Tax administration and compliance: evidence from medieval Paris

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Abstract

Using actual tax rolls and other historical records, we describe and analyze the workings of a direct tax that was used in Paris in the late 14th century to finance particular royal initiatives. Called the *tailles*, it involved an agreement between the crown and the city government on a fixed amount of revenue to be collected from the city, but left the collection to be administered by the city itself. We use data and a theoretical model of the *tailles* to argue that its features allowed the collection of a direct tax in a way that incurred minimal administrative costs, effectively deterred evasion, allowed the city to maintain its fiscal independence, and avoided the civil unrest that often plagued other taxes levied by the crown. We conclude with a discussion of the lessons to be gleaned from this for modern direct taxation systems.

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Introduction

The problem of tax compliance is as old as is the levying of taxes. While there has been a great deal of research on tax compliance since the publication of Allingham and Sandmo's seminal 1972 paper, two recent surveys of the field [Andreoni, et al (1998) and Slemrod (2007)] have both concluded that our understanding of the factors that influence tax compliance is still minimal. Inducing compliance from taxpayers is important to governments for many reasons. Non-compliance obviously reduces the revenue raised from any tax system, but in addition, non-compliance can undermine the legitimacy of the government, and non-compliance that is unevenly distributed across social classes, professions or income levels can lead to social unrest if not violence. Consequently, governments expend considerable resources on reducing tax evasion, and innovations in tax administration that induce high compliance rates at reasonable cost are extremely important.

This paper analyzes a particular tax-collection mechanism that was used in medieval Paris to finance wars and other activities carried out by the French crown. The information we uncover regarding its implementation, as well as results from a theoretical model, indicate that this mechanism – known as the *tailles* – was able to collect the revenues the crown desired at low cost and with high levels of compliance, despite the minimal bureaucratic machinery available to the French king for collecting taxes. In one sense, the primary difficulty in collecting taxes has remained constant throughout history. Citizens have superior information about the base on which most taxes are collected, particularly their own income and wealth. In medieval times and for long afterward, this led governments to rely on taxes levied on easily observed transactions. In the case of medieval Paris, this implied taxing goods that entered and left the city walls. However, such indirect taxes have many undesirable features; they are in particular generally regressive, which can be a trigger for social unrest. While direct taxes on personal income and wealth can avoid these difficulties, they are harder to collect because of the asymmetric information problem mentioned. Medieval kings had relatively modest administrative capabilities, and there were, of course, none of the third-party record-keeping and reporting

mechanisms in place that modern governments use. Moreover, attempts by the crown to send royal tax collectors (and sometimes troops) into cities to collect taxes ran the risk of igniting riots.

One method used by many government bureaucracies in medieval and early modern Europe to collect direct taxes was to delegate tax assessment and collection to 'private' tax collectors (tax farmers) and local governments. The variation of this in which we are interested arose in France at the end of the 12th century. Under that scheme a given tax liability earmarked for a specific royal initiative was agreed to by the crown and a local government, and it was left to local authorities to partition that liability among its taxpayers and collect the agreed total payments. Variations of this de-centralized tax collection system were used in a variety of times and places, but this paper is concerned with its adoption by agreement between the French king, Phillip the Fair, and the city government of Paris, which was a self governing city – a 'Free City' - during the years between 1292 and 1313. We have data taken from the actual tax rolls drawn up for the *tailles* implemented in Paris for 7 of the years in that span, and less detailed information for two other years. We use this information, as well as information on other, similar, *tailles* of the era to determine the key features that resulted in the French crown and the city leaders agreeing to use this system.

We find that two key aspects of the Parisian *tailles* were critical to its success. First, it used the information that citizens had about one another's economic circumstances, coupled with public revelation of individual tax liabilities to deter tax evasion at low cost. Second, it embodied a principle referred to by Wolfe (1972) as an "impot de repartition" – a repartition tax whereby a fixed sum is agreed on to be collected, and is then divided amongst taxpayers; this repartition system implies that the cost of tax evasion by some taxpayers is borne directly by fellow taxpayers. We argue that these factors enabled the city to collect, on a number of occasions, an income and wealth tax in a city that numbered some 200,000 inhabitants, without civil unrest. We further demonstrate that this was accomplished with minimal administrative machinery, and at a remarkably low cost for the time.

