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A SRAFFIAN APPROACH TO THE RELATIONSHIP BETWEEN THE INTEREST RATE AND THE PROFIT RATE

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Abstract: This paper tries to offer a new interpretation of the relationship between interest rate and profit rate, based on the profitability of bank capital and a rethinking of the traditional multi-sectoral depiction of the economy: that is, considering the banking sector as a particular 'productive' sector with a specific price equation. The tool of the Sraffian-type price equation is used to study and represent this relationship within the framework of the Sraffian "Marxian" approach of Garegnani. In order to describe the operation of the banking sector with such a tool, a careful analysis of the necessary and normal coefficients of a banking sector price equation is conducted and the compatibility of economic concepts such as input, output and capital with endogenous money theory is discussed.

The results of this investigation show the possibility of conceiving a causal relationship between the rate of profit to the rate of interest, with the central bank wielding significant influence. These findings can also reconnect and develop the different cues in Marx's analysis of the financial system, which are apparently contradictory.

Keywords: Sraffian price equation; bank profitability; interest rate, endogenous money; Marx.
JEL Codes: E11; E43; G21

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Introduction

In this paper we propose a depiction of the banking sector through the instrument of the Sraffian-type price equation (Sraffa, 1960), in the framework of the Sraffian "Marxian" approach of Garegnani (1984) – as termed by Roncaglia (2000, 2005). This analysis based on banking price equations fits into the broader debate on the relationship between the interest rate and the profit rate[1] and appears to be key to its interpretation. Although this approach is now fairly well established in the literature (Pegoretti, 1983; Franke, 1988; Panico, 1988; Ciccarone, 1998; Shaikh 2016; Dvoskin and Feldman, 2021), open questions remain regarding its compatibility with endogenous money theory. In addition, looking at previously developed financial models (Gattei, 1983; Pegoretti, 1983; Franke, 1988; Panico, 1988; Dvoskin and Feldman, 2021), inconsistencies emerge which are less related to the banking sector price equation than to the introduction of the banking/financial sector into production sector price equations. Pegoretti (1983) even goes so far as to deny the theoretical concept of *general profit rate* (an idea criticized by Gattei, 1983).

In addition, it is interesting to note that while Panico (1988) and Dvoskin and Feldman (2021) adhere to the monetary explanation of the distribution (with similar conclusions to Pivetti, 1991) and consider the interest rate as the independent variable of the distribution, Shaikh (2016), on the contrary, considers the real wage as the independent distributional variable. So, from this point of view there is a practically opposite view among the approaches using the price equation instrument in the banking sector.

This paper discusses some basic preliminary elements for approaching the banking industry through the price equation that have not yet been discussed in the relevant literature. This discussion helps to clarify and resolve some of the problems and unclear issues from previous contributions. The careful examination of the workings of the banking sector as well as of the price equation tool itself allow some doubts regarding the compatibility of this approach with endogenous money theory to be resolved, clarify how to conceive of a capital-credit relationship in the banking sector, and illustrate several details about the relationship between finance and production at the theoretical level.

After considering these preliminary issues, an attempt is made to model the relationship between finance and production through the price equations of the banking sector and those of the real sector, taking into account the previous analysis on banking. In this formulation, real wages are also adopted as the independent variable, following Shaikh (2016), in homage to the classical tradition in this regard. In this model we also attempt to give a new interpretation of the relationship between interest rate and profit rate using bank profitability as a key: the bank, like any other industry, must obtain from the invested capital a rate of profit at least equal to the normal one - defined as the rate of profit generated on newly

[1] On the relationship between interest rate and distribution in a broader sense, see Lofaro, Matamoros and Rochon, 2023.

installed capital goods, obtained using the available dominant technique, for a normal level of capacity utilisation. The result is that the interest rate can be identified as the 'price' of the 'commodity' loan.

This representation is also based on the classical economists' and Marx's conception of the interest rate as a part of the rate of profit, as well as some elements of post-Keynesian analysis of the interest rate, the banking sector and its relationship with the central bank. Moreover, the introduction into the study of the possibility of a stable higher-than-normal bank profit rate makes it possible to extend the horizons of this analysis, as well as explain certain elements of Marx's Book III of *Capital* in an innovative way (Marx, [1894] 1959).

To attempt to model the banking industry with price equations, it is necessary to potentially consider the bank as a kind of industry, with identifiable inputs, outputs and anticipated capital (Franke 1988; Panico and Pinto, 2018).[2] This implies a certain broadening of views and a small dose of 'poetic license'. In any case, the approach in question has been fairly well established in the literature for over 40 years and is certainly well-founded.[3] One may certainly disagree with this analogy between bank and production, but this approach is fundamental to studying the relationship between interest and profit rate, on which it can provide a new interpretation. This approach also implies a rethinking of the traditional multi-sectoral economic structure. The banking industry is no longer considered ancillary to the productive structure, but appears instead as sector integrated into the productive sectors, albeit with special characteristics.[4] In addition, an input-output approach helps to better understand the workings of the banking industry itself.

Therefore, once the analogy between banking and production is admitted (if not accepted), it is necessary to adhere to strict and stringent logic regarding the formulation of the resulting price equations, otherwise the approach in question loses explanatory capacity and theoretical utility. Finally, it was decided to study the traditional (commercial) banking sector because it is fundamental to understanding the relationship between interest rate and profit rate. The other operations that banks engage in, from financial advisory to the so-called shadow banking system, have no place in this

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[2] See also Klein (1971) and Hancock (1985) in a marginalist context.

[3] Panico and Pinto (2018) illustrate different ways of representing the financial system. They trace the interpretation of it as a particular industry back as early as Marx (and we might add Ricardo). Moreover, Panico and Pinto (2018, p. 49) list the characteristics of the banking industry:

> 1. It intermediates between those having financial surpluses and deficits in their balance sheets. 2. It provides the other industries with services (loans or other financial products), which are necessary to carry out production since firms have to solve cash-flow problems in order to manufacture and sell their product. In this case, the financial industry provides the other industries with "intermediate" services, whose revenues do not directly appear in the value-added. 3. It produces financial services by bearing some material costs, like any other industry. These costs also depend on the norms of financial regulation. 4. It provides firms, capitalists and workers with loans that finance their investment and consumption activity. In this case, as in that of financial services sold to the government and the foreign sectors, the financial industry sells "final" services that directly enter into the value-added of the economy. 5. Like any other industry, the financial industry is organised to make pressures on political bodies in order to affect legislation and increase its earnings.

[4] On this type of analysis, see already Ricardo ([1816] 1951); Marx ([1894] 1959).

analysis, which focuses on the function of providing money capital that productive capitalists transform into productive capital (See Marx, [1894] 1959). These other activities, often ancillary to the main credit activity and nonetheless important in the functioning of contemporary finance, are beyond the scope of this paper.

The first section outlines the literature on the relationship between interest rate and profit rate and then focuses on those contributions that place the banking sector's price equation at the centre of this analysis. This critical review of the literature also highlights doubts and problems associated with these contributions. The second section discusses the compatibility of the price equation instrument applied to the banking sector with endogenous money theory. The third proposes a new interpretation of the relationship between the interest rate and the profit rate based on bank profitability and a banking sector price equation, where an attempt is made to solve the problems outlined above. Finally, the fourth section offers some insights on the compatibility and similarity between what is developed in this paper and some elements of Marx's analysis of the financial system of capitalism. Conclusions follow. Finally, Appendix A relates the bond rates to the bank interest rate determined in the model.

1. Literature review

For the Classics, Smith ([1776] 1904) and Ricardo ([1821] 1951), the rate of interest is a part of the rate of profit and the latter determines the former, in a residual position compared to the premium for the *risk and trouble* - objective or presumed - of entrepreneurial activity.

Tooke (1826, section I) and John Stuart Mill ([1844] 1967) on the contrary, consider the two rates to be unrelated and hold that they can vary freely, even in opposition to each other. Furthermore, Mill ([1848] 1965) makes it clear that the interest rate depends on the supply and demand for credit, and considers that the rate of profit has no influence on it. Mill ([1848] 1965, Book III, Chapter XXIII) then introduces a fundamental element: the bank. Mill ([1845] 1965) observes that most credit is in fact given by credit professionals, i.e. bankers. Mill identifies a further subtle but fundamental element: the activity of the banker is entrepreneurial and therefore must guarantee the banker-entrepreneur a profit rate at least equal to the normal profit rate. The borrower, on the other hand, pays an interest that must necessarily be less than the profit rate in order to be repaid.

Also for Marx ([1857-1858] 1997, [1894] 1959) profit is divided into two parts, which are appropriated by two *subclasses* of capitalists: the capitalists of money and those of industry, in contrast to each other. The interest rate is the part of the profit rate that goes to the financial capitalist, and results from the struggle for the division of profit between the two types of capitalists and the general conditions of the monetary sector of the economy. The profit rate also influences the interest rate, in an echo of Smith

and Ricardo's approach. It can be seen that for Marx, the interest rate is determined by multiple elements, which are not easily reconciled in a clear and precise manner.

Panico (1988) and Pivetti (1991) state that the interest rate and risk premium are given, while the real wage is not. The result is that the sum of interest and risk premium gives the profit rate and prices and so the real wage.[5] Finally, Shaikh's approach (2016, chapter 10, pp. 443-490), has the same causal relationship as Marx's, although the rate of interest is determined endogenously as the price of production of the banking sector (loan). In this last approach it can be more simply argued that the determination of the relation between the (bank) interest rate and the profit rate occurs in two stages: firstly, the profit rate determines the rate of interest like any other price[6]; secondly, having identified the rate of interest in the first, the profit rate is divided between financial and productive capitalists, where the share of productive capitalists is determined residually. While Marx considers the interest rate to be exogenously determined in a way that is not too clear or rigorous, Shaikh explains what determines it, but in a separate stage of the analysis, which makes the two approaches very close. This innovative approach should therefore not be confused with that of Smith and Ricardo, who consider the interest rate the endogenous variable for quite different reasons and determine it in a rather different way (see Pivetti, 1991, chapter 7).

Table 1 summarises the relationships between interest rate and profit rate of the authors illustrated (for further study, see the literature reviews in these contributions: Panico, 1988; Pivetti, 1991; Shaikh, 2016; Dvoskin and Feldman, 2021; Zolea, 2022), where: r = rate of profit; r_b = banking rate of profit; π = profit of enterprise; i_b = banking interest rate; i = interest rate:

[5] Smith, 2011, affirms that Thomas Tooke also proposed the idea that the money rate governed the normal profit rate, with both the money rate and remuneration for risk and trouble treated as exogenous.

[6] Shaikh (2016) first determines profit rate and prices and then the interest rate. Thus, it can be assumed that for Shaikh (2016) credit is a non-basic commodity, otherwise prices and profit rate should be determined simultaneously.

Table 1. Overview diagram

APPROACH	INDEPENDENT VARIABLES	DEPENDENT VARIABLES	RELATION PROFIT RATE - INTEREST RATE
Smith, Ricardo	r, π	i	$r - \pi = i$
Marx	r, i_b	π	$r - i_b = \pi$
Monetary explanation of distribution (Pivetti)	i, π	r	$i + \pi = r$
Shaikh	r	i_b, π	$r \rightarrow i_b$ $r - i_b = \pi$

Note that in the table Marx ([1894] 1959) and Shaikh (2016) treat the interest rate as the bank rate, unlike Smith ([1776] 1904) and Ricardo ([1821] 1951), and later Pivetti (1991). Panico (1988) definitely treats a bank rate of interest, but, as will be discussed later, it is not clear whether it is immediately comparable with that of the other authors and so it has been omitted from the table.

1.1 A methodological note

Before proceeding with a critical discussion of the most recent contributions and proposing a different approach to analysing the relationship between the interest rate and the rate of profit, it is appropriate to clarify the methodological approach to be taken in this analysis. Of the three main interpretations of the price equations and Sraffa's (1960) approach - the Smithian (Sylos Labini), the Ricardian (Pasinetti) and the Marxian (Garegnani) position-[7] the view we adopt in this discussion is that of Garegnani's (1984) interpretation of Sraffa (1960), based on *natural prices* and *long-run positions*.

Roncaglia (1977, 2005), who follows the Smithian approach, views Sraffa's (1960) analysis as a 'snapshot' of the productive structure of the economy at a given moment in time, which investigates the conditions for reproducing a capitalist economy while assuming a uniform rate of profit.

Pasinetti (1981, 1993, 2007), on the other hand, seeks to develop a theory that is neutral on the *institutional* organisation of society, thus focusing on a 'natural' economic system, purified of those

[7] For this reconstruction of the three Sraffian strands, see Roncaglia (2000, 2005).

institutional aspects that in real economies affect this system in various directions. The study of these aspects takes place in a second stage of the analysis. Pasinetti (1981, 1993, 2007) then discusses a (natural) system of full employment and looks for the necessary requirements for balanced growth. He therefore finds that in this system the rates of profit of the various integrated sectors are different from each other, and are such in order to guarantee an amount of profit equal to the level of equilibrium investment - that is, that level which in turn guarantees the expansion of productive capacity at a rate equal to the rate of population growth added to the rate of growth of per capita demand for each consumption good. The increase in income and per capita demand corresponds in equilibrium to the increase in per capita product due to technical progress. Essentially, therefore, Pasinetti's (1981, 1993, 2007) approach focuses on what conditions should abstractly become true in order to ensure full employment in the *natural economic system* and not on what conditions actually occur in the economic system conditioned by *institutional elements*.[8] Pasinetti (1981, 1993) also states that the link between interest rate and profit rate is institutional. Abstractly, therefore, interest rate and rate of profit are not linked and it would be possible to have one without the other: for example, Pasinetti (1981, 1993) assumes in the natural system that there is an economy with loans between workers, but without capitalists. In this case, there would be a rate of interest but not a rate of profit. Pasinetti's (1981, 1993, 2007) analysis of the relationship between the rate of interest and the rate of profit thus differs greatly from the view in certain similar aspects as those of the other economists discussed above (Zolea, 2022). A detailed study of the role of finance in this approach therefore requires a specialised study which delves deeper and later than the elaboration of the model proposed in the following pages, which is more immediately compatible with the reference literature.

Garegnani's (1984) approach involves the logical distinction of economic analysis into a ‘core', where the relationships are logical-mathematical and the analysis follows a deductive approach, and a part outside this *core*, where historical, social, political and cultural aspects also come into play and the analysis follows an inductive approach. Moreover, Garegnani (see for example Garegnani, 1990), taking up the terminology of classical economists (Smith, Ricardo and also Marx), believes that market prices *gravitate* toward natural prices, which can be defined as long-period, and it is precisely on the latter that economic analysis should focus its attentions (*long-run positions*).

In this paper we follow Garegnani's approach and interpretation of Sraffa's (1960) idea, which appears the most suitable for this analysis. Indeed on the one hand, this approach seems more immediately compatible with the classical and Marxian analyses of the interest rate. On the other, many of the more recent models of the relationship between the rate of interest and the rate of profit are closer to and based

[8] See Roncaglia (2000, 2005).

on this analysis. In addition, Garegnani's (1984, 1990) approach allows for a separate discussion of the analysis of a banking sector price equation and its relationship to the general rate of profit and the price system, as well as a broader analysis open to historical and social political influences of the monetary policy of the central bank.

1.2 Some critical notes on more recent approaches

After outlining conceptions of the relationship between the interest rate and the profit rate from the classical economists to the present, we proceed to discuss the problems of those approaches that have placed bank profitability at the centre of this relationship by establishing a price equation for the banking sector.

Three approaches can be identified: the first is that of Panico (1988),[9] the second is carried forward by Pegoretti (1983), Franke (1988) and Dvoskin and Feldman (2021), and the third by Shaikh (2016).[10]

Panico (1988) is one of the pioneers of the use of the price equation in banking. His contribution is therefore fundamental and is often the starting or comparison point for many subsequent studies (Shaikh, 2016; Dvoskin and Feldman, 2021). However, Panico (1988) introduces the bank interest rate on short-term loans as a cost of production in the price equations of productive industries. This choice presents some doubts over the use of financial coefficients in productive price equations, since, in order to include financial coefficients within the price equations of the real productive sector, it is necessary for these coefficients to have the feature of *necessity* and *normality*, which is hardly conceivable. It is indeed rather difficult to assume a certain *objective* value of the percentage of debt capital toward which all firms in the industry should strive. Although it is not clear what type of loan and related interest rate Panico (1988) is referring to,[11] even when only considering the bank advances used by firms to make payments, it is difficult to assume a certain *normal value* for each firm in the industry.

From this point of view, Pivetti's (1991) approach to the monetary determination of the distribution, in

[9] Panico has offered many contributions on the topic over the years, with various adjustments, modifications and revisions. We refer in this paper to the 1988 book, the most comprehensive and representative work. In any case, the aspects that are discussed occur in all formulations.

[10] Ciccarone's (1998) can be considered a fourth approach. Ciccarone (1998) develops an alternative model to Panico's one of monetary determination of distribution. However, this last model presents problems in the assumptions about the structure of rates, since it assumes a proportional relationship between the rate on deposits and the rate on loans. This implies that, as rates vary, their difference also varies proportionally and so bank profit. This does not seem to correctly describe the functioning of the banking system. Moreover, in Ciccarone's model the distributional contrast may be mitigated by the variation of the deposit rate in the opposite direction to that of the real wage, a phenomenon whose relevance for the distribution could be dubious.

[11] Panico (1988) includes in his equations the short-term interest rate on transactions such as bank advances, but multiplies it by a coefficient indicating "the total amount of bank loans" (Panico, 1988, p. 187). Panico (1988) explicitly states that the rate used is the short-term rate on bank advances, but this is at odds with the condition that the interest rate be less than the profit rate: indeed, it seems reasonable to only apply this condition to monetary capital transformed into physical capital that allows for a profit rate, and not to bank advances.

which changes in the interest rate affect the distribution through changes in the rate of profit - where the former is a part of the latter - is more convincing. In Pivetti's (1991) approach, therefore, the interest rate does not enter the price equations as a cost of production. In fact, although in both cases an increase in the rate of interest leads to a reduction in the real wage, in Pivetti's (1991) approach there is an increase in the rate of profit, while in Panico's (1988) there is an increase in financial costs (this reflection echoes the arguments of Lavoie, 2023, in connection with the debate with Weber and Wasner, 2023, regarding profit-led inflation).

A similar issue concerns the approach of Pegoretti (1983), which was sharply criticised by Gattei (1983), and taken up by Franke (1988) and Dvoskin and Feldman (2021). In this approach, the total profit rate within the price equation varies depending on whether the capital is equity or debt and on financing conditions. As pointed out by Gattei (1983), an important concept such as *the tendency toward uniformity of the normal profit rate* is missing in this analysis, and the cause is the introduction of the *financial decomposition* of capital within the price equation. [12]

While Pegoretti (1983) explicitly affirms the abandonment of the concept of uniformity of profit rates, Dvoskin and Feldman (2021) speak of positive or negative 'quasi-rents' that lead, essentially, to different rates of profit depending on the financing of investments (through equity capital, debt capital contracted on good terms and debt capital contracted on worse terms). A curious paradoxical effect of this approach is that the least expensive method of financing should become the dominant method by eliminating competition: assuming that self-financing, for example, is more advantageous than debt, by including this element within a price equation, the fully self-financed firm would systematically produce at a lower cost (and thus selling at a lower price) than the others and eliminate them from the market.

An even more absurd element can be found by considering firms' assets, such as deposits. As loans enter these approaches into the price equations, so too must deposits. As the rate on deposits increases, or even just the volume of deposits, the price should fall, potentially reaching zero or even negative territory. A firm that accumulates deposits, given the assumptions of financial coefficients of assets and liabilities within the price equations, would logically reduce prices, competing with other firms. Indeed, within the context of the price equation, it is irrelevant whether the capital is equity or debt: the normal profit rate is obtained on all employed capital, irrespective of the part of profits that will be paid as interest.

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[12] This passage from Marx ([1894] 1959, p. 356-357) can be interpreted in the direction of distinguishing between the real composition of capital (equity and debt) and the theoretical analysis of the relationship between the rate of interest and the rate of profit, which can be summarised through the tool of the price equation:

> If we inquire further as to why the limits of a mean rate of interest cannot be deduced from general laws, we find the answer lies simply in the nature of interest. It is merely a part of the average profit. […] The way how the two parties who have the claim to it divide the profit is in itself just as purely empirical a matter belonging to the realm of accident as the distribution of percentage shares of a common profit in a business partnership.

The use of financial coefficients in the price equations of the production sector, and even more so the decomposition of the rate of profit according to the composition of capital, seems to present major doubts and conceptual difficulties.[13] The problem lies in the introduction of the financial composition of capital within the production sector price equations, which inserts coefficients that are neither normal nor necessary in a forced manner, confusing the analytical tool of the price equation with an accounting analysis that is valid only at the aggregate level.

Conversely, the approach used by Shaikh (2016) seems to be more robust and does not have the problems highlighted in the previous contributions. However, some doubts remain about a simplifying assumption adopted by Shaikh (2016) that is too stringent: considering the rate on deposits to be zero. Shaikh (2016) considers the cost of deposits to be zero and therefore does not introduce them into the banking price equation (see Toporowski, 2020). Although in recent years the rate on deposits has been very low, zero or even negative, not considering deposits in a theoretical discussion seems like a simplification with repercussions too broad to be acceptable without further analysis. In addition, Shaikh (2016) considers the independent variable to be the real wage and gives no role in determining the bank interest rate to the central bank (as will be seen more clearly in section 3, this element is partly related to the choice to consider the rate on deposits equal to zero and thus remove them from the equation): given the real wage, the interest rate depends solely on the profit rate (determined residually relative to

[13] Arena (2015), pp. 193-194:

> It is, however, essential to take the analysis further and to investigate the dividing line between technical and social factors more closely. An important passage in the Sraffa Archives provides a significant point of departure for this analysis:
>
> > Interest appears thus as the necessary means of overcoming an obstacle to production. It is a social necessity as distinguished from the material necessity of, say, putting coal into a locomotive that it may do its work. There are many other such socially necessary costs which appear as technical necessities. Thus, the work of a ticket collector on a bus or a railway: obviously, the railway would run equally well if no tickets were collected; but, if everybody travelled without paying, the shareholders would stop it; the work of the ticket collector prevents the shareholders from stopping the railway; the shareholders would be as effective in stopping trains as lack of coal in the engine. The ticket collector is therefore as productive as the fireman. (Sraffa D3/12 18/11)
>
> This passage reiterates the importance of the distinction between "social" and "material necessity." Even if a technical or material necessity is similar to a social necessity, the two must not be confused or conflated. Hence, even if a "ticket collector is as productive as a fireman," we cannot consider them as equivalent. The ticket collector's primary role is to safeguard, at least indirectly, the interests of the shareholders, whereas the fireman's principal task is to protect the technical viability of the bus or the railway; without the latter there is a real risk of the destruction of capital. This is also why for Sraffa interest cannot be justified as a productive and necessary ingredient related to production, but rather as a strictly legal and conventional tool depending on institutions and conventions in a given society (Sraffa, D1/15 2). This is finally why Sraffa often expresses his doubts on the usual justifications for the necessity of interest (Sraffa, D1/15 6 and D3/12 7 44).

See also Barba and De Vivo (2012), p. 1485:

> The case of increased circulation costs may be portrayed as a worsening in the technique of production. But this worsening is not related to the production activity strictly defined. It should be noted that (abstracting from the existence of exhaustible natural resources) only if the technique is defined in this wider sense is an absolute worsening in the conditions of production possible. No worsening in the conditions of production stricto sensu is conceivable: one would otherwise have to maintain that for some inexplicable accident the better technique has been forgotten and is no longer available.

the wage along with relative prices) and bank costs. Although logically this analysis presents no problems,[14] it appears to be somewhat difficult to discuss the determination of interest rates without assigning any role to the central bank. As will be seen in section 3, it is possible to keep the real wage as the independent distributional variable, while showing the influence of the central bank on the determination of bank interest rates.

2. Banking price equation and endogenous money theory

Before proceeding with the presentation of our banking sector price equation, the compatibility of this instrument with the endogenous money approach is discussed. In fact, many authors (Pegoretti, 1983; Franke, 1988; Panico, 1988; Ciccarone, 1988; Shaikh 2016; Dvoskin and Feldman, 2021) have used the price equation tool to describe the functioning of the banking sector with different and also rather conflicting approaches. Thanks to these authors, this methodology became quite established in the literature, but these authors did not discuss its compatibility with the idea of endogenous money.[15] The functional analysis of the banking sector carried out by Zolea (2023a, 2023b) is highly useful for building a theoretical foundation for using the price equation in the banking sector in a manner consistent with the endogenous money approach. This analysis is particularly relevant for using Sraffa's approach in banking (Hodgson, 1981): echoing the ideas of Cesaratto (2021), endogenous money is essentially the correct description of how the banking and financial system works and not a theory that can be debated. It is therefore vital for the literature which uses banking price equation to have a solid foundation in endogenous money theory.

2.1 Deposit as a bank input

The first point to be addressed concerns deposits. The various authors who have tried to work out a price equation for the banking sector have always considered them among the bank's costs. In fact, banks usually pay interest on the deposits they collect, and this seems to go in the direction of considering deposits as an input of the banking sector. However, endogenous money theory states that banks granted

[14] Shaikh (2016) believes that the interest rate is a part of the profit rate and therefore that the former is minor when compared with the latter. Shaikh (2016) further explains the so-called 'Gibson's paradox' by stating that as prices increase, bank costs increase and therefore banks increase their price, that is, the interest rate on loans. As prices rise, therefore, the interest rate could take an increasing share of the profit rate. Too high an interest rate does not seem compatible with a developed capitalist system (Marx, [1905-1910] 1971, vol. III). Shaikh (2016), however, does not hypothesise any economic mechanism to prevent or avoid this explosive dynamic, which could also lead in the abstract to an interest rate higher than the rate of profit.

[15] On this subject, see among many others: Lavoie (1984), Moore (1988a, 1988b), Rousseas (1989), Wray (1992); Palley (1987, 1991, 2002), Rochon (1999, 2001), Rochon and Vernengo (2003), Deleidi and Levrero (2019), Deleidi (2020).

credit based on demand, and when they grant a loan, they create both a loan and a deposit at the same time. In most banking systems, then, a certain percentage of deposits must be held in reserve at the central bank. So, the logical chain goes from loans to deposits and reserves, rather than vice versa.

However, the analysis of individual bank behaviour is more complex. First, it should be noted that the usefulness of reserves derives precisely from the fact that there are multiple banks (Graziani, 2003). Banks use reserves to manage payments among themselves. When considering banks at an aggregate and consolidated level, any need for reserves is eliminated. Banks create bank money, and the liabilities of these banks (deposits) are used as means of payment in the real sector. In turn, banks use central bank liabilities, i.e. central bank money, or reserves, as means of payment.

While banks can therefore create bank money (*deposits*) *ex-nihilo*, they cannot create central bank money (*reserves*). So, banks need reserves to adjust payments both between themselves and with the central bank.

Banks can obtain central bank money from the central bank itself (usually in exchange usually), which *creates* new money by responding to banks' demand, or they can ask other banks for it. Indeed, just as some banks may find themselves short of reserves, other banks may find themselves in excess and therefore find it convenient to lend them out. Liquidity needs depend on the reserve requirement and the needs for payments to other banks that each bank faces. In reality, the central bank acts as a clearing house, and banks generally exchange only the net of active and passive reserve movements.

The peculiarities and specifics of banking systems are actually more complex, and there are short- and long-term liquidity markets, but an in-depth discussion of these issues is beyond the scope of this article. The important points underlying the reasoning being developed here are the need for central bank money as a bank input and the fact that banks exchange reserves with each payment that occurs between them (although in reality only the net of daily assets and liabilities are exchanged). Returning to deposits, each time a deposit is exchanged between two bank accounts, an equal amount of reserves passes between one bank and the other (net). So, through deposit shifts banks raise central bank liquidity or reserves. Of course, when a loan is created, and thus a debit and credit entry for the bank, there is no passing of reserves, but usually the loan is made for a financial necessity: in short, the lender will use the loan and transfer the deposit, while the bank that made the loan will be left with a credit on the credit side and the bank that received the deposit with a debt (the deposit received). In exchange for this debt, however, the receiving bank will also receive reserves (assets), while the first bank will have to surrender reserves (liabilities).

It is clear that the primary source remains the central bank but reserves already injected into the system circulate among banks through the interbank market and the movement of deposits.

Although, therefore, the input for the bank appears to be central bank money, indirectly deposits turn

out to be one of the means by which the central bank raises reserves. This reasoning thus gives greater soundness and substantiation to the choice of including deposits among the bank's inputs within the price equation. For a more detailed discussion of this topic, see Zolea (2023a).

2.2 Bank capital

Another element to be discussed, again connected to the endogenous money approach, is related to the identification of *necessary* and *normal* value that capital must take in order to be included in the price equation of the banking sector.[16]

Following the endogenous money theory, banks create loans *ex-nihilo*. As a result, it is difficult to identify the capital needed to carry on the bank's business. Two considerations must be made, however. The first is that some physical capital is always necessary for banking. Consider the physical location where the bank relates to customers, offices, vaults, etc. It seems quite evident, however, that the bank enjoys economies of scale:[17] given this minimum capital, therefore, the amount of loans the bank can create can vary considerably. Moreover, while one might think that a greater territorial presence with more branches (and thus more capital) indicates a greater ability to absorb demand, modern technological and computing innovations and internet banking go in the opposite direction.

The second consideration is that although it is not possible to identify a *technical* coefficient for bank capital, it is possible to identify a *normative* one. In fact, international agreements (the Basel Accords) impose a certain amount of capital proportional to risk-weighted assets. It is therefore possible to define a capital/output ratio and so a certain amount of capital can be identified for a given output in the banking price equation (see Zolea, 2023b).[18]

Finally, it should be pointed out that the criticism regarding financial coefficients in price equations only applies to productive sectors. For a sector such as banking, however, loans and deposits can be included as outputs and inputs. Actually, a certain amount of capital can be identified in relation to output, and deposits can be identified as an important banking input. Deposits within the banking price equation seem to have the required characteristics of necessity and normality. It may be more complicated to assume a precise relationship between deposits and loans, but it is not impossible, as we

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[16] Note that Dvoskin and Feldman (2021, p. 11) mention the problem of the relationship between capital and credit (output) in the price equation of the banking sector:

> Equity capital […] can be assumed to be given at a particular level […] because the Central Bank controls this ratio through financial regulation aimed at preventing, for instance, an overexpansion of credit in the economy.

[17] A nod to this idea can already be found in Marx ([1932] 1988).

[18] Some post-Keynesian authors (Descamps and Soichot, 2003; Disyatat, 2008; Borio and Disyatat, 2009; Disyatat, 2011) believe that capital requirements can be a limit on money creation, while others are against (Lavoie, 2019). Zolea (2023b) takes a different interpretation by introducing the concept of *normal capacity utilisation* in banking: the result is that under normal conditions, capital requirements do not affect the supply of credit, which therefore adjusts to demand. Further discussion of this argument is beyond the scope of this paper.

can see in the next lines.

It can be argued that the 'banking production cycle' includes the production cycle of the real sector. Let us try to explain this idea with an example. A bank provides a loan to an enterprise, which uses it to purchase goods-capital and wages, and starts production. If the product is then sold and the enterprise makes a profit, part of this profit is given to the bank in the form of interest. After paying costs, because of this interest the bank in turn earns a rate of profit on invested capital at least equal to the normal one. At the point when the credit is used to purchase capital-goods, the producer's deposit will pass to the capital-goods producer, while between the banks of the two producers there will be a pass-through of reserves of equal amounts (although, as noted, the actual pass-through concerns only the net). In this respect, the 'banking production cycle' works in reverse (not counting the material and physical part of banking production, such as the internet line, workers' wages, etc., which must be advanced): first the 'product' (loan) is 'sold', then the 'inputs' are 'sourced' (deposit). In turn, profit does not depend on the 'sale' of the 'product' (i.e., the giving of credit) but on the successful production and sale of the product by the capitalist who received the credit. The capital required by laws does not enter this cycle directly, but it is necessary for the bank as a requirement to be able to carry on its business legally and safely and thus to find customers.

By this reasoning we have found a certain link between loans and deposits that can be used in the price equation.

3. A price equation of the banking sector

We propose here an original model of the relationship between the profit rate and the interest rate, in order to explain the functioning of the banking sector. It should be noted that only traditional banking activities related to deposits and loans are considered here, whereas in reality many other types of services can contribute to bank profits.[19] In addition, only production credit is analysed, following the tradition of the authors discussed in section 1.[20] In fact, it is intended to analyse the banking sector theoretically, at a high level of abstraction. The objective of this paper is to study the *core function* of the bank, that is, the one traditionally related to deposit-taking and loan lending from a theoretical point of view, regardless of the shares of income related to the various branches of modern banking

[19] See DeYoung and Rice (2004a), (2004b); Lapavitsas and Mendieta-Muñoz (2019).

[20] For a theoretical discussion of real estate mortgage and consumer credit in a Sraffian approach, see Zolea (2025b).

activities.[21]

It should be noted that the interest rate that constitutes a part of the profit rate should be a medium to long term rate adjusted for inflation; the profit rate, on the other hand, is a quantity that does not depend, by construction, on inflation (it is in fact derived from the ratio between two quantities measured in value, profit and capital). For simplicity, in the model we abstract from price changes with the result that the nominal interest rate coincides with the real interest rate: in the presence of inflation, in fact, the interest rate on loans already agreed upon differs from that on new loans, greatly complicating the concept of normality in bank lending.

In addition, note that the output of a firm is usually a flow. By contrast, the amount of bank credit on which the bank earns interest is a stock, to which the flow of new credit is added year by year. It can be argued, however, that the bank offers *a flow of services*, i.e. the possibility of using capital productively, the possibility of having monetary capital available (echoing the discourse of Marx, [1894] 1959, concerning the monetary function of capital). This idea can be likened to a lease where the tenant pays monthly for the right to use a property.

Like any other industry, competition and free movement of capital in the banking sector mean that the capital invested generates a profit at least equal to the normal profit rate prevailing in the economy (Mill, [1844] 1967, p. 305; Marx, [1894] 1959, various references including p. 277; Panico, 1988, p. 91; Shaikh, 2016, p. 449; Lapavitsas and Mendieta-Muñoz, 2019, p. 451). The interest rate thus serves a dual role. On the one hand, it is the main income of the traditional banking sector, and once costs are subtracted it must guarantee the banker a profit rate on invested capital at least equal to the general rate of profit. So, the interest rate can be regarded as the price of the 'commodity' loan and be determined in the same way as the prices of other commodities, subject to certain particularities. On the other, taking up Marx's analysis, the interest rate is the part of the profit rate that remunerates the *financial function* of capital. So, a capitalist who borrowed the entire capital would pay the interest rate to the banker (financial function) and keep for himself what is left over from the difference between the profit rate and the interest rate. Conversely, a capitalist who used only equity capital would perform both the financial and productive functions and get the entire profit rate. In between we find all possible effective combinations of equity and debt capital, where the interest actually paid is in relation to the debt capital only, but the financial function of capital, in the abstract, concerns the entire capital invested, regardless

[21] Some of these activities could be included in the framework of bank price equations through joint production. However, the fact that banks must have a certain amount of capital proportional to their risk-weighted assets implies that each banking activity could have its own identifiable and distinct capital (subject, however, to physical capital and the salaries of workers who may play multiple roles).

of ownership.[22] Going back to Marx's distinction between *productive capital* and *interest-bearing capital*, by definition, only *productive capital* enters the sphere of production: if a firm takes a loan of X dollars to produce a certain commodity, in the production of this commodity do not enter X dollars, but Y commodities paid X dollars.

Another feature of this modelling is that loans do not enter the production equations, since the capital goods purchased by the loans themselves do. As we mentioned earlier, the introduction of financial coefficients within the price equations of productive industries does not seem to be correct. The result is that the loan is to be considered a non-basic commodity (Nell, 1988; Barba and De Vivo, 2012)[23], not entering into any productive price equation.[24] It also follows that the general profit rate should not be determined simultaneously with the interest rate and can be considered as given (something similar is implicit in Shaikh, 2016). On the contrary, once the general profit rate is determined in the sectors producing (basic) commodities, competition will push the bank profit rate towards that level.

In the following pages we try to develop an economic-financial model based on these assumptions, which also considers the deposit rate and the influence of the central bank on interest rates.

Let us start the analysis from three simple equations describing the real production system, where:

w = monetary wage,

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[22] Let us try to explain the idea better with an example. Let us assume a profit rate of 10% and an interest rate of 4%. Let us further assume that 50% of the capital is equity and 50% debt. The interest paid on the capital amounts to 4% of 50% of the capital. The productive capitalist is left with 6% on 50% of the capital and 10% on the remaining 50%. Conversely, the financial function of capital is remunerated at 4% and the productive function at 6%. In this case, however, the productive capitalist also partially performs the financial function. Only in the case where the capital is 100% debt is the remuneration of the financial function actually equivalent to the interest paid on the debt capital.

[23] If the entrepreneur pays the rate of interest on debt capital and earns the rate of profit on equity capital, he does not get a return on debt capital either, and it is not easy to explain why he should use it. Underlying this argument seems to be the idea that debt capital is considered an (necessary and normal) input to production, rather than the capital needed to purchase the means of production, an argument that is contradictory by definition: let us imagine a production in which, given a certain amount of equity capital, the capitalist purchases quantity X of commodity 1, Y of commodity 2 and Z of commodity 3, where commodity 3 is 'debt capital'; debt capital enters here as an input, not as capital, and this is contradictory and questionable.

[24] In this regard we recall Barba and De Vivo (2012), p. 1490 and p. 1494:

> 'Banks were only offering the service of channelling funds from lenders to anyone who was disposed - often induced-to borrow. [...] This service cannot be deemed to have added value from any reasonable point of view. That the intermediating sector is 'producing' something is an optical illusion. It simply offers a chance of realising a capital gain by 'passing the parcel' to someone else. Everybody would agree that some financial intermediation may perform a valuable function (e.g. reducing a solvent borrower's need of self-finance), but those revenues for financial firms arose from activities unable to create any 'social value' or from activities whose result has to be properly understood as the enjoyment from betting, a production that can hardly pass the test of being 'productive of the means of production'.'; 'Applying this reasoning to the financial sector, we discuss whether the services produced by it are to be considered as basic commodities. We argue that contrary to what could at first sight appear, many financial services really consist of the provision of gambling facilities and have to be regarded as the final consumption of luxury goods.'.

See also Nell (1988), p. 264:

> 'Would not the provision of financial services be a non- basic industry? So the rate of profit would determine the rate of return on such services'.

$\boldsymbol{\omega}$ = vector representing the basket of commodities that constitute the real[25] wage,

$\boldsymbol{p}$ = vector of prices,

r = general rate of profit,

r_b = general profit rate of the banking sector,

$\boldsymbol{Q}$ = output matrix of the production sector,

Λ = loans (banking sector output),

$\boldsymbol{A}$ = matrix of industry inputs,

$\boldsymbol{K}_b$ = vector of material inputs of the banking sector,

i = lending interest rate on loans,

τ = interest rate on deposits,

τ^* = main refinancing rate set by the central bank,

D = deposits (one of the main inputs of the banking sector),

$\boldsymbol{l}$ = vector of labour inputs in the industrial sector,

l_b = amount of labour employed in the banking sector.

It is also assumed that all capital is circulating, there is no joint production nor interbank market (to simplify the analysis), and prices are normalised by taking the monetary wage as given. Given the basket of commodities that constitute the real wage, it is possible to determine the price system and the profit rate simultaneously (Garegnani, 1978-79, 1984). There are $n+2$ equations and $n+2$ unknowns $\boldsymbol{p}$, r, w:

[1] $\boldsymbol{pQ} = \boldsymbol{pA}\,(1 + r) + w\boldsymbol{l}$

[2] $w = w^*$

[3] $w = \boldsymbol{p\omega}$

Now we add the banking sector, where loan is the output of the banking industry, and the bank profit rate is equal to the normal one (as we can see in [6], since the bank is a non-basic sector, the profit rate r in [4] has already been determined through equations [1] - [3]):

[25] Following Panico (1988), p. 202. Furthermore, Panico (1983), pp. 159-160, states:
'For the moment [...] we find ourselves with only one degree of freedom in the proposed analytical model. This degree of freedom can be eliminated if we consider i as an independent variable, or if we take as given the <<basket of commodities>> which constitutes the real wage. In the latter case, one must add the following equation $w = \boldsymbol{\lambda p}$ where $\boldsymbol{\lambda}$ is a line vector representing the <<basket of commodities>> that make up the real wage.' (our translation).
Panico in his model takes the first way, we preferred instead to follow the second, as in the Classics and in Shaikh (2016).

[4] $i\Lambda = \boldsymbol{pK}_b\,(1 + r_b) + \tau D + wl_b$

[5] $\tau = \tau^*$

[6] $r_b = r$

[7] $i < r$

The system is now composed of $n+5$ equations and $n+5$ unknowns (to the previous two we must add i, τ and r_b), plus the condition that the interest rate must be strictly less than the profit rate [7], as in the other contributions discussed. [1] is the equation for the real productive sector, while [4] is the equation for the banking sector: i.e. the interest rate must guarantee for each lending unit the reintegration of capital, the profit rate considered normal in the banking sector (set equal to the general rate in [6]) on the invested capital, as well as the coverage of deposit rates on deposits and the payment of bank workers' wages. Moreover, the lending rate on bank loans determines the part of the profit rate that goes to the bankers. It must respect the condition [7], i.e. it must be strictly lower than the profit rate, otherwise it would not be convenient for the productive capitalist to get into debt.

While in [4] i appears as the price of the produced commodity, it does not appear in [1] since it is included in r, as in Shaikh (2016) - and in Marx - in Table 1. A similar reasoning applies to the rate on deposits τ: while these are included in the inputs of the banking sector, they do not appear in the price equations of the real sector. As we will see more clearly in the following pages, deposits affect the real sector because the part of the profit paid in the form of interest is to be considered net of what is earned on deposits.

The main refinancing operations rate of the central bank is the rate at which banks can refinance themselves and obtain liquidity. Therefore, it seems reasonable to regard refinancing at the central bank as an alternative for banks to taking deposits (Zolea, 2023a):[26] intuitively the idea is that the central bank determines the cost of liquidity. Central banks use different policy rates (for example, the ECB controls as many as three interest rates), from the main refinancing market to the overnight market, in *corridor* or *floor* systems. Furthermore, banks have deposit rates on deposits and lending rates on loans, not to mention the interbank market. However, it seems quite accepted and evident that central banks are able to influence bank rates. The simple connection between the main refinancing rate and the deposit [5] is a useful gimmick to link policy interest and bank interest in a simple and clear way. Thus, for simplicity, the deposit rate τ is set as equal to the main refinancing rate set by the central bank.

[26] Of course, the central bank provides reserves or central bank money, whereas a deposit at a bank is bank money. However, beyond clearing houses, a transfer of deposits in the real sector corresponds sooner or later to a transfer of reserves between banks. For more details, see Zolea (2023a).

It follows that the deposit rate is exogenously[27] determined (τ^*), as a cost, while the lending rate is the price of bank output loan.

3.1 Distributional implications

Having made these observations, we note that an increase in the deposit rate leads to an increase in the loan rate, so that the bank can reach the normal profit rate in the changed condition.[28] An increase of the lending rate leads to a reduction of the residual profit rate which remains to the productive capitalists. If the change in the interest rate were to be long-lasting, over a longer period, the productive capitalists might try to influence the central bank to lower rates or raise prices at the expense of workers. Unlike the monetary theory of distribution, where the change in the interest rate leads, through various steps, to a change in real wages, in the case outlined in this paper the change in interest rates only leads to direct effects on the residual of the profit rate, with the real wage and the total profit rate remaining constant.[29] There is a (fairly) automatic mechanism only in the variation of the active bank rate against a variation of the passive one. However, this does not mean that the effects on distribution hypothesised by Pivetti (1991) and Panico (1988) may not actually occur, but in the long run that they may in a more mediated and indirect way depending on the dynamics of the contrasts between workers and capitalists and between productive and financial capitalists (Zolea, 2025a).[30]

In reality, even the change in the lending bank rate following a change in the deposit rate may not be so automatic. First, it should be noted that when the central bank rate falls to zero (while the bank

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[27] See Moore (1988b), p. 266, on the role of central bank interest rates, consistent with the approach of this article:

> Central banks establish domestic short-term nominal interest rates by exogenously setting the marginal supply price of liquidity to the banking system.

See also Hicks (1989), p. 107, who considers the deposit rate 'the king-pin of the system'.

[28] As in post-Keynesian models using mark-up.

[29] As in Marx; see for example Marx (1905-1910), vol. II, pp. 453-454, and Argitis (2001).

[30] Regarding the choice of considering the real wage as the independent variable of the distribution even in a contemporary economic context, see Garegnani, 1984, pp. 320-321:

> When within this approach to distribution we envisage changes in the rate of real wages over time, we may attribute these changes to either of two circumstances: a long-term evolution of the social conditions determining the level of subsistence, *or* the kind of economic circumstances which authors like Smith or Marx thought might keep the wage above the level of subsistence even for long periods of time […]. In the first case, the real wage will evidently have to be taken as a given magnitude in the "core" of the theory […]. The same will be true in the second case only if the share of the surplus taken up by the wage depends on circumstances acting through the wages. The real wage will then appear in the "core" as the magnitude which has been determined in both level and composition by the circumstances in question: profits will continue to be determined as a pure residual, though now they will not constitute the entire surplus.

Garegnani, 1984 p. 320, footnote 49, continues:

> 'The view that the wage can exceed the level of subsistence for long periods of time seems indeed implied also in the very idea of a rising subsistence level. This rise can result only from wages remaining above the previous subsistence level for a period of time which is long enough to engender those 'habits' which may then become a 'second nature' in Torrens's phrase later adopted by Ricardo […] and by Marx […]).'.

deposit rate to the central bank or *deposit facility rate* falls below zero), as in recent years, there could be difficulties for banks to adjust their rates (see Bernanke, 2015; Bertocco and Kalajzic, 2018; Pressman, 2019). Moreover, from [4] we see that an increase in τ leads to an increase in i ($\tau\uparrow \rightarrow i\uparrow$), but the change in the lending rate is *not automatic*, but such that the normal profit rate r is granted. Thus, the size of the change in the lending rate depends on the volume of loans and deposits. An increase in costs equal to $\Delta\tau D$ must be matched by an increase in income of the same magnitude. In other words: $\Delta\tau D = \Delta i \Lambda$. Only in the case where $D=\Lambda$ is it fair to say that i varies to the same degree as τ. If this is not the case, different scenarios may arise. If $D>\Lambda$, the change in the lending rate will be greater than the change in the borrowing rate; if $D<\Lambda$, the opposite will occur. Thus, in this model the central bank's control over rates is mediated by bank profitability.

Conversely, change in the distribution leads to a change in the relative prices of commodities and the interest rate, the latter understood as the price of bank output. Assuming, for example, an increase in the real wage in the price equation of the banking sector [4] there would be an increase in w, a decrease in r (and thus r_b) and a change in prices ($\boldsymbol{p}$) which multiply the matrix of banking sector inputs ($\boldsymbol{K}_b$). Depending on the proportion between labour to capital in the banking sector, one could attempt to estimate the overall effect of the change in the opposite direction to the real wage and the profit rate; however, one cannot know *a priori* whether the change in the vector of relative prices of the banking inputs will increase or decrease, as this depends on the proportions between capital and labour in each of those commodities and in the commodities necessary (directly or indirectly) for the production of those commodities. Thus, the effect on the interest rate of a change in the distribution cannot be known *a priori* (see Sraffa, 1960). However, a change in the distribution will undoubtedly cause the interest rate to vary, changing almost all the parameters of the bank price equation.

It must also be considered that a reduction in the profit rate could lead to an incompatibility with the condition whereby the interest rate must be lower than the profit rate [7].[31] Indeed, assuming a reduction in the profit rate, if the interest rate were to increase (or not decrease proportionally), the interest rate needed to cover banking costs and remunerate the capital invested in banking could be higher than the profit rate. This hypothesis, although interesting on a theoretical level, would be very difficult to recreate in the real economy, as it would in fact cause the structural failure of the entire banking system. It should therefore be noted that the central bank can intervene to reduce the effects of a change in the distribution on the financial structure, e.g. by decreasing the deposit rate if the interest rate on loans rises as the profit rate falls, with the result that the increase in the lending rate is curbed (or even reduced).[32]

[31] As we discussed about Shaikh (2016).

[32] The central bank could also reduce the capital requirements for banks, allowing them to take greater advantage of the economies of scale.

Moreover, changes in the distribution usually occur slowly and in the long run, allowing banks to adjust the 'productive structure' to changing conditions, making this hypothesis more of a theoretical possibility than a concrete issue.

Concluding the argument, central bank action is much more frequent and of immediate effect than changes in distribution. In a short-run analysis, therefore, the distribution can be taken as given, while the interest rate on loans and the entire rate structure respond to central bank influences.[33]

We now come to discuss the issue of financial decomposition of capital, which we have previously criticised within the framework of price equations. We show the decomposition of the profit rate in order to take into account the existence of deposits and the interest rate paid by banks to depositors. However, equation [8] is not part of the model, as it shows an aspect of the financial-economic system at the accounting-aggregate level, i.e. by means of different instruments to the price equations.

[8] $rK - (i\Lambda - \tau D) = \pi K$

With restrictive assumptions, i.e. assuming that every loan corresponds to a deposit and that all the capital in the economy (set equal to 1, for example) is debt (in the form of bank loans), at the aggregate level we will have $\Lambda = D = K = 1$ and it will therefore be possible to see the relationship between rates:

[8.1] $r - (i - \tau) = \pi$

Where π is what remains to the productive capitalist of the profit rate after paying the interest rate on the borrowed capital. The coefficients indicating the amount of loans and deposits (Λ and D), at the non-aggregate level, actually vary from firm to firm and do not possess a general feature: as has just been shown, there is a relationship between the rate of profit and the rate of interest, where the former determines the latter; on the contrary, how the profits of a firm are divided between bankers and entrepreneurs is 'a purely empirical matter' (Marx, 1894, p. 357), depending on the amounts lent by the bank to the entrepreneur in the form of loans and by the entrepreneur to the bank in the form of deposits, on which lending and borrowing rates will be paid. More generally, from the real sector of the economy a part of the profits goes to the financial sector according to the volume of assets (including deposits) and liabilities (including bank loans) of the real sector and the various rates of each form of these assets and liabilities.

Instead, the theoretical *financial function of capital* (Marx [1857-1858] 1997, [1894] 1959) is a different matter. As we underlined above, it is an abstract magnitude, not immediately and simply equivalent to

[33] It is indeed undeniable that the central bank influences interest rates. However, in this analysis, this does not imply adherence to the monetary theories of distribution.

the actual and empirical remuneration of debt capital.[34]

4. Some further insights and developments about Marx's approach to finance

The analysis developed in the previous pages indicates that the profit rate determines the bank interest rate as the price of production in that sector. This reasoning is more related to Marxian and post-Keynesian approach than to that of Smith and Ricardo. For the classical economists the rate of profit *directly* determines the rate of interest, whereas in this paper the rate of profit determines the rate of interest in the same way as it does for the prices of *non-basic* commodities. Essentially, it is the *competition* and the *tendency towards the natural price* (Garegnani, 1990) that determine the banking rate of interest. In addition, the deposit interest rate set by the central bank plays an essential role in this analysis, because it influences the interest rate in the same way as changes in the price of a key (imported) commodity (such as oil).

Finally, assuming that the banking sector presents particular and stable viscosities to the functioning of competition, e.g. due to an oligopolistic type of concentration, institutional barriers to entry the particular regulation of the sector or else some type of agreement or cartel among banks,[35] the condition [6] is no longer binding, and the system is better described by:

[6.1] $r_b \geq r$

It should also be noted that this monopolistic structure in particular results in an increase in the price of output leading to a higher-than-normal profit rate, but does not imply a reduction in the amount of output produced, which is in fact demand-dependent, as post-Keynesian endogenous money theory states.

All this seems to better explain Marx's approach, which recognises multiple influences on the interest rate by the profit rate, by economic, institutional and conventional conditions, by competition in the loan market and by the contrast between workers and capitalists and subclasses of capitalists. The framework outlined in this paper clarifies these seemingly contradictory[36] elements of Marx's thought. One element that at first sight contrasts with Marx's statement in Volume III of *Capital* (but not with the *Grundrisse*) is that the determination of the bank lending rate as the price of this industry indicates the existence of a *natural price*, which might suggest a *natural rate of interest*, a hypothesis strongly

[34] For example, Shaikh (2010) in order to obtain the net enterprise profit of productive capitalists, proposes to subtract from total profits a share equal to the product of a representative interest rate on debt capital and the entire invested capital.

[35] On banking concentration, see Hilferding (1910); Mazzucato (2018).

[36] It should be remembered that Volume III of Capital was published posthumously by Engels, who found many difficulties in reorganising and understanding Marx's unfinished manuscripts, in particular the chapters about interest rate and banks.

opposed by Marx.[37] This latter aspect of Marx's theory, however, can be linked to the critique of the classical economists on the *direct determination* of the interest rate as a *natural part* of the profit rate (see Shaikh, 2016, p. 451). The approach developed in these pages proposes a determination of the interest rate dictated by technical (and normative) conditions of production as well as by bank profitability. In this sense the interest rate can be defined as *natural*, in the same way as the prices towards which *market prices* gravitate are generally defined in classical theory (Garegnani, 1984, 1990). All this, then, does not seem to contradict the Marxian line of thought and indeed specifies better from an analytical point of view many aspects of it.

Moreover, the hypothesis of a monopolistic banking sector reinforces Marx's approach, according to which the interest rate is an independent variable that varies in relation to the contrast between subgroups of capitalists:[38] as a result of a bargaining power reinforced by the high degree of concentration in the banking sector, banks can raise the prices of their services in order to obtain higher profits, in particular they can raise the interest rate on loans beyond the level that guarantees a normal profit rate on bank capital. This hypothesis seems to better explain Marx's approach in a formally clearer way, where the interest rate is taken as an exogenous variable: under the explicit hypothesis of a stably non-competitive banking market, the bank profit rate is no longer equal to the normal profit rate and cannot be taken as given.

Conclusions

This paper dealt with the approach of using the instrument of the price equation to describe and model the operation of the (traditional) banking industry, as part of the more general theoretical investigation of the relationship between the rate of interest and the rate of profit.

First, the main thoughts and ideas in the literature on the relationship between the rate of interest and the rate of profit from Smith to the present day were briefly reviewed. The results of this review, schematised for an easier understanding of similarities and divergences among the various approaches, reveal that in the most recent contributions the use of the banking sector price equation appears to be increasingly common. Indeed, the banking sector is seen as a critical point of linkage between the interest rate and profit rate. In any case, it should be stressed that even these modern contributions are often based on interpretations and reinterpretations of the thinking of the classical economists (Smith and Ricardo) and Marx.

[37] See for instance the passages already cited in Marx (1894), pp. 356-357, and Lapavitsas (1997), p. 99.

[38] Epstein (1992) reason about how the contrast between subgroups of capitalists and between them and workers is reflected in the type of central bank.

The analysis in this paper, using the lens of the 'Marxian' perspective on Sraffa (1960), focused on certain aspects of the approach to the use of the price equation in banking that have not yet been adequately discussed and clarified in the literature. Firstly, it is important to highlight that the coefficients present within Sraffian-type price equations must have the features of *normality* and *necessity*. This on the one hand implies the investigation of the coefficients that enter the banking price equation, and on the other the study of how the banking and financial system affects the price equations of the real productive sector.

To consider banking as a special 'productive' sector, one must certainly extend the usual concepts of 'production'. Yet, it turns out to be possible to identify inputs, output and capital as in other industries. However, an appropriate analysis is needed to justify the idea of considering deposits as an input and loans as an output and to identify what bank capital is needed for the creation of bank money. While not simple, the task is possible, while maintaining a high level of abstraction and without chasing the complexity of each particular case in the intricate financial world.

Beginning with loans - which, unlike other outputs, are a stock and not a flow - one can consider the right of use of borrowed capital a flow and it is this right of use that is the output of the bank (this idea echoes both Marx's financial function of capital and the idea implicit in renting real estate, where monthly rent is paid to use the real estate). Deposits can be considered an indirect source of central bank money (input), along with the central bank and the interbank market. Thus, if the bank collects deposits, it also collects reserves, which it uses in interbank payments. Finally, international agreements on bank finance require that bank capital be equal to a certain percentage of risk-weighted assets. As a result, a ratio of capital to output can be identified. An important factor in this regard is the investigation of the compatibility of these two points with endogenous money theory. An incompatibility with endogenous money theory would indeed be quite problematic. On the contrary, as shown in this paper, considering the bank as a productive sector with some capital, input and output is not incompatible with endogenous money. In fact, the idea of money creation can be represented quite well by assuming a production process with large economies of scale. A pure intermediation activity, on the other hand, although seemingly more compatible with an input and output approach, is rather far from concepts that can be assimilated to those of production and production cycle.

On the other side of the coin, it is necessary to clarify that finance can have effects on productive sectors because the interest rate is a part of the profit rate. Instead, inserting financial coefficients as costs (and gains) into productive price equations leads to inconclusive and paradoxical results, such as the loss of the concept of trend uniformity within the rate of profit, or the reduction of the natural price of commodity production as deposits increase. It should also be noted that the renunciation of the inclusion of financial coefficients in the productive price equations by no means also implies the abandonment of

the monetary theory of distribution nor its confirmation. Both Pivetti's (1991) and Shaikh's (2016) approaches do not encounter such problems, in which the former considered the interest rate and the latter the real wage as independent distributional variables.

After discussing these issues, price equations of the banking sector and the real sector were proposed, where the real wage is the independent variable and the central bank indirectly determines the rate on deposits. The lending rate in turn depends on bank profitability and costs (the deposit rate and real wage, etc.). In fact, it was decided to use the real wage as the independent variable in this model in deference to the tradition of the classics and to be consistent with the approach of Garegnani (1978-1979, 1984). This choice also echoes Shaikh (2016), but also puts the central bank and deposits into a post-Keynesian perspective.

Thus, it is shown that the determination of the bank interest rate depends on a set of elements in which the normal profitability of capital is included, but also the policies of the central bank. One can imagine that the central bank sets the price of an important input, as it might be for an import commodity for another industry. It can be argued that in the short term, given the rate of profit, the interest rate depends on the central bank. In the long term, given the costs of the banking sector, the interest rate depends on the profit rate (in fact, in the approach of Garegnani, 1984, 1990, the profit rate is by definition a long-term magnitude). Interestingly, these results are in line with Marx's analysis ([1894] 1959), which saw multiple seemingly contradictory determinants of the interest rate, from the conflict between classes and between financial and productive capitalists to economic and institutional conditions. If we then consider the banking sector to be one with a particular market concentration, the bank profit rate would no longer be equal to the normal profit rate, but higher, and the interest rate would essentially become an independent variable related to the degree of concentration.

This further passage brings these results even closer to Marx's reflections, where the real wage determines the distribution between labour and capital and the interest rate that between productive and financial capitalists, within a rate of profit already determined by the capital-labour contrast.

A possible future development of this research could entail an attempt to introduce the banking industry as a particular sector in Pasinetti's approach, analysing its role in the integrated sectors theorised by this economist. This investigation would be developed within the institutional analysis hypothesised by Pasinetti, where finance and money play an important role in the contemporary capitalist system.

Appendix A. Bond rates and bank profitability

Once the model of the banking sector and its interaction with the productive sector has been illustrated, and the lending rate on bank loans has been determined, it is possible to derive a further insight into the structure of interest rates, which completes the analysis in this study, in particular by the addition of bond lending. In section 3 it was shown how the lending rate on bank loans depends on the profit rate; we now illustrate the link between other interest rates and the banking profit rate, a link in which bank lending and borrowing rates play a fundamental role.

Having obtained the bank lending rate via [4], we can imagine an interest rate structure dependent on the main refinancing rate set by the central bank and the baking loan rate. The first rate determines the floor of the rate structure (see [5]), while the second one, in turn dependent on the first one and the profitability of bank capital (see [4]), determines the ceiling; bond rates would be in the middle. If the rate of a bond were lower than the deposit rate (equal for hypothesis to the main refinancing rate) it would be more convenient to deposit money in the bank, facing a lower level of risk and having more liquidity; *mutatis mutandis* if this rate were higher than the loan rate, it would be more convenient to borrow directly from banks and not to issue bonds.

Bonds are securities and have a much higher circulation than bank loans; this implies buying and selling them for capital gains. Apparently bank loans have no circulation at all, but recent financial innovations and securitisation operations have created an indirect market for bank loans. Bonds are not contractible, and usually require the payment of a lower interest rate and are long-term.[39] A bank loan has higher rates, can be short-term or long-term, can be granted to large and small enterprises and is contractible. In addition, bank lending often places greater constraints on the management of the enterprise (the distribution of dividends, mergers, purchases or further indebtedness).

In spite of these differences, it seems reasonable to assume that in many cases[40] bonds and bank loans are alternatives and thus follow the structure outlined above, although there are obvious circumstances where this is not the case: for example, it is very difficult for small enterprises to issue bonds; since the alternative is missing, their only external source of financing is the bank.

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[39] We can also assume that bonds have higher fixed costs than loans. Issuing and managing bonds is much more complex than borrowing from a bank. It therefore requires a specialised service within or outside the firm.

[40] It should be noted that there can be many cases where a bond interest rate is higher than the interest rate on a bank loan. For example, an investment might be considered too risky by the banking system, and the only option for the enterprise is to finance itself on the market hoping to find investors at a high rate. There are many possible valid reasons for company management of financing that could lead to higher bond rates than bank rates (for example the distribution of company risk, difficulties in bank financing or tax reasons), but in this study we only analyse the theoretical link at a very general and abstract level with the profit rate.

We can explain why the bond rate is usually lower than the bank rate. The interest rate on bank loans must guarantee, after payment of costs and wages, a profit rate on bank capital at least equal to the normal one, whereas for the bond rate there is no such need, since the purchase of bonds does not involve any entrepreneurial activity, nor, among other things, any production costs. Moreover, unlike banking, the purchase of a bond usually involves the use of one's own capital,[41] which makes it more difficult to conceive of a bond interest equal to the general profit rate. The banker, in fact, gets the profit rate on the *invested capital*, not on the *lent capital*.[42] For the bondholder, on the other hand, profit must be related to the lent capital: to obtain the normal profit rate on the lent capital, the bondholder would have to buy a bond with an interest rate equal to the general profit rate itself, but no company would ever issue a bond at such a rate (which implies zero profit for the company issuing the bond).[43] It therefore seems structurally impossible for the bond interest rate to equal the profit rate. On the other hand, the bond market seems to be little linked to the forces of competition operating in productive sectors, but rather linked to dynamics of return on investment risk and financial speculation.

Public securities such as government bonds can then be added to the picture. These securities, regardless of contingent situations such as the European 'spread' increase or the recent sovereign debt crisis, are considered among the safest securities and usually offer rather low interest rates. Government bonds could be placed between bank borrowing rates and bond rates. This can be represented this way:

[9] $\tau < i_p < i' < i < r$

where:

i' = bond rate,

i_p = government bond rate.

Exploration of this topic could be an exciting starting point for future studies.

[41] Leaving aside cases of financial engineering and leverage buyouts. Moreover, a bank could use deposits to buy bonds.

[42] As Ricardo ([1816] 1951, p. 108) already stated. Furthermore, Ricardo ([1816] 1951, p. 109):

> But the profits of the Bank essentially depend on the smallness of the stock of cash and bullion; and the whole dexterity of the business consists in maintaining the largest possible circulation, with the least possible amount of their funds in the unprofitable shape of cash and bullion.

[43] On the other hand, capital invested in shares earns a return equal to the profit rate, but is subject to greater risk than capital invested in bonds.

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