The Effects of Restrictive Monetary Policy on the Risky Businesses

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February 2024

1 Introduction

The purpose of this article is to analyze the effects that a restrictive monetary policy has on the real economy. In particular, an attempt will be made to answer the following question:

What effect does a change in interest rates have on high-yield firms?

The literature on the effects that money has on the real market is abbondant and varied. In order not to be repetitive, this article will focus only on one particular sector of industry, the high-risk corporate sector. That sector will be used as a proxy for analytically assessing the real effects that a restrictive monetary policy has on aggregate supply.Specifically, an attempt will be made to answer also the following question:

What effects does an imbalance in the high-risk-return investment sector have on the real economy?

As will be seen below, a restrictive monetary policy affects at first the market portfolio. A change in this one in turn disrupts the microeconomic-real equilibrium, inciding on the capital stock.

The considerations that will be made seem in some ways contrary to Keynesian Macroeconomy advocates, where a restrictive monetary policy is associated with a contraction in consumption, then in aggregate demand and ultimately in gross domestic product. On closer analysis, however, the two models are not contradictory, since one of the conclusions of this model is also that of increased demand for investment. However, it is well known that restrictive monetary policy is undesirable in periods when there is already a contraction in aggregate demand. On the other hand, such a policy has its merits, chief among them resurrecting the instrument of monetary policy that may have proved ineffective after a policy of zero interest rates perpetrated for too long. In addition, increased demand for investment pays off in the long run by increasing available capital and thus productivity.

1.1 Assumptions

Assume a market characterized by perfect competition. The market for goods and services is assumed to be in equilibrium, and the demand for capital is the only one directly influenced by monetary policy. This, in turn, is implemented independently by the central bank through a change in the interest rates of riskless, or deterministic, assets. The financial market, on the other hand, is regulated by both monetary policy and individual assets sold in the market. The match between the former and the aggregate of all possible portfolios gives rise to the market, or equilibrium, portfolio. At the aggregate level, the market supply of financial assets is described by the Markowitz model, also called the Markovitz bullet (1952). This describes the frontier of possible portfolios in the financial market, given the expected return, variance and covariance of each individual asset.

The set of possible portfolios is described specifically not by its individual assets, but by its risk-return pair. In formulas:

$$\mu_p = \sum_{i \epsilon M} w_i \cdot E(i) \tag{1}$$

$$\sigma_p = \sum_{i \epsilon M} w_i^2 \cdot Var(i) + \sum_{i,j \epsilon M, i \neq j} w_i \cdot w_j \cdot Covar(i,j) \tag{2}$$

Where M is the set of all assets available in the market, w is the weight of those assets in the portfolio, and *E(.)*, *Var(.)* and *Covar(.)* espectively the function which takes one or more random variables as an argument and returns the mean, variance, and covariance.

As (1) shows, the expected return of the portfolio is equal to the weighted sum of the individual returns of its component assets. Risk, on the other hand, is expressed by (2) and represented by the weighted sum of the various standard deviations and covariance of different assets. Each portfolio available in the market can then be expressed by the pair $\mu - \sigma$, without specifying individual assets or weights. Since the frontier in the Markowitz model is monotinic, we are sure that each yield is associated with a single variance. To simplify the model, assume that such a set can be described by the following function:

$$\mu_1(\sigma) = (\sigma - \alpha)^\gamma + \beta \tag{3}$$

with:

$$\alpha, \beta, \gamma > 0 \wedge \gamma = (0, 1) \tag{4}$$

As (3) shows, the expected return is an increasing function of the standard deviation. Moreover, since γ is between 0 and 1, (3) is strictly concave.

Suppose now that the central bank imposes an interest rate of μ_0. The investor is now given the opportunity to choose a portfolio that a mix of risky and deterministic assets. The frontier of possible portfolios then becomes:

$$\mu_2(\sigma) = a \cdot \sigma + \mu_0 \tag{5}$$

with:

$$\alpha > 0 \tag{6}$$

As (5) shows, the possibility of also choosing among deterministic assets makes the frontier equal to a straight line. In particular, (3) and (5) are tangent at the point $\sigma^* - \mu^*$, which corresponds to the market portfolio [1]. Graphically, we can represent (3) and (5) as follows:

[1] In the model, the pair $\sigma^* - \mu^*$ is endogenous; however, it is possible to observe this function empirically through stock market indexes

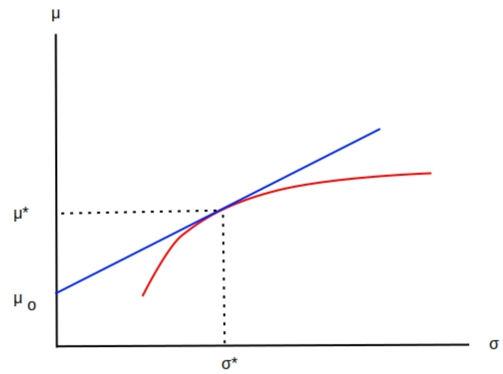

Figure 1: Frontier of possible portfolios

As Figure 1 shows, the intersection of (5) with lasse y occurs at the point μ_0, which corresponds to a variance of 0. Furthermore, knowing at least two points on the line (5), we can describe the slope a as follows:

$$a = \frac{\mu^* - \mu_0}{\sigma^*} \tag{7}$$

As (7) shows, in the denominator we have only σ^*, since the risk associated with μ_0 is 0.

Now, we know that (3) and (5) are tangent, so at the point $\sigma^* - \mu^*$ they have the same first derivative. Specifically, the derivative of (3) is equal to:

$$\frac{d\mu_1}{d\sigma} = \gamma(\sigma - \alpha)^{\gamma-1} \tag{8}$$

Equalizing (7) and (8) at the point $\sigma^* - \mu^*$ gives:

$$\frac{\mu^* - \mu_0}{\sigma^*} = \gamma(\sigma^* - \alpha)^{\gamma-1} \tag{9}$$

By adjusting the terms of (9), we can express the return of the market portfolio as a function of the return of the risk-free asset:

$$\mu^*(\sigma^*(\mu_0), \mu_0) = \gamma \cdot (\sigma^*(\mu_0) - \alpha)^{\gamma-1} \cdot \sigma^*(\mu_0) + \mu_0 \tag{10}$$

As (10) shows, μ^* is a function of both σ^* and μ_0. By readjusting the terms, we can also express σ^* as a function of μ_0 as follow:

$$(\sigma^*(\mu_0) - \alpha)^{\gamma-1} \cdot \sigma^*(\mu_0) = \frac{\mu^* - \mu_0}{\gamma} \tag{11}$$

As (11) shows, σ^* is an implicit function of μ_0.

2 Monetary Policy Change

2.1 The Short Run

Suppose now that the central bank decides to pursue a restrictive monetary policy. This can happen for several reasons, of which perhaps the one most famous is the contrast of inflation. In our model, such variation is an exogenous shock that *in primis* disrupts the equilibrium in the financial market [2].

A change in μ_0 affects only (5), since (3) does not depend on it. Since (7) is greater than 0, this variation increases the intercept, decreasing the slope of (3). In formulas:

$$\frac{d\mu_1}{d\mu_0} = -\frac{\sigma}{\sigma^*} + 1 \tag{12}$$

In the left-hand side of (12) we have two contrasting effects, a negative one given by the first member and a positive one given by the second member. However, being $\frac{\sigma}{\sigma^*}$ he positive effect dominates over the negative effect.

Now, to measure what effect a change in μ_0 as on the market portfolio, we calculate the derivative of (10):

$$\frac{d\mu^*}{d\mu_0} = \frac{\delta\mu^*}{\delta\sigma^*} \cdot \frac{\delta\sigma^*}{\delta\mu_0} + \frac{\delta\mu^*}{\delta\mu_0} = \gamma \cdot (\sigma^*(\mu_0) - \alpha)^\gamma \cdot \frac{d\sigma^*}{d\mu_0} \cdot \frac{\sigma^* \cdot (\gamma - 1) + 1}{(\sigma^*(\mu_0) - \alpha)^2} + 1 \tag{13}$$

Also in (13) as in (12), we have two contrasting effects, a negative one given by the first member and a positive one equal to 1. However, since the first member is between 0 and 1, we can say that the total effect moves in the same direction as μ_0.

Graphically, the variation of μ_0 an be represented as follows:

[2] This variation is called exogenous because μ_0 is not a variable but a parameter and therefore considered given

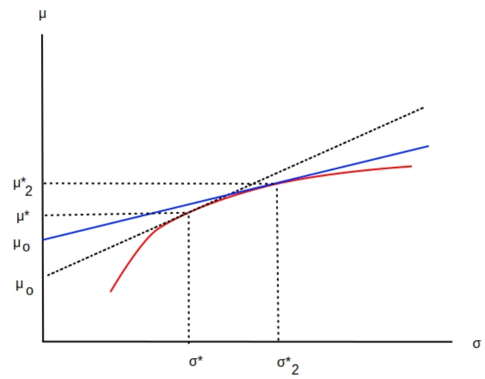

Figure 2: Financial market equilibrium after a change in μ_0

As Figure 2 shows, only (5) shifts, while (3) remains fixed. Note how a change in μ_0 increases σ^* proportionally more than μ^*; this effect is intuitable given the concavity of (3). From an economic point of view, this mechanism is quite reasonable in the short run, where a change in interest rates gives rise only to a reorganization of weights w_i as described in (2), leaving the functional form unchanged. From the above we can draw the first conclusion of the following model.

T1: *Given the postulates of the previous section, a restrictive monetary policy, implemented through a change in interest rates, increases both the return and the riskiness of the market portfolio in the short run; however, the latter increases in greater proportion than the former. Moreover, the spread between the two changes increases the greater the risk of the market portfolio.*

Let us now move from the macro-financial sector to the microeconomic sector to see the effects that such monetary policy has on industry. In particular, let us take as a reference the capital market of indistrie characterized by high risk-return. Let us further assume that each firm has the same production function, which takes only capital as an input. The capital demand of the representative firm is then equal to [3]:

$$K(r(\mu_0) \tag{14}$$

[3] In the case where each enterprise has constant returns to scale, the use of representative company, instead of n acompanies operating in the market, produces the same results

Such that:

$$\frac{\delta K}{\delta r} < 0 \tag{15}$$

And:

$$\frac{\delta r}{\delta \mu_0} > 0 \tag{16}$$

Where K denotes precisely the quantity of capital demanded and r the interest rate offered; the latter increases in the same direction as μ_0, in analogy with what we saw in (12) and (13). In (14), μ_0 is the exogenous variable, and by multiplying (15) by (16) we know that the total effect of a change in it moves in the opposite direction from the quantity demanded. In other words, μ_0 has the same function as price has in the consumer goods market.

Instead, the capital supply is equal to the aggregate savings:

$$S(r) \tag{17}$$

Such that:

$$\frac{\delta S}{\delta r} > 0 \tag{18}$$

Where S enotes precisely the aggregate savings. As shown by the (17) and (18), a change in r increase the amount of capital offered; moreover, S does not depend on μ_0.

By solving the system composed of (14) and (17), we obtain the equilibrium in the high-yield capital market. Graphically:

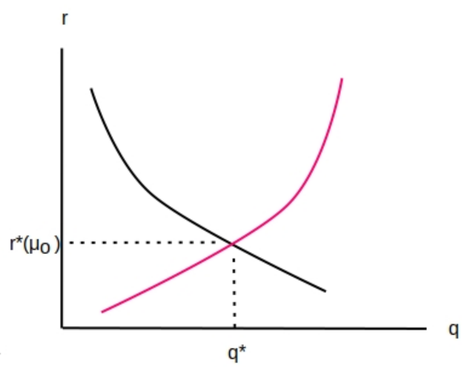

Figure 3: High-yield capital market

CAs Figure 3 shows, the meeting of demand (in black) and supply (in purple) gives rise to the equilibrium quantities $r(\mu_0)^* - q^*$. Moreover, since all functions are either strictly concave or convex, for each level of μ_0 exists one and only one equilibrium point. From the above we can draw the following conclusion::

T2: *Assuming that the central bank knows both the preferences of saverators and the production function of high-yield firms, through monetary policy it can indirectly affect the real economy either by sta- biling a certain stock of capital, or by setting a certain level of return on it.*

Suppose now, as in the previous paragraph, that μ_0 increases as a result of a monetary policy decision. The pair $r(\mu_0)^* - q^*$ is no longer the equilibrium point, as (14) has shifted upward. Graphically:

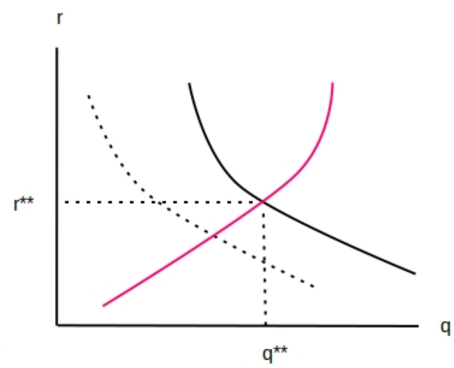

Figure 4: Equilibrium change in the high-yield capital market

As Figure 4 shows, risky firms now weigh more in the market and demand more capital from investors to finance their projects. This gives rise *in primis* to a larger stock of capital, which then translates into more research and development, more modern machinery, etc. *In secundis*, the greater demand for savings is accommodated by households at a higher interest rate, as the opportunity cost of consumption-savings increases. The higher cost of capital must be covered at the time the bond matures [4] through investment returns. These, in turn, must yield more, because the capital to finance itself costs more. This goal is achieved only through taking on more risk. From the point of view of consumption, as household income is given, greater saving reduces consumption, contracting aggregate demand. This, however, is stimulated by higher demand for investment from high-yield firms. It should be emphasized, however, that the investment demand of low-yielding firms decreases accordingly. We can therefore draw the following conclusion:

T3: *In the short run, a restrictive monetary policy reduces aggregate consumption, increases the investment demand of high-yield firms and reduces that of low-yield firms. The total effect is that of reduced output.*

Thus, the real negative effects of a restrictive monetary policy emerge from the above.

[4] Or continuously if they are stocks

2.2 The Long Run

The discussion would not be complete without analyzing the effects of monetary policy in the long run. In the previous section, first the financial market and then the real market were observed; we therefore follow the same route in the long run.

In the financial market, a change in the interest rate, as seen, increases the return-risk pair of the market portfolio. This not only changes the composition of that portfolio, but also incentivizes risky firms to enter the market. Thus, what varies is the set M of (2); this variation decreases the concavity of (3), increasing the parameter γ. To measure this, we calculate the derivative of (3) with respect to γ:

$$\frac{d\mu_1}{d\gamma} = ln(\sigma - \alpha) \cdot (\sigma - \alpha)^{\gamma} \tag{19}$$

As (19) shows, the result is greater than zero: at the same σ, a change in γ increases the return of each available market portfolio. Graphically, this effect can be represented as follows:

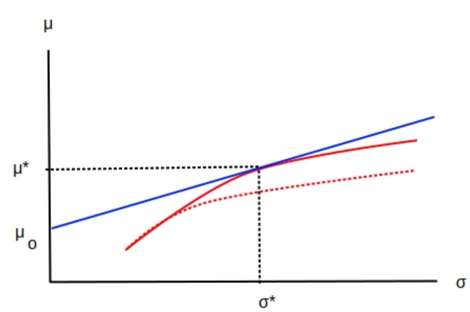

Figure 5: Financial market after the entry of new companies

As observed in Figure 5, (3) has changed shape by pushing in- behind the market portfolio return. However, since there are no entry barriers to the capital market, it is reasonable to assume that this effect is smaller than the positive effect analyzed in the short run. In addition, as new firms are of the risky type, the curvature of (3) increases especially in the second half of the graph in Figure 5.

Coming to the real market, we have mentioned how greater savings-investment contracts consumption. It is beyond the scope of this article to analyze the performance of the economy in the long run; however, it is possible to say that while in the short run the negative effect dominates, in the long run the positive effect dominates, as invested capital is remunerated and, above all, the higher productivity of firms generates more income for households.

3 Conclusions

In the introduction of this article, we asked what effect restrictive monetary policy has on the real economy. In light of our analysis, we can say that it produces two different effects, depending on whether we consider the short and the long perid. In the former case, a higher interest rate on deterministic assets changes the composition of the market portfolio, increasing both expected return and risk. The latter, moreover, increases in greater proportion than the return. On the real side, the greater weight on risky firms pushes them to raise more capital, increasing both the return to savers and the capital stock within the economy. This, in turn, increases GDP as investment spending increases, but at the same time reduces it as consumption spending decreases. In the short run, therefore, from the real point of view the negative effect dominates, as consumption has a greater weight than savings in the composition of aggregate demand.

In the long run, invested capital generates returns, both by remunerating savers with the agreed-upon interest rate and by generating greater output due to the increased capital endowment. On the other hand, more risky firms enter the market, attracted by the higher expected profits: this generates in the real market the equal and opposite effect seen in the short run. However, it stands to reason that the first effect dominates over the second. In addition, lower market portfolio returns reduce aggregate savings, stimulating aggregate consumption and generating further growth.

In conclusion, in the short run the effect on growth is negative, while in the long run it is definitely positive.

References

In writing this article, the following manuals can be consulted for reference to the modellu used:

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