Direct tax collection in modern developed economies typically exhibits neither of these features. Individual and corporate income tax returns are typically held to be confidential, and the total

revenue collected via any particular tax in any given period is typically a random variable. Nonetheless, our results have implications for current issues in tax compliance and administration. Lenter, Shackelford and Slemrod (2003) document the fact that at least some information from individual and corporate income tax filings has been made publicly available in various countries at different times. They review the arguments for and against this sort of revelation, noting in particular that improved compliance is one of its claimed virtues. Our analysis of the *tailles* shows that, whatever may be the other merits of public revelation of tax information, there is little reason to expect it to improve compliance on its own. This is in part because we find that the re-partition feature of the *tailles* was, somewhat surprisingly, also critical to its being so effective. Modern tax systems have come to rely heavily on third-party reporting to raise the cost of tax evasion and improve compliance. Nevertheless, in some situations, typically when a relatively small number of wealthy taxpayers have a substantial informational advantage over the government, a *tailles*-like mechanism can yet be useful in some modern-day tax-collection systems. One recent example arose in the 2009, in US legislation titled `The Patient Protection and Affordable Care Act' (H.R 3590). We detail this feature of the 'Obamacare' bill at the end of the paper, and consider what it implies about contemporary tax-collection and compliance.

The paper is organized as follows. Section II places our work in the large literature on tax compliance and reviews other work that has used tax rolls from the same period. Section III lays out in detail what is known about the actual implementation of the *tailles* in medieval Paris as well as in other places and times. Using this information as a guide, Section IV then develops a theoretical model of the *tailles* mechanism, derives the model's unique equilibrium and shows how the theoretical predictions change if any of the key aspects of the model are altered. Section V discusses further issues that arise from the theoretical results, while section VI concludes

II. Related Literature

There is a considerable literature devoted to tax compliance issues. The seminal paper on the deterrence of false reporting of an individual's tax base is Allingham and Sandmo (1972), which analyzes the behavior of a single taxpayer with private information about their own income, who

makes a report of that income to the tax authority. The tax authority's role is to set a fixed probability of detecting an under-report by the taxpayer, and to set the penalty incurred if an under-report is detected. The tax authority is non-strategic, and the emphasis is on determining the values of these parameters which will deter under-reporting. An advance on this approach was made in a series of papers [see, for example, Reinganum and Wilde (1985), (1986), Chander and Wilde (1998)] which adopted a principal-agent approach to tax compliance by having the tax authority (the principal) as well as the taxpayer act strategically, and derived the equilibrium behavior by both parties. The environment in this literature remains one of a tax authority dealing with a single taxpayer with private information regarding his true income, and the equilibrium strategies inevitably involve randomization.

A recent survey of the literature on tax evasion by Slemrod (2007) uncovers no work that analyses the use of information held by fellow-taxpayers to aid a tax authority in deterring under-reporting, even though taxation authorities in many countries do make attempts to encourage citizens to report tax evasion by others.[3] Myles and Naylor (1996) develop a multi-taxpayer model of tax evasion, but the mechanisms for improving compliance that are analyzed there are social norms and group conformity, rather than taxpayers' information about one another.

There is, however, a large general literature on the use of 'mutual monitoring' in multiple-agent environments in which the agents have superior information to the principle regarding the behavior of other agents. Knez (2001) analyzes an incentive system adopted by Continental Airlines that relied on mutual monitoring and sanctioning by employees, and Fehr and Simon (2000) show that adding the possibility of mutual punishment by individuals in a public goods game can increase the amount contributed. Besley and Coate (1995) among others analyze the working of micro-financing systems like the Grameen Bank in which groups of lenders are mutually responsible for their loans. However, in the Continental and public-good environments it is the agents themselves who are required to punish/sanction sub-optimal behavior by their colleagues, rather than inducing a separate authority to do so, and in the group-lending context the only recourse available to a single lender is to repay the loan of another lender who would

[3] See, for example, http://www.endfraud.co.uk/Tax%20Fraud.html.

otherwise default. Thus, the central concept analyzed here of giving informed taxpayers appropriate incentives to trigger audits of one another by an uninformed authority, is missing.

