Nevertheless, Bank Millennium reported a TCR of 6.10% higher than the required ratio.

In the next upcoming years, it is expected a strong recovery of the Polish economy. However, it was considered a prudent scenario where the difference between the reported ratios and the minimum required ones will hold constant and equal to the difference reported in 2020, which was 4.63% in CET1 ratio, 5.27% in Tier 1 ratio and 6.10% in Total Capital Ratio.

Due to the impact of Covid-19 and the situation regarding Swiss franc-indexed mortgage loans, there may be a situation of capital or assets decrease to cover possible expenses or obligations. In this way, a prudent scenario was considered concerning capital adequacy ratios, as a new wave of Covid-19 could emerge (since Polish citizens are reticent about the vaccine, according to Deutsche Welle[13]) and possible

[13] Anti-vaccine sentiment rife in Poland, in Deutsche Welle on 31/12/2020. Source: https://www.dw.com/en/anti-vaccine-sentiment-rife-in-poland/a-56100878

compensation to customers affected by loans in Swiss francs may lead to a capital reduction (less retained earnings). See Appendix Q3 – CET 1, Tier 1 and TCR Estimation for further details about the calculation.

Investment in Regulatory Capital: Summary

When analysing both the historical and expected ratios, it can be concluded that minimum required capital ratios are fulfilled, which means that Bank Millennium complies with all minimum regulatory requirements. As a summary of all assumptions above, to compute the reinvestment in regulatory capital it was considered the capital ratios under Basel III plus the Pillar II RRE FX Buffer (Exhibit 6.3).

See Appendix Q4 - Summary of Regulatory Capital for more details about solvency ratios and invested capital.

Total Ratios to Fulfill:	**2020**	**2021 [E]**	**2022 [E]**	**2023 [E]**	**2024 [E]**	**2025 [E]**	**2026 [E]**
Total Ratios to fulfill (Basel + RRE)	29,25%	29,25%	29,25%	26,25%	23,37%	21,85%	
Total Regulatory Capital	14 957 865	16 338 197	18 092 153	17 850 263	17 255 365	17 496 400	17 846 328
Reinvestment	**-802 941**	**1 380 332**	**1 753 956**	**-241 890**	**-594 897**	**241 035**	349 928

Exhibit 6.3 - Reinvestment in Mandatory Capital Ratios
Source: Author

6.4. Cost of equity and Perpetual Growth

Cost of equity

The cost of equity rate represents the required return that an investor is expecting to receive when investing in a firm. To use the CAPM, some assumptions are needed.

As risk-free rate it was considered that the 10 years Poland bonds should be an accurate estimator since government bonds are the most trustworthy asset. The levered beta appropriate to a large and mature bank tends to be one, as stated by Damodaran (2009). The country risk premium of Poland and the equity risk premium were estimated taking into account a study done by Damodaran (2020) where the author analysed the impact of globalization in the estimation of the country risk premium.

Exhibit 6.4 summarizes the cost of equity's computation:

Ke	Source	Notes
Risk Free Rate	1,75% World Government Bonds	10 Years Yield Poland Zero Coupon bond
Beta	1,00 Damodaran Literature	[A] Damodaran (2009)
Equity Risk Premium	6,48% Damodaran Study 2020	
Country Risk Premium	1,25% Damodaran Study 2020	
Ke	**9,48%**	

Exhibit 6.4 - Cost of equity estimation

It was assumed that the cost of equity will remain constant over the period under analysis.

Perpetual Growth

A study done by McKinsey&Company (2015) defines Poland as Europe's new growth engine in 2025. Before the Covid-19 impact, the Polish GDP was growing around 5% per year since 2015, which points towards the aspirational scenario identified in a research study done by McKinsey&Company in 2015. Even in 2020, the fall of the Polish GDP was not so bad as first expected, which is a good signal of consistency of its economy. Thee level of uncertainty due to the Covid-19 virus, the disbelief regarding the covid-19 vaccine among Poles and the associated economy's recovery are some key points that should be accounted for when defining the perpetual growth. For that reason, it was assumed a perpetual growth of 2%, not because of low potential but as a manner to account for future's uncertainty.

7. Valuation

This chapter presents the valuation results from each valuation model previously presented in the Literature Review Chapter.

7.1. FCFE

The FCFE focuses on potential dividends that could be distributed to shareholders. If the standard model is computed, the value per share of Bank Millennium should be PLN 6,29, as summarized in Exhibit 7.1 below:

Free Cash Flow for Equity (FCFE-Standard)	
NPV	1 610 992
TV	6 022 574
Equity Value (000' PLN)	7 633 566
Nº of Shares outstanding	1 213 116 777
Value Per Share	6,29
Share Value Reference 12/2020	3,15
Difference	3,14
% Difference	99%

Exhibit 7.1 - FCFE Standard Model Valuation Results

The value per share is PLN 3,14 higher than the value observed in the market (which is PLN 3,15). This high value per share results from limitations related to Capex, WC and debt computation (some values were considered as zero due to the impossibility of computation). See Appendix R – FCFE Valuation for more detailed computations.

For this reason, Damodaran (2009) suggest an adjustment to the standard FCFE model, recommending that the best cash flow estimation is considering the net income less the reinvestment in regulatory capital because as the bank grows it will need to increase its equity to fulfil minimum capital requirements: net income is being used to increase equity rather than distributed to shareholders and so it should reduce the available cash flow. To compute the reinvestment in regulatory capital, recall that

it was considered the ratios under the Pillar 2' Basel plus the Pillar II RRE FX Buffer (see Appendix Q4 - Summary of Regulatory Capital). Doing such adjustment, the value per share is then:

Free Cash Flow for Equity (FCFE-Damodaran Adjustment)	
NPV	1 074 929
TV	4 643 241
Equity Value (000' PLN)	5 718 171
Nº of Shares outstanding	1 213 116 777
Value Per Share	4,71
Share Value Reference 12/2020	3,15
Difference	1,56
% Difference	49%

Exhibit 7.2 - FCFE Adjusted Model Valuation Results

The fair value per share under this adjustment should be PLN 4,71, 49% above the market value but closer than the standard model result. See Appendix R – FCFE Valuation for more detailed computations.

The main drive of this model is the expected net income and investment in regulatory capital. However, the model does not capture dynamics in the balance sheet which may impact the fair value per share. For instance, this model does not capture the liquidity and profitability of the bank (think about the Loans-to-Deposits ratio) which may be a crucial variable behind the fair value of the bank.

7.1.1 Equity Cash-Flow (ECF)

As presented before, there is another adjustment to the FCFE that might capture better the fair value per share of a bank – ECF approach. Following such model, the fair value per share of Bank Millennium should be PLN 2,15, as shown in Exhibit 7.3:

Equity Cash Flow (ECF)	
NPV	1 618 907
TV	991 592
Equity Value (000' PLN)	2 610 499
Nº of Shares outstanding	1 213 116 777
Value Per Share	2,15
Share Value Reference 12/2020	3,15
Difference	-1,00
% Difference	-32%

Exhibit 7.3 - ECF Model Valuation Results

See Appendix S – ECF Valuation for more detailed computations.

The model's rationale is that variations in equity express if earnings are being invested in regulatory capital or not. In fact, according to solvency ratios (see Appendix Q4 - Summary of Regulatory Capital), it can be seen that in 2021 and 2022 it is expected to have a significant investment in regulatory capital

(around PLN 1.3bn and PLN 1.7bn) due to the FX loans mortgage issue (decreasing the cash flow). ECF model also considers other comprehensive income which increases significantly the equity cash flow. However, the investment in regulatory capital is more than the income. The ECF leads to a lower value because of the investment in regulatory capital in the next 2 years, decreasing significantly the value per share.

7.2. Residual Income Model (RI)

Following the RI model, it is needed to compute the cost of equity employed. The rationale is that if net income is being invested in mandatory capital, the available income to shareholders will be reduced since there is less money retained. RI also accounts for the opportunity cost of the investment being made. Exhibit 7.4 summarizes the results:

Residual Income (RI)	
NPV	372 373
TV	3 318 283
Equity Value (000' PLN)	3 690 657
Nº of Shares outstanding	1 213 116 777
Value Per Share	3,04
Share Value Reference 12/2020	3,15
Difference	-0,11
% Difference	-3,6%

Exhibit 7.4 - Residual Income Model Valuation Results

According to this model, the value per share should be PLN 3,04 (3,6% below the market value). RI captures the remaining value for shareholders after the reinvestment in mandatory capital. RI model considers the regulatory capital as being 6% (Tier 1) of the RWA (considering 20% for amounts due for banks, 75% for loans and 100% for securities). Exhibit 7.5 below represents the considerations for RWA:

RWA and Regulatory Capital Computation:		**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Due for Banks	20%	357 686	246 200	313 799	326 000	298 554	316 218	357 331
Loans	75%	52 211 543	55 566 257	57 368 286	59 598 748	61 749 953	63 557 742	65 326 795
Secutiries, Investments and trading a	100%	23 077 643	19 624 320	19 958 715	21 707 770	23 379 440	24 473 763	25 423 749
Total RWA		**75 646 872**	**75 436 776**	**77 640 800**	**81 632 517**	**85 427 947**	**88 347 723**	**91 107 876**
Tier 1	6%							
Regulatory Capital (Equity Capital)		**4 538 812**	**4 526 207**	**4 658 448**	**4 897 951**	**5 125 677**	**5 300 863**	**5 466 473**

Exhibit 7.5 - RWA Computation for Residual Income Model Valuation

Also, it considers the cost of this investment, i.e., the cost of making these investments instead of investing in another project that could increase the rate of return for shareholders.

See Appendix T – RI Valuation for further details. This model seems appropriate to value Bank Millennium SA share price, reflecting the main cash flow drivers (net income and the cost of investment in regulatory capital).

7.3. Bond Pricing

This model depends upon the adjusted net value of assets, which is the market value of assets less the market value of liabilities. Remind that most financial instruments have an active market, and that is why it is common to record an asset's value using its market value rather than its cost (as stated before in the Literature Review chapter). Based on this, it was considered that book value of assets reflect its market value.

To compute the market value of liabilities it was pursued the Damodaran estimation suggestion. He suggests[14] that the simplest way to estimate the market value of debt is to consider the entire book value of debt as a one coupon bond (considering the coupon equal to the total interest expenses and the average maturity of debt). Then, it is just needed to discount the bond at the current cost of debt, as expressed in the next formula:

$$Estimated\ MV\ Debt = Interest\ Expenses * \left[1 - \left(\frac{\frac{1}{(1+rd)^m}}{rd}\right)\right] + \frac{Book\ Value\ of\ Debt}{(1+rd)^m} \quad (16)$$

Being rd the average current cost of debt and m the average maturity in years.

Notice that it was just considered the amount of interest-bearing liabilities as deposits from customers/other banks and debt securities issued. Subordinated debt (like bonds) were left aside because such debt instrument pays interest (coupon) just at the end of its maturity (which are 2027 and 2029 in the case of Bank Millennium) and not annually. Therefore, it makes no sense to consider the interest rate to be paid 6 years from now since the valuation is in 2020.

Since the market value of assets and liabilities is computed, it can be calculated the NAV and the respective market value of equity. See Appendix U – Bond Pricing Model Valuation for further details. Exhibit 7.6 summarizes the results:

Bond Pricing Model	
NPV	4 691 602 550
TV	0
Equity Value (PLN)	4 691 602 550
Nº of Shares outstanding	1 213 116 777
Value Per Share	3,87

Share Value Reference 12/2020	3,15
Difference	0,71
% Difference	23%

Exhibit 7.6 - Bond Pricing Model Valuation Results

According to this model, the fair value per share of Bank Millennium should be PLN 3,87 (23% more than the observed market value of PLN 3,15 at the end of 2020).

[14] Damodaran: Estimating market value of debt. Source: Estimating market value of debt (nyu.edu)

The model only considers part of the liabilities of the firm instead of all debt. For instance, this model does not capture the issues regarding the law battle in the courts due to the CHF loans mortgage. Since the model does not account for it, it is expected that the model leads to a higher value. Also, there are debt instruments which interest rate or maturity is difficult to estimate, and if such instruments are excluded from the computation it might be difficult to reach an accurate value of debt.

7.4. Relative Valuation

7.4.1 Peers Selection

The choice of the peer group is crucial: the more comparable the peer group is with the firm being valued, the greater the valuation's accuracy. The peer group should reflect the risk and growth of the firm being valued. The first criterion was the size of the banks, this is, the assets of each one. According to the Corporate Finance Institute, there are 10 relevant banks in Poland (Bank Millennium included).

