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# Turgot's Calculations on the Effects of Indirect Taxation

*Richard van den Berg and Daniel Russell*

## ABSTRACT

A newly recovered manuscript contains Turgot's calculations of the harmful effects of indirect taxes in comparison to the imposition of a direct tax on the freely disposable incomes of landowners. It shows an unexpected side of Turgot, who was thought to have been reluctant to apply mathematics to economic reasoning. His assumptions and mathematical method are explained and compared to Quesnay's notion of *repompement* and Du Pont's *Courbes politiques*.

**KEYWORDS** Turgot, taxation, physiocracy, mathematical economics

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## 1. Introduction

There is a tantalising footnote in the second volume of Gustave Schelle's *Œuvres de Turgot*, which describes an unknown manuscript of the illustrious 18<sup>th</sup> century author and statesman. It reads:

In a memo entitled *Appréciation des effets de l'impôt indirect*, Turgot carries out a series of calculations, relying on the principles of Quesnay's *Tableau Économique*, in order to see if, as was held in physiocratic circles, the real charge of an indirect tax was doubled due to the charges of collection and the damages to the net product (Schelle 1914, ii, 312, n.a).<sup>1</sup>

The reason why this is fascinating is that in none of his *known* writings Anne Robert Jacques Turgot (1727-1781) made any serious attempt to give application to 'the principles of' Quesnay's famous arithmetical schemes by means of 'a series of calculations'. Until now, however, this single sentence by Turgot's early 20<sup>th</sup> century editor has remained our sum total of knowledge about this particular manuscript.<sup>2</sup> The reason for this is that, disappointingly, Schelle continued his footnote with an

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CONTACT Richard van den Berg [r.van-den-berg@kingston.ac.uk](mailto:r.van-den-berg@kingston.ac.uk) Business School, Kingston University, Kingston Hill Campus, Kingston upon Thames, KT2 7LB, United Kingdom. Daniel Russell, Business School, Kingston University, United Kingdom.

<sup>1</sup> Unless indicated otherwise, translations are our own.

<sup>2</sup> There does not seem to exist any subsequent commentary on, or investigation of, Schelle's remarks. Neither is there any earlier mention of Turgot's calculations. Crucially, Du Pont's edition of Turgot's *Œuvres* (1808-1811), which before Schelle was the principal source for students of Turgot's work, lacks any reference to them. Whether Du Pont did in fact know Turgot's calculations is an issue considered in section 4 below.

explanation of why he had decided *not* to include it in his edition of Turgot's collected works: 'The memo is too shapeless [*trop informé*] to be reproduced. It is sufficient to say that in this period Turgot started to discuss physiocratic opinions' (*ibid.*).

Any later researcher who would have wanted to investigate the matter further could not do so, at least not from the early 1970s onwards, because the Lantheuil collection, which contained Turgot's private papers and to which the manuscript in question clearly belonged, was inaccessible. Only recently, with their transfer to the *Archives Nationales*, have these papers become available.<sup>3</sup> This allows one to confirm that the memo to which Schelle referred is still present in the collection and is in fact a five-page set of calculations, carrying the title *Appréciation des effets de l'impôt indirect*.<sup>4</sup>

The current paper assesses for the first time the contents of Turgot's memo, which is presented in English translation in appendix 1. It proceeds in the following way. Section 2 discusses Turgot's reasons for the various assumptions on which his calculations are based. Section 3 examines his actual calculations and arithmetical method. Section 4 compares Turgot's contribution with a number of the physiocratic writings on the same topic, and looks in particular at related ideas, namely Quesnay's notion of *repompement* and Du Pont's *courbes politiques*. Section 5 is a conclusion.

## 2. Context of Turgot's assumptions

It is difficult to date Turgot's memo precisely. The paper on which it is written is identical to the paper on which he wrote rough notes that he gave the title *Matériaux pour le mémoire sur les impositions*.<sup>5</sup> Those notes were very probably made in preparation for a *Mémoire sur les Impositions* of which Turgot subsequently only commenced a *Plan* and on which he is likely to have stopped working by the end of 1763.<sup>6</sup> From this one could conclude that it is more likely than not that Turgot also wrote the memo with the calculations considered here in the early 1760s, perhaps in 1763, but this is not at all certain.

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<sup>3</sup> The sale of the family archive of the Turgots was completed in February 2015. See the official press release: <http://www.culture.gouv.fr/Presse/Archives-Presses/Archives-Communiqués-de-presse-2012-2018/Année-2015/Acquisition-par-l-Etat-des-manuscrits-Turgot>. With their entry into the *Archives Nationales* in March 2015 the collection that Schelle and others called the Lantheuil archive has been renamed *Fonds Turgot*.

<sup>4</sup> The reason to emphasise the fact that this manuscript is 'still present' is that regrettably Turgot's papers have not, as the government's press release would have it, 'reached us practically intact' (see previous note). A significant number of other writings that Schelle *did* transcribe for his edition of Turgot's *Works* from originals in the Lantheuil archive have since gone missing. For some instances see below notes 12, 21, 52 and 60.

<sup>5</sup> Schelle (ii, 308-310); AN 745AP/42, dossier 11, images 2-7. The watermark and countermark are the same as what is found in the paper on which '*Appréciation*' was written (AN 745AP/42, dossier 11, images 11-14). In addition, superimposition of the papers on a light box shows that the stretches on the paper are identical. This makes it highly likely that the paper used for both drafts was produced at the same place and time. We are grateful to Frédéric Moyer for providing us with this detailed information.

<sup>6</sup> This *Plan*, of which the manuscript version is lost, was presumably intended as advice to the controller-general Bertin (1719-1792) who was dismissed in December 1763; hence its dating to that year (see Du Pont iv, 203; Schelle ii, 293-4; Groenewegen 1977, xxi-xxiii).

By this time he had for some years been the King's *Intendant* in the Limousin. This position brought with it responsibility for the administration of a complex and irregular tax system, and this inspired the ambitious official to write various reports, opinions, and private reflections dealing with tax reform.<sup>7</sup> Some of these writings are of a highly practical and specific nature; others clearly aim at a more theoretical and abstracted level of analysis. The earliest known writing of the latter kind is the just mentioned draft *Mémoire sur les Impositions*. In it Turgot argued that under ideal circumstances taxation would take the form of a direct tax on the rent incomes of land proprietors.

In this opinion, as he made clear, he followed 'M. Quesnay [who] was the first to establish the correct notion of the revenue, when he learnt to distinguish the *gross product* [*produit brut*] from the *net product* [*produit net*]' (Groenewegen 1977, 102; Schelle ii, 301-2). Being conversant with publications like Mirabeau's *Théorie de l'impôt* (1760) and *Philosophie rurale* (1763)<sup>8</sup>, Turgot explained that this distinction was based on the calculation of all costs involved in the cultivation of landed properties in comparison with the expected sales value of the harvests. Quesnay had shown, according to Turgot, that to obtain the net product it was

necessary to deduct from the sale of the produce: firstly, all the expenses or *annual advances*; secondly, the interest on the *original advances*; thirdly, their maintenance and the replacement of their inevitable decay, at least equal to the interest; fourthly, the subsistence and reasonable profit of the entrepreneur farmer and his agents, the wages of their labour and of their industry (Groenewegen 1977, 103; Schelle ii, 302; emphasis in the original).<sup>9</sup>

The remainder of the sales value of the agricultural produce, after all costs of cultivation were deducted, would normally be paid as rent to land proprietors. Competitive forces would prevent successful cultivators from retaining more than a 'necessary' income. As Turgot explained: 'the cultivator has to live; he has to have his subsistence; he has to get the profit that encourages him to cultivate, that makes him take that occupation rather than another; [but] do not fear that he will receive too much; if he insists on too much, another [cultivator] would soon come and offer the proprietor a better deal' (Schelle iii, 8).<sup>10</sup> This, Turgot insisted, had direct consequences for the theory of taxation: 'the

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<sup>7</sup> In volumes 2 and 3 of the collected works Schelle included a range of Turgot's official missives and letters about the implementation and assessment of various taxes in the Limousin. Still others remain unedited in the *Archives Départementales* of Haute-Vienne in Limoges (see Kiener and Peyronnet 1979, 325).

<sup>8</sup> These are the two works that are specifically mentioned in Turgot's *Plan* (see Schelle ii, 305).

<sup>9</sup> Here Turgot was not very clear which of these components of cost corresponded to the 'opportunity cost' of capital. This notion would be developed more distinctly in his later writings where he argued that the necessary return on capital employed in agricultural production would establish 'a kind of equilibrium' with those of alternative allocations of a same sum. While that notion does not figure prominently in the physiocratic literature (although it occurs in some places), Turgot's more ambiguous formulation in the passage quoted above is not unlike, for example, the discussion in *Philosophie rurale* (ch. ix, 189-190) about '*l'intérêt du capital des avances*'.

<sup>10</sup> The idealised portrayal of the determination of the terms of land leases under the pressure of competitive bidding by commercial farmers was common amongst physiocratic authors in their more theoretical writings (see van den Berg 2000, 198 n.5), even while they recognized that the reality was different in large parts of rural France. In the *Reflections* too Turgot insisted that '[...] when competition

cultivator makes calculations [about the necessary costs of cultivation] when he leases a piece of land: it is the surplus [*le surplus*] which he gives to the proprietor that makes up the revenue, and it is only on this revenue that taxes can be levied' (Groenewegen 1977, 103; Schelle ii, 302).

From the early 1760s therefore, Turgot was convinced of the principle that 'the theory of taxation' boiled down to the simple 'maxim' that 'the process of the advances and labour of agriculture [...] can neither be constrained nor interrupted without ruin' (Schelle ii, 640). Only taxes taken directly from the *produit net* would allow an undisturbed cycle of reproduction, because

the surplus, which the cultivator gives to the proprietor of the soil [and which] forms the latter's revenue, not being in any way necessary to the reproduction of the following year, is completely free, disposable and susceptible to division among the titular owner, the recipient of the tith, the feudal collector, the State, etc. (Groenewegen 1977, 123; Schelle ii, 630).

Turgot would not deviate from these principles until his death two decades later. Nevertheless he seems to have felt that a rigorous demonstration of these principles was wanting. The desirability of the latter appears to have motivated both Turgot's *Appréciation* and his, presumably subsequent, decision in 1765 to organise an essay competition that offered a prize for the submission that would 'best demonstrate and calculate [*démontré et apprécié*] the effect of indirect taxation on the revenue of the owners of land'.<sup>11</sup> In a letter to his critical correspondent David Hume, who he tried to persuade to take part in the competition, we are given a glimpse of his concern with finding a precise demonstration of the effects of indirect taxes. He explained that his reason for organizing a prize competition about the effects of indirect taxes was

to encourage work on the estimation of the effects of the indirect tax, an evaluation about which I myself am *not yet certain, as far as the share concerned*, rather than to have a discussion on the general question, about which I am fully convinced.<sup>12</sup>

This passage is noteworthy for two reasons. First, the phrase '*l'appréciation des effets de l'impôt indirect*' is identical to the title of the newly discovered memo. This may

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among [the farmers] is very keen [*fort animée*], they give [the proprietor] the whole of this surplus, since the proprietor will let his land only to the man who offers the highest rent' (Groenewegen 1977, 72; Schelle ii, 571). He developed this point in greater detail in the sixth letter on the grain trade of November 1770 (see Schelle iii, 305-6).

<sup>11</sup> See Schelle (ii, 430-433) for the text of Turgot's announcement of the prize competition of the Royal Agricultural Society of Limousin. Further details about the essay competition are provided by Decroix (2006, 97-99) and Orain (2008, 60-62).

<sup>12</sup> Letter dated 7 September 1766; translation in Groenewegen (1992, 14, emphasis added). The original reads: '*pour engager à travailler sur l'appréciation des effets de l'impôt indirect, évaluation encore incertaine pour moy quant à la quotité, que pour faire traiter la question générale, sur laquelle j'ay une conviction entière*'. It should be noted that the copy of this letter which at one time was present in the Lantheuil collection, and of which Schelle (ii, 500-503) published a transcript, is now missing from the *Fonds Turgot*. Fortunately, the original is preserved in the National Library of Scotland (MS23157 no. 85).

suggest that Turgot when writing to Hume had in mind the kind of exercise that we find in the memo.<sup>13</sup>

Second, Turgot distinguished between, on the one hand, the general principle that indirect taxes were harmful to reproduction, something about which he was ‘fully convinced’, and on the other hand, a precise demonstration showing the *extent to which* the costs of imposing indirect taxes on goods would exceed those of a direct *impôt unique* on the incomes of landowners, something about which he was ‘not yet certain’.