A paper whose environment bears some resemblance to that in our formal model of the *tailles* is Bandyopadhyay and Chatterjee (2010). They develop a model of criminal activity in which citizens have better information than the police about whether their fellow citizens have committed a crime. The action available to citizens is to report others criminal activity to the police. The key question analyzed in their paper is how such citizen reporting affects criminal activity in observably distinguishable groups.

The theoretical literature on implementing social choice correspondences (Ma (1988) and Moore and Repullo (1988) are classic references) demonstrates that under quite general conditions one can construct an extensive-form game which will induce a set of agents with superior information to adopt any profile of actions that a principal wishes, as a (unique) subgame perfect equilibrium of that game. Our point here, however, is not to demonstrate that the Parisian authorities of medieval France *could* find a mechanism to collect taxes in such an informational environment, but to show how the incentives inherent in the mechanism they actually used allowed them to solve the problem they faced at minimal administrative cost.

A small number of previous recent studies have made use of the Parisian tax rolls. The tax rolls analyzed in this paper have been studied by Bourlet (1992) mainly for the purpose of an anthro-toponymic study. Herlihy (1995) analyzed the 1292 and 1313 tax rolls and briefly addressed issues related to migration, occupations and gender differences. Bove (2004) also used the tax rolls in his study of the Parisian elites. Desicmon (1989) analyzed the Parisian tax roll of 1571. Rigaudière (1982, 1989, 2002), studied the *tailles* imposed in southern France and more specifically attempted to answer the question of how income and wealth information was verified by tax collectors. The institutional detail we use in the model is derived mainly from his papers.

III. The Parisian *Tailles* of Philip the Fair

1. Data

Our data is extracted from the tax rolls of the *taille* imposed by Philip the Fair on Paris starting in 1292. There are seven existing rolls: 1292, 1296,7,8,9, 1300 and 1313. The first six correspond to the same imposition totaling 100,000 *livres parisis* to be paid in installments.[4] The last tax roll, of 1313, was earmarked to pay for the knighting of the prince, the future king Louis X. In addition we have qualitative information on the collection of two additional *tailles* of 10,000 *livres* in 1302 (for a war against Bruges) and in 1308 (for the marriage of Isabel, the king's daughter).[5] This tax was levied on the citizens of Paris and excluded the privileged tax exempt classes of the nobility, clergy, students and professors. It included the Italian merchants (*lombards*) and Jews who were not citizens of the city.[6] Who exactly in Paris was classified a citizen – a 'burgher' - is open to debate. According to Duby (1980), only those that enjoyed the privileges of citizens that were related to residency requirements paid these taxes. A court case in the *Parloir* (the city's court) from 1308 defines a citizen (*bourgeois*) as someone living in the city and paying the *taille* and other charges imposed by the city.[7]

The tax rolls differ in coverage. Table 1 shows the first - 1292 - being the largest, including all segments of the taxable population: The rich (*gros*) the poor (*menus*), the Jews (who were expelled in 1305) and the *Lombards* (Italians). Separate lists were drawn for each of these groups, but the tax roll of 1296 is missing the list of the poor. All the subsequent tax rolls after 1292 exclude some of the neighborhoods outside the city walls. All of the rolls include the names of citizens who have died during the year. The tax roll of 1313, which records the fewest tax payers, has fewer parishes included in it than the previous ones[8].

[4] There is some doubt as to whether the tax roll of 1292 was actually a roll of collected taxes rather than an initial survey of taxpayers.
[5] Le Roux and Victor (1846).
[6] The privilege to tax the Italian aliens was given to the city by Philip le Hardi in 1282, The royal decree is cited in Le Roux and Victor (1846) Vol. II p. 261.
[7] Le Roux and Victor (1846) Vol. II p. 171.
[8] Although the roll of 1296 appears to be the smallest, the roll of the poor is not part of the records we have for that year.