To be comparable, it was considered that the maximum difference between the asset's value of Bank Millennium and as of other banks should be less than the standard deviation (PLN 99.75bn) of the asset's value of the banks being considered. Such criteria left 6 banks to be considered as comparable in the first stage. Exhibit 7.7 below summarises the banks to be considered and their asset's value at the beginning of 2021:

Bank	Assets 2021	Peer group?	Difference to Millennium Assets's
PKO BP	384,25	No	-280,21
Pekao	247,91	No	-143,87
Santander Bank Polska	238,24	No	-134,2
mbank	194,22	Yes	-90,18
Ing Bank Śląski	194,82	Yes	-90,78
BNP Paribas	122,1	Yes	-18,06
Bank Millennium	**104,04**		**0**
Getin Noble Bank	49,09	Yes	54,95
Alior Bank	79,88	Yes	24,16
Citi Handlowy	58,82	Yes	45,22
Standard Deviation	99,75		

Exhibit 7.7 – Relative Valuation Comparable Firms
Source: Corporate Finance Institute. Unit: Billion PLN

According to this first criterion, the peer group is composed of mBank, Ing Bank Slaski, BNP Paribas, Getin Noble Bank, Alior Bank and Citi Handlowy Bank.

However, as stated before, the choice of the peer group is crucial for the valuation process. For that reason, it was considered another 4 criteria to analyse the comparability within the 6 selected banks. The criteria were Moody's Long-Term Rating, Market Capitalization, PS ratio and ROE of 2019.

The long term rating reflects the risk of each bank; market capitalization reflects the size of the bank in the stock market; PS reflects the value that the market recognizes as fair for each share of the bank (it captures market expectations); ROE measures the financial performance of the bank (it was considered the ROE of 2019 because 2020 was atypical and using the ROE of 2020 would reduce the comparability). All these criteria reflect different and important aspects of the banks being analysed.

Exhibit 7.8 summarises the criteria and respective values:

	Unit: bn	Source: The Banks	Source: Financial Times	Source: Google Finance	Source: Annual Reports	
Bank	**Assets 2021**	**Moodys Rating 2020**	**Market Cap 2021**	**P/S 2021**	**ROE 2019**	**Criteria in Accordance**
mbank	194,22	A2	14 680 000 000	214,40	6,25%	2
Ing Bank Śląski	194,82	A1	25 600 000 000	174,40	12,80%	0
BNP Paribas Bank Polska	122,1	A3	9 740 000 000	60,00	5,51%	3
Bank Millennium	**104,04**	**A3**	**6 200 000 000**	**3,78**	**6,23%**	0
Getin Noble Bank	49,09	B2	183 300 000	0,18	-23,34%	1
Alior Bank	79,88	Ba2	4 810 000 000	23,00	3,69%	2
Citi Handlowy	58,82	A3	6 430 000 000	39,20	6,79%	3

Exhibit 7.8 – Relative Valuation Criterias and Peer Group
Sources: Corporate Finance Institute, Financial Times, The Banks, Google Finance and Annual Reports of the Banks

With such criteria, it was concluded that the most accurate peer group should be composed by mBank, BNP Paribas Bank Polska, Alior Bank and Citi Handlowy Bank (since they have more criteria in accordance to Bank Millennium)[15].

With the peer group selected, the next step is to choose the multiples to use to run the equity valuation of Bank Millennium.

7.4.2 Multiple Selection

Considering what was presented in the Literature Review chapter, it was chosen to use PER, PBV, PS and P/Deposits.

It should be tried to adjust the multiples to increase comparability within the peers. Given the characteristics of Bank Millennium and the sector environment, it was computed the PER excluding the impact of provisions due to FX mortgage loans from the net income, since the impact was different within the peer group. Another adjustment was the computation of PER considering Other Comprehensive Income. The objective is to analyze if such result impacts significantly the ratio or not.

It was decided to use harmonic means when computing the peer group multiple's averages, following the recommendation of Damodaran (2006). However, a results' comparison from the use of arithmetic and harmonic means will be done. Also, notice that the use of harmonic means is not mathematically possible with negative values. However, Bank Alior PER is negative; for that reason, it was excluded from the mean in that multiple.

Exhibit 7.9 summarizes the average of the multiples of December 2020:

Bank	PER	PER (with OCI)	PER (without FX Loans Provisions)	PBV	PS	P/Deposits
Bank Alior	-7,12	-12,84	-7,12	0,34	0,49	0,03
Bank Hand	26,64	6,77	1,10	0,61	2,60	0,07
BNP Paribas Bank Polska	12,79	5,87	10,40	0,78	1,98	0,10
mBank SA	73,10	12,33	6,74	0,46	1,09	0,06
Harmonic Mean	23,18	7,52	2,60	0,49	1,04	0,06

Exhibit 7.9 - Relative Valuation Average Multiples of the Peer Group

[15] Notice that it is considered the consolidated figures of the peers (as well it was considered about Bank Millennium).

7.4.3 Valuation

After the average multiples are computed, it is simply multiplying it by the driver's value. See Appendix V1 – Historical Multiples Valuation for each multiple valuations. Exhibit 7.10 summarizes de results obtained with each multiple considered:

Share Price according to:	2020	Difference to Market Value
PER	0,44	-2,72
PER (with OCI)	1,38	-1,78
PER (without FX Loans Provisions)	1,24	-1,91
PBV	3,70	0,55
PS	3,15	0,00
P/Deposits	3,71	0,55

Share Price according to:	2020	Difference to Market Value
Average of all multiples used	2,27	-0,88
Average PER, PS and PBV	2,43	-0,72
Average without PER	2,70	-0,45
Average only PER	1,02	-2,14
Average of PBV and PS	3,43	0,27

Market Value	3,15

Exhibit 7.10 – Relative Valuation Summary of Results

As it can be noticed, considering the average of all multiples computed, the EQV per share should be around PLN 2,27. However, if it is considered the average of the multiples without PER, the average price per share jumps to PLN 2,70. The negative impact of PER reflects the observed reduction in earnings of banks during 2020 due to the Covid-19. Also, the net income of Bank Millennium was strongly affected by the provision's creation regarding the problem of FX loans in CHF. The impact of this issue was very different within the peer group which reduces the comparability.

The PS ratio is the multiple that leads to the closest share price (PLN 3,15). However, usually when pursuing a Relative Valuation approach, it is common to use a combination of multiples to increase the accuracy of the valuation. PS ratio is useful when analysing a recent company that has not yet made a profit or had a loss or a setback recently (which was the case in 2020).

It can be concluded that the best multiples combination to use in Bank Millennium equity valuation are PBV and PS ratios. These ratios are the ones that give the nearest result to the market value. If an average of PBV and PS ratios is computed, the expected value per share should be PLN 3,43, very close to PLN 3,15 market value.

It would be expected that P/Deposits could lead to an accurate valuation since it is the most specific multiple in use. However, that did not happen. One possible reason why this multiple has not given an accurate valuation is the fact that it only considers part of the bank's assets and does not reflect its counterpart, that is, it is like it is valuing the bank considering only revenue and excluding costs (which can significantly affect the market's perception of fair value per share).

7.4.3.1 Historical *Versus* Forward-Looking Multiples

Following the conclusion of Forte *et al.* (2020) that forward-looking multiples should lead to more accurate valuations than historical multiples (and 2-year forward-looking outperforms 1-year forward-

looking multiples), it was analysed if it holds true in the case of Bank Millennium. To carry out this analysis, it was computed the two years forward-looking PER, PBV and PS ratios.

It was estimated the next two years (2021 and 2022) main value drivers needed to compute the multiples i.e, net income, book value and sales (interest income and commissions) for the peer group. To forecast the main value drivers, it was considered the GDP growth rate of Poland for 2021 and 2022. See Appendix V2 – Forward-Looking Multiples Valuation to see more details about the computation of forward-looking multiples (1 and 2 years forward).

Having the average forward-looking multiples, it is simply multiplying it by the value driver of 2020.

The summary of historical and forward-looking results is presented in Exhibit 7.11 below:

	Share Price Historical Multiples	Share Price 1-year Forward Looking Multiples	Share Price 2-year Forward Looking Multiples
PER	0,44	0,42	0,41
PBV	3,70	3,58	3,50
PS	3,15	3,05	2,98
Average PS and PBV	3,43	3,31	3,24
Average Total	2,43	2,35	2,30
Difference to Market Value:			
Average PS and PBV	0,27	0,16	0,09
Average Total	-0,72	-0,80	-0,86
Market Value	3,15	3,15	3,15

Exhibit 7.11 – Relative Valuation: Historical, 1-year and 2-years Forward-Looking Multiples Valuation With Harmonic Means

The combination of PS and PBV continues to be the most appropriate combination to value Bank Millennium. Also, as expected by Forte *et al.* (2020), the forward-looking multiples outperform the historical multiples (it leads to a smaller difference) and the 2-year forward-looking outperforms the 1-year looking, with a difference of only PLN 0,09.

By doing the forward-looking multiples, it is tried to capture the future expectation on the sector, as an attempt to overcome the "snapshot" limitation of multiples valuation. Also, 2020 was an abnormal year; considering the average of the next two years (which is expected to be the years of recovery and coming back to normal) the valuation captures the expected future growth.

It can be concluded that, within Relative Valuation, the most appropriate approach is to consider a combination of PS and PBV 2-year forward-looking multiple valuation.

7.4.3.2 Arithmetic *Versus* Harmonic Means

Remind that Damodaran (2006) defends the use of harmonic means when pursuing Relative Valuation since it gives better estimates for the peer group than arithmetic ones.

In a scenario where arithmetic means would be used instead of harmonic ones, the results would be:

	Share Price Historical Multiples	Share Price 1-year Forward Looking Multiples	Share Price 2-year Forward Looking Multiples
PER	0,50	0,48	0,47
PBV	4,08	3,94	3,86
PS	4,69	4,53	4,43
Average PS and PBV	4,38	4,24	4,14
Average Total	3,09	2,98	2,92
Difference to Market Value:			
Average PS and PBV	1,23	1,08	0,99
Average Total	-0,07	-0,17	-0,24
Market Value	3,15	3,15	3,15

Exhibit 7.12 – Relative Valuation: Historical, 1-year and 2-years Forward-Looking Multiples Valuation With Arithmetic Means

As it can be concluded, both valuation based on historical and forward-looking multiples leads to a worst result when compared with the use of the harmonic means. For instance, the share price according to PS and PBV using 2-year forward-looking and harmonic means is PLN 3,24 while using arithmetic means is PLN 4,14. It can be concluded that the use of harmonic means leads to a more accurate valuation when compared with arithmetic ones.

8. Differences and Results' Summary

8.1. Final observations about differences

All models presented before (except Relative Valuation) relies on book values that do not capture market expectations. For instance, news or an important public release may affect the share market price much faster than book values, which leads to differences between the market share price and the share price obtained through the theoretical models.

These models do not capture non-financial aspects such as Environment, Social and Governance (ESG) issues. More than ever ESG aspects are a critical variable in the decision-making process of an investment opportunity. Such factors may influence the market share price but are not considered directly in the valuation theoretical models.

Also, DCF models need several assumptions and inputs to proceed with the valuation. Assumptions are always subjective and mostly they are based on the analyst expertise, leading to a result that is easily manipulated. The differences between market and theoretical values were expected. Velasco & Wong (2013) made a critical examination of 171 researches on the valuation of some of the largest European banks during the year 2011. The study concluded that there is a large gap between financial literature and real-world practice of bank valuation methods.

Another particularity of Bank Millennium is related to the FX CHF loans mortgage. This problem remains within the Polish banking sector since 2008 and each bank has a different exposure to the possible costs that may occur as legal actions against banks. This issue makes the peer group less comparable and causes deviations between the market share price and the one obtained with Relative Valuation.

Another reason that justifies the observed differences is the normal market trading. Buying and selling trading affects the current stock price: when selling is stronger than buying, the stock price declines, and the opposite remains true. Investors buy and sell for a variety of reasons such as speculation or the need to raise cash (which have little to do with stock valuation). Trading movements change the stock price faster than a company's theoretical stock valuation.

