



HAL
open science

Sraffa and the revenue of the owner of non- renewable natural resources: notes on a never- ending debate

Yoann Verger

► **To cite this version:**

Yoann Verger. Sraffa and the revenue of the owner of non- renewable natural resources: notes on a never- ending debate . 2017. hal-01596166

HAL Id: hal-01596166

<https://hal.science/hal-01596166>

Preprint submitted on 27 Sep 2017

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Sraffa and the revenue of the owner of non-renewable natural resources: notes on a never-ending debate

Yoann Verger

21/04/2017

Abstract

A rich literature exists about the way to handle non-renewable natural resources in the context of classical theory. This article sums up the different approaches that we could consider when we calculate the revenue of the owner of a non-renewable natural resource in a Sraffian framework. It clarifies the concepts of differential rent, depreciation of wasting assets, Hotelling rent, and rent as a share of the product, and links this last concept with some empirical facts about non-renewable natural resource extraction industries.

Key words: Sraffa, non-renewable natural resource, rent, Hotelling, extractive industry

JEL classification: B24, B51, Q31

Sraffa et le revenu du propriétaire d'une ressource naturelle non-renouvelable: notes sur un débat sans fin

Yoann Verger

21/04/2017

Résumé

Une riche littérature existe concernant la façon de considérer les ressources naturelles non-renouvelables dans la théorie classique. Cet article résume les différentes approches que nous pouvons considérer lorsque l'on calcule le revenu d'un propriétaire d'une ressource naturelle non-renouvelable dans un système Sraffien. Il clarifie les concepts de rente différentielle, dépréciation d'un actif décroissant, rente d'Hotelling, et rente comme partage du produit, et lie ce dernier concept avec quelques faits empiriques concernant les industries extrayant les ressources naturelles non-renouvelables.

Key words: Sraffa, ressource naturelle non-renouvelable, rente, Hotelling, industrie extractive

1 Introduction

From Parrinello (1983) [15] to Fratini (2016) [4], a seemingly never-ending debate runs in the Sraffian literature about the way to handle non-renewable natural resource in the context of classical theory. Sraffa scarcely talks about natural resources, and about the revenue that you can get by owning these resources, in his book. However, it is interesting to note that the three basic commodities that are introduced as an example of an industrial system, in chapter IV of his book are iron, coal, and wheat, i.e. three commodities that needs a direct exploitation of three natural resources to be produced: one renewable resource, land, for wheat, and two non-renewable resources, iron and coal deposits, for iron and coal.¹ Natural resources are presented by Sraffa as key components for the reproduction of the economic system, hence the question of their exhaustion appears truly important.

This article presents how the revenue of the owner of non-renewable natural resources is calculated in a Sraffian framework. The difference between renewable and non-renewable resources is actually not straightforward; and one can assume that there should be no difference in kind between the revenue of the owner of a renewable resource and the revenue of the owner of a non-renewable resource (section 2). However, natural resources that are non-renewable may be viewed as wasting assets, and the question of the depreciation of this asset arises (section 3 and 4). Finally, it appears from empirical facts that the revenue of the owner can be presented as a share of the net product of the company mandated for the extraction of the natural resource (section 5).

2 Differential rent

In chapter XI, Sraffa says that, if the natural resource is scarce, its owner can get a differential rent. The fact that the natural resource is scarce can only be seen by looking at the conditions of production (the equations of production). If one commodity is produced by two distinct processes that use a natural resource, then a differential rent will arise that may be earned by the owner of the natural resource. The two distinct processes may use different qualities of the natural resource, or they may use the same quality, but with different proportions of the means of production and labour. The first case gives rise to the extensive differential rent, the second case to the intensive differential rent.

Sraffa only presents an example with a renewable natural resource, land, but he says in the beginning of the chapter that the owner of a non-renewable natural resource can also earn this kind of revenue:

Natural resources which are used in production, such as land and mineral deposits, and which being in short supply enable their owners to obtain a rent, can be said to occupy among means of production a position equivalent to that of 'non-basics' among products. (Sraffa, 1960 [20], § 85).

Thus, starting with the example presented by Sraffa in his chapter IV, and then adding two processes in order to express the scarcity of the non-renewable natural resources only, we could get the following system:

¹He previously introduced the commodity "pig" in chapter one.

$$\begin{array}{rccccccc}
45 \text{ t. iron} & + & 60 \text{ t. coal} & + & 30 \text{ qr. wheat} & + & \frac{3}{32} \text{ labour} & \rightarrow & 85 \text{ t. iron} \\
45 \text{ t. iron} & + & 60 \text{ t. coal} & + & 30 \text{ qr. wheat} & + & \frac{3}{32} \text{ labour} & \rightarrow & 95 \text{ t. iron} \\
30 \text{ t. iron} & + & 95 \text{ t. coal} & + & 60 \text{ qr. wheat} & + & \frac{6}{32} \text{ labour} & \rightarrow & 225 \text{ t. coal} \\
20 \text{ t. iron} & + & 30 \text{ t. coal} & + & 90 \text{ qr. wheat} & + & \frac{4}{32} \text{ labour} & \rightarrow & 225 \text{ t. coal} \\
40 \text{ t. iron} & + & 40 \text{ t. coal} & + & 200 \text{ qr. wheat} & + & \frac{16}{32} \text{ labour} & \rightarrow & 480 \text{ qr. wheat} \\
\hline
180 & & 285 & & 410 & & 1 & & \text{Totals}
\end{array} \tag{1}$$

The case of the iron industry will lead to the rise of an extensive differential rent, as the technique of production is the same in both processes. The case of the coal industry will lead to the rise of an intensive differential rent, as the techniques of production are different in both processes. In both cases, the rent may be sized by the owner of the non-renewable resources, coal and iron deposits.

In order to calculate the rents, the price system may be written in this way (knowing that for the intensive rent, the process which is more productive per unit of natural resource should need more capital and labour per unit of output, otherwise the rent will be negative):

$$\begin{array}{l}
(45p_{iron} + 60p_{coal} + 30p_{wheat})(1 + \pi) + \frac{3}{32}w + \rho_{iron\ ore\ 1} = 85p_{iron} \\
(45p_{iron} + 60p_{coal} + 30p_{wheat})(1 + \pi) + \frac{3}{32}w + \rho_{iron\ ore\ 2} = 95p_{iron} \\
(30p_{iron} + 95p_{coal} + 90p_{wheat})(1 + \pi) + \frac{6}{32}w + \rho_{coal\ ore} = 225p_{coal} \\
(20p_{iron} + 30p_{coal} + 60p_{wheat})(1 + \pi) + \frac{4}{32}w + 30\rho_{coal\ ore} = 225p_{coal} \\
(40p_{iron} + 40p_{coal} + 200p_{wheat})(1 + \pi) + \frac{16}{32}w = 480p_{wheat}
\end{array} \tag{2}$$

As for the rent on iron ore, the first process appears to less profitable than the second one: thus the first process shall not earn a differential rent, i.e. $\rho_{iron\ ore\ 1} = 0$ (in this particular example, this can be asserted without knowing the prices, but in the general case, a comparison between the level of the different wages if the rate of profits is fixed from outside, or the different rates of profits if the wages are fixed from outside, will help to find the most profitable process).

3 Depreciation of wasting assets

Kurz and Salvadori (2015 [13]) report that Sraffa, in a draft of *Production of Commodities by Means of Commodities* from 1958, has considered to write a passage, at the end of Chapter XI on Land, § 91, on the fact that wasting assets such as mineral deposits should make allowance of depreciation in the same way than “live” capital such as machine. The draft is reported to be written in this way, the first paragraph being the part included in the book, and the second paragraph the passage finally deleted:

“Machines of an obsolete type which are still in use are similar to land in so far as they are employed as means of production, although not currently produced. The quasi-rent (if we may apply Marshall’s term in a more restricted sense than he gave it) which is received for those fixed capital items which, having been in active use in the past, have now been superseded but are worth employing for what they can get, is determined precisely in the same way as the rent on land. And like land such obsolete instruments have the properties of non-basics and are excluded from the composition of the Standard product. {...}

On the other hand, as in the case of other wasting assets (such as mineral deposits) the annual depletion must be taken into account, which gives rise to as many separate processes as are the years of the asset’s prospective residual life, on the same principle as was done in Chapter X for ‘live’ fixed capital.” (Kurz et al., 2015 [13], quotation from Sraffa, 1960 [20], § 91 and from unpublished Sraffa Papers, folder D3/12/96)

The principle of depreciating fixed capital is that, depending on the initial price, the expected life-span, and the decreasing productivity of the asset, an annual charge is paid for interest and depreciation

during all the expected life-span (instead of accounting the price of the fixed capital only for the year of the purchase). The method devised in Chapter X to calculate this annual charge is to consider that, at each period of production during the life-span of the asset, an older fixed capital is jointly produced, with a different price, and reused the next year. At the last period, nothing (or only scrap) is jointly produced. Thus a price appears for each dated fixed capital, and the subtraction of the price of the fixed capital jointly produced from the price of the fixed capital used during the period of production gives the annual charge to be paid to the producer of the fixed capital.

In order to know the initial price of a “live” capital, it is sufficient to know the means of production and labor required to produce this asset. One reason that could explain why Sraffa did not finally insert the above passage in his book is that, contrary to fixed capital, the initial price of wasting assets such as exhaustible resources deposits is not a straightforward concept, as such assets are not produced by any human industry. Gibson (1984) [5] suggests, however, that the discovery cost should be taken into account. For instance, if the owner of the natural resource has invested some means of production and labour to find the new mine, he can then sell the right to exploit the mine to an extracting company and the annual charge to be paid to him can be calculated on the same principle as for ‘live’ fixed capital.

4 The Hotelling rule

Another kind of revenue that frequently appears in the neo-Ricardian literature is also linked to the depreciation of the wasting asset: the Hotelling rent (Parrinello, 1983; Schefold, 1989; Kurz et al., 1997; Kurz et al., 2000; Kurz et al., 2001; Bidard et al., 2001; Bidard et al., 2001; Kurz et al., 2009; Kurz et al., 2011; Kurz et al., 2015) [15, 17, 10, 9, 8, 2, 1, 12, 11, 13]. The Hotelling rule states that, given long-term equilibrium conditions (i.e. equal rate of profits for all industries), the rentier sells units of his natural exhaustible resource at a price which increases at each period following the rate of profits, so that he can earn the uniform rate of profits of the economy on his “conservation” activity. I.e, if he decides during one period of production to sell nothing, the value of his stock of natural resource will increase at a rate equal to the ruling rate of profits from this period of production to the next one.²

On this regard, two points must be stressed. First, this kind of revenue is a logical consequence of the assumption that we consider a long-period equilibrium state of the economy, where it is not possible for an economic actor to earn less (or more) than the ruling rate of profits. Second, to calculate the price of the natural resource, and consequently the revenue of its owner at the present period of production, it is not enough to know the present conditions of production. A back-stop technology that will replace the existing wasting asset must be anticipated. At the period of exhaustion of the wasting asset, the revenue of its owner will equal the differential rent that will exist between the value of the commodities produced with the help of its natural resource, and the value of the commodities produced by the back-stop technology. The revenue of the owner of the natural resource at the present period can be known by going backward from the period of exhaustion, knowing the Hotelling rule (with y_t the price of the natural resource at period t and r the uniform rate of profits):

$$y_t = (1 + r) y_{t+1} \quad (3)$$

Then it is clear that to calculate this kind of revenue, a “photograph” of the market at one point of time is not enough. And it is clear that, if the uniform rate of profits is not assumed to be the equilibrium rate of profits of an economy in a long-term position, but rather a “conventional” uniform rate of profits,

²If he earns less than the ruling rate of profits on its conservation industry, he would have an incentive to change its activity and to sell everything in the present period of production. If he earns more than the rate of profits, he would have an incentive to sell nothing in present period of production. Thus, the Hotelling theory states that he must earn exactly the ruling rate of profits on its conservation activity so that the economy can be in an equilibrium state.

necessary only for the sake of Sraffa's argumentation (see for instance for such a point of view Hicks, 1985; Sinha, 2012, 2016 [6, 19, 18]), then the logic behind the Hotelling rule falls into pieces. These two points may explain why Sraffa did not introduce this kind of revenue into his book.

5 Rent as a share of the product

In a recent paper, Fratini (2016) [4] investigates rent as a share of the gross product. He shows how, in the Sraffian framework, this view of rent can help to better understand the institutions governing the distribution of the national product (in the line of Adam Smith, Ricardo and Marx), instead of only considering rent per unit of land. In his numerical examples, he does not relate the existence of the rent with the existence of a differential rent. Then the rent as a share of the gross product appears in Fratini as a tax (or a tithe) that could ensure a revenue to the owner of the natural resource even if no differential rent exists for the company extracting the natural resource.

In another paper, Ravagnani (2008) [16] shows that in the context of oil market in the United States of America, the revenue earned by the owner of the oil deposits was much more related to conventions and relations of power with the company that extracts the deposit than with consideration of the Hotelling rule:

“We therefore submit for discussion, as a constructive contribution to the current debate, the view that royalties on exhaustible resources could appropriately be encompassed within the logical structure of the classical theory of value and distribution as separately determined ‘independent variables’. The conventional arrangements based on percentage royalties could be accommodated with no difficulty in the normal positions defined by Sraffa's equations by taking the share of the resource price attributed to landowners as a ‘given’ coefficient reflecting the (persistent) share paid on average in the actual economy.” (Ravagnani, 2008) [16]

The study of empirical data (IMF, 2012 [7]) on the fiscal regimes imposed on extractive companies by governments owning exhaustible natural resources shows that parameters that determine the conventional arrangements on percentage royalties are: the expected differential rent, uncertainty (on prices, geology, input costs, change in fiscal or political regime, exhaustion of the resource), asymmetric information between the extractive company and the government, and monopolies (either on the extraction of the resource or on the ownership of the resource). Governments have then several possibilities to collect their share of the product. The different mechanisms listed in IMF (2012) [7] are: signature and production bonus, royalties (rent as a share of product value), corporate or variable income tax (tax on profits and differential rents), resource rent taxes (tax on differential rents only, i.e. income less the average rate of profits), production sharing (rent as a share of the physical product), state participation (rent received as dividends, as any shareholder), and social investments from the extractive company (the company pays the rent through the construction of a road or a school, for instance).

No matter the fiscal regime chosen by the government, the tax rate can be reduced to a share of the net product of the extractive industry, the latter being defined as the sum of the profits and the differential rent earned by the extractive industry. Simulation methods (FARI model, Luca and Puyo, 2016 [14]) and analysis of accounting data shows that the tax rate on the net product t is between 65 and 85 percent for oil and gas industries, and between 45 and 65 percent for other mining industries (IMF, 2012) [7].

The introduction of the share of the net product as a “given” coefficient change the price system. In the case of a private company that extracts a natural resource owned by a State, the net product may be shared between the State and the private company. If the sharing occurs after the product has been sold,

or if the company does not try to change prices once the tax is announced, the taxation of the net product has no impact on prices. The price system may be represented in this way, with t the tax rate on the net product:

$$\begin{aligned}
& 45p_{iron} + 60p_{coal} + 30p_{wheat} + \frac{3}{32}w + t_{iron1} (45p_{iron} + 60p_{coal} + 30p_{wheat}) \pi \\
& \quad + (1 - t_{iron ore 1}) (45p_{iron} + 60p_{coal} + 30p_{wheat}) \pi = 85p_{iron} \\
45p_{iron} + 60p_{coal} + 30p_{wheat} + \frac{3}{32}w + t_{iron2} [(45p_{iron} + 60p_{coal} + 30p_{wheat}) \pi + \rho_{iron ore 2}] \\
& \quad + (1 - t_{iron 2}) [(45p_{iron} + 60p_{coal} + 30p_{wheat}) \pi + \rho_{iron ore 2}] = 95p_{iron} \\
30p_{iron} + 95p_{coal} + 90p_{wheat} + \frac{6}{32}w + t_{coal1} [(30p_{iron} + 95p_{coal} + 90p_{wheat}) \pi + \rho_{coal ore}] \\
& \quad + (1 - t_{coal 1}) [(30p_{iron} + 95p_{coal} + 90p_{wheat}) \pi + \rho_{coal ore}] = 225p_{coal} \\
20p_{iron} + 30p_{coal} + 60p_{wheat} + \frac{4}{32}w + t_{coal2} [(20p_{iron} + 30p_{coal} + 60p_{wheat}) \pi + 30\rho_{coal ore}] \\
& \quad + (1 - t_{coal 2}) [(20p_{iron} + 30p_{coal} + 60p_{wheat}) \pi + 30\rho_{coal ore}] = 225p_{coal} \\
& \quad (40p_{iron} + 40p_{coal} + 200p_{wheat}) (1 + \pi) + \frac{16}{32}w = 480p_{wheat}
\end{aligned} \tag{4}$$

If the net product is taxed before the product is sold, or if the private company tries to avoid the effect of tax by increasing the prices (to see an example of this concerning a tax on profits, see Dome, 1992 [3]), prices could be impacted. The price system may be represented in this way:³

$$\begin{aligned}
& 45p_{iron} + 60p_{coal} + 30p_{wheat} + \frac{3}{32}w + \\
& \left(1 + \frac{t_{iron ore 1}}{1 - t_{iron ore 1}}\right) (45p_{iron} + 60p_{coal} + 30p_{wheat}) \pi = 85p_{iron} \\
& 45p_{iron} + 60p_{coal} + 30p_{wheat} + \frac{3}{32}w + \\
& \left(1 + \frac{t_{iron 2}}{1 - t_{iron 2}}\right) [(45p_{iron} + 60p_{coal} + 30p_{wheat}) \pi + \rho_{iron ore 2}] = 95p_{iron} \\
& 30p_{iron} + 95p_{coal} + 90p_{wheat} + \frac{6}{32}w + \\
& \left(1 + \frac{t_{coal 1}}{1 - t_{coal 1}}\right) [(30p_{iron} + 95p_{coal} + 90p_{wheat}) \pi + \rho_{coal ore}] = 225p_{coal} \\
& 20p_{iron} + 30p_{coal} + 60p_{wheat} + \frac{4}{32}w + \\
& \left(1 + \frac{t_{coal 2}}{1 - t_{coal 2}}\right) [(20p_{iron} + 30p_{coal} + 60p_{wheat}) \pi + 30\rho_{coal ore}] = 225p_{coal} \\
& (40p_{iron} + 40p_{coal} + 200p_{wheat}) (1 + \pi) + \frac{16}{32}w = 480p_{wheat}
\end{aligned} \tag{5}$$

It is interesting to notice that in the last system of equations, the differential rent is distributed entirely to the extractive company. As we are considering only basic commodities (for a definition of basic and non-basic commodity, see Sraffa, 1960 [20], § 60), as soon as the tax rate on the net product t of any company increases, all prices and rents will change and the maximum rate of profits will decrease. The case of the second iron company is an exception, as the increase of the tax will only lower the

³Only a part of what is effectively produced by the private company is brought to the market. Let us say that T is the share of the physical gross product that is taken by the government. The price of the non-renewable resource will then be of the following form, if the company tries to earn the uniform rate of profits π and to distribute the uniform wage w :

$$Kp_k (1 + \pi) + lw + \rho = Xp_x (1 - T)$$

With K the quantity of the input (assuming that there is only one input), X the quantity of the output (physical gross product), and ρ the (possible) differential rent. The net product being defined as the value of the gross product less the value of the input and the value of labour, the share of the net product that goes to the government is defined as:

$$t = \frac{TXp_x}{Kp_k\pi + \rho + TXp_x}$$

Then the price system can also be written in this way:

$$Kp_k (1 + \pi) + lw + \rho + \frac{t}{1 - t} (Kp_k\pi + \rho) = Xp_x$$

Or in this way:

$$Kp_k + lw + \left(1 + \frac{t}{1 - t}\right) (Kp_k\pi + \rho) = Xp_x$$

extensive differential rent earned by this company.⁴

6 Conclusion

This article clarifies the different concepts that we must consider when we calculate the revenue of the owner of a non-renewable natural resource in a Sraffian framework. For a snapshot point of view, what matter to calculate prices and revenues are the conditions of production of the commodities that needs a non-renewable natural resource to be produced, and the distribution of the net product of the companies that produced these commodities. From a dynamic point of view, what matters is the stocks of the natural resource, the evolution of demand and technologies, the possibility of back-stop technologies, and the change of the institutional framework that ensure the distribution of the net product. From a policy point of view, it is important to understand the real cost of production of the commodities that use non-renewable natural resources, so that taxes can be adequately designed depending on the policy chosen (either recovery of maximum revenue, or incentive for private prospecting and exploitation, or protection of the natural resource, etc.).

The debate about non-renewable resources in the context of classical theory largely focused on the Hotelling rule, and more specifically on how to calculate the Hotelling rent. Only recently another line of thought started to emerge, where the revenue of the owner of the natural resource depends on the institutions governing the relations between the owner of the natural resource and the company that extracts the natural resource (Ravagnani, 2008; Fratini, 2016 [16, 4]). A revenue above uniform profits exists for the extractive company as soon as there is differential rent, and this revenue may be seized by the owner of the natural resource. But empirical data show that in many cases a part of the differential rent is kept by the extractive company. Hence, from the point of view taken in section 5, there exists no “natural law” about who should earn the revenue coming from the extraction of a non-renewable resource, as well as there exists no “natural” regime property for such resources (they could be considered as a common good of humanity, or as a State property, a community property, etc.). This line of research, which could be linked with current heterodox approaches such as Institutional and Marxian, seems a promising way to continue this never-ending debate.