The tax rolls consist of a list of taxpayers recorded according to residency (i.e., street address). In addition to the taxpayer's name we often find information about his or her occupation and place of origin. The tax rolls of 1292 (Geraud, 1837), 1296, 1297 and 1313 (Michaelsson, 1951, 1958 and 1962) were extracted from the archives and are available in printed form. The remaining rolls – those of 1298, 1299 and 1300 are available only in their original manuscript form and were entered manually into the database. In the rolls, the city was divided into geographic tax units associated with the parish church. Larger parishes were further divided into wards. Taxpayers were grouped according to streets or street sections they lived in. Although we have no written record detailing the division of the tax burden by parishes, the division of the rolls into those geographical units suggests that the tax burden was divided among these tax units

In addition to the tax rolls themselves we used the registers of the merchant court of Paris (the *livre* de *parloir*) that was transcribed by Le Roux and Victor (1846).[9] The registers provide supporting evidence on the institutional details of the administration of the tax.

2. The critical elements of the *tailles*

In this sub-section we will use what is known about the Parisian *tailles* as well as other similar tax systems to establish what we believe to be the key features of its implementation during this period.

Motivation for adopting the tailles

According to the history of the *tailles* studied here, it was the city of Paris that chose to substitute the *taille* for a sales tax (*aide*) (Bourlet, 1992). The city negotiated with the crown on the amount to be delivered and the crown left it to the city's government to assess and collect it. It appears that this taxation mechanism was mutually advantageous for the bourgeoisie and the crown. The crown was assured a given tax revenue, thereby reducing fiscal uncertainty. In Burgundy, in contrast, the princely city of Dijon was subject to a wealth tax which was administered by the

[9] Le Roux and Victor (1846) call attention to the fragmentary nature of the documents, but argue that they are most complete for the period 1290-1315 which conveniently corresponds to the tax tolls studied. Nevertheless, Bove (2004) suggests that their transcription should be used cautiously as there are errors, particularly in dating some of the documents.

Duke of Burgundy's men and was calculated at a fixed rate of 2% of the assessed wealth. Tax revenues, therefore, fluctuated from one tax assessment to the next (Dubois, 1984).

Administration costs for any direct tax are typically high. The small scale of the king's bureaucracy and his limited political and military powers resulted in a preference for farming out tax collection – the *taille* was no exception. However, one difference between other tax farm arrangements and the adoption of the *taille* in Paris lay in the city's motivation for agreeing to it: the *taille* arrangement protected the city's fiscal independence, rather than being a means to maximize (net) tax revenues.[10]

Another feature of the Parisian *taille* system that worked to the advantage of both the Crown and the City can be inferred from the adoption of a similar scheme earlier in the Midi – the region around Toulouse. Wolff (1956) argues that in Toulouse and other towns in the Midi, the Count of Toulouse in 1270 introduced the Northern version of the *taille* to the consulates of the South.[11] According to the documents studied by Wolff, the aim of switching from indirect taxes to direct ones in these cases was to attenuate civil tensions that were widespread in the Southern consulates. The conflicts were a result of the regressive nature of indirect taxation and resentment of the city oligarchies by the lower classes. Thus, adoption of the *tailles* in Paris likely appealed to both parties as a way to minimize the likelihood of civil unrest. Indeed, an attempt in 1382 by the king's agents to collect taxes from the city directly resulted in violent riots (Cohn 2006).

While the tax rolls we have provide a great deal of information about the Parisian *tailles*, many of the institutional details must be inferred from similar systems used in other times and places. There is reason to believe that this is by design, due to the city's desire to maintain the autonomy of its public finances. According to Descimon (1989), who analyzed a similar Parisian tax roll of 1571, the Parisian city government kept these tax rolls secret from the crown and carefully guarded the detailed information about its taxpayers. Descimon suggests that those tax rolls were burnt after the taxes were delivered, indicating the importance of such fiscal independence to the City's leaders.

[10] One related potential benefit to the city was that it could use its fiscal independence to issue low interest debt in the form of rents – Luchaire (1911).
[11] The consulates were a governing body of a city that included landed aristocracy.

The fixed sum (repartition)

Despite the limits of historical knowledge about the Parisian *tailles*, tax rolls and other documents that survived in Paris and other cities over the early modern period have allowed scholars to infer many of the principles of this sort of tax. The following account is based on the summary provided by Wolfe (1972) in appendix G to his book.