8.2. Summary of results and conclusions

Exhibit 8.1 below presents the valuation results' summary:

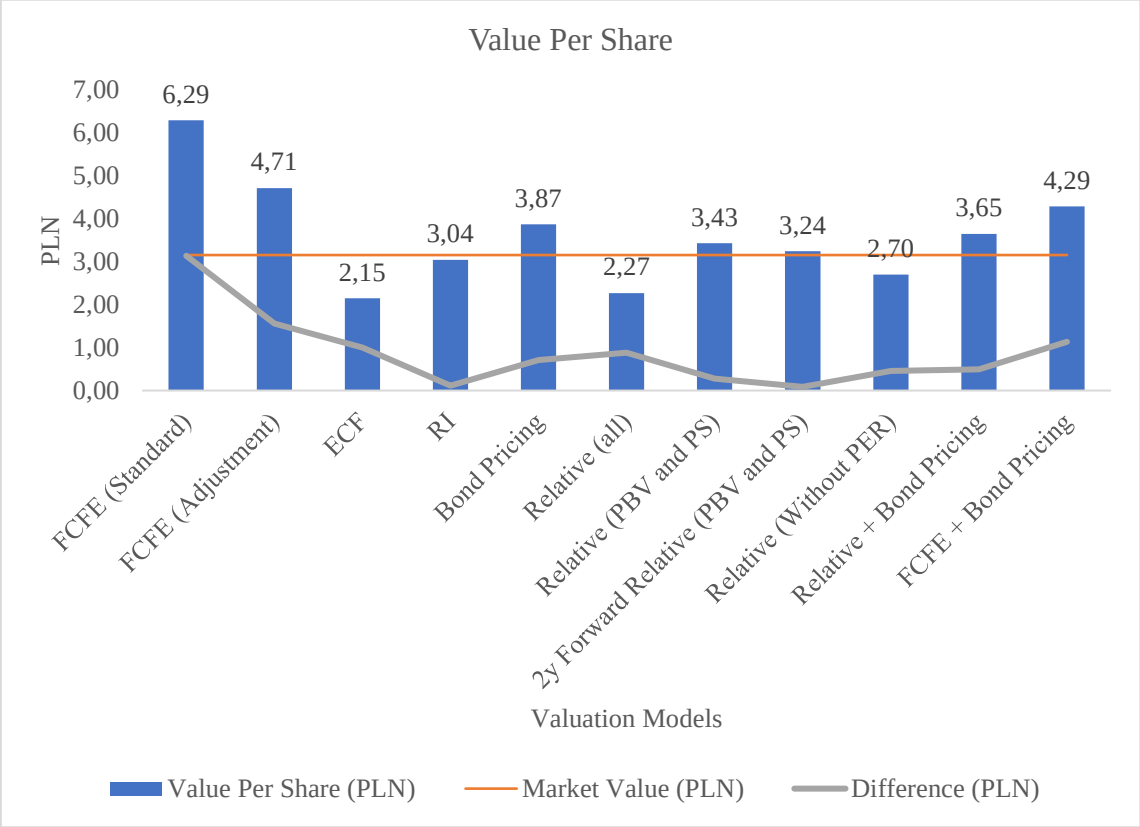

Exhibit 8.1 - Valuation Results Comparison

As it can be concluded, the lowest value corresponds to the ECF model. It should be taking into consideration that this model considers the variation in equity and OCI. Also remind that, for estimation purposes, retained earnings were used to square the BS. For that reason, the model is capturing these balances and they may be not the true behaviour of retained earnings. However, this limitation is difficult to overcome since few accounting figures might be used to square de BS.

The higher and most different value corresponds to the standard FCFE model (as expected). The FCFE adjusted considers the investment in mandatory capital ratios. Notice that the investment in regulatory capital is based on several assumptions that were made.

If a comparison is carried out between FCFE adjusted and RI, they are not very different from each other: both consider that the best cash flow estimation is the net income less the investment made in

regulatory capital but the models lead to very different values. The RI considers only a part of some assets classes (as presented in the Literature Review Chapter) to compute the RWA while the FCFE considers the whole amount of the same assets. Also, the FCFE adjusted does not account for the opportunity cost of the investment being made, i.e., the cost of investing in mandatory capital rather than investing the money in some high-yielding project. On the other hand, the RI accounts for this cost. It can be concluded that considering just a part of risky assets rather than the whole to estimate the RWA may be more correct to value Bank Millennium. Also, the cost of the investment done in regulatory capital should be reflected in the valuation, leading to a more accurate valuation.

According to Hrdý (2018), a combination of i) Relative Valuation plus Bond Pricing Model and ii) FCFE plus Bond Pricing model could be useful to value a financial service firm. However, the results are not so bright as expected: combine different models may lead to a decrease in the valuation accuracy because it relies on the simple average of the values and not on the fundamentals of the value (which are different between models).

Regarding the Relative Valuation models, it seems that multiples valuation are a very appropriate model to value Bank Millennium since almost all the results involving multiples valuation are very close to the reference market value per share.

A model is considered as appropriate if the difference between the share price in the market and the one obtained with a model is less than PLN 0,45 (being the standard deviation of the difference between market and intrinsic value, excluding the standard FCFE because it is clearly an outsider). Exhibit 8.2 summarizes the results:

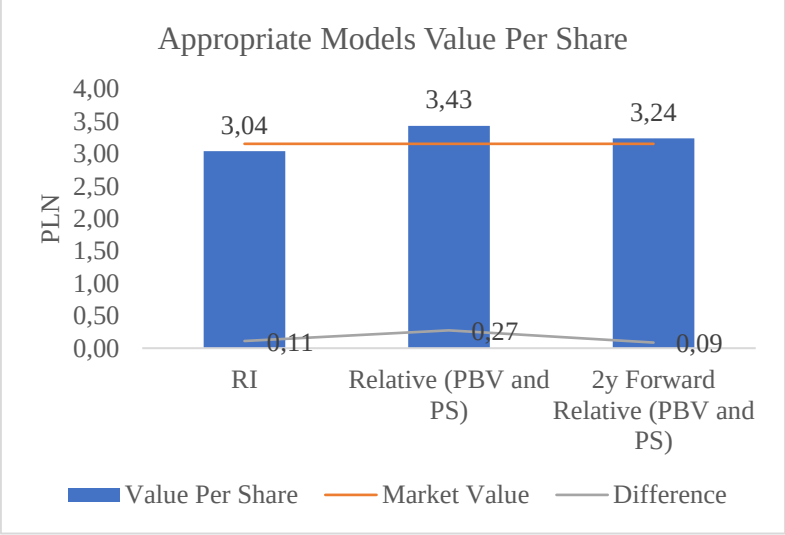

Exhibit 8.2 - Appropriate Models Comparison

These are the models that are appropriate to value Bank Millennium. Within them, the most appropriate model to capture the share price of Bank Millennium is Relative Valuation considering 2-year forward-looking PS and PBV ratios computed with harmonic means.

It should be noticed that Relative Valuation seems to be the most appropriate valuation model to value Bank Millennium since 2 out of the 3 appropriate models has multiples involved (with historical or forward multiples).

The historical combination of PBV and PS ratios lead to a very close valuation of PLN 3,43, being the difference to the market value only PLN 0,27. When it comes to the PS and PBV forward-looking combination, the difference is only PLN 0,09, leading to a share price of PLN 3,24.

Notice that historical and forward-looking valuations lead to the same conclusion: the share price is undervalued (the fair value is higher than the value traded in the market).

The RI is the only DCF model that produces an acceptable valuation and it concludes that the share price is overvalued since the intrinsic is PLN 3,04 and the market price is PLN 3,15.

Remind what Damodaran (2009) argues about DCF and Relative Valuation: if assumptions in DCF models are aligned, it is expected that multiples valuation points in the same direction as DCF models. However, the models lead to the opposite conclusion: DCF supports a selling action while Relative Valuation supports a buying action. This opposite result can derive from two reasons: assumptions are not aligned or the market is systematically over/underpricing the entire banking sector, which leads to a deviation between both models.

With all that said, it can be concluded that the most appropriate model to value Bank Millennium is Relative Valuation considering a combination of 2-year forward-looking PS and PBV ratios since it leads to the smaller difference between the expected and observed market value. According to this model, the share price of the bank seems to be slightly undervalued, since the fair value is above the observed market value.

It is worth saying that the historical Relative Valuation approach is a snapshot of a moment meaning that it does not account for growth potential and dynamics, being less reliable when used alone. However, as an attempt to overcome this limitation, Forte *et al.* (2020) suggest using 2-year forward-looking multiples to try to incorporate future expectations in the valuation being made. This approach seems to work well and his conclusions hold true for Bank Millennium: forward-looking multiples outperform historical ones and 2-years forward-looking captures even better the expected growth in the sector than 1-year forward-looking multiples.

9. Conclusion

Evaluate a non-financial firm is already quite a task; when it comes to value a financial services firm, such as a bank, it becomes a challenging mission due to the specific characteristics of the sector. The differences in accounting rules, the existence of regulatory constraints and the difficulty of Cash Flow estimation makes the valuation process more difficult since most valuation models do not consider these aspects. There is little consensus regarding the choice of which model is better to value a financial service firm. Despite this, there are theoretical valuation models which several authors defend to be acceptable to properly value a bank. Knowing that, it was decided to analyse which model better captures the specific characteristics of Bank Millennium.

The chosen models to pursue the Bank Millennium equity valuation were the FCFE (and adjusted models suggested by the authors), RI, Bond Pricing Model and Relative Valuation.

Notice that this valuation is based on 2020 accounting figures. The 2020 year was strongly affected by the impact of Covid-19 around the world and, particularly in Poland, the Franc Suisse-denominated loans mortgage issue within the Polish banking sector had also a significant impact in the sector.

11 valuation models were applied (standard and subsequent variations of the models) and only 3 are considered as appropriate: RI, Relative Valuation (PBV and PS) historical and 2-year forward-looking. Notice that within the 3 models, 2 respect to Relative Valuation and only one respects DCF models (RI).

The most different value corresponds to the standard FCFE model, as expected, since the computation of WC or the variation of debt was considered as zero due to the difficulty of identifying what these are in a financial firm. FCFE adjusted (considering the investments in regulatory capital) and RI are not very different from each other but leads to different values because RI considers only a part of some assets classes to compute the RWA as well as the opportunity cost of the investment in regulatory capital while FCFE adjusted considers the whole amount of the same assets and does not account for the opportunity cost.

The combinations suggested by Hrdý (2018) are not more accurate than the standalone values. These combinations seem to decrease the valuation accuracy because it relies on the simple average of the values per share and not in the fundamentals of the values.

Regarding Relative Valuation models, it seems that multiples valuation are a very appropriate model to value Bank Millennium since almost all the results involving multiples valuation are close to the market value per share.

Both historical and forward-looking PS and PBV multiples lead to an appropriate approach to value Bank Millennium. However, and as expected by Forte *et al.* (2020), the forward-looking multiples valuation leads to a more accurate valuation than historical multiples and 2-year forward-looking outperforms the 1-year looking. It can be concluded that the most accurate model to value Bank Millennium is Relative Valuation considering a combination of 2-year forward-looking PS and PBV

ratios, and the share price of Bank Millennium seems to be slightly undervalued since the fair value is PLN 3,24 and the market is trading at PLN 3,15.

Damodaran (2006) suggest the use of harmonic means instead of arithmetic ones when computing the average multiples of the peer group. When comparing the results from Relative Valuation using harmonic and arithmetic means it can be concluded that harmonic means lead to a more accurate valuation than arithmetic ones.

Some reasons justify the differences observed between the theoretical and market value per share. When changes happen in the environment of the firm, the share market price changes must faster than book values; for instance, an important public release may affect the share market price much faster than book values, which leads to differences between the market share price and the share price obtained through the theoretical models.

DCF models do not capture non-financial aspects ESG issues. More than ever ESG aspects are a critical variable in the decision-making process of an investment opportunity. Such factors may influence the investor behaviour and change the market share price but are not considered directly in the valuation theoretical models.

Also, DCF models need several assumptions and inputs to proceed with the valuation. Assumptions are always subjective and mostly they are based on the analyst expertise, leading to a result that is easily manipulated.

Another reason that justifies the observed differences is normal market trading (when selling is stronger than buying, the stock price declines, and the opposite remains true). Investors buy and sell for a variety of reasons which, in several cases, may have little to do with stock valuation.

Summing up, within the applied models, the most appropriate model to value Bank Millennium is a combination of PS and PBV 2-year forward-looking multiples using harmonic means, leading to a fair value of PLN 3,24, being the share slightly undervalued at the end of the year (since the reference market share price is PLN 3,15).

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11. Appendices

Note: All amounts in thousands PLN (000) if nothing contrary is mentioned.

