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Gabriel Ferraz Aidar

ESSAYS ON ECONOMIC POLICY FROM A SRAFFIAN STANDPOINT

Rio de Janeiro
2022

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Tese apresentada ao Programa de Pós-Graduação em Economia da Universidade Federal do Rio de Janeiro, como requisito para a obtenção do título de Doutor em Economia Industria.

Orientador: Prof. Dr. Franklin Leon Peres Serrano

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Rio de Janeiro, 12 de agosto de 2022.

Prof. Dr. Franklin Leon Peres Serrano - Presidente

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Profª. Drª. Julia de Medeiros Braga – Membro Externo
Universidade Federal Fluminense (UFF)

Prof. Dr. Matías Vernengo – Membro Externo
Bucknell University

Para Cíntia

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The reconstruction of economic theory will inevitably precipitate a reinterpretation of economic policy and problems (Eatwell, 1982 Preface p. vi).

ABSTRACT

This dissertation aims to reevaluate some of the analytical tools employed in the examination of economic policies from a Sraffian perspective, following Eatwell's (1982) suggestion made four decades ago. The dissertation explores beyond the core of the Sraffian approach (Eatwell, 2012) initially applying the Sraffian methodological and theoretical critique to Neoclassical welfare theory. It examines the impact of the transition in Neoclassical theory from the traditional method of long-period equilibrium to the intertemporal equilibrium method (Garegnani, 1976) on Neoclassical welfare theory. It strengthens Garegnani's (2007) argument on the inadequacy of the Neoclassical approach to welfare economics in general and of the notion of Pareto-efficiency in particular. Second, it proposes an evaluation of the interaction among real tax incidence, distribution and output from a Sraffian standpoint. To do so, we integrate taxation whitihin a framework of distributive conflict, employing the Sraffian approach to conflict inflation (Pivetti, 1991; Serrano, 1993, 2010; Stirati, 2001). Additionally, utilizing the Sraffian supermultiplier, it connects the effects of the analysis of real tax incidence on distribution with the determination of the levels of effective demand. Consequently, it shows where Haavelmo's (1945) results holds in the presence of endogenous tax incidence. Third, recognizing the constraints imposed by the external balance of payments on economic policy and its implications for monetary policy whitin the Sraffian context of exogenous interest rates (Pivetti, 2019; Serrano and Summa, 2015), a theoretical framework is presented to analyze the short-run dynamics of nominal exchange rates under exogenous interest rates, elastic exchange rate expectations and free but imperfect international capital markets. This framework reveals that such context will tend to impose limits on the Central Bank's ability to sustain very low interest rates. Moreover, it shows that free or 'clean' floating exchange rate regimes are intrinsically unstable, as the nominal exchange rate is ultimately an institutional or policy (and distributive) variable, that has no 'fundamental equilibrium' level.

Keywords: Sraffian; Taxation; Fiscal Policy; Open Economy Model.

LIST OF FIGURES

CONTENTS

INTRODUCTION

The revival of classical surplus approach led by Sraffa, Garegnani and others in the 1960s and 1970s provided not only a critique of the Neoclassical theory of distribution, value and output, but also an alternative logically consistent theory of value and distribution (Garegnani, 1984). This framework benefits from past contributions from classical authors such as Smith, Ricardo and Marx, and, at the same time, accommodates the (long-period) theory of effective demand within the classical surplus approach (Garegnani, 1978, 1979). In this context, Eatwell (1982) suggested four decades ago that it was time for the 'redevelopment of classical theory' to provide a reinterpretation of economic policies (and problems). Eatwell's suggestions could have provided a more solid basis for development policies both for the traditional Keynesianism in macroeconomics, still based on the Neoclassical theory of value and distribution (Garegnani, 1978, 1979), and for the pioneers in heterodox development economics, who adopted the Neoclassical Pigouvian 'market failure' approach to justify State regulation and public investments (Meier, 1984)[1].

Despite this solid theoretical background and the promising contributions from the heterodox literature during the 1960s and 1970s, the changes coming from the geopolitical and social contexts at the end of the Golden Age shifted the economic profession into a different direction. Most of the mainstream economic profession abandoned traditional Keynesianism and the Pigouvian 'market failure' approach to economic policy. In their place, the intertemporal general equilibrium, or the temporary general equilibrium, became dominant and implied a change in the notion of equilibrium in Neoclassical theory (Garegnani, 1976; Petri, 1978). In this context, in macroeconomics, Monetarism, and its New Classical variant, became dominant, whereas the 'missing markets' approach to Neoclassical welfare replaced the older 'market failure' in the mainstream economic profession (Serrano, 2014)[2]. The changes within the World Bank and the International Monetary Fund were part of this more significant change. In the 1980s, these institutions began to advocate for liberalization, privatization and austerity policies in developing countries (Eatwell and Milgate, 2011, chap. 15). Keynesian policies in the North and 'Developmental States' in the Global South (with the notable exception of certain East-

1 See the first essay for a more detailed analysis of the 'market failure' approach.

2 Garegnani and Petri (1982), curiously in the same year of Eatwell's preface, identified a paradoxical divergence between Neoclassical pure theory, which was uncomfortable with the Sraffian critique, and the dominant economic policy which was becoming at the time 'pre-Keynesian'.

Asian countries) were discarded despite the theoretical development mentioned above (Medeiros, 2013).

In the 2000s, the Global Financial Crisis in the advanced countries provoked a modest return of Keynesian policies, as expressed in some publications of the mainstream economic profession and reports from the International Monetary Fund (Fiebiger and Lavoie, 2017; Furman and Summers, 2020; IMF, 2021, chap. 1; Serrano, 2014)[3]. In addition to being limited to recession periods only, these publications advocated for a return of Keynesian policies without abandoning the Neoclassical theory of value, distribution and output, in particular the natural rate of interest and the natural rate of unemployment (Galbraith, 2020; Vernengo and Ford, 2014)[4]. Moreover, the concept of an intertemporal (or temporary) equilibrium, expressed in a model with utility maximization, well-behaved demand function for factors and markets clearing in each period of time, is still dominant in the new Keynesian literature (Galí, 2018).

Following Eatwell's (1982) suggestion, this dissertation aims to reassess some analytical tools used for the analysis of economic policies from a Sraffian perspective. By the Sraffian approach, we mean the contributions after Sraffa and Garegnani proposed the revival of the classical surplus approach in the 1960s and 1970s. This approach is composed by its core, which provides the general analytical relationships between distribution and relative prices in market economies under free competition given the technical conditions, the levels of output and the socioeconomic factors related to distribution (Garegnani, 1984; Petri, 2021, chap. 1). We then explore out of this core (Eatwell, 2012) the implications of the Sraffian critique to Neoclassical welfare theory and to introduce additional factors, such as real tax incidence and exchange rate dynamics.

So, in the first essay, we examine the impact of the transition in Neoclassical theory from the traditional method of long-period equilibrium to the method of intertemporal equilibrium (Garegnani, 1976) to Neoclassical welfare theory. Our contribution in this essay consists of showing that this change has had a key influence on Neoclassical theory on the way externalities are dealt with under the assumption of complete future markets. Such analyses have changed from the original approach in Pigou's The Economics of Welfare, focused on what is now known as 'market failure', to the focus on the notion of 'missing markets', pioneered by Coase

3 The failure of the liberal agenda during the 1990s in the Global South also provoked the return of more developmental (and pragmatic) States in part of the periphery (notably South America) in the early 2000s. See Serrano (2014) and Medeiros (2013).

4 Notice that a much more Keynesian approach to economic policy survived among heterodox authors and, in particular, with the revival of Lerner's (1943) Functional Finance in the Modern Monetary Theory. See Summa (2022).

(1960) and Arrow (1969). In this context, we also apply the Sraffian theoretical and methodological critiques to both the older 'market failure' and the newer 'missing market' approaches to Neoclassical welfare theory. The results of this essay strengthen Garegnani's (2007) argument on the inadequacy of the Neoclassical approach to welfare economics in general and of the notion of Pareto-efficiency in particular.

In presenting a theoretical critique of the Neoclassical welfare theory and, in particular, to the notion of Pareto-efficiency, we could clear the ground for a different approach to the analysis of economic policies. Note that the Neoclassical notion of (goods or factors) price distortion has no place if Pareto-efficient equilibrium does not hold. Consequently, there is no more reference for normative economics based on the principle of efficiency. The Sraffian approach to price and distribution does not necessarily offer an alternative normative reference for economic analysis, and it leaves the normative reference for economic policy open for debate.

In the second essay, we propose an analysis of the interaction of real tax incidence, distribution and output from a Sraffian standpoint. To do so, we integrate taxation in a framework of distributive conflict using the Sraffian approach to conflict inflation (Pivetti, 1991; Serrano, 1993, 2010; Stirati, 2001). Using the Sraffian supermultiplier, we connect the effects of real tax incidence on distribution with the levels of effective demand, and then we are able to show in what circumstances Haavelmo's (1945) results hold with endogenous tax incidence. In doing so, the second essay provides two main contributions. First, we show that the real incidence of goods taxation falls entirely on wages only under the particular assumption of given real profit markups. This is the view of Kalecki (1937) and part of the Kaleckian literature (Laramie, 1991; Mott and Slatiery, 1994), but in our framework is just one particular case of a more general approach. Second, we argue that the evaluation of the expansionary nature of balanced budgets depends on the assumptions regarding the form of taxation and the parameters of the distributive conflict. In the particular case of a sales tax, we show that Haavelmo's results can be valid regardless of the direction in which taxation causes a redistribution of income. Once we apply this Sraffian framework to the study of taxation, it becomes clear that the distributive conflict and the tax and fiscal regimes are important to understand the consequences of real tax incidence for effective demand. Hence, both the distributive conflict between wages and profits and the conflicts in the heart of the State around tax and fiscal policy are crucial to the understanding of the interaction between taxation and output. These two conflicts should be seen as important constraints to the goals of economic policy.

If the distributive conflict represents an internal constraint to economic policy aims, the external balance of payments constraint imposes another type of restriction to the conduct of economic policy, with important implications for monetary policy in the Sraffian context of exogenous interest rates (Pivetti, 1991; Serrano and Summa, 2015). To illustrate one important implication of dealing with an external constraint under exogenous interest rates, in our final essay, we present a theoretical framework to analyze the short-run dynamics of nominal exchange rates under exogenous interest rates and free but imperfect international capital markets. We show that, in this context, introducing elastic exchange rate expectations leads to further changes in the spot (and forward) exchange rates in the same direction and that these changes tend to be cumulative. We thus find that such context will tend to put limits on the ability of the central bank to sustain very low interest rates and that free or 'clean' floating exchange rate regimes are intrinsically unstable, as the nominal exchange rate is ultimately an institutional or policy (and distributive) variable, that has no 'fundamental equilibrium' level. We also derive the implications for monetary policy and exchange market interventions of this potential instability. Our results may help to explain both the empirical prevalence of dirty floating exchange rate regimes, as well as some aspects of the uncovered interest parity 'failure'.

1 FROM MARKET FAILURE TO MISSING MARKETS: THE CHANGE IN THE NOTION OF EQUILIBRIUM AND WELFARE ECONOMICS

1.1 Introduction

The existence of market failure in Neoclassical economics corresponds to situations in which competitive markets do not produce a Pareto-efficient allocation[1]. In other terms, the first welfare theorems do not hold. Consequently, the competitive market equilibrium is not Pareto-efficient. Market failure is generally associated with the concept of externalities[2]. In their textbook on the economics of the public sector, Stiglitz and Rosengard (2015, chap. 4) present externalities as one of five other sources of market failure. The authors dedicate one chapter to this concept. In Mas-Colell et al. (1995, chap. 11), externalities and public goods are presented as sources of market failure that prevent the Pareto-efficient outcomes of the competitive general equilibrium model. Externalities are then central in Neoclassical economics to guide State intervention in market economies.

The concept of externalities is generally understood as external effects that may affect consumers' utility, or firms' production functions. Both textbooks mentioned above provide two kinds of solutions to externalities that can restore Pareto-efficient market equilibrium. One solution is the Pigouvian taxes/subsidies. The other solution is propriety rights enforcement, which 'internalize' externalities under the conditions of the Coase Theorem. Stiglitz and Rosengard (2015, chap. 6) call the former "Public Sector Solutions" and the latter "Private Solutions" to externalities.

We argue in this essay that the different solutions indicated to the externalities problem for Neoclassical economics were, in fact, sequential instead of parallel solutions. We show how the understanding of this concept changed over time in the historical development of Neoclassical theory. From the original concept of external economies, in Book IV of Marshall's *Principle of Economics* and Pigou's *Economics of Welfare*, to the formal presentation of externalities as missing markets in Arrow (1969), we see a shift in the Neoclassical understanding of the notion and causes of externalities.

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[1] As it is largely known, Pareto-efficiency, in a production economy, is defined as a situation in which any change in the given allocation of goods and factors inputs will cause a decrease in the production of at least one firm and a decrease in the utility of at least one consumer. A formal treatment can be found in chapters 3 and 14 in Petri (2021).

[2] This essay deals only with competitive markets. Therefore, for simplicity, we do not deal with the Neoclassical discussion of market failure related to non-competitive markets.

In its initial treatment, externalities are defined as a market failure that prevent the equalization of marginal private net product and marginal social net product[3]. As initially discussed by Pigou (1932) in a Marshallian long-period equilibrium framework, the solution for the market failure is the introduction of subsidies or taxes. Unlike this approach, Arrow (1969) puts forth a formal presentation of externality as caused exclusively by missing markets in an intertemporal competitive general equilibrium framework. Thus, the latter development implies market (or private) solutions to externalities as the right incentives through newly created or reformed markets. In this case, the Neoclassical answer is 'more markets' instead of 'market correction'.

This change is already identified in the literature (Berta, 2017; Papandreou, 1994). Our contribution is to add what seems to be another relatively little-noticed consequence of the major change in Neoclassical economics's concept of equilibrium as initially shown by Garegnani (1976). Neoclassical economics's major change has transformed general equilibrium theory from its long-period version to its new intertemporal form as developed, for instance, by Debreu (1959)[4]. A critical assumption of this version is complete markets[5], which is used to derive the first theorem of welfare economics. We argue that this new concept of equilibrium is central to understanding the shift in the approach to externalities. Therefore, although both notions of externalities (market failure and missing market) are still presented today, the more formal derivations of externalities in the context of intertemporal general equilibrium is connected to the concept of missing markets, as clearly put forth by Mas-Colell et al. (1995, p. 358).

Once we associate the changing notion of externalities with the emergence of the new notion of intertemporal general equilibrium, we can apply the criticism of Neoclassical welfare theory in both the market failure and missing market versions. In the former, the indeterminacy of the long-period equilibrium (Garegnani, 1990) means the theoretical impossibility to determine Pareto-efficiency, and reverse capital deepening and reswitching also undermine the tendency towards full employment. In the latter, the assumption of complete markets (including future markets) is very unrealistic, and so are the conditions necessary for the economy to reach this sequency of equilibria (Petri, 2021, chap. 14)[6]. Our conclusions reinforce Garegnani's

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3 See chapter IX from Pigou (1932).

4 Garegnani (1976) stresses a second possibility, which is *temporary* equilibrium as originally developed by Hicks (1946).

5 In case of temporary equilibrium, one has to assume that price expectations are based on perfect foresight (Petri, 2021).

6 These problems may explain why the market-failure approach to externalities remains in the microeconomic textbooks. See, for instance, Mas-Colell et ali. (1995, chap. 11).

(2007) position on the inadequacy of the Neoclassical approach to welfare economics in general and of the notion of Pareto-efficiency in particular.

The essay is divided into six sections. After this introduction, a brief description of the change in the notion of equilibrium in Neoclassical economics is provided (section 1.2). We then present the original concept of external economies as found in Marshall's *Principle of Economics*, Pigou's *Economics of Welfare*, and other developments from the 1950's that provided more explicit definitions of externalities as a market failure (section 1.3). Next, we show the change in the concept of externalities and its connection to the major shift in the Neoclassical notion of equilibrium (section 1.4). In the subsequent section, we discuss the Sraffian criticism of Neoclassical welfare analysis based on the concept of externalities in the long-period and intertemporal versions of Neoclassical general equilibrium (section 1.5). Final remarks close the essay (section 1.6).

1.2 The change in the notion of equilibrium in Neoclassical economics

Neoclassical authors such as Wicksell and Marshall have worked with the method of long-period equilibrium positions associated with a uniform rate of profit and constant equilibrium relative prices. These theoretical prices of goods and factors of production explained by the theory were understood as gravitational centers around which the actual prices fluctuate (Garegnani, 1990). According to this tradition, the forces determining the long-period method's theoretical variables are more persistent than the numerous events and accidents that may affect the actual or observed variables. It does not mean that the independent variables that determine the equilibrium (preferences, technology and factor endowments) do not change, but they change more gradually than actual market prices. In this approach, the representation of a uniform rate of profit, around which the actual rates of profit gravitate, is central feature of the assumption of free competition among firms in all sectors. The condition of a uniform rate of profit requires that the composition of the capital endowment is endogenously adjusted while the total amount of capital in real terms is fixed.

In the Intertemporal General Equilibrium (IGE) model, this old tradition of a long-period equilibrium is abandoned in favor of a 'very' short-period analysis (Petri, 2021, chap. 8), in which both the size and composition of the initial capital endowment are taken as given in physical terms. This assumption is not compatible with a uniform rate of profit (Garegnani, 1990). Moreover, instead of an atemporal equilibrium position, there is a sequence of equilibrium positions corresponding to each period. Hence, one of the crucial assumptions in the IGE approach is the completeness of markets, including futures markets. So, instead of having long-period equilibrium prices, we have a path of short-run equilibrium prices, and the economy is supposed to be in its equilibrium position at each moment of time.

Garegnani (1976, 1990) and Petri (1978) argue that the change from the notion of the long-period equilibrium to the IGE is a consequence of the difficulties of measuring the quantity of capital independently of distribution.

After this very brief discussion of the change in the notion of equilibrium in Neoclassical economics, we will show, first, the original version of the concept of externalities as developed by Marshall and Pigou. In the sequence, we present how Arrow's (1969) contribution to the notion of externalities as missing markets is a formal consequence of the shift in Neoclassical economics towards the IGE approach.

1.3 External economies and market failure

1.3.1 Marshall's approach to external economies

The concept of external economies is put forth in the Book IV of the *Principles of Economics* (Marshall, 1920[2013]). Marshall presents in this volume his supply theory in the context of partial equilibrium by introducing the determinants of land and labor supply and the determinants of returns of scale in the industries – among which he highlights the division of labor, the use of machinery, the industrial localization, the scale of production and the business management. According to Mongiovi (1996), one of Marshall's main interests in his discussion of the supply is to deal with increasing returns, which he had considered an empirical element of a growing economy.

Marshall (1920[2013]) summarizes the distinction between what he considers internal and external economies:

> We may divide the economies arising from an increase in the scale of production of any kind of goods, into two classes-firstly, those dependent on the general development of the industry; and, secondly, those dependent on the resources of the individual houses of business engaged in it, on their organization and the efficiency of their management. We may call the former external economies, and the latter internal economies. In the present chapter we have been chiefly discussing internal economies; but we now proceed to examine those very important external economies which can often be secured by the concentration of many small businesses of a similar character in particular localities: or, as is commonly said, by the localization of industry (Marshall, 1920[2013], p. 221).

Whereas the internal economies are correlated with labor division and the increase in machinery usage, the external economies have their causes found in the geographical concentration of specialized industries. Consequently, external economies allow for increasing returns for the industry where firms are too small to observe internal returns of scale:

> Again, the economic use of expensive machinery can sometimes be attained in a very high degree in a district in which there is a large aggregate production of the same kind, even though no individual capital employed in the trade be very large. For subsidiary industries devoting themselves each to one small branch of the process of production, and working it for a great many of their neighbours, are able to keep in constant use machinery of the most highly specialized character, and to make it pay its expenses, though its original cost may have been high, and its rate of depreciation very rapid (Marshall, 1920[2013], p. 225)[7].

In addition to the concentration of specialized industries, Marshall mentions throughout his Book IV other potential causes of external economies, such as reductions in transportation costs, improvements in communication, and the publicization of technical knowledge. In this sense, Marshall's view on the potential increasing returns in the industries is compared to Adam Smith's insights on the division of labor and cumulative processes in the accumulation process, as suggested by Vaggi and Groenewegen (2003, p. 233) and by Toner (1999, p. 8).

However, Marshall's analysis is based upon the Neoclassical competitive long-period equilibrium. Therefore, decreasing returns at the firm level, which are needed to derive the supply curve, are incompatible with his inquiry on increasing returns. As Sraffa (1925, 1926) dealt with the inconsistency suggesting that the Marshallian economies need to be external to the firms but internal to the industries. Nonetheless, some of the examples given by Marshall, such as a reduction in transportation costs or the publicization of technical knowledge, seem impossible to be limited only to one particular industry. However, if the increasing returns of some industry impact others, the condition of partial equilibrium method do not hold (Mongiovi, 1996).

Due to the problems that increasing returns brought to the Neoclassical approach, we identify that the debate over increasing returns spanned in three branches. The first one is derived from the cost controversy of the 1920's (Brondino and Lazzarini, 2017) and resulted in the models of imperfect competition, such as Robinson (1933) and Chamberlin (1933). A second branch, which could also be connected to the cost controversy, is the debate around the

[7] It is worth mentioning that Marshall (1920[2013]) discuss mostly cases of increasing returns (either internal or external) for industries. Although decreasing return is not discarded, its causes are limited to managerial complexity of growing firms in Chapter XII.

'empty boxes' (Clapham, 1922) and the literature on increasing returns such as Young, Rosenstein-Rodan, Hirschmann, Myrdal and Kaldor (Toner, 1999). Finally, the third segment was pursued by Pigou (1932). Pigou embraces the concept of external economies in the *Economics of Welfare* as central to the analysis of welfare. It is worth saying that although Marshall deals with welfare analysis establishing the concepts of consumer's and producer's surplus (respectively on Chapter VI, Book III, and Chapter IX, Book IV), it is Pigou who proposes the connection between external economies and the welfare analysis. That is why the rest of this section deals with the Pigouvian approach to external economies.

1.3.2 Applying the external economies concept to the welfare analysis: Pigou's formulation

We limit our analysis in this essay to Pigou's welfare theory as presented in the *Economic of Welfare*. In Part I of Pigou (1932), he connects the measure of welfare to his definition of national dividend in the economy. By national dividend, Pigou understands the total amount (in money value) of goods and services produced each year minus the expenses to keep the stock of capital intact (Pigou, 1932, Part I, Chapter III). Since welfare and the national dividend are related, the maximum national dividend is also the economy's maximum welfare. Additionally, Pigou considers the optimality of the national dividend distribution in Part II of his work. Here, the core idea is the notion of marginal net product. The marginal net product is also measured in money value and corresponds to the marginal increment of some given quantity of a specific resource (Pigou, 1932, Part II, Chapter II). However, there is a difference between the private marginal net product and the social marginal net product. While the former corresponds to a return limited to an economic agent (being a consumer or a firm), the last is understood as:

> (…) the total net product of physical things or objective services due to the marginal increment of resources in any given use or place, no matter to whom any part of this product may accrue (Pigou, 1932, p. 134).

To maximize welfare, Pigou (1932, Part II, Chapt. III) argues that the social marginal net product in all occupations must be the same, because if there were room to increase the social marginal product in one occupation, the transference of resources to this occupation would increase total welfare. Moreover, the author argues that perfect competition can maximize total welfare provided that the private marginal net product equals the social marginal net product (Pigou, 1932, Parti II, Chapt. IV). Although not formally developed, this result is close to the latter notion of the first welfare theorem, which states that competitive markets produce Pareto-efficient allocation.

Nevertheless, as shown in Pigou's (1932) Chapters IX and XI, the private marginal net product may be different from the social marginal net product, preventing perfect competition to maximize social welfare. In explaining the causes of this inequality, Pigou uses the Marshallian concept of external economies to argue that external costs or benefits can be generated in the production process of a firm or by providing services that may affect other parties not involved in the transaction. In other words, the provision of a given good or service generates positive (negative) effects that are not compensated by whom is benefited (paid by whom causes the harm).

One famous example of such an external benefit is the lighthouse. The lighthouse is used to describe a situation in which the a ‘well-placed lighthouse’ does not charge for its service of ship's orientation (Pigou, 1932, p. 184). An example of a not compensated external cost is pollution. The pollution generated, for instance, by a firm A which affects the production of a firm B (which is not a producer nor a consumer of the goods produced by A) is an external cost (not charged) that A causes to B. In the case of negative external effects mentioned by him in his example of pollution, taxes that reflect the external costs can correct the divergence between private and social marginal net product.

Therefore, Pigou reasons that we should have state intervention, mainly through taxes or subsidies, whenever there is a divergence between private return and social outcome. Pigou also includes as a public tool for increasing welfare the public investments on the well-known examples of positive external economies and public goods (later defined by Samuelson (1954))[8] still used today, such as investments in parks, railways, and research and development.

Note that despite the later criticism coming from Coase (1960) as we will see below, Pigou seemed to be skeptical about legal arrangements that could eventually correct the divergence between private and social marginal products by creating markets where there is not. According to him:

> § 13. It is plain that divergences between private and social net product of the kinds we have so far been considering cannot, like divergences due to tenancy laws, be mitigated by a modification of the contractual relation between any two contracting parties, because the divergence arises out of a service or disservice rendered to persons other than the contracting parties. It is, however, possible for the State, if it so chooses, to remove the divergence in any field by "extraordinary encouragements" or "extraordinary restraints" upon investments in that field. The most obvious forms which these encouragements and restraints may assume are, of course, those of

8 Samuelson’s proposition is inspired in the Pigouvian idea of divergence between the social return of public goods’ consumption and the private return associated with its production.

> bounties and taxes. Broad illustrations of the policy of intervention in both its negative and positive aspects are easily provided (Pigou, 1932, p. 192).

After Pigou (1932), numerous authors have dealt with the concept of externalities[9] in the context of Neoclassical theory, exploring the sources of market failure[10]. Those authors have provided more precise and more explicit definitions of externalities. Scitovsky (1954), for instance, proposes the distinction between technological and pecuniary externalities. Whereas the latter is associated with all direct interdependence among producers that change market prices, and thus affect their profits, the former affects either the utility or the production functions and this impact is not reflected in market prices.

Pecuniary external economies' case is exemplified with the problem related to the installation or expansion of new industrials plants. In this case, the industrial firm's profit is a function of its outputs, factors inputs, and other firms' outputs inputs. Scitovsky then argues that an expansion (or installation) of a new industrial plant causes a decrease in its output prices and increases the firm's profitability that consumes its output as a factor input. In turn, these firms can now expand, causing an increase in demand for their inputs. This last effect will then increase the input price (or the output price for the first firm). In the end, this process will generate an increase in social gains. Scitovsky (1954) stresses that markets cannot reach this outcome, for the private return for the first firm, in the beginning, does not compensate for the higher cost of an expansion in production. Scitovsky (1954) expresses through this concept his strong belief that in a decentralized economy, numerous failures will result from coordination problems in markets. Thus, for him, the solution would necessarily pass by the State coordination, mainly through investments in new industrial sectors[11].

Bator (1958) discarded pecuniary externalities because it is incompatible with Neoclassical competitive equilibrium, because any interdependence captured by prices (in output and factors of production) cannot be considered an unpaid benefit. If the implicit productivity increase of a new investment is reflected in a decreasing input price, he argues, competition among profit-maximizing firms will produce an optimal equilibrium. Hence, this author's most important feature in our investigation is his more precise and explicit explanation of the causes of externalities. Moreover, similar to Pigou (1932), he does not consider that

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9 It is worth stressing that Pigou (1932) did not use the word "externality". The word was introduced during the 1950s (Gehrke, 2015).

10 See Papandreou (1994).

11 That is why Scitovsky (1954) had a great influence in the development economics literature that stressed the role of the State coordinating investments (see Toner (1999)).

enforcing appropriability can translate into a proper solution to market failure. In his own words:

> But I think it more natural and useful to broaden rather than restrict, to let 'externality' denote any situation where some Paretian costs and benefits remain external to decentralized cost revenue calculations in terms of prices. If, however, we do so, then clearly 'nonappropriability' will not do as a complete explanation. Its concern with the inability of decentralized markets to sustain the solution-prices and quantities called for by a price-profit-preference type calculation, as computed by a team of mathematicians working with IBM machines, tends to mask the possibility that such machine-calculated solution q's may well be nonefficient. It explains failure 'by enforcement', but leaves hidden the empirically more important phenomena which cause failure by 'non-existence', 'signal', and 'incentive' (Bator, 1958, p. 362 and 363).

In sum, we saw the Pigouvian market failure view on externalities in this section. For these authors, a market failure reflects interactions between economic agents not captured by competitive market prices. Note that according to this view, even if markets were created for these externalities, they would fail to internalize them adequately. This approach to Neoclassical welfare excludes the possibility of creating markets as a real possibility to correct externalities. In the next section, we will see how the change in the notion of Neoclassical general equilibrium in the 1960s influenced welfare economics.

1.4 Missing markets in the Neoclassical intertemporal general equilibrium model

1.4.1 Coase's critique to Pigou

The main target of Coase's (1960) critique is the *Economics of Welfare* from Pigou. His critique relies on the argument that in the presence of a non-market interdependence between agents, it may be preferable for both agents to bargain a market solution. In this case, any legal arrangement that helps create propriety rights, and allows for a bargain, will provide a better social result than the one created by State intervention through taxes or subsidies.

To defend his argument, Coase (1960) implicitly assumes a partial equilibrium competitive framework, since no wealth effects nor the impacts on other markets are considered. In his arguments, an example is presented: a cattle-raiser who causes negative (external) effects to his neighbor who grows crops. Coase argues that if the cattle-raiser is liable for the inflicted damage, he will pay the farmer for the generated 'disservice' up to the point that its cost is below its marginal cost on production. Also, the affected farmer will accept payments to the extent that the cost of damage is below the payment (the farmer can also choose not to produce). Therefore, in the optimal position, the additional cost paid for the inflicted damage will be equal to the first firm's marginal product and the marginal cost of damage of the second firm. According to Coase (1960), this situation allows for maximum production.

Coase argues that the imposition of a direct tax/subsidies may provoke unpredictable results caused by price distortions. So these sorts of measures would reduce the efficiency of markets. He proposes another example to justify his ideal of inefficiency: the waste of time of a person waiting in the red line in an empty street. In this case, if the rushed driver could pay other drivers to cross the intersection of the roads, instead of wasting time waiting while there are no other drivers on the other road, everybody would be better off. Another relevant example is his answer to Pigou's use of the example of lighthouses.

Coase (1974) tackles the historical evolution of lighthouses, the famous Pigouvian example of externalities. According to the author, the British Lighthouse system's development has shown that private owners could charge for the lighthouse service. Private firms could provide this service, which would be compensated by the payment of light dues by shipowners. The role of the State is then limited to enforcing the propriety rights of the lighthouse. Coase (1974) is, therefore, not just presenting the possibility of private solutions to the lighthouse problem but also trying to justify that the private funding by shipowners of this activity is more efficient than the usage of public resources.

Although Coase (1960) did not build a formal model, he stresses the implicit assumption in the past explanation that there are no transaction costs to establish the legal arrangement necessary for bargaining. Besides, the legal authority must be able to enforce propriety rights, or, in other words, damage must be liable to someone. Finally, it is also supposed that both parties have equal bargaining power in this transaction, meaning that firms must operate under perfect competition. No matter how famous has become Coase's theorem, as we will see, it was not until Arrow's (1969) contribution that this proposition was formalized.

1.4.2 From market failure to missing markets: Arrow’s intervention and the shift in the notion of equilibrium

The emergence of the Neoclassical IGE approach, as developed by Debreu (1959), provided the necessary formal basis for Coase's idea. In this model, it is assumed that commodities (and markets) are differentiated not just by their physical proprieties but also by their delivery date and location. Markets are then assumed to be complete for different goods, location and time, and prices are determined for each of the distinguished commodities:

> A commodity is characterized by its physical properties, the date at which it will be available, and the location at which it will be available. The price of a commodity is the amount which has to be paid now for the (future) availability of one unit of that commodity (Debreu, 1959, p. 28).

This definition of commodities, or markets, as mentioned in section 1.2, is directly connected to the treatment given by the solution to a general equilibrium model with heterogenous capital goods. This assumption is also behind the first welfare theorem, which states that the competitive equilibrium of markets generates optimal welfare outcomes, in other words, Pareto-efficient results. Thus, all competitive equilibria are Pareto-efficient. To obtain this strong result, among other assumptions (such as convexity of preferences and technology sets), the model needs to assume market completeness ('universal price quoting') and perfect competition ('price taking') for all traded goods (Mas-Colell et al., 1995, p. 550)[12].

From this condition of market completeness and its relation to the first welfare theorem, it is straightforward that any external obstacles to market efficiency can be understood as an institutional problem of missing markets, which brings us back to Coase (1960). In this context Arrow (1969) is a pioneer in stating that externalities are nothing but missing markets. Berta (2017) suggests that there would be a lack of rigorous definition of externalities in the Pigouvian tradition before Arrow's intervention. Unlike this understanding, we interpret Arrow's intervention as a formal adaption of the concept of externalities to the Neoclassical IGE model. In particular, given the mentioned importance of the assumption of complete markets in this framework, it is a logical consequence that the only reason to exist 'external' effects should be associated with a missing market[13]. As we argued in section 1.3, the authors who developed the idea of market failure following Pigou's original idea did not seem to consider the abstract idea of complete markets. Hence, their approach did not lack more rigor, but were rather skeptical of market solutions to the failures they were observing.

Arrow (1969) represents externalities formally as non-independent utility functions in his model. If prices do not mediate these interactions, markets will not be complete because goods (or services) will be exchanged without attributed prices. Consequently, the competitive equilibrium ceases to be considered Pareto-efficient, and the first welfare theorem does not

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[12] Papandreou (1994) also emphasizes the role of non-convexities causing externalities. In this case, other problems arise, such as imperfect competition. Since we are restricting our analysis to perfect competition, which does not change our central argument in this essay, we do not deal with problems related to non-convexities in general equilibrium models.

[13] Note that one can also find the notion of 'incomplete markets' in Neoclassical IGE models. It is related to any incapacity of markets transferring wealth to the future due to the absence of appropriate financial instruments in the presence of uncertainty. We are not dealing with uncertainty in Neoclassical general equilibrium models in this essay. For a more detailed discussion, see Petri (2021, chap. 9).

hold. Therefore, a critical assumption behind the first welfare theorem is that the consumer's utility function depends only on her consumption bundle (i.e. an independent utility function) (Petri, 2021, chap. 14).

Since externalities cause the interdependency of the utility functions, Arrow (1969) deals with these externalities by artificially transforming them into commodities, so he internalizes these effects by defining prices for them. In doing so, Arrow restores the complete markets assumption and the first welfare theorem becomes valid again. This solution is also translated into the already mentioned Coase's theorem, provided that the hypothesis of no transaction costs and perfect competition hold (Mas-Colell et al., 1995, p. 357). Therefore, in the intertemporal version, an external effect such as pollution (carbon emissions, for instance), should be dealt with by creating markets that cover all the possible emissions in time, space and 'states of the world'. The 'propriety rights' for emission should be defined in terms of all those categories. For instance, a carbon emission right should be defined as 1 million ton of CO2 to be emitted in 2050, in Rio de Janeiro in a rainy day.

The pollution 'good' damages other firms and/or consumers, who demand compensatation for this right to pollute. It should also include the not-yet-born consumers (since future markets should also be complete) whose preferences affect the equilibrium prices today[14]. Therefore, carbon emitters and other firms and/or consumers affected by carbon emissions would trade these rights attributing present (and future) prices for the right to pollute that would satisfy both sides[15] (under free competition[16]). These would be Pareto-efficient prices, and they define an equilibrium path, i.e., each period (and in each place and state of the world) the economy is in a Pareto-efficient equilibrium. Accordingly, the assumption of market completeness is central to this argument. Besides, the IGE approach provides a theoretical formalization of Coase's original reasoning that market creation would provide better social outcomes compared to State intervention. In our example, creating a market for CO2 emission rights would be more efficient than imposing a Pigouvian pollution tax. It is clear then that externalities' descriptions as market failure or as missing markets are not parallel ideas as sometimes presented in textbooks. Instead, both explanations for externalities are sequential and follow the Neoclassical theory's shift with the replacement of the long-period notion of equilibrium with the intertemporal equilibrium (and its assumption of complete markets).

14 This idea of not-yet-born consumers impacting prices today in IGE is found in Petri (2021, chap. 8).

15 It is important to notice that there would be no trade in disequilibrium conditions. The observed prices of carbon emission rights would already be the equilibrium ones.

16 In this case large multinational companies responsible for carbon emission would equally compete with small local companies or local consumers.

Notice that the lighthouse's problem that we saw in Pigou’s and Coase’s work is understood by Arrow (1969) as a matter of lack of competition preventing an optimal market solution. He points out that the lighthouse may be able to charge for its services, so a market solution is possible. However, the potentially limited number of competitors makes the market for lightning orientation unlikely competitive. In that case, Coase’s theorem does not apply, and market creation is a non-efficient solution.

Note also that Arrow himself acknowledges that the assumption of complete markets in an intertemporal model seems implausible:

> ‘Finally, in this review of the elements of competitive equilibrium theory, let me repeat the obvious and well-known fact that in a world where time is relevant, the commodities which enter into the equilibrium system include those with future dates. In fact, the bulk of meaningful future transactions cannot be carried out on any existing present market, so that assumption (M), the universality of markets, is not valid (Arrow, 1969, p. 504)’.

In contrast to this statement, he provides a formal treatment of externalities as missing markets in a Neoclassical IGE approach, and this is the same model largely diffused in his advanced microeconomic textbook with Frank Hahn (Arrow and Hahn, 1971, p. 132 to 136).

Another example of such contradiction is the fact that Mas-Colell et al. (1995) present formally externalities only in the context of partial equilibrium analysis. Although they limit their analysis to the (long-period) Marshallian world, they consider the missing market approach, in the context of the IGE, as a more logical and formally convenient cause of externalities (Mas-Colell et al., 1995, pp. 358 and 359). One hypothetical answer to this contradiction could be that, as Arrow (1969) himself pointed, the Neoclassical IGE model and the assumption of complete markets are too strong to develop the welfare analysis. The limitation to the partial equilibrium case, in which there are no wealth effects, and the supply and demand of other markets are given, would provide a more plausible welfare assessment. However, this hypothesis is confronted by the fact that the same textbook provides a formal presentation of the first welfare theorem in the context of the competitive general equilibrium model, in which the intertemporal framework is a particular version of the main model (Mas-Colell et al., 1995, p. 732). Therefore, the contradiction in this textbook regarding the different approaches to externalities remains.

1.5 Neoclassical welfare economics from a Sraffian standpoint

1.5.1 The ‘market failure’ welfare economics

In section 1.3 of this essay, we saw that Pigouvian externalities were caused by the divergence between the private marginal product and the social marginal product due to different types of market failure. This Neoclassical formulation, which can still be found in textbooks on the economics of the public sector (Stiglitz and Rosengard, 2015, chap. 4), is based on the traditional long-period general equilibrium. In the absence of externalities, perfect competition produces the equivalence between private and social marginal products, and the economy reaches a Pareto-efficient equilibrium. In the presence of externalities, State intervention, such as taxes and subsidies, can equalize private and social marginal products (under perfect competition) and restore the Pareto-efficient equilibrium.

The various aspects of the Sraffian critique of the long-period version of Neoclassical general equilibrium theory also apply to the Pigouvian welfare economics. A first Sraffian critique concerns the supply of capital. Garegnani (1990) shows that in order to determine a uniform rate of profit, the long-period version of the Neoclassical theory requires that endowment of capital should be expressed as a single magnitude in real value. However, under heterogenous capital, the relative prices of the different capital goods in the endowment will necessarily vary when the distribution between wages and profits changes. This change in relative prices will inevitably change the real value of the capital endowment measured in any numeraire. Therefore, the actual quantity of capital of the economy will only be determined if the distribution is already known and cannot be used to determine the rate of profits. The main implication of this is that there isn't and cannot be a proof of the existence of the long-period general equilibrium of the economy. If there is no proof existence of the long-period general equilibrium position, there is neither a proof of the Pareto-efficiency of such position under heterogenous capital. Moreover, this indeterminacy in regard to the quantity of capital also undermines the position of the demand functions of labor and all other factors of production, rendering the determination of their marginal products impossible. Thus, there is also no such a thing as a rigorously defined private marginal product of factors to compare with the social marginal product.

A second Sraffian critique concerns the demand side of the factors of production. The critique consists of demonstrating that the choices of technique, even abstracting from the insoluble problems with defining the quantity of capital, may not always be inversely related to the relative price of each factor of production due to reverse capital deepening (in which the intensity of use of a factor decreases when its price falls) and reswitching (when the same technique is actually chosen at very different levels of the rate of profits). The demonstration of the reverse capital deepening and reswitching deprives the theory of a solid basis for postulating well-behaved demand curves for factors of production.

Therefore, both aspects of the Sraffian critique imply that there is also no solid general basis for the idea of a tendency to full employment equilibrium. But without this tendency to full employment, as pointed out by Garegnani (2007), the notion of Pareto-efficiency loses any usefulness because, in the context of idle resources, everyone can be better off, for instance, by increasing aggregate effective demand.

1.5.2 The 'missing market' welfare economics

The missing market welfare economics is subject to the general Sraffian critique of the IGE approach[17]. Petri (2017) emphasizes three problems: (i) the impermanence problem ,(ii) the substitutability problem and (iii) the price change problem.

The impermanence problem corresponds to the lack of persistency of the intertemporal equilibrium path determined from the arbitrary initial endowment of heterogenous capital goods. The equilibrium path is not independent of the endogenous changes in the capital endowment that will occur as the relative production of different capital goods varies in the adjustment process. Therefore, the equilibrium positions over time are not a gravitational center to market adjustments, as was the case in the long-period equilibrium. In this case, although there is no internal inconsistency, it does not seem to have any practical relevance to treat this changing equilibrium as a Pareto-efficient benchmark for market outcomes and regulation. Thus, there is no room in this framework for trial-and-error exchanges between the economic agents to produce a Pareto-efficient outcome. Instead, the auctioneer tale (and complete markets) provides equilibrium prices and endowments before transactions occur. From a pragmatic point of view, this framework does not seem to be a useful tool for policy guidance.

The second problem mentioned by Petri (2017) is the substitutability problem. The need to specify the capital endowment as a set of specific heterogenous capital goods in order to avoid having to take as given the quantity of capital in terms of its real value requires that the techniques in use in the economy should use very different proportions of each of these capital goods and labor (and other factors of production). This would be necessary to ensure

[17] Fratini (2019) distinguishes two streams regarding the criticism raised against the IGE. First, the critique of the methodological notion of intertemporal (or temporary) equilibrium itself. The second set of critiques stresses the possibility of reswitching and reverse capital deepening in the intertemporal (or temporary) general equilibrium. Since there is still an ongoing controversy regarding this point (see Garegnani (2012)), we shall not refer to this second strain here.

that the demand curve for each of these capital goods would be sufficiently elastic. This is an extremely implausible assumption, as most specific capital goods can only be combined in very rigid ways with labor and other factors of production.

The third problem, as mentioned by Petri (2017), is the price change problem. Unlike the long-period theory, equilibrium relative prices in the IGE approach are not expected to remain constant because capital endowments will necessarily change in the equilibrium path. So, to determine the impact of these changes from the initial period of the analysis, the whole set of prices that will rule in the subsequent period must be known. This leaves the Neoclassical intertemporal approach with two alternatives: either to assume given expected prices under perfect foresight (as in temporary general equilibrium) or to assume complete future markets. Both alternatives are very unrealistic. In particular, the idea of complete markets used for Neoclassical welfare analysis implies that markets for every period of time and state of the world actually exist. This would also require that all the preferences, technologies and endowments of production factors in the future are already known.

According to Ciccone (1999), the assumption of complete markets also implies that there is an almost infinite list of possible contingent markets, which brings further indeterminacy in this model for market and equilibrium prices – besides the unrealistic assumption that agents will have perfect information about such distinguished and objectively unpredictable markets.

In addition to being unlikely that the economy could tend to this kind of equilibrium path and to the unrealism of the assumption of complete markets, the missing market approach to welfare is based on the assumption of price-taking perfect competition. However, it is very unlikely that such contingent markets could be competitive. Moreover, the idea that agents in the markets created to internalize externalities would behave as price takers, without a good justification in terms of ease of entry and exit or large numbers, makes the proofs that such markets could be efficient be often presented as mere analogies. In our former example of markets for carbon emission rights, it is equivalent to saying that big multinational companies are as price takers as the local consumers affected by carbon emissions in Rio de Janeiro.

1.6 Final remarks

The first contribution of this essay was to show how the change in the notion of equilibrium in Neoclassical equilibrium impacted the welfare analysis in this approach. This was done by a non-exhaustive analysis of the evolution of the notion of externalities from

Marshallian/Pigouvian external economies to Arrow's contribution. In this process, the analysis of externalities moved from a 'market failure' basis to a 'missing markets' justification. Moreover, we argued that this change was profoundly influenced by the little-noticed migration from a long-period general equilibrium approach to an intertemporal general equilibrium approach in neoclassic theory.

The second contribution of this essay consisted of showing that the Sraffian criticism of both the long-period and intertemporal approaches to Neoclassical theory apply fully to these two versions of welfare theory. In particular, the underlying unrealism of the complete markets assumption seems to explain why in fact the welfare analysis as presented, for instance, in Mas-Colell et al. (1995, chap. 11) is developed under the long-period version of the general equilibrium approach. Petri (2021, chap. 14) stresses this ambiguity, noting that Neoclassical welfare theorists do not seem to grasp that the method of long-period general equilibrium is incompatible with the modern formulation of the IGE model. So the Sraffian critique eliminates the (Pareto) efficiency concept as a reference for normative economics. It is not our intention here to deal with what happens next, but is worth noting that the Sraffian approach to price and distribution leaves the debate open for normative economics.

In our view, the issues discussed here are of particular interest for understanding the fate of postwar development economics (as discussed in our introduction to the dissertation) that mainly relied on the Pigouvian market failure approach, either through subsidies, taxes, or public investments. In the 1980's, international institutions such as the World Bank and the IMF had a drastic shift in their orientation from market failure to missing markets as the roots of development problems, which was presented as a solid theoretical foundation for neoliberalism. Therefore, the above-mentioned tools to correct market failure that was highly important to economic development in many countries were replaced by propriety rights enforcement and incentives for more efficient markets. Privatization and the focus on creating markets has become since then a persistent reference in the developing world (Serrano, 2014)[18]. Given the failure of such strategies in both economic and social terms, it is high time we critically examine the theoretical foundations of the Neoclassical welfare theory.

[18] The extent of this ideological onslaught may be measured by reference to Krueger (1990) critique of market failure based development economics using the very unrigorous concept of 'government failure': '...policies directly controlling private economic activity are likely to be less efficacious in terms of achieving their objectives than policies that provide incentives for individuals to undertake the activities which are deemed desirable. This can often be achieved by finding ways which strengthen the functioning of markets (Krueger, 1990, p. 21)'.

2 IMPACTS OF TAX INCIDENCE ON DISTRIBUTION AND EFFECTIVE DEMAND IN A SRAFFIAN FRAMEWORK

2.1 Introduction

In Haavemo's (1945) balanced-budget multiplier, tax incidence is assumed fixed and has no effect on distribution. Haavelmo argued that he wanted to show that his conclusions on the possibility of expansionary effects of balanced budgets did not depend on the size of the propensity to consume assuming no income redistribution through taxation. In this essay, we will develop Haavelmo's balanced budget multiplier in a situation in which we endogenize the real tax incidence. In order to do so, we need to integrate taxation in a framework of distributive conflict. To fulfill this objective, we will utilize the Sraffian approach to value and distribution, particularly its modeling of conflict inflation (Pivetti, 1991; Serrano, 1993, 2010; Stirati, 2001). Also, we will connect the effects of real tax incidence on the levels of effective demand and output using the Sraffian supermultiplier (Serrano et al., 2019). Although the role of government spending in economic growth has been incorporated in some recent supermultipler demand-led models (Allain, 2015; Dutt, 2013, 2019; Freitas and Christianes, 2020; Serrano and Pimentel, 2019), real tax incidence and its effects on effective demand and output are far less studied in this literature.

The introduction of taxation in the Sraffian literature was first presented in Metcalfe and Steedman (1971). Eatwell (1980) connected the effect of taxes in the price equations with effective demand assuming balanced budgets. Serrano and Pimentel (2019), in their turn, showed the validity of Haalvemo's results on the expansionary effects of taxation under the balanced budget assumption in the context of the Sraffian supermultiplier. Our work builds on this previous Sraffian literature and provides two main contributions. First, we show that the real incidence of goods taxation relies on wages only under the particular assumption of given real profit markups, which makes the view from Kalecki (1937) and part of the Kaleckian literature (Laramie, 1991; Mott and Slatiery, 1994) as one particular case of a more general approach. Second, we argue that the assessment of the expansionist nature of balanced budgets depends on the assumptions regarding the form of taxation and the parameters of the distributive conflict. In the particular case of a sales tax, we show that an increase in government spending entirely financed by the rise in the sales tax rate, under a balanced budget, is always expansionary as long as the real profit markup is not exogenous, even if workers do not save.

In other words, we show that Haavelmo's results can be valid even when taxation provides a redistribution of income.

The essay is organized into seven sections. After this introduction, the second section outlines the general framework, based on a very simple version of the Sraffian corn model, to study the interaction between different forms of indirect taxation and distribution for a given level of output. The third section presents the different impacts of basic and non-basic goods taxation on distribution. The fourth section of the essay shows the classical closures to distribution and the implications for the real tax incidence. The fifth section explores the situations in which the rate of profit and wage may react to changes in prices due to taxation in a Sraffian conflict inflation model. The sixth section integrates effective demand, using the supermultiplier and balanced budgets, with real tax incidence. The final section presents our final remarks.

2.2 A simple Sraffian framework for taxation

2.2.1 The basic model

In any kind of model, the real tax incidence depends on relative prices and distribution. In the Neoclassical approach, relative prices, distribution (factors prices) and output are simultaneously determined. Based on given preferences, technology and factor endowments, the elasticities of substitution of demand and supply determine the real burden of taxation over consumers and suppliers (Fullerton and Metcalf, 2002). Neoclassical welfare theorems, in their turn, provide the Pareto-efficiency benchmark to assess the social outcome of taxation (Petri, 2021, chap. 14). Taxation may lead to the dilemma between efficiency and equity: in addition to changes in distribution, taxes distort the costs of factors of production. For instance, indirect payroll taxes may lead to the reduction of employment and output. Alternatively, taxes on wages may reduce the labor supply reducing employment and output[1].

Once we consider the limitations of the Neoclassical demand and supply apparatus to determine relative prices, output and distribution, as shown by Sraffa (1960), Garegnani (1970), and others, a different framework for the study of tax incidence is needed. These limitations from the Neoclassical approach break down the tendency to full employment and the Paretian

1 For a survey on this literature, see Martinez-Vazquez et al. (2011).

notion of efficiency as we saw in the first essay of the dissertation (Garegnani, 2007)[2]. In the alternative Sraffian framework, there is a separation between the determination of output and the theory of value and distribution, and the analysis of tax incidence for a given level of output depends on the technical coefficients of productions and the assumptions regarding the distributive variables, which ultimately reflects the bargaining power of workers and capitalists.

In order to provide a simple framework to assess tax incidence, we will consider a closed economy that produces only one good ('corn'), and it uses homogenous labor for its production, besides corn itself. This simplification will not allow us to consider the different impacts of taxation on the different baskets of goods consumed by the different social classes. Also, we will not deal with the consequences of heterogenous tax rates levied on different economic sectors nor check the effects of changes in the composition of gross output over tax incidence. Note that one of the crucial changes in a multi-sector Sraffian model is that relative prices vary in complex ways when distribution changes, and these changes, especially when there are alternative production methods, undermine the idea of a generally Neoclassical idea an inverse relation between factor intensity and factor prices. Metcalfe and Steedman (1971) study the choice of technique in the context of different forms of taxation. One of the main results shown by the authors is that the choice of technique is not straightforward: the heaviest taxed good does not necessarily present the highest relative price. Therefore, new 'reswitching' points are possible[3].

The corn model provides a simple and insightful framework for the study of the real tax incidence and the distribution between wages and profits that is easily connected to analysis of aggregate output as we will do further below. Note also that the use of multiple sectors and basic goods does not change the main results we are interested on[4].

Our formal model consists of one good X, and output and capital consist of the same commodity. There is only circulating capital, which is fully consumed in each period of production. Moreover, labor productivity is fixed, which leads to constant technical coefficients. Also, we assume post-factum wages, so they are not considered advanced capital.

2 The meaning of separation here does not mean that distribution (and taxation) has no effect whatsoever on output. It only means that there are multiple possible functional relations between those variables, depending on more specific assumptions.

3 One little-noticed consequence of that is the critique of one important Neoclassical welfare tenet: the Pigouvian tax. Suppose the State, for instance, wants to tax one given input because it harms the environment. In that case, there is no guarantee that the resultant dominant technique chosen in the process of competition will be less intensive in the usage of the given input. There is no guarantee that other techniques will become more profitable with the introduction of a Pigouvian tax, which in the end should prove to be useless (Gehrke and Lager, 1995).

4 Metcalfe and Steedman (1971, pp. 178–79) show that the effects on the wage-frontier and the choice of techniques are independent of the number of basic commodities entering in the net output.

The price level equation assuming a uniform (between producers) real rate of profits on replacement costs for this economy is given by:

(1) $PX = PaX(1 + r) + PblX$

Where X is the economy's gross output, P corresponds to the price level of gross output, a is the technical coefficient, r is the real rate of profit, b the real wage[5] and l is the labor coefficient[6]. The economy's surplus is $1 - a$ and it is divided between wages and profits according to equation (2). Also, from equation (2), It is easy to derive the wage frontier for this economy simply by solving for the real wage in equation (3):

(2) $1 - a = ar + bl$

(3) $b = \frac{1-a(1+r)}{l}$

Next, we will include taxation in this economy. According to the OECD classification (OECD, 2020), taxes are differentiated according to their tax base. The 6 groups are: (i) taxes on income, profits and gains; (ii) social contributions; (iii) taxes on payroll and workforce; (iv) taxes on propriety; (v) taxes on goods and services; and (vi) other taxes. Taxes from (i) to (iv) are generally understood as direct taxes on individual and corporate income, propriety or wealth, whereas (v) and (vi) are understood as indirect taxes that are levied on expenditures, in particular through value-added, sales and payroll taxes.

In the Neoclassical theory, the discussion on tax incidence tends to focus on direct versus indirect taxes and their effects on relative prices and distribution (Fullerton and Metcalf, 2002; Martinez-Vazquez et al., 2011). According to this approach, direct taxation corresponds to taxes levied on income or wealth of taxpayers. On the other hand, indirect taxation consists of taxs levied on market transactions irrespective of the economic conditions of the buyer or seller of the good or service. Therefore the legal incidence will differ from the real incidence in the unique case of indirect taxation.

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5 In a multi-sectoral model, b should be considered as the basket of goods consumed by workers. Notice that in this formulation, an increase in real wage means that new (and probably more expensive) itens are included in workers' consumption. The opposite occurs when the real wage decreases.

6 In a multi-sectoral model, the scalar a is equivalent to an input-output matrix and l is equivalent to the labor input vector. Also, in a multi-sectoral model, r is uniform assuming that competition brings this equality and w is uniform under the hypothesis of homogenous labor.

From a Sraffian standpoint, we can approach the same difference between the nominal (or legal) and real incidence with a different perspective. What is central to determine if the legal incidence differs from the real incidence is how much the tax is passed on to prices and that, in turn, depends on whether or not the tax is part of normal costs of production of the dominant technique used by firms[7]. If a given tax is part of normal costs of production, it must be included in the price level equation above and, hence, it will impact distribution depending on how the rate of profit and wages react to the increase in costs and prices. For instance, income tax could be considered part of the price equations if we assume that workers succeed in maintaining the value of their after-tax real wage[8]. In this case, the nominal incidence could be different from the real incidence, because workers would be able to pass on to capitalists the burden of income taxation. In the same sense, if we assume that competition equalizes the after-tax rate of profit, corporate income tax could also be subject to different real tax incidences.

In the simple model proposed in this paper, we assume that there is no difference between nominal and real incidence once taxes are levied on personal income, corporate profits and private wealth. Also, social security contributions levied on workers will not enter our price equation. Although Eatwell (1980) includes those taxes in the price equations, we do not follow his choice: it seems more realistic to consider that workers bargain for gross wages (before taxes). For instance, minimum wage policies usually determine the gross wage value. In sum, the study of real tax incidence in this paper focuses on the taxes that directly impact the price level equation above, namely: sales taxes t_s, value-added taxes t_{va} and payroll taxes t_{pr}[9]. The general framework presented below draws on Metcalfe and Steedman (1971) and Eatwell (1980). Following these authors, we use a uniform tax rate. Since this paper deals with a one-sector economy, heterogenous tax rates are unnecessary.

2.2.2 Sales tax

[7] Or, from a Kaleckian approach, if taxes are part of firms' prime costs (Laramie, 1991).

[8] See Eatwell (1980). For a discussion on capital/wealth tax and its impacts see Laramie and Mair (2001).

[9] We consider payroll taxes and social security contributions paid by employers as similar in this paper. The only difference between both forms of taxation is that social security contributions entitle the employee to receive a future social benefit. For the debate over social security contributions and the analogy with insurance payments, see Cesaratto (2005, chap. 1).

In the case of sales tax, the sale price for corporations is $\frac{P}{1+t_s}$. An example of this tax is sales taxes in the US, which are levied on sales from the retail sector[10]. So, the price equation becomes:

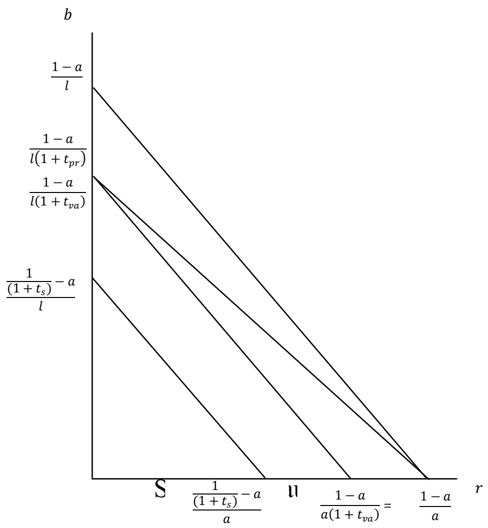
$$(4)\ P = Pa(1+r)(1+t_s) + Pbl(1+t_s)$$

Taxation reduces the social surplus available for capitalists and workers for a given level of output. The new division of the surplus, including taxation by the State, is given by equation (5) below. Also, the wage frontier makes a parallel shift toward the origin, as shown in Figure 1 below. This is shown by the new wage frontier in equation (6). Both the maximum real wage and the rate of profit are reduced, but the slope of the wage frontier does not change.

$$(5)\ 1 - a = ar + bl + t_s[a(1+r) + bl]$$

$$(6)\ b = \frac{\left(\frac{1}{(1+t_s)}\right) - a(1+r)}{l}$$

Figure 2.1: Wage Frontier with sales, value-added and payroll taxes



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2.2.3 Value-added tax

[10] Sales taxes in the US respond for 5.0% of GDP (or 17,6% of total public revenue) according to OECD (2020).

The imposition of value-added has a similar effect regarding a sales tax, because the wage frontiers shifts towards the origin, as shown in Figure 2.1 above. The value-added tax t_{va} is added to the profit rate and nominal wage per unit of gross output. The price equation is:

(7) $P = Pa(1 + r(1 + t_{va})) + Pbl(1 + t_{va})$

Solving equation (7) for the total surplus, we obtain the share of taxation in total surplus, and we can also derive the new wage frontier (equation (9)):

(8) $1 - a = t_{va}[ar + bl] + ar + bl$

(9) $b = \frac{\frac{1}{(1+t_{va})} - a\left(\frac{1}{(1+t_{va})} + r\right)}{l}$

The slope of the wage frontier does not change again. However, there is a less significant reduction in the surplus available for wages and profits since taxation, in this case, does not include the intermediate good used in the production process. Hence, the case of a value-added tax translates into a parallel shift of the wage frontier. However, the maximum rate of profit and the real wage are higher compared to the case of a sales tax.

Payroll taxes should be considered a particular case of the value-added tax in which only the labor cost is taxed. So the price equation becomes:

(10) $P = Pa(1 + r) + Pbl(1 + t_{pr})$

There is not much difference between this case and the value-added tax situation. The wage frontier, in this case, rotates counter-clockwise from the original wage frontier in Figure 1 above. Note that the maximum rate of profit will coincide with the zero-tax situation, and the maximum real wage equals the maximum real wage under a value-added tax. The total surplus and the wage frontier will be given by:

(11) $1 - a = t_{pr}[bl] + ar + bl$

(12) $b = \frac{1-a(1+r)}{l(1+t_{pr})}$

2.3 Taxation with basic and non-basic goods

So far, we have dealt with an economy in which only one good is produced and entered as means of production. The main results we have demonstrated do not depend on this assumption. However, a critical aspect of taxation is related to the differentiation of basic and non-basic goods. According to Sraffa:

> A tax on a basic product then will affect all prices and cause a fall in the rate of profits that corresponds to a given wage, while if imposed on a non-basic it will have no effect beyond the price of the taxed commodity and those of such other non-basic as may be linked with it (Sraffa, 1960, p. 55)"

Therefore, the study of real tax incidence relies solely on the examination of taxation on basic goods. Sraffa's quotation corresponds to a situation of a fixed and exogenous subsistence real wage. In this case, an indirect tax levied on consumption will decrease the after-tax equilibrium rate of profit. This view corresponds, for instance, to the taxation of classical economists such as Ricardo and Smith (Dome, 1992; Roncaglia, 2009, chap. 4). For those authors, taxation on the consumption of 'necessaires' reduces the rate of profit. In contrast, taxation on the consumption of 'luxury' goods will simply raise its relative price with respect to the chosen numeraire. To illustrate this argument, let's assume that the economy produces goods 1 and 2. However, only good 1 enters as circulating capital for the production of both itself and good 2. Moreover, the real wage is exogenously determined and it consists of a given quantity of good 1. Hence, good 1 is a basic, while good 2 is a non-basic. This economy can be represented by the following system:

(13) $$P_1 = P_1 a_{11}(1+r) + P_1 b_1 l_1$$

(14) $$P_2 = P_1 a_{12}(1+r) + P_1 b_1 l_2$$

As it is well-known, we can solve the system of equations above, assuming p_1 as the numeraire, and show that the normal rate of profit depends solely on the technical coefficient and the real wage. Suppose now that a tax is levied on the consumption of the non-basic (or 'luxury') good. Equation (14) above needs to be rewritten, which brings about equation (15) below. Distribution was not affected by the inclusion of a consumption tax on the luxury good. The only effect of taxation is the increase of the relative price of good 2 that increase at a rate t_s as shown in equation (16):

(15) $P_2{}' = P_1 a_{12}(1+r)(1+t_s) + P_1 b_1 l_2 (1+t_s)$

(16) $\frac{P_2{}'}{P_1} = \frac{P_2}{P_1}(1+t_s)$

If the relative price of good 2 did not rise at a rate t_s, then the rate of profit in this sector would fall. Consequently, capitalists would move their means of production from this sector to the other, and the production of 2 would fall. In the end, this would lead to an increase in the relative price of 2. Competition would then imply that the relative price of good 2 would increase at a rate t_s. The result above is changed if some 'luxury' goods are included in the real wage. The classical economists considered this hypothesis and argued that, in this situation, the consumption tax would reduce the normal rate of profit (Stirati, 1994, p. 72). Well, in that case, the good is no longer a 'luxury', and it shall be considered a basic good. Hence, a consumption tax levied on good 2, which is now part of the workers' consumption basket, will impact the normal rate of profit.

Following the classical tradition, we explored the taxation of basic and non-basic goods assuming a given real wage in this exercise. It is not difficult to show that if we relax the assumption of a fixed real wage, the real wage can also be impacted by the taxation of basic goods. However, it does not change the main result of this section: that taxing luxury goods (or non-basic goods) does not impact distribution.

2.4 Taxation and distribution I: the classical closures to the distribution theory

2.4.1 Taxation with a given real wage

So far, we only saw the reduction in total surplus expressed by a shift in the wage frontier. In order to examine how taxation is actually shared between wages and profits, we need to consider the different closures to distribution theory. In the Classical Political Economy, real wages are exogenously given and equal to a socially-determined subsistence level that enables workers to reproduce themselves (Levrero, 2018; Stirati, 1994). Hence, the real wage $\bar{b}$ becomes exogenous to our model, and it is determined outside the price equation. If we introduce a sales tax under the condition of a given real wage, we have:

(17) $P = Pa(1+r)(1+t_s) + P\bar{b}l(1+t_s)$

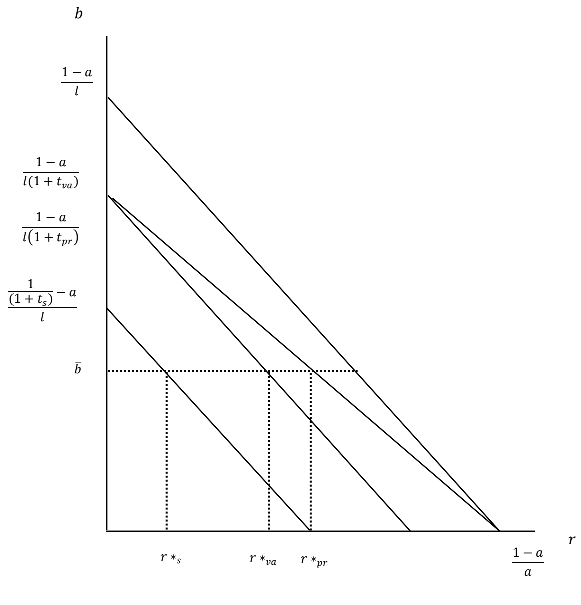
In this context, it is clear that the real incidence entirely relies on profits. If we replace $\bar{b}$ in the wage frontier, we have:

(18) $$r^*{}_s = \frac{\left(\frac{1}{(1+t_s)}\right) - \bar{b}l}{a} - 1$$

(19) $$\frac{\partial r^*{}_s}{\partial t_s} = -\frac{1}{a}\left\{\frac{1}{(1+t_s)^2}\right\} < 0$$

The profit rate after-tax $r^*{}_s$ becomes the endogenous variable that adjusts according to the size of the tax rate t_s and the exogenous real wage (equation (18)). Also, it is straightforward that the derivative of the rate of profit in relation to the nominal tax rate t_s is negative (equation (19)). Notice that the size of the reduction of the rate of profit also depends on each form of taxation. Figure 2.2 below shows that value-added and payroll taxes will be less harmful to profits than sales taxes whenever the real wage is fixed: $r^*{}_s < r^*{}_{va} < r^*{}_{pr}$[11].

Figure 2.2: The wage frontier with a given real wage



Source: the author.

From this very simple model, it becomes clear why any tax levied on the consumption of 'necessaires' necessarily reduces profits for classical economists, such as Smith and Ricardo.

[11] See the appendix for the equations with valued-added tax and payroll taxes.

Dome (1992) shows that in Ricardo's *Principles of Political Economy and Taxation* any increase in this type of tax will reduce the uniform rate of profit, since the other distributive variable (rent) is also given. The strong assumption behind this result relies on the fact that workers are considered to be able to increase their nominal wage according to inflation in each period, so the real wage is not reduced by the increase in prices after the introduction of the new tax. In this same context, this exercise shows that payroll taxes (or social security contributions paid by employers) may not reduce real wages, which opposes the Neoclassical interpretation of labor market taxation reducing real wages.

2.4.2 Taxation with a given real rate of profit

If the classical economists took the real wage as given in order to determine prices and distribution, Sraffa (Sraffa, 1960, p. 33) argues that the rate of profit could be taken as given in the price system and potentially determined by the monetary rate of interest. Pivetti (1991) suggests then that the exogenous distributive variable in the price system is the real rate of profit $\bar{r}$, which is determined by the targeted real rate of interest pursued by the Central Bank (Pivetti, 2007; Stirati, 2001). The price equation with a sales tax becomes:

(20) $$P = Pa(1+\bar{r})(1+t_s) + Pbl(1+t_s)$$

Under a fixed real rate of profit, the real incidence of taxation is on wages, since capitalists pass on to prices the proportional increase in costs of production. The real wage becomes endogenous to the exogenous rate of profit and nominal tax rate. We can therefore rewrite the wage frontier from equation (12) as:

(21) $$b^*{}_s = \frac{\left(\frac{1}{(1+t_s)}\right) - a(1+\bar{r})}{l}$$

The real wage $b^*{}_s$ becomes endogenous to the exogenous rate of profit $\bar{r}$ and the sales tax rate. The result of an increase in the tax rate is analogous to the previous case (see equation (22)). Moreover, the after-tax real wage will be relatively lower in the case of sales tax, value-added tax and payroll tax, respectively: $b^*{}_s < b^*{}_{va} < b^*{}_{pr}$ (see Figure 3). Note that the payroll tax renders the biggest real wage compared to the other forms of taxation.

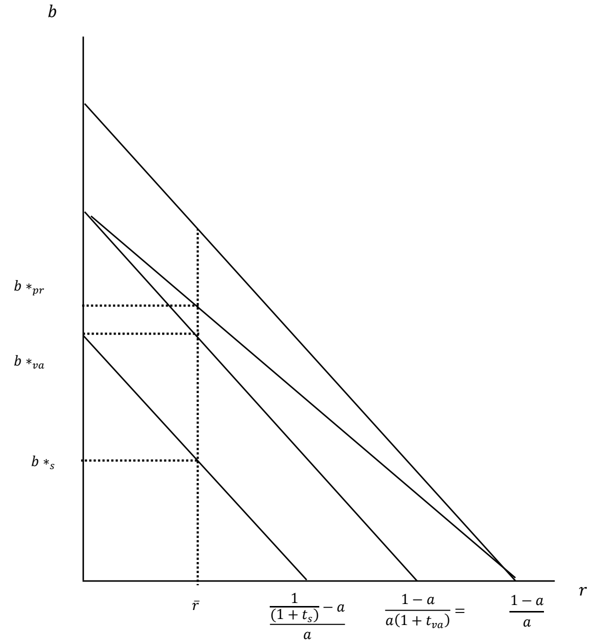
(22) $$\frac{\partial b^*{}_s}{\partial t_s} = -\frac{1}{a}\left\{\frac{1}{(1+t_s)^2}\right\} < 0$$

From a different perspective, but with similar results for our analysis of real tax incidence, Kalecki and some Kaleckians economists adopted a fixed real gross profit margin determined by the degree of monopoly of each sector (Kalecki, 1954[2003]; Lavoie, 2014, p. 172)[12]. The price equation based on the costs of production can be transformed in order to show that the gross profit margin depends positively on the real rate of profit and the technical coefficient a (Dutt, 1999, p. 103; Lavoie, 2014, p. 177). Therefore, a fixed real profit margin is equivalent to a fixed real rate of profit. In this context, Kalecki (1937) argues that taxes on wage goods are fully passed on to prices and cause a proportional decrease in real wages. The same results are obtained in some Kaleckian works on tax incidence (Laramie, 1991; Mott and Slatiery, 1994). As we saw in this case, the rate of profit remains constant, and the introduction of a tax on wage goods provokes a decrease in real wages.

Both classical economists and Kalecki were critical of imposing taxes on the consumption of wage goods for different reasons. Whereas the criticism in the classical economists was associated with the negative impact on the rate of profit (due to fixed real wages), in the case of Kalecki and Kaleckians, there is a negative impact on real wages (due to a fixed gross profit margin or real rate of profit). In Ricardo, the reduction in the rate of profit, because of the assumption of Say's Law, causes a decrease in the rate of accumulation. In Kalecki, the reduction in the real wage decreases the size of the multiplier and the level of output.

[12] It is worth noting that Kalecki (1971) and Rowthorn (1977) considered the possibility of wage rises depressing markups. For a more recent approach, see Blecker and Setterfield (2019).

Figure 2.3: The wage frontier with a given rate of profit



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2.5 Taxation and distribution II: introducing the conflict inflation model

2.5.1 The Sraffian conflict inflation framework and the aspiration gap

We saw that in the Classical authors, workers obtained their desired real wage even after taxes. This is due to the fact that the real wage is a socially-determined variable. Hence, the distributive conflict is limited to the social/institutional factors behind the so-called subsistence wage. In the case in which capitalists obtained a fixed real rate of profit even after taxes, being this rate determined by the real interest rates (Pivetti, 1991) or by the degree of monopoly (Kalecki, 1954; Lavoie, 2014, p. 172), the distributive conflict is focused on the monetary policy or the degree of competition in each industry.

However, a third situation may occur when neither capitalists nor workers obtain the same pre-tax income level once a new tax is introduced. Capitalists can pass on to prices the increase in costs due to taxation, but workers can also be able to bargain for nominal wage increases. If the claims over the surplus after taxes are incompatible, conflict inflation occurs. The resulting real wage and real rate of profit after taxes become endogenous to the conflict dynamics. To deal with conflict inflation, and specify the possibilities of tax incidence, we will draw on original conflict inflation models (Okishio, 1977; Rowthorn, 1977) to derive a simple framework of conflict inflation drawing on the Sraffian literature (Pivetti, 1991; Serrano, 1993, 2010; Stirati, 2001).

We first introduce two new price equations:

(23) $$P = Pa(1 + r_w)(1 + t_s) + Pb_w l(1 + t_s)$$

(24) $$P = Pa(1 + r_k)(1 + t_s) + Pb_k l(1 + t_s)$$

Equation (23) represents the price equation related to the workers' desired level of the real wage b_w and the real rate of profit r_w compatible with it. b_w can be considered as the socially accepted basket of goods for workers' consumption. Equation (24), in its turn, represents the capitalists' desired real rate of profit r_k and the real wage b_k compatible with it. r_k could be related to the monetary interest rate as in the Monetary Theory of Distribution (Pivetti, 1991). Conflict inflation exists when r_k and b_w are incompatible with the available surplus. This is equivalent to:

(25) $$a(1 + r_k)(1 + t_s) + b_w l(1 + t_s) > 1$$

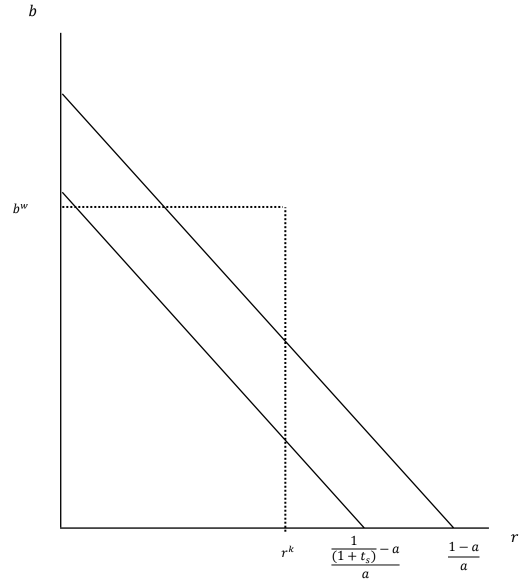
(26) $$ar_k + b_w l > 1 - a - t_s[a(1 + r_k) + b_w l]$$

(27) $$a(1 + r_k) + (1 - a(1 + r_w) > 1 - t_s[a(1 + r_k) + b_w l]$$

(28) $$b_w l + (1 - b_k l) > 1 - t_s[a(1 + r_k) + b_w l]$$

Equation (25) is analogous to the condition presented in Okishio (1977, p. 21), providing the initial condition of conflict inflation. Equation (26) shows that the available surplus after tax is incompatible with income claims. Equations (27) and (28) express this incompatibility in terms of the two desired rates of profits and the two desired real wages, respectively. The conditions in equations (25) and (26) are illustrated in figure 2.4 below.

Figure 2.4: The wage frontier with conflicting claims



Source: the author.

In the previous sections, the rate of profit was defined in terms of replacement costs, which correspond to the costs when the production is sold. In this case, distribution is assumed to have already been determined. However, once we consider conflicting claims in a monetary economy, we must discuss the relations between nominal wages, nominal rate of profits and prices[13]. In this context, competition implies that capitalists will have a uniform rate of profit based on their historical costs at the beginning of the production cycle ($t-1$), which may be not the same prices when production is sold (because of inflation). Since we are assuming that wages are only paid when the product is sold, the price equation becomes (from now on, the subscript -1 means one period lag):

(29) $$P = P_{-1}a(1+r_k)(1+t_s) + Wl(1+t_s)$$

The nominal wage in equation (29) is W. It is clear that in this equation r_k is equivalent to the nominal rate of profit, which corresponds to capitalists' targeted rate of profit at the beginning of the production cycle. Competition implies that any sum of capital invested in production must generate the same nominal rate of profit at the beginning of the production

[13] The implications of the differentiation between replacement and historical costs pricing was introduced in the heterodox literature by Harcourt (1959) and the Cambridge Economic Policy Group (Cripps and Godley, 1976; Meade, 1981; Tarling and Wilkinson, 1985). Later, this was taken up by some Sraffian, such as Pivetti (1991), Serrano (1993) and Stirati (2001).

cycle. In this sense, the nominal rate of profits is based on historical costs, and that is why the input price in equation (29) is P_{-1}. The real rate of profit will only be determined when the product is sold, and it will be determined by the nominal rate of profit reduced by the changes in primary costs and in the nominal wage that took place between the beginning and the end of the production cycle. So the real interest rate is defined in terms of replacement costs and the end of the production cycle[14]. The real wage, in its turn, will be determined by confronting the bargained variation in nominal wages and the final variation of prices.

In sum, both the real rate of profit and the real wage become endogenous variables. The different assumptions regarding wage and profit targets and their resistance to inflation will determine the after-tax distribution. We will now explore our framework considering that nominal wages change according to the distance between the targeted real wage and the actual real wage (the so-called aspiration gap). Later, we will introduce profit and wage resistance and present the more general version of our Sraffian conflict model.

2.5.2 The aspiration gap

In Okishio (1977) and Rowthorn (1977), workers increase their nominal wage in proportion to the gap between the desired basket of goods b_w and the actual real wage and it is the basis of the models of inflation based on the so-called aspiration gap (Lavoie, 2014, chap. 8). In terms of our model, (one plus) the rate of increase of nominal wages is given by:

(30) $$\frac{W}{W_{-1}} = \frac{b_w}{b_{-1}}$$

Where W_{-1} and b_{-1} are, respectively, the nominal and real wages observed in the previous period. According to equation (30), workers demand higher nominal wages whenever the observed real wage is below their target . We can rewrite equation (30) in order to obtain the expression for the nominal wage:

(31) $$W = b_w P_{-1}$$

14 See Bastos (2002, chap. 5) for a detailed discussion on nominal/real rate of profit and historical/replacement costs.

From equation (31) we grasp why Okishio considers that "labourers raise the money wage rate of the next period so as to procure their required real wage rate (…), using current prices as a basis of calculation (Okishio, 1977, p. 20)[15]". Replacing equation (31) in equation (29) leads us to:

$$(32) \qquad P = P_{-1}a(1+r_k)(1+t_s) + P_{-1}b_w l(1+t_s)$$

Dividing both sides of the equation by the price level of the previous period P_{-1}, we have:

$$(33) \qquad 1+\hat{p} = a(1+r_k)(1+t_s) + b_w l(1+t_s)$$

Because of the condition expressed in equation (25), equation (33) describes a constant rate of inflation caused by the incompatibility of claims over the after-tax surplus. Moreover, replacing equation (28) in (33) gives us:

$$(34) \qquad 1+\hat{p} = 1 + (b_w - b_k)l(1+t_s)$$

Hence, the rate of inflation is constant, and it is a positive function of the divergence between the claims over the surplus and the tax rate. Note that equation (34) is analogous to Lavoie (2014, p. 551) and Rowthorn (1977), the major difference being the inclusion of taxation.

To check the real tax incidence in this context, let's look at the equilibrium real wage and rate of profit after tax:

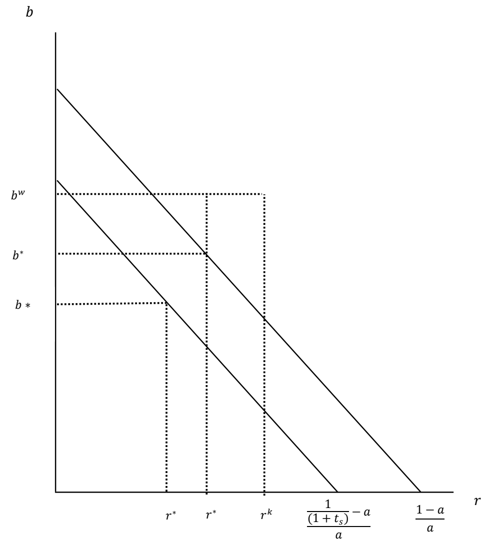
$$(35) \qquad b^* = \frac{P_{-1}b_w}{P} = \frac{b_w}{1+\hat{p}} = \frac{b_w}{1+(b_w-b_k)l(1+t_s)}$$

$$(36) \qquad 1+r^* = \frac{1+r_k}{1+\hat{p}} = \frac{1+r_k}{1+(b_w-b_k)l(1+t_s)}$$

[15] Okishio develops a multi-sector model and assumes that wage are paid in advance, but these assumptions do not change the main results we derived in this essay.

The resulting real wage after-tax b^* is below the desired workers' real wage b^w. Moreover, it is also a decreasing function of the tax rate t_s. The same occurs with the equilibrium real rate of profit r^*, which is below the targeted rate of profit r^k, and it is a decreasing function of the tax rate t_s. It is clear from the equations above that both capitalists and workers have a proportional reduction in their share of the surplus after-tax. Also, final distribution will only be compatible with the original claims over profits and wages without conflict and taxes. Figure 2.5 below illustrates our results for the aspiration gap in our model.

Figure 2.5: The Wage Frontier with conflicting claims (2)



Source: the author

2.5.3 Wage and profit resistance

The closure of the previous section, based on the work of Okishio (1977) and Rowthorn (1977), did not consider that capitalists and workers may resist to actual or expected inflation. According to Okishio (1977, p.21), '(…) it is difficult to make the fairly reasonable assumptions concerning the expectations of the classes (…)'. We agree with Okishio's concern in using expectations in his model. However, not considering the past inflation seems contradictory to the idea of bargaining a desired real wage (or a real rate of profit). As Lavoie (2014, p. 549-550) put out, past inflation is one of the critical issues in labor bargaining. Rudd (2022), for instance, shows that past inflation (and not inflation expectations) are important to explain recent US inflation. Also, if the nominal interest rates are considered a floor to the nominal rate of profit[16] even if other factors may also affect it, a monetary policy pursuing a targeted real interest rate can also introduce inflation indexation in the nominal rate of profit (Stirati, 2001). Hence, introducing inflation resistance, the nominal rate of profit and the nominal wage rate of growth will be given by:

(37) $$1 + n = (1 + r_k)(1 + x_k \widehat{p_{-1}})$$

(38) $$\frac{W}{W_{-1}} = \frac{(1 + x_w \widehat{p_{-1}}) b_w}{b_{-1}}$$

(39) $$W = P_{-1}(1 + x_w \widehat{p_{-1}}) b_w$$

For convenience, in equation (37) above, the nominal rate of profit is now n, being r^k the targeted nominal rate of profit and x_k the fraction of past inflation incorporated in the rate of profit. The variation of nominal wages, in equation (38), also includes a fraction x_w of past inflation[17]. Note that differently from the previous presentation of the aspiration gap without wage resistance, workers bargained variation in nominal wages now incorporates the observed change in prices. Rewriting equation (38) for the level of the current nominal wage gives us equation (39). We are able now to incorporate wage and profit resistances in our price equation simply replacing the nominal rate of profit and nominal wage given by equations (37) and (39) in equation (29):

(40) $$P = P_{-1} a (1 + r_k)(1 + x_k \widehat{p_{-1}})(1 + t_s) + P_{-1}(1 + x_w \widehat{p_{-1}}) b_w l (1 + t_s)$$

In order to obtain the rate of inflation, let's divide both sides of equation (40) by P_{-1}:

(41) $$1 + \hat{p} = a(1 + r_k)(1 + x_k \widehat{p_{-1}})(1 + t_s) + (1 + x_w \widehat{p_{-1}}) b_w l (1 + t_s)$$

The result is a first-order difference equation for the rate of inflation $\hat{p}$. The stability condition for the rate of inflation implies that:

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[16] For the discussion of the interest rate determining the nominal rate of profit, see Lucas (2021), Serrano (2010) and Stirati (2001).

[17] In a more complex model, x_k and x_w could be related to the relative frequency of wage and price adjustments (see references in note 13).

(42) $$x_k a(1+r_k) + x_w b_w l < \frac{1}{1+t_s}$$

If the condition presented in equation (42) does not hold, the conflict is too intense and there will be hyperinflation. Since the rate of inflation has a positive feedback through the rate of profit and wage resistance, equation (42), in economic terms, means that the condition for inflation not to be explosive is that the fraction of conflict inflation related to wage/profit resistance must be compatible with the available surplus net of taxes. We can illustrate this condition in the situation where the real rate of profit is fully indexed to past inflation ($x_k = 1$). In that case:

(43) $$x_w < \frac{\frac{1}{1+t_s} - a(1+r_k)}{b_w l} = \frac{b_k}{b_w}$$

Because capitalists succeed in restoring the value of their targeted rate of profit, the degree of wage resistance x_w needs to be lower than the ratio of conflict between the real wage compatible with the targeted rate of profit b_k and the workers' targeted real wage b_w.

Analogously, if wages are fully indexed ($x_w = 1$), the condition of stability implies:

(44) $$x_k < \frac{\frac{1}{1+t_s} - b_w l}{a(1+r_k)} = \frac{1+r_w}{1+r_k}$$

Now workers succeed in obtaining their targeted real wage, so the degree of the rate of profit resistance has to be lower than the ratio of conflict between the rate of profit compatible with this target and the capitalists' desired rate of profit. Note that, in line with Stirati (2001; 2018), if wages and profits are fully indexed ($x_w, x_k = 1$), the inflation rate will be explosive. Any divergence between distributive claims will cause accelerating inflation over time. Also, according to the condition expressed in equation (42), if x_k and x_w are high enough, explosive/accelerating inflation is possible even with no full indexation.

If the stability condition in equation (42) holds, from equation (41), we derive the equilibrium rate of inflation:

(45) $$\hat{p}^* = \frac{(1+t_s)[a(1+r_k) + b_w l] - 1}{1 - (1+t_s)[x_k a(1+r_k) + x_w b_w l]}$$

The equilibrium rate of inflation is a positive function of the targeted distributive variables and the degree of wage/rate of profit resistance as in the tradition of conflict inflation models (Lavoie, 2014, chap. 8). Also, inflation is positively related to taxation. However, differently from the previous section, because we assumed that past inflation is passed on to prices, the increase of inflation is more than proportional to the tax rate t_s.

Both after-tax real wage and the real rate of profit are endogenous and depend on the distributive parameters of the conflict inflation model. The equilibrium after-tax real wage is given by:

(46) $$b^* = \frac{P_{-1}(1+x_w\hat{p}^*)b_w}{P} = \frac{(1+x_w\hat{p}^*)b_w}{1+\hat{p}^*} = \frac{[(1-x_w)-(1+t_s)a(1+r_k)(x_k-x_w)]b_w}{(1+t_s)[a(1+r_k)(1-x_k)+b_w l(1-x_w)]}$$

One first observation b^* is lower than workers' desired real wage b_w because capitalists react to the increase in wages. As expected, $b^*$is an increasing function of the degree of wage resistance x_w and the targeted real wage b_w. However, the equilibrium real wage is a negative function of capitalists' desired rate of profit r_k and their degree of profit resistance x_k. Finally, the real wage is a decreasing function of the tax rate t_s. The derivative of b^* in relation to the tax rate is:

(47) $$\frac{\partial b^*}{\partial t_s} = \frac{b_w(x_w-1)}{(1+t_s)^2[a(1+r_k)(1-x_k)+b_w l(1-x_w)]} \leq 0$$

The derivative is always negative because the degree of wage resistance is equal or lower than unity. However, a higher degree of wage resistance dampens the negative impact of an increase in the tax rate on the real wage – the other result will be a higher equilibrium rate of inflation according to equation (45). It is interesting to explore what happens when $x_w = 1$. It is easy to check in equation (46) that the real wage is not affected by changes in the tax rate and it equals b_w. In this case, the result is the same of section 2.4.1, which is consistent with the Classical Political Economy approach for distribution. Through full incorporation of past inflation, workers succeed in obtaining their target b_w. Hence, taxation is fully shifted to capitalists. After an increase in the tax rate, for instance, although during a transitory period the real wage may be below b_w because of the initial increase in inflation, as inflation converges to its equilibrium level, the real wage converges to b_w. This means that no matter the partial degree of the rate of profit resistance, workers are able to obtain their desired real wage and taxation does not reduce their income.

Let us now check the real rate of profit:

(48) $$1 + r^* = \frac{(1+r_k)(1+x_k\hat{p}^*)}{1+\hat{p}^*} = \frac{[(1-x_k)-(1+t_s)b_w(x_w-x_k)](1+r_k)}{(1+t_s)[a(1+r_k)(1-x_k)+b_w l(1-x_w)]}$$

As expected, the impacts of the exogenous variables on the equilibrium rate of profit r^* are exactly the opposite of equation (46) for the real wage. The equilibrium rate of profit is an increasing function of its degree of resistance x_k and the desired rate of profit r_k, whereas it is a negative function of workers' wage resistance x_w and their targeted real wage b_w. Note that if wages are perfectly indexed to past inflation ($x_w = 1$), equation (48) becomes:

(49) $$1 + r^* = \frac{[1-(1+t_s)b_w]}{a(1+t_s)}$$

The result obtained in equation (49) is compatible with equation (18), which gave us the rate of profit consistent with workers' claims. Hence, in this case, $r^* = r_w$. However, if the rate of profit, instead of wage, is perfectly indexed to past inflation, $x_k = 1$, equations (46) and (49) tell us that $b^* = b_k$ and $r^* = r_k$. In this case, capitalists are able to keep their real rate of profit at their target no matter the tax rate or workers' wage resistance. Hence, we are back to an exogenous rate of profit as seen in section 2.4.2 of this essay.

When neither distributive variables are fully indexed to inflation, the derivative of r^* in relation to t_s is negative:

(50) $$\frac{\partial r^*}{\partial t_s} = \frac{(1+r_k)(x_k-1)}{(1+t_s)^2[a(1+r_k)(1-x_k)+b_w l(1-x_w)]} \leq 0$$

As in the case of wages, a higher degree of profit resistance softens the negative impact of an increase in the tax rate on the rate of profit.

In sum, our conflict inflation model allowed us to explore the alternative closures to the after-tax distribution. We saw that the extreme situations of full wage or profit resistance bring us back to the pure exogenous real wage or rate of profit, respectively, where the endogenous distributive variable completely absorbs taxation. Also, when wage and profit resistances to inflation are absent but incompatible claims over income are present, we arrive at Okishio (1977) and Rowthorn (1977) original model, which leads to a shared real taxation. Finally, when partial inflation resistance is present, both the real wage and the rate of profit become endogenous to the conflict model's exogenous parameters, that is, the degree of indexation and the targeted/bargained distributive variable. The size of each of these parameters determines who gets a higher after-tax income.

One important aspect not mentioned so far is the determination of these exogenous variables of this model, notably the distributive parameters such as r^k, b^w, x_w and x_k. We briefly mentioned the social subsistence wage (Levrero, 2018), the Kaleckian degree of monopoly (Kalecki, 1954[2003]) and the Monetary Theory of Distribution (Pivetti, 1991). However, other effects such as unemployment and other institutional aspects shall play a role in determining those variables[18]. Also, the form of taxation and the political context can also impact those variables. As argued by Rowthorn (1977, p. 220):

> 'In the case of higher taxes, however, the situation is less straightforward, as these are often accompanied by higher government expenditure, the benefits of which may partially compensate for the loss of disposable income caused by higher taxes. But this does not mean that these taxes will be passively accepted by workers or capitalists in the private sector. Government expenditure may be used for a variety of purposes, such as the armed forces, the social services and welfare payment to the aged, the sick and the poor; the willingness of capitalists and workers to support this kind of expenditure depends upon their evaluation of its social usefulness'.

In that context, the State can intervene in the after-tax distribution (and inflation) as in Cesaratto (2008), who argues that through the provision of 'social wage goods', such as free education/health, public infrastructure, or transport subsidies for workers, the State reduces the costs of workers' subsistence. In terms of our model, this translates into a smaller targeted real wage b^w. According to equation (48), this, in turn, tends to mitigate pressures on conflict inflation. Alternatively, those public investments can raise the economy's productivity, reducing the technical coefficients in equation (48), which increases the social surplus and reduces conflict inflation.

2.6 Taxation, distribution and effective demand under balanced budgets

2.6.1 Tax incidence and effective demand

[18] See Lucas (2021) and Serrano (2019) for a more in-depth discussion.

In the previous sections, we assumed a given level of output in order to explore the real tax incidence on wages and profits. Now, in order to discuss Haavelmo's (1945) results, we expand our model to explore the impact of taxation on the level of effective demand and output assuming a government's balanced budget. Our model builds on Eatwell's (1980) pioneering examination of taxation, distribution and effective demand. However, our model distinguishes itself from Eatwell's analysis in two important aspects. First, it explicitly considers two different forms of taxation, that is, income and goods taxation. Secondly, we consider that private capacity-generating investment (from now on only investment) is induced by demand, using the Sraffian supermultiplier model (Serrano et al., 2019), which is consistent with the approach to inflation and distribution explored in this paper. According to this model, investment is induced by demand, so any increase in public spending positively impacts productive investment through a flexible accelerator mechanism[19]. We try to add to the previous effort of Serrano and Pimentel (2019), who already expanded Haalvemo's results in the context of the Sraffian supermultiplier, and show the validity of both Haavelmo and Serrano and Pimentel results when we endogenize real tax incidence following our conflicting claims model.

Since we are assuming a balanced budget, we do not need to explore the dynamics of public debt nor the effects of public debt on distribution and effective demand. Note that the different forms of government financing, be it through taxation or debt issue, would have heterogeneous effects on distribution (Lerner, 1944, chap. 24). However, differently from Eatwell (1980), who was interested in finding the combinations of taxation depending on the full-employment target and distribution, in our model there is no such a target, and the tax rate is considered exogenous.

2.6.2 Tax incidence and effective demand: the case of a sales tax

In order to analyze aggregate demand, we need rewrite equation (3) in terms of quantities:

(51) $$X = [Xa(1 + r^*) + Xb^*l](1 + t_s)$$

[19] Note the investment is not affected by the rate of profit in opposition to the Kaleckian literature (Serrano and Freitas, 2017). One important consequence of this choice is that real taxation on profits will not impact investment differently from the case of Kalecki (1937)

In equation (51), X corresponds to gross output/income, whereas b^* and r^* depict the equilibrium real wage and rate of profit (after sales tax) given by equations (46) and (48), respectively. Reorganizing equation (51):

(52) $$X = aX + Xar^* + Xb^*l + t_s[Xa(1 + r) + Xbl]$$

So we can write the sales tax revenue in terms of output and the tax rate:

(53) $$T_{sales} = \frac{t_s}{1+t_s}X$$

Once we write the tax revenue in terms of gross output/income, it is easy to check that the tax revenue is a positive function of the tax rate but at a decreasing rate. The increase in tax revenues is counterbalanced by the reduction in the after-tax output. Gross output will be given then by:

(54) $$X = aX + Xar^* + Xb^*l + \frac{t_s}{1+t_s}X$$

Since we are incorporating income taxes in our model, wages and profits in equation (54) include income taxes. Hence, considering a closed economy, from the demand-side, gross output/income will be equal to:

(55) $$X = C + I + G$$

Where C corresponds to final consumption, I is equal to investment and G depicts government expenditures.

Consumption is determined by an autonomous component Z, by the propensities to consume out of wages c_w and profits c_π. However, the disposable income is defined in terms of net wages and profits, so the consumption function becomes:

(56) $$C = Z + [c_w b^* l(1 - t_w)X + c_\pi r^* a(1 - t_\pi)X]$$

Where t_w and t_π are income tax rates on wages and profits, respectively. Investment is induced by demand according to a flexible accelerator in which the capital stock adjusts to the expected growth of effective demand for a given capital-output ratio a (Serrano et al. (2017)). So the investment rate can be expressed as:

(57) $$I = a(1 + g^e)X$$

Where g^e corresponds to the expected growth of effective demand. Finally, as we are interested in assessing Haavelmo's insights on balanced-budget multipliers, government expenditures are equal to public revenue. Total taxation, in its turn, is the sum of income and sales taxes. So we have:

(58) $$G = T_{income} + T_{sales}$$

(59) $$G = \left[t_w b^* l + t_\pi r^* a + \frac{t_s}{1+t_s}\right] X$$

Replacing equations (56), (57) and (59) in equation (55), allows us to solve the system of equations for X:

(60) $$X = Z + \left\{[c_w + t_w(1 - c_w)]b^* l + [c_\pi + t_\pi(1 - c_\pi)]r^* a + a(1 + g^e) + \frac{t_s}{1+t_s}\right\} X$$

(61) $$X = \frac{Z}{1 - \left\{b^* l[c_w + t_w(1 - c_w)] + r^* a[c_\pi + t_\pi(1 - c_\pi)] + \left(\frac{t_s}{1+t_s}\right)\right\} - a(1 + g^e)}$$

The present model is made to show the effect of changes in taxation on the level of effective demand and output. We also assume that the economy is in its long-period position, and we assume that g^e is fixed, so only changes in distribution and taxation may cause variations in the supermultiplier[20]. Note also that since we assumed balanced budgets, government expenditures are induced, and the only autonomous expenditure in equation (61) is the component of private consumption Z. Hence, changes in taxation and, consequently, on government spending do not impact the long-run rate of growth of output, but it will impact the

[20] For the dynamic proprieties of the Sraffian supermultiplier, see Freitas and Serrano (2015).

(super)multiplier and have level effects: it will change the size of output and the productive capacity[21].

In equations (60) and (61), we followed Serrano and Pimentel (2019) and rearranged the consumption function considering the impact of direct taxation on wages and profits and the impact of government spending induced by taxation. So, it becomes clear that Haavelmo's results are independent of the size of the different propensities to consume, assuming a fixed tax incidence on distribution, because:

(62) $$t_w(1-c_w) > 0$$

(63) $$t_\pi(1-c_\pi) > 0$$

Equations (62) and (63) explicit that Haavelmo's results do not depend on the different sizes of the propensity to consume, but his results are determined by the fact that the propensity to consume of the government, which equals one, is always greater than the propensity to consume of workers and capitalists (Serrano and Pimentel, 2019). Also, it is clear that if workers have a higher propensity to consume, $c_w > c_\pi$, taxing profits will always be more expansionary under balanced budgets[22]. However, we need now to explore if these results still hold if we relax the assumption of exogenous real tax incidence. As we already argued, changes in 'indirect' taxation, which interfere with the normal costs of production, may have different results for distribution, according to the relative bargaining power of the two classes[23]. To explore the effect of expanding government expenditures with a balanced budget and endogenous real tax incidence, we must consider the impact of changes in t_s in the equilibrium real wage b^* and real rate of profit r^*. So, we replace equations (46) and (48) in (61), which gives us:

(64) $$X = \frac{Z}{1-\left\{\frac{[(1-x_w)-(1+t_s)a(1+r_k)(x_k-x_w)]b_w}{(1+t_s)[a(1+r_k)(1-x_k)+b_w l(1-x_w)]} l[c_w+t_w(1-c_w)] + \left\{\frac{[(1-x_k)-(1+t_s)b_w(x_w-x_k)](1+r_k)}{(1+t_s)[a(1+r_k)(1-x_k)+b_w l(1-x_w)]} - 1\right\} a[c_\pi+t_\pi(1-c_\pi)] + \left(\frac{t_s}{1+t_s}\right)\right\} - a(1+g^e)}$$

As equation (64) shows, the supermultiplier is endogenous to changes in distribution caused by changes in t_s or in the parameters of the distributive conflict x_w, x_k, b_w and r_k. Note,

[21] See Freitas and Serrano (2015) for the relation between changes in the supermultiplier and the level and rate of growth of output.

[22] Note that in a more general setting the indirect taxation of non-basic (luxury) goods would have a similar effect as a higher income tax rate on profits.

[23] Haavelmo (1945) considers a specific distribution function in order to assume that taxation will not interfere in distribution.

first, that according to equation (64), the supermultiplier with balanced budgets is always positive. Second, in order to obtain the net effect on the level of output of raising government spending by means of a raise in the sales tax rate, we take the derivative of X in relation to t_s:

(65) $$\frac{\partial X}{\partial t_s} = \frac{\mu^2 Z\{a(1+r_k)(1-x_k)[1-c_\pi-t_\pi(1-c_\pi)]+b_w l(1-x_w)[1-c_w-t_w(1-c_w)]\}}{[a(1+r_k)(1-x_k)+b_w l(1-x_w)]} \geq 0$$

For convenience, we wrote the supermultiplier as μ. The derivative in equation (65) is always greater or equal to zero because the Keynesian stability condition with income tax implies that $c_\pi + t_\pi(1 - c_\pi) < 1$ and $c_w + t_w(1 - c_w) < 1$[24]. In economic terms, the result above indicates that although the increase in the sales tax rate reduces both the after-tax real wage and rate of profit, it is expansionary because the propensity to consume of the government, which is equal to one, is greater than the average propensity of consume of workers and capitalists. This result, as we saw in the case of direct taxation, is independent of the size of the different propensities to consume and the real tax incidence – given that the distributive conflict is not explosive: $x_k \leq 1$ and $x_w \leq 1$. Therefore, independently of the income distribution after the raise in indirect taxation, the level of gross output (and income) is higher than before.

If, however, we adopt the Kaleckian assumption of a fixed real rate of profit based on a fixed markup ($x_k = 1$), the derivative above becomes:

(66) $$\frac{\partial X}{\partial t_s} = \frac{\mu^2 Z\{b_w l(1-x_w)[1-c_w-t_w(1-c_w)]\}}{[b_w l(1-x_w)]} \geq 0$$

In that case, an increase in the tax rate is totally absorbed by a reduction in the wage share net of taxes because capitalists succeed in passing on to prices the increase in the tax rate. Therefore, the increase in the tax rate causes an increase in output as long as workers' propensity to consume is below unity. If, as in Kalecki (1937), workers consume their entire income ($c_w = 1$), the derivative above equals zero, and Haalvemo's results are not valid anymore for an increase in the sales tax – which is the original result obtained by Kalecki (1937) a few years before Haavelmo (1945).

Now, if the wage resistance restores the purchasing power desired by workers, as in the Classical authors, the real wage becomes fixed ($x_w = 1$) and the derivative of equation (65) becomes:

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[24] Also, we have from the previous section that $x_k < 1$ and $x_w < 1$ otherwise inflation would be explosive.

$$(67) \qquad \frac{\partial X}{\partial t_s} = \frac{\mu^2 Z\{a(1+r_k)(1-x_k)[1-C_\pi - t_\pi(1-C_\pi)]\}}{[a(1+r_k)(1-x_k)]} \geq 0$$

Since it is implausible to assume a propensity to consume out of profits equal to one, it is clear that Haalvemo's results, in this case, are unequivocal. The fact that wage resistance transfers the fiscal burden to profits, which allows an increase in government spending, mitigates the negative impact on total consumption and increases output. Note that the introduction of effective demand changes the Classical skepticism, under Say's law, concerning consumption tax and its allegedly negative effect on accumulation.

Finally, we can explore what happens to the effect of taxation on gross output when the wage x_w and profit resistances vary x_k. In order to do that, we take a look at the second derivative of $\frac{dY}{dt_s}$ in relation to x_w and x_k:

$$(68) \qquad \frac{\partial^2 X}{\partial t_s \partial x_w} = \frac{\mu^2 Za(1+r_k)(1-x_k)b_w l\{[1-c_\pi - t_\pi(1-c_\pi)] - [1-c_w - t_w(1-c_w)]\}}{[a(1+r_k)(1-x_k)+b_w l(1-x_w)]^2}$$

$$(69) \qquad \frac{\partial^2 X}{\partial t_s \partial x_k} = \frac{\mu^2 Za(1+r_k)b_w l(1-x_w)\{[1-c_w - t_w(1-c_w)] - [1-c_\pi - t_\pi(1-c_\pi)]\}}{[a(1+r_k)(1-x_k)+b_w l(1-x_w)]^2}$$

The difference between $c_w - t_w(1 - c_w)$ and $c_\pi - t_\pi(1 - c_\pi)$ defines which equation above is positive or negative. In the extreme case where $c_w = 1$, it is clear that equation (68) is always positive, whereas equation (69) is always negative. In economic terms, it means that because the propensity to consume out of wages is maximum, whenever the wage share is more 'resistant' to increases in the sales tax rate, protecting the wage share against the increase in taxation, the (positive) impact of t_s on output rises. When $c_w > c_\pi$, which tends to be a more realistic situation, equation (68) will be negative, and equation (69) positive, only when direct taxation over profits t_π is substantially higher than direct taxation on wages t_w. In other words, if direct taxation is sufficiently progressive ($t_\pi > t_w$) to offset the difference in the propensities to consume (so equation (69) becomes negative), more resistant wages against inflation make the raise in t_s less expansionary because it reduces more than proportionally the revenues out of direct taxation – and consequently government spending increases less than previously.

In sum, the difference in the propensities to consume and the real tax incidence do not overturn Haavelmo's results. However, the intensity of the expansion in gross output caused by an increase in the 'indirect' tax rate depends on the real tax incidence, which in our model is given by the parameters of the distributive conflict, the size of the propensities to consume and the size of the direct tax rates.

2.6.3 Tax incidence and effective demand: the case of a payroll tax

The relation of taxation, distribution and effective demand was explored in the previous sections using the case of sales tax. The use of a value-added tax does not change the insights we obtained above. However, the use of a payroll tax slightly changes the result regarding Haavelmo's theorems on balanced budgets.

As we already discussed, employees' payment of social security contributions does not affect the price equation. Thus, for us, changes in the social security contribution rate impact direct taxation over wages expressed by t_w in our model. Therefore, raising this rate necessarily reduces net wages. On the contrary, payroll taxes should be considered as a component of the normal costs of production, and its impact on wages (and output) is ambiguous. The payroll tax revenue in this case can be defined in terms of gross output as:

(70) $$T_{pr} = t_{pr} b^* l X$$

The revenue of 'indirect' taxation, in this case, depends on the wage share in gross income. Hence, total public revenue and government spending are given by:

(71) $$G = T_{income} + T_{pr}$$

(72) $$G = \left[t_w b^* l + t_\pi r^* a + t_{pr} b^* l\right] X$$

(73) $$G = \left[\left(t_w + t_{pr}\right) b^* l + t_\pi r^* a\right] X$$

Replacing the new equation (73) above in the system of equations (55) to (57), we can solve again for gross output:

(74) $$X = Z + \left\{\left[c_w + t_w(1 - c_w) + t_{pr}\right] b^* l + [c_\pi + t_\pi(1 - c_\pi)] r^* a + a(1 + g^e)\right\} X$$

(75) $$X = \frac{Z}{1 - \left\{b^* l\left[c_w + t_w(1 - c_w) + t_{pr}\right] + r^* a[c_\pi + t_\pi(1 - c_\pi)]\right\} - a(1 + g^e)}$$

The tax rate t_{pr} in the supermultiplier is now dependent on the size of the wage share $b^{*}l$. However, the wage share is endogenous to the real tax incidence. So, again, we need to replace b^{*} and r^{*} by the equations that give the equilibrium after-tax variables. In the case of payroll taxes, b^{*} and $r^{*}$are presented in the appendix by equations (104) and (105), which leads us to:

(76) $$X = \frac{Z}{1-\left\{\frac{b^{w}[(1-x_{w})-a(1+r^{k})(x_{k}-x_{w})]}{a(1+r^{k})(1-x_{k})+b^{w}l(1+t_{pr})(1-x_{w})}l[c_{w}+t_{w}(1-c_{w})+t_{pr}]+\left\{\frac{(1+r^{k})[(1-x_{k})-b^{w}l(1+t_{pr})(x_{w}-x_{k})]}{a(1+r^{k})(1-x_{k})+b^{w}l(1+t_{pr})(1-x_{w})}-1\right\}a[c_{\pi}+t_{\pi}(1-c_{\pi})]\right\}-a(1+g^{e})}$$

The derivative of X with respect to t_{pr} gives us the net effect of a raise in taxation:

(77) $$\frac{dY}{dt_{pr}} = \frac{\mu^{2}Zb^{*}l}{a(1+r_{k})(1-x_{k})+b_{w}l(1+t_{pr})(1-x_{w})}\{b_{w}(1-x_{w})[l-c_{w}-t_{w}(1-c_{w})-t_{pr}(1-l)]+(1+r_{k})(1-x_{k})[1-c_{\pi}-t_{\pi}(1-c_{\pi})]\}$$

The sign of the above derivative depends on the second term in brackets on the right-hand side of equation (77). Whereas we know that $1-c_{\pi}-t_{\pi}(1-c_{\pi})>0$, the result of the expression $l-c_{w}-t_{w}(1-c_{w})-t_{pr}(1-l)$ depends on the size of the technical relation between labor and gross output l of the dominant technology. The tax revenue depends on the weight of labor in the dominant technology, as shown by equation (70) above. Hence, Haavelmo's results, in the case of a payroll tax, are not unequivocal and it is dependent on the value of the technical labor coefficient. Hence, under balanced budgets, the increase in government spending financed by a raise in the payroll tax rate is expansionary whenever the labor coefficient l is sufficiently high in order to compensate for the reduction in consumption out of wages and the decrease in public revenue out of direct taxation.

Note that if nominal wages are fully indexed to inflation, that is $x_{w}=1$, the derivative of equation (77) is always positive. In economic terms, it means that when a payroll tax is raised, but the wage resistance avoids a reduction in the after-tax wage and in workers' consumption, the Haavelmo's results apply. This is an analogous result also obtained by Barba (2006), who shows that if the real wage is fixed (in our case $x_{w}=1$), then an increase in social security contributions in order to finance pensions is expansionary. In this regard, the usual argument in favor of cutting payroll taxes to promote more private investment and growth does not hold[25].

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[25] See OECD (2011) as an example of this literature.

2.7 Final remarks

Our paper tried to deal with Theorems I and III of Haavelmo (1945) relaxing the condition that taxation does not interfere in distribution. From a Sraffian standpoint, real tax incidence depends ultimately on the conditions of distributive conflict, in particular the degree profit and wage resistance. On the one hand, the Classical Political Economy view on taxation, as we argued, was represented in our model by a full wage resistance. Hence, any increase in goods taxation would be ultimately paid capitalists. On the other hand, Kalecki (1937), Pivetti (1991) and some Kaleckians can be united in assuming a full profit resistance. In this case, the taxation of wage goods would be ultimately paid by a decrease in real wages.

Moreover, we argued that the Classical framework of real tax incidence can be compatible with either Say's Law or effective demand. We adopted the supermultiplier approach to the level of effective demand and gross output in order to examine the expansionary nature of balanced budgets. In particular, we showed that, in this situation, Haavelmo's conclusion holds even when we endogeneize the real tax incidence in the case of sales tax (independently of the distribution of the real taxation).

This paper is a contribution to a different perspective on the assessment of taxation. From a Sraffian standpoint, first, real tax incidence should be studied through the analysis of the distributive conflict between wages and profits. Secondly, the implications of real tax incidence to output reflect the chosen theory of output and accumulation, which in our case is the Sraffian supermultiplier. Finally, both tax and fiscal regimes are also important to understand the consequences of real tax incidence to effective demand. In addition to the distributive conflict between wages and profits, the conflicts in the heart of the State that affects the forms of taxation and fiscal policy are crucial to the understanding of the interaction of taxation and output. These two conflicts should be seen as the real constraint to the goals of public finance.

Appendix: taxation and distribution with value-added and payroll taxes

Value-added tax

a) A given real wage

The endogenous rate of profit with a fixed real wage $\bar{b}$

(78) $$r^* = \frac{\left(\frac{1}{(1+t_{va})}\right) - \bar{b}l}{a} - \frac{1}{(1+t_{va})}$$

b) A given rate of profit

The endogenous real wage with a fixed rate of profit $\bar{r}$:

(79) $$b^* = \frac{\frac{1}{(1+t_{va})} - a\left(\frac{1}{(1+t_{va})} + \bar{r}\right)}{l}$$

c) A given nominal wage

We need to rewrite the price equation as:

(80) $$P = P_{-1}a[1 + r_k(1 + t_{va})] + \bar{W}l(1 + t_{va})$$

The equilibrium price leve:

(81) $$P^* = \frac{\bar{W}l(1+t_{va})}{1 - a[1 + r_k(1+t_{va})]}$$

The equilibrium real wage:

(82) $$b^* = \frac{\frac{1}{(1+t_{va})} - a\left(\frac{1}{(1+t_{va})} + r_k\right)}{l}$$

The equilibrium rate of profit:

(83) $$r^* = r_k$$

d) A desired real wage

The equation for the price level now becomes:

(84) $$P = P_{-1}a[1 + r_k(1 + t_{va})] + P_{-1}b_w l(1 + t_{va})$$

The rate of inflation:

(85) $$1 + \hat{p} = a[1 + r_k(1 + t_{va})] + b_w l(1 + t_{va})$$

The equilibrium real wage:

(86) $$b^* = \frac{b^w}{a[1+r_k(1+t_{va})]+b_w l(1+t_{va})}$$

The equilibrium rate of profit:

(87) $$1 + r^* = \frac{1+r^k}{a[1+r_k(1+t_{va})]+b_w l(1+t_{va})}$$

e) Wages and profits inflation resistance

We rewrite equation for the price level as:

(88) $$P = P_{-1}a[1 + r_k(1 + t_{va})](1 + x_k\widehat{p_{-1}}) + P_{-1}(1 + x_w\widehat{p_{-1}})b_w l(1 + t_{va})$$

The equilibrium rate of inflation:

(89) $$\hat{p}^* = \frac{a[1+r_k(1+t_{va})]+b_w l(1+t_{va})-1}{1-\{x_k a[1+r_k(1+t_{va})]+x_w b_w l\}}$$

The equilibrium real wage:

(90) $$b^* = \frac{b^w\{(1-x)-a[1+r_k(1+t_{va})](x_k-x_w)\}}{a[1+r_k(1+t_{va})](1-x_k)+b_w l(1+t_{va})(1-x_w)}$$

The equilibrium rate of profit:

(91) $$1 + r^* = \frac{(1+r_k)[(1-x_k)-b_w l(1+t_{va})(x_w-x_k)]}{a[1+r_k(1+t_{va})](1-x_k)+b_w l(1+t_{va})(1-x_w)}$$

Payroll tax

a) A given real wage

The endogenous rate of profit with a fixed real wage $\bar{b}$

(92) $$r^* = \frac{1-\bar{b}l\frac{1}{(1+t_{pr})}}{a} - 1$$

b) A given rate of profit

The endogenous real wage with a fixed rate of profit $\bar{r}$:

(93) $$b^*_{ssc} = \frac{1-a(1+\bar{r})}{l(1+t_{pr})}$$

c) A given nominal wage

We need to rewrite the price equation:

(94) $$P = P_{-1}a(1 + r^k) + \bar{W}l(1 + t_{pr})$$

The equilibrium price leve:

(95) $$P^* = \frac{\bar{W}l(1+t_{pr})}{1-a(1+r_k)}$$

The equilibrium real wage:

(96) $$b^* = \frac{1-a(1+r_k)}{l(1+t_{pr})}$$

The equilibrium rate of profit:

(97) $$r^* = r_k$$

d) A desired real wage

Equation (26) now becomes:

(98) $$P = P_{-1}a(1 + r_k) + P_{-1}b_w l(1 + t_{pr})$$

The rate of inflation:

(99) $$1 + \hat{p} = a(1 + r_k) + b_w l(1 + t_{pr})$$

The equilibrium real wage:

(100) $$b^* = \frac{b_w}{a(1+r_k)+b_w l(1+t_{pr})}$$

The equilibrium rate of profit:

(101) $$1 + r^* = \frac{1+r_k}{a(1+r_k)+b_w l(1+t_{pr})}$$

e) Wages and profits inflation resistance

We rewrite equation (35) as:

(102) $$P = P_{-1}a(1 + r_k)(1 + x_k\widehat{p_{-1}}) + P_{-1}(1 + x_w\widehat{p_{-1}})b_w l(1 + t_{pr})$$

The equilibrium rate of inflation:

(103) $$\hat{p}^* = \frac{a(1+r_k)+b_w l(1+t_{pr})-1}{1-[x_k a(1+r_k)+x_w b_w l(1+t_{pr})]}$$

The equilibrium real wage:

(104) $$b^* = \frac{b^w[(1-x_w)-a(1+r_k)(x_k-x_w)]}{a(1+r_k)(1-x_k)+b_w l(1+t_{pr})(1-x_w)}$$

The equilibrium rate of profit:

(105) $$1+r^* = \frac{(1+r_k)[(1-x_k)-b_w l(1+t_{pr})(x_w-x_k)]}{a(1+r_k)(1-x_k)+b_w l(1+t_{pr})(1-x_w)}$$

3 EXOGENOUS INTEREST RATE AND EXCHANGE RATE DYNAMICS UNDER ELASTIC EXPECTATIONS

3.1 Introduction

Recent contributions to the heterodox literature on floating nominal exchange rates have established two important points. The first is that there is really no 'fundamental' or equilibrium level of the nominal exchange rate toward which it tends, being ultimately an institutional or conventional variable. Vernengo (2001) suggested that more or less sustainable levels of the exchange rate are of a 'conventional' nature and much influenced by policy choices, in contrast with the 'natural' equilibrium exchange rate determined by the Purchasing Power Parity (PPP) condition. Given this, the second point is that expected exchange rates are always an important determinant of both the spot and forward exchange rates. Harvey (2009, 2019) developed a Post Keynesian portfolio approach to exchange rate determination. His approach strongly emphasizes 'FX market psychology', and that exchange rate expectations are open to multiple determinants, depending on agents' mental models.

This paper aims to contribute to a third related line of research concerning the implications of different assumptions on the formation of exchange rate expectations. Lavoie and Daigle (2011) have shown the consequences for exchange rate dynamics of the predominance of either 'chartist' or 'conventionalist' behavior in the FX market. Our purpose here is to introduce elastic exchange rate expectations in the sense of Hicks (1946, pp. 270–272), by assuming that agents always revise their expectations to a certain extent in light of what has actually happened. We do this by means of a simple theoretical framework for the short-run[1] dynamics of nominal exchange rates under exogenous interest rates and free but imperfect international capital markets, extending the critique of the Mundell-Fleming model in Serrano and Summa (2015), by assuming that agents follow a simple rule of adaptive expectations. We show this is sufficient to demonstrate that elastic expectations lead to changes in the exchange rate, and that these tend to be cumulative.

We also derive some implications for monetary policy and exchange market interventions of this intrinsic instability. We think that our results may be useful both to account for certain alleged 'puzzles' found in the literature on the 'Unconvered Interest Parity (UIP)

[1] The long-run dynamics associated to the balance of payments constraint, such as Thirlwall's law is not treated in this paper. For the discussion on these topics, see Bhering et al. (2019), Blecker and Setterfield (2019, chap. 8 ,9 and 10) and Lavoie (2014, chap. 7).

failure' and also help to explain the empirical predominance of dirty floating regimes (Calvo and Reinhart, 2002; Frankel, 2019).

After this introduction, our general equation for nominal exchange rate determination in the foreign exchange market is presented in section 3.2. In section 3.3, we use it to derive and briefly criticize both the Real and the Uncovered Interest Parity conditions. Following this, in section 3.4 we introduce elastic exchange rate expectations and derive the associated alternative exchange rate dynamics under adaptive expectations. We then introduce a dirty floating exchange rate regime and derive some implications for monetary policy (in section 3.5). In section 3.6, we briefly discuss possible longer run aspects of our analysis. The relation between our simple model results and the empirical literature on the UIP 'failure' is then presented in section 3.7. Section 3.8 concludes the essay with brief final remarks.

3.2 A simple framework for the foreign exchange market

3.2.1 The spot FX market

The balance of payments BP_t consists of the current account CA_t, the total private capital flows F_t and the change in official reserves ΔR_t as shown in equation (1)[2]. The balance of payments represented in equation (1) always equals zero[3]. We also omit pure accounting transactions that do not involve the actual exchange of currencies, and therefore have no impact on the exchange rate. Both to simplify the analysis and because we are concerned only with the very short-run, we take the current account balance as exogenously given. The change in official reserves here refers to desired changes. The Central Bank may reduce or increase the quantity of foreign currency available in the spot market. In a "free" or 'clean' floating exchange rate regime, the change in reserves is zero.

In equation (2), we split the private capital flows into the long-run foreign capital flows ${F_{LR}}_t$, and the short-run capital flows ${F_{SR}}_t$, the latter is defined as all those that depend on interest-rate differential[4]. ${F_{LR}}_t$ is considered exogenous throughout the paper. In equation (3),

[2] As our purpose is purely theoretical, we are omitting the errors and omissions that occurs in the real-world data. Also, we are considering in equation (1) a net lending position in the Financial Account with a positive signal, which is different from the standard presentation of the net lending position with a minus signal by the International Monetary Fund (IMF). For a complete description of the balance of payments accounting see https://www.imf.org/external/pubs/ft/bop/2007/pdf/bpm6.pdf.

[3] This corresponds to what Lavoie (2014, chap. 7) calls the accounting balance of payments.

[4] It is worth noticing that the division between short-run and long-run flows we follow here is not equal to the accounting definition (which is rather arbitrary) commonly used in the official data of the balance of payments.

the short-run capital flows ${F_{SR}}_t$ are determined by the difference between the domestic interest rate i_t and foreign interest rate of reference ${i^*}_t$. We add up the spread associated with the country-risk ρ_t and the expected devaluation of the exchange rate[5] $\frac{E^e_{t+1}}{E_t}$ to the interest rate differential. The parameter γ represents how much capital flows respond to the interest-rate differential, the country-risk and the expected rate of change of the nominal exchange rate. The changes in agents' net financial positions, including changes in banks' holdings of foreign exchange, are included as part of the short-run flows in the spot foreign exchange market[6].

$$(1)\ BP_t = CA_t + F_t - \Delta R_t = 0$$

$$(2)\ F_t = {F_{LR}}_t + {F_{SR}}_t$$

$$(3)\ {F_{SR}}_t = \gamma\left(\frac{(1+i_t)}{(1+{i^*}_t)(1+\rho_t)\left(\frac{E^e_{t+1}}{E_t}\right)} - 1\right)$$

In equation (4), the spot exchange rate is the endogenous variable that will adjust to balance the demand and supply of foreign exchange.

$$(4)\ CA_t + {F_{LR}}_t + \gamma\left(\frac{(1+i_t)}{(1+{i^*}_t)(1+\rho_t)\left(\frac{E^e_{t+1}}{E_t}\right)} - 1\right) - \Delta R_t = 0,\ \gamma > 0$$

In equation (5), we express equation (4) in terms of the expected rate of change of the nominal exchange rate, while in equation (6) it is expressed in terms of the level of the nominal exchange rate.

Hence, a part of foreign direct investment (FDI) inflows, which are commonly defined as long-run flows, may be considered as short-run flows here when it is motivated by interest-rate differentials. ECLAC (2019) shows that almost one third of FDI in Latin America in 2018 consisted of intercompany loans. These transactions within firms seem to be explained by the low cost of borrowing (low interest rates) of the foreign affiliates in advanced economies. Therefore, in this paper, long-run capital flows investment are simply the ones not caused by interest-rate differentials.

5 The nominal exchange rate is defined as the value of one unit of foreign currency in terms of the domestic currency. So, an increase of the nominal exchange rate corresponds to the local currency depreciation in terms of the foreign currency of reference. Note that E^e_{t+1} means the exchange rate that agents expect at the current period t to happen in period *t*+1.

6 For a comprehensive institutional description of FX markets, see (Harvey, 2009).

$$(5)\ \frac{E^e_{t+1}}{E_t} = \left(\frac{(1+i_t)}{(1+i^*{}_t)(1+\rho_t)}\right)\frac{1}{\left[1+\left(\frac{\Delta R_t - CA_t - F_{LR_t}}{\gamma}\right)\right]}$$

$$(6)\ E_t = \frac{E^e_{t+1}\left[1+\left(\frac{\Delta R_t - CA_t - F_{LR_t}}{\gamma}\right)\right]}{\left(\frac{(1+i_t)}{(1+i^*{}_t)(1+\rho_t)}\right)}$$

Therefore, the current level of the nominal exchange rate is determined by its expected value, the return differential between foreign and domestic assets, the degree of response of short-run capital flows to this differential, the changes in official reserves, the net current account and the long-run capital flows balances.

3.2.2 The forward FX market[7]

According to Keynes (1923, pp. 94–95) spot and forward markets are tied through arbitrage because of the Covered Interest Parity (CIP) condition. The CIP expresses a non-arbitrage condition according to which the forward premium in the FX forward market must equal the interest differential, otherwise investors would obtain non-risky profits out of this difference. This non-arbitrage condition determines the necessary relation between the forward and spot nominal exchange rates but does not directly determine the levels of any of these two variables. This is shown in equation (7):

$$(7)\ E^f_t = E_t\left[\frac{(1+i_t)}{(1+i^*{}_t)(1+\rho_t)}\right]$$

The forward market is the market for exchange to be delivered in the future. Thus, the difference between the spot and the forward nominal exchange rates must be equal to the difference of interest rates in both currencies, reflecting the costs of borrowing in one currency and investing in the other and respecting the ‘no-arbitrage condition’. In other words, this is the

[7] There is a significant number of derivative markets for currencies. These derivative markets can be deliverable (forward markets) or non-deliverable (future markets), depending on local institutional arrangements. Because of arbitrage, forward or future market prices are always very close to each other. Brazil is a classic example of a deep non-deliverable futures market for dollars, whereas Mexico has a large forward market for dollars (BIS, 2015).

same thing as the Covered Interest Parity, which is largely verified in the empirical literature (Lavoie, 2014, chap. 7; Sarno, 2005)[8].

It is clear from this perspective that any change in the spot market must be immediately connected also to a proportional change in the forward market[9]. Hence, speculation does not occur by some mismatch between forward and spot rates. It occurs because someone wants to buy low to sell at a higher price at the subsequent period (or vice versa), and this depends only on current expectations about the actual exchange rate that will prevail in the future. According to Kindleberger: '(…) the forward contract in foreign exchange introduces no real change into foreign exchange theory (Kindleberger, 1939, p. 179)'.

Using this connection between forward and spot markets, we can easily also derive the equation that determines the level of the nominal forward exchange rate as shown in equation (8):

$$(8)\ E_t^f = E_{t+1}^e \left[1 + \left(\frac{\Delta R_t - CA_t - F_{LR_t}}{\gamma}\right)\right]$$

Therefore, the level of the forward nominal exchange rate is determined by the expected value of the spot exchange rate, the degree of response of short-run capital flows to this differential, the changes in official reserves, the net current account and the long-run capital flows balances.

We can see in equations (6) and (8) that both the spot and the forward exchange rate are influenced by the expected spot exchange rate. Speculation causes changes in E_{t+1}^e and impacts both markets at the same time. Note that in equation (8), the expected spot exchange rate is not, in general, equal to the forward exchange rate, because of the effect on the spot market of the variables representing the flows of foreign exchange coming through the net current account and capital flows[10]. Because of the CIP condition, the forward exchange rate is also affected by these flows. The forward exchange rate would be equal to the expected spot exchange rate only under the very unrealistic assumption of perfect and efficient international capital markets in

[8] According to Lavoie (2000, 2014, chap. 7), in mature markets, where big wholesale banks operate and there is no shortage of liquidity in currencies traded, banks receive orders from clients and engage in covered operations, passing this cost to their clients (which is equal to interest rate differentials between both currencies). This is what Lavoie calls the Cambist view.

[9] Otherwise, large 'arbitrage' profits would be made in foreign exchange markets.

[10] Note that contrary to Lavoie (2014, pp. 485–86), unless $\gamma = \infty$, the divergence between the expected spot exchange rate and the forward exchange rate does not necessarily determines directly the changes in the spot exchange rate.

which interest-rate differentials would always bring an infinite amount of capital. This can be seen in equation (8) by setting $\gamma = \infty$.

The fact that the forward exchange rate does not directly determine the level of the spot exchange rate does not mean that existence of forward markets has no effect on the determination of the spot exchange rate. According to Kindleberger the real contribution the forward market makes is: '(…) in providing inexpensive opportunities for hedging and speculation or the real character of the forward contract (Kindleberger, 1939, p. 181)'.

We can represent this effect of forward markets in the exchange rate dynamics through the parameter γ, which measures the sensitivity of short-run foreign investment to the interest-rate differential. The existence of large forward markets would tend to lead to higher levels of γ, both for short-run capital inflows at outflows.

3.2.3 Exchange rate expectations

In what regards exchange rate expectations, it can be either inelastic or elastic in the sense of Hicks (1946, pp. 270-272). Inelastic expectations are independent of past observations of the exchange rate and could be determined by market conventions, inflation expectations, etc. By contrast, elastic expectations are influenced by past observations of the actual exchange rate. In this paper, we will represent these different assumptions by means of a simple equation of adaptive expectations as shown in equation (9) [11].

(9) $E_{t+1}^{e} = E_{t}^{e} + \beta(E_{t-1} - E_{t}^{e})$, where $0 \leq \beta \leq 1$

If the parameter β equals zero, then expectations are inelastic. If β equals one, then expectations follow the naïve version of adaptive expectations. If β is in the interval between zero and one, then expectations are elastic, but may also be affected by exogenous shocks. In this case, the initially expected level of the exchange rate is exogenous but the point is that this will be revised to a certain extent according to the actually observed values[12].

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[11] Note that in equation (9) we are assuming that agents in period t form expectations about the exchange rate in period $t + 1$ based on information available to them up to period $t - 1$.

[12] In this framework, multiple exogenous shocks to expectations can be represented by simply replacing the initial condition for a new one.

3.3 Exchange rate determination under inelastic expectations

3.3.1 The Neoclassical approach

In perfect international capital markets, there is free capital mobility and also there are no credit constraints, and an infinite amount of capital is always instantly available at an interest rate slightly above the international rate of reference.

In our model, the assumption of perfect international capital markets is represented by an infinite speed of adjustment of short-run capital flows in response to interest-rate differentials (Gandolfo, 2016, p. 60). In equation (5), the parameter γ will be infinite, and the second term on the right-hand will tend to one. It also implies that the sovereign risk ρ_t equals zero.

Combining the assumptions of perfect capital markets and of inelastic exchange rate expectations $\beta = 0$, we can rewrite equation (5) as:

$$\text{(10)} \qquad \frac{E_{t+1}^{e}}{E_t} = \frac{(1+i_t)}{(1+i^*{}_t)}$$

Equation (10) is the traditional equation associated with the UIP condition. Perfect capital markets and inelastic expectations imply that the interest rate differential must coincide with the expected currency devaluation. Considering that the Central Bank exogenously determines the nominal interest rate, and the expected level of the nominal exchange rate is given, equation (10) determines the level of the current spot exchange rate (Blanchard, 2017, chap. 19)[13]. Therefore, starting from an equilibrium situation, an increase (decrease) of the interest-rate differential causes an initial appreciation (depreciation) of the level of the spot exchange rate. Since the expected level of the exchange rate is not affected, this appreciation (depreciation) of the spot rate creates an expectation of a future depreciation (appreciation), which is in line with the positive interest-rate differential according to the UIP. Hence, despite the shock caused by the change in the domestic interest rate, the level of the expected exchange rate does not change, but the level of the spot exchange rate adjusts to make the expected rate of change of the exchange rate equal to the interest-rate differential.

[13] If the money supply is taken as exogenous, the domestic nominal interest rate becomes endogenous. In that case, the expected **rate of change** of the nominal exchange rate is taken as exogenously given and the domestic nominal interest rate is determined by the foreign interest rate plus the expected rate of change of the exchange rate. For a critique of these versions, see Lavoie (2000).

In the Neoclassical approach, because of the assumption of the neutrality of money, in the long-run this expected rate of change of the nominal exchange rate is further assumed to be equal to the differential of domestic p_t and foreign p_t^* rates of inflation. These assumptions guarantee both the PPP and Real Interest Parity conditions[14].

$$(11) \qquad \frac{1+p_t}{1+p_t^*} = \frac{1+i_t}{1+i^*_t}$$

$$(12) \qquad \frac{1+i^*_t}{1+p_t^*} = \frac{1+i_t}{1+p_t}$$

3.3.2 The heterodox approach

From a heterodox perspective, there is no assumption of long-run neutrality of money and hence no tendency to the PPP condition. In the latter case, however, the fact that changes in the nominal exchange rate have a strong effect on the rates of inflation in many countries may give the impression that PPP tends to prevail in the long-run but in fact this is not the case, as the causality runs from the exchange rate to cost-push inflation and not the other way around (Vernengo, 2001).

In this heterodox perspective, even with free mobility of capital, the international capital markets are seen as imperfect and external credit rationing is an important determinant of the balance of payments constraint (Lavoie, 2014, chap. 7; Serrano and Summa, 2015). Therefore, without perfect capital markets, the response of capital flows to interest-rate differentials γ is not infinite (and may well fall to zero as we will see in the next section). In this case, even when the expected nominal exchange rate is assumed to be inelastic and determined by market conventions (Harvey, 2009; Lavoie and Daigle, 2011), there is no convergence to the UIP condition. Hence, the level of the nominal spot exchange rate is given by equation (6).

3.4 Exchange rate dynamics, elastic expectations and exogenous interest rate under imperfect capital markets

3.4.1 Imperfect capital markets and elastic exchange rate expectations

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[14] For a critique of these conditions, see Lavoie (2000) and Vernengo (2001).

In order to present a more realistic alternative model, we first assume free but imperfect capital markets in the sense of Serrano and Summa (2015). In this view, the degree of response of short-run capital flows to this differential γ is never infinite. Moreover, this parameter falls to zero in situations in which there is a 'sudden stop' or international credit rationing for capital inflows. In this situation, however, γ will remain positive and probably quite high for capital outflows. The nature of the response of short-run capital flows to interest-rate differentials will depend on the perception in international markets of the structural situation of the country's balance of payments. This will be reflected in the country's sovereign spread ρ_t, that for each country will depend both on the general conditions of international credit markets and on the specific market assessment of the specific country's actual risk of default on its foreign currency liabilities. As the actual balance of payments situation of a country worsens, the risk premium tends to increase and beyond a certain point, international credit will be severely rationed.

We must also drop the assumption of inelastic exchange rate expectations because it is too unrealistic to assume that expectations will never be revised to any extent in light of what actually happened. From now on, we will assume that exchange rate expectations are always to some extent elastic. In terms of our adaptive-expectations equation, this means that $\beta > 0$ in equation (9) above.

Elastic expectations have been formalized in terms of 'chartist' behavior of some agents, which simply project that the recent past change in actual exchange rates will continue in the future. Our approach differs from that in two aspects. First, we make expectations directly about the level of the exchange rate and not of its change. Second, in our formulation there is room for an initial exogenous level of the expected exchange rate, and it is this initial level that always will be at least partially revised according to what actually happened.

Lavoie and Daigle (2011) model exchange rate expectations assuming heterogenous agents. Some agents are called 'conventionalists' and have a conventional and inelastic expectation about a long-run level of the nominal exchange rate[15], while others follow a 'chartist' behavior. In contrast, in our model, agents are neither exclusively 'conventionalist' nor 'chartist'. Whenever they think there is some reason for the past to be very different from

[15] In Lavoie and Daigle's model it is assumed that the conventionalists '(…) stick to some exogenously given convention of the long-run exchange rate value, in the belief that the short-run expected exchange rate will tend to move towards this value' (Lavoie and Daigle, 2011, p. 441). Note this makes the revision of the short-run expected exchange rate move in the opposite direction of the actually realized spot exchange rate (see equation (7) in Lavoie and Daigle (2011, p. 441)) and therefore it is not a case of elastic expectations in our sense.

the future, they change the initial expected level of the exchange rate exogenously. However, they also will not keep holding those initial expectations unchanged over time if they perceive that they do not correspond to what happened in reality.

As it is well known (Gandolfo, 2005, pp. 29-31), adaptive expectations of this sort (equation 9), with β greater than zero and smaller than one, starting from any initial exogenous level, always converges to:

(13) $$E^e_{t+1} = E_{t-1}$$

The influence of any exogenous initially expected level of the exchange rate will tend over time to vanish as expectations are endogenously revised by actual outcomes.

By replacing equation (13) in (6), we get that the level of the spot exchange rate is given by:

(14) $$E_t = E_{t-1}\frac{\left[1+\left(\frac{\Delta R_t - CA_t - F_{LR\,t}}{\gamma}\right)\right]}{\left(\frac{(1+i_t)}{(1+i^*{}_t)(1+\rho_t)}\right)}$$

(15) $$\frac{E_t}{E_{t-1}} = \frac{1+\left(\frac{\Delta R_t - CA_t - F_{LR\,t}}{\gamma}\right)}{\left[\frac{(1+i_t)}{(1+i^*{}_t)(1+\rho_t)}\right]}$$

Equation (15) shows that in our model with elastic expectations, there is no equilibrium level of the nominal exchange rate but just a tendency toward a particular rate of change of the exchange rate. This rate of change will be *inversely* related to the interest-rate differential and to the net current account and long-run capital inflows. Moreover, discretionary purchases of reserves by the Central Bank are positively related to the rate of change of the exchange rate.

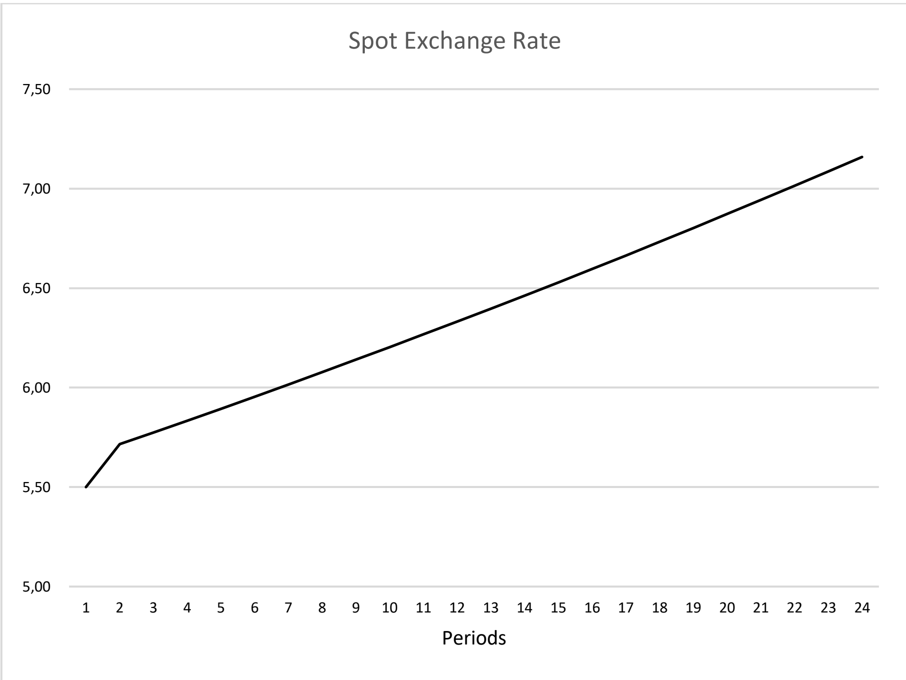
Of course, at any given time, there may be changes in any of the independent variables of equation (15), or in the exogenous initially expected level of the exchange rate that will make the actual rate of change of the exchange rate move away from its previous trend. However, what matters to us is that, after any exogenous shock, the spot exchange rate will be always tending back to the rate of change given by equation (15).

We can illustrate this tendency of the rate of change of the exchange rate by means of simple simulations. We do this by first replacing equation (9) into (6) and then giving values for all the parameters, namely, the initially expected level of the exchange rate and the other independent variables[16].

Let's consider a situation where the interest-rate differential (including risk) is zero, but the long-run inflows of capital are assumed not to be large enough to compensate a negative net current account, and the Central Bank does not intervene in the FX market (a free-floating regime). The following condition holds:

$$(16) \qquad \frac{1+\left(\frac{\Delta R_t - CA_t - F_{LR_t}}{\gamma}\right)}{\left[\frac{(1+i_t)}{(1+i^*{}_t)(1+\rho_t)}\right]} > 1$$

Figure 3.1: Simulated exchange rate devaluation process



Source: the author

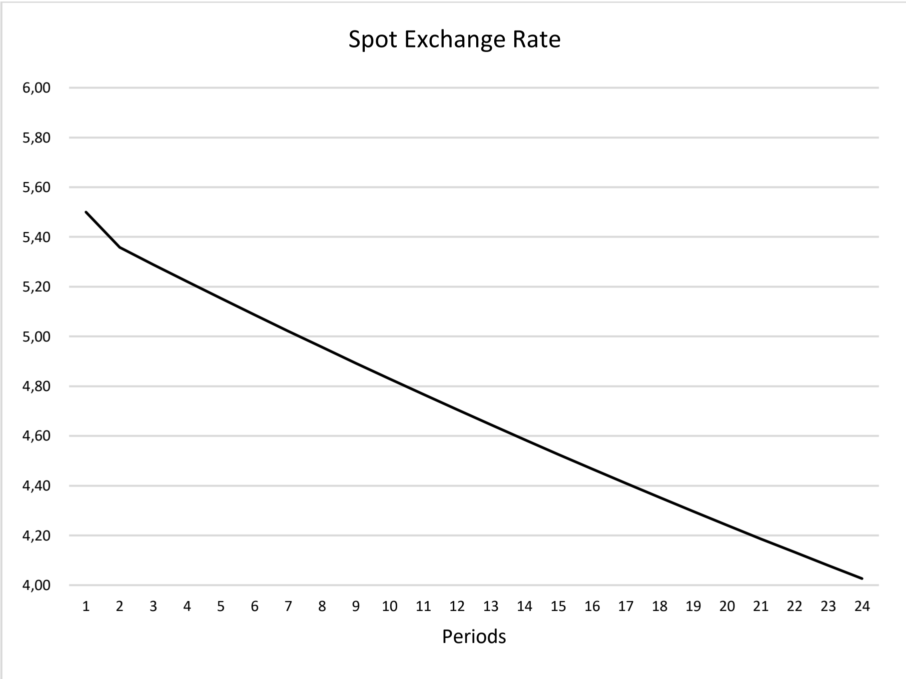
Figure 3.1 shows us that in this case, the level of the exchange rate tends to continuously depreciate over time at the rate described by equation (15). Next, we suppose a situation in which the current account deficit is still assumed to be, in absolute terms, larger than the long-run capital inflows. However, now we also assume a considerable positive

16 See the appendix for a description of the values given to the parameters and variables of our model in the simulations.

interest-differential (including risk) attracting short-run capital flows, such that the following condition holds:

(17) $$\frac{1+\left(\frac{\Delta R_t - CA_t - F_{LR_t}}{\gamma}\right)}{\left[\frac{(1+i_t)}{(1+i^*_t)(1+\rho_t)}\right]} < 1$$

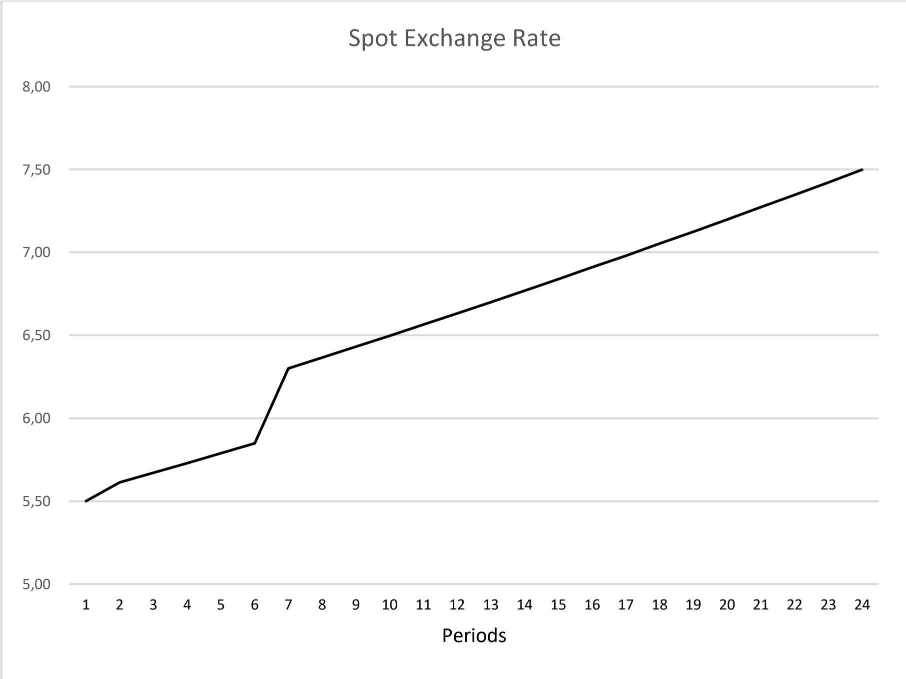
Figure 3.2: Simulated exchange rate appreciation process



Source: the author

Figure 3.2 shows a process of continuous appreciation of the exchange rate (again, there is no intervention in FX markets). Finally, we can return to our first simulation and condition (16) to show what happens if an exogenous shock in exchange rate expectations occurs. Suppose that a new, higher initially expected level of the exchange rate appears in period 6 because of an exogenous expectation shock. The result is shown in Figure 3.3. The shock causes a more rapid increase of the nominal exchange rate from period 7 on. However, the exchange rate returns later to its previous rate of depreciation as given by equation (15).

Figure 3.3: Simulated exchange rate devaluation process (with an exogenous shock on expectations)



Source: the author

Post Keynesian authors (Harvey, 2009) have argued that expectations in FX markets destabilize such markets. As imbalances in the FX markets give rise to changes in exchange rates rather than leading to an equilibrium level of this variable, our results show that in fact it is elastic exchange rate expectations that make free floating exchange rate regimes intrinsically unstable.

The ultimate cause of this basic instability is that, contrary to markets for produced goods, in the FX market there is no supply (or normal) price that would limit the cumulative effects of speculation (Kaldor, 1976). In the case of produced goods, a demand price much greater than the supply price will eventually lead to a large increase in their supply reducing the demand price. And a demand price lower than the supply price will tend to cause a large reduction in their supply causing the demand price to rise. Hence, exchange rate expectations have no objective anchor, apart from the policies and announcements of the Central Banks (when those are credible). In other words, there is no such a thing as a 'fundamental' level of the exchange rate, as the spot exchange rate only reflects the Central Bank's policy choices and the external constraints, both regarding trade and finance of each country (Vernengo, 2001).

3.5 Dirty floating exchange rate regime

3.5.1 Central Banks' interventions

Although we have shown that free floating regimes are intrinsically unstable, in the real world we do not observe such extreme instability in the FX markets. But this is actually the result of policy interventions of various types as in fact no country really has a completely free floating exchange rate regime, as shown in the 'fear of floating' literature (Calvo and Reinhart, 2002; Frankel, 2019; Steiner, 2017)[17].

Central banks try to limit the instability associated with free floating regimes by managing the exchange rate using various types of intervention. A frequent instrument used by Central Banks is spot FX market interventions: direct trading of international reserves in spot markets (Patel and Cavallino, 2019). Other intervention tools used are derivatives traded in forwards markets (Farhi, 2017). Also, Central Banks can set the domestic nominal interest rate to affect interest-rate differentials and short-run capital flows. Sometimes, instead of changes in the domestic interest rate, Central Banks introduce taxes on short-run capital inflows or outflows to affect the interest-rate differentials net of taxes.

3.5.2 Reserve interventions

One way of intervening in a dirty floating regime is when the Central Bank either announces or just acts to achieve a floor E^{min} or a ceiling E^{max} to the exchange rate to control the expected rate of change of the spot exchange rate. Given its target, the Central Bank will buy or sell the necessary quantity of international reserves to reach it.

When there is a strong tendency towards exchange rate appreciation, the Central Bank may set a floor $E_{min} \geq E^{e}_{t+1}$ to stop this process. In this case, the Central Bank must accumulate reserves until it completely stops the expected appreciation. In that case, it is reasonable to assume that the Central Bank can hit its target since it does it by accumulating reserves paying for them in its own currency. We can show this by modifying equation (6) to include the target floor E_{min} and solving for the necessary purchase of reserves:

[17] Note that the exchange rates of the US, even in periods in which it is following a policy of 'benign neglect', cannot be seen as a case of pure free-floating as the interventions of the Central Banks of the other countries do not allow this to occur.

(18) $$\Delta R_t = \gamma\left(\frac{(1+i_t)}{(1+i^*{}_t)(1+\rho_t)\left(\frac{E^e_{t+1}}{E_{min}}\right)} - 1\right) + CA_t + F_{LR}{}_t$$

Things become much more complicated when the Central Bank tries to target a ceiling when there is a tendency towards a continuous depreciation. In this case, $E_{max} < E^e_{t+1}$ and the Central Bank must sell the necessary quantity of international reserves to reach E_{max} as we see in equation (19) below:

(19) $$\Delta R_t = \gamma\left(\frac{(1+i_t)}{(1+i^*{}_t)(1+\rho_t)\left(\frac{E^e_{t+1}}{E_{max}}\right)} - 1\right) + CA_t + F_{LR}{}_t$$

However, since international reserves are finite and denominated in a currency that the Central Bank of this country cannot issue, its capacity to hit and maintain the exchange rate target will depend on the availability of potentially scarce international reserves. Moreover, the Central Bank's target may not be credible if the traders in the FX market have reasons to doubt the capacity of the Central Bank to sell enough reserves to stop the process of exchange rate depreciation. Speculative attacks may happen if agents perceive that the monetary authority will not be able to sustain the target, something which can accelerate the process of depleting international reserves.

Note that in our model any purchase or sale of international reserves will affect the level of the spot exchange rate according to equation (6). However, if this intervention is once for all, this effect will be temporary. Only if the Central Bank is prepared to buy or sell foreign exchange reserves in the amount given by equations (18) or (19) in each period the level of the spot exchange rate can be stabilized over time[18].

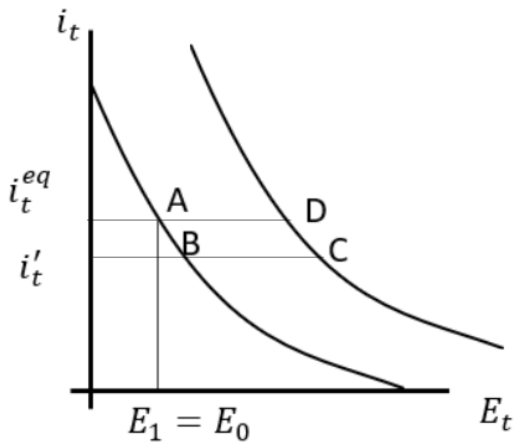
3.5.3 Dirty floating and monetary policy

[18] Interventions in forward FX markets may also occur (BIS, 2015). In this case, the Central Bank sells (or buys) long-positions in foreign currency to dampen the demand for foreign (or domestic) currency. When successful, the effect of this type of intervention could be represented in terms of a smaller γ while the intervention lasts.

Figure 3.4 expresses our model in interest-rate-level of the exchange rate plane. According to equation (15), the nominal interest rate i_t^{eq} that will stabilize the exchange rate at some level over time will be given by:

(20) $$i_t^{eq} = [(1 + i^*{}_t)(1 + \rho_t)] \left[\frac{1}{\gamma}\left(\Delta R_t - CA_t - F_{LR_t}\right)\right] - 1$$

Figure 3.4: Nominal Interest rate and the level of the spot exchange rate



Source: the author

This particular level of the nominal interest rate i_t^{eq} is determined by two sets of variables. The first set is defined by the sum of the international rate of reference and the country-risk. The second set corresponds to the desired change in international reserves (corresponding to Central Bank purchases) minus the sum of the current account and the flow of long-run capital flows. These variables are divided by the short-run capitals' sensitivity coefficient to the interest differential. If the Central Bank reduces the interest rate to i'_t, everything else remaining constant, the exchange rate will at first depreciate because the interest-rate differential is smaller, and the economy will move from point A to point B. However, because the expectations are elastic, the depreciation will continue through time, so our initial curve in Figure 4 will shift upwards, and the economy will move from point B to C. This process will continue if the interest rate remains below i_t^{eq}.

In order to interrupt this cumulative process of depreciation, the Central Bank has to raise the interest rate back to i_t^{eq}. In this case, the depreciation process will stop but the exchange rate will be at a more depreciated level compared to the initial position (point D). But if the Central Bank wants to restore the initial level of the exchange rate E_0, it will need to raise the interest rate above i_t^{eq} for a while, causing an appreciation and shifting back the curve to the left in Figure 3.4.

However, if the Central Bank wants to have a specific target for the level of the exchange rate, and at the same does not want to reduce its international reserves below a certain point, then it must set the domestic interest rate at the level that is necessary to generate an interest differential large enough to attract short-run international capitals and stop the process of depreciation. The domestic interest rate must be equivalent to:

$$(21) \qquad i_t = \left[(1 + i^*{}_t)(1 + \rho_t)\left(\frac{E_{t+1}^e}{E_t^{target}}\right)\right]\left[1 - \frac{1}{\gamma}\left(CA_t + F_{LR}{}_t\right)\right] - 1$$

Equation (21) shows the domestic interest compatible with the targeted level of the exchange rate E_t^{target} rate. The last point to notice is that this kind of policy of setting floors and ceilings can be dynamic in the sense that the Central Bank can change its policy objectives very often (for example, daily). So, in the process of exchange rate appreciation, the Central Bank can at the same time set floors each day and control the pace of exchange rate appreciation. It is entirely possible to the Central Bank by setting its nominal interest rate (and interest differentials) to accumulate reserves and appreciate domestic currency at the same time (as long as international conditions allow it). In other words, this is what has been called ‘systematic managed floating' regime (Frankel, 2019). Note in managed floating regimes policy tools such as interest rates, taxes, sale and purchases of reserves, forward market interventions and announcements may be used to different extents and in different combinations over time, such that the actual degree of appreciation or depreciation that will be observed in reality will depend both on external shocks and the economic policy objectives.

3.6 Beyond the short-run

The focus of this paper has been on the very short-run dynamics of the nominal exchange rate, under the provisional assumption that the balance of current account remains constant during the fast adjustment process of financial capital flows.

However, even in the very short-run, in which we can safely take the volume (quantities) of imports and exports as basically given, as the nominal exchange rate is changing all the time, the current account balance in foreign currency could only have been taken as given because we made two implicit special additional assumptions. The first is that the country under consideration is a price taker in all international markets for all goods and (non-factor) services it exports. The second is that all foreign liabilities of this country are effectively denominated and paid in foreign currency. Only under these assumptions both the balance of trade of goods and services and the net income to abroad can remain constant as the nominal exchange rate changes.

But these assumptions, while convenient, are a bit too extreme. It is true that for many developing countries that mostly export commodities, the bulk of their merchandise exports are sold in international markets whose international prices will certainly not change with changes in the nominal exchange rate of one specific exporting country. However, even this type of peripheral country exports a few differentiated products either in a few higher tech niches or typical traditional products of that country whose prices could in principle be seen as basically being set by their costs plus profit margins in domestic currency. Moreover, if we think of non-factor services exports, there are a number of services that are also priced basically in local currency, such as tourism (which is naturally very differentiated between regions). To the extent that the country in question exports such products (goods and services) we would have the traditional, so called 'initial', perverse J curve effect (Gandolfo, 2016, chap. 9). A devaluation of the local currency will immediately reduce the inflow of dollar exports.

In terms of our simple model, this effect would tend to accelerate the tendency towards continuous depreciation of the currency in the short-run. So, removing the simplifying assumption that the trade balance in goods and services in foreign currency remains constant would only strengthen our results.

Things however could be different when we look at the net income payments to abroad. If we assume the country in question is a net debtor in its own currency, i.e., it does not lend abroad in its own currency (or does very little) but does attract a lot of foreign capital to its domestic assets denominated in its own currency (public debt and stock markets, for instance), then we will have what we could call an 'inverted financial J curve' initial effect. In this case an exchange rate depreciation will immediately reduce the foreign currency value of net income payments abroad. And this effect will immediately decrease the foreign currency value of the current account. Therefore, in the case of a tendency towards depreciation, the more a country has effectively borrowed in its own currency the more the tendency towards continuous depreciation may be somewhat dampened. This curious effect seems to have not been widely noticed, but may be of some importance nowadays as the so called 'original sin' appears to have been reduced drastically for many 'emerging market' countries and many developing countries are now borrowing in their own currency (Akyüz, 2021). Note that we are not talking about the well-known effect that these exchange rate changes have on the stock of foreign net liabilities of the country, but on the current flows of payments arising from those liabilities.

When we try to move beyond the short-run and want to consider the possible longer run effects of changes of the exchange rate on the balance of trade of goods and services in our model, we do not have much to add to what is well known in the heterodox literature (Vernengo and Caldentey, 2020). These effects could easily be added to our framework by making export and import volumes being a lagged function of the real exchange rate and of the domestic and foreign levels of economic activity. The lags on the real exchange rate would naturally be much longer than the initial lag on nominal exchange rate expectations in our model. Whether the adjustment of the current account at given levels of local and world activity would counteract the results of our model when there is a tendency towards cumulative depreciation, for instance, would depend on two things. First, on the lasting effect of the nominal exchange rate on the real exchange rate, and second on the well-known Marshall-Lerner conditions, which may or may not hold. But there is also of course the much stronger and certain negative effect of a real devaluation on real wages. This effect reduces domestic consumption and the level of activity, and this reduction leads to a fall in imports, which in reality sadly tends to be the main 'automatic' adjusting variable of the balance of payments in many developing countries.

We can then see that beyond the short-run many different things may happen in a free-floating regime, some of which may increase even more the intrinsic exchange rate instability. And even in cases when these further effects tend to dampen the instability, these not only may take too long but also, and more importantly, may have a number of undesirable consequences on inflation, income distribution and activity levels. Therefore, we conclude first that considering these longer run effects would reinforce the need for a managed floating exchange rate regime. Moreover, from our analysis, it becomes clear that free floating exchange rate regimes will not automatically eliminate the balance of payments constraint. Hence, the problems related to the longer run external constraint with capital flows need to be addressed with the kind of analyses and policies that come from the structuralist heterodox literature of balance of payments constraint growth (Bhering et al., 2019; Thirlwall, 2019).

3.7 Empirical failure?

As it is well-known, the empirical Neoclassical literature on exchange rates have encountered serious difficulties that have been called ‘puzzles’ (Sarno, 2005). One puzzle was found by Meese and Rogoff (1983), who showed that a random-walk model outperforms a structural model (based on the ‘fundamentals’) in forecasting the level of the nominal exchange rate. For us this is not really a puzzle but a result of the fact that there is no long-run ‘fundamental’ equilibrium level of the exchange rate. Additionally, the fact that real exchange rates does not present mean reversion is in contradiction with the idea of a long-run tendency towards PPP (Sarno, 2005)[19].

Another ‘puzzle’ is the so-called ‘UIP failure’. According to the UIP condition, the expected rate of change of the nominal exchange rate should be positively correlated to the interest rate differentials. The empirical estimates usually make use of the ‘Fama regression’ (Fama, 1984), which we represent by equation (22). In this equation, the expected change of the nominal exchange rate is equal to the forward exchange rate premium plus an error term. Note that the forward exchange rate premium corresponds to the CIP condition. Since a non-arbitrage condition gives this parity, the difference between the forward exchange rate and the spot exchange rate is exactly equal to the interest rate differential. Therefore, the term in parenthesis is equivalent to the interest rate differential and equation (22) is analogous to our equation (10) in which we defined the UIP. Since the expected exchange rate is not an observable variable, one additional step is necessary to arrive at the proper ‘Fama regression’, that is the assumption of the Unbiased Efficiency Hypothesis (UEH). This assumption means that the expected exchange rate is made equal to the actually observed variable in the future (Lavoie, 2014, chap. 7). Equation (22) then becomes equation (23) which is equivalent to the one used for empirical estimations (Chin and Frankel, 2020; Fama, 1984; Sarno, 2005).

(22) $$\frac{E^e_{t+1}}{E_t} = \alpha + \theta\left(\frac{E^f_t}{E_t}\right) + \vartheta_{t+1}$$

[19] There is an endless controversy on this issue, with some stressing the low power of conventional statistical tests to reject the null hypothesis of a unit root or no cointegration between the nominal exchange rate and price indexes. In reaction to that, a discussion emerged about the most appropriate time span to apply unit root or cointegrations tests, about the proper price index to calculate the real exchange rate and the development of non-linear tests. In any case, Sarno (2005) emphasizes that even in the studies ‘proving’ that real exchange rates are mean reversing, persistent PPP deviations are found.

$$(23) \qquad \frac{E_{t+1}}{E_t} = \alpha + \theta\left(\frac{E_t^f}{E_t}\right) + \vartheta_{t+1}$$

For the UIP condition to hold, θ should be equal to one and α equal to zero. However, empirical estimates usually find a negative estimated θ parameter, which is also different from 1 (in absolute value), and a non-zero α. Poor empirical results are so recurrent that there is a specific name in literature for this phenomenon – the 'UIP failure'. To us, these results far from being a 'failure' are fully compatible with our model of exchange rate dynamics (equation (15)). The non-zero α probably represents the fact that with free but imperfect capital markets the interest rate differential is not the only determinant of changes in the exchange rate. This could also be reflected in a θ different from one in absolute terms that may also be capturing the effect of the country-risk[20]. The negative θ means that exchanges rates tend to appreciate (depreciate) when interest rate differentials are higher (lower), which is opposition to the UIP condition. However, this is precisely the sign that we would expect in our model with elastic exchange rate expectations.

Note that our view is also similar to what Frenkel and Taylor (2006, p.7)[21] called the 'speculative' view of exchange rates. A 'speculative' view means that the exchange rate will depreciate when the local interest rate decreases.

The direct consequence of the failure of both the PPP and UIP is the empirical rejection of a long-run equilibrium exchange rate defined by the 'fundamentals'. Exchange rates are volatile, unrelated to differences in prices, and interest rate differentials amplify (rather than mitigate) this volatility. Sarno (2005) calls this the 'disconnect puzzle'.

The empirical literature about carry-trade also confirms the 'UIP failure'. The simple fact that carry-trade operations in 'high-interest currencies' are often profitable implies that speculation against the UIP can be a profitable strategy (Brunnermeier et al., 2008). On the other hand, this is consistent with our model in which the exchange rate speculation is basically destabilizing, and appreciation or depreciation processes tend to be cumulative[22].

20 Many Neoclassical authors refer to the missing effect of the country-risk in their discussions about the 'UIP failure' (Chin and Frankel, 2020).

21 Unfortunately, the authors do not want to abandon the traditional interest parity conditions and make the unrealistic assumption of an endogenous domestic nominal interest rate. They explicitly say that the 'speculative' view: "(…) can be made consistent with the parity theorems if it is assumed that there is a relatively strong positive feedback of expected exchange rate increases into the domestic interest rate via the bond market equilibrium condition" (Frenkel and Taylor, 2006, p. 7).

22 BIS (2015) indicates that speculative carry trade operations are to a great extent realized nowadays through forward and futures markets ('derivative carry trade').

3.8 Final remarks

In this essay we developed a simple theoretical framework to analyze the short-run dynamics of nominal exchange rates under exogenous interest rates and free but imperfect international capital markets. In contrast with the Neoclassical models based on the UIP condition, we introduced elastic exchange rate expectations and showed that the level exchange rate is intrinsically unstable and do not tend to converge to a long-run equilibrium defined either by the Neoclassical 'fundamentals' or by heterodox 'conventions' in a free-floating regime. Note that the form in which we introduced elastic expectations in our model in terms of simple adaptive expectations is in principle consistent but does not require more complex assumptions about heterogenous agents.

Due to this intrinsic instability, Central Banks tend to adopt managed floating exchange rate regimes and intervene using various instruments to prevent cumulative processes and to keep the exchange rate oscillating within certain bounds, according to their general macroeconomic policy targets. In this regime, what frequently appears as pure market 'conventions' on expected exchange rates are in fact often reflecting to a certain extent the indications given by the Central Bank actions and announcements of where it wants the nominal exchange rate to go. When these actions and announcements are credible, something that depends on the more structural conditions of the balance of payments situation (including the stock of foreign exchange reserves), they can have a strong effect on market expectations, limiting the intrinsic market instability.

Appendix: simulation parameters

In all three scenarios simulated in section 4.4, we assumed:

Parameter/Variable	Value
γ	100,000
β	0.5
ΔR_t	0
KA_t	0
CA_t	-14,000
F_{LR_t}	12,000
i^*_t	2.0%
ρ_t	3.0%
E_0^e	5.5

Also, each simulation individually considered:

Simulation	Parameter/Variable	Value
1	i_t	5.0%
2	i_t	10.0%
3	i_t	5.0%
	E_6^e	6.50

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