Generally, the king of France had to finance his expenditures from revenues raised from his feudal domain. On special occasions the king levied extraordinary taxes – the *aide* – usually in the form of a sales tax. These taxes could be levied automatically, according to feudal custom, in the case of a marriage of the king's daughters and the naming of his heir. The tax could also be used to finance wars that had to be approved by the parliament. We will argue below that the infrequent and irregular nature of these taxes, along with other features particular to the Parisian situation, imply that each instance of the *tailles* should be considered a one shot tax game.

The *tailles* in France were divided into two types – the *taille reele* and the *taille personelle*. The former was a property tax often called *'fougae'* - hearth tax - and was levied mainly in the *midi* and the south of France. The latter was a tax on personal wealth that included also moveable wealth and income, and was levied in the north of France. The Paris *tailles* were therefore a tax on all wealth and income from labor and capital.

We argue that a critical feature of this *taille personelle* was what Wolfe terms an "impot de repartition" – a repartition tax whereby a given amount to be collected is divided amongst taxpayers. Recall that the city negotiated a lump sum tax to be delivered to the king – it therefore turned the tax allocation and collection process into a constant-sum game, whereby a taxpayer who evaded taxation by either falsely declaring his taxable wealth and/or income, or by not paying his assessed tax, fell as a burden on other tax payers. Unlike modern taxes, where the government sets tax rates and is therefore, the residual claimant of the tax assessment and collection process, the medieval monarchy made sure that taxpayers internalized the costs of tax evasion[12].

[12] This mode of repartition – the division of a lump sum tax between tax payers - was common in small rural communities.. This became the norm in Burgundy after 1376 (Leguai 1970)

Information collection and verification

The successful implementation of the *tailles personelles* to collect the sum agreed to with the crown depended on the city government's ability to a) extract the necessary wealth information from each taxpayer and b) to enforce the collection of the resulting individual tax liabilities. Clearly, it wished to do this at minimal cost.

After negotiating with the King on the total amount the city should deliver to the crown, the city leaders had to determine how to distribute the tax burden across its citizens. This in turn required a general assessment of the city's wealth and then the allocation of tax quotas to the various parishes, which were the local tax units (with some exceptions, as detailed later).

Little is recorded about the first stage and the information historians have is derived from a few rare examples which survived – none from Paris. However, these similar *tailles* were usually levied according to the following principle: the very poor paid a poll tax, the very wealthy, above a certain (variable) cutoff paid a proportional wealth tax that normally ranged from one to ten percent. Most taxpayers paid a proportional income tax.[13]

The critical issue was the extraction of accurate wealth and income information and enforcement of collection. This was achieved, in Paris and other large cities, by dividing the city into parishes with some parishes further divided into wards. To ensure that the principles that operated at the city level would also carry through at lower levels, the lump sum levied on the city was divided into quotas for each parish.[14] The actual assessment and collection of the tax was supervised by the city government but carried out by a varying number (between 13 and 24) of unpaid 'worthy' assessors (*Prud'hommes)* elected by the city government. A measure of the low cost of this taxation mechanism, on which we elaborate later, can be deduced from the fact that the process of assessing a city of 200,000 residents was carried out by such a small number of unpaid collectors.[15]

[13] Boutaric (1861) p. 261. Desportes (1977)
[14] Descimon (1989) documents this further sub-division of the tax in 16th century usage.
[15] See discussions in Farr (1989) and Desportes(1977) for Dijon and Reims respectively. The collection costs were augmented by paid clerks that wrote up the tax lists and city police that guarded the money collected.

How much confidence could the city leaders have that the assessors had obtained truthful wealth and income statements from taxpayers? We know little about how the process was carried out in Paris for the *tailles* we analyze, but from other sources we can infer a good deal about the process.