Appendix A – Historical and Expected Balance Sheet (BS)

ASSETS	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]	Criteria to Forecast
Cash/deposits with banks	574 962	625 897	758 545	785 357	807 751	839 156	673 386	737 715	919 808	Cash/Deposits (average)
Central bank funds	1 505 189	1 824 279	1 444 899	674 932	651 532	621 933	646 667	442 279	454 906	GDP growth
Securities	19 321 151	23 225 154	23 077 643	19 624 320	19 958 715	21 707 770	23 379 440	24 473 763	25 423 749	Correlation Analysis
Trading assets	1 417 005	920 219	1 029 887	445 641	761 244	790 841	819 386	843 375	866 849	Trading Assets/Deposits (average)
Gross loans	48 908 306	54 470 547	71 577 008	76 460 977	78 856 750	81 922 678	84 879 660	87 364 594	89 796 282	Forecast Loan Portfolio
Allowance for loans losses	-1 497 228	-1 758 867	-1 961 618	-2 372 635	-2 365 703	-2 457 680	-2 546 390	-2 620 938	-2 693 888	% Impairment/Gross loans (3%)
= Net loans	47 411 078	52 711 680	69 615 390	74 088 342	76 491 048	79 464 998	82 333 270	84 743 656	87 102 393	
Equipment and Intangible Assets	265 636	307 105	1 008 983	956 594	975 726	995 240	1 015 145	1 035 448	1 056 157	Strategy Plan
Taxes (current and deferred)	288 178	335 726	541 828	665 174	589 660	612 586	634 697	653 278	671 461	Taxes/Gross Loans (average)
Other assets	358 216	508 854	439 219	531 425	549 038	570 384	590 972	608 273	625 204	Other assets/deposits (average)
Total assets	**71 141 415**	**80 458 914**	**97 916 394**	**97 771 785**	**100 784 714**	**105 602 908**	**110 092 964**	**113 537 788**	**117 120 528**	

LIABILITIES	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]	Criteria to Forecast
Deposits	57 273 255	66 243 769	81 454 765	81 510 540	84 064 533	87 332 937	90 485 201	93 134 243	95 726 522	Loans-to-Deposits Ratio (LtD) (2020)
Central bank / Other banks	2 353 131	1 788 857	1 578 848	1 057 652	1 418 429	2 734 027	2 625 295	2 447 550	2 662 093	GDP growth
Short term borrowing	190 111	231 633	353 000	168 553	277 364	288 147	298 548	307 288	315 841	Short term borrowing/Deposits (average)
Long term debt	2 035 297	1 938 697	3 246 996	3 086 185	3 189 115	3 301 743	3 409 408	3 503 517	3 597 438	Forecast Long Term Debt
Provisions	67 752	112 452	165 178	607 650	1 446 055	1 726 203	1 478 147	629 359	290 870	Cost Estimation
Tax liabilities	26 988	22 309	38 590	30 843	33 315	34 611	35 860	36 910	37 937	Taxes Liabilities/Deposits (average)
Other liabilities	1 422 282	1 736 811	2 137 498	2 219 386	2 296 332	2 400 654	2 496 129	2 571 312	2 644 723	GDP growth rate
Total liabilities	**63 368 816**	**72 074 528**	**88 974 875**	**88 680 809**	**92 725 142**	**97 818 323**	**100 828 589**	**102 630 180**	**105 275 425**	

EQUITY (Shareholders equity)	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]	Criteria to Forecast
Share capital	1 213 117	1 213 117	1 213 117	1 213 117	1 213 117	1 213 117	1 213 117	1 213 117	1 213 117	Constant
Common stock	1 147 502	1 147 502	1 147 502	1 147 481	1 147 481	1 147 481	1 147 481	1 147 481	1 147 481	Constant
Accumulated other comprehensive income	-34 795	73 692	70 093	199 857	192 928	184 163	176 839	171 513	166 616	Inverse GDP growth rate
Retained earnings	5 446 775	5 950 075	6 510 807	6 530 521	5 506 046	5 239 823	6 726 938	8 375 497	9 317 889	NI (N-1) - Inv. Reg. Capital
Total equity	**7 772 599**	**8 384 386**	**8 941 519**	**9 090 976**	**8 059 571**	**7 784 585**	**9 264 375**	**10 907 608**	**11 845 103**	

BS Criteria to Forecast					
Historical Data	**2017**	**2018**	**2019**	**2020**	**Average**
% Impairment / Gross loans	-3,06%	-3,23%	-2,74%	-3,10%	-3,03%
Cash / Deposits	1,00%	0,94%	0,93%	0,96%	0,96%
Trading Assets / Deposits	2,47%	1,39%	1,26%	0,55%	0,91%
Other assets / deposits	0,63%	0,77%	0,54%	0,65%	0,65%
Short term borrowing / Deposits	0,33%	0,35%	0,43%	0,21%	0,33%
Taxes / Gross Loans	0,59%	0,62%	0,76%	0,87%	0,75%
Taxes Liabilities / Deposits	0,05%	0,03%	0,05%	0,04%	0,04%

Source: Annual Reports of Bank Millennium

Appendix B – Historical and Expected Profit and Loss (P&L)

Non-Interest Revenue	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]	Criteria to Forecast
Results on Financial Assets	217 009	225 880	315 243	324 816	254 234	276 058	296 919	310 641	322 585	Average Results on Financial Assets/(Securities+Trading Assets)
Other operating Result	-8 041	682	-6 407	-88 294	-6 079	-6 316	-6 544	-6 735	-6 923	Average Other operating Result/(Deposits+Loans)
Net Fees and Commission Income	663 553	661 069	699 153	746 056	428 013	444 654	460 704	474 192	487 390	% Net Fees and Commission/(Deposits + Loans)
Total Non-Interest Revenue	872 521	887 631	1 007 989	982 578	676 168	714 396	751 080	778 097	803 053	
Interest Income	2 398 938	2 561 919	3 374 836	3 092 119	3 704 953	3 849 000	4 116 219	4 236 390	4 354 305	Interest rate to be received*Amount
Interest Expense	-702 470	-744 444	-937 917	-543 519	-374 874	-395 752	-548 665	-563 073	-579 697	Interest rate to be paid*Amount
Net Interest Income	1 696 468	1 817 475	2 436 919	2 548 600	3 330 079	3 453 249	3 567 554	3 673 317	3 774 609	
Total Net Revenue	2 568 989	2 705 106	3 444 908	3 531 178	4 006 246	4 167 645	4 318 634	4 451 415	4 577 661	
(-) Provisons Created / Change of provisions	0	-14 157	-234 797	-727 182	-838 405	-280 148	-93 610	-90 790	-88 198	Provisions' variation and Inverse GDP Growth
(-) Impairment Losses of financial and non finat	-255 358	-202 476	-403 936	-564 802	-781 484	-831 850	-881 594	-921 000	-958 573	% Securities Gains (Losses)/Securities
(-) Non-Interest Expenses (Operating Costs)	-1 149 723	-1 213 765	-1 545 183	-1 542 379	-1 591 797	-1 631 926	-1 673 246	-1 715 078	-1 757 954	Inflation rate growth
(-) Depreciation	-52 971	-54 227	-180 872	-210 411	-189 097	-192 879	-196 737	-200 672	-204 685	Depreciation / Tangible and Intangible Assets
(-) Banking Tax	-188 326	-198 477	-247 991	-279 147	-298 183	-310 196	-321 434	-331 317	-340 714	Banking Tax/Total Net Revenue (Average)
Pre-tax Income	922 611	1 022 004	832 129	207 257	307 280	920 646	1 152 012	1 192 558	1 227 537	
(-) Taxes	-243 996	-263 954	-274 611	-188 118	-87 344	-261 692	-327 457	-338 982	-348 925	Average Effective Tax rate (2017-2019)
(+) Extraordinary Gains / Discontinued Ops	2 612	2 601	3 214	3 678	4 139	4 657	5 241	5 897	6 636	Extraordinary gains Growth rate (Average)
Net income	**681 227**	**760 651**	**560 732**	**22 817**	**224 075**	**663 612**	**829 796**	**859 473**	**885 249**	
(/) Basic Shares	1 213 116 777	1 213 116 777	1 213 116 777	1 213 116 777	1 213 116 777	1 213 116 777	1 213 116 777	1 213 116 777	1 213 116 777	
(=) Basic EPS	0,56	0,63	0,46	0,02	0,18	0,55	0,68	0,71	0,73	

P&L Criteria to Forecast					
Historical Data	**2017**	**2018**	**2019**	**2020**	**Average**
Weight: Results on Financial Assets/(Securitie:	1,05%	0,94%	1,31%	1,62%	1,23%
Weight: Other operating Result/(Deposits+Loa:	-0,01%	0,00%	0,00%	-0,06%	0,00%
Weight: Banking Tax/Total Net Revenue	-0,07	-0,07	-0,07	-0,08	-7,44%
Taxes / Pre-tax income = Effective Tax rate	-0,26	-0,26	-0,33	-0,91	-28,42%
Extraordinary gains Growth rate		0,00	0,24	0,14	12,53%

Source: Annual Reports of Bank Millennium

Appendix C – Macroeconomic Indicators

Macroeconomic Indicator	Source	Unit	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]	2026 [E]
GDP (constant prices)	IMF	Billions PLN	1 947	2 052	2 145	2 086	2 159	2 257	2 347	2 417	2 486	2 550
GDP Growth Rate (constant prices)	IMF	%	4,83%	5,35%	4,54%	-2,72%	3,47%	4,54%	3,98%	3,01%	2,86%	2,56%
Inflation (average of year)	IMF	Index	169,83	172,55	176,53	182,53	188,38	193,13	198,02	202,97	208,04	213,24
Inflation Growth Rate (average of year	IMF	%	1,98%	1,60%	2,31%	3,40%	3,20%	2,52%	2,53%	2,50%	2,50%	2,50%
Total Investment (% GDP)	IMF	%	19,91%	20,77%	19,75%	17,31%	17,02%	17,70%	18,34%	18,64%	18,82%	18,80%
Total Investment	IMF	Billions PLN	388	426	424	361	367	400	430	450	468	479
Average Wages	Trading Economics and IMF	PLN	4516,69	4863,74	5198,58	5 457	5 646	5 902	6 137	6 322	6 503	6 669
Total Employment	Moodys Analytics	Thousands PLN	16 404	16 409	16 467	16 555	17 129	17 907	18 619	19 180	19 728	20 234

Source: IMF, Trading Economics and Moodys

Appendix D - Correlation Coefficient Between Credit Segments and Macroeconomic Indicators

000 PLN

Loans Exposure:	2017	2018	2019	2020
Financial intermediation	172 828	261 392	384 191	269 481
Industry and Construction	5 836 781	6 286 366	6 410 923	5 705 660
Wholesale and retail business	4 037 554	4 882 821	4 965 966	5 409 468
Transport and communication	2 343 036	2 516 588	2 558 622	2 344 751
Public Sector	245 345	184 916	125 869	76 419
Mortgage Loans	26 104 033	28 319 185	36 432 136	41 000 677
Consumer	6 849 047	8 009 590	15 925 237	16 438 676
Others sectors	3 319 682	4 009 688	4 774 064	5 215 843
Total	48 908 306	54 470 546	71 577 008	76 460 975
Control	0	0	0	0
Growth Rate		11,37%	31,40%	6,82%

Macroeconomic indicators that might explain the behaviour of the categories identified above:

Macroeconomic Indicator	Source	Unit	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
GDP (constant prices)	IMF	Billions PLN	1 947	2 052	2 145	2 086	2 159	2 257	2 347	2 417	2 486
GDP Growth Rate (constant price	IMF	%	4,83%	5,35%	4,54%	-2,72%	3,47%	4,54%	3,98%	3,01%	2,86%
Inflation (average of year)	IMF	Index	170	173	177	183	188	193	198	203	208
Inflation Growth Rate (average of	IMF	%	1,98%	1,60%	2,31%	3,40%	3,20%	2,52%	2,53%	2,50%	2,50%
Total Investment (% GDP)	IMF	%	19,91%	20,77%	19,75%	17,31%	17,02%	17,70%	18,34%	18,64%	18,82%
Total Investment	IMF	Billions PLN	388	426	424	361	367	400	430	450	468
Average Wages	Trading Economics and IM	PLN	4 517	4 864	5 199	5 457	5 646	5 902	6 137	6 322	6 503
Total Employment	Moodys Analytics	Thousands PLN	16 404	16 409	16 467	16 555	17 129	17 907	18 619	19 180	19 728

Historical Correlation	Macroeconomic Indicator					
Credit Segments:	GDP (constant prices)	Inflation	Total Investment	Average Wages	Total employment	Most Accurate Estimator
Financial intermediation	**96%**	48%	46%	66%	36%	GDP Growth rate
Industry and Construction	51%	-27%	**96%**	-4%	-42%	Total Investment Growth Rate
Wholesale and retail business	81%	90%	-15%	**95%**	81%	Average Wages Growth Rate
Transport and communication	63%	-12%	**92%**	12%	-28%	Total Investment Growth Rate
Public Sector	-82%	-98%	30%	**-100%**	-92%	Average Wages Growth Rate
Mortgage Loans	76%	**98%**	-41%	97%	96%	Inflation Growth Rate
Consumer loans	84%	91%	-25%	**94%**	88%	Average Wages Growth Rate
Others sectors	85%	96%	-25%	**100%**	91%	Average Wages Growth Rate

Source: Annual Reports of Bank Millennium, IMF, Trading Economics and Moodys

Appendix E – Expected Loan Portfolio

Loans Exposure:	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]	Criteria/Growth rate:
Financial intermediation	269 481	278 824	291 491	303 083	312 212	321 126	GDP Growth rate
Industry and Construction	5 705 660	5 802 884	6 311 411	6 797 440	7 115 608	7 391 811	Total Investment Growth Rate
Wholesale and retail business	5 409 468	5 597 014	5 851 287	6 083 992	6 267 242	6 446 172	Average Wages Growth Rate
Transport and communication	2 344 751	2 384 705	2 593 686	2 793 420	2 924 172	3 037 678	Total Investment Growth Rate
Public Sector	76 419	73 770	70 418	67 618	65 581	63 709	Average Wages Growth Rate
Morgage Loans	41 000 677	42 314 273	43 381 232	44 479 415	45 591 524	46 731 261	Inflation Growth Rate
Consumer loans	16 438 676	17 008 605	17 781 306	18 488 468	19 045 341	19 589 086	Average Wages Growth Rate
Others sector	5 215 843	5 396 676	5 641 847	5 866 224	6 042 914	6 215 439	Average Wages Growth Rate
Total	**76 460 975**	**78 856 750**	**81 922 678**	**84 879 660**	**87 364 594**	**89 796 282**	