*Inter alia*, this wording does not necessarily mean that he had not yet made his calculations by the autumn of 1766. It may instead indicate that he had made them but was not fully satisfied with them. Both the material comparison of papers and the fact that Turgot left his memo unfinished, somewhat favour the latter interpretation.<sup>14</sup>

The distinction between the general effect of indirect taxes and its precise demonstration may have been motivated by Turgot’s dissatisfaction with the estimations regarding the effects of indirect taxes that Quesnay and his followers had presented up to that point (something discussed further in section 4). In the event, the prize competition, despite resulting in a winning entry by Saint-Péravy and a commendation for the much more original *Essai* by Graslin, did not yield the more precise analysis of the effects of indirect taxation that Turgot had hoped for. This, at least, was the conclusion he reached in a subsequent letter to Hume where he expressed his wish to continue to reflect on ‘a subject dear to my heart which I believe capable of proof.’<sup>15</sup>

It appears that the elusive ‘proof’ Turgot had in mind was of a mathematical kind. Perhaps the translation of the French word *démonstration* with the English ‘proof’ has the disadvantage of importing the suggestion of a stricter meaning than Turgot may have intended. That is to say, he is more likely to have had in mind a precise numerical illustration (as in the *Appréciation*), as opposed to the deduction of mathematical truth from a set of axioms. However, it is difficult to agree fully with the recent argument of Charles and Théré (2017, 22) that the *Intendant* was not interested in mathematical demonstrations at all and that he disapproved on epistemological grounds of Quesnay’s attempts to support his economic theories by means of calculations and figures.<sup>16</sup>

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<sup>13</sup> Admittedly, as was suggested by one of the referees, the use of the same phrase in the two documents does not preclude the possibility that Turgot meant something less precise when using the term *appréciation* in his letter to Hume, since it may refer to various kinds of evaluations of the effects of indirect taxes, either of an empirical or theoretical nature.

<sup>14</sup> For the first point see above n.5; for the second point see note 39. There is also no evidence that Turgot made his calculations in direct response to submissions to the prize competition. For what it is worth, the paper on which Turgot wrote his reports about the submissions of Saint-Péravy (AN745AP/40 dossier 2, images 124-133) and Graslin (*ibid.*, images 134-139) differs from that of the *Appréciation*.

<sup>15</sup> Translation Groenewegen (1992, 24). This letter is dated 8 March 1768. The original reads: ‘*car c’est une matiere que j’ay a coeur et que je crois susceptible de demonstration*’ (National Library of Scotland MS23157 no. 88). The sole publication of this letter appears to have been in Hill Burton (1849, 162-163).

<sup>16</sup> Charles and Théré argue that ‘[c]learly, Turgot did not share Quesnay’s epistemology. For him, neither sensory evidence nor calculations were needed to create a set of economic principles.’ They suggest that Turgot would have been opposed to Quesnay’s entire quantitative approach to economic analysis. A more

Rather than denying the merit of supporting economic arguments with calculations *per se*, all Turgot professed to on some occasions was that he struggled with the technical details of the *Tableau* and that he was unwilling to accept their accuracy as a matter of faith. For example, in a letter to Du Pont, dated 29 March 1765, Turgot confessed that he was still struggling to follow certain numerical details of ‘the doctrine of our common master [Quesnay]’:

[...] even though you attribute to me a full initiation [into the doctrine], there are still mysteries to me and I am not entirely satisfied about the foundations of our algebra. I am like the disciples of Leibnitz who use differential and integral calculus and who arrive at certain truths without being perfectly satisfied with the line [of reasoning] that led them there. I therefore need the work that you promise us for myself (Schelle ii, 436).

If Turgot’s newly discovered memo shows anything then it is that, rather than eschewing calculations, he in fact made his own attempts to give substance to his claim that the harmful effects of indirect taxation were ‘capable of demonstration’.

Turgot’s approach to such a demonstration was rather thoughtful. He was careful to explain that calculations should only be applied to highly simplified cases. In a draft that is found alongside the *Appréciation*<sup>17</sup>, he indicated the simplifying assumptions that would have to be made in order to develop a generalised analysis of the effects of indirect taxes. In particular, one would have to abstract from two actual characteristics of such taxes.

First, one would have to abstract from the fact that ‘taxes on consumption goods are of infinite variety’. That is, of course indirect taxes were levied in many different ways (*la forme*), at a variety of rates, and there also were considerable differences between towns and the countryside in the amounts consumed of differently taxed goods (*le fond*), all suggesting that the incidence of such taxes was variable (Schelle ii, 310).<sup>18</sup> However, for the sake of simplicity one would have to make the radical assumption of a *single* rate of indirect tax being imposed on *all* goods traded in the economy.

Second, one would have to abstract from the fact that the incidence of indirect taxes varied with ‘the greater or lesser competition in trade, which results in the greater or lesser ease with which the sales value [*valeur vénale*] approaches the fundamental

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measured position is that of Larrère (1992, 17-22) who argues that Turgot rejected some of the overly general assumptions on which Quesnay and his followers based their calculations such as constant returns on advances in agriculture. This is indeed very clear from Turgot’s criticism of Saint-Péravy’s calculations (see note 30 and van den Berg 2000). But such criticism did not imply a general rejection of the application of calculations to economic questions.

<sup>17</sup> In the *Fonds Turgot* the set of calculation is immediately preceded by another unfinished draft that develops similar principles, entitled *Effets de l’impôt indirect* (AN 745AP/42, dossier 11, images 8-10). The latter draft Schelle *did* include in his edition of Turgot’s collected works (see Schelle, ii, 310-312). It should be noted that the paper on which this draft was written, differs from that used for the preceding and subsequent drafts (see note 5 above). This *may* mean that it is of a somewhat different date. Schelle (ii, 310), without the benefit of a material comparison, suggested the possibility that this draft was written ‘after 1763’. We simply cannot be sure.

<sup>18</sup> For a recent introduction to the complexities of the fiscal regulations of the *ancien régime* see Chanel (2015). Turgot did of course have an extensive practical experience with these complexities.

value [*valeur fondamentale*] with the least possible difference' (*ibid.* 311).<sup>19</sup> This second aspect was something Turgot elaborated upon at some length in another letter to Hume. Replying to the latter's detailed argument that in practice the incidence of indirect taxes varied widely,<sup>20</sup> Turgot acknowledged that Hume was right to argue that the sales value of any merchandise or hire of labour was determined by 'the relationship of supply and demand'.<sup>21</sup> In practice the incidence of indirect taxes could indeed vary depending on the uneven impact they may have on demanded and supplied quantities of various goods. However, under 'natural' circumstances, he argued, one must assume that the current prices of any product, as well as the wages of labour would tend towards the 'fundamental value', that is to say, their necessary costs of reproduction.<sup>22</sup> In order to reason in a strict and simplified manner about the effects of indirect taxes, one could therefore abstract from the deviations of sales values, or market prices, from their fundamental values.

Turgot was explicit in stating both abstractions as a way of simplifying his analysis:

Since one should simplify the question, one should suppose from the outset the natural state of things [*les choses dans leur état nature*] and, consequently, assume competition being pushed as far as it can be. We also have to assume a general imposition [both] on towns and on the countryside. The question will thus be reduced to its most simple terms the more one assumes the merchandise affected [to be] of the most general consumption and the most general production (Schelle ii, 311).

As we will see presently, the upshot of these simplifying assumptions for his calculations on the effects of indirect taxes was that additional sums raised by government were always presumed to raise the prices of all commodities proportionally and to the full extent of the tax.

The simple case to which Turgot chose to apply his calculations was the following:

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<sup>19</sup> He called this possibility of different levels of competition in different industries an 'external circumstance' [*circonstance étrangère*] implying that the normal or 'natural' situation was one of 'full competition'. About the conception of full competition in physiocratic writings see van den Berg (2004).

<sup>20</sup> Hume made this argument in a letter he probably wrote in late September 1766. Léon Say (1888, 53-55) first published in the original English the part of the letter containing this argument -though not the preceding account of Hume's ongoing troubles with Rousseau. It was published in full in Greig (1932, 88-95). The original is in the *Fonds Turgot* (AN 745AP/41, dossier 2, images 108-110).

<sup>21</sup> '*le rapport de l'offre et de la demandé*'. Turgot to Hume, 25 March 1767; translation Groenewegen (1992, 18). The copy of this letter on which Schelle (ii, 658-665) based his transcript is absent from the *Fonds Turgot*. The original of Turgot's letter is still present in the National Library of Scotland (MS23157 no. 86).

<sup>22</sup> 'the fundamental price [...] for a commodity is what the thing costs to the workman. In the case of the workman's wage [*le salaire de l'ouvrier*], the fundamental price is the cost of his subsistence. It is impossible to tax the wage earner without increasing the price of his subsistence, since to his former expenditure that of the tax must be added. The fundamental price of labour is therefore raised. Now, although the fundamental price is not the immediate basis of the current value, it is, however, a minimum below which it cannot fall. For if a merchant loses on his wares, he ceases to sell or manufacture; if a workman cannot live by his labour, he becomes a beggar or a migrant. This is not all: the workman must have a certain profit, to meet contingencies and raise a family. In a nation where commerce and industry are free and active, competition settles this profit at the lowest possible rate' (Groenewegen 1992, 18; Schelle ii, 663).



The State needs a given sum [of money]; the question is to compare what the landowner pays in the case of direct taxation with what he pays in the case of indirect taxation, supposing that the people pay the same sum in each case; I say supposing because this supposition will not be correct. It is evident that the costs of the administration [*les frais de régie*] of the indirect taxation are incomparably more considerable than those of direct taxation, being moreover accompanied by an infinity of frauds (Schelle ii, 311-312).

There are two things worth noting about this way of framing the question. First, Turgot assumed a case where 'the State needs a given sum', rather than one in which it decided to impose a specific rate of taxation. The former was the practice of the French state with regards to some direct taxes like the *taille*; the latter was the preferred system of the physiocrats.<sup>23</sup> Turgot's choice in the *Appréciation*, however, rather than a political preference, was probably more motivated by the logic of the analytical exercise he had in mind, of which, as we will see, one objective was to *determine* the different additional rates of tax associated with the two ways of raising additional government revenue. Second, Turgot set aside a number of perceived additional disadvantages of indirect taxes, such as the higher costs of collection and the greater scope for fraud on the part of tax collectors and tax evasion by consumers.

### 3. The Calculations

As can be seen in appendix 1, Turgot's calculations start with the assumption of a set of numbers representing the different categories of spending in a highly stylised economy. These categories are identical to the ones he outlined in his correspondence with Hume. To make this point, we add the figures from which Turgot started his calculations in square brackets to the following passage of his letter of 25 March 1767:

[...] the principle from which I start and which I believe to be incontestable [...] is that there is no other possible revenue in a state than the annual product of the soil. That the *total product* [2100m] is divided into *two parts*: one destined for the *reproduction* of the following year [1400m], which includes not only that part of the product which is *consumed in kind* by the entrepreneur-farmers [600m], but also what they use to pay the wages of all the different types of workmen who work for them – blacksmiths, wheelwrights, barrel makers, weavers, tailors, etc.; it also includes their profits and the interest on their advances [800m]. The other part is the *net product*, which the farmer gives to the proprietor [700m].<sup>24</sup>

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<sup>23</sup> For Turgot's discussions of the differences between these two systems see especially Schelle (ii, 305-6 and v, 517-18). He neatly summed up the essential difference as follows: 'Under the first system it is the rate of the contribution of each proprietor in relation to the sum total of his revenue that is certain and determined by law, and the sum that the State draws to support public expenditure is uncertain. By contrast, under the second system the sum demanded by the State is certain and the rate at which each proprietor contributes out of his revenue is uncertain' (*ibid.* v, 518). See Delmas (2009, 82-3) for a brief general overview of the attitudes of French advocates of fiscal reform in the 18<sup>th</sup> century towards *le système des impôts de quotité* versus *le système des impôts de répartition*.

<sup>24</sup> Translation Groenewegen (1992, 17; emphases added). As pointed out in n.21, the draft version of the letter on which Schelle based his transcript is now missing. There are some minor differences in wording between Schelle's transcript and the sent letter in the National Library of Scotland.

These numbers meant that total expenditures [*la totalité des dépenses*] in this economy were 1.5 billion, that is, the sum of the net product (700 millions) plus the expenditures by cultivators (800 millions). Not counted were, first, the own consumption of the agricultural class, *i.e.* seed, food and fodder, because this did not 'enter into trade', and, second, the expenditures of the artisans, who were paid out of the expenditures of the cultivators because 'that would be double counting'.<sup>25</sup>

The assumption that the net product is 1/3 of the total product is of some interest. Of course this, like the other numbers, may have simply been an arbitrary choice.<sup>26</sup> But it differed from Quesnay's customary assumption in the later *Tableaux* of the net product as being 2/5 of the total product. Instead, Turgot's division of the total product into 1/3 surplus and 2/3 farmers' income is more reminiscent of Cantillon's well-known three rents theory (see Cantillon 2015, 212).<sup>27</sup> It is worth noting, however, that Quesnay in one of his early economic writings, the article *Impôts*, had also assumed a division that was identical to Cantillon's.<sup>28</sup> Since we know that Turgot owned a copy of that article and wrote some comments on it around the mid-1760s, it seems plausible that he derived this particular assumption from Quesnay's early economic writing.<sup>29</sup>

Turgot initially assumed that 3/7<sup>th</sup> of the net product was taken in tax by the Sovereign, to be 'distributed to salaried public Magistrates, Soldiers, People of the Church &c.', and that 4/7<sup>th</sup> was the remaining income of the land proprietors. If the state next decided to raise another 50 million on top of the existing 300 million, it could do so in two ways. On the one hand 'if it is levied by way of direct taxation then the part of the proprietors will

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<sup>25</sup> The idea that counting the incomes of artisans would be a *double emploi* is typical for the physiocratic demarcation of the boundaries of 'national income', according to which only agriculture contributed. This does of course imply the view that non-agricultural activities were 'non-value-adding'. Elsewhere Turgot's position on this issue is complicated due his insistence on the regular existence of profit in manufacturing and trade. In the *Reflections* he appears to have wanted to reconcile the idea that only agriculture was capable of *generating* a surplus over costs of production with the idea that some of this surplus was *distributed* as incomes earned outside agriculture. For discussions see Faccarello (1990) and van den Berg (2010, 50-51).

<sup>26</sup> For instance, his reason for choosing the sum of 2100 million for the total product may simply have been that it neatly divides by three. It does not correspond precisely with any of the figures Quesnay chose in his *Tableaux* for *réproduction totale*. The most that can be said is that in some of the early *zig-zags* based on annual advances of 600, the total reproduction is calculated at a somewhat comparable magnitude of 2705 (see Quesnay 2005, 446).

<sup>27</sup> Turgot owned a copy of Cantillon's *Essai* (see Tsuda 1974, 494) and in a letter written in 1771 referred to this work in a positive manner (Schelle iii, 500). There is some evidence that he already read Cantillon in the 1750s (I make this point in more detail in van den Berg 2019).

<sup>28</sup> Quesnay had written this article in the late 1750s, probably 1757 or 1758, for inclusion in the *Encyclopédie*. After that work ran into problems with the censor, he had withheld it and it remained unpublished until 1908. The relevant passage reads: 'the expenses which the husbandman [*laboureur*] incurs in order to cultivate land [...] are about equal to two-thirds of the product of the harvest, [and] ought to be returned to the husbandman through the harvest itself in order to be expended anew in the cultivation of land. Thus two-thirds of the harvest forms no part of the profit [*profit*] which is yielded by this harvest. This kind of wealth, therefore, which is used in the cultivation of land, ought not to bear the burden of any taxes at all, for if any part of it is taken away from the cultivator the products of landed property will be correspondingly reduced' (translation Meek 1962, 103; for the original French see Quesnay 2005, 218).

<sup>29</sup> In fact, the only known copy of *Impôts*, preserved in the *Archives Départementales* of Haute-Vienne in Limoges, is the one once owned by Turgot.

evidently be reduced to 350 million'. Not devoting a further word to this, Turgot can be said to imply that, the net product being a freely disposable and non 'price-determining' share of total production, the only effect of the tax would be a redistribution of income from proprietors to the state.<sup>30</sup>

On the other hand, things would be different if 'the legislator prefers the way of indirect taxation'. Pages 2 and 3 of the memo are devoted to an analysis of this case. Assuming that all merchandises would have a same level of tax imposed, this meant a rate of 1/30, this being the fraction of 50 million over the total expenditures in the economy of 1.5 billion. Even though this tax would raise 50 million it would *not* give the sovereign the same additional spending power when compared to a direct tax raised on the net product: in the case of the indirect tax *only* the prices of all merchandises in the economy were now raised by 1/30. Importantly, this increase in the general price level would affect the expenditures of the state too.

To compensate for this loss in 'real value' of the tax receipts, the total tax revenue of 350 million would also have to increase by an additional fraction of 1/30. This required that another 11,666,666 (=350million/30) would have to be raised on top of the initial additional tax of 50 million. The imposition of this tax, however, would cause another round of increasing prices, this time by a further fraction of 1/129 (= 11,666,666/1.5 billion). This in turn would again lead to a loss of real value of the tax revenue, which was now 361, 666,666 and to compensate for this a fraction of 1/129 of that amount, or an additional 2,803,617 would have to be raised. This sequential process of additional taxes, giving rise to increasing prices, followed by increasing taxes would run through a number of rounds. The increases involved would, however, be smaller each round, or, as Turgot put it, each 'increase again influences all expenditures and those [*i.e.*, the increases] in taxes. But the increase becomes ever smaller and smaller [it is a] decreasing series'.<sup>31</sup>

Turgot did in fact calculate two of these decreasing series. The initial one was:

$$50m+11,666,666+2,803,617+679,196+165,375+40,277+10,000= 65,365,131$$

This, however, he replaced with the series:

$$50m+1,166,666+233,592+64,030+15007+3516= 51,482,811$$

The main reason for the difference is due to the second term: Turgot appears to have made a simple error in the later calculation by dividing 350 million by 300 instead of by

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<sup>30</sup> The tax burden on the net product would increase from 3/7 to 1/2. One should not conclude from this that Turgot meant that all proprietors would pay the same increase in absolute terms. In his other writings, especially his *Observations sur le mémoire de Saint-Péravy*, he carefully developed the insight that different landed properties, both due to different natural fertilities of soils and due to investments to improve productivity of the land, yielded different amounts of rent. An increased level of tax on the net product was to be raised in proportion to the rents collected, those lands yielding little rent paying less in absolute terms.

<sup>31</sup> 'cette augmentation influe encore sur toutes les dépenses et sur celles de l'impôt. mais l'augmentation devient toujours de plus en plus petite [...] [une] serie décroissante'

30 (or he simply miscounted the number of sixes when rounding to whole units). This error was then carried forward in the subsequent terms. For this reason the initial sequence, which he crossed out but which is still legible, is the more interesting one. One unintended advantage of the fact that Turgot performed the calculation twice is that it allows us to confirm the algorithm he used. This algorithm is examined in more detail in appendix 2A.

Having arrived at the final increase in indirect taxes of 65,365,131 as opposed to the 50 million that a direct tax on the net product would have yielded instantly, Turgot attempted to explore how the former sum would be distributed over the different social groups, that is, the state, the proprietors of land and the cultivators. Pages 4 and 5 of his memo are devoted to this question. He started with the observation that the sum total of indirect taxes had added 'about 1/23', or approximately 4.4%, to 'all expenditures' [*toutes les dépenses*].<sup>32</sup> Given this last statement, one would perhaps expect a simple inflation of the expenditures of *each* of the three social groups, and hence of total expenditures, by the same percentage, as follows :

*Figure 1a. Distributional effects of the additional taxes (in millions)*

	<i>Before AdditionalTax</i>	<i>Direct Tax Case</i>	<i>Indirect Tax Case (+1/23)</i>
<i>State</i>	300	350	<b>365.365131</b>
<i>Proprietors</i>	400	350	365.365131
<i>Cultivators</i>	800	800	<b>834.782608</b>
<i>Total</i>	1500	1500	1565512870

If this were the case, the differences between the effects of direct and indirect taxes would be purely nominal. There would be no different distribution of the tax burden when compared to what he expected to happen in case of a direct tax. But this is not how Turgot reasoned. Of the figures in the final column he only presented the figures in bold. The final tax revenue of the state he arrived at by means of his calculation involving the decreasing series, as explained above and in appendix 2A. The additional costs of the cultivators he obtained straightforwardly by increasing the original expenditures of 800 million by 1/23<sup>rd</sup>.<sup>33</sup> By contrast, he developed a different argument concerning the final income/expenditure of the class of proprietors.

<sup>32</sup> This fraction, which he obtained by dividing 65,365,131 by 1.5 billion, is indeed very close to the precise result of 65,383,113/1.5 billion, which gives a fraction of 1/22.94 (see appendix 2A).

<sup>33</sup> The number 34,782,608 is exactly 800 millions divided by 23 (ignoring the remainder, as he did throughout).

This can be understood in part from the principles discussed in section 2. In Turgot's conception the incomes of proprietors, unlike those of the cultivators, did not represent a payment for 'advances' made or 'necessary costs' of production. Instead it was a variable surplus left over after all costs of cultivation had been deducted. This had two consequences. First, when the farmers were faced with additional costs, not being able to bear them, they would pass them on to the proprietors, or rather 'the farmer reduces his lease by the total sum of the increase in his expenditures'.<sup>34</sup> As a result of the deduction of the increased cost incurred by the farmers (that is, 34,782,608) from the net product, the revenue of the proprietors class was reduced from 400 millions before the new tax to 365, 217,392.

Furthermore, Turgot argued, in a somewhat ad hoc manner, that the farmers faced an additional increase in costs of the *avances primitives*, which he arbitrarily estimated at 10% of the general increase in the costs of farmers, or 3,478,260.<sup>35</sup> This amount also deducted from proprietors income, he calculated the remainder to be 361,738,932.<sup>36</sup>

Finally, he argued that

since the proprietor can only spend his revenue and cannot increase his revenue, like the farmer-cultivator can increase his takings [*reprises*], one should not take 1/23 more [*en dehors*], but 1/24 less [*en dedans*] to calculate what he pays in increase of [the cost of] expenditure.

What Turgot seems to say here is that, unlike the farmers, the land proprietors would not be able to compensate for the higher prices of the goods they had to buy by increasing the costs of their 'land rental service'.<sup>37</sup> Hence to express this loss of

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<sup>34</sup> He took care to point out that this involved another 'abstraction', namely from the fact that it may take time for farmers to renew the terms of their leases after the effects of additional taxes were felt. Turgot pointed out that he assumed that the change in tax burden for farmers could be 'considered anticipated, [hence] we suppose that the farmer could immediately pass on [*renverser sur le champ*] to the proprietor the effect of the indirect tax' (cf. Turgot's use of the term *l'impôt anticipé*, in accordance with physiocratic usage, in Schelle ii, 432). Here, presumably, Turgot did not want the time it would take for adjustments of lease contracts to complicate his main argument. On another occasion, however, he did not fail to provide a detailed explanation of the significance of lags in the adjustments of terms of lease contracts for the profitability of agricultural enterprises (see Schelle iii, 301-3). By similarly emphasising the temporary inflexibility in contractually agreed rent payments for the incidence of taxation in his *Appréciation*, he could have made more of the immediate financial burden that indirect taxes would place on cultivators. Arguments along these lines were developed, for example, by Le Mercier de la Rivière (1767, 277-8) or Baudeau (1768, 174-186).

<sup>35</sup> This was ad hoc in the sense that earlier in the memo Turgot had not distinguished between *avances annuelles* (the means of production used up within one agricultural cycle) and the *avances primitives* (the means of production lasting more than one cycle). One would have thought that some of the 800 million spent by farmers on commodities produced by blacksmiths, wheelwrights, barrel makers etc. would be classed as *avances primitives* and therefore the increase in prices of such goods would already have been included in the 4.4% increase. Perhaps one should therefore say that adding another 10% was something of an afterthought. This percentage was often used in the physiocratic literature to account for the costs of *avances primitives*, and it was sometimes estimated as a percentage of *avances annuelles* (see e.g. Quesnay 2005, 469).

<sup>36</sup> Here he made a small error: taking 38,260, 868 away from 400,000,000 gives 361,739,132. Therefore Turgot was out by 200.

<sup>37</sup> In effect Turgot conceived land payments as 'unearned incomes'. That is to say, they were not payments for the delivery of a service, of which the price were to be raised when its 'cost of production' increased. The same conception of rent in physiocratic theory more widely, and in the *Tableaux* specifically, posed

purchasing power, he argued that their income should be deflated by 15, 072, 455 (or 361, 738, 932 divided by 24)<sup>38</sup>. The total reduction in proprietors' income would thus be 34,782,608 + 3,478,260 + 15,072, 455 = 53, 333, 323.

This is where the memo breaks off.<sup>39</sup> There is one additional line to the alternative calculation which Turgot attempted. It compares the total reduction in proprietors' income, due to the indirect tax, to the total increase in government revenue, due to the same. In terms of Turgot's original calculation this difference would be 65,365,131 minus 53,333,323, that is, 12,031,808.<sup>40</sup> This remainder is of some interest because it seems to represent the part of the cost of the indirect tax that would *not* be borne by the proprietors. The only other class that it could fall on would be that of the farmers. Following this reasoning, figure 1b may be said to represent what, in Turgot's view, would be the distributional effects of the indirect tax.

*Figure 1b. Distributional effects of the additional taxes (in millions)*

	<i>Before Additional Tax</i>	<i>Direct Tax Case</i>	<i>Indirect Tax Case</i>
<i>State</i>	300	350	300 + 65.365131
<i>Proprietors</i>	400	350	400 - 53.333323
<i>Cultivators</i>	800	800	800 - 12.031808
<i>Total</i>	1500	1500	1500

The conclusion that the indirect tax would in the end also affect the incomes of the class of cultivators, although not stated in so many words in the memo, confirms what he wrote elsewhere about the harmful effects on the incomes of producers, with subsequent repercussions for the level of (agricultural) output. As he had put it in his 'Plan for a Paper on Taxation':

it is obvious that it is [the proprietors'] revenue alone in which the tax can share, since it could not encroach upon the share of the cultivator without removing his interest in cultivation, without forcing him to consume his advances and consequently to reduce his activities and his productive expenditures. As the output [*la production*] of successive years becomes less, the encroachment of the tax would become more and more destructive, and the output and the

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problems for later 'translations' of the physiocratic depiction of the economic process into modern input-output terms. For a discussion of this point see Steenge and van den Berg (2007, 340).

<sup>38</sup> Turgot did not state his reason for using 1/24 instead of 1/23 (or 1/30 instead of 1/29 in his alternative calculation). Presumably he intended it as a correction for the fact that he was now calculating a reduction in a sum, rather than an increase.

<sup>39</sup> The (non-digitised) sixth page of the document remained empty. This suggests that Turgot stopped rather than that his continuation has gone missing. In the absence of further textual evidence it is vain to speculate whether Turgot meant to continue or revisit this particular piece of analysis.

<sup>40</sup> In the alternative calculation the numbers are 51,482,811 (the total sum of indirect taxes, see above p.8) minus 42,666,698 (the sum of three deductions arrived at using the same logic as in the original calculations). This gave a remainder [*Reste*] of 8,816,112.

sources of the State's revenues would be exhausted together with the revenue of the proprietors (Groenewegen 1977, 104; Schelle ii, 303).

To be sure, Turgot did not proceed in his *Appréciation* with an analysis of the successive decline in cultivators' advances, agricultural outputs, rents and state revenue. That next step, one could say, would have led him to the kind of analysis Quesnay's dynamic *Tableaux* were designed to illustrate.

#### 4. Comparison with similar contemporary efforts

That last assertion invites a more precise assessment of the extent to which Turgot's calculations are compatible with physiocratic discussions of the effects of indirect taxes. As was shown in section two, the general conceptions on which Turgot based his demonstration, such as the assumption of a solely taxable *produit net*, were surely inspired by Quesnay. At the same time, it was also suggested that his calculations may have been a response to a perceived lack of clarity in the estimation of the effects of indirect taxation that are found in the physiocratic literature.

With regards to the first point, it needs to be emphasised that Turgot shared with Quesnay and his followers a fundamental conviction about the need for a sounder tax base for the heavily indebted French state. In their view this would require a wholesale reform of the many anomalies in the existing fiscal system, and above all of the tax exemptions of the nobility and the church, that is to say, the major land proprietors of the *ancien régime*. In his private correspondence Turgot was rather explicit in his view that it was

blindingly obvious that in no country one would ever have thought of taxing the cultivator, had it not been for the privilege the French nobility enjoys of not having to pay any tax; [this is] another absurdity that the Government has not dared to attack head on (letter to De Monthyon, colleague intendant in Auvergne, dated 2 December 1768, in Schelle iii, 9).

Unsurprisingly, in his official communications he was more circumspect. Tax reform was a highly contentious, politically charged topic. Any would-be reformer was advised to tread carefully, as the Marquis de Mirabeau learned when the publication of his *Théorie de l'impôt* in 1760 landed him in prison.<sup>41</sup> But if an immediate radical reform of the tax system was not a realistic political goal, this did not prevent them from discussing the theory of taxation frequently, preferably in technical detail.

It is in this latter respect that Turgot, on occasion, expressed reservations. For example, in 1767 Turgot complained in a letter to Du Pont about the 'obscurity of the proposition

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<sup>41</sup> Thanks to his social status and the intervention of powerful contacts on his behalf, Mirabeau's incarceration, in comfortable surroundings of the chateau de Vincennes, only lasted two weeks, followed by an exile to his private estate for a mere two months. Nevertheless, the episode warned him and other *économistes* not to challenge the fiscal policies of the government and the interests of the *financiers* too openly.

that the charges of indirect taxes on the revenue [of landowners] is double'.<sup>42</sup> He was referring to an unexplained assumption made by Quesnay and some of his followers that the costs of collecting indirect taxes and other encumbrances could be estimated to be as high as the sum actually raised for the sovereign.<sup>43</sup>

Turgot's problem with this was *not* that he felt any less than the *économistes* that indirect taxation would impose a host of additional costs. This is clear from a comprehensive list of reasons for opposing indirect taxation and advocating a direct tax on land rents that he included in his *Plan d'un Mémoire sur les Impositions* of 1763. It reads:

*Firstly*, because [...] only the proprietor is liable to taxation; *Secondly*, because direct taxation is less expensive to levy, and thus the proprietor gains the whole amount of the costs and the gain of the chef collectors, tax farmers or agents; *Thirdly*, because indirect taxation imposes a multitude of constraints on commerce; because it entails lawsuits, frauds, penalties, the loss of a large number of people, a war between the government and its subjects, a lack of proportion between crime and punishment, and a continual and almost irresistible temptation to fraud, which is yet subject to cruel punishment; *Fourthly*, because indirect taxation attacks liberty in a thousand ways; *Fifthly*, because it is greatly prejudicial to consumption, and by this destroys itself; *Sixthly*, because the expenses of the State are increased by it, since the State pays it on its own expenditure and on that of all its agents; *Seventhly*, because it gives a competitive advantage in trade to foreign merchants; *Eighthly* and finally, because its results cannot be calculated precisely, while a proprietor is always able to determine what proportion of his revenue he pays (Groenewegen 1977, 98-9; Schelle ii, 297).

Not only did Turgot discuss these various points in more detail in other places,<sup>44</sup> one finds repeated and lengthy discussions of these aspects in the writings on taxation of Quesnay and his closer followers, such as Mirabeau, Du Pont, Le Mercier de la Rivière, Baudeau and Le Trosne.<sup>45</sup> It is in this sense that Delmas (2009, 98; cf. Weulersse 1910,

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<sup>42</sup> Letter dated 20 February 1766 (Schelle ii, 504-515). The identity of physiocratic author of the specific *Mémoire sur l'impôt anticipé* on which Turgot was here commenting (*ibid.* 514) is not certain. For a discussion see Quesnay (2005, 1299-1300). In the official call for the prize competition Turgot made the same point that 'in some [physiocratic] writings' the costs of indirect taxes had been estimated to be 'double of what is paid if the State had demanded the proprietors directly the same sum as the public Treasury draws from indirect taxation' (Schelle ii, 433).

<sup>43</sup> This assumption is found already, for example, in the *Tableau* that purported to analyse the detrimental effects of taxation in the sixth part of Mirabeau's *L'Ami des hommes* (1760): 'The *Tableau* demonstrates the destructive effects of Taxes surcharged and absorbed by the charges of collectors and collection [*frais de régie & de perception*]. It is constructed on the basis of 400 million of net product, or of total revenue; & two hundred million of Taxes, with a surcharge of [another] two hundred million for costs of collection' (Quesnay 2005, 511). Even though this doubling was here no more than an assumption, whether or not informed by some 'empirical' estimation, Mirabeau would write about it as if it was the *result* of a rigorous demonstration (see his letter of November 1762, cited by Weulersse 1910, ii, 356 n.3)

<sup>44</sup> See e.g. Schelle (ii, 648; iv, 515) for the idea that once indirect taxes become too high, people are prepared to assume the risks involved with frauds and the smuggling of contraband; or about the high costs involved with collecting indirect taxes (Schelle iv, 515).

<sup>45</sup> This paper cannot deal with the physiocratic discussions of the theory of taxation as a whole. Delmas (2009) is a useful recent attempt to give an impression of this large topic. Delacroix (2006) provides the larger French context of fiscal thought during the *Ancien Régime*. As indicated, apart from Mirabeau's *Théorie de l'impôt* and *Philosophie rurale*, Quesnay's articles *Impôts* probably exercised most influence



ii, 353) has rightly concluded that ‘on fiscal matters Turgot displayed great physiocratic orthodoxy’.

At the same time, however, Turgot was dissatisfied with ‘obscure’ estimates of the *combined* effect of these different arguments as amounting to doubling the sum raised in indirect taxes. Of the various arguments Turgot listed, it seems that it was exclusively the sixth point that his *Appréciation* was meant to elucidate. Hence, contrary to Schelle’s suggestion (see above p.1), the *Appréciation* was *not* Turgot’s attempt to examine whether the physiocrats were right to estimate the *total* of ‘charges of collection and damages to the net product’ at double the ‘real charge’ of an indirect tax: the charges of collection were explicitly left out of consideration in his calculations (see above p.7).

Similarly laying aside all other arguments, how did Quesnay and his immediate followers treat the idea that ‘the expenses of the State are increased by [indirect tax], since the State pays it on its own expenditure and on that of all its agents’? It has to be said that on the whole their discussions of this specific point were ambiguous. Or at least, apart from one exception to be discussed below, their analyses did not take the form of a series of compensations in prices and tax levies. Of course, on the face of it, Quesnay’s famous *zig-zag Tableaux* were also based on a decreasing series of expenditures that represented the annual expenditures between economic ‘classes’.<sup>46</sup> But when it came to analysing the effects of taxes on annual reproduction, the *Tableau* could only show a displacement of expenditure away from the ‘productive’ agricultural class that did not involve a sequential process of taxes raising prices followed by increased taxes.<sup>47</sup>

Still, one can find verbal accounts of the kind of phenomenon to which Turgot devoted his calculations. For example, in *Philosophie rurale* Mirabeau and Quesnay argued, like Turgot, that the effects of indirect taxes should be calculated in comparison to the levying of a direct tax of the same amount on the net product. They wrote:

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on Turgot’s conceptions in the *Appréciation*. Quesnay’s *Second problème économique*, first published in *Physiocratie* (1767-8), discussed below, was his most extensive later attempt to trace the effects of indirect taxes. Other more notable physiocratic discussions of the theory of taxation in connection to Turgot’s views are Le Mercier de la Rivière (1767, ch. xxvii to xxxiv), Baudeau (1768), and Le Trosne (1770) (1779). The latter massive work developed in much greater detail ideas that were similar to the *Mémoire sur les municipalités* (see below).

<sup>46</sup> Hishiyama (1960, 3-4) showed that the mechanism of the dynamic *Tableaux* can be written as a diminishing series. Eltis (1975) adopted the same formalisation. For a discussion of the modern reception of the dynamic *Tableaux* in relation to Input-Output transcriptions of the *Tableaux* see Steenge and van den Berg (2007, 332-336). Arguably, the only other significant instance in the same period of the application of a diminishing series to an economic problem is the analysis in Auxiron (1766) of the rebalancing of the sizes of the agricultural and artisan sectors after a ‘disturbance’ (a doubling of the population in an economy facing diminishing returns in agriculture). This takes the form of an oscillating series that is quite different from what is implied in either Turgot’s *Appréciation* or Quesnay’s *Tableaux* (see van den Berg and Dhesi 2004).

<sup>47</sup> Instead, the displacement took the familiar form of a relative shift in landowners’ expenditures towards the ‘sterile class’. Thus in the sixth part of *l’Ami des Hommes* the *Tableau* that purported to show the ‘*dépredations relativement à l’impôt*’ showed a shift from the ideal spending pattern of half of the rent incomes on each class to  $\frac{1}{4}$  to the ‘productive’ class and  $\frac{3}{4}$  to the ‘sterile’ class (Quesnay 2005, 510-511).

one should calculate receipts and damage [from taxes] by comparing the even and proportional tax levied on the revenues [*i.e.*, the net incomes] in a state of prosperity, by comparing it, I say, with the disastrous and illusory deduction of the *repompement* that is inseparable from those kinds of taxes, which devour the very revenues of the Sovereign (Mirabeau 1763, 192).

The opaque notion of *repompement* appears to resemble Turgot's analysis. The term itself had a medical connotation. It was used in the contemporaneous physiological literature to describe various kinds of gradual, often harmful, 'build ups' within the animal and human body.<sup>48</sup> In the physiocratic literature *repompement* appears with some frequency and sometimes in connection with the illusory part of tax receipts that were due to the rise in prices.<sup>49</sup> Explaining Quesnay's use of the term in the article 'Second Economic Problem', Ronald Meek described *repompement* as the effect that 'the government and the tax farmers, when they spend the tax receipts on goods and services, will lose to the extent that these goods and services have risen in price as a result of the imposition of the 'indirect taxes' (Meek 1962, 198 n.1).

While this sounds very similar to the phenomenon Turgot was analysing in his *Appréciation*, the calculations Quesnay offered to quantify it appears to have little in common with the former's method.<sup>50</sup> Quesnay considered a numerical example in which 500 million of indirect taxes were levied in an economy where total expenditures were 5500 million. Amongst the effects of these indirect taxes, he calculated a *repompement* of 73 million, a sum that was obtained by taking 1/11<sup>th</sup> of three categories of national expenditure. Beyond the fraction of 1/11, which was obtained from the proportion between indirect taxes and total expenditures, Quesnay's reasoning was obscure.<sup>51</sup> There certainly was no attempt, like Turgot's, to calculate a sequential

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<sup>48</sup> While Quesnay did not use the term in his *Essai physique sur l'œconomie animale* (1747), Buffon and Daubenton in their *Histoire naturelle* (1766, i, 123) described the production of semen as a *repompement continu* in the animal body. Tissot (*Œuvres* 1770, viii, 636) explained the build up to an epileptic fit as a *repompement* of fluids in the body. In the *Encyclopédie* the same term was used in several medical entries: 'Impureté' (vol. 8, 636) stated that some physicians justified the bleeding of patients to avoid the *repompement* of impurities in the blood; 'Inflamatoires, maladies' (vol.8, 727) noted that inflammations involved a *repompement dangereux* in the blood; also see 'Lait, maladie de' (vol. 9, 211) and 'Métastase' (vol. 10, 441).

<sup>49</sup> Before he became Quesnay's follower Mirabeau (1756, 101) had already compared the need for government to make money circulate throughout the state to the action of the heart, which continually pumps and pushes [*repompe & repousse*] blood. In *Théorie de l'impôt* (1760, 171) he used the word somewhat differently to indicate the surcharges of tax collectors: 'But always the activities of contractors, which do not yield the treasury more than 115 million in tax revenues, surcharges [*repompe-t-elle*] at least 60 million on the 200 [million] of taxes expended in the Kingdom'. These uses differ from the use of the noun *repompement* in the passage quoted from *Philosophie rurale* (the term is also used on page 266 of the same work) where seems to denote the 'inflationary' effect of indirect taxes. Later Quesnay used *repompement* in his 'General Maxims' (Meek 1962, 262; Quesnay 2005, 596). Also see n.51 below.

<sup>50</sup> Interestingly, in his editor's introduction to Quesnay's '*Second problème économique*' in *Physiocracy*, Du Pont made a link between the Doctor's attempt to analyze the different effects of direct and indirect taxes and Turgot's effort to stimulate work on this issue. It was, Du Pont wrote, 'a truly interesting question for the happiness of nations, which currently occupies a large number of learned men, in England [...] and in France, where the Royal Society of Agriculture of Limoges has made it the subject of one of its prize competitions' (Quesnay 2005, 619).

<sup>51</sup> The 73 million was composed of 1/11<sup>th</sup> of 'direct taxes of 300 millions', 1/11<sup>th</sup> of 'the portion of the indirect taxes amounting to 250 millions which accrues to the sovereign' and 1/11<sup>th</sup> of '250 millions of

series of compensations in prices and tax levies. Perhaps it may be argued that it was precisely a failure like this of Quesnay to back up some aspects of his calculations with an intelligible method that motivated Turgot to attempt 'to do the work by myself' (see above p.4).

However, despite the significant difference in mathematical method, Turgot nevertheless seems to have had the same phenomenon as Quesnay in mind when he wrote some years later to Benjamin Franklin<sup>52</sup> that, due to the derangement of prices resulting from indirect taxes,

what the public treasury receives is to a great extent no more than an illusory resource [*une ressource illusoire*], since the expenditures of the state, like those of private persons, pay for the taxation by the increase in price of commodities and wages. Therefore the State receives less and the people pay more (Schelle v, 515).

Apart from the term *resource illusoire*, which figures in a number of physiocratic discussions of the effects of indirect taxes that are said to be due to *repompement*, Turgot's letter to Franklin is also interesting for a somewhat different description of the phenomenon he had tried to analyse. Once more Turgot explained to Franklin the great benefits of a direct tax on the *produit net* compared to the indirect taxes on goods. With respect to the former:

Taxes levied on the landowners only take from them part of a free income [*revenu libre*] the disposal of which may be varied without changing anything to the order and the proportion of all active parts of society. Everything remains in its place, all values that circulate in trade keep the same ratio [*rapport*] amongst themselves (Schelle v, 513-514).

This in contrast to the disturbing effect of indirect taxes due to which all kinds of labour, and all merchandise,

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costs entailed by the indirect taxes' (Meek 1962, 197; cf. Quesnay 2005, 630). Apparently, Quesnay took only these components into account, and not the expenditures of the 'productive class' or those of the proprietors, because the former alone related to taxation. Beyond that Quesnay's reasoning is hard to follow (cf. Pressman 1994, 102). A similar thing may be said of a later work that appears to calculate the size of *repompement* after the introduction of an indirect tax. In *Loix naturelles de l'agriculture et de l'ordre social*, Butré argues: 'The public revenue is no more than an illusory mass, because of the *repompement* undergone by the indirect tax, which absorbs a quarter of it. Such is the effect of this disastrous collection, it surcharges all expenditures, alters all exchange values, and gives them a false appearance that is but a pure illusion, through the false prices that it gives to consumption goods' (Butré 1781, 167). How exactly Butré arrived at the fraction of one quarter is not clear. On page 166 he stated that in his example the indirect tax was 280 million and the costs of collection 120 million; this 400 million is a quarter of the total expenditures of 'nearly 1600 million'. But how this relates to the estimate of a *repompement* of one quarter is hard to say. About Butré's quantitative contributions see Sabbagh (2017) and Charles and Théré (2016). Judging by a couple of denigrating remarks in his letters to Du Pont, Turgot did not have a high opinion of Butré (Schelle ii, 520-21; iii, 15).

<sup>52</sup> This writing was another unfinished manuscript, composed in 1777 after his dismissal and intended for the instruction of Benjamin Franklin at the time of the American Revolution. As Albertone (2014, 112-118) explains, even though Franklin was an enthusiastic partisan of the economic principles of the physiocrats, he ended up rejecting the *impôt unique* for practical reasons. Unfortunately, these materials as transcribed by Schelle (v, 510-519) from the Lantheuil archive are missing from the *Fonds Turgot*. Another copy is found, however, in AN AP154/II/155. I thank one of the reviewers for this reference.

receive an increase in value [...], the repercussions of which are propagated further, which can neither be foreseen nor calculated [and which] derange the natural course of industry (Schelle v, 514).

The phrase 'repercussions propagated further' (*les reflets propagés au loin*) is significant because it is a very similar formulation that was used in the one physiocratic analysis of indirect taxation that *does* contain a decreasing series which bears a more than superficial resemblance to Turgot's *Appréciation*, namely Du Pont's work on *Courbes politiques*.

The only known version of this paper is contained in a letter to the son of the Margrave of Baden, but Du Pont had apparently presented an earlier version at one of the Marquis de Mirabeau's renowned Tuesday meetings in early 1774.<sup>53</sup> This was of course a time of renewed hope for the *économistes*: in May of that year a new King came to the throne and by August Turgot was installed as *contrôleur général des finances* (minister of finance). Du Pont, who Turgot had appointed a general inspector of trade a month later, recommended in his letter the application of mathematics to economic principles as a means to support reform. He argued that reforming men of state should be supported by mathematicians in providing exact demonstrations of the effects of fiscal policies, since '[t]o produce a properly rigorous assessment, a method and habit of calculation are required which ordinary politicians [*les politiques ordinaires*] do not possess' (Spiegel 1955, 2). To be sure, he saw mathematical demonstrations less as tools for predicting the precise effects of new policies (a kind of econometrics *avant la lettre*) than as a powerful means of persuasion:

The conquest of the mathematicians will do much to improve the reputation of the correct principles of political economy, contributing thereby to the happiness of mankind and hastening the long-delayed rule of these principles (Spiegel 1955, 1).<sup>54</sup>

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<sup>53</sup> The *mémoire* he read on that occasion is apparently lost (for details see Spiegel 1955, iv, n.6). Du Pont's letter was only published in 1892 by Carl Knies, though without the intriguing diagram that represents his decreasing series. Not until 1955 did Du Pont's numerical analysis receive much attention, when Spiegel published an English translation of the letter and included the diagram. Subsequently, Theoharis (1961) added it to the expanding collection of 'early contributions' to mathematical economics that had started to be compiled since the late 19<sup>th</sup> century. Also see Maclain (1977, 132-5). Recently, Charles and Théré (2016, 318, n.25) have found that the diagram, as published by Spiegel, can no longer be located in the Margrave of Baden family archive. Instead they have discovered an early draft of the diagram, reproduced in Excerpt 3 of their article.

<sup>54</sup> Enlisting the assistance of mathematicians would be 'a good idea [...] to gain, through their support, secured by their own labor, the support of a large number of persons with whom their opinion carry weight' (Spiegel 1955, p. 16). It was for this reason, he noted, that he had sent a copy of his *mémoire* to Daniel Bernoulli. The latter's response is not known. In this connection one should also note the one surviving letter of a correspondence between Du Pont and Isnard (Eleutherian Mills Historical Library W2-27). In this letter, dated 28 December 1773, 'Du Pont discusses the principles of differential calculus in a manner that Isnard, who at the time was teaching this subject, would have recognised as rather inept' (van den Berg 2006, 12). There is no mention in the letter of the application of mathematics to economic theory. Therefore the possible connection with *Courbes politiques* is limited to the fact that both writings show Du Pont's interest in this period with phenomena of incremental quantitative change. For a more general discussion of Isnard's mathematical contributions in comparison to Du Pont and Butré see Charles and Théré (2016, 318-320).

Like Turgot's *Appréciation*, Du Pont's objective was to provide a demonstration of the harmful effects of indirect taxation. He started by stating that the imposition of indirect taxes meant that '[t]he prices of products, of labor, and of services, all the instruments for the procurement of satisfactions, must be modified, and modified to the disadvantage of society' (Spiegel 1955, 3). To explain this he distinguished three steps in this 'modification'. First, when some goods had a tax imposed, then the producers of those goods would have to raise their prices, because they could not encroach on the sales value necessary to cover their costs. Second, once the prices of goods that formed part of the normal subsistence of other producers were raised, then the latter would also be 'compelled to raise [their] wage correspondingly in order to procure the same amount of subsistence'.<sup>55</sup> Next he noted that '[t]he third and following increases are the result of the progressive repercussions [*la progression causée par les reflets*] of these various taxes on all products and all types of labor. With every step the causes of this progression multiply and become more complex. They behave, however, according to rule' (Spiegel 1955, 5; Knies 1892, 292).

It were these 'progressive repercussions' (*reflets*) that formed the focus of the subsequent analysis. Like Turgot, Du Pont concluded that the progression would take the form of a decreasing series, or as he put it 'this progressive diffusion has a terminal point' [*cette progression a un terme*] (Spiegel 1955, 10; Knies 1892, 295). Upon closer inspection, however, there were some significant differences between the analyses of the two men. Beside the fact that only Du Pont illustrated the progression he envisaged with an actual curve, what he described was not the progressive increases in prices that would occur upon the *introduction* of direct taxes, but the recovery of prices after these taxes were *removed*.<sup>56</sup> In addition, the actual mathematical formula that described the decreasing series was defined as follows: 'the increase in the price obtained by the original sellers is assumed for each period to amount to three fourth of the increase of the preceding period' (Spiegel 1955, 13). This was a considerably less complicated rule than the one Turgot had used, as is shown in more detail in Appendix 2B. Du Pont noted however that his rule was 'a purely hypothetical assumption' simply chosen for ease of calculation:

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<sup>55</sup> For example 'the baker must include among the cost of his subsistence, which determines his wage, his own and his family's consumption of meat. The increase in the price of this [meat] must further raise the price of his bread' (Spiegel 1955, 3). In reality, he explained to his young correspondent, there were of course not just two professions but 'over one hundred', such as 'wool merchants, drapers, tailors, tanners, shoemakers' etc. which were 'all mutually interrelated' (*ibid.* 4).

<sup>56</sup> One would perhaps expect a *fall* in prices once taxes were removed, also because, as we just saw, at the beginning of his letter Du Pont described the *increases* in prices subsequent to the introduction of indirect taxes. Later on he argued, however, that the taxes produced a margin between producer prices 'at first hand' and consumer prices. The removal of the taxes would give rise to a reduction of consumer prices at the same time as allowing a rise in producer prices. Higher prices for farmers would allow them to extend production to less fertile lands (see Spiegel 1955, 7-8) giving rise to larger agricultural output and higher rent payments which 'would give the owners of land an opportunity for diffusing wages amongst artisans and for stimulating activities which would supply the latter with the means to acquire goods and to multiply their satisfactions' (*ibid.* 9). The discussion on these pages is reminiscent of Turgot's discussion of differential returns in agriculture in his report on the prize essay of Saint-Péray of 1767, but which admittedly had not been addressed in the *Appréciation*; cf. above n.30.

A greater or lesser proportion is a strong possibility. There are good reasons for the belief that the proportion tends to decline. For example, if that of the second period is three-fourth of that of the first, that of the third may be two-thirds of that of the second, that of the fourth one-half of that of the third, and that of the fifth only one-third of that of the fourth, and so on (*ibid.*)

This passage shows that Du Pont was contemplating a mathematically more complicated series with ever decreasing fractions. Even though he did not suggest the precise progression in proportions that Turgot had calculated, it does raise the question whether Du Pont was familiar with the efforts of his friend when writing the passage.

That possibility is not entirely fanciful given the fact that Du Pont was a confidant of Turgot to whom he trusted other manuscripts. For example, around the same time that he spoke on his *Courbes politiques*, Du Pont also presented Turgot's *Lettres sur la justice criminelle* at Mirabeau's Tuesday gatherings.<sup>57</sup> Of course it is not necessary that Du Pont, before writing *Courbes politiques* actually saw Turgot's *Appréciation*, which after all was a very rough draft.<sup>58</sup> Instead the two men may simply have exchanged views in conversation about how indirect taxes would produce a series of *reflets* and then each gave different expressions to essentially the same idea. Either way, no concrete evidence is available to support a strong case for an influence of Turgot on Du Pont's *Courbes*.<sup>59</sup> All that can be said is that the two works belong to a same distinct class in the wider quantitative apparatus of physiocratic economics.

## 5. Conclusion

The discovery of Turgot's *Appréciation des effets de l'impôt indirect* comes as a surprise. It probably dates from the beginning of his most creative period at Limoges

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<sup>57</sup> This work was started in 1771 as a series of letters between Turgot and Condorcet. Not only did Du Pont present a version of this work at Mirabeau's Tuesday dinners but he also sent a copy to the Margrave of Baden (see Knies 1892, 233ff; Schelle i, 4; iv, 3; iii, 513-539; AN745AP/41 dossier 2, images 64-68). Of course, a more famous example of a work that Turgot entrusted to Du Pont was the manuscript of the *Réflexions*, which was subsequently published in the *Ephémérides du citoyen*.

<sup>58</sup> A somewhat different question is whether Du Pont got to read Turgot's *Appréciation* eventually. This is likely. Certainly from just after his friend's death in March 1781 Du Pont had access to his private papers, acting as his literary executor, and claiming in a letter to Malesherbes of April 1781 that 'only I have had all his manuscripts' (cited in Schelle 1888, 213, n.1). He kept possession of various manuscripts until at long last he produced Turgot's *Œuvres* in 1808-11, in the mean time even carrying some of them across the Atlantic and back (see Saricks 1965, 314-15). Given his authorship of *Courbes politiques* one would think that Du Pont should at least have been interested in Turgot's calculations. Maclain (1977, 135) has suggested that Du Pont did not return to his one mathematical contribution after 1774, but this is contradicted by the fact that as late as 1796 he presented a version of *Des Courbes politiques* to the Class of Moral and Political Sciences of the French National Institute (see *La Décade philosophique, littéraire et politique*, issue 28 June 1796, 141; also see Staum (1996, 293, n.9) who has a reference to the *Archives de l'Institut, Académie des Sciences morales et politiques* document A3, *Procès-verbaux* of the presentations to the class of 12 floréal year IV (1 May 1796).

<sup>59</sup> In correspondence from the mid-1760s onwards Turgot regularly commented on Du Pont's publications and his editorial activities. The latter also sometimes sent him drafts of his writings for comment. But the only indication that he *may* also have sent Turgot a draft of his *Courbes politiques* comes in a letter dated 14 March 1774 (which would be about the right time) which Turgot starts with: 'I have received, my dear Du Pont, your little sheet together with your manuscript about prices' (*J'ai reçu, mon cher Du Pont, votre petit billet avec votre manuscrit sur les prix.*' Schelle iii, 661). Unfortunately this is all Turgot says about that document.

when besides his *Reflections on the Formation and Distribution of Wealth*, he also wrote, amongst other things, his observations on Saint-Péray's essay, 'Value and Money', the 'Paper on Lending at Interest' and his 'Letters on the Grain Trade'. Each of these writings contained highly original contributions to what at the time was considered a 'new science'. The *Appréciation* shows us yet another side of his economic thought: unexpectedly, perhaps, Turgot also engaged in mathematical reasoning.

In order to appreciate his effort we must in the first place acknowledge that all we have is a rough draft. The fact that the perfectionist Turgot left his memo unfinished may well indicate that, like in other cases, he was not fully satisfied with his results.<sup>60</sup> One of the likely difficulties he faced was that he was not a trained mathematician. Perhaps there is truth in Morellet's (belated and not always reliable) recollection that his one-time friend 'never had a true aptitude for mathematics, and often complained about not having achieved a greater proficiency in it' (Morellet 1822, 13).<sup>61</sup> Besides some evident calculation errors, the main obstacle to a more elegant demonstration was the overly complicated rule that he happened upon for deriving his decreasing series.

A second thing to consider is the question what the practical purposes were of Turgot's arithmetical exercise. The most likely thing, we have suggested, was that he wished to give a precise demonstration of one particular aspect of physiocratic fiscal doctrine, namely the disturbing effects of indirect taxes on prices throughout the economy, leading to 'illusory' inflated government revenues and an undesirable redistribution of incomes. At least in part such a demonstration had the purpose of satisfying his personal intellectual desire to understand a mechanism precisely, not to be content with vague notions of *repompement*, but to be 'perfectly satisfied with the line of reasoning' (cf. above p. 4). At the same time, the demonstration was not a 'test of theory': his belief in the larger economic truth that indirect taxes were harmful to the order of economic reproduction did not depend on a precise calculation, which was after all only possible by virtue of some thorough simplifications. As Du Pont wrote to his royal correspondent about his calculations 'I am not far off from the right result', only to clarify immediately, [...] I refer to the mathematical result; the politico-economic result has been known for a long time and the mathematicians can teach us nothing in this respect' (Spiegel 1955, 16; Knies 1892, 300). Turgot, we saw, expressed similar sentiments in his

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<sup>60</sup> For example, this is probably true for his fascinating but unfinished draft of 'Value and Money'. This point is made in more detail in van den Berg (2014). Unfortunately, this manuscript is another example of the many pieces that are now missing from the *Fonds Turgot*.

<sup>61</sup> Turgot's mathematical writings are now accessible (AN745AP/39 dossier 3). Like Du Pont, he may have wanted to interest more capable mathematicians in his economic studies. In the period 1765-6 he tried to employ the mathematician Jean-Étienne Montucla (1725-1799) after introducing him to *Philosophie rurale* (see Schelle ii, 440, 515). But this employment, which followed Montucla's trip to Guyana to work under Turgot's brother, Étienne François, seems to have been of short duration (see letter of 15 May 1764 [745AP/34 doss.2 im.73]). A letter of 16 July 1768 (AN745AP/41 doss.2, im.202-3) suggests some on-going contacts at a later date. From the early 1770s Turgot developed a friendship with Condorcet with whom on some occasions he discussed mathematical topics. There is, however, no evidence of him having asked Condorcet's advice in applying mathematics to the theory of taxation. After Turgot's death, however, Condorcet would discuss the former's views of taxation in his *Vie de Monsieur Turgot*. On that occasion he attempted to illustrate these views by means of a long mathematical footnote (see Condorcet 1786, 178-184). However, this exposition appears to have no relation with Turgot's calculations.

correspondence with Hume. At best, calculations could be a means of persuasion, Du Pont argued, to convince politicians and citizens of ‘the correct principles of political economy’. Whether Turgot ever hoped to use a more advanced version of his *Appréciation* for the same purposes we do not know.

What we do know, is that when he was called to the high office of *contrôleur-général* he initially had hopes of being able to implement the fundamental tax reforms that were so urgently needed. In the *Mémoire sur les municipalités* the need for an overhaul of the existing fiscal system was stated in blunt terms.<sup>62</sup> It recounted to the king that over time the nobility and the clergy had been partially exempted from various direct taxes, such as the *taille*, the *capitation* and the *vingtièmes*. The loss of the revenues that this entailed to the state had necessitated the introduction of ‘a multitude of taxes of various types on all kinds of trades and consumption goods’:

Through these indirect taxes, [previous kings] have managed, in effect, to draw contributions from the nobility and the clergy, when they are forced to pay in their expenditures for the various taxes imposed on all the objects they want to enjoy, and when they lose even more on the value of the products subject to those taxes and harvested on the land of which they are the proprietors (Schelle iv, 593).

Due to high costs of collection and enforcement, the higher prices of commodities and lower levels of production, indirect taxes imposed considerable ‘false costs’ [*faux frais*] and since the nobility and clergy owned most of the arable land of the kingdom, ‘more than four fifth’, they also ended up paying most of these additional charges.

The nobility and clergy [...] suffer infinitely more from the diminution of their revenues that result from [false costs] than would have been the case with a contribution that is regular and proportional to their wealth, if expenditures, enjoyments, works, trade [and] agriculture had been left free and flourishing (Schelle iv, 594).

If His Majesty wished to ‘render your kingdom opulent and at the same time your treasury filled’ then he should consider ‘introducing a form [of taxation] that is less onerous and less destructive in order to replace the [indirect] taxes from which the two first orders are not exempt [anyway]’ (*ibid.*). Even if this advice to the king was not supported by calculations like those of Turgot’s *Appréciation* or Du Pont’s *Courbes politiques*, this was surely the political context in which the latter exercises had been conceived.

As we know, in the event Turgot’s ministry soon ran into heavy opposition against his reforms of the grain market, the guilds, and the *corvée*. This prevented him from even presenting to the king his far-reaching ideas for reforming the apparatus of the state. Despite his later fame as an enlightened statesman and brilliant economic theorist, in the immediate term much of Turgot’s work in both of these respects was left incomplete. We can now add his *Appréciation* to the body of writings that attests to this fact.

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<sup>62</sup> Significantly, it was Du Pont who under Turgot’s instructions drafted this proposal for the fundamental reform of the administrative apparatus. For the collaboration of the two men on this ambitious document and its subsequent fate see Schelle (iv, 568-574). For a more general assessment see Skorniki (2011, chapter 4).





## Appendix 1. Turgot's Memo

The *Archives Nationales* have digitised Turgot's *Appréciation des effets de l'impôt indirect* (AN 745AP/42, dossier 11, images 11-14). For the French original, the URL is

[https://www.siv.archives-nationales.culture.gouv.fr/siv/media/FRAN\\_IR\\_054019/c-4vs6cs153--1mauj76nnfqcl/FRAN\\_0041\\_2444\\_L](https://www.siv.archives-nationales.culture.gouv.fr/siv/media/FRAN_IR_054019/c-4vs6cs153--1mauj76nnfqcl/FRAN_0041_2444_L)

The following is an English translation of the memo. The numbers struck through, from page 2 onwards, are his first set of calculations, which Turgot subsequently replaced with less consistent ones (see n.63).

[page 1] Calculations on the effects of indirect taxes

Let there be a Kingdom where the total product = 2,100,000,000

The net product = a third of the total product =  
700,000,000

The part of the Sovereign distributed to salaried public Magistrates,

Soldiers, People of the Church etc.,  $\frac{3}{7}$ <sup>th</sup> of the net product = 300,000,000

The part of the landowners  $\frac{4}{7}$ <sup>th</sup> of the net product = 400,000,000

The total of expenditures is equal to the sum of the net product plus the expenditures of the cultivators, that is to say, the sum of the total product minus the goods consumed immediately by the cultivator without being sold, be it as seed, be it for their nourishment and that of their ploughing animals. Let us assume that consumption in that way is  $\frac{6}{21}$ <sup>st</sup> of the product, that

is= 600,000,000

The total of expenditures= 1,500,000,000

I do not comprise in the expenditures the return of salaries [of the manufacturing class] to the earth, to reproduce the revenue, that would be double counting.

Now [suppose] that the state needs 50 million. If it is levied by way of the direct tax the share of the proprietors will evidently be reduced to 350 million.

[B]ut if we assume that the legislator prefers the way of indirect taxation and suppose [,] without troubling ourselves too much with the means [of doing it] [,] that this indirect tax could be distributed across all [page 2] branches of consumption in such a way that none be charged more than another and that there be the least possible disturbance in the course of trade. [I]n a word, that all merchandises be taxed like beverages are in the *pays d'aide ou d'excise* and that none are exempt apart from the

products consumed by the cultivator. [L]et us also abstract from the costs of collection [*frais de regie*].

I say that 50 million is the thirtieth [part] of the total of expenditures, amounting to 1500 million.

50,000,000

[T]hus from this first point of view the expenditures will increase by 1/30 and consequently also the expenditure of 350 million needed by government [,] assuming all prices remain the same. [T]here will therefore be a need for 11,666,666<sup>Lb</sup> extra [;] one should therefore add to the 50 of tax

~~11,666,666~~

1,166,666<sup>63</sup>

which should be regarded as a new tax that raises the whole mass of expenditures ~~by one hundred 1/129~~<sup>64</sup> by about 1/1285<sup>65</sup> and consequently that the mass of Royal expenditures which was already raised to ~~361,666,666~~ 351,166,666

will be increased to ....

2,803,617<sup>66</sup>

233,592<sup>67</sup>

[T]his new increase will again fall on the total of expenditures and will raise them ~~by 1/535~~<sup>68</sup> about 1/5488<sup>69</sup>

Total ~~64,470,283~~<sup>70</sup>

51,400,258<sup>71</sup>

[page 3] The Royal expenditures will consequently be increased by a proportion 1/535–1/5488 of ~~364,470,283~~ 351,400,258 [which] is....

~~679,196~~<sup>72</sup>

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<sup>63</sup> The deleted number is obtained by dividing 350 by 30. The number replacing it, however, appears to be the result of dividing 350m by 300. Since this does not follow from Turgot's reasoning, it appears to be a basic error. It is carried into the next terms and explains most of the divergence between the original calculations and their replacements.

<sup>64</sup> 11,666,666/1500m

<sup>65</sup> 1,166,666/1500m

<sup>66</sup> 361,666,666/129

<sup>67</sup> There appears to be a calculation error here: 351,166,666/1285=273,281 and not 233,592. The latter number could be obtained by dividing the government expenditure number by approximately 1503, but that number does not follow from Turgot reasoning.

<sup>68</sup> 2,803,617/1500m

<sup>69</sup> Note that this number is obtained by 273,281/1,500m. Therefore, even though Turgot wrote down the number 233,592 just above, he must in fact have calculated the correct number 273,281 ; see note 67.

<sup>70</sup> 50m+11,666,666+2,803,617

<sup>71</sup> 50m+1,166,666 +233,592

64,030<sup>73</sup>

[B]y this new increase the expenditures are again raised by a ~~1/2208~~<sup>74</sup>  
1/23426.<sup>75</sup> [T]his again requires the increase in the total tax by ~~1/2208~~  
1/23426

The ~~2208 of 365149479~~ 23,426 of 351464288 is  
~~165,375~~

15007<sup>76</sup>

[T]his new increase raises the expenditures by ~~1/9070~~<sup>77</sup> 1/15007<sup>78</sup> and consequently  
the Royal expenditure and the tax.

Which should provide for ~~1/9070 of 365,314,854~~  
~~40277~~

1/15007 of 351,479,295  
3516<sup>79</sup>

[T]his increase again influences all expenditures and taxation but this  
increase becomes each time smaller and smaller and we can neglect from  
here on the further terms of this decreasing series [which is] more or less  
in the progression of 4 to 1 by adding only another 10000<sup>1b</sup> for all other  
terms, that is

10,000

The total of taxation that is necessary to supply the need that the  
state has for 50 million is therefore in total.....

65,365,131<sup>80</sup>

51,482,811<sup>81</sup>

Let us now see what effect that taxation has on the proprietors

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<sup>72</sup> Here Turgot makes an error that leads to an underestimation of over 2000, since 364,470,283/535= 681,253.

<sup>73</sup> 351,400,258/5488

<sup>74</sup> 679,196/1500m

<sup>75</sup> 64,030/1500m

<sup>76</sup> Here Turgot appears to divide 351,464,288 by 23420 rather than by 23426.

<sup>77</sup> 165,375/1500m

<sup>78</sup> Here Turgot writes down the wrong answer since 15,007/1,500,000,000= 1/99,953. But see next note.

<sup>79</sup> This result is obtained from the calculation 351,479,295/99,953. This denominator makes sense given the previous step, although there Turgot wrote down the wrong denominator ; see previous note.

<sup>80</sup> 50m +11,666,666 +2,803,617 +679,196 +165,375 +40,277 +10,000

<sup>81</sup> 50m + 1,166,666 + 233,592 + 64,030 + 15,007 + 3,516

[page 4] To get ~~the increase~~ the proportion of the increase in expenditures one should divide the total of expenditures which is 1,500,000,000 by the sum total of the tax, that is to say, by ~~65,365,131~~ 51,482,811. The quotient is about ~~23~~ 29 [T]hus all expenditures are increased by a ~~1/23~~ 29.

The net product having been evaluated at 1/3 of the total product and the part of the cultivators at 2/3, that is to say, at 1,400,000,000 of which we have assumed that 600,000,000 were consumed in kind [hence] the expenditure of the cultivators is 800,000,000 of which ~~1/23~~ 29 is =

~~34,782,608~~

27,586,206

the increase in the expenditure of cultivators.

[S]ince in the investigation that occupies us here we abstract from ~~anticipated tax~~ the effects of tax that is considered anticipated, we assume that the farmer can immediately pass the tax onto the proprietor, or if one want all leases are terminated [i.e. adjusted] at the moment of the establishment of the tax. [T]hat being assumed.

[I]f the farmer reduces his lease by just the sum of the increase of his expenditure [,] the proprietors will lose

~~34,782,608~~

27,586,206

And their revenue will be reduced from 400 million to ~~365,217,392~~ 372,413,794

~~their expenditure can only be equal to their revenue but since that expenditure has loaded by a tax of one 23rd on the prices of the things purchased and consequently by a...~~

But it is evident that this annual increase in costs is [also] an increase [page 5] to the sum of original advances of the farmer, of which the annual advances of the first year are always a part. [Y]et the farmer must always comprise in the calculations of his takings interests at 10 % of all his original advances, he will therefore from the future rents not only

~~34,782,608~~

27,586,206

but also a 10th of that sum, that is

~~3478260~~

2758620

The total decrease in the rents

~~38,260868~~

30,344,826

by that the Revenue of the Proprietors is found to be reduced from 400,000,000 to ~~361,738,932~~ 369,655,174

Since the proprietor can only spend his revenue and cannot increase his revenue [,] like the farmer-cultivator can increase his takings, one should not take 1/~~23~~ 29 more but a 24<sup>th</sup> 30<sup>th</sup> to calculate what he pays in increase of expenditure. ~~29<sup>th</sup> of 361,738,932 is 15,072,455~~—the 30<sup>th</sup> of 369,655,174 is 12,321,872 which added to what he pays less in takings makes in total

~~53,333,323~~

51,482,811

Which deducted from the tax

42,666,698<sup>82</sup>

Leaves

8,816,112

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<sup>82</sup> 27,586,206 + 2,758,620 + 12,321,872

## Appendix 2A. Turgot's Calculations and Method

As discussed in section three of this paper, Turgot presented a decreasing series of tax receipts that would result from a recursive process of increasing prices and further hikes in indirect taxes. His calculations of one of the series of additional sums and decreasing fractions of price/tax hikes and their final sums are as follows (the fractions in square brackets he did not actually present):

Round	Additional Tax	Fraction
1	50,000,000	1/30
2	11,666,666	1/129
3	2,803,617	1/535
4	679,196	1/2208
5	165,375	1/9070
6	40,277	[1/37242]
7	10,000	[1/150000]
<i>Total</i>	65,365,131	1/23

Turgot's fractions can be expressed algebraically as a changing combination of two constants  $x$  and  $y$ , where  $x$  is the initial proportion of additional tax (50m) to total expenditures (1500m) and  $y$  the proportion of previous taxes (300m) to total expenditures. Using these expressions the additional taxes and fractions are recalculated.

Round	Fraction as Algebraic expression (where $x= 1/30$ and $y= 1/5$ )	Fraction (rounded to integer)	Additional tax (actual fraction *1500m)
1	$X$	1/30	50,000,000
2	$x(x+y)$	1/129	11,666,667
3	$x(x+y)^2(1+x)$	1/533	2,812,963
4	$x(x+y)^3(1+x)^2(1+x(x+y))$	1/2195	683,512
5	$x(x+y)^4(1+x)^3(1+x(x+y))^2(1+x(x+y)^2(1+x))$	1/9015	166,396
6	$x(x+y)^5(1+x)^4(1+x(x+y))^3(1+x(x+y)^2(1+x))^2(1+x(x+y)^3(1+x)^2)$	1/37013	40,526
7	$x(x+y)^6(1+x)^5(1+x(x+y))^4(1+x(x+y)^2(1+x))^3(1+x(x+y)^3(1+x)^2(1+x(x+y)^4(1+x)^3)$	1/151956	9,871
8		1/623832	2,404
9		1/2561026	586
10			143
11			35
12			8
13			2
<i>Total</i>		1/23	65,383,113

The relative small differences between our numerical results and those of Turgot are due to different rounding, one calculating error (see note 72) and the fact that Turgot stopped at the 7th round, estimating the sum of remaining terms at 10,000. The algebraic expressions of the fractions reveal the rather involved logic of the series. We have chosen to stop writing the expression at round seven by which point the progression in the terms is clear.

## Appendix 2B Comparison with Dupont's Approach

### Appendix 2B: Comparison with Du Pont's Approach

In order to compare the logic of Turgot's decreasing series with the one proposed by Dupont, we need to give a general expression to the latter. The following expressions differ in form from the presentation by Theocharis (1961, pp.85-6) to facilitate the comparison with Turgot's approach. First, Dupont's decreasing series can be expressed as follows:

Let  $p$  = start price

$i$  = first increment

$x$  = proportional price increase

Round	Total Price	Price Increase
0	$p$	
1	$p + i$	$i$
2	$p + (1 + x)i$	$xi$
3	$p + (1 + x + x^2)i$	$x^2i$
....		
$n$	$p + (1 + x + \dots + x^{n-1})i$	$x^{n-1}i$
$\infty$	$p + \lim_{n \rightarrow \infty} (1 + x + \dots + x^{n-1})i$	0

Now, if we multiply the coefficient of  $i$  by  $\frac{1-x}{1-x}$  we get:

Round	Total Price	Price Increase
0	$p$	
1	$p + \frac{1}{1-x}i - \frac{x}{1-x}i$	$i$
2	$p + \frac{1}{1-x}i - \frac{x^2}{1-x}i$	$xi$
3	$p + \frac{1}{1-x}i - \frac{x^3}{1-x}i$	$x^2i$
....		
$n$	$p + \frac{1}{1-x}i - \frac{x^n}{1-x}i$	$x^{n-1}i$



$$\infty \quad p + \frac{1}{1-x} i \quad 0$$

To confirm, if we use Du Pont's figures, that is,  $p = 1000$ ,  $i = 125$  and  $x = \frac{3}{4}$ , we get:

Round	Total Price	Price Increase
0	1000	
1	$1000 + 500 - \frac{3}{4} 500 = 1125$	125
2	$1000 + 500 - \frac{9}{16} 500 = 1218.75$	93.75
3	$1000 + 500 - \frac{27}{64} 500 = 1289.06$	70.31
4	$1000 + 500 - \frac{81}{256} 500 = 1341.80$	52.74
...		
8	$1000 + 500 - \frac{3}{65536} 500 = 1499.98$	0.02
$\infty$	$1000 + 500 = 1500$	0

We can now compare the general expressions of the series of Du Pont and Turgot.

For Turgot's series let

$E =$  total expenditure (1.5 billion)

$x =$  additional tax/total expenditure ( $\frac{1}{30}$ )

$y =$  original tax as fraction of TE ( $\frac{1}{5}$ )

Round	Du Pont's Series	Turgot's Series
0	$p$	$yE$
1	$p + \frac{1}{1-x} i - \frac{x}{1-x} i$	$yE + xE$
2	$p + \frac{1}{1-x} i - \frac{x^2}{1-x} i$	$yE + (1+x+y)xE$
3	$p + \frac{1}{1-x} i - \frac{x^3}{1-x} i$	$yE + (1+(x+y)(1+(1+x)(x+y)))xE$
4	$p + \frac{1}{1-x} i - \frac{x^4}{1-x} i$	$yE + (1+(x+y)\left(1+(1+x)(x+y)\left(1+(1+x)(x+y)(1+x(x+y))\right)\right))xE$
5	$p + \frac{1}{1-x} i - \frac{x^5}{1-x} i$	$yE + (1+(x+y)\left(1+(1+x)(x+y)\left(1+(1+x)(x+y)\left(1+(1+x)(x+y)(1+x(x+y))\right)\right)\right)\left(1+(1+x)(x+y)(1+x(x+y))\right)\right))xE$

By round five it is clear that, in mathematical terms, Turgot's approach is considerably more complicated. Note that Du Pont's series is a geometric series. That is, there is a constant ratio between successive terms. Since for Du Pont's series the ratio is less than one, the limit of the sum of the series can be found (as given above). By contrast, Turgot's series is not a geometric series. Since there is no constant ratio between successive terms, there is no simple expression for the limit of the sum of the series.

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## References

- Albertone, M. 2014, *National Identity and the Agrarian Republic. The Transatlantic Commerce of Ideas Between America and France (1750-1830)*. Franham: Ashgate.
- Baudeau, N. 1768. *Lettres d'un citoyen a un magistrat sur les vingtiemes et les autres impôts*. Amsterdam: Arkstée & Merkus.
- Chanel, G. 2015. Taxation as a Cause of the French Revolution: Setting the Record Straight. *Studia Historica Gedanensia* 6, pp.65-81.
- Charles, L. and Théré, C. 2016. Charles Richard de Butré: pioneer of mathematical economics. *Journal of the History of Economic Thought*, 38 (3), 311-327.
- Charles, L. and Théré, C. 2017. Physiocracy as an Eighteenth-Century Science. *Research in the History of Economic Thought and Methodology. Including a Symposium on the Historical Epistemology of Economics*. Emerald pp.11-34.
- Condorcet, J.-A.-N. de Caritat, marquis de, 1786. *Vie de Monsieur Turgot*. Londres.
- Delmas, B. 2009. Les physiocrates, Turgot et le grand secret de la science fiscale. *Revue d'histoire moderne et contemporaine*, 56, 2, avril-juin, pp. 79-103.
- Du Pont, P.S. 1808–1811. *Œuvres de M. Turgot, Ministre d'état, Précédées et Accompagnées de Memoires et de Notes Sur sa vie, Son Administration et Ses Ouvrages*. Paris: Bellin. 9 vols.
- Eltis, W.A. 1975. François Quesnay: A Reinterpretation1: The *Tableau Economique*. *Oxford Economic Papers*, 27, 167-200.
- Faccarello, G. 1990. Le legs de Turgot: Aspects de l'économie politique sensualiste de Condorcet à Roederer. *Economies et Sociétés*, 13, 67-107.
- Fournier de Flaix, E. M.E. 1885. *La Réforme de l'impôt en France* [Reprint 1979, Geneva: Mégariotis].
- Groenewegen, P.D. 1977. *The Economics of A.R.J. Turgot*. The Hague: Martinus Nijhoff.
- Groenewegen, P.D. 1992. *Turgot. Extracts from his economic correspondence with Du Pont de Nemours, David Hume, Josiah Tucker, Condorcet, Morellet and others*. Reprints of Economic Classics series 2, Number 6. Sydney: University of Sydney.
- Hill Burton, J. 1846. *Letters of Eminent Persons addressed to David Hume*. Edinburgh and London: Blackwood.
- Hishiyama, I. 1960. The Tableau Economique of Quesnay –Its Annalysis, Reconstruction, and Application. *Kyoto University Economic Review*, 30, 1, pp. 1-46.

- Kiener, M.C. and Peyronnet, J.-C. 1979. *Quand Turgot régnait en Limousin*. Paris: Fayard.
- Knies, C. (ed) 1892. *Carl Friedrichs von Baden Brieflicher Verkehr mit Mirabeau und Du Pont*. Heidelberg: Carl Winter. Volume 2.
- Larrère, C. 1992. L'Arithmétique des physiocrates: la mesure de l'évidence. *Histoire & Mesure*, pp.5-24.
- Le Mercier de la Rivière, P.P. 1767. *L'ordre naturel et essentiel des sociétés politiques*. London: Nourse, Paris: Desaint.
- Le Trosne, G.-F. 1770. *Les effets de l'impôt indirect prouvés par les deux exemples de la gabelle et du tabac*. [Paris]
- Le Trosne, G.-F. 1779. *De l'administration provinciale et de la réforme de l'impôt*. Basel.
- Maclain, J.J.1977. *The Economic Writings of Du Pont de Nemours*. Newark: University of Delaware Press.
- Mirabeau, V. Riquetti, Marquis de, 1756. *L'Ami des Hommes, ou Traité de la Population, nouvelle édition corrigée. Seconde Partie*. Avignon.
- Mirabeau, V. Riquetti, Marquis de, 1760. *Théorie de l'impôt*. [n.p.]
- Mirabeau, V. Riquetti, Marquis de, 1763. *Philosophie rurale ou économie générale et politique de l'agriculture* Amsterdam: Les Libraires associés.
- Orain, A. 2008. Jean-Joseph-Louis Graslin (1727-1790). Un itinéraire dans son siècle. In: Ph. Le Pichon and A. Orain (eds.) *Graslin. Le temps des lumières à Nantes*. Rennes: Presses Universitaires
- Pressman, S. 1994. Quesnay's Theory of Taxation. *Journal of the History of Economic Thought* 16, Spring, pp.86-105.
- Quesnay, F. 2005. *Œuvres Économiques Complètes et Autres Textes*. C. Théré, L. Charles and J.-C. Perrot (eds.) Paris: INED.
- Sabbagh, G. 2017. An unrecorded Physiocratic précis by Charles Richard de Butré and the experiment of Karl Friedrich of Baden-Durlach in Dietlingen. *The European Journal of the History of Economic Thought*. 24, 1, pp.1-24.
- Saricks, A. 1965. *Pierre Samuel Dupont de Nemours*. Lawrence: The University of Kansas Press.
- Schelle, G. 1913-1923. *Œuvres de Turgot et documents le concernant*. Paris: Félix Alcan. 5 vols.
- Skornicki, A. 2011. *L'économiste, la cour, et la patrie: l'économie politique dans la France des Lumières*. Paris: CNRS.
- Spiegel, H.W.1955. *Pierre Samuel du Pont de Nemours On Economic Curves*. Baltimore: John Hopkins Press.

- Staum, M.S. 1996. *Minerva's Message. Stabilizing the French Revolution*. Montreal & Kingston: McGill-Queen's University Press.
- Steenge, A.E. and van den Berg R. 2007. Transcribing the Tableau Économique: Input-Output Analysis à la Quesnay. *Journal of the History of Economic Thought*, 29 (3) pp.331-358.
- Theocharis, R.D. 1961. *Early Developments in Mathematical Economics*. Second edition 1983 Philadelphia: Porcupine Press.
- Tsuda, T. 1974. *Catalogue des livres de la bibliothèque de Turgot d'après le catalogue manuscrit conservé dans la Bibliothèque nationale, Paris*. Tokyo: Hitotsubashi University.
- Van den Berg, R. 2000. Differential rent in the 1760s: two neglected French contributions. *The European Journal of the History of Economic Thought*, 7(2), pp. 181-207.
- Van den Berg, R. 2004. "Un état de pleine concurrence": old and new controversies about the physiocratic theory of value. *Économies et Sociétés*, 38(8/9), pp. 1431-1458.
- Van den Berg, R. 2006. *At the Origins of Mathematical Economics. The economics of A.N. Isnard (1748-1803)*. London and New York: Routledge.
- Van den Berg, R. 2010. John Gray's Essential Principles of the Wealth of Nations. In: Allington, N. F. B. and Thompson, N.W., (eds.) *English, Irish and subversives among the dismal scientists*. Bingley, U.K.: Emerald. pp. 37-72. (*Research in the history of economic thought and methodology series*, no. 28)
- Van den Berg, R. 2014. Turgot's *Valeurs et mommaies*: our incomplete knowledge of an incomplete manuscript. *The European Journal of the History of Economic Thought*, 21(4), pp. 549-582.
- Van den Berg, R. 2019. Turgot's Theory of Capital and Interest in its contemporary context. *Paper presented at the HES conference in New York*
- Van den Berg R. and Dhesi, G. 2004. "The equilibrium is never perfect": the dynamic analysis of C.-F.-J. d'Auxiron. *History of Political Economy*, 36(1), pp. 1-29.
- Weulersse, G. 1910. *Le Mouvement Physicocratique en France*. 2 vols. Paris: Alcan.