MONETARY POLICY AND ASSET VALUATION: A NEW APPROACH FOR EFFECTS OF MONETARY POLICY’S TRANSMISSION MECHANISM

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Resumo: Desenvolvemos um modelo de simulação monetária e financeira baseado em cinco modelos adaptados de valuation de bancos. Cada um deles estima os valores intrínsecos das cinco principais instituições financeiras do setor bancário brasileiro: Itaú / Unibanco, Banco do Brasil, Bradesco, Santander e BTG Pactual. O período analisado vai do quarto trimestre de 2011 ao terceiro trimestre de 2020. Inicialmente, consolidamos as demonstrações financeiras desses bancos. Em seguida, projetamos a tabela agregada de usos e fontes três trimestres à frente e descontamos para o quarto trimestre de 2020, de acordo com os cinco modelos de valuation mais pesquisados por analistas fundamentalistas. Em seguida, calculamos as elasticidades do valor intrínseco do setor bancário, como um todo, em relação à variação da taxa básica de juros (taxa SELIC, definida pelo Banco Central do Brasil). Finalmente, fizemos algumas simulações usando esta nova abordagem para análise de mecanismo de transmissão. Essa abordagem, em suma, tenta complementar a análise tradicional do mecanismo de transmissão pelo canal de preços dos ativos. Propomos uma outra alternativa: o canal do valor intrínseco dos ativos. Embora a análise do efeito da política de juros sobre o preço dos ativos seja relevante, procuramos mostrar que as técnicas de avaliação também podem contribuir para o debate sobre os canais do mecanismo de transmissão da política monetária. Os resultados mostram que o impacto dessas mudanças no setor bancário não tende a afetar negativamente seus valores intrínsecos. De fato, na maioria das situações, os bancos aumentam seu valor intrínseco com taxas de juros básicas mais baixas. Ele também perdem muito pouco valor intrínseco quando as taxas de juros sobem. Isso explica por que os investidores brasileiros geralmente compram ações de bancos como forma de se proteger contra o aumento das taxas de juros. Esses resultados também ajudam a desmistificar a noção errônea de que os principais bancos brasileiros preferem um ambiente macroeconômico com altas taxas básicas de juros. Isso, de certa forma, contradiz o que alguns economistas no Brasil disseram nas últimas décadas.

Palavras-chave: mecanismo de transmissão, política monetária, avaliação de ativos, taxa de juros, setor bancário.

Abstract: We have developed a monetary and financial simulation model based on five adapted bank valuation models. Each of them estimate the intrinsic values of the five main financial institutions of the Brazilian banking sector: Itaú/Unibanco, Banco do

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MONETARY POLICY AND ASSET VALUATION: A NEW APPROACH FOR EFFECTS OF MONETARY POLICY’S TRANSMISSION MECHANISM

Brasil, Bradesco, Santander and BTG Pactual. Analyzed period goes from the fourth quarter of 2011 to the third quarter of 2020. Initially, we consolidated the financial statements of these banks. Then, we projected the aggregated sources/uses table three quarters ahead and discounted it for the fourth quarter of 2020, according to the five valuation models most researched by fundamentalist analysts. After this, we calculated the elasticities of the intrinsic value of the banking sector, as a whole, in relation to the changes in Brazil’s basic interest rate (SELIC rate, defined by Central Bank of Brazil). Finally, we did some simulations using this new approach to transmission mechanism analysis. This approach, in short, try to complement the traditional analysis of the transmission mechanism by the asset price channel. We propose another alternative: the channel of the intrinsic value of the assets. Although the analysis of the effect of interest policy on the price of assets is relevant, we have tried to show that valuation techniques can also contribute to the debate over the channels of the transmission mechanism of monetary policy. The results show that the impact of these changes on the banking sector does not tend to negatively affect their intrinsic values. Indeed, in most situations, banks increase their intrinsic value with lower base interest rates. They also lose very little intrinsic value when interest rates rise. This explains why Brazilian investors usually buy bank’s stocks as a way to protect themselves against rising interest rates. These results also help to demystify the erroneous notion that the main Brazilian banks prefer a macroeconomic environment with high basic interest rates. This, in a way, contradicts what some economists in Brazil have said in recent decades.

Keywords: transmission mechanism, monetary policy, asset valuation, interest rate, bank sector.

1. INTRODUCTION

According European Central Bank, the transmission mechanism of monetary policy is “the process through which monetary policy decisions affect the economy in general and the price level in particular.”

The chart below illustrates the different transmission channels of monetary policy decisions (ECB):

Figure 1: The channels of transmission mechanism

Source: European Central Bank (2017)
The purpose of this article is to investigate the effect of Central Bank of Brazil’s policy decisions of change the basic interest rate (Selic rate) on the intrinsic values of the five most relevant banks that compose the Brazilian concentrated banking sector. We use a new methodology, based on estimations of five main stock valuation models, according Fernández (2004 and 2008).

In this sense, these models answers how much the increases or reductions in the Selic rate by the Monetary Policy Committee of the Central Bank can increase or decrease the intrinsic value of Brazilian banks.

According to Loayza and Schmidt-Hebbel (2002, p. 3) there are five transmission channels of monetary policy. The five channels: (i) interest rate; (ii) exchange rate; (iii) monetary and credit aggregates; (iv) asset prices; and (v) expectations. The first and most traditional of them is the interest rate channel. In the view of these authors it is commonly considered as the most important channel and depends on other connections that have been analyzed in the macroeconomic literature. They also claim that, at the outset, there is no reason to focus on only one asset price, the interest rate, as the single transmission channel of monetary policy. The cited authors consider that decisions of the monetary authority can lead to important effects on stock prices, bonds, real estate and exchange rates. Therefore, we consider that is important not only to verify the effects of monetary policy on asset prices, but also on their intrinsic values, which are defined by valuation techniques widely used by fundamentalist analysts in various financial markets around the world. So, we try to substitute the traditional of asset prices channel approach for an alternative approach of banks’ intrinsic value channel.

2. VALUATION MODELS

The first subsection reviews the valuation literature. The second deals with the five main valuation models used in our research

2.1 Valuation Models

The focus of this review is on the literature on discounted cash flow valuation models.

Bodie, Kane and Marcus (2009, 589) consider that the intrinsic value of a stock (the ultimate object of valuation techniques) corresponds to the present value of the cash payments to its buyer, which includes dividends and amounts arising from the final sale of the shares, discounted at an appropriate risk-adjusted interest rate.
With a similar but broader view, Damodaran (2006, p. 3) considers asset valuation to be at the heart of many analytical activities that are done in finance. It is useful both in the study of market efficiency and in the analysis of corporate governance issues or in the comparison of different investment decision rules for the capital budget.

Analysts usually use a diverse set of valuation models. There are those that are simple and there are others well refined. Some examples: i) discounted cash flow model - the focus of this article - that relates the value of an asset to the present value of expected future cash flows in that asset; ii) settlement and accounting evaluation model, which aims to evaluate the existing assets of a company, using accounting estimates of value or the own book value as the beginning of the process; (iii) a model that estimates the value of an asset taking into account the pricing of other "comparable" assets in relation to a common variable (such as profits, cash flows, book value or sales); iv) a contingent valuation model that uses pricing options to measure the value of the assets that resemble to, in general or in part, the options (this class of models fits the theory of real options).

According to Parker (1968), the pioneering interest rate tables date back to 1340. And it is the same Parker who attributes to the first publication on the subject, the "Pratica della Mercatura" of 1766, to Francesco Pegolotti, a Florentine businessman and politician.

However, the truly seminal contributions to discounted cash flow valuation techniques were established by Alfred Marshall (1907) and Bohm-Bawerk (1903). Both explored the notion of present value in their works in the early twentieth century, influencing Irving Fisher, who developed and sophisticated it in The Rate of Interest of 1907 and The Theory of Interest of 1930. In both works, Fisher Proposed four alternative approaches to analyzing investments. According to him, they would generate the same results. He argued that when faced with various investment alternatives, one should choose the investment: (i) which has the highest present value at the market interest rate; ii) whose present value of the benefits exceeds the present value of the costs; (iii) whose "rate of return on sacrifice" exceeds the market interest rate; or (iv) that compared to the next most expensive investment, generate a rate of return on the cost higher than the market interest rate. It should be noted that the first two approaches follow the net present value rule. The third is a variant of the internal rate of return (IRR) approach. The latter corresponds to the marginal rate of return approach.

As Fisher did not go deeply into the notion of the rate of return, other economists came to explore the idea better. Starting from the analysis of a single investment,
Boulding (1935) deduced the internal rate of return of an investment from its expected cash flows and from an initial investment.

Keynes (1936) argued that the "marginal efficiency of capital" could be calculated as the discount rate that makes the present value of an asset's returns equal to its current price and that is equivalent to the rate of return (the same of Fisher) of an investment.

Samuelson (1937) explored the differences between the internal rate of return and net present value approaches. He also argued that rational investors should maximize the net present value, not the IRR.

In the past 50 years, discounted cash flow models have spread and expanded their scope for insurance and business valuation. There is no doubt, according to Damodaran (2006), that this impulse was stimulated by the developments of portfolio theory. For fundamentalists (and unlike chartist) the value of a stock is different from the price of it, and investors seek to know how the value oscillations occur and try to anticipate possible price swings. The classic form for this type of approach is the dividend discount model, which is the basis of corporate finance theory. The value of a company is the sum of all expected dividend payments, discounting their present net value. However, these components are affected by uncertainty.

2.2 Valuation Models

These five models described in this subsection are the most important and researched in the valuation literature. According to Fernández (2008), the models of discounted cash flows that are historically receiving the most attention from financial researchers, fundamental analysts and valuation experts are the ones we will use to estimate our bank system intrinsic values: Myers (1974), Miles and Ezzell (1980), HPR (Harris and Pringle, 1985, and Ruback, 1995), Damodaran (1994) and Fernández himself (2004 and 2008).

Table 1: Equations used in all the five valuation models

<table>
<thead>
<tr>
<th>Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) $VAC_0 = \sum_{t=1}^{\infty} \frac{CFac_t}{(1 + Ke_t)\ldots(1 + Ke_t)}$</td>
</tr>
<tr>
<td>2) $D_0 = \sum_{t=1}^{\infty} \frac{CFd_t}{(1 + Kd_t)\ldots(1 + Kd_t)}$</td>
</tr>
</tbody>
</table>
In the five models, we have a nomenclature of the variables:

- VTS is the value of tax shields, which is the value of the reduction of the taxable income of an individual or legal entity. This reduction is obtained through legal deductions arising from interest payments, medical expenses, philanthropic donations, depreciation and amortization, etc. Such deductions affect part of the taxpayer's taxable income in a given year or differ in future years due payments (Fernández, 2004 and 2006). With this, the tax benefit reduces the total amount of taxes payable by a company or taxpayer;
- $D_0$ is the value of the debt in the current period, which in this model is equal to $VA_0$, the current value of the expected flows for the shares;
- $K_d$ is the the required return of the company's debt;
- $T$ is the tax rate on the company;
- $K_e$ is the required profitability of the company's shares (or the cost of own resources);
- $K_u$ is the required profitability of the shares of the company not leveraged (with $D_0 = 0$);
- $V_u$ is the value of the shares of the company not leveraged (with $D_0 = 0$);
- VAC\(_0\) is the value of the shares in the present (when \(t = 0\));
- WACC is the weighted average cost of capital;
- \(\beta_L\) is the beta for a leveraged (with debt) company, \(Ke = R_F + \beta_L \cdot P_M\);
- \(\beta_u\) is the beta for a unlevered company (without debt), \(Ku = R_F + \beta_u \cdot P_M\);
- \(\beta_d\) is the beta for the debt of a company, \(Kd = R_F + \beta_d \cdot P_M\);
- \(R_F\) is the risk-free rate;
- \(P_M\) is the prime market risk rate;
- CFac\(_t\) is the expected cash flow for the stocks in \(t\);
- CFd\(_t\) is the expected flow for the debt in \(t\);
- FCF\(_t\) is the free cash flow in \(t\) or CFac\(_t\) (for an unlevered company).

**Table 2: Myers (1974) - first model**

<table>
<thead>
<tr>
<th>Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>(VTS = T \cdot Kd \cdot \sum_{t=1}^{\infty} \frac{D_t-1}{(1 + Kd)^t})</td>
</tr>
<tr>
<td>(Ke = Ku + \frac{Vu - VAC_0}{VAC_0} \cdot (\beta_u - \beta_d))</td>
</tr>
<tr>
<td>(VA_0 = \frac{\Delta D_t}{(1 + Kd)})</td>
</tr>
<tr>
<td>(WACC = Ku - \frac{[(VTS \cdot (Ku - Kd) + D_0 \cdot Kd \cdot T)]}{VAC_0})</td>
</tr>
<tr>
<td>(\beta_L = \beta_u + \left(\frac{Vu - VAC_0}{VAC_0}\right) \cdot (\beta_u - \beta_d))</td>
</tr>
</tbody>
</table>

**Table 3: Miles and Ezzel (1980) - second model**

<table>
<thead>
<tr>
<th>Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>(VTS = Kd \cdot T \cdot \frac{(1 + Ku)}{(1 + Kd)} \sum_{t=1}^{\infty} \frac{D_{t-1}}{(1 + Ku)^t})</td>
</tr>
<tr>
<td>(Ke = Ku + \frac{D_0}{VAC_0} \cdot (Ku - Kd) \cdot \left[1 - \frac{Kd \cdot T}{1 + Kd}\right])</td>
</tr>
<tr>
<td>(VA_0 = \frac{D_t}{(1 + Ku)^t} - \frac{D_{t-1}}{(1 + Ku)^{t-1} \cdot (1 + Kd)})</td>
</tr>
</tbody>
</table>
Where: $D_{-1}$ is the debt in the previous period that is equal to $V_{t-1}$, the value of the share income flow also in the previous period (In the same way as Fernández (2004 and 2008) and in opposition to the models of Myers (1974), HPR (1985 and 1995) and Damodaran (1994), where this identity is defined for both variables at $t = 0$ and not at $t-1$).

In the model of Miles and Ezzell (1980), we also have the following identity:

$$Kd = R_F + \beta_L \cdot P_M$$ \hspace{1cm} (3.12)

Where it is possible to observe that the definition of the $Kd$ is (apparently) the same in the four models. But in fact, the calculation of $\beta_L$ is modified from model to model, which causes the results to differ, even though $R_F$ and $P_M$ are the same for all models.

Table 4: HPR - Harris and Pringle (1985) and Ruback (1995), third model

<table>
<thead>
<tr>
<th>Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>$VTS = \left( \frac{(D_{t-1} = VA_{t-1}) \cdot Kd \cdot T}{1 + Ku} \right)$</td>
</tr>
<tr>
<td>$Ke = Ku + \left[ \frac{D_0}{VAC_0} \right] \cdot (Ku - Kd)$</td>
</tr>
<tr>
<td>$VA_0 = \frac{\Delta D_t - D_{t-1}(Ku - Kd)}{(1 + Ku)^t}$</td>
</tr>
<tr>
<td>$WACC = Ku - \frac{Kd \cdot T}{VAC_0 + D_0}$</td>
</tr>
<tr>
<td>$\beta_L = \beta_u + \frac{D_0}{VAC_0} \cdot (\beta_u - \beta_d)$</td>
</tr>
</tbody>
</table>
Table 5: Damodaran (1994) – fourth model

<table>
<thead>
<tr>
<th>Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>( VTS = \frac{D_0 \cdot Ku \cdot T - D_0 \cdot (Kd - R_F) \cdot (1 - T)}{Ku} )</td>
</tr>
<tr>
<td>( Ke = Ku + \frac{D_0 \cdot (1 + T)}{VAC_0} \cdot (Ku - R_F) )</td>
</tr>
<tr>
<td>( VA_0 = \frac{\Delta D_0 - D_0 \cdot (Kd - R_F) \cdot (1 - T)}{(1 + Ku)^t} )</td>
</tr>
<tr>
<td>( WACC = Ku \left( 1 - \frac{D_0 \cdot T}{VAC_0 + D_0} \right) + \frac{(Kd - R_F) \cdot (1 - T)}{VAC_0 + D_0} )</td>
</tr>
<tr>
<td>( \beta_L = \beta_u + \frac{D_0(1 - T)}{VAC_0} \cdot \beta_d )</td>
</tr>
</tbody>
</table>

Table 6: Fernández (2004 and 2008) - fifth model

<table>
<thead>
<tr>
<th>Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>( VTS = Ku \cdot T \sum_{t=1}^{\infty} \frac{D_{t+1}}{(1 + Ku)^t} )</td>
</tr>
<tr>
<td>( Ke = Ku + \frac{D_0(1 - T)}{VAC_0} \cdot (Ku - Kd) )</td>
</tr>
<tr>
<td>( VA_0 = \frac{\Delta D_0}{(1 + Ku)^t} )</td>
</tr>
<tr>
<td>( WACC = Ku \left( 1 - \frac{D_0 \cdot T}{VAC_0 + D_0} \right) )</td>
</tr>
<tr>
<td>( \beta_L = \beta_u + \frac{D_0(1 - T)}{VAC_0} \cdot (\beta_u - \beta_d) )</td>
</tr>
</tbody>
</table>

These five models estimates intrinsic values of the largest multiple banks (wich have activities as commercial banks) that are part of the theoretical portfolio of the Bovespa Index (B3). Together, they add 65.3% of the total assets of the whole financial system, as well 69.6% of sistemic net equity, 65.7% of total funding, 77% of net profits, 63.7% of credit operations, 71.8% of agencies and 79.2% of bank service points (table 7).
Table 7: The size of Itaú/Unibanco, Banco do Brasil, Bradesco, Santander and BTG Pactual

<table>
<thead>
<tr>
<th>Banks</th>
<th>Total Assets</th>
<th>Credit portfolio</th>
<th>Current liabilities</th>
<th>Funding</th>
<th>Net equity</th>
<th>Net profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Itaú Unibanco</td>
<td>348,440,114.01</td>
<td>122,214,678.1</td>
<td>323,192,578.68</td>
<td>243,858,925.91</td>
<td>25,247,535.33</td>
<td>799,538.13</td>
</tr>
<tr>
<td>Banco do Brasil</td>
<td>311,229,607.10</td>
<td>118,432,851.7</td>
<td>291,268,145.60</td>
<td>243,134,264.64</td>
<td>19,961,461.50</td>
<td>550,818.60</td>
</tr>
<tr>
<td>Bradesco</td>
<td>248,434,420.67</td>
<td>86,731,875.85</td>
<td>223,740,691.30</td>
<td>183,490,626.41</td>
<td>24,693,729.37</td>
<td>747,996.67</td>
</tr>
<tr>
<td>Santander</td>
<td>175,927,396.85</td>
<td>70,582,618.39</td>
<td>161,896,101.66</td>
<td>119,406,802.36</td>
<td>14,031,295.19</td>
<td>672,833.82</td>
</tr>
<tr>
<td>BTG Pactual</td>
<td>50,547,528.59</td>
<td>8,394,568.36</td>
<td>45,938,067.06</td>
<td>28,475,070.65</td>
<td>4,609,461.71</td>
<td>182,530.63</td>
</tr>
<tr>
<td>Sum of the bank's indicators</td>
<td>1,134,579,067.2</td>
<td>406,356,592.4</td>
<td>1,046,035,584.3</td>
<td>818,365,689.97</td>
<td>88,543,483.09</td>
<td>2,953,717.8</td>
</tr>
<tr>
<td>Sum of the financial system</td>
<td>1,738,587,988.1</td>
<td>638,136,926.3</td>
<td>1,611,306,436.7</td>
<td>1,245,309,552.1</td>
<td>127,281,551.3</td>
<td>3,836,085.8</td>
</tr>
<tr>
<td>Percentages</td>
<td>65.3%</td>
<td>63.7%</td>
<td>64.9%</td>
<td>65.7%</td>
<td>69.6%</td>
<td>77.0%</td>
</tr>
</tbody>
</table>

Source: Statistics of Central Bank of Brazil (BCB)\(^4\).

### 3. DATA SOURCES, FORECASTS AND CASH FLOW

The model was developed in RStudio 3.6.1, for forecasting sources/uses table using the techniques of discounted value of future profits, as described by Dermine (2008, appendix B of chapter 5). The projections of the banks' financial statements were made using the method proposed by Santos (2019, chapter 3). Analyzed period of such statements goes from the fourth quarter of 2011 to the third quarter of 2020. We also use Wolfram Mathematica 10.0 (for the deduction of elasticities and perform simulations) and Excel 2010 (for plotting graphs and storing the final results and balance sheet data).

The standardized financial statements are in accordance with CVM rules. CVM is the “Comissão de Valores Mobiliários” or, roughly, the “Brazilian Security Exchange Commission - SEC”. The following tables follow a methodology adapted to Brazilian accounting standards based on the definitions of Fernández (2008), Damodaran (2012) and Copeland, Koller and Murrin (2001).

Table 8 describes the sources of the model parameters.

Table 8: Sources of parameters used in the model

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Meaning and data used</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>R(_F)</td>
<td>R(_F) = 12-month LTN return - Average IPCA expectations for the next 12 months. LTN is a national treasury bond.</td>
<td>Central Bank of Brazil (Banco Central do Brasil - BCB).</td>
</tr>
</tbody>
</table>

Kd | Required return on company debt. | Authors’ calculations.

K_M | K_M = equity risk premium = R_F + P_M. | B3 S.A and Central Bank of Brazil – BCB.

β_i | β_i = quarterly beta of PETR3. | Authors' calculations based on data from B3 S.A.

β_d | Beta of the company’s debt, given by Kd= R_F + β_d.P_M. | Authors' calculations based on data from B3 S.A.

β_u | Beta of unlevered company’s stocks, given by Ku= R_F + β_u.P_M. | Authors' calculations based on data from B3 S.A.

β_L | Beta of levered company’s stocks, given by Ke= R_F + β_L.P_M. | Authors' calculations based on data from B3 S.A.

P_M | P_M = Brazilian prime rate (TPB or “taxa preferencial brasileira” | Central Bank of Brazil (Banco Central do Brasil - BCB).

T | Tax burden = total taxes paid / net sales revenue | Bank’s income statements and Exame Magazine’s “Best and Bigger Yearbook” (“Melhores e Maiores” - Revista Exame). The tax burden data were obtained from the yearbook and converted into BRL at the commercial exchange rate BRL/USD = 5.6401 (Central Bank of Brazil - BCB, september 2020).


In table 9, we aggregated a sources/uses table for bank sector, as defined by Copeland, Koller and Murrin (2001). It is useful to highlight that this table is a proxy of a cash flow model, given that banks do not have cash flows demonstrations, only non-financial companies use to have to.

Table 9: Model of sources/uses table adapted for bank sector

<table>
<thead>
<tr>
<th>Financial income</th>
</tr>
</thead>
<tbody>
<tr>
<td>(+) Revenue from services rendered</td>
</tr>
<tr>
<td>(-) Expenses on financial intermediation</td>
</tr>
<tr>
<td>(=) Gross profit from financial intermediation</td>
</tr>
<tr>
<td>(-) Provision for loan losses</td>
</tr>
</tbody>
</table>

In table 9, we aggregated a sources/uses table for bank sector, as defined by Copeland, Koller and Murrin (2001). It is useful to highlight that this table is a proxy of a cash flow model, given that banks do not have cash flows demonstrations, only non-financial companies use to have to.

Table 9: Model of sources/uses table adapted for bank sector
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(+ Non-financial revenue (includes foreign exchange income)
(-) Non-financial expense
(-) Taxes
(=) Net revenue
(+) Non-operational items
(+ Depreciation
(=) Operational cash flow

(+ Balance (sources)
Loans due (gross)
(-) Provisions and unrealized revenue
(=) Borrowings paid (net)
(+) Elevation of deposits
(+ Increase in external indebtedness
(+ Increase in other forms of liabilities
(+ Increase in accounts to pay

(- Balance (uses)
New loans granted
(+ Increase in held securities
(+ Increase in receivable accounts
(+ Increase in net tangible assets
(+ Increase of other assets
(- Decrease in deposits
(- Decrease in external debt

(=) Free cash flow to the share capital


4. RESULTS
We have two subsections. The first one analyzes the estimates of the five valuation models. The second shows the elasticities results that each model computed in Wolfram Mathematica 10.0. In this second, we also explore the results of these simulations. That is, we investigate the responses of intrinsic values of the banking sector to the variations in the basic Selic interest rate defined by the Monetary Policy’s Committee of Central Bank of Brazil (Copom/BCB).

All results of the following tables have been converted to US dollars using the following exchange rate: BRL 5.64 = 1 US$. This is the exchange rate in September 30, 2020, the day when the latest financial statements used in models were released.

4.1 Intrinsic Value Estimates of Brazilian Bank Sector
Assuming the interest rate of 2%, prevailing in September 2020 until January 2021, when this article was finished, we found the results of table 10.
We note that the VAC results of almost all models are close each other. The result of model 4, however, differs. In fact, some assumptions of Damodaran’s model, especially the formula he uses for calculating his VTS, explain the difference in results.

However, we maintain the results of Damodaran’s model, which is widely used by fundamentalist analysts worldwide and has a reputation for reliability in company and stock valuations.

### 4.2 Results of Models’ Simulations Considering Different Basic Interest Rate’s Scenarios

As expected, the elasticities of the intrinsic values of the financial sector in relation to the variations in the basic Selic rate were similar in the calculations of all models.

The interesting thing is to realize that the intrinsic values of the banking sector tend to fall with the increase of the basic rate of interest (Selic rate) and vice versa. This runs counter to a common view in Brazil that banks become more profitable with the Selic rate increase. Heterodox economists, union leaders, presidents of business associations and important entrepreneurs in the agricultural sector share this mistaken view of the effect of changes in basic interest rate on banking sector dynamism. Some translated quotes clarify this point:

Once again, with this measure [increase in the Selic rate], all sectors will be penalized, except one, which is the financial system. For every 1% increase in the Selic rate, the financial sector profits from approximately R $ 12 billion to R $ 13 billion, with the rollover of public debt. If the movement were reversed, the savings that the government would make would be enough to make the total exemption from investments. (Neto, 2010, president of Brazilian Machine and Equipment Association – ABIM AQ)

The process of reducing the interest rate of the economy, which tends to take the Selic to single digits this year, as signaled by the Central Bank (BC), will affect the result of Brazilian banks. (Union of Bank Employees in Campina Grande and Region – “Bancários CGR”, February 2, 2012).

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**Table 10: Main valuations’ results obtained by the five models (in US$ billions)**

<table>
<thead>
<tr>
<th>Resultados Valuation’s</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAC</td>
<td>799,371.8</td>
<td>799,389.9</td>
<td>799,390.3</td>
<td>787,015.0</td>
<td>799,396.7</td>
</tr>
<tr>
<td>WACC</td>
<td>0.17840</td>
<td>0.17838</td>
<td>0.17839</td>
<td>0.17863</td>
<td>0.17840</td>
</tr>
<tr>
<td>β_L</td>
<td>0.64858</td>
<td>0.69405</td>
<td>0.89784</td>
<td>0.65311</td>
<td>0.63680</td>
</tr>
</tbody>
</table>

Source: Authors’ estimates based on bank’s quarterly balance sheets, according table 4, and considering a 2% level of basic Selic rate in September 2020 until January 2021.
MONETARY POLICY AND ASSET VALUATION: A NEW APPROACH FOR EFFECTS OF MONETARY POLICY’S TRANSMISSION MECHANISM

If the Selic (basic interest rate in the economy) rises, as it has been, we will have an increase in the minimum remuneration of the financial market. Ultimately, if banks are unable to lend their funds, they can invest them in treasury bills. Therefore, the higher the interest paid on these bonds, the more banks earn from this type of transaction. (Rugitsky, a Professor of Economics at University of São Paulo cited by Costas, March 23, 2015).

Although their intrinsic values do not fall too much at higher interest rates, it is clear that when the Selic rate falls below 7% the elasticities show a considerable increase in their intrinsic values. In future articles, we will investigate whether such a conclusion is due to the expansion of its credit volume and, above all, what type of credit provided is more profitable for the banks (table 11).

Table 11: Elasticities of the intrinsic values of Brazilian bank sector in relation to the variations in the basic Selic rate (in USD billions)

<table>
<thead>
<tr>
<th>Basic interest rate SELIC</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2%</td>
<td>799,371.8</td>
<td>6.81%</td>
<td>799,389.9</td>
<td>6.74%</td>
<td>799,390.3</td>
</tr>
<tr>
<td>3%</td>
<td>780,331.6</td>
<td>4.27%</td>
<td>780,577.1</td>
<td>4.23%</td>
<td>780,584.5</td>
</tr>
<tr>
<td>4%</td>
<td>773,736.9</td>
<td>3.39%</td>
<td>774,052.3</td>
<td>3.36%</td>
<td>774,062.8</td>
</tr>
<tr>
<td>5%</td>
<td>767,246.8</td>
<td>2.52%</td>
<td>767,626.5</td>
<td>2.50%</td>
<td>767,640.3</td>
</tr>
<tr>
<td>6%</td>
<td>760,858.9</td>
<td>1.67%</td>
<td>761,297.7</td>
<td>1.65%</td>
<td>761,315.0</td>
</tr>
<tr>
<td>7%</td>
<td>754,571.5</td>
<td>0.83%</td>
<td>755,064.0</td>
<td>0.82%</td>
<td>755,085.1</td>
</tr>
<tr>
<td>8%</td>
<td>748,382.1</td>
<td>-</td>
<td>748,923.5</td>
<td>-</td>
<td>748,948.6</td>
</tr>
<tr>
<td>9%</td>
<td>742,288.8</td>
<td>-0.81%</td>
<td>742,874.5</td>
<td>-0.81%</td>
<td>742,903.6</td>
</tr>
<tr>
<td>10%</td>
<td>736,289.6</td>
<td>-1.62%</td>
<td>736,915.1</td>
<td>-1.60%</td>
<td>736,948.3</td>
</tr>
<tr>
<td>11%</td>
<td>730,382.4</td>
<td>-2.41%</td>
<td>731,043.6</td>
<td>-2.39%</td>
<td>731,081.1</td>
</tr>
<tr>
<td>12%</td>
<td>724,565.5</td>
<td>-3.18%</td>
<td>725,258.2</td>
<td>-3.16%</td>
<td>725,300.0</td>
</tr>
</tbody>
</table>

Source: Authors’ simulations based on bank’s quarterly balance sheets, according table 4.

Within the range of 2% to 12% of the basic Selic rate, the elasticities, in modulus, are very close, according to the simulations of the five models. There are some slightly differences only in Damodaran’s model (figure 2).
This corroborates a very common practice of stock market investors in Brazil: when there is a recession or when interest rates rise, they usually protect their assets by buying stocks from banks.

With this new approach of analysis of the mechanism of transmission by the interest rate channel (and using discounted cash flow valuation models, which is an innovative method in financial and monetary literature), we obtained results that showed that the Brazilian banks increase their intrinsic value when the basic rate of interest falls. Another point is they lose very little intrinsic value when this rate rises.

The Central Bank of Brazil had to raise basic interest rates several times, because the country, like other Latin American ones, has a history of high inflation. Only since 2017, interest rates fell for the 10th consecutive time and reached 7% per year, the lowest level in history until then. In September 2020, the date of the last balance sheets and data we analyzed, the basic Selic rate reached 2%, a new historic low. According Rezende (2020)⁵, the steady decline in future interest rates in December 2020 and the inflationary pressures that were in the short term, caused the real interest rate to reach even lower levels. Estimated results by Valor Data (statistics department of Valor Econômico, the bigger and most influential business newspaper in Brazil) cited by this author, from the

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360-day interest swap contract, discounting the one-year inflation projection, indicates a negative real rate of -1.17%, the lowest level since the beginning of the historical series, in 2002.

However, even with negative real rates and the Covid 19 pandemic that hit the country in March 2020, the stocks of the five main Brazilian banks performed a resilient trajectory, given that the demand for credit has increased a lot and both Central Bank and Ministry of Economics, adopted policies to encourage the credit supply to micro and small companies.

This dynamic was proposed by Maffilli, Bressan and Souza (2007). They analyzed the relations between capital structure, credit and treasury loans, spread and the efficiency index with the profitability, measured as the ROE, of Brazilian banks between 1999 and 2005:

This relationship between macroeconomic environment, credit granting and spread is quite consistent, since the lower the inflationary risks, the more the basic interest rates fall, the lower is the spread and with this there is a tendency to increase the supply of credit in the economy resulting in greater profitability. As the period was marked by circumstances other than these, the bank's profitability behavior followed the inverse rule, that is, to increase its profitability in the period, the best strategy was to charge more for the operation carried out. (Maffilli, Bressan and Souza, 2007, p. 134).

Given the periods of greatest uncertainty in the Brazilian economy, we consider the analysis of Diamond (1984), Flannery (1994), as well Diamond and Rajan (2001). They stressed that banks make decisions aimed at a greater degree of liquidity (for example, treasury operations, mainly investments in federal government securities). They leave the decisions to expand the credit portfolio in the background. Again, Maffilli, Bressan and Souza (2007) found this result for the case of Brazilian banks, showing that increases in treasury and declines in the volume of credit were related to the higher profitability of commercial banks. When they investigated the application in federal government bonds, looking at the perspective of the banking sector, they saw two advantages: the liquidity of the bonds and the zero weight, signaling low risk, that they have in the allocation of equity in the sense of non-compliance with the rules of Basel Agreement.

They also considered that, as the fluctuation in the basic interest rate and the instability of the economy may affect the spread of investments in federal public securities. This can make them more profitable than credit operations, which occurred, according to the authors, in 2002 and 2003, during the economic crisis motivated by the speculative attack on the Brazilian currency, BRL.
Such considerations show that the flexibility and strength of Brazilian banks, combined with the highly concentrated structure of a system based on multiple (or universal) banks, helped to guarantee a high profitability history for many years. It is common knowledge that Brazilian banks are among the most profitable in the world. What is not so widespread, since the low interest scenario is something recent in Brazil, is the notion that they tend to be more profitable precisely in this macroeconomic environment of lower basic interest rates.

In figure 3, which describes, in the period of 7/11/16 until 9/29/20, the daily series of closing prices of the five banks' stocks in comparison with the basic interest rate defined by COPOM - Monetary Committee of the Central Bank of Brazil, we can see such resilience and consistent rises with rapid recoveries after two critical events.

The two critical events in this period are:

(i) In May 2017, Brazil's President Michel Temer was close to being toppled thanks to testimony given by J & F's owners, Joesley and Wesley Batista, under a suspicious plea bargain. President Temer, apparently, talked with Mr. Joesley Batista about making hush-money payments to silence an ex-powerful politician, Eduardo Cunha, who was under arrest; and

(ii) The Covid 19 pandemic that arrived in Brazil in March 2019. It was only in January 2021 that vaccination began to be implemented. There were more than 200 thousand deaths in the country and the quarterly GDP growth rates in 2020 were -1.5% in the first quarter, - 9.6% in the second and a recovery of 7.7% in the third.

In addition to their little variations of intrinsic values (figure 2), the closing prices also tend to show very low volatility (figure 3).

One can also observe that the four largest banks with the most robust commercial portfolios have series with lower volatilities. Specially when compared to volatilities of non-financial companies’ stocks. Thus, only one bank does not fall into this category: BTG Pactual (BPAC3). It is the unique bank in this group that is more focused on its investment and credit portfolio for large companies than in the typical commercial banks activities’, as the other ones (figure 3).
5. CONCLUSIONS

We calculate the intrinsic values of the main Brazilian banks and aggregate the results to value the banking sector. We also estimate the elasticities of the Central Bank of Brazil's decisions to raise and lower basic interest rates on the banking sector, based on an innovative approach to the intrinsic value channel of these banks. We use five simulation models based on the main assessment models, as defined and described by Fernández (2004 and 2008).

These five valuation’s models have generated different intrinsic values ’estimates of the main financial institutions of the Brazilian banking sector: Itaú Unibanco, Banco do Brasil, Bradesco, Santander and BTG Pactual.

The first empirical evidence we found points out that estimates of financial sector’s intrinsic values’ elasticities in relation to changes in the basic interest rate defined by Central Bank of Brazil (Selic rate) were very similar in all models.

The second evidence shows that the banking sector’s intrinsic values shows a downward trend as the referred basic interest rate rises. This is an evidence that goes against the common sense of many Brazilian economists who claim that banks benefit when the Selic basic interest rate increases. Although their intrinsic values do not decrease much with the increase in basic interest rates, when the Selic rate drops to levels below
7%, elasticities shows, in all valuation models computations, not negligible rises in intrinsic value of bank sector. In future articles, we will analyze whether this result is associated with increases in the supply of credit and also what type of credit offered causes more impact on the intrinsic value of Brazilian bank sector.

This performance of the sector's intrinsic value is reflected in the series of closing prices adjusted by the dividends of the analyzed banks' shares. These series have high resilience to critical events and low volatility. The exception is the BTG Pactual (BPAC3) stock price series, which is a multiple bank more focused on investment banking activities than on the typical operations of commercial banks (such those of the other four banks in the sample).

This explains why Brazilian investors often buy banks' stocks as a way to protect themselves against rising interest rates. Our results also help understand the high resilience and solidity of these banks, known as major federal government debt lenders.

REFERENCES


MONETARY POLICY AND ASSET VALUATION: A NEW APPROACH FOR EFFECTS OF MONETARY POLICY’S TRANSMISSION MECHANISM