Estimator: GDP	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
GDP (billions)	1 947	2 052	2 145	2 086	2 159	2 257	2 347	2 417	2 486
Growth Rate of GDP	4,83%	5,35%	4,54%	-2,72%	3,47%	4,54%	3,98%	3,01%	2,86%
Total Investment (%GDP)	19,91%	20,77%	19,75%	17,31%	17,02%	17,70%	18,34%	18,64%	18,82%
Total Investment (Value)	387,75	426,04	423,61	361,21	367,36	399,55	430,32	450,47	467,95
Growth rate total investment (value)		9,87%	-0,57%	-14,73%	1,70%	8,76%	7,70%	4,68%	3,88%

Estimator: Average Wages	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
Average Wages	4 517	4 864	5 199	5 457	5 646	5 902	6 137	6 322	6 503
Average Wages Growth Rate	7,06%	7,68%	6,88%	4,97%	3,47%	4,54%	3,98%	3,01%	2,86%

Estimator: Inflation	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
Inflation (index)	170	173	177	183	188	193	198	203	208
Growth rate		1,60%	2,31%	3,40%	3,20%	2,52%	2,53%	2,50%	2,50%

Source: Annual Reports of Bank Millennium, IMF, Trading Economics and Moodys

Appendix F – Expected Securities Amount

	2017	2018	2019	2020
Securities	19 321 151	23 225 154	23 077 643	19 624 320

Macroeconomic Indicator:	Source	Unit	2017	2018	2019	2020
GDP (constant prices)	IMF	Billions PLN	1 947	2 052	2 145	2 086
GDP Growth Rate (constant prices)	IMF	%	4,83%	5,35%	4,54%	-2,72%
Inflation (average of year)	IMF	Index	169,83	172,55	176,53	182,53
Inflation Rate Growth Rate (average of year)	IMF	%	1,98%	1,60%	2,31%	3,40%
Total Investement (% GDP)	IMF	%	19,91%	20,77%	19,75%	17,31%
Total Investement	IMF	Billions PLN	388	426	424	361
Average Wages	Trading Economic	PLN	4 516,69	4 863,74	5 198,58	5 456,81
Total Employment	Moodys Analytics	Thousands PLN	16 404	16 409	16 467	16 555

Macroeconomic Indicator	Correlation
GDP (constant prices)	0,59
Inflation (average of year)	-0,13
Total Investment	0,92
Average Wages	0,11
Total Employment	-0,30

	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
GDP (billions)	2 086	2 159	2 257	2 347	2 417	2 486
Growth Rate of GDP	-2,72%	3,47%	4,54%	3,98%	3,01%	2,86%
Total Investment (%GDP)	17,31%	17,02%	17,70%	18,34%	18,64%	18,82%
Total Investment (Value)	361	367	400	430	450	468
Growth rate total investment (value)		1,70%	8,76%	7,70%	4,68%	3,88%
Securities (Expected)	**19 624 320**	**19 958 715**	**21 707 770**	**23 379 440**	**24 473 763**	**25 423 749**

Source: Annual Reports of Bank Millennium, IMF, Trading Economics and Moodys

Appendix G – Expected Liabilities to Customers (Deposits)

Historical Data	**2017**	**2018**	**2019**	**2020**					
Loans-to-Deposits Ratio (LtD)	85,39%	82,23%	87,87%	93,81%					
Average 2017-2019	85,17%								
	2017	**2018**	**2019**	**2020**	**2021 [E]**	**2022 [E]**	**2023 [E]**	**2024 [E]**	**2025 [E]**
Gross loans	48 908 306	54 470 547	71 577 008	76 460 977	78 856 750	81 922 678	84 879 660	87 364 594	89 796 282
LtD					93,81%	93,81%	93,81%	93,81%	93,81%
Deposits	**57 273 255**	**66 243 769**	**81 454 765**	**81 510 540**	**84 064 533**	**87 332 937**	**90 485 201**	**93 134 243**	**95 726 522**

Source: Annual Reports of Bank Millennium

Appendix H – Expected Long Term Debt

000 PLN

Long Term Debt:	Note:	**2017**	**2018**	**2019**	**2020**
Sale and repurchase agre	33	0	50 324	90 712	248 566
Debt securities issued	34	1 156 473	809 679	1 183 232	558 560
Subordinated debt	35	701 971	701 883	1 546 205	1 540 209
Derivatives - Hedge acco	23	176 853	376 811	426 847	738 850
Total		2 035 297	1 938 697	3 246 996	3 086 185
Control		0	0	0	0

Macroeconomic indicators that might explain the behaviour of the categories identified above:

Macroeconomic Indicator	**Source**	**Unit**	**2017**	**2018**	**2019**	**2020**	**2021 [E]**	**2022 [E]**	**2023 [E]**	**2024 [E]**	**2025 [E]**
GDP (constant prices)	IMF	Billions PLN	1 947	2 052	2 145	2 086	2 159	2 257	2 347	2 417	2 486
GDP Growth Rate (constant prices)	IMF	%	4,83%	5,35%	4,54%	-2,72%	3,47%	4,54%	3,98%	3,01%	2,86%
Inflation (average of year)	IMF	Index (PLN)	169,83	172,55	176,53	182,53	188,38	193,13	198,02	202,97	208,04
Inflation Rate Growth Rate (average	IMF	%	1,98%	1,60%	2,31%	3,40%	3,20%	2,52%	2,53%	2,50%	2,50%
Total Investment (% GDP)	IMF	%	19,91%	20,77%	19,75%	17,31%	17,02%	17,70%	18,34%	18,64%	18,82%
Total Investment	IMF	Billions PLN	388	426	424	361	367	400	430	450	468
Average Wages	Trading Economics and I	PLN	4 517	4 864	5 199	5 457	5 646	5 902	6 137	6 322	6 503
Total Employment	Moodys Analytics	Thousands PLN	16 404	16 409	16 467	16 555	17 129	17 907	18 619	19 180	19 728

Historical Correlation:	Macroeconomic Indicator					
	GDP (constant prices)	Inflation	Total Investment	Average Wages	Total employment	Most Accurate Estimator
Sale and repurchase agreements	0,55	**0,98**	-0,90	0,92	0,98	Inflation Growth Rate
Debt securities issued	-0,17	**-0,66**	0,61	-0,58	-0,64	Inflation Growth Rate
Subordinated debt	0,81	0,87	-0,70	**0,90**	0,86	Average Wages Growth Rate
Derivatives - Hedge accounting	0,64	**0,98**	-0,82	0,95	0,94	Inflation Growth Rate

Debt Segment:	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]	Criteria
Sale and repurchase agreements	248 566	256 530	262 998	269 656	276 398	283 308	Inflation Growth Rate
Debt securities issued	558 560	576 455	590 991	605 952	621 102	636 629	Inflation Growth Rate
Subordinated debt	1 540 209	1 593 608	1 666 006	1 732 263	1 784 438	1 835 384	Average Wages Growth Rate
Derivatives - Hedge accounting	738 850	762 522	781 749	801 538	821 579	842 118	Inflation Growth Rate
Total Long Term Debt	**3 086 185**	**3 189 115**	**3 301 743**	**3 409 408**	**3 503 517**	**3 597 438**	

Estimator: Inflation	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
Inflation (index)	170	173	177	183	188	193	198	203	208
Growth rate					3,20%	2,52%	2,53%	2,50%	2,50%

Estimator: Average Wages	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
Average Wages	4 517	4 864	5 199	5 457	5 646	5 902	6 137	6 322	6 503
Average Personal Income growth ra	7,06%	7,68%	6,88%	4,97%	3,47%	4,54%	3,98%	3,01%	2,86%

Source: Annual Reports of Bank Millennium, IMF, Trading Economics and Moodys

Appendix I – Expected Provisions

	PLN Amount	Source:
Banking System Loans total (PLN)	91 716 040 000	Bloomberg
Banking System Costs total (PLN)	34 500 000 000	S&P Global Market
CHF Loans Bank Millennium (in PLN)	14 344 610 000	2020 Annual Report
Costs to Millennium = Total Provision	5 395 883 261	
Bank Millennium % of Costs	0,16	

Provisions:	**2017**	**2018**	**2019**	**2020**	**2021 [E]**	**2022 [E]**	**2023 [E]**	**2024 [E]**	**2025 [E]**	**Criteria**
Others	21 720	51 742	53 393	51 728	56 250	58 437	60 546	62 319	64 053	Average % of Others Provisions/Gross Loans
Legal issues	46 032	60 710	111 785	555 922	1 389 805	1 667 766	1 417 601	567 040	226 816	Estimation
Growth rate considered					150%	20%	-15%	-60%	-60%	
Total	**67 752**	**112 452**	**165 178**	**607 650**	**1 446 055**	**1 726 203**	**1 478 147**	**629 359**	**290 870**	

% Others Provisions/Gross	0,04%	0,09%	0,07%
Average %	0,07%		

	Total Possible Provison:
Costs Estimation	5 395 883 261
Growth Rate Estimation	5 269 028 716
Difference	126 854 545

Source: Bloomberg, S&P Global Market and 2020 Annual Report of Bank Millennium

Appendix J – Expected Equity

EQUITY (Shareholders equity)	**2017**	**2018**	**2019**	**2020**	**2021 [E]**	**2022 [E]**	**2023 [E]**	**2024 [E]**	**2025 [E]**	**Criteria to Forecast**
Share capital	1 213 117	1 213 117	1 213 117	1 213 117	1 213 117	1 213 117	1 213 117	1 213 117	1 213 117	Constant
Common stock	1 147 502	1 147 502	1 147 502	1 147 481	1 147 481	1 147 481	1 147 481	1 147 481	1 147 481	Constant
Accumulated other comprehensive income	-34 795	73 692	70 093	199 857	192 928	184 163	176 839	171 513	166 616	Inverse GDP growth rate
Retained earnings	5 446 775	5 950 075	6 510 807	6 530 521	5 506 046	5 239 823	6 726 938	8 375 497	9 317 889	NI (N-1) - Inv. Reg. Capital
Total equity	**7 772 599**	**8 384 386**	**8 941 519**	**9 090 976**	**8 059 571**	**7 784 585**	**9 264 375**	**10 907 608**	**11 845 103**	

Source: Annual Reports of Bank Millennium and IMF

Appendix K – Expected Net Interest Income

Interest Income

	Loans	
	APR	**Interest Rate**
Loans (Average)	7,12%	6,12%

	Mortgage		
	APR	**Interest rate**	**Commission**
Mortgage Loan	3,83%	2,41%	1%
Home Equity	4,94%	3,94%	
Consolidated Loan	4,48%	3,48%	
Average	4,42%	3,28%	

Received from Costumers:

Average Int. rate loans and mortgage	4,70%
2023-2025 Int. Rate	4,85%

Received from Central Bank:

2020-2022	0%
2023-2025	0,15%

	2021	2022	2023	2024	2025
Receive from Costumers:					
Loans	78 856 750	81 922 678	84 879 660	87 364 594	89 796 282
Interest rate	4,70%	4,70%	4,85%	4,85%	4,85%
Interest income	3 704 953	3 849 000	4 115 249	4 235 727	4 353 623
Receive from central bank:					
Amount	651 532	621 933	646 667	442 279	454 906
Interest rate	0%	0%	0,15%	0,15%	0,15%
Interest income	0	0	970	663	682
Total Interest Income	**3 704 953**	**3 849 000**	**4 116 219**	**4 236 390**	**4 354 305**

Interest Expense

Source: Bank Millennium Website	
Interest Rates on deposits:	
Lokata Horyzont	0,20%
Lokata Mobilna	0,50%
Lokata Millenet	0,05%
Lokata Aukcje	1,00%
	0,44%
Pay to Costumers:	
Average Int. rate on deposits	0,44%
2023-2025 Int. Rate	0,59%
Pay to Central Bank:	
Source: NBP official website	
Interest Rate (Lombard):	
2020-2022	0,50%
2023-2025	0,65%

	2021	2022	2023	2024	2025
Pay to Costumers:					
Deposits	84 064 533	87 332 937	90 485 201	93 134 243	95 726 522
Interest rate	0,44%	0,44%	0,59%	0,59%	0,59%
Interest expense	367 782	382 082	531 601	547 164	562 393
Pay to central bank:					
Amount	1 418 429	2 734 027	2 625 295	2 447 550	2 662 093
Interest rate	0,50%	0,50%	0,65%	0,65%	0,65%
Interest income	7 092	13 670	17 064	15 909	17 304
Total Interest Expense	**374 874**	**395 752**	**548 665**	**563 073**	**579 697**
Net Interest Income	**3 330 079**	**3 453 249**	**3 567 554**	**3 673 317**	**3 774 609**

Source: 2020 Annual Report of Bank Millennium and website, National Bank of Poland

Appendix L – Expected Net Fees and Commissions Income

	2017	2018	2019	2020
Gross loans	48 908 306	54 470 547	71 577 008	76 460 977
Deposits	57 273 255	66 243 769	81 454 765	81 510 540
Net Fees and Commission Income	663 553	661 069	699 153	746 056
% Net Fees and Commission/(Average Deposits + Loans)	0,62%	0,55%	0,46%	0,47%
Average	0,53%			
Correlation Net fees/commissions and Deposits	0,83			
Correlation Net fees/commissions and Loans	0,92			

