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Nassau Senior and the Long-Term Effect of Tithes

Naoyuki Wakamatsu*

Abstract

The paper argues that Senior was still under the influence of Ricardo's economics from the point of view of economic growth. Senior generally emphasized a sustainable growth of economy brought by the prudential check to population and the technological progress in agriculture, but it depended on wise institutions. However, on the other hand, he was familiar enough with Ricardian growth which enabled him to develop the initial effect of taxes, also existed in Ricardo, into the long-term consequences on the stationary state. In this sense, Senior was the orthodox successor of Ricardo, which means that his growth theory should be understood in the continuity with Ricardo's growth theory.

Keywords: Nassau Senior; David Ricardo; tithe; economic growth; stationary state

JEL Codes: B12; B31

I. Introduction

When many historians of economic thought refer to David Ricardo (1772–1823), they will meet so many fragmentary arguments by him, some of them may find them like puzzle. But careful reading to his texts enables us to understand that Ricardo initially constructs fundamental principles, then, attempts to develop several discussions on them (Kurz 2015). However, since Ricardo's main "purpose was to elucidate principles, and to do this [he]

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imagined strong cases” (Ricardo 1951–73, VIII, 184; see also I, pp. 121–122), some contemporary economists were distracted by them and expressed a contrasting view of Ricardo’s ideas. Among them was Nassau William Senior (1790–1864).

According to Bowley, “Senior was the most distinguished of a group of economists who drew their inspiration from more varied sources than did the orthodox Ricardians” (1937; see also O’Brien 1981). Indeed, Senior aimed to develop his economics from perspectives distinct from Ricardo’s, including abstinence theory. Their differences are believed to extend beyond their theoretical conclusions to their methodologies. While previous studies have characterized the approaches of Ricardo and Senior as hypothetical deduction (cf. Blaug 1992; O’Brien 1975), Depoortère argues that their theories are grounded in induction. However, “while Senior [...] tried to deduce the principles of political economy from a few premises obtained by simple observation of facts”, Ricardo “intended to establish the principles [...] by abstracting from causes that may act on quantities, the consequences of which are studied *ceteris paribus* during the synthesis” (Depoortère 2013, p. 39; italics in the original). We acknowledge that the differences in their methodologies *generally* resulted in distinct theoretical conclusions. Specifically, Senior argued that as the population grows, both the prudential check to population and the technological progress which at least counteracts the diminishing returns of land occur. That is, he maintained that the Ricardian stationary state does not materialize.

However, the theoretical distance between Ricardo and Senior may actually not be that far. Because, while Senior argues abstinence theory, he also deals with the theory of cost of production (O’Brien 1975). Furthermore, the general discussion of Senior on economic growth is established when wise institutions properly functions. *Otherwise, the economy will reach a stationary state due to the diminishing returns of land.* We recognize that this significant aspect of Ricardo’s economics also exists in Senior’s work.

Here, from the standpoint of tax theory, Senior introduced an argument that was absent from Ricardo’s work. In *An Outline of the Science of Political Economy* (1836; hereinafter *Political Economy*), Senior asserts that the “immediate effect” of tithes, as Ricardo argued, is an increase in the price of raw produce. However, he claimed that the “ultimate effect” in the stationary state results in lower gross output (consumption) while

maintaining the same price of corn as in a stationary state without taxation. Consequently, gross rent and total wages fall below their respective levels in the stationary state without taxation. Senior appears to extend the initial effect of tithes, which almost also exists in Ricardo, into a long-term effect in the stationary state. Regarding the latter effect, specifically, whether the price of raw produce in the stationary state after taxation aligns with its value without taxation, its accuracy remains uncertain without rigorous analysis. Therefore, this study aims to clarify the long-term effect of tithes within the framework of Ricardian growth. We argue that, in this respect, Senior was an orthodox successor to Ricardo.

The remainder of this paper is structured as follows: Section II re-examines the characteristics of Ricardian growth based on previous studies. Section III outlines Senior's discussion on economic growth and tithes. We begin by explaining Senior's main position on economic growth from the perspective of wise institutions and the desire to improve the human condition; subsequently, we examine the initial and long-term effects of tithes within the *Political Economy*. Section IV introduces Pasinetti's Ricardian model. Section V reconstructs Senior's view of the long-term effect of tithes using a Pasinetti model. Section VI presents the paper's conclusion.

II. Ricardian Growth and the Stationary State

Before delving into Senior's discussion on economic growth, we first re-examine the characteristics of Ricardian growth. Here, numerous studies have explored various interpretations of Chapter 5 "On Wages" from Ricardo's *Principles of Political Economy and Taxation* (hereinafter *Principles*).¹ The outline is as follows:

For example, Sraffa (1951) argues that Ricardo's framework fundamentally relies on a given real wage at the natural wage² (see also Garegnani 1984), whereas Pasinetti (1960)

¹Ricardo's *Principles of Political Economy and Taxation* (1817) is included in Vol. I of *The Works and Correspondence of David Ricardo* (Ricardo 1951–73). Here, the volume number is referenced in Roman numerals.

²Here, "the concept of 'natural wage' in Ricardo [...] must not be mistaken for a physiological minimum of subsistence", but it "should be conceived of in terms of a social and historical subsistence level" (Kurz and Salvadori 1995, pp. 472–473). Since "[i]t varies at different times in

proposes a “fixed-wage” approach, refining Sraffa’s interpretation. However, Hollander considers a “variable-wage” approach over the natural wage, as central to Ricardo and develops a basic variable-wage model (Hicks and Hollander 1977; Hollander 1979). Casarosa (1978) further extends the Hicks–Hollander model by introducing the concept of dynamic equilibrium. Since then, numerous studies have embraced the fixed-wage approach (cf. Kurz and Salvadori 1995, Chatzarakis et al. 2024).

However, Wakamatsu (2025) demonstrates that in Chapter 16 “Taxes on Wages” of *Principles*, Ricardo employs not only comparative statics based on fixed wages but also a dynamic analysis based on variable wages, revealing that the concept of dynamic equilibrium is found in Ricardo’s theory. We therefore consider that Ricardo adopts both fixed- and variable-wage approaches, although the core of his theory remains grounded in the former.

If this is correct, a defining characteristic of Ricardian growth emerges: irrespective of the growth path of wages, the economy will eventually reach a stationary state due to the diminishing returns of land. Under the fixed-wage approach, with externally determined capital and population growth rates, the economy expands while maintaining constant real wages over the long term. Under the variable-wage approach, through the difference between the capital and population growth rates, the economy grows while decreasing real wages in the long term.³ However, in both cases, the economy ultimately reaches a stationary state as the marginal product of labor in agriculture gradually declines, leading to capital and population growth rates dropping to zero.

Hereafter, we consider this idea as the *basic* characteristic of Ricardian growth and explore its connection to Senior’s economic growth.

III. Senior on Economic Growth and Tithes

This section explains Senior’s arguments on economic growth and tithes. First, we explore

the same country, and very materially differs in different countries. It essentially depends on the habits and customs of the people” (*Works I*, pp. 96–97).

³The fixed-wage approach is regarded as comparative statics, whereas the variable-wage approach considers the dynamics.

his theory of economic growth with a focus on the agricultural sector and its connection to the desire to improve the human condition. Second, we outline his discussion on the initial effect of tithes and the long-term effect on the stationary state concerning Ricardian growth.

Senior's Economic Growth and the Wise Institutions

Regarding the economic growth, Senior generally critiques Ricardo, but he recognizes that Ricardo's argument is *logically* valid.

He assumed the lands of every country to be of different degrees of fertility, and rent to be the value of the difference between the fertility of the best and the worst land in cultivation. The remainder of the produce he divided into profit and wages. He assumed that wages naturally amount to neither more or less than the amount of commodities necessary to maintain the labourer and his family in health and strength. He assumed that in the progress of population and wealth agricultural labour becomes less and less proportionally productive. And he inferred that the share of the produce of land taken by the landlord and by the labourer must constantly increase, and the share taken by the capitalist diminish. / *This was a logical inference, and would consequently have been true in fact, if the assumed premises had been true.* (Senior 1848, pp. 302-303; italics added)

Senior argues that Ricardo incorporates the theory of differential rent and the assumption of natural wage that is determined by the social subsistence. However, Senior disputes these claims, asserting that "almost every one of them is false." For example, rent "might exist if the whole territory of a country were of uniform quality" and "[i]n civilized countries [the laborer] almost always receives much more; in barbarous countries he sometimes obtain less." Furthermore, "[t]he corn now raised with the greatest labour in England is raised with less labour than that which was raised with the least labour 300 years ago, or than that which is now raised with the least labour in Poland" (Senior 1848, p. 303). Therefore, if we assume the conditions of a civilized country as described by Senior, economic growth would prevent the Ricardian stationary state from materializing.

So why does Senior's theory of economic growth in a civilized society differ from Ricardian growth? To understand this, we must examine his argument concerning the relative growth rates of population and subsistence. In the *Two Lectures on Population* (1829), he argues as follows:

The popular doctrine certainly is, that population has a tendency to increase beyond the means of subsistence, or, in other words, that, whatever be the existing means of subsistence, population has a tendency fully to come up with them, and even to struggle to pass beyond them, and is kept back principally by the vice and misery which that struggle occasions. I admit that population has the power (considered abstractedly) so to increase, and I admit that, under the influence unwise institutions, that power may be exercised, and the amount of the subsistence bear a smaller proportion than before to the number of people; and that vice and misery, more or less intense and diffused, according to the circumstances of each case, must be the result. What I deny is, that, under wise institutions, there is any *tendency* to this state of things. I believe the tendency to be just the reverse. (Senior 1829, pp. 35–36; italics in the original)

Here, Senior criticizes the Malthusian principle of population, which asserts that population tends to increase rapidly than subsistence. He views that Malthus emphasizes the forces driving population growth, such as marriage, as natural. In contrast, Senior emphasizes the regulating force on population growth, specifically the desire to improve our condition “under wise institutions”, as the natural factor.

You [Malthus] would still say, that in the absence of disturbing causes, population has a *tendency* to increase faster than food, because the comparative increase of the former is a mere compliance with our natural wishes, the comparative increase of the latter is all effort and self-denial. I should still say, that, in the absence of disturbing causes, food has a tendency to increase faster than population, because, in fact, it has generally done so, and because I consider the desire of bettering our condition as natural a wish as the desire for marriage. (Senior 1829, p. 58; italics in the original)

Therefore, in Senior's economics, when disturbing causes hinder the operation of the desire to improve our condition, the Malthusian principle of population takes effect. However, Senior argues that, in general, this desire under wise institutions tends to prevail, leading to a tendency for subsistence to grow faster than population.

Senior maintains his argument on population and subsistence in the *Political Economy*. But what wise institutions foster the desire to improve our condition, and how do the institutions and the desire influence population and subsistence growth? To address this problem, we can specifically analyze it through the discussion of the check to population and the increasing agricultural productivity in the *Political Economy*.

Regarding the population issue, Senior, like Malthus, categorizes checks on population into preventive and positive measures.⁴ Among these, the positive check, such as war and famine, is primarily observed in "nations imperfectly civilized", "uncivilized, or partially civilized, nations" and "barbarous [...] people" (Senior 1836, p. 33). That is, Senior generally argues that in a *fully civilized society, the positive check hardly occurs*.

Senior then discusses the preventive check, which he categorizes into "Promiscuous Intercourse and Abstinence from Marriage." However, "[t]he first does not appear to be of sufficient importance to require much consideration", as "there are scarcely any females whose fecundity is prevented or diminished by promiscuous intercourse." Meanwhile, "abstinence from marriage is almost uniformly founded on the apprehension of a deficiency of some of the things which we have denominated by the general term Wealth, or, in other words, on Prudence" (Senior 1836, p. 35; italics added). Thus, when discussing the preventive check, Senior primarily refers to prudence as its underlying factor.

When examining the prudential check, we must first categorize goods according to Senior's classification. He divides them into three types: necessities, decencies and luxury:

By *Necessaries*, then, we express those things, the use of which is requisite to keep a given individual in the health and strength essential to his going through his habitual

⁴"The first are those which limit fecundity, the second those which decrease longevity. The first diminish the number of births, the second increase that of deaths" (Senior 1836, p. 31).

occupations. / By *Decencies*, we express those things which a given individual must use in order to preserve his existing rank in society. / Every thing else of which a given individual makes use, or, in other words, all that portion of his consumption which is not essential to his health and strength, or to the preservation of his existing rank in society, we term *Luxury*. (Senior 1836, p. 36; italics in the original)

Among these goods, the fear of wanting mere necessities and luxuries seldom causes the prudential check. This is because,

[a]mong all classes the check imposed by an apprehended deficiency of mere luxuries is but slight. The motives, perhaps we might say the instincts, that prompt the human race to marriage, are too powerful to be much restrained by the fear of losing conveniences unconnected with health or station in society. Nor is population much retarded by the fear of wanting mere necessities. In comparatively uncivilized Countries, in which alone, as we have already seen, that want is of familiar occurrence, the preventive check has little operation. (Senior 1836, pp. 37–38)

Notably, Senior asserts that in the (comparatively) uncivilized society, the positive check frequently occurs, whereas the preventive check (based on prudence) is seldom observed. That is, *the prudential check generally operates in a civilized society.*

Additionally, Senior generally associates the prudential check with the fear of wanting decencies in a civilized society, such as England:

The great preventive check is the fear of losing decencies, or, what is nearly the same, the hope to acquire, by the accumulation of a longer celibacy, the means of purchasing the decencies which give a higher social rank. When an Englishman stands hesitating between love and prudence, a family actually starving is not among his terrors; against actual want he knows that he has the fence of the poor-laws. But, however humble his desires, he cannot contemplate without anxiety a probability that the income which supported his social rank, while single, may be insufficient to maintain it when he is married; that he

may be unable to give to his children the advantages of education which he enjoyed himself, in short, that he may lose his caste. Men of more enterprise are induced to postpone marriage, not merely by the fear of sinking, but also by the hope that in an unincumbered state they may rise. (Senior 1836, p. 38; italics added)

This passage illustrates that the prudential check stems from the desire to improve our condition. If individuals foresee a decline in their social rank or a barrier to upwards mobility due to population growth, they regulate their population increase to mitigate such concerns.⁵ Furthermore, behind such individual behavior lies the institutional framework of a civilized society, where, for example, property rights are effectively protected and social rank is maintained. In other words, *under such wise institutions in a civilized society*, the desire to improve our condition operates.

Senior considers that countries typically progress from a primitive state to a civilized society. In the latter state, food tends to increase faster than population:

If it be conceded that there exists in the human race a natural tendency to advance from barbarism to civilization, and that the means of subsistence are proportionably more abundant in a civilized than in a savage state, and neither of these propositions can be denied, it must follow that there is a natural tendency in subsistence to increase in a greater ratio than population (Senior 1836, p. 48).⁶

Notably, Senior considers that in a civilized society, there occurs not only the prudential check to population, but also an increase of food in contrast to a more primitive

⁵Thus, “[i]t is by this desire of decencies, as distinguished from necessities, that long-settled civilized Countries are preserved from the evils of a population greatly exceeding the means of comfortable subsistence” (Senior 1836, p. 38).

⁶Considering “the earliest records of those nations which are now civilized”, Senior also states that “But if a single Country can be found in which there is now less poverty than is universal in a savage state, it must be true that, under the circumstances in which that Country has been placed, the means of subsistence have a greater tendency to increase than the population. Now this is the case in every civilized Country” (Senior 1836, p. 48).

society. As is already seen, the former is ultimately achieved through the wise institutions, from the passage, they develop as society progresses from a rude state to a civilized state. The institutions thus formed also act on the latter:

At present we will only say that knowledge, security of property, freedom of internal and external exchange, and equal admissibility to rank and power, are the principal causes which at the same time promote the increase of subsistence, and, by elevating the character of the people, lead them to keep at a slower rate the increase of their numbers. And that restrictions on exchange and commerce, artificial barriers excluding the great majority of the community from the chance of social eminence, and, above all, ignorance, and insecurity of person and property, are the general causes which both diminish the productiveness of labour, and tend to produce that brutal state of improvidence in which the power of increase, unchecked by prudence, is always struggling to pass the limits of subsistence, and is kept down only by vice and misery. (Senior 1836, p. 49; italics added)

That is, wise institutions in a civilized society not only regulate population growth but also drive an increase in food.⁷ In the latter case, this prevents the Ricardian differential rent from arising, as it increases agricultural labor productivity. To understand this, we next examine Senior's perspective on rent.

Regarding rent, Senior initially acknowledges the effect of diminishing returns in agriculture:

The advantage possessed by land in repaying increased labour, though employed on the same materials, with a constantly increasing produce, is overbalanced by the diminishing proportion which the increase of the produce generally bears to the increase of the labour. (Senior 1836, p. 83)

⁷Thus, Senior "thought that a satisfactory solution to the population problem is only possible when racial characteristics and social institutions give full play to the natural ambition of men" (Bowley 1937, p. 122).

Thus, Senior presents “[t]he proposition that, in agriculture, additional labour generally produces a less proportionate result, or, in other words, that the labour of twenty men employed on the land within a given district, though it will certainly produce more than that of ten men, will seldom produce twice as much.”⁸ He further illustrates this principle with an example, stating that the “imaginary farm is a miniature of the whole Kingdom” (Senior 1836, pp. 84–85). If such a circumstance had been established, the differential rent would have emerged.

However, Senior acknowledges that, “the proposition which we have been endeavouring to illustrate, though general, is not universal; it is subject to material exceptions.” Here, he first argues that in underdeveloped agricultural settings with inadequate knowledge or institutions, labor productivity remained low. However, if obstacles such as “the negligence or ignorance of the occupier, or proprietor” and “obstacles of ownership” are removed, *the productivity of additional labor would rise significantly*. Examples of the former include cases where “drainage and embankment,” necessary for cultivation, are not provided due to the shortage of knowledge, whereas examples of the latter include issues such as the “enclosure of a common” and farmers’ land lease agreement (Senior 1836, p. 85). These examples mean that the labor productivity is low in comparatively uncivilized society.

Then, Senior argues that “the most important exception to the general rule takes place when increase of labor is accompanied by increase of skill” (Senior 1836, p. 86). That is,

[m]ore efficient implements, a better rotation of crops, *a greater division of labour*, in short, improvements in the art of agriculture, *generally* accompany the increase of agricultural labour. They always accompany that increase when it is accompanied by an increase of the capital as well as of the population of a Country; and *they always counteract, and often outweigh, the inferiority or diminished proportional powers of the soil to which they are applied*. (Senior 1836, p. 86; italics added)

It is worth noting that this passage describes that an increase in agricultural labor is

⁸See also, Senior (1836, pp. 105–106).

generally accompanied by technological progress in agriculture. In this regard, Senior's series of explanations is somewhat misleading, as he had previously asserted that diminishing returns of land represent a *general* proposition. However, here, he states that "[t]he total amount of the annual agricultural produce of Great Britain has much more than doubled during the last hundred years; but it is highly improbable that the amount of labour annually employed in agriculture has also doubled" (Senior 1836, p. 86). Therefore, in Senior's view, what is *generally* observed in a civilized society is an improvement in agricultural technology sufficient to (at least) offset the effects of diminishing returns. Consequently, land quality appears to be uniform, leading to the emergence of absolute rent rather than differential rent.

Here, it is significant that Senior addressed the issue of agricultural improvement such as "*a greater division of labour*" not within a comparatively uncivilized society with inadequate knowledge or institutions, but rather within *a civilized society* such as Britain. This can be understood as follows: According to Senior, the division of labor develops further in "an advanced state" than in "a rude state of Society" (Senior 1836, p. 74). Considering the context of population growth, there is "a natural tendency to advance from barbarism to civilization", during this process, wise institutions such as "*knowledge, security of property, freedom of internal and external exchange*", which are necessary for developing the division of labor, are formed (Senior 1836, pp. 48–49; italics added). Therefore, in a civilized society with well-established institutions, the division of labor reaches its highest degree. This highly developed division of labor aligns with the agricultural technology advancements that (at least) counteract diminishing returns in the society.

This subsection explored why Senior's theory of economic growth in a civilized society fundamentally differs from Ricardian growth. According to his view, wise institutions (and the desire to improve our condition cultivated by them) lead to both the prudential check to population and the enhancement of agricultural labor productivity. Consequently, food generally tends to increase faster than population. Therefore, against Ricardo, "Senior denied the reality of any tendency for the pressure of population to bring about a stationary state" (Bowley 1937, p. 174).

However, Senior's such evaluation to Ricardo is unfair. For, while Ricardo indeed argued that an economy arrives at a stationary state due to diminishing returns of land, this is the case of "mere analytical propositions" that do not take into account the technological progress in agriculture or the corn imports, and not "a prediction on the future course of events or historical generalization" by him (Depoortère 2013, p. 39). Rather, this is only the basic stance in Ricardo's economics, his theory becomes more fruitful based on that. In fact, in Chapter 31 "On Machinery" added in the third edition of the *Principles* (1821), he explicitly argues that machines are introduced into production when diminishing returns are in effect.⁹ Hence, any fair argument against Ricardo should mention this issue as well.

In Any case, "Senior's denial, however, depended on his belief that the increase of population tends to produce improvements and increase of productivity per head, and on his reliance on the ambition, prudence and forethought of the human race. *Only if these influences failed to materialize would he admit the immanence of stationary equilibrium in the Ricardian sense*" (Bowley 1937, p. 174; italics added). In this context, Senior's explanation of the long-term effect of tithes assumes a scenario in which technological progress in agriculture fail to materialize as population grows. In other words, wise institutions do not function effectively. The next subsection outlines Senior's discussion on how tithes influence the stationary state within the framework of Ricardian growth.

The Effects of Tithes on Economic Growth

This subsection outlines Senior's discussion on the relationship between economic growth, focusing on the agricultural sector, and tithes. Initially, we provide an overview of the context leading to this discussion in the *Political Economy*. Subsequently, we confirm the initial effect of tithes in the capital accumulation process. Finally, we organize the

⁹Ricardo writes: "With every increase of capital and population, food will generally rise, on account of its being more difficult to produce. The consequence of a rise of food will be a rise of wages, and every rise of wages will have a tendency to determine the saved capital in a greater proportion than before to the employment of machinery. Machinery and labour are in constant competition, and the former can frequently not be employed until labour rises" (Ricardo 1951-73, I, p. 395).

discussion of the long-term effect on the stationary state.

In “Distribution of Wealth” of the *Political Economy*, Senior outlines three primary social classes, laborers, capitalists and landlords (the “Proprietors of Natural Agents”), who receive wages, profits and rent, respectively (Senior 1836, pp. 88–89). Additionally, critiquing Ricardo, Senior argues that most goods are not produced under free competition but rather within monopolies that leverage the power of natural agents.¹⁰ He identifies four types of monopoly, among which the production of raw produce falls into the fourth category. Here, diminishing returns would emerge if technological advancements fail to accompany population growth.¹¹

Consequently, Senior categorizes production circumstances into five classes, including the case where monopoly is absent. Regarding this, he examines how to determine the price of commodities within Class 5,¹² which includes raw produce, as follows:

The price of the commodities comprised in the fifth and last class, those which are produced under what may be called unequal competition or qualified monopoly, where all persons may become producers, but every additional quantity is obtained at a greater proportionate expense, has a constant tendency to coincide with the cost of production of that portion which is continued to be produced at the greatest expense. (Senior 1836, p.

¹⁰“Now it is clear that the production in which no appropriated natural agent has concurred, is the only production which has been made under circumstances of perfectly equal competition. And how few are the commodities of which the production has in no stage been assisted by peculiar advantages of soil, or situation, or by extraordinary talent of body or mind, or by processes generally unknown, or protected by law from imitation” (Senior 1836, p. 103).

¹¹*“The fourth and last class of monopolies exists where production must be assisted by natural agents, limited in number, and varying in power, and repaying with less and less relative assistance every increase in the amount of labour and abstinence bestowed on them. It is under these circumstances that the greater part of the raw produce, whatever it be, which is the staple food of the inhabitants in every Country, potatoes in Ireland, wheat in England, or rice in India, is produced”* (Senior 1836, p. 105; italics in the original).

¹²Regarding Class 5, Senior argues: “5. A monopoly under which the monopolist is not the only producer, but has peculiar facilities which diminish and ultimately disappear as he increases the amount of his produce” (Senior 1836, p. 111).

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This explanation aligns with the determination of raw produce price within the theory of differential rent.¹⁴ Following this, Senior presents a numerical example of differential rent, in which the difference in output or its value between the most inferior land and superior land constitutes the rent. On the most inferior land, however, no rent arises. The value of the product generated on this land “is absorbed by the cost of production”, and is divided into wages and profits (Senior 1836, pp. 115–116). This indicates that Senior understands the basic framework of the theory of differential rent as argued by Ricardo.¹⁵ However, while explaining the diminishing returns of land, Senior also introduces the idea that technical progress in agriculture can offset these effects as the population grows, as well as the emergence of absolute rent (Senior 1836, pp. 108–109, p. 118).

However, in “some remarkable consequences of the proposition [...] that additional labour when employed in Manufactures is *more*, and when employed in Agriculture *less*,

¹³Regarding the cost of production, Senior states, “By *Cost of Production*, then, we mean the sum of the labour and abstinence necessary to production”, it is “to use a more familiar expression, at a price equal to the amount of the wages and the profits which must be paid to induce the producers to continue their exertions” (Senior 1836, p. 101, p. 103).

¹⁴“Case 5 is the most important, as it includes production under conditions of differential advantages and diminishing returns, and therefore rents arise. (It includes agriculture.)” (Bowley 1937, p. 99).

¹⁵In this numerical example, the cost of production in the most inferior land is assumed to be originally 100 pounds. However, when production is extended through the additional labor and abstinence, the cost of production in the new most inferior land is assumed to continue to be 100 pounds (Senior 1836, pp. 115–116). Regarding the theory of the differential rent, as at least the additional labor is bestowed to land in equal units (Senior 1836, pp. 84–85), it can be said that Senior assumes a case in which the value produced by each unit of labor is equal. In this regard, it is considered that some influences are caused in money wages if a new inferior land is cultivated. However, here, such changes of money wages do not affect the cost of production. Thus, it assumes the case where the capital intensity is equal among all goods. Therefore, Senior’s argument is considered as if the value or the price of each good is determined according to the amount of labor necessary to the production. Such a supposition is assumed in sections 4 and 5.

efficient in proportion; or, in other words, that the efficiency of labour increases in Manufactures in an increasing ratio, and in Agriculture in a decreasing ratio" (Senior 1836, p. 119; italics in the original), *Senior further develops the discussion of diminishing returns.* Regarding agriculture, he examines how diminishing returns impact the price of manufactured goods, depending on the extent to which raw produce is incorporated into the manufacturing process.¹⁶ Additionally, he explores the effects of taxation on the price of raw produce within the framework of diminishing returns,¹⁷ addressing the long-term effect of tithes.

Senior first outlines the effects of tithes on economic growth, as follows:

It has been supposed, however, that the price of agricultural produce would rise to the full amount of the tax, and that the whole amount of that tax would consequently fall on consumer. This is the opinion of Mr. Ricardo and of Mr. Mill. And it is on this ground that they both maintain that the effect of tithes is to produce a rise in the price of raw produce equal to the whole value of the tithe, and affecting equally all classes so far as they are consumers of raw produce. We believe that the *immediate* effect of a general tax on raw produce is to raise its price, but to an amount not equal to that of the tax; but that its *ultimate* effect is to diminish the consumption and production of raw produce, but to leave its price unaffected. (Senior 1836, pp. 122-123; italics in the original)

Senior divides the effects of tithes into "the *immediate* effect" and "the *ultimate* effect." The former refers to the initial effect which is caused when tithes are imposed in the capital

¹⁶Senior explains this problem using the examples of bread and lace. For example, in the case of bread, because the value of raw produce occupies a large proportion of the total value of bread, when the price of wheat rises through the diminishing return, the influence on the price of bread is relatively large. Contrary, in the case of lace, since the value of raw produce occupies a small proportion of the total value of lace, when the price of cotton rises through the diminishing return, the influence on the price of lace is relatively low (Senior 1836, pp. 119-120).

¹⁷In this case, "[t]axes on agricultural produce in its unmanufactured state" is assumed (Senior 1836, p. 120). Furthermore, Senior does not appear to assume the difference of capital intensity among goods here.

accumulation process, whereas the latter represents the long-term effect that this initial effect brings as a result of economic growth.

The initial effect primarily means that the price of raw produce increases as a result of taxation, in this point Senior acknowledges the argument by Ricardo (and James Mill (1773–1836)). However, they are different of whether it just increases by the sum equal to the taxes. Then, we confirm how their difference is caused. Regarding the initial effect of tithes, Senior writes more concretely as follows:

To prove our first proposition we need only show that the rise of price, which we admit to be the immediate consequence of the imposition of the tax, would diminish the consumption, and consequently the production of the taxed commodity. It has been shown already that, as production is diminished; the expense of producing the quantity still produced is diminished: and that the price of agricultural produce depends on the expense of producing that portion of it which is produced at the greatest expense, or, in other words, under circumstances of equal competition. That no person would diminish his consumption of corn in consequence of the rise of its price, is therefore a premise necessary to the conclusion which we are combating. [...] But the bulk of the community, consisting of the labourers who receive no parish assistance [...] will soon be the great majority; and the smaller shopkeepers and farmers, unquestionably regulate, in a great measure, their purchases of wheat by its price. (Senior 1836, p. 123)

According to Senior, the price of raw produce increases by an amount equal to the tax immediately upon its imposition. Specifically, a tenth of the product from each land is collected by the church as tithes, which are taxes in kind, while the remainder is disposable in the market (Senior 1836, p. 126). At this time, the price of corn increases by 10% compared to its pre-tax value, as total post-tax revenue must match pre-tax levels to maintain profits before taxation (Senior 1836, p. 121). Therefore, tithes function as an ad valorem tax. This mechanism of the effect of tithes is also found in Ricardo (1951–73, I, p. 156, p. 177).

However, Senior contends that the price of raw produce does not consequently

increase by an amount equal to the tax. This is where the concept of diminishing returns becomes relevant. In the passage, he assumes that laborers initially earn wages exceeding the subsistence level. If laborers reduce their consumption of raw produce due to the price increase following taxation, agricultural cultivation declines.¹⁸ Then, the labor productivity at the new most inferior land improves, leading to a slight reduction in the cost of production per unit of raw produce. Therefore, while the price of raw produce after this adjustment remains higher than its pre-tax value, it does not increase by an amount equal to the tax imposed.

Senior divides economics into theoretical and practical branches, of which, the latter includes the issue of tithes. In this regard, for example, several human motivations, climate, and soil must be considered when examining the practical branch, so that the consequence may be imprecise (Senior 1827, pp. 8–10). This position seems to be reflected to Senior's argument regarding the initial effect of tithes. Furthermore, the argument may be similar to Malthus's method in terms of the short-term disequilibrium of food supply and the changes in consumer's behavior accompanying it. On the other hand, Ricardo examines the impact of rising price of raw produce due to taxation on money wages and the profit rate, *applying comparative statics* (Eagly 1983; Dome 1992). In such a scenario, other variables were assumed to remain theoretically constant, and the price of raw produce would remain elevated by an amount equal to the tax.

Hence, regarding the initial effect of tithes, in general, there was a consensus between Ricardo and Senior in terms of the price of raw produce to increase after taxation. Of course, they are different of whether it just increases by the sum equal to the taxes, which is not the

¹⁸At this time, money wages will increase, because some agricultural workers are unemployed through the reduced demand for raw produce. Then, as Senior (1836, pp. 115–116) assumes, if the value produced by each unit of labor is equal, the rate of profits will decrease. On the other hand, Senior appears to analyze this aspect depending on the partial equilibrium, as he does not explicitly address the specific use of the raw produce collected as tithes and the response to unemployment caused by the taxes. However, from the passage, it is at least clear that tax revenues are not used for employing unproductive workers and expanding of production. Therefore, we assume the case that the church unproductively consumes tax revenues without creating an additional demand for labor in section V.

essential problem in considering the long-term effect of taxes as is seen later. Therefore, Ricardo and Senior shared a basic awareness of the initial effect of tithes. However, the latter discussion has the following characteristics: (1) the immediate effect of tithes originates from the result that tithes reduce the (marginal) products of labor disposable in the market, leading to a rise in the price of raw produce equivalent to the tax; (2) if population growth occurs following the decline of production after the process (1), the price of raw produce eventually returns to the level described in (1). Therefore, for simplicity, this paper considers the explanation of (1) as the initial effect of tithes when reconstructing Senior's discussion in section 5.¹⁹

Having explained the initial effect of tithes, Senior then examines the long-term effect.

We now proceed to prove our second proposition, namely, that the ultimate effect of a tax on raw produce is not to raise its price, but to diminish the quantity produced. [...] Now, the ultimate effect of tithes, or of any other tax, on the cultivation of land, is precisely the same as if the Country in which they[tithes, or of any other tax] have long prevailed were thereby rendered rather less extensive, or rather less fertile, and consequently, rather less populous, and probably also rather poorer than it otherwise would have been. (Senior 1836, pp. 123-124)

Senior compares the long-term growth situation of an economy subject to tithes with that of an untaxed economy, and argues that the initial price difference between them, arising from the imposition of tithes, will eventually disappear. Considering the issue of the speed of capital accumulation, the point at which the prices of raw produce in the taxed and untaxed economies coincide depends on the length of time it takes to reach a stationary state from the point at which taxes are imposed. In this regard, suppose that two economies are identical in all aspects, including real wages, except for the initial effect of tithes. At that point, the price of raw produce in the taxed economy is higher than that in

¹⁹From Ricardo's discussion, at this time, money rents are equal before and after taxation. This is because the after-tax revenue of the output in each land remains the same as before taxation (Ricardo 1951-73, I, p. 157, pp. 176-177, p. 181).

the untaxed economy. In the former, because tithes reduce the (marginal) products of labor disposable in the market, its rate of capital accumulation is lower than that of the latter.

Then, the long-term effects of tithes are almost divided into the following cases. While the price of raw produce in the untaxed economy gradually approaches that in the taxed economy, (i) the prices may, in some cases, overtake and be overtaken by each other during a capital accumulation process, eventually coinciding during that process; (ii) the prices may, in some cases, overtake and be overtaken by each other during a capital accumulation process, eventually coinciding in a stationary state; (iii) the prices may eventually coincide in a stationary state because the price of raw produce in the untaxed economy cannot catch up with that in the taxed economy during the capital accumulation process. If the fertility of land at the taxed point is sufficiently high, that is, if the time required to reach the stationary state is sufficiently long, Case (i) will occur. By contrast, the lower the fertility of land at the taxed point, that is, the shorter the time required to reach the stationary state, Cases (ii) and (iii) will occur in that order.

In this regard, Senior seems to be aware the relationship between the point where taxes are imposed and the point where the long-term effect is caused. Since, when Senior illustrates the proposition, probably supposing Case (i), he assumes that taxes are imposed “*from time immemorial*” compared to the point where the long-term effect is caused.²⁰ This suggests that if the taxes were imposed at a more recent point in time, the effect would be caused at the points where the taxed and untaxed economy has progressed further than the points Senior originally assumes. Furthermore, it is important to note that the proposition inherently involves a discussion of Ricardian growth leading to a stationary state. From the discussion in the former subsection, it follows that diminishing returns of land apply when wise institutions do not function properly, and in the case, the Malthusian principle of population operates in the long term. Then, as far as the marginal product of labor in

²⁰“If England, *from time immemorial*, had been rather more extensive, or rather more fertile than it now is, no one will suppose that the price of provisions would have been lower than it now is. We should have had rather more corn, and a rather greater population to eat that corn, than we now have. The increase would have been positive, not relative. [...] So if tithes had never existed, we should have had rather more corn, and a rather larger and probably a rather richer population; every thing else would have been as it is” (Senior 1836, p. 124; italics is added).

agriculture exceeds natural wages, population would continue to increase at the subsistence level over the long term. Diminishing returns of land and the Malthusian principle of population are the necessary assumptions to logically derive the Ricardian stationary state, considering them, the economy eventually reaches the state where the capital and population growth rates become zero. In fact, in his *Principles of Political Economy* (1848), John Stuart Mill (1806–1873) interpreted Senior's discussion as that of the stationary state assuming Case (ii) or (iii) (Mill 1848, pp. 843–847). Considering these things, Senior provided a universal proposition regarding the long-term effect of tithes applicable to both the capital accumulation process and the stationary state.

It is important that the passage has no reference of the technological progress as to offset the effects of diminishing returns of land. As is already seen, Senior developed the discussions of the theory of differential rent besides this. However, in each case, he finally referred to the technological progress at least causing constant returns, so that they did not associate with the stationary state *which is the long-term consequence of the diminishing returns of land*. Therefore, the proposition of the long-term effect of tithes is an interesting issue of Senior due to including the case of the stationary state, in this sense, he may be similar to Ricardo's method.

Then, we examine the proposition regarding the stationary state to deepen our understanding to Senior and Ricardo from the perspective of such Ricardian growth and methodology. In the state, the long-term effect of taxes results in the same price level but a lower output (consumption) of raw produce, leading to a reduction in gross rent and wages compared to the stationary state without taxes. In this regard, Senior did not concretely address the issue of the dynamic transition process in explaining the effect, so that we consider that he mainly did the comparative static analysis of taxes on the stationary state. Some of these outcomes can be directly inferred from the initial effect of tithes. Because tithes reduce the (marginal) products of labor disposable in the market, they create a similar effect to a decrease in land fertility. If the economy continues to grow under this condition, it will reach a less extensive stationary state compared to the state without taxes. Therefore, the output (consumption) of raw produce, the gross rent, and the gross wages also decline.

However, whether the price of raw produce is consistent between the stationary states of taxed and untaxed economies is not necessarily obvious without rigorous analysis. To address this, we reconstruct Senior's discussion on long-term effect of tithes using a mathematical Ricardian model. In our analysis, we employ the Pasinetti model as it provides a useful framework for considering Ricardian growth. While we consider the characteristic of the Ricardian growth is that the economy arrives at the stationary state due to diminishing returns of land, assuming a defined growth path during the capital accumulation process enhances the mathematical analysis. Senior acknowledges the theory of differential rent and incorporates the assumptions of diminishing returns of land and the Malthusian principle of population in his analysis of the long-term effect of tithes.²¹ Therefore, we can use a Pasinetti model which employs a fixed-wage approach at the natural level. In the next section, we first explain a Pasinetti model without taxation.

IV. Pasinetti's Ricardian Growth Model

This section outlines Ricardian growth using a fixed-wage approach based on Pasinetti (1960). We construct a two-commodities model: corn and gold. To analyze the effect of tithes on money prices in the stationary states in the next section, we introduce a gold sector along with the agricultural sector. Corn is "only one type of wage-good", whereas gold is "a luxury good" and "the monetary unit is that quantity of gold." The economic system consists of three classes: workers, landowners and capitalists. Workers supply labor to capitalists and receive wages, which they use to purchase necessities (corn). Landowners acquire rent by leasing their land to agricultural capitalists and spend their income on luxury goods (gold). Capitalists generate profits through production and invest their income on capital accumulation (corn) (Pasinetti 1960, p. 82, p. 84).

Let us now reconstruct a simple model of Ricardian economic growth.

The Model

$$X_1 = f(N_1) = N_1^\beta \tag{1}$$

$$X_2 = \alpha N_2 \tag{2}$$

²¹In the case, the total profits in long-term are ultimately calculated by subtracting the total money wages based on natural wages and money rents from the total revenue.

$$K = \omega_S N \quad (3)$$

$$R = f(N_1) - N_1 f'(N_1) \quad (4)$$

$$P_1 = X_1 - R - \omega_S N_1 \quad (5)$$

$$p_1 = \frac{1}{f'(N_1)} \quad (6)$$

$$p_2 = \frac{1}{\alpha} \quad (7)$$

$$p_2 P_2 = p_2 X_2 - p_1 \omega_S N_2 \quad (8)$$

$$\pi = p_1 X_1 - p_1 \omega_S N = (1 - p_1 \omega_S) N \quad (9)$$

$$p_2 X_2 = p_1 R \quad (10)$$

$$r = \frac{\pi}{p_1 K} = \frac{f'(N_1) - \omega_S}{\omega_S} \quad (11)$$

$$\frac{\dot{K}}{K} = \phi r. \quad (12)$$

In the above system, X_1 and X_2 are the annual gross output of corn and gold, respectively, denoted in real terms; K is the real capital stock; N_1 and N_2 are the number of workers employed in corn and gold production, respectively, with N representing the total number of workers; R is the rent in real terms; $f'(N_1)$ is the marginal product of labor of corn production; α is the labor productivity of gold production given exogenously with $\alpha > 0$; ω_S is natural wages per worker given exogenously; P_1 is the profits in real terms (corn); p_1 and p_2 are the corn and gold prices, respectively; P_2 is the profits in real terms (gold); π is the total profits in terms of the standard of value; r is the profit rate; \dot{K}/K expresses the capital accumulation rate; ϕ is a reaction coefficient that is given exogenously with $0 < \phi < 1$; and β is a parameter given exogenously with $0 < \beta < 1$.

Equation (1) is the production function of corn, which has the following properties: $f'(0) > \omega_S$, $f'(N_1) > 0$, and $f''(N_1) < 0$. The diminishing returns are expressed with the index β . While Pasinetti does not set the function concretely, we do so to analyze the stationary state. Equation (2) is the production function of gold. Given the assumption that the desire to improve human condition operates effectively, gold productivity remains constant. Equation (3) expresses the supply-demand balance of labor, with real wages

fixed at the natural level in the long term. Equation (4) expresses the theory of differential rent. Equations (5) and (8) are definitional expressions of profits in corn and gold sectors. Equations (6) and (7) mean that the corn and gold prices are determined by the quantity of labor required for each production. Equation (9) defines total profits. Equation (10) expresses the supply–demand balance of gold. Equation (11) means that the profit rate is determined by the marginal product of labor of corn production. Equation (12) is the capitalists’ investment function.

From Equations (11) and (12), the capital accumulation rate decreases with economic growth because $f'(N_1)$ diminishes if N_1 increases, since $f''(N_1) < 0$. Similarly, the population growth rate declines because it aligns with the capital accumulation rate in Pasinetti model. Consequently, the economy, while advancing along the natural wages, finally converges with the stationary state. Figure 1 illustrates the state in the Pasinetti model:

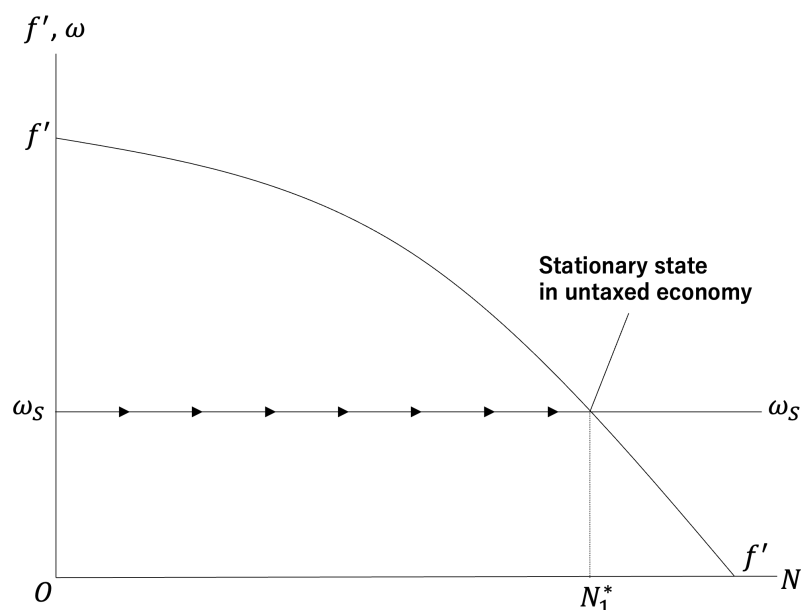


Figure 1. The stationary state in the untaxed economy.

No growth occurs in this state because the real wage rate is ω_S and the profit rate is zero. Substituting this into Equation (11), the minimum profit rate is $0 = \{f'(N_1^*) - \omega_S\}/\omega_S$, where N_1^* represents the labor force of the corn sector at the stationary state. Considering Equation (1), we concretely obtain the labor force as follows:

$$N_1^* = \left\{ \frac{\beta}{\omega_S} \right\}^{\frac{1}{1-\beta}}. \quad (13)$$

Then, from Equations (1), (6), and (13), the price of corn in the stationary state (p_1^*) is expressed as follows:

$$p_1^* = \frac{1}{f'(N_1^*)} = \frac{1}{\omega_S}. \quad (14)$$

We can also determine the labor force in the gold sector at the stationary state. Based on Equations (1), (2), (4), (6), (7), and (10), the concrete labor force of the gold sector is $N_2 = \{(1 - \beta)/\beta\}N_1$. Considering Equation (13), we obtain the labor force in the stationary state (N_2^*) as follows:

$$N_2^* = \frac{1 - \beta}{\beta} \left\{ \frac{\beta}{\omega_S} \right\}^{\frac{1}{1-\beta}}. \quad (15)$$

Thus, we obtain the total labor force in the stationary state (N^*) as follows:

$$N^* = \frac{1}{\beta} \left\{ \frac{\beta}{\omega_S} \right\}^{\frac{1}{1-\beta}}. \quad (16)$$

This section has outlined Pasinetti's Ricardian growth model without taxation. We assume that Senior's growth theory, particularly concerning the corn sector, aligns with the Pasinetti model. As discussed in section III, Senior recognized the long-term effect of tithes on the stationary state. Therefore, in the next section, we analyze the long-term effect of tithes within the Ricardian system by applying the insights from section III to the Pasinetti model.

V. Tithes and Economic Growth

This section incorporates tithes into the model in section IV and analyzes the long-term effect of tithes on the stationary state.

Here, technological progress and corn imports do not occur and the church unproductively consumes tax revenues without creating an additional demand for labor. The changes in money wages by tithes do not affect rent or the prices.

Initial Effect of Tithes

Before analyzing the long-term effect of tithes, we explain the initial effect of tithes in the

capital accumulation process using the following equations:

$$X_{1\tau} = \frac{1}{1 + \tau} X_1 \quad (17)$$

$$p_{1\tau} = (1 + \tau)p_1 \quad (18)$$

$$R_\tau = \frac{1}{1 + \tau} \{f(N_1) - N_1 f'(N_1)\} \quad (19)$$

where τ is the tax rate ($0 < \tau < 1$); $X_{1\tau}$ and R_τ are the after-tax gross output of corn and the after-tax rent in real terms, respectively; and $p_{1\tau}$ is the corn price after taxation.

Equation (17) expresses that the constant proportion of the gross output of corn ($\tau X_1 / (1 + \tau)$) is collected by a church as tithes, which are taxes in kind, while the remainder is disposable in the market. If $\tau = 0.1$, Equation (17) roughly corresponds to tithes. Equation (18) expresses that the corn price after taxation ($p_{1\tau}$) is determined as the total revenue after taxation ($p_{1\tau} X_{1\tau}$) becomes equal to the value before taxation ($p_1 X_1$) to maintain profits before taxation. Consequently, tithes are an ad valorem tax. Equation (19) expresses that landlords *indirectly* pay taxes, as the nominal rent after taxation ($p_{1\tau} R_\tau$) is identical to that before taxation ($p_1 R$) while the corn price rises.

From the discussion of section III, we consider Equations (17) and (18) to be the initial effect of tithes. In this case, Equation (18) shows that the money prices of raw produce increase because of the effect, without needing to use the gold sector.

Long-Term Effect of Tithes

Next, we examine the long-term effect of tithes on the stationary state. Assuming that the Ricardian growth such as Pasinetti did is applied to Senior's discussion, the effect is explained using the following equations:

$$\pi_\tau = p_{1\tau} X_\tau + p_2 X_2 - p_{1\tau} R_\tau - p_{1\tau} \omega_S N = \{1 - (1 + \tau)p_1 \omega_S\} N \quad (20)$$

$$r_\tau = \frac{\pi_\tau}{p_{1\tau} \omega_S N} = \frac{\frac{f'(N_1)}{1 + \tau} - \omega_S}{\omega_S} \quad (21)$$

$$\left. \frac{\dot{K}}{K} \right|_\tau = \phi r_\tau \quad (22)$$

where π_τ and r_τ are the total profits and the profit rate after taxation, respectively; and $\left. \frac{\dot{K}}{K} \right|_\tau$ expresses the capital accumulation rate after taxation.

Equations (20) and (21) are the definitional expressions of profits and the profit rate after taxation, respectively. They express that nominal wages rise according to tithes and fall on profits.²² In this case, Equation (22) is the capitalists' investment function after taxation.

The economy, while advancing along the natural wages, finally converges with the stationary state. Figure 2 shows the state after taxation:

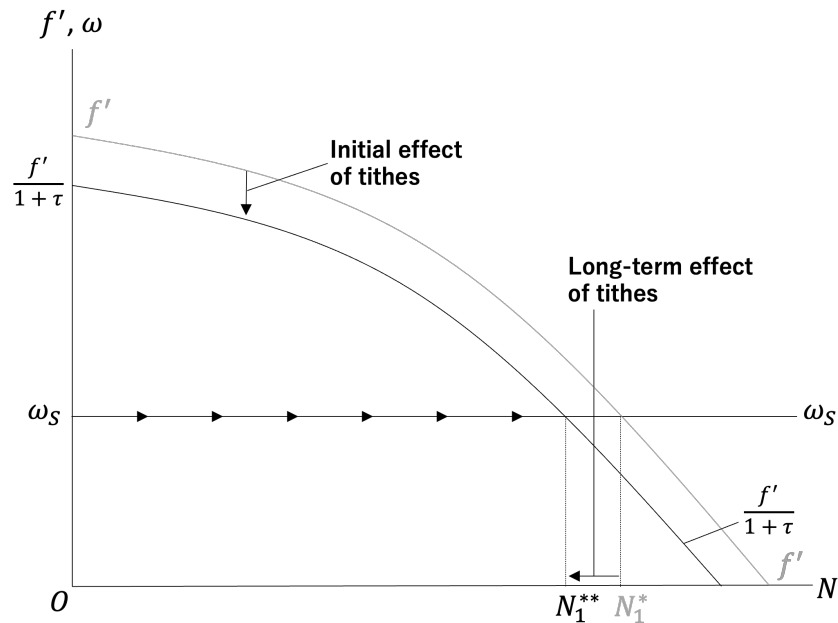


Figure 2. The stationary state in the taxed economy.

No growth occurs in this state as the real wage rate is ω_S and the profit rate is zero. Thus, substituting the latter into Equation (21), the minimum rate of profits after taxation is $0 = \{f'(N_1^{**})/(1 + \tau) - \omega_S\}/\omega_S$, where N_1^{**} is the labor force of the corn sector at the stationary state. From Figure 2, we can easily confirm that the initial effect of tithes, in the sense of reducing the (marginal) product of labor disposable in the market, plays an important role in causing the long-term effect, in the sense of retrograding the stationary state in the taxed economy compared to the state in the untaxed economy. Considering

²²As in Ricardo's case (Ricardo 1951-73, I, p. 159), for simplicity, here, since the initial point, we assume that real wages are at the natural level, and that through the initial effect of tithes, nominal wages rise according to taxes and the profit rate decreases.

Equation (1), we concretely obtain the labor force at the stationary state after taxation as follows:

$$N_1^{**} = \left\{ \frac{\beta}{(1 + \tau)\omega_S} \right\}^{\frac{1}{1-\beta}}. \quad (23)$$

Then, from Equations (1), (6), and (23), the *after-tax* price of corn in the stationary state (p_1^{**}) is as follows:

$$p_1^{**} = \frac{1}{f'(N_1^{**})} = \frac{1}{(1 + \tau)\omega_S}. \quad (24)$$

Moreover, we know the labor force of the gold sector in the stationary state after taxation. From Equations (1), (2), (6), (7), (10), (18), and (19), the concrete labor force of the gold sector after taxation is identical to that before taxation. Considering Equation (23), we obtain the labor force in the stationary state (N_2^{**}):

$$N_2^{**} = \frac{1 - \beta}{\beta} \left\{ \frac{\beta}{(1 + \tau)\omega_S} \right\}^{\frac{1}{1-\beta}}. \quad (25)$$

Hence, we obtain the total labor force in the stationary state after taxation (N^{**}) as follows:

$$N^{**} = \frac{1}{\beta} \left\{ \frac{\beta}{(1 + \tau)\omega_S} \right\}^{\frac{1}{1-\beta}}. \quad (26)$$

We have examined the economy that reached the stationary state with tithes. Now we obtain the long-term effect of tithes on the stationary state by comparing the discussions in sections IV and V.

First, the market prices of corn in the stationary states *measured by money* are consistent in the taxed and untaxed economies. Considering gold as the numeral, this is confirmed from Equations (7), (14), and (24):

$$\begin{aligned} p_{1M}^* &\equiv \frac{p_1^*}{p_2}, p_{1M}^{**} \equiv \frac{p_1^{**}}{p_2} \\ \frac{p_{1M}^*}{p_{1M}^{**}} &= \frac{f'(N_1^{**})}{f'(N_1^*)} = 1 + \tau \\ p_{1M}^* &= p_{1M}^{**}(1 + \tau) \end{aligned} \quad (27)$$

where p_{1M}^* is the market price of corn in the stationary state without taxes and p_{1M}^{**} is the *after-tax* price of corn in the stationary state with taxes, *which are denoted in money terms*. Equation (27) means that the market price of corn in the stationary state with tithes is

consistent with that without tithes.²³

Second, the stationary state with taxes retrogrades than that without taxes. This is confirmed by comparing Equations (13) and (23). Thus,

$$N_1^* > N_1^{**}. \quad (28)$$

Third, the total population and output in the taxed economy are below those levels in the untaxed economy. In this regard, from Equations (16) and (26), we know the relationship of the total population in the taxed and untaxed economies. Thus,

$$N^* > N^{**}. \quad (29)$$

Furthermore, from Equations (13), (15), (23), and (25), we know that the total output in the taxed economy is also below the level in the untaxed economy, as well as the total population.

Fourth, from Equations (28) and (29), in the stationary state with taxes, less output and consumption of corn are brought than those without taxes.

Those four arguments mean that “the *immediate* effect of a general tax on raw produce is to raise its price [...] but that its *ultimate* effect is to diminish the consumption and production of raw produce, but to leave its price unaffected” (Senior 1836, pp. 122-123; italics in the original), hence, it causes a decrease in the gross rent and wages, compared to the stationary state without taxes. Thus, we reconstructed Senior’s argument of the long-term effect of tithes on the stationary state using Ricardian growth.

VI. Conclusion

In the *Political Economy*, Senior expanded the initial effect of tithes in the capital accumulation process into the long-term effect on the stationary state. Regarding the former, Senior acknowledged Ricardo’s argument in terms of the price of raw produce to increase after taxation. Moreover, regarding the latter, Senior held the issue within the framework of Ricardian growth. Whether consciously or unconsciously, developed Ricardo’s theory. In this sense, Senior was the orthodox successor of Ricardo.

²³Here, if increasing returns of gold production is assumed, Equation (27) is not established. In other words, the condition that the wise institutions do not appropriately function is essential to establish the discussion.

This indicates that Senior is still under the influence of Ricardo's economics. As discussed in section III, Senior's main criticism of basic Ricardian growth stemmed from its implications for human progress. However, he was keenly aware of the problems of diminishing returns and the stationary state, as the case where wise institutions (and the desire of bettering our condition) should not function, which enabled him to develop the initial effect of tithes into the long-term consequences. Therefore, it seems that Senior's general stance on economic growth can also be considered as an extension of Ricardo's economics. For, while Ricardo dealt with the strong cases of diminishing returns as principles, he also, more realistically, considered the introduction of machines into production that would increase labor productivity. In our view, the discussion appears to align with arguments supporting endogenous growth. Senior's argument of the human progress as a driving factor must be discussed in relation to the issue with Ricardo in the future.²⁴

On the other hand, it may be said that Senior have been the person who tried to mediate between Ricardo and Malthus. His argument of the initial effect of tithes was similar to Malthus's method in terms of the short-term disequilibrium of food supply and the changes in consumer's behavior accompanying it. However, in the long-term effect, it was similar to Ricardo's method in terms of leading to a stationary state in the long term as "strong cases" to "elucidate principles" (Ricardo 1951-73, VIII, p. 184).²⁵ Therefore, it appears that Senior constructed a more comprehensive theoretical framework combining the latter long-term method with the former short-term method.

²⁴In this regard, Kurz (2015, pp. 835-839) deals with Ricardo on machinery regarding the induced innovation. Furthermore, Kurz and Salvadori (2003) address the history of endogenous growth theory, though they do not have examined the relationship between endogenous growth and Senior's economic thought. Exploring the relationship between Ricardo and Senior may offer deeper insights how we understand and approach the concept of endogenous growth. Regarding this, Hollander (1979, pp. 567-589) attempts to associate Ricardo's economic growth with Senior's, but he does not appear to have been fully examined that from the perspective of endogenous growth.

²⁵Thus, indeed, there is the methodological difference between Ricardo and Senior as Depoortère (2013) argues, however, their method may still be similar in some points.

Finally, this study could not fully demonstrate the significance of Senior's contributions in relation to Mill's argument. According to Mill (1848), Senior was the first person to analyze the dynamic effect of taxes. However, Senior's approach was, in reality, a comparative static analysis of stationary states. Thus, a thorough comparison of Mill's stance on taxation and growth with those of Senior is warranted.

References

- Blaug, Mark. 1992. *The Methodology of Economics or How Economists Explain*. Second edition. Cambridge: Cambridge University Press.
- Bowley, Marian. 1937. *Nassau Senior and Classical Economics*. London: G. Allen and Unwin.
- Casarosa, Carlo. 1978. "A New Formulation of the Ricardian System." *Oxford Economic Papers* 30 (1): 38–63.
- Chatzarakis, Nikolaos, Tsaliki, Persefoni, and Tsoulfidis, Lefteris. 2024. *Economic Growth and Long Cycles: A Classical Political Economy Approach*. London and New York: Routledge.
- Depoortère, Christophe. 2013. "William Nassau Senior and David Ricardo on the Method of Political Economy." *Journal of the History of Economic Thought* 35 (1): 19–42.
- Dome, Takuo. 1992. "Ricardo's Theory of Tax Incidence: A Sraffian Re-interpretation." *Cambridge Journal of Economics* 16 (1): 43–53.
- Eagly, Robert V. 1983. "Tax Incidence in Ricardian Analysis." *Public Finance* 38 (2): 217–231.
- Garegnani, Pierangelo. 1984. "Value and Distribution in Classical Economists and Marx." *Oxford Economic Papers* 36 (2): 193–226.
- Hicks, John. and Hollander, Samuel. 1977. "Mr. Ricardo and Moderns." *Quarterly Journal of Economics* 91 (3): 351–369.
- Hollander, Samuel. 1979. *The Economics of David Ricardo*. Toronto: University of Toronto Press.
- Kurz, Heinz D. 2015. "David Ricardo: On the Art of "Elucidating Economic Principles" in the Face of a "Labyrinth of Difficulties"." *European Journal of the History of Economic Thought* 22 (5): 818–851.
- Kurz, Heinz D. and Salvadori, Neri. 1995. *Theory of Production: A Long-period Analysis*. Cambridge: Cambridge University Press.

- —. 2003. *Classical Economics and Modern Theory: Studies in Long-Period Analysis*. London: Routledge.
- Mill, John Stuart. [1848] 1965. *Principles of Political Economy with Some of Their Applications to Social Philosophy*, 2 vols. In *Collected Works of John Stuart Mill*, Vols. 2-3, edited by J. M. Robson. Toronto: University of Toronto Press.
- O'Brien, Denis P. 1975. *The Classical Economists*. Oxford: Clarendon Press.
- —. 1981. "Ricardian Economics and the Economics of David Ricardo." *Oxford Economics Papers* 33 (3): 352-386.
- Pasinetti, Luigi L. 1960. "A Mathematical Formulation of the Ricardian System." *Review of Economic Studies* 27 (2): 78-98.
- Ricardo, David. 1951-73. *The Works and Correspondence of David Ricardo*, edited by P. Sraffa and M. H. Dobb, 11 vols. Cambridge: Cambridge University Press.
- Senior, Nassau. W. [1827] 1998. *An Introductory Lecture on Political Economy*. In *Senior (1998)*. Bristol: Thoemmes Press, vol. I.
- —. [1829] 1998. "Two Lectures on Population, to which is added, a correspondence between the author and the Rev. T. R. Malthus." In *Senior (1998)*. Bristol: Thoemmes Press, vol. III.
- —. [1836] 1998. *An Outline of the Science of Political Economy*. In *Senior (1998)*. Bristol: Thoemmes Press, vol. I.
- —. [1848] 1998. "J. S. Mill on Political Economy." *The Edinburgh Review* 88: 293-339. In *Senior (1998)*. Bristol: Thoemmes Press, vol. I.
- —. 1998. *Collected Works of Nassau William Senior*, edited by D. Rutherford. Six volumes. Bristol: Thoemmes Press.
- Sraffa, Piero. 1951. "Introduction." In *Ricardo (1951-73)*. Cambridge: Cambridge University Press, vol. I.
- Wakamatsu, Naoyuki. 2025. "Ricardo and the Origin of Dynamic Tax Analysis." *European Journal of the History of Economic Thought* 32 (2): 293-316.