⁴It is important to notice that the real cost of production is not changed by the tax, only the distribution is changed. This point is touched upon by Sraffa in one of his unpublished papers:

“Pantaleoni, Saggi, I, 146 n.

(quoted by Jannaccone, 342 n)

Is real cost of production increased by ~~an increase in a~~ the imposition of a specific tax on product? Yes, says Pantaleoni: the cost per unit of wheat is increased in exactly the same way if 11 hours instead of 10 are required to produced it, or if, having the government taken 10% of the produce, 10 hours now produce only 9/10 of a unit. The reply to Pantaleoni is – is then the wheat obtained by the Government produced without cost?

Special case of taxes (tasse di Einaudi) which are levied by the State to defray cost incurred in order to contribute to the production of the commodity taxed (e.g. taxes on motor cars, affected to road fund, contribute to produce the services of motor cars).” (unpublished Sraffa Papers, folder D1/13: 6 (17); B.III.12.xxv)

References

- [1] Christian Bidard, Guido Erreygers: “Further reflections on the corn-guano model”, *Metroeconomica*, pp. 254-268, 2001.
- [2] Christian Bidard, Guido Erreygers: “The Corn-Guano Model”, *Metroeconomica*, pp. 243-253, 2001.
- [3] Takuo Dome: “Ricardo's theory of tax incidence: a Sraffian re-interpretation”, *Cambridge Journal of Economics*, pp. 43-53, 1992.
- [4] Saverio M. Fratini: “Rent as a share of product and Sraffa's price equations”, *Cambridge Journal of Economics*, pp. 599-613, 2016.
- [5] Bill Gibson: “Profit and Rent in a Classical Theory of Exhaustible and Renewable Resources”, *Journal of Economics*, pp. 131-149, 1984.
- [6] J. Hicks: *Sraffa and Ricardo: a critical view*. Basil Blackwell, 1985.
- [7] IMF: *Fiscal Regimes for Extractive Industries: Design and Implementation*, 2012. URL www.imf.org/external/np/pp/eng/2012/081512.pdf.
- [8] Heinz D. Kurz, NeriSalvadori: “Classical economics and the problem of exhaustible resources”, *Metroeconomica*, pp. 282-296, 2001.
- [9] Heinz D. Kurz, NeriSalvadori: “Economic dynamics in a simple model with exhaustible resources and a given real wage rate ”, *Structural Change and Economic Dynamics*, pp. 167-179, 2000.
- [10] Heinz D. Kurz, NeriSalvadori: “Exhaustible resources in a dynamic input-ouput model with 'Classical' features”, *Economic Systems Research*, pp. 235-252, 1997.
- [11] Heinz D. Kurz, NeriSalvadori: *Exhaustible resources: rents, profits, royalties and prices*. Routledge, 2011.
- [12] Heinz D. Kurz, NeriSalvadori: *Ricardo on exhaustible resources, and the Hotelling Rule*. Routledge, 2009.
- [13] Heinz D. Kurz, NeriSalvadori: *The 'classical' approach to exhaustible resources*. Routledge, 2015.
- [14] Oana Luca, Diego Mesa Puyo: *Fiscal Analysis of Resource Industries: (FARI) Methodology*, 2016.
- [15] Sergio Parrinello: *Exhaustible natural resources and the classical method of long-period equilibrium*. Macmillan, 1983.
- [16] Fabio Ravagnani: “Classical Theory and Exhaustible Natural Resources: Notes on the Current Debate”, *Review of Political Economy*, pp. 79-93, 2008.
- [17] Bertram Schefold: *Mr Sraffa on joint production and other essays*. Unwin Hyman, 1989.
- [18] Ajit Sinha: *A revolution in economic theory. The economics of Piero Sraffa*. Palgrave Macmillan, 2016.
- [19] Ajit Sinha: “Listen to Sraffa's silences: an new interpretation of Sraffa's Production of Commodities”, *Cambridge Journal of Economics*, pp. 1323-1339, 2012.
- [20] Piero Sraffa: *Production of Commodities by Means of Commodities*. K. K. Vora, Vora & Co, 1960.