	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
Gross loans	78 856 750	81 922 678	84 879 660	87 364 594	89 796 282
Deposits	84 064 533	87 332 937	90 485 201	93 134 243	95 726 522
Average Amount	81 460 642	84 627 808	87 682 431	90 249 419	92 761 402
% Net Fees and Commission/(Deposits + Loans)	0,53%	0,53%	0,53%	0,53%	0,53%
Net Fees and Commission Income	**428 013**	**444 654**	**460 704**	**474 192**	**487 390**

Source: Annual Reports of Bank Millennium

Appendix M – Expected Provisions Created

Provisons Created	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
(-) Provisons Created / Change of provisions	0	-14 157	-234 797	-727 182	-838 405	-280 148			
Provisions Created Growth rate			1559%	210%	15%	-67%			
Provisions Created Growth rate (Expected)							67%	3,01%	2,86%
Total		**-14 157**	**-234 797**	**-727 182**	**-838 405**	**-280 148**	**-93 610**	**-90 790**	**-88 198**

Source: Annual Reports of Bank Millennium

Appendix N – Expected Impairment Losses on Financial and Non-Financial Assets

	2017	2018	2019	2020	Average
Impairment financial assets	-255 358	-202 476	-403 936	-564 802	
Securities	19 321 151	23 225 154	23 077 643	19 624 320	
% Securities Gains (Losses) / Securities	-1,32%	-0,87%	-1,75%	-2,88%	-1,71%
Impairment financial assets	-255 358	-202 476	-403 936	-564 802	
Allowance for credit impairment	-1 497 228	-1 758 867	-1 961 618	-2 372 635	
% Impairment financial assets / Allowance for credit impairment	-17,06%	-11,51%	-20,59%	-23,80%	-18,24%

Correlation Impairment and allowance	0,91

	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
Securities	19 624 320	19 958 715	21 707 770	23 379 440	24 473 763	25 423 749
% Weight	-1,71%	-1,71%	-1,71%	-1,71%	-1,71%	-1,71%
	-334 686	-340 389	-370 218	-398 728	-417 391	-433 593
Allowance for loans losses	-2 372 635	-2 418 156	-2 530 738	-2 647 152	-2 760 865	-2 878 024
% Weight	-18,24%	-18,24%	-18,24%	-18,24%	-18,24%	-18,24%
		441 095	461 632	482 867	503 609	524 980
Impairment financial assets		**-781 484**	**-831 850**	**-881 594**	**-921 000**	**-958 573**

Source: Annual Reports of Bank Millennium

Appendix O – Expected Operating Costs

Macroeconomic Indicator	Source	Unit	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
GDP (constant prices)	IMF	Billions PLN	1 947	2 052	2 145	2 086	2 159	2 257	2 347	2 417	2 486
Inflation (average of year)	IMF	Index	169,83	172,55	176,53	182,53	188,38	193,13	198,02	202,97	208,04
Inflation Rate Growth Rate (average of year)	IMF	%	1,98%	1,60%	2,31%	3,40%	3,20%	2,52%	2,53%	2,50%	2,50%

Non-Interest Expenses (operating costs)	1 149 723	1 213 765	1 545 183	1 542 379

Correlation:	
GDP (constant prices)	0,87
Inflation (average of year)	0,89

	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
Inflation Growth Rate		3,20%	2,52%	2,53%	2,50%	2,50%
Operating Costs	**-1 542 379**	**-1 591 797**	**-1 631 926**	**-1 673 246**	**-1 715 078**	**-1 757 954**

Source: Annual Reports of Bank Millennium and IMF

Appendix P – Expected Depreciation Costs

	2017	2018	2019	2020	Average
Equipment and Intangible Assets	265 636	307 105	1 008 983	956 594	
Depreciation	-52 971	-54 227	-180 872	-210 411	
Weight Depreciation / Tangible and Intangible Assets	-19,9%	-17,7%	-17,9%	-22,0%	-19,4%
Correlation (Assets and Depreciation)	-0,98				

	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
Tangible and Intangible Assets	975 726	995 240	1 015 145	1 035 448	1 056 157
Weight	-19,4%	-19,4%	-19,4%	-19,4%	-19,4%
Depreciation	**-189 097**	**-192 879**	**-196 737**	**-200 672**	**-204 685**

Source: Annual Reports of Bank Millennium

Appendix Q1 - Mandatory Capital Ratios

('000 PLN)

Relevant Ratios Summary:	**2017**	**2018**	**2019**	**2020**	**2021 [E]**	**2022 [E]**	**2023 [E]**	**2024 [E]**	**2025 [E]**
Capital ratios under Basel III:									
Total	8%	8%	8%	8%	8%	8%	8%	8%	8%
Tier 1	6%	6%	6%	6%	6%	6%	6%	6%	6%
CET 1	4,50%	4,50%	4,50%	4,50%	4,50%	4,50%	4,50%	4,50%	4,50%
Minimum requirements:									
Leverage Ratio	3%	3%	3%	3%	3%	3%	3%	3%	3%
Minimum Reserves	3,50%	3,50%	3,50%	2,00%	0,50%	0,50%	0,50%	0,50%	0,50%
Pillar II RRE FX Buffer:									
Total Capital Ratio (TCR)	5,41%	6,27%	4,87%	3,35%	3,35%	3,35%	2,35%	1,35%	0,35%
Tier 1 ratio	4,06%	4,70%	3,65%	2,52%	2,52%	2,52%	1,52%	0,52%	0,00%
CET 1 Ratio	3,03%	3,51%	2,73%	1,88%	1,88%	1,88%	0,88%	0,00%	0,00%

Appendix Q2 – RWA Estimation

Forecast	**2017**	**2018**	**2019**	**2020**	**2021 [E]**	**2022 [E]**	**2023 [E]**	**2024 [E]**	**2025 [E]**
Rwa – Risk Weighted Assets									
Bank Millennium:									
Total RWA	32 693 600	36 635 500	48 124 600	51 138 000	55 857 083	61 853 513	68 001 000	73 835 537	80 075 058
Total Assets to consider	71 726 613	81 066 096	97 887 982	97 991 227	101 035 993	105 882 378	110 398 540	113 861 726	117 461 594
Eurobank:									
Total Rwa	9 159 072	9 079 667							
Total Assets to consider	13 493 129	14 139 348							
RWA / Total Assets	49,11%	48,02%	49,16%	52,19%	55,28%	58,42%	61,60%	64,85%	68,17%
RWA / Total Assets Growth Rate		-2%	2%	6%	5,94%	5,67%	5,44%	5,28%	5,13%
Correlation GDP and RWA/Assets	-0,98								

Note: 1st is computed the RWA/Assets Growth Rate trough GDP growth rate, 2nd compute RWA/Assets Ratio following the growth rate and last compute Total RWA (=Total Assets * RWA/Assets Ratio)

Total assets to consider: Cash and deposits at Central Banks, Gross Loans and Other financial assets.

Appendix Q3 – CET 1, Tier 1 and TCR Estimation

Own Funds	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]	2026 [E]	Criteria to forecast:
Capital	2 360 619	2 360 619	2 360 619	2 360 598	2 360 598	2 360 598	2 360 598	2 360 598	2 360 598	2 407 810	Perpetual Growth
Retained Earnings	5 446 775	5 950 075	6 510 807	6 530 521	5 506 046	5 239 823	6 726 938	8 375 497	9 317 889	9 504 247	Perpetual Growth
Other Equity Instruments	0	0	0	0	0	0	0	0	0	0	
Subordinated Debt	701 971	701 883	1 546 205	1 540 209	1 593 608	1 666 006	1 732 263	1 784 438	1 835 384		
Own Funds From Equity	7 807 394	8 310 694	8 871 426	8 891 119	7 866 644	7 600 421	9 087 536	10 736 095	11 678 487	11 912 057	
Cet 1 / Own Funds From Equiy	84%	87%	92%	95%	89%	91%	92%	92%	91%	91%	Average of the 4 previous years
Cet 1	6 548 800	7 243 000	8 138 500	8 439 000	7 034 461	6 901 704	8 335 123	9 846 705	10 617 629	10 874 495	
Tier 1	6 548 800	7 243 000	8 138 500	8 439 000	7 034 461	6 901 704	8 335 123	9 846 705	10 617 629	10 829 981	
Remaining Own Funds	1 960 565	1 769 577	2 279 131	1 992 328	2 425 790	2 364 723	2 484 676	2 673 828	2 896 243	1 037 562	
Tier 2 / Remaining On Funds	33%	40%	67%	77%	54%	59%	64%	64%	60%	62%	Average of the 4 previous years
Tier 2	641 800	700 000	1 530 000	1 530 000	1 311 251	1 404 276	1 598 668	1 701 722	1 748 055	642 575	
Total	**7 190 600**	**7 943 000**	**9 668 500**	**9 969 000**	**8 345 712**	**8 305 980**	**9 933 791**	**11 548 428**	**12 365 683**	**11 472 557**	

Required versus Actual Ratios	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]	Criteria to forecast:
CET 1 Ratio Actual	20,03%	19,77%	16,91%	16,50%	12,59%	11,16%	12,26%	13,34%	13,26%	Minimal + Required (4,5%)
Cet 1 Ratio (Minimum)	13,53%	12,89%	12,73%	9,13%	9,13%	9,13%	9,13%	9,13%	9,13%	Hold Constant.
Difference to Basel's base rate	9,03%	8,39%	8,23%	4,63%	4,63%	4,63%	4,63%	4,63%	4,63%	
Tier 1 Ratio Actual	15,65%	15,84%	16,91%	16,50%	12,59%	11,16%	12,26%	13,34%	13,26%	Minimal + Required (6%)
Tier 1 Ratio (minimum)	14,56%	15,58%	15,15%	11,27%	11,27%	11,27%	11,27%	11,27%	11,27%	Hold Constant.
Difference to Basel's base rate	8,56%	9,58%	9,15%	5,27%	5,27%	5,27%	5,27%	5,27%	5,27%	
Total Capital Ratio Actual	17,18%	17,37%	20,09%	19,49%	14,94%	13,43%	14,61%	15,64%	15,44%	Minimal + Required (8%)
Total Capital Ratio (Minimum)	18,91%	19,15%	18,37%	14,10%	14,10%	14,10%	14,10%	14,10%	14,10%	Hold Constant.
Total Capital Ratio (Minimum) - Tier 1 Ratio (Minim	4,35%	3,57%	3,22%	2,83%	2,83%	2,83%	2,83%	2,83%	2,83%	Hold Constant.
Difference to Basel's base rate	10,91%	11,15%	10,37%	6,10%	6,10%	6,10%	6,10%	6,10%	6,10%	
Cash and deposits at Central Banks	2 080 151	2 450 176	2 203 444	1 460 289	1 459 283	1 461 089	1 320 053	1 179 994	1 374 714	
Total deposits	57 273 255	66 243 769	81 454 765	81 510 540	84 064 533	87 332 937	90 485 201	93 134 243	95 726 522	
Cash and deposits at Central Banks / Total Deposits	3,63%	3,70%	2,71%	1,79%	1,74%	1,67%	1,46%	1,27%	1,44%	
Minimum reserves	3,50%	3,50%	3,50%	2,00%	0,50%	0,50%	0,50%	0,50%	0,50%	
Extra cash ratio	0,13%	0,20%	-0,79%	-0,21%	1,24%	1,17%	0,96%	0,77%	0,94%	
Minimum Cash and deposits at Central Banks / Total I	2,71%	2,71%	2,71%	1,21%	-0,29%	-0,29%	-0,29%	0,29%	1,27%	Average of the 4 previous years

Short and Long Term Measures:	2017	2018	2019	2020	2021 [E]	2022 [E]	2023 [E]	2024 [E]	2025 [E]
Leverage ratio	9,40%	9,21%	8,51%	8,74%	7,06%	6,61%	7,64%	8,74%	9,15%
Leverage ratio (required by Basel III)	3%	3%	3%	3%	3%	3%	3%	3%	3%
Difference to Basel's base rate	6%	6%	6%	6%	4%	4%	5%	6%	6%