The fact the rolls are constructed according to residence – by the taxpayer's address - alludes to the way the assessment was conducted; through a house to house canvas. The information collected by the assessors during the canvas might, nonetheless, be false. Rigaudiere (1989) has attempted to determine how reports were verified for the *tailles* levied in France more generally. The common features of the verification mechanisms he describes relate to the use of neighbors to verify wealth and income declarations. They included measures such as the assessors revisiting the neighbors when they had suspicions about a tax statement, and to call on neighbors to testify before a committee in cases of suspect statements. In Dijon, assessed taxpayers were required to provide the assessors with names of neighbors that can confirm their declaration. Other methods relied on making public the assessments and allowing neighbors to challenge them. Rigaudiere (1982) describes the process of collecting the *taille* in Saint Flour and shows that assessed taxpayers could challenge their assessments and neighbors were involved in the process. Decsimon (1989) alludes to the presentation of the tax rolls before the general assembly of Paris in 1571.[16] Evidence from small communities in the 17th century suggests that the tax rolls were read to the community during mass in the parish church.[17] While most of the documented evidence comes from periods after 1300, it is likely that the evidence drawn from rural communities that retained age old customs in the area around Paris, together with evidence from Paris from the 16th century can be used to infer the customs prevailing in Paris at the time.

One shot game

We noted above that other instances of the *tailles* often involved the collection of taxes for infrequent and unpredictable purposes. However, the first six tax rolls we have are known to have been for the purpose of collecting a pre-determined sum in installments. Nonetheless, we

[16] Descimon (1989, p. 76).
[17] Challet for Saint Vert, Lemarchand (2008), Follain and Larguier (2000,2005).

argue that the task of collecting information from taxpayers and collecting the resulting taxes in each of these years is best treated as a one-shot game.

An important fact in this regard is that medieval cities' populations were very dynamic. During the 13th century the population of Paris more than doubled. Migration was the most important source of population growth as death rates were high. Indeed, our data show that each tax roll contains numerous variations in taxpayers' vital and economic circumstances. First, the overlap between taxpayers within the years we have data for is not high: the proportion of taxpayers that appeared in the roll of 1292 that appear in **any** subsequent year is about 40%. 50% of those appearing in the tax roll of 1300, which covered fewer citizens, were also listed in earlier rolls. The tax assessed on individuals also varied even over consecutive years.[18] Moreover, over the years, our tax rolls document taxpayers that got married, became widowed, and died. Children reached adulthood and apprentices became masters. Some taxpayers changed residences and sometimes even their occupations. In short, from the data extracted from the rolls it is evident that substantial new information had to be collected every year, suggesting that the *tailles* was not a repeated game.

Equally significant is the fact that each tax collection game was played by a different set of tax assessors. Out of the 13 assessors of 1292, 10 were themselves assessed by different assessors in subsequent years. Of the 24 assessors in 1298/1300 14 were assessed by others.[19] All of this suggests that each tax collection can be thought of as a one shot game, as both the taxpayer population and the assessors they dealt with changed substantially from assessment to assessment.

Universality

As mentioned, only the nobility, the clergy, faculty and students were exempt from paying the *tailles*. The coverage of the *tailles* was otherwise universal. In medieval cities there was a distinction between residents (that included clergy, nobility and aliens) and citizens. The direct

[18] To be tabulated when data processing is complete.
[19] The list of assessors for the years 1293-1297 are missing, so we cannot calculate exactly how many times the assessors switched roles with those being assessed.

taxes were levied on all citizens, including the city elites, the poor and the dead. The records of the Paris *taille* show that in 1292 – 1313 poor taxpayers paid less than five percent of the total tax. The wealthier citizens would hardly have noticed if the poor had been excluded from paying (and it may be that in 1296 they were), but it appears to have been important for all citizens to be included. The inclusion on the lists of dead taxpayers is also significant. Since the planning of the tax assessment was based on living taxpayers, a taxpayer that died during the tax year could not be readily absolved. If the dead taxpayers were to be dropped from the list, their burden would have to have been picked up by surviving ones. Since death rates were not low in medieval Europe, a provision for collecting taxes from the survivors of deceased taxpayers was important, since one way to evade a direct tax is to avoid being assessed at all. For the *tailles,* even (a perhaps fraudulent claim of) death was not a successful way to avoid taxation.

Further, the assessors and the city leaders were neither exempt from the tax nor given preferential treatment. We found that all the Parisian political elite (the mayor - *prevot de marchands,* his lieutenants – *the echevins,* and members of the city parliament - *the elus*) are accounted for in the tax rolls – they did not exempt themselves or their families. Indeed, Bove (2004) in his study of the wealthy elites in Paris, compared the tax assessments of the wealthy individuals and families before and after assumption of political power and shows that privilege did not favor them: their assessments did not decline with their taking office.

Informed assessors

We noted above that the *tailles* was overseen on the city leaders' behalf by a relatively small number of assessors. We also know a good deal about those assessors. From the *livre de parloir* transcribed by Le Roux and Victor (1846) we have the names of tax assessors for 5 of the years that the tax was collected [1292, 1298/1300, 1302, 1308, 1313]. Table 2 provides the details on the assessors. Their names and occupations were given in the text and their tax payments and residences were inferred from the tax rolls. The mention of their profession suggests that professional affiliation was a key selection criterion. Assessors coming from the professions would be familiar with business conditions generally and particularly those affecting their own profession. This mattered, especially in a medieval world populated with professional guilds that kept secret many of their business practices. Table 2 shows the breakdown of the professional

affiliation of the assessors sorted by their average tax assessment. This is contrasted with the distribution of taxpayers in 1300 according to these professions and their rank in terms of average tax. It can be readily seen that the assessors in this year were drawn largely from the professions that paid the highest average tax, and that the assessors' average tax payments from each profession were generally above the average for all members of that profession. Further, Table 3 displays the years in which the assessors whose names we know appeared as taxpayers in all the rolls we have. Assuming these individuals were in Paris and economically active in the years between those in which their names appear as taxpayers, Table 3 implies that 47 of the 66 assessors whose names we know lived and worked in Paris for 7 or more of the years between 1292 and 1313. Finally, the assessors were amongst the most affluent citizens of Paris. Table 4 shows their rank in the tax distribution. More than half of the assessors belonged to the top 5% of the distribution of tax payments and all but one of these whose assessment we could determine belonged to the top two deciles.

Moreover, evidence from the tax roll of 1296 suggests that there existed another tier of tax assessors or collectors at the tax unit level. The opening paragraph of the tax roll of 1296 lists 5 names of people responsible for the tax of the first ward of the first parish. Unlike the list of the citywide assessors, they were not listed by their profession. The criteria for their appointment appears to have been residential, as they all resided in that tax unit. Their tax assessments are lower than that of the citywide assessors; they belonged to the third decile of the income distribution, a rank below the *prud'hommes*. This suggests that the tax administration consisted of two tiers. The upper tier first assessed the citywide tax base and distributed quotas among tax units. The lower tier consisted of residents of each tax unit who were responsible for the assessment and collection within their own units.

IV. A model of the *taille* mechanism in Paris

In this section we build a formal model of the *tailles* mechanism as it appears to have functioned in medieval Paris. The model encompasses the properties laid out in the previous section. That is, it involves the collection of a fixed sum, denoted as P, from a given set of taxpayers, denoted as $N=\{1,2,...,n\}$, each of whom has a value of wealth, w_i. (We refer to this as 'wealth', but it can be taken to be whatever value(s) the tax is to be assessed on.) The set N does not contain any

individuals who were exempted from the tax, such as the nobility and clergy. In a case where the poor were assessed a fixed small amount, P is to be interpreted as the remaining tax revenue quota after these small amounts have been subtracted, and the poor are assumed not to be part of the game we describe.

The taxation mechanism works broadly as follows. Taxpayers know the value of their wealth, and report it to an assessor upon request, with other taxpayers having the opportunity to observe and ultimately to challenge those reports. A challenge results in a thorough audit of the challenged report, which uncovers the true value of the challenged taxpayer's wealth, and may then result in an adjustment to their tax liability. Our key informational assumption is that, in addition to the taxpayer herself, at least one other taxpayer knows the true value of each citizen's wealth. The assessors' only task is to receive the reports from taxpayers and make them public, so they have no strategic role *as assessors*. However, consistent with the reality of the *tailles*, they are themselves taxpayers, who are assessed themselves, and may themