High Inflation, Higher Taxes and Negative Interest Rates: Are These the Villains of the Macedonian Capital Stock

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Our intention in this article is to examine the possible consequences on the Macedonian capital stock generated by the ongoing economic crises, originated from the Russian – Ukraine conflict, as well as to evaluate the eventual effects on capital accumulations from the upcoming tax reform starting from January 2023. In order to deflect invading Russia, western countries nave implemented numerous sanctions, but so far they haven't achieved their primary goal. Instead, a surge of inflation has occurred, especially on food, energy and oil, indicating on the economic fragility and energy dependency of the European countries. And this trend wasn't exceptional for North Macedonia, on the contrary, the inflation rates are record breaking ever since 1994. Meanwhile, the monetary policy was "sluggish" and unable to offer an adequate response to the accelerated spiral of inflation. The Central bank raised the basic interest rate, but not enough to incorporate the inflation premium. As a result, the real interest rate has fallen deeply into the negative zone, which could, as we can see from the research bellow, possibly decrease the marginal productivity of capital and therefore the capital stock. On the other hand, the intended tax reform is also expected to interfere the cycle of capital accumulations, but in much smaller effect. All these determinants are examined with application of the model of domestic capital formation, developed on the foundations of Neoclassical Theory of Investment, the concept of Marginal Productivity of Capital and the principles of Marginal Effective Tax Rates. The results will reveal that there is a real possibility for sharp contraction of investment and for the first time in the last 3 decades, disruption of the perpetual cycle of capital stock in domestic economy.

Keywords

Investment, Capital Stock, Regression, Tax Reform, Taxes, North Macedonia, Real Interest Rate, Inflation, Crises, Marginal Productivity of Capital, Theory etc.

1. Introduction

Marginal productivity of capital refers to the percentage change of output when an additional unit of capital is employed. Since the rate of capital employment is determined by its rate of return, the theory suggests that there is a positive relationship between the return of capital (i.a. the interest rate) and the output (i.a. productivity, growth). That is because interest rates, representing the price of capital, are also a determinant of the minimum expected return from investment projects, and therefore of the productivity level required for such investments. With other words, the greater the real interest rate is, the greater the investment and growth is, and *vice versa*. The chart below illustrates the output as a function of capital unit (as well as the diminishing returns of capital overtime).

Chart 1. Marginal Productivity of Capital Slope
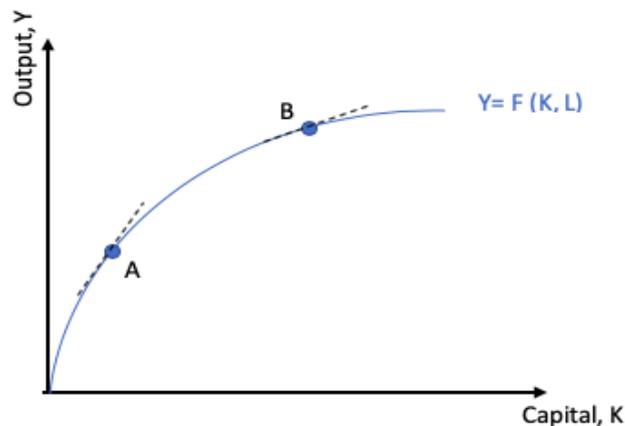
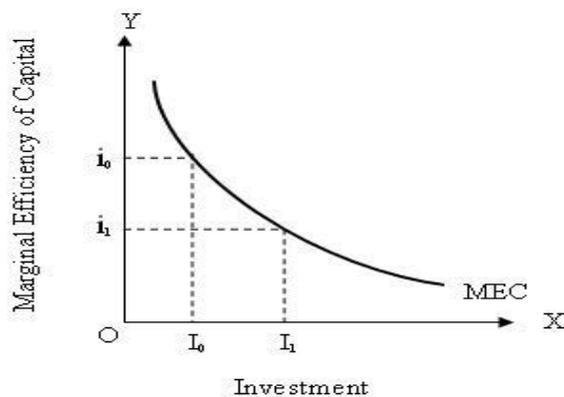**Source:** Tutorhelpdesk.com;

Indeed, most of the empirical studies confirm the truthfulness of this thesis, finding the best terrain for research in the period from the World War II until the 1990s, when the accelerated economic expansion was associated with higher real interest rates. Other group of empirical studies also confirms the positive correlation between these two indicators, but on the downhill side. For example, Bergeaud, Cette & Lecat argue there is a clear evidence that economic growth in all advanced countries has slowed consistently since the 1970s, and has fallen to a historical low since the Great Recession [1], and accordingly, the authors find one reasonable explanation, that the slowdown could be related to the long-term decline of real interest rates, especially manifested since the early 1990s [2]. The literature even offers investigations that are conclusive with negative relationship between the interest rate and productivity growth. In that context, Lunsford studied the long-run correlation of real interest rates and productivity growth from 1914 to 2016, by using the method of rolling averages well as new statistical techniques that are designed to isolate long-run patterns in the data. In contrast to the standard economic theory, he found that the long-run correlation between real interest rates and productivity growth is actually negative in the observed period [3].

Recently, we are witnessing a trend of gradual decline of real interest rates, which are historically observed around zero percentage points (zero real interest rates – ZRIR) or even falling below the market equilibrium, into the negative zone (negative real interest rates – NRIR). The Central banks were fond of implementing this kind of monetary policy with intention to "expel money" out into the economy and promote growth and investment, but this strategy may prove itself wrongful, as the interest rates may lose its signaling function as a true price of capital. Namely, in this "unreal" condition, investors could abstain from investment as they prefer to invest in "real" investment projects with "real" money, paid with "real" interest rate, the funds may remain "sterile" in the banks, while the growth could remain stagnant. Empirical

studies also confirm the negative implication on investment generated by negative real interest rates, even in the countries of the third world. For example, Reichel [4] tested the hypotheses of the so-called "Financial Repression", i.e. administered interest rates below market equilibrium in Nigeria. The results of the research strongly support the "classical" predictions of this theory: the domestic savings rate is positively affected by the real interest rate (although the effect is relatively weak) and financial savings show a much stronger positive response. Furthermore, the author revealed that persisting negative real interest rates (which may be due to high inflation rates) depress capital productivity which is the main determinant of growth. Reichel concluded at the end, "An examination of the impact of inflation (which itself is to a considerable extent due to excess money supply) shows that low inflation rates could promote growth, whereas higher rates depress investment efficiency and growth" [5].

Concerning our research, there is another approach in the Economic Theory that deserves our attention, and that is the concept of marginal efficiency of capital. Introduced by J.M. Keynes, he defines the term as "the rate of discount which would make the present value of the series of annuities given by the returns expected from the capital asset during its life just equal its supply price" [6]. It's the rate of discount which would equate the price of a fixed capital asset with its present discounted value of expected income from the future. In order for the investment to occur, the project must generate sufficient rate of return above the cost of the capital i.e. the interest rate. As a consequence, an inverse correlation between the rate of interest and investment should exist (higher interest rate produces less investment and opposite). The following graph clearly depicts the negative relationship of the quantity of investment and the interest rate hypothesized under the concept of marginal efficiency of capital.

Chart 2. Marginal Efficiency of Capital Curve

Fig.4.4: MEC Curve

Source: Tutorhelpdesk.com;

The Neoclassical Theory of Investment represents an extension of the Keynesian theoretical concept briefly explained above. According to it, the capital stock in the economy or, the investment demand is determined by marginal product of capital (MPK) and user cost of capital. The profit maximizing firm will add to its capital stock an additional unit of investment, as long as the value of marginal product of capital exceeds the rental or user cost of capital. The accumulation of capital (i.e. capital stock) can be derived from the so-called Cobb-Douglas production function. It defines the production output as a function of labor and capital. By differentiating with labor, the formula could be easily rearranged to show the foundation of this theory that the desired stock of capital depends on the size of output and real cost of capital: the higher the rental cost of capital, the lower will be the desired capital stock; the greater the expected output the greater the desired capital stock.

As we can see, the Neoclassical Theory of Investment in fact, integrates both of the previous concepts and unlike the Accelerator Theory of Investment that relates the changes in the stock of capital only to the changes in output (or income), in Neoclassical Theory the desired stock of capital depends not only on the output, but also on the capital price. If we have in mind that user cost of capital is determined by the rate of interest, rate of depreciation, expected rate of inflation and the various features of tax system such as corporate tax rate, investment tax break, we can generalize that this theoretical foundation could be in line with our research.

Beginning from the neoclassical idea that the capital stock is a function of GDP and cost of capital, we extend this formulation by differentiating the cost of capital in two components: the economic (non-tax) component of the cost of capital, mainly determined by discount (interest) rate, inflation rate and depreciation rate: and the tax component of cost of capital, predominantly determined by the different tax rates. The main purpose of our research is to examine how the investment in North Macedonia reacted to changes of output, changes of economic parameters (interest rate and inflation) and different tax derogations. Specifically, will the combination of low interest rates, high inflation premium and intended tax reform be harmful to investment and depress the investment cycle? Based on the results from the research we will try to evaluate the implications of the current economic condition on capital stock and make predictions for the current and the following year. The model which is used for the purpose is the domestic capital stock model [7], where the capital stock is derived from the Cobb-Douglas production function (the capital is assumed as a single factor of production), and the components of cost of capital are developed according to the methodology of effective marginal tax rate (EMTR) from Devereux & Griffith [8]. The choice for the last was made because of the exceptional capability of this method to capture every single modification of the existing tax rates within a single tax rate. Therefore, we consider EMTR as an appropriate (synergetic) measurement of the effective tax burden a tax reform can generate on a single unit of investment in every aspect (tax wedge).

2. The model

The production function can be written as it follows:

$$[1] \quad Y = Af(K, L)$$

where Y stands for output, K stands for capital, L represents labor and A is exogenously determined level of technology (note that change in A will cause a shift in the production function). Assuming that technological level remains constant, the marginal product of capital (MPK) is defined as percentage change of Y as result of the percentage change of K:

$$[2] \quad MPK = \frac{\Delta Y}{\Delta K};$$

To maximize profits, a firm will equate the marginal product of capital to the cost of capital p:

$$[3] \quad MPK = P;$$

$$[4] \quad \frac{Y}{K} = P$$

Rearranging the equation, we may write for K:

$$[5] \quad K = \frac{Y}{P}$$

Taking the natural log for K gives:

[6] $\ln(K) = \ln(Y) + \ln(P)$

To measure the effects separately, P is differentiated in two different components: non-tax component NTC; and tax component TC. Accounting for this, we may rewrite the cost of capital as:

[7] $P = NTCxTC$

Once again, taking the natural *log,* this time for P yields:

[8] $\ln(P) = \ln(NTC) + \ln(TC)$

And integration of term [8] in term [6] produces the equation:

[9] $\ln(K) = \ln(Y) + \ln(NTC) + \ln(TC)$

The percentage change of K is approximately equal to the first difference of the previous equation:

[10] $\ln(K)_t - \ln(K)_{t-1} = \left[\ln(Y)_t - \ln(Y)_{t-1}\right] + \left[\ln(NTC)_t - \ln(NTC)_{t-1}\right] + \left[\ln(TC)_t - \ln(TC)_{t-1}\right]$;

There is one more thing to do to complete our model. An exogenous (dummy) variable is added to the system to capture the effect from the external shocks on the flows of capital stock. An external shock is defined if any of these conditions are met in the observed period: annual inflation over 8%, financial crises, war crises, energy crises etc. Crises dummy variable (Cdummy) is 1 if any of these conditions are detected, otherwise 0. Implementation of the dummy variable in term [9] gives:

[11] $\ln(K) = \ln(Y) + \ln(NTC) + \ln(TC) + Cdummy$

And the proposed econometrical regression model finally becomes:

[12] $\ln(K) = \alpha + \alpha_1 \ln(Y) + \alpha_2 \ln(NTC) + \alpha_3 \ln(TC) + \alpha_4 Cdummy + \varepsilon$

It observes the process of capital formation (the dependent variable) as a function of four independent variables: the output, the non-tax (economic) segment of cost of capital and the tax segment of cost of capital. The meaning of symbols K, Y, NTC, TC and Cdummy is explained before, α is the intercept, ε represents the error, and α1, α2, α3 and α4 are independent variables coefficients of regression.

3. The data

The time series data for the regression analysis is organized in table 1. The observed period of domestic capital formation is from 1994 to 2021. In the following lines we explain shortly the variables present in the table.

Table 1 Time series data (regression input parameters in *ln* values)

Year	ln(K)	ln(Y)	ln(NTC)	ln(TC)	Crises
1994	4,2211	4,9864	2,9107	3,8695	1
1995	4,4977	5,133	2,873	3,8695	1
1996	4,7197	5,173	2,9397	3,6861	0
1997	4,8975	5,2258	2,9428	3,6861	0
1998	5,0467	5,2729	3,0787	3,6861	0
1999	5,1693	5,3424	3,1104	3,6861	0
2000	5,2873	5,4655	2,7644	3,6861	0
2001	5,3667	5,4546	2,6912	3,6581	0
2002	5,4585	5,497	2,8792	3,6581	0
2003	5,5415	5,5544	2,8148	3,6581	0
2004	5,6301	5,6075	2,8088	3,6581	0
2005	5,7094	5,6871	2,6686	3,6581	0
2006	5,7996	5,7685	2,4362	3,6581	0
2007	5,9164	5,8999	2,5169	3,6625	0
2008	6,0475	6,0204	2,0706	3,6405	0
2009	6,1435	6,0179	2,8513	3,6368	1
2010	6,2602	6,0733	2,7167	3,6368	1
2011	6,3698	6,1308	2,4782	3,6368	0
2012	6,4597	6,1282	2,4544	3,6368	0
2013	6,5467	6,2137	2,4114	3,6402	0
2014	6,6473	6,265	2,5847	3,7817	0
2015	6,7175	6,3261	2,5233	3,8364	0
2016	6,7973	6,3882	2,4816	3,8364	0
2017	6,8578	6,4267	2,3234	3,8364	0
2018	6,901	6,4893	2,2935	3,8364	0
2019	6,9535	6,5358	2,3485	3,8364	0
2020	6,998	6,4861	2,2732	3,8364	1
2021	7,0521	6,5798	2,0281	3,8364	1

Source. Author's calculations.

The dependent variable is ***capital stock***, given in *natural log* values. The approach used to construct the ***capital stock K*** (in nominal terms) is the perpetual inventory method [9]:

[13] $\quad K_t = (1-\delta)K_{t-1} + I_t$

The initial capital stock K_0 value is estimated according to Caselli [10]:

[14] $\quad K_0 = \dfrac{I_0}{g+\delta}$

where I_0 is the investment in the first year of time series available, δ is the depreciation rate and *g* is the annual geometric growth rate for the investment series.

The first independent variable is *natural log* value of nominal ***output (GDP)***. Technically speaking, the first difference of *ln(Y)* is the growth rate of GDP. Nominal output is consistent with the other indicators that are generally expressed in nominal values (nominal interest rate,

nominal capital stock). The source information for domestic output is the State Statistical Office.

Non-tax component is the second independent variable converted in *ln* values. It quantifies the impact on investment triggered by change in economic parameters such as discount (interest) rate p, inflation rate π and depreciation rate δ. We argue that natural log values are advantageous than the original percentage points because they fit more accurately with regression data (the same accounts for the tax component). The non-tax component NTC takes the form of [11]:

$$[15]\ NTC = \rho + \delta(1+\pi) - \pi;$$

In the methodology of Devereux & Griffith [12], the discount rate p is based on the nominal interest i. Under normal circumstances, in order to preserve the purchasing power of money, the nominal interest rate should approximate the real interest rate r plus the inflation premium π. This condition is known as The Fisher effect, which is a Theory that describes the relationship between inflation and both real and nominal interest rates. It states that the real interest rate equals the nominal interest rate minus the expected inflation rate. Therefore, real interest rates fall as inflation increases, unless nominal rates increase at the same rate as inflation. We already mentioned the widespread trend of low real interest rates nearing zero percentage points (ZRIR), or even falling below the zero threshold (NRIR). In addition, we illustrate the long-term relation between inflation premium, nominal and real interest in the period 1994-2021.

Chart 1. The relation between inflation, nominal and real interest rate
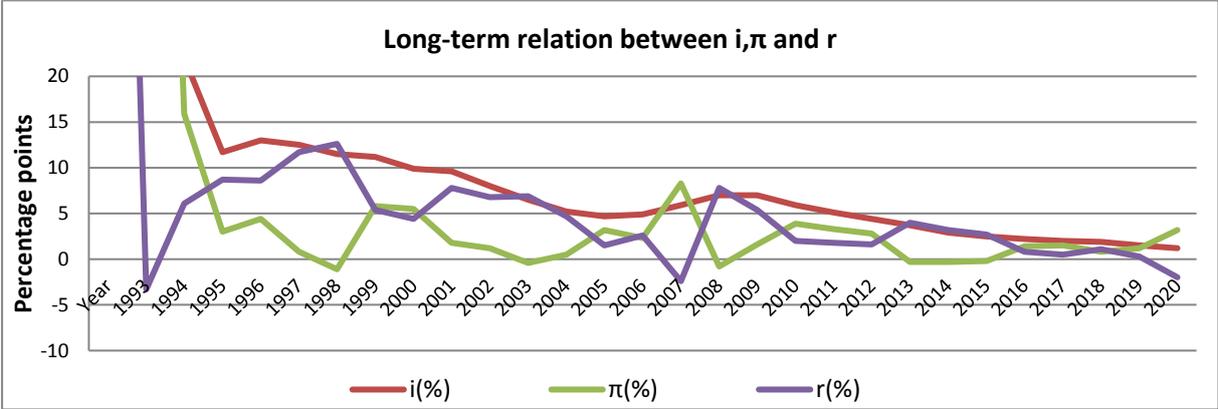
Source: Own presentation.

The convergence of these three variables is easily visible. The real interest rate periodically falls below the equilibrium, especially when the inflation is very high. There are also two distinct periods on the long-term path of real interest rate: one from 1994 to 2008 when the real interest was relatively high: and the other from 2008 to present day, when the interest rate was very low. Nevertheless, the long-term tendency of falling real interest rate near the zero percentage point is obvious from the graph, especially from the last 5 years. The data for the discussed variables is presented in table 2.

Table 2 Inflation premium, nominal and real interest rate

Year	i(%)	π(%)	r(%)
1993	483,8	349,8	134
1994	118,5	121,8	-3,3
1995	22	15,9	6,1
1996	11,7	3	8,7
1997	13	4,4	8,6
1998	12,5	0,8	11,7
1999	11,5	-1,1	12,6
2000	11,2	5,8	5,4
2001	9,9	5,5	4,4
2002	9,6	1,8	7,8
2003	8	1,2	6,8
2004	6,5	-0,4	6,9
2005	5,2	0,5	4,7
2006	4,7	3,2	1,5
2007	4,9	2,3	2,6
2008	5,9	8,3	-2,4
2009	7	-0,8	7,8
2010	7	1,6	5,4
2011	5,9	3,9	2
2012	5,1	3,3	1,8
2013	4,4	2,8	1,6
2014	3,7	-0,3	4
2015	2,9	-0,3	3,2
2016	2,5	-0,2	2,7
2017	2,2	1,4	0,8
2018	2	1,5	0,5
2019	1,9	0,8	1,1
2020	1,5	1,2	0,3
2021	1,2	3,2	-2

Source: Central bank of North Macedonia

Tax component of cost of capital, which is also transformed in natural log values, is the third independent variable of the regression model. TC separates the effects that are being predominantly caused by derogations of tax code. Except the elements of tax nature, such as the corporate tax rate t, tax allowance A, financial constraints variable F and tax discrimination variable γ, this segment also contains economic variables as well, appearing as a byproduct of derivation. To minimize the chance of interference with the dominant tax variables, they are being held constant over the course of time, according to the assumptions of METR (annual: inflation rate 2%, nominal interest rate 7,1%, real interest rate 5%). The complex equation for TC is described as it follows [13]:

$$[16] \quad TC = \frac{(1-A)}{(1+\pi)(1-t)} + \frac{(1+p)e}{(1+\pi)(1-t)[p+\delta(1+\pi)-\pi]} - \frac{F(1+p)}{\gamma(1+\pi)(1-t)[p+\delta(1+\pi)-\pi]}$$
$$-\frac{\delta}{[p+\delta(1+\pi)-\pi]} \quad ;$$

The evolution of Macedonian tax system dates from 1991 untill the present day. At the beginning progressive personal income tax rates were introduced in two income brackets 23% and 35%, then the rates were reduced to 18% and 23%. The tax reform from 2006 abolished the progressive system of taxation and a single proportional personal income tax rate was introduced instead (15%, 12%, 10% subsequently) On the other hand, taxation of corporate income was proportional with 35% at the beginning, additionally the rate was lowered at 23%, then reduced twice at 15% and 12%, while the current tax rate is positioned at 10%. This means that there is a *flat tax rate system* with single proportional tax rate on both personal and corporate income. Table 3 gives chronological information about the basic tax rates used in the regression.

Table 3 Relevant domestic tax parameters in period 1994 - 2021

Tax parameter:	Rate
Capital allowances (straight-line method)	
- industrial buildings (L=28,57 years)	3,5%
- equipment (machinery) (L=6,66years)	15%
- intangibles (L=5 years)	20%
Corporate tax rate (mandatory)	
(1993-1995, 1996-2006, 2007, 2008, 2009-2014, 2014-2021)	30%, 15%, 12%, 10%, 0%,10%
Split corporate tax rate on distributions (2009-2014)	10%
Personal tax rates on capital income (mandatory)	
- interest income (1993-2021)	0%
- dividends (1993-2000, 2001-2006, 2007, 2008-2021)	23%, 15%, 12%, 10%
- capital gains	
(1993-2000, 2001-2006, 2007, 2008-2012, 2013-2021)	23%, 15%, 12%, 10%, 0%

Source: Ministry of finance

Another group of taxes crucial for the effects on investment are the personal income taxes on capital income. Usually, the group is consisted of 3 different taxes: the dividend income tax, the capital gains income tax and the interest income tax. Under the normal, classical tax system, when the firm earns a single unit of income from investment, first it is taxed at firm's level with the corporate tax and then after the distribution, the income is taxed once again at shareholder's level with the existing personal taxes on capital income. This generates distortions in a form of double taxation, possible tax evasion and different preferences to the sources of capital. Historically observed, there were 3 different tax systems with different forms of integration between corporate and personal taxes and 1 regime yet to be in force from January 2023. They are described in the paragraphs below.

Paragraph 1

Classical Corporation Tax system (1994-2001). The CCT is a rudimentary form of corporate tax that treats the corporate income in a conservative and fundamental way. It is a taxing system of companies in which the company is treated as a taxable entity, separate from its own shareholders. The profits of companies under this system are therefore taxed twice, first when made by the company and again when distributed to the shareholders as dividends and capital gains. Formally, there is no integration at all between the corporate and personal income tax under the CCT system. In the essence of the Classical Corporation Tax is double taxation of corporate income [14].Technically speaking, a Classical System makes no allowance for "double" taxation, so that dividend income is subject to corporate income tax and taxed again as personal income. [15]. Considering this, we can identify the CCT system

as (t, md, mi, z), where t - corporate income tax, md – dividend income tax, z – capital gains income tax and mi – interest income tax.

If the return on investment is labeled as r, and the pre-tax rate of return as p`, then the effect on investment is determined by the "tax wedge p` - r". Measuring the difference between p` and r, it reveals how much of the pre-tax return on a unit of investment is "stripped out" in a form of taxes. Following this explanation, we present the value of tax wedge in the 3 investment alternatives:

Classical Corporation Income Tax System (CCT) $(t = m^i = m^d = z)$	Tax wedge p`- r
Debt	0
New equity issues	$r\left[\dfrac{(1-m^i)}{(1-t)(1-m^d)}-1\right]$
Retained earning	$\dfrac{rt}{(1-t)}$

From the equity financed alternative we can see that double taxation is concentrated at the shareholder level. Since all relevant taxes are present in the formula, the level of the imposed tax burden depends from their interrelation and their mandatory tax rate. Because the interest rate is deductible on the corporate's tax base, there's no effective tax burden at all in the debt finance option. In the case of retained earnings, after the gross earnings had been taxed at corporate level, the net earnings had been retained but not distributed among the shareholders. So, the relevant taxes on personal level are absent in the formula except the corporate tax t.

Paragraph 2

Flat Tax Rate System (2006-present day). Flat tax rate system implements a single proportional tax rate on corporate and personal income. The proponents think that efficiency is the main advantage of this taxing regime and the ability to eliminate distortion from double taxation. Namely, the condition that must be met under this system is the identity between the corporate tax t, and the personal income tax on dividend income md, capital gains income tax z, and interest income tax mi (mi = md = z = t) [16]. Now let's see how this condition reflects itself over the 3 investment alternatives.

Flat Tax Rate System (FTR) $(t = m^i = m^d = z)$	Tax wedge p`- r
Debt	0
New equity issues	$\dfrac{rt}{(1-t)}$
Retained earnings	$\dfrac{rt}{(1-t)}$

This comparison indicates that the tax burden between the two variants of equity investment (stock issues and reinvestment of earnings) is technically identical. Therefore, the system of proportional (flat) tax rates manages to preserve neutrality and eliminate distortion between the different forms of equity investments and, as we can see, because the personal taxes are equal to the corporate tax, the overall burden on the investment is no higher than the burden imposed on corporate level (elimination of double taxation).

Paragraph 3

Split Rate Corporate Tax System. Under a split rate system there are 2 different statutory tax rates, one that applies to retained earnings, the other to distributed earnings [17].The policy makers might choose between the 2 different strategies concerning the split rate system.

Taxation of distributions, retentions exempt from taxation (2009 – 2014). *The first strategy is to tax the profit that is being distributed to the shareholders while retentions of the profit are exempt from taxation, which implies the condition of (td, t = 0), This approach in the tax policy is intended to give stimuli to the investor to reinvest the profit, instead to consume it, since the burden for the first alternative is significantly lower. In this sense, this concept of corporate taxation is considered as a form of tax incentive, a mechanism that accelerates capital formation. Also, this approach in the policy restores the neutrality between debt and retained earnings, but only in the absence of personal taxes. In practice, Macedonia and Estonia are examples of countries that have already experienced the split corporate tax. Originally, in Macedonia the measure was called "Tax exemption on undistributed earnings". According to it, all the retentions were exempted from the corporate income tax, while the distributions of the profit were taxed with the regular corporate income tax rate of 10% (t = 0; td = 0,1). The implications of this strategy on the return of investment is the following:*

Split Corporate Tax System (SCRT) *Taxation of distributions, retentions exempt from taxation (td, t = 0)*	*Tax wedge p`- r*
Debt	0
New equity issues	$\dfrac{rt_d}{(1-t_d)}$
Retained earnings	0

Taxation of retentions, distributions exempt from taxation (2023-????). *The second option is the strategy to target retentions (retained profits) while profit distributions are exempt from taxation, which in this case implies the condition of (td = 0, t). The authorities apply a lower rate (alternatively zero rate) on distributed profits which will serve to compensate for the personal tax paid on dividend income. As a result, this variant generates an excessive tax burden on the investment financed with retentions [18]. With this approach in tax policy, actually the authorities equalize the treatment between debt and new equity with intention to deliver a certain compensation for the tax burden levied on dividend distributions, but once again only if the remaining personal taxes are absent or with zero rate. The new upcoming tax reform in North Macedonia includes imposition of extra burden on reinvestments of the profit of domestic firms. Most of the experts disagree with this measure as they fear it might disrupt investment and the process of capital accumulation.*

Split Corporate Tax System (SCRT) *Taxation of retentions, distributions exempt from taxation (td = 0, t)*	*Tax wedge p`- r*
Debt	0
New equity issues	0
Retained earnings	$\dfrac{rt}{(1-t)}$

Looking back at the data from table 1, we can notice that *In (TC)* values decrease from their highest level at 3,8695 in 1994 to their lowest level at 3,6368 from 2008 to 2013, and then bounce back again from 2015 to 2021 to a new level that is almost as high as their maximum measured at 3,8364. This means that the tax system is gradually losing its ability to support investment. Now, that a new paradigm is taking place within the government's program for fiscal consolidation, chances that the last could happen becomes more objective.

Crises dummy is the fourth independent variable in the regression analysis labeled *Cdummy*. It is dichotomous in nature which means that displays only 2 values: 1 if there is ongoing crises in the current period of any kind (for example, high inflation, financial shocks, war and military crises, energy crises, pandemic crises etc.); and 0 if otherwise. Our observational data detected 6 periods when the dummy's propositions are generally met. Those are 1994 and

1995 (the transitional years of hyperinflation when the inflation premium was measured at 121,8% and 15,9% subsequently, 2009 and 2010 which are the years of the global financial crises (supposing that there is a lagging effect in domestic economy) and 2020, 2021, the years of the horrific pandemic crises that nearly ravaged the global economy on unimaginable scale. The effect from the Russian – Ukraine conflict which poses another real threat for the international economy, will be considered further in our discussion.

3. Results and discussion

Table 4 from below assembles the results from the regression analysis. All regression indicators are statistically significant proving that the model is statistically valid. The p-value for the intercept and all the independent variable is less than the standard probability level of 5% (p-value < 0,05), which means that the null hypothesis must be rejected. In addition, we interpret the coefficients of regression for the independent variables.

Table 4 Summary results from the regression analysis

SUMMARY OUTPUT			ANOVA					
Regression Statistics					*df*	*SS*	*MS*	*F*	*Signif. F*
Multiple F	0,996707		Regressio	4	18,161332	4,5403331	868,727948	1,0008E-24
R Square	0,993425		Residual	23	0,1202076	0,0052264		
Adjusted I	0,992281		Total	27	18,28154			
Standard E	0,072294							
Observati	28							
	Coeff.	*Stand. Err.*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-3,60767	0,801555	-4,50084	0,000162	-5,265817	-1,94953	-5,26581723	-1,94952982
Y	1,801739	0,051465	35,00912	1,87E-21	1,6952755	1,9082018	1,69527552	1,90820179
NTC	0,239548	0,087272	2,744833	0,011539	0,0590113	0,4200838	0,05901132	0,42008379
TC	-0,4388	0,174676	-2,51209	0,019467	-0,800147	-0,077457	-0,80014693	-0,07745742
Cdummy	-0,08927	0,03563	-2,50554	0,019751	-0,162977	-0,015566	-0,16297662	-0,01556594

Source: Data analysis in excel (author's calculations).

GDP (national income) or *output* is the biggest generator of investment and capital formation in North Macedonia with estimated coefficient of 1,80 (1% increase in GDP or Y results with 1,80% increase in capital stock K). This finding is absolutely consistent with the major part of empirical studies, but also with the Accelerator Theory and the Neoclassical Theory of Investment. The results prove the positive relationship between income and investment, suggesting that the bigger the expansion of income is, the more investment will occur. The contraction of output that the world and our country are experiencing currently is more likely to reduce the optimism of investors and the overall level of investment. Governments will face a tough decision whether to support the economy or fight against the galloping inflation. The policy of low interest rates is just another fading attempt of salvation in short-term which may in long-term prove "fatal" for investment.

The second significant contributor to the capital stock growth is the *non-tax component* of cost of capital with regression coefficient of 0,24. This means that 1% increase in NTC yields with additional 0,24% growth of capital stock. Yet, the contribution to capital stock is marginal because the investment demand is inelastic to the changes of NTC ($\alpha_2 < 1$). Having in mind that this variable is basically determined by the economic fundaments such as inflation premium, depreciation rate (held constant) and nominal interest rate, we can generalize that this relationship is also consistent with the concept of Marginal Productivity of Capital explained before.

One thing that deserves attention in our discussion here is the *underlying relation between **the real interest rate** and **investment or growth.*** Namely, the methodology applied here uses the nominal interest and inflation and as we know from the theory, the difference between them gives the real interest rate. Also, MPK theory suggests that the real interest is the true determinant of investment and thus the capital formation and growth. With other words, this indicator sends true signal of the marginal productivity of capital as a factor of production. Analyzing the data of the real interest in table 2, we found that there is downward tendency of its long-term path to the axis equilibrium at zero percentage point. In the periods when the economic growth was relatively high, the real interest was also high (1994 – 2008), and when the growth was slow, that was consistent with the periods when the real interest was low too (2009-2021). There is another conclusion that can be drawn here. The long-term tendency of decreasing real interest rate overlaps the long-term tendency of increasing public debt. This is especially obvious in the last five years when the real interest was only 0,8% in 2017, 0,5% in 2018, 1,1% in 2019, 0,3% in 2020, -2% in 2021 and above -10% as predicted in 2022. At the same time the debt was increased from the confortable zone of 45% in 2017 to hardly bearable 60% of GDP. At the same time the reference rate of the Central Bank was at its historically lowest minimum. Considering this, we argue that the monetary policy of low interest rate might be a cheap strategy to finance the public debt and budgetary deficit on behalf of the economic growth and investment. If the last is true we may raise the moral question: Is the Central bank agent to the government or agent to the private economy? But this has to be answered in another research.

In addition we will try to uncover the phenomenon of negative real interest rate (NRIT). The literature review discovers several facts in relation to NRIT described in the next paragraph:

Paragraph 4

- *Negative interest rate policy is controversial macroeconomic policy based on the pre-Keynesian economic understanding that there is a natural interest rate that ensures full employment. Translated in monetary terms, it's the policy of neutral interest rate: a long-term low interest rate consistent with stable inflation [19]. Sometimes, the theory argues, when the investment becomes saturated, low interest rate cannot increase the aggregate demand and the interest has to fall below into the negative zone to boost growth.*
- *Under normal circumstances, the inflation premium builds in the nominal interest over the real interest rate. Expectations of inflation are therefore the main driver of long-term interest rates. When the inflation rate is higher than the nominal interest rate, which occasionally happens in short-term, the real rate becomes NRIT.*
- *Simply put, interest is the cost of credit or the cost of money. It is the amount a borrower agrees to pay to compensate a lender for using her money and to account for the associated risks [20]. Normally, interest rates would be positive to encourage savings and investment, and the longer the term, the higher the interest rate would have to be. On the other hand, negative interest could have serious implications on savings and investment.*
- *The policy of NRIT conducted by the Central Banks and other regulatory bodies can have negative impact on banks profitability and the interest rate spread, which is the difference between what they pay on deposits and what they charge on loans. As a consequence, banks are forced to defend the spread margin by passing the negative interest rates on depositors or by charging fees on their savings.*
- *Negative interest rates imposed by a central bank effectively mean commercial banks are required to pay for holding excess reserves with the central bank. For example, if the deposit rate were −1%, for every $10 million held with the central bank, the commercial bank would have a balance of around $9.9 million at the end of a year [21]. In theory, the commercial banks will avoid to maintaining large balances with the central bank and will instead lend money to businesses and consumers (extension of traditional monetary policy).*
- *When interest rates are negative, banks charge interest on deposits giving to savers incentive to switch deposits into holding cash. The same stands with investments. The real rate of return on an investment is its actual rate of return minus the prevailing inflation rate. If you choose to invest 10.000 euros in 5 year bonds with 5% interest and the inflation is 10%, the real return is -5%, which means you will receive only 9.500 euros after the holding period. Instead of investing*

you might choose to spend your money and buy for example a car. Negative real returns can erode the initial value of capital even in the case of safe investments.

- *NRIR increases the preference to present value of money at the same time decreases the preference to its future value. As a consequence, in the economy consumption expands while investment contracts.*
- *Technically, when there is inflation and negative interest rates, the borrower returns less than the initial amount of the money borrowed from the lender. In that sense, NRIR effectively redistributes wealth from the lender in favor to the borrower (borrowers are paid to borrow money instead to be charged) and consequently the value of debt decreases. Governments use this strategy of extensive public debt to fund public spending with low or negative interest rates. If this is true, it is not the high, but the low or negative interest rate the one that promotes the "crowding out" of private sector and investment on the long-run.*

Tax component (TC) is the third independent variable influencing the capital stock, but here the correlation is negative. Calculations from the model measured coefficient of regression of -0,44 (1% increase of TC generates 0,44% decrease in capital stock). This is also in line with the economic theory specifically considering the distortive nature of taxes and the fact that they increase the cost of investment. Specifically, the theoretical concepts of marginal efficiency of capital, the cost of capital and the methodological approach of METR, in all at their theoretical foundations lies the relation between taxes and investment. The impact of the wedge is also inelastic with $\alpha_3 < 1$. Correlation between the overall cost of capital (expressed as a product of NTC and TC) and the formation of capital is also consistent with the general findings. The coefficient of regression of -0,1056 (-0,44 x 0,24) indicates on the small but inverse impact this factor creates. Nevertheless, the inverse relationship between these two raises the awareness of the government: when growth and investment is in the focus, the level of taxation becomes important.

The fourth independent variable is the **Crises dummy variable** (Cdummy). Logically, the coefficient of regression here is negative with value of -0,089. Considering the dichotomous nature of this variable we may transform -0,089 to percentage points with the following formula:

$$[16] \quad \left[\exp(-0{,}089)-1\right]x100;$$

The approximate value is -8,5%, meaning that the occurrence of a crises in the current period will reduce the capital stock in overall of 8.5%. This is very important for the present and also for the future to see how the war, inflation, economic and energy crises from 2022 will reflect on the capital stock, investment and growth. The uncertainty is real as nobody can predict will the Russian-Ukraine conflict end and will the spiraling prices on food and energy calm in the years to come.

4. Predictions Based on the Model

In this section we make predictions for the capital stock in the current year 2022 and the next 2023. The predictions are based on the assumptions of our model, the models coefficients of elasticity, the World Banks projections for the economic growth and inflation, and some subjective assumptions. Considering the instability of the international economic environment, we express our reservations and recommend our projections to be taken cautiously. In that sense, we understand the predictions only as a general indication for the eventual outcome in respect to capital stock and future investment.

Year 2022. The World Bank predicts GDP growth of 2,1%, inflation of 11%, the current reference rate is 3,5% assuming annual nominal rate of 3%, record low real interest rate of -8%, all tax parameters remain unchanged, dummy gets value 1 because of the multiple crises conditions. If we incorporate all information, the predicted *ln* of capital stock in 2022 will be 6,976:

[17] $\ln(K) = -3{,}607 + 1{,}802 * 6{,}7030 + 0{,}240 * 0{,}281 - 0{,}44 * 3{,}836 - 0{,}089$

This result is lower compared to the previous year, so there is a real possibility for sharp contraction of investment in 2022 and for the first time in the last 3 decades, the perpetual cycle of capital stock in domestic economy could be disrupted (the level of capital stock goes back two years). If we analyze the different components, the inflation originating from the war conflict may be one of the main contributors for this condition. The Central Bank didn't raise the referrence rate sufficiently to upgrade the inflation premium and the real interest plummeted sharply below the zero percentage points. This lowered the productivity of capital and the value of NTC. The presence of high inflation rates during the current year, indicates that the conditions for the dummy variable are also met. We send recomendations to the authorities from the Central Bank to implement further restrictions in the monetary policy and raise the interest rate additionally.

If we want to measure the contraction of capital stock in absolute numbers, we can transform the ln value of K in 2022 and compare it with the transformed *ln* value of K in 2021. The transformation is done through the expression:

[18] $\exp(\ln(k));$

The aplication of this formula gives the estimated absolute value of K at 1.070,402 bilion denars in 2020 and 1.154,921 bilion denars in 2021, meaning that domestic capital accumulation could decrease in total of 84,519 bilion denars in absolute value. That's approximatelly 1.35 bilion euros loss on the production (capital) base of the macedonian domestic economy (public sector and FDI not concidered).

Year 2023. The predictions for the capital stock in 2023 are interesting because of the upcoming tax reform from january 2023 and its potential effect on investment. Projected growth of GDP is 2,5%, inflation 5,6%, nominal interest 2% (the refference rate tends to become neutral again), real interest rate around -3,5%, once again dummy receives 1 as predictions for the war and energy crises are not optimistic. The next year will bring novelties in a form of new tax reform as new tax rates will come in force in jaunuary 2023:

Table 3 Relevant new tax rates (January 2023)

Tax parameter:	Rate
Corporate tax rate (mandatory)	10%
Split corporate tax rate on retentions	10%
Personal tax rates on capital income (mandatory)	
- interest income (from deposits)	10%
- dividends	15%
- capital gains (mean holding period 10 years)	10%

Source: Ministry of finance.

Variable TC gets 3,883 *ln* value with the new tax rates (previously 3,836). This means that the impact from the reform is marginal (but significant in absolute numbers), and also we have to account for the lagging effect as the adjustments in investment demand will shift in the future. Assembling the information in the model, the value of capital stock in 2023 is estimated at 7,252:

[18] $\ln(K) = -3{,}607 + 1{,}802 * 6{,}781 + 0{,}240 * 1{,}823 - 0{,}44 * 3{,}883 - 0{,}089$

This tells us that probably, in 2023 the investment will recover and capital formation will be back on its long-term equilibrium track.

To see how much that marginal change in TC will translate in absolute numbers, we will estimate the absolute value of K in 2023 and compare it with the absolute value of K in 2022. The difference is approximately 27,931 billion denars or 450 million euros reduction on the capital base!. It seems that after all, the effective level of taxation does matter. To trade a potential loss of efficiency of 450 million euros for a potential gain in public revenues of only 54 million euros is rather comic than reforming.

There are few things we'd like to mention in regards to the reform. First, the need for fiscal consolidation is more than necessary as the public debt crossed the red line of 60% of GDP, and there is still increasing pressure on the government spending. Only the timing is controversial because the reform is scheduled at the height of the economic crises. Second, it's the controversial measure to tax the retentions. It is perceived as one of the most unpopular measure among the business community, and also receives "bad grades" form academics in terms of efficiency and investment. Much better choice would be a proportional increment on the statutory corporate tax rate, or even imposing a progressive taxation above a certain threshold of the profit base. According to us, even a temporary "crises tax" that would target only the firms that earn an extra profit during crises (such as oil and energy companies, traders with unfair profit margin), would be much better option than this controversial measure, which in the essence is "charging" the subjects who want to invest. Third, it's the taxation of interest income from deposits, another irrational measure with very shallow fiscal effect of only 5 million euros of revenues, but with large potential for erosion of depository base. We argue that there is no point of implementation of such a measure if the obligation is postponed until the moment of succession in the EU.

5. Conclusion

In this article we evaluated the possible effects from the economic crises and the upcoming tax reform on the investment performance and capital stock. For that purpose a model of investment demand and capital formation is used based on the Marginal Productivity of Capital Hypothesis and the methodology of Marginal Effective Tax Rates. The proposed model was able to separate the effects of the economic parameters, such as the inflation, depreciation rate and interest rate, from the effects that are predominantly caused by taxes. The results from the model reveal strong and positive correlation between the output and capital stock and weak positive correlation between the economic fundaments and capital stock. On the other side, a negative and inelastic relationship is determined between taxes and accumulations. Of course, the manifestation of crises is negatively implicated on the capital stock. All of these findings are consistent with the economic theory that explains the mechanisms of capital formation. We also used the coefficients of regression to predict the capital stock in 2022 and 2023. The biggest contributors for the eventual sharp decline of capital stock in 2022 are the inflation, the monetary policy of negative tax rates and the influence from the economic crises. In 2023 the prospective rise of the effective level of taxation might have another limiting consequence over the investment and capital stock. We also used our findings to impose a certain critic addressed to the policy makers especially in regards to the monetary policy of low (negative) interest rates and the intended measure for taxing retentions.

6. References

1   Bergeaud, A, G Cette and R Lecat (2016), "Productivity trends in advanced countries between 1890 and 2012", Review of Income and Wealth 62(3).
2   Bergeaud, A, G Cette and R Lecat (2019), "The Circular Relationship Between Productivity Growth and Real Interest Rates", Banque de France working paper 734.
3   Lunsford K., (2017), " Productivity Growth and Real Interest Rates in the Long Run", Federal Reserve Bank of Cleveland Working Papers.

4   Reichel R., (1991), "The Macroeconomic Impact of Negative Real Interest Rates: Some Econometric Evidence", Savings and Development Journal Vol. 15, No. 3.

5   Reichel R., (1991), "The Macroeconomic Impact of Negative Real Interest Rates: Some Econometric Evidence", Savings and Development Journal Vol. 15, No. 3.

6   Keynes, J.M.,(1936) „The General Theory of Employment, Interest, and Money", p. 135.

7   Gruevski I., Gaber S (2020)., „Determinants of the Capital Demand in Macedonia: Do Low Tax Rates Really Play an Important Role for Domestic Investment", IJSBAR;

8   Devereux M P, Griffith R. (1999) The taxation of discrete investment choices, The institute of fiscal studies, Warwick University, 1999

9   Hall, J., Scobie, G. (2005) "Capital Shallowness: A problem for New Zealand?", New Zealand Treasury Working Paper;

10 Caselli F. (2003). "The Missing Input: Accounting for Cross-Country Income Differences", Handbook of Economic Growth, NBER, Harvard University;

11 Gruevski I., Gaber S., (2020) „Determinants of the Capital Demand in Macedonia: Do Low Tax Rates Really Play an Important Role for Domestic Investment", IJSBAR, 2020;

12 Devereux M P, Griffith R. (1999) The taxation of discrete investment choices, The institute of fiscal studies, Warwick University, 1999

13 Gruevski I., Gaber S.,(2020) „Determinants of the Capital Demand in Macedonia: Do Low Tax Rates Really Play an Important Role for Domestic Investment", IJSBAR, 2020;

14 Gruevski, Ilija and Gaber, Stevan (2018) Other Tax Models That Alleviate the Burden on Equity Financed Investments: Analysis of the Full Integration Tax System, the Dividend Exemption Tax System and the Flat Tax Rate System. International Journal of Sciences: Basic and Applied Research (IJSBAR).

15 Devereux M P, Griffith R. (1999) The taxation of discrete investment choices, The institute of fiscal studies, Warwick University, 1999.

16 Gruevski, Ilija and Gaber, Stevan (2018) Other Tax Models That Alleviate the Burden on Equity Financed Investments: Analysis of the Full Integration Tax System, the Dividend Exemption Tax System and the Flat Tax Rate System. International Journal of Sciences: Basic and Applied Research (IJSBAR).

17 Devereux M P, Griffith R. (1999) The taxation of discrete investment choices, The institute of fiscal studies, Warwick University, 1999

18 Gruevski, Ilija and Gaber, Stevan., (2014), Corporate Taxation and Investment: The Case of the Split Rate Corporate Tax System in Macedonia. Economic Analysis.

19 Haksar V., Kopp E., (2020), „Back to basics: How can interest rates be negative", Journal of finance and development, IMF;

20 Haksar V., Kopp E., (2020), „Back to basics: How can interest rates be negative", Journal of finance and development, IMF;

21 PIMCO, (2017) „How do negative interest rates work", Understanding investing,