Appendix Q4 - Summary of Regulatory Capital

Bank Millennium Capital Ratios Basel III	**2017**	**2018**	**2019**	**2020**	**2021 [E]**	**2022 [E]**	**2023 [E]**	**2024 [E]**	**2025 [E]**
Total Capital (Actual)	17,18%	17,37%	20,09%	19,49%	14,94%	13,43%	14,61%	15,64%	15,44%
Requirement Pilar 1	8%	8%	8%	8%	8%	8%	8%	8%	8%
Requirement Total (Minimum)	18,91%	19,15%	18,37%	14,10%	14,10%	14,10%	14,10%	14,10%	14,10%
Tier 1 (Actual)	15,65%	15,84%	16,91%	16,50%	12,59%	11,16%	12,26%	13,34%	13,26%
Requirement Pilar 1	6%	6%	6%	6%	6%	6%	6%	6%	6%
Requirement Total (Minimum)	14,56%	15,58%	15,15%	11,27%	11,27%	11,27%	11,27%	11,27%	11,27%
CET 1 (Actual)	20,03%	19,77%	16,91%	16,50%	12,59%	11,16%	12,26%	13,34%	13,26%
Requirement Pilar 1 (Tier 1)	4,50%	4,50%	4,50%	4,50%	4,50%	4,50%	4,50%	4,50%	4,50%
CET 1 (Minimum)	13,53%	12,89%	12,73%	9,13%	9,13%	9,13%	9,13%	9,13%	9,13%
Leverage Ratio (LR)	9,40%	9,21%	8,51%	8,74%	7,06%	6,61%	7,64%	8,74%	9,15%
Requirement LR	3%	3%	3%	3%	3%	3%	3%	3%	3%
Cash Reservers	3,63%	3,70%	2,71%	1,79%	1,74%	1,67%	1,46%	1,27%	1,44%
Requirement Cash Reserves	2,71%	2,71%	2,71%	1,21%	-0,29%	-0,29%	-0,29%	0,29%	1,27%
Total Capital - Requirement Capital	-1,73%	-1,78%	1,72%	5,39%					
Target Total ratio					14,10%	14,10%	14,10%	14,10%	14,10%

('000 PLN)

Relevant Ratios Summary:	**2017**	**2018**	**2019**	**2020**	**2021 [E]**	**2022 [E]**	**2023 [E]**	**2024 [E]**	**2025 [E]**
Capital ratios under Basel III:									
Total	8%	8%	8%	8%	8%	8%	8%	8%	8%
Tier 1	6%	6%	6%	6%	6%	6%	6%	6%	6%
CET 1	4,50%	4,50%	4,50%	4,50%	4,50%	4,50%	4,50%	4,50%	4,50%
Minimum requirements:									
Leverage Ratio	3%	3%	3%	3%	3%	3%	3%	3%	3%
Minimum Reserves	3,50%	3,50%	3,50%	2,00%	0,50%	0,50%	0,50%	0,50%	0,50%
Pillar II RRE FX Buffer:									
Total Capital Ratio (TCR)	5,41%	6,27%	4,87%	3,35%	3,35%	3,35%	2,35%	1,35%	0,35%
Tier 1 ratio	4,06%	4,70%	3,65%	2,52%	2,52%	2,52%	1,52%	0,52%	0,00%
CET 1 Ratio	3,03%	3,51%	2,73%	1,88%	1,88%	1,88%	0,88%	0,00%	0,00%
Bank Millennium is in compliance?									
Total Capital Ratio (TCR)	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance
Tier 1 ratio	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance
CET 1	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance	Compliance

Capital ratios under Basel III:	**2017**	**2018**	**2019**	**2020**	**2021 [E]**	**2022 [E]**	**2023 [E]**	**2024 [E]**	**2025 [E]**
Total	8%	8%	8%	8%	8%	8%	8%	8%	8%
Tier 1	6%	6%	6%	6%	6%	6%	6%	6%	6%
CET 1	5%	5%	5%	5%	5%	5%	5%	5%	5%
Leverage Ratio	3%	3%	3%	3%	3%	3%	3%	3%	3%
Pillar II RRE FX Buffer:									
Total Capital Ratio (TCR)	5,41%	6,27%	4,87%	3,35%	3,35%	3,35%	2,35%	1,35%	0,35%
Tier 1 ratio	4,06%	4,70%	3,65%	2,52%	2,52%	2,52%	1,52%	0,52%	0,00%
CET 1 Ratio	3,03%	3,51%	2,73%	1,88%	1,88%	1,88%	0,88%	0,00%	0,00%
Total Ratios to fullfill	34,00%	35,98%	32,75%	29,25%	29,25%	29,25%	26,25%	23,37%	21,85%

Total Ratios to Fulfill:	**2017**	**2018**	**2019**	**2020**	**2021 [E]**	**2022 [E]**	**2023 [E]**	**2024 [E]**	**2025 [E]**	**2026 [E]**	**Criteria to forecast:**
Total Ratios to fulfill (Basel + RRE)	34,00%	35,98%	32,75%	29,25%	29,25%	29,25%	26,25%	23,37%	21,85%		
Total Regulatory Capital	14 229 908	16 448 317	15 760 807	14 957 865	16 338 197	18 092 153	17 850 263	17 255 365	17 496 400	17 846 328	Perpetual Growth
Reinvestment		**2 218 409**	**-687 511**	**-802 941**	**1 380 332**	**1 753 956**	**-241 890**	**-594 897**	**241 035**	349 928	

Source: Annual Reports of Bank Millennium and Basel III

Appendix R – FCFE Valuation

Standard FCFE Approach							
	2020	2021	2022	2023	2024	2025	2026
Standard FCFE Approach:	**0**	**1**	**2**	**3**	**4**	**5**	**g**
EBIT	0	0	0	0	0	0	0
(-) Interest expenses	0	0	0	0	0	0	0
=EBT	207 257	307 280	920 646	1 152 012	1 192 558	1 227 537	1 252 088
(-) Taxes	-188 118	-87 344	-261 692	-327 457	-338 982	-348 925	-355 903
=Net Income	19 139	219 936	658 954	824 555	853 576	878 612	896 185
(+) Depreciation	-210 411	-189 097	-192 879	-196 737	-200 672	-204 685	-208 779
=Net Cash Flow	-191 272	30 839	466 075	627 818	652 904	673 927	687 406
(-) Capex (investment in Equipment and Intangible Assets)	-52 389	19 132	19 515	19 905	20 303	20 709	21 123
+/- var of WC	0	0	0	0	0	0	0
+/- var of Debt	0	0	0	0	0	0	0
(-) Capital Increase	0	0	0	0	0	0	0
=FCFE	-243 661	49 971	485 590	647 723	673 207	694 636	708 529
Cost of equity	9,48%	9,48%	9,48%	9,48%	9,48%	9,48%	9,48%
Perpetual Growth							2,00%
Terminal Value							9 472 314
Present Value	-243 661	45 644	405 135	493 611	468 608	441 655	6 022 574

Free Cash Flow for Equity (FCFE-Standard)	
NPV	1 610 992
TV	6 022 574
Equity Value (000' PLN)	7 633 566
N° of Shares outstanding	1 213 116 777
Value Per Share	6,29

Share Value Reference 12/2020	3,15	Source: Bloomberg
Difference	3,14	
% Difference	99%	

Source: Author

Base Scenario								
Damodaran suggested Adjustment:								
Inputs:								
Cost of Equity (Ke)	**9,48%**							
Perpetual Growth Rate (g)	**2,00%**							
		2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
		0	**1**	**2**	**3**	**4**	**5**	**g**
Net Income		19 139	219 936	658 954	824 555	853 576	878 612	896 185
(-) Reinvestment in Regulatory Capital		-802 941	1 380 332	1 753 956	-241 890	-594 897	241 035	349 928
=FCFE		822 080	-1 160 396	-1 095 002	1 066 445	1 448 474	637 577	546 257
Cost of equity		9,48%	9,48%	9,48%	9,48%	9,48%	9,48%	9,48%
Perpetual Growth								2,00%
Terminal Value								7 302 898
Present Value		822 080	-1 059 916	-913 577	812 707	1 008 257	405 377	4 643 241

Free Cash Flow for Equity (FCFE-Damodaran Adjustment)	
NPV	1 074 929
TV	4 643 241
Equity Value (000' PLN)	5 718 171
N° of Shares outstanding	1 213 116 777
Value Per Share	4,71

Share Value Reference 12/2020	3,15	Source: Bloomberg
Difference	1,56	
% Difference	49%	

Source: Author

Appendix S – ECF Valuation

ECF Valuation								
Inputs:								
Cost of Equity	9,48%							
Perpetual Growth	2,00%							
		2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
		0	**1**	**2**	**3**	**4**	**5**	**g**
(+) Net income		22 817	224 075	663 612	829 796	859 473	885 249	
(-) Variation in book value of equity		149 457	-1 031 405	-274 987	1 479 790	1 643 233	937 496	
(+) Other compreenshive income		199 857	192 928	184 163	176 839	171 513	166 616	
ECF		**73 217**	**1 448 407**	**1 122 762**	**-473 156**	**-612 247**	**114 369**	**116 656**
Cost of equity (ke)		9,48%	9,48%	9,48%	9,48%	9,48%	9,48%	9,48%
Perpetual Growth Rate (g)								2%
Terminal Value								1 559 578
Present Value		73 217	1 322 988	936 738	-360 578	-426 174	72 717	991 592

Equity Cash Flow (ECF)	
NPV	1 618 907
TV	991 592
Equity Value (000' PLN)	2 610 499
Nº of Shares outstanding	1 213 116 777
Value Per Share	2,15

Share Value Reference 12/2020	3,15	Source: Bloomberg
Difference	-1,00	
% Difference	-32%	

Source: Author

Appendix T – RI Valuation

Aggelopoulos Article:							
000 PLN							
Balance sheet template for bank valuation.	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Assets:		**0**	**1**	**2**	**3**	**4**	**5**
Cash/Due from Banks	1 788 432	1 230 998	1 568 996	1 629 998	1 492 772	1 581 090	1 786 657
Balances with BoG (trade balance)	1 444 899	674 932	651 532	621 933	646 667	442 279	454 906
Securities & Investments	23 077 643	19 624 320	19 958 715	21 707 770	23 379 440	24 473 763	25 423 749
Loans (net)	69 615 390	74 088 342	76 491 048	79 464 998	82 333 270	84 743 656	87 102 393
PPE	1 008 983	956 594	975 726	995 240	1 015 145	1 035 448	1 056 157
Accrued Income	541 828	665 174	589 660	612 586	634 697	653 278	671 461
Other Assets	439 219	531 425	549 038	570 384	590 972	608 273	625 204
TOTAL ASSETS	97 916 394	97 771 785	100 784 714	105 602 908	110 092 964	113 537 788	117 120 528
Liabilities:							
Due to Banks	1 578 848	1 057 652	1 418 429	2 734 027	2 625 295	2 447 550	2 662 093
Deposits	81 454 765	81 510 540	84 064 533	87 332 937	90 485 201	93 134 243	95 726 522
Bonds Issued	3 599 996	3 254 738	3 466 478	3 589 891	3 707 956	3 810 806	3 913 279
Deferred Tax Liability	38 590	30 843	33 315	34 611	35 860	36 910	37 937
Other Liabilities	2 302 676	2 827 036	3 742 387	4 126 857	3 974 276	3 200 671	2 935 592
Total Shareholders' Equity	8 941 519	9 090 976	8 059 571	7 784 585	9 264 375	10 907 608	11 845 103
TOTAL LIABILITIES AND SHAREHOLDER EQUI	97 916 394	97 771 785	100 784 714	105 602 908	110 092 964	113 537 788	117 120 528

RWA and Regulatory Capital Computation:		**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Due for Banks	20%	357 686	246 200	313 799	326 000	298 554	316 218	357 331
Loans	75%	52 211 543	55 566 257	57 368 286	59 598 748	61 749 953	63 557 742	65 326 795
Secutiries, Investments and trading :	100%	23 077 643	19 624 320	19 958 715	21 707 770	23 379 440	24 473 763	25 423 749
Total RWA		**75 646 872**	**75 436 776**	**77 640 800**	**81 632 517**	**85 427 947**	**88 347 723**	**91 107 876**
Tier 1	6%							
Regulatory Capital (Equity Capital)		**4 538 812**	**4 526 207**	**4 658 448**	**4 897 951**	**5 125 677**	**5 300 863**	**5 466 473**

Base Scenario								
Inputs:								
Cost of Equity	9,48%							
Perpetual Growth	2,00%							
		2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
		0	**1**	**2**	**3**	**4**	**5**	**g**
Equity Capital n-1		4 538 812	4 526 207	4 658 448	4 897 951	5 125 677	5 300 863	5 466 473
Ke (cost of equity)		9,48%	9,48%	9,48%	9,48%	9,48%	9,48%	9,48%
Cost of Equity Employed (boy)		430 279	429 084	441 621	464 326	485 914	502 522	518 222
Net Income		22 817	224 075	663 612	829 796	859 473	885 249	902 954
Cost of Equity Employed (boy)		430 279	429 084	441 621	464 326	485 914	502 522	518 222
Residual income		**-407 462**	**-205 010**	**221 991**	**365 470**	**373 559**	**382 727**	**390 381**
Perpetual Growth Rate (g)								2%
Terminal Value								5 219 001
Present Value		-407 462	-187 257	185 210	278 514	260 028	243 341	3 318 283

Residual Income (RI)	
NPV	372 373
TV	3 318 283
Equity Value (000' PLN)	3 690 657
Nº of Shares outstanding	1 213 116 777
Value Per Share	3,04

Share Value Reference 12/2020	3,15	Source: Bloomberg
Difference	-0,11	
% Difference	-0,04	

Source: Author

Appendix U – Bond Pricing Model Valuation

	2020
	0
ROE	0,25%
Cost of Equity	9,48%
MV Assets (Market Cap)	3 966 891 861
Book value of assets = Market Value	**97 771 785 000**
N° Shares	1 213 116 777
Market Share Value 30.12.2020	3,27
MV Liabilities	**-79 435 478 810**
Book value Debt	83 126 752 000
Interest Expenses	543 519 000
Average Maturity	1,58
Current cost of debt	0,33%
NAV	**177 207 263 810**
MV	**4 691 602 550**

Bond Pricing Model	
NPV	4 691 602 550
TV	0
Equity Value (000' PLN)	4 691 602 550
N° of Shares outstanding	1 213 116 777
Value Per Share	3,87

Share Value Reference 12/2020	3,15
Difference	0,71
% Difference	23%

Historical Data from 2020 Annual Report of Bank Millennium SA:
Interest Liabilities:

Debt securities issued	**Note**	**2020**	**Average Interest rate**	**Maturity (years)**
Deposits	32	81 510 540	0,44%	1,58
Central bank	31	1 057 652	0,50%	2,54
Debt securities issued (leasings and others)	34	558 560	0,06%	0,63
Total		83 126 752	0,33%	1,58

Source: Author and 2020 Annuam Report of Bank Millennium

Appendix V1 – Historical Multiples Valuation

Bank	PER	PER (with OCI)	PER (without FX Loans Provisions)	PBV	PS	P/Deposits
Bank Alior	-7,12	-12,84	-7,12	0,34	0,49	0,03
Bank Hand	26,64	6,77	1,10	0,61	2,60	0,07
BNP Paribas Bank Polska SA	12,79	5,87	10,40	0,78	1,98	0,10
mBank SA	73,10	12,33	6,74	0,46	1,09	0,06
Harmonic Mean	23,18	7,52	2,60	0,49	1,04	0,06

PER	2020
Bank Millennium Earnings	22 817 000
Peer Group PER	23,18
Bank Millennium Equity V	528 961 617
N° Shares	1 213 116 777
Price per Share	**0,44**

PER (with OCI)	2020
Bank Millennium Earnings	222 674 000
Peer Group PER	7,52
Bank Millennium Equity Value	1 673 515 390
N° Shares	1 213 116 777
Price per Share	**1,38**

PER (without Provisions)	2020
Bank Millennium Earnings	578 739 000
Peer Group PER	2,60
Bank Millennium Equity Value	1 505 959 881
N° Shares	1 213 116 777
Price per Share	**1,24**

PBV	2020
Bank Millennium BV	9 090 976 000
Peer Group PBV	0,49
Bank Millennium Equity V	4 494 078 273
N° Shares	1 213 116 777
Price per Share	**3,70**

PS	2020
Bank Millennium Sales	3 688 963 800
Peer Group PS	1,04
Bank Millennium Equity Value	3827119337
N° Shares	1 213 116 777
Price per Share	**3,15**

P/Deposits	2020
Bank Millennium Deposits	81 510 540 000
Peer Group P/Deposits	0,06
Bank Millennium Equity Value	4 497 554 662
N° Shares	1 213 116 777
Price per Share	**3,71**

Source: Author

Appendix V2 – Forward-Looking Multiples Valuation

1 Year forward-looking multiples

Year	2020	2021 [E]
GDP Growth Rate		3,47%

PLN

Bank Alior	2020	2021 [E]	Per Share
Net Income	-311 233 000	-322 023 448	-2,47
Book Value	6 559 602 000	6 787 023 401	51,99
Sales	4 548 622 000	4 706 322 725	36,05
Share Market price 31/12/2020	17		
Nº Shares	130 553 991		
PER	**-6,88**		
PBV	**0,33**		
PS	**0,47**		

Bank Handlowy	2020	2021 [E]	Per Share
Net Income	172 395 000	178 371 935	1,37
Book Value	7 580 967 000	7 843 799 126	60,03
Sales	1 764 045 000	1 825 204 440	13,97
Share Market price 31/12/2020	35		
Nº Shares	130 659 600		
PER	**25,75**		
PBV	**0,59**		
PS	**2,52**		

BNP Paribas	2020	2021 [E]	Per Share
Net income	733 095 100	758 511 507	5,15
Book Value	12 030 527 000	12 447 625 371	84,44
Sales	4 734 847 000	4 899 004 145	33,23
Share Market price 31/12/2020	64		
Nº Shares	147 418 918		
PER	**12,36**		
PBV	**0,75**		
PS	**1,91**		

mBank	2020	2021 [E]	Per Share
Net income	103 831 000	107 430 821	2,54
Book Value	1 667 506 700	1 725 319 157	40,73
Sales	6 932 914 000	7 173 278 128	169,36
Share Market price 31/12/2020	179		
Nº Shares	42 355 695		
PER	**70,65**		
PBV	**4,40**		
PS	**1,06**		

	1-year Forward looking		
Bank	**PER**	**PBV**	**PS**
Bank Alior	-6,88	0,33	0,47
Bank Hand	25,75	0,59	2,52
BNP Paribas Bank Polska SA	12,36	0,75	1,91
mBank SA	70,65	0,44	1,06
Harmonic Mean	22,41	0,48	1,00

PER	**2020**
Bank Millennium Net Income	22 817 000
Peer Group PER	22,41
Bank Millennium Equity Value	511 237 029
Nº Shares	1 213 116 777
Price per Share	**0,42**

PBV	**2020**
Bank Millennium BV	9 090 976 000
Peer Group PBV	0,48
Bank Millennium Equity Value	4 343 489 492
Nº Shares	1 213 116 777
Price per Share	**3,58**

PS	**2020**
Bank Millennium Sales	3 688 963 800
Peer Group PS	1,00
Bank Millennium Equity Value	3 698 879 195
Nº Shares	1 213 116 777
Price per Share	**3,05**

		Difference to Market Value
Expected Share Price (PER, PBV and PS)	2,35	-0,80
Expected Share Price (PS and PBV average	3,31	0,16
Market Value	3,15	

2 Years forward-looking multiples

Year	2020	2021 [E]	2022 [E]		
GDP Growth Rate		3,47%	4,54%		
PLN					
Bank Alior	**2020**	**2021 [E]**	**2022 [E]**	**Average**	**Per Share**
Net Income	-311 233 000	-322 023 448	-336 652 973	-329 338 211	-2,52
Book Value	6 559 602 000	6 787 023 401	7 095 357 874	6 941 190 638	53,17
Sales	4 548 622 000	4 706 322 725	4 920 130 966	4 813 226 845	36,87
Share Market price 31/12/2020	16,97				
Nº Shares	130 553 991				
PER	**-6,73**				
PBV	**0,32**				
PS	**0,46**				

Bank Handlowy	**2020**	**2021 [E]**	**2022 [E]**	**Average**	**Per Share**
Net Income	172 395 000	178 371 935	186 475 372	182 423 653	1,40
Book Value	7 580 967 000	7 843 799 126	8 200 142 920	8 021 971 023	61,40
Sales	1 764 045 000	1 825 204 440	1 908 123 478	1 866 663 959	14,29
Share Market price 31/12/2020	35,15				
Nº Shares	130 659 600				
PER	**25,18**				
PBV	**0,57**				
PS	**2,46**				

BNP Paribas	**2020**	**2021 [E]**	**2022 [E]**	**Average**	**Per Share**
Net income	733 095 100	758 511 507	792 970 685	775 741 096	5,26
Book Value	12 030 527 000	12 447 625 371	13 013 120 992	12 730 373 181	86,36
Sales	4 734 847 000	4 899 004 145	5 121 565 904	5 010 285 025	33,99
Share Market price 31/12/2020	63,60				
Nº Shares	147 418 918				
PER	**12,09**				
PBV	**0,74**				
PS	**1,87**				

mBank	**2020**	**2021 [E]**	**2022 [E]**	**Average**	**Per Share**
Net income	103 831 000	107 430 821	112 311 403	109 871 112	2,59
Book Value	16 675 067 000	17 253 191 573	18 037 004 066	17 645 097 819	416,59
Sales	6 932 914 000	7 173 278 128	7 499 160 154	7 336 219 141	173,21
Share Market price 31/12/2020	179,20				
Nº Shares	42 355 695				
PER	**69,08**				
PBV	**0,43**				
PS	**1,03**				

	Average of 2021-2022		
Bank	**PER**	**PBV**	**PS**
Bank Alior	-6,73	0,32	0,46
Bank Hand	25,18	0,57	2,46
BNP Paribas Bank Polska SA	12,09	0,74	1,87
mBank SA	69,08	0,43	1,03
Harmonic Mean	21,91	0,47	0,98

PER	**2020**
Net Income	22 817 000
Peer Group PER	21,91
Bank Millennium Equity Value	499 882 205
Nº Shares	1 213 116 777
Price per Share	**0,41**

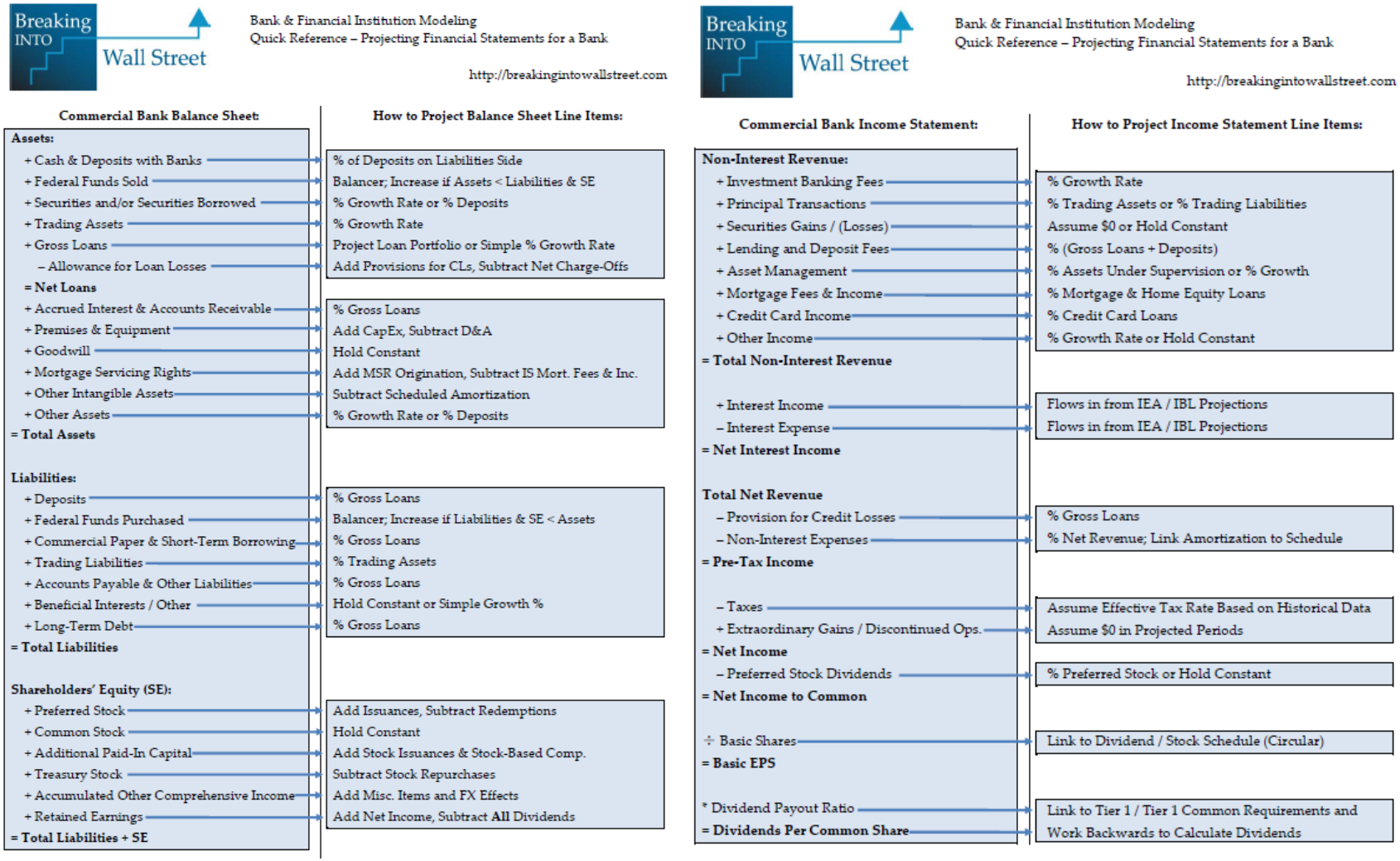
PBV	**2020**
Bank Millennium BV	9 090 976 000
Peer Group PBV	0,47
Bank Millennium Equity Value	4 247 018 468
Nº Shares	1 213 116 777
Price per Share	**3,50**

PS	**2020**
Bank Millennium Sales	3 688 963 800
Peer Group PS	0,98
Bank Millennium Equity Value	3 616 725 280
Nº Shares	1 213 116 777
Price per Share	**2,98**

		Difference to Market Value
Expected Share Price (PER, PBV and PS)	2,30	-0,86
Expected Share Price (PS and PBV average)	3,24	0,09
Market Value	3,15	

Source: Author

Appendix W – Bank & Financial Institution Model



Source: Breaking Into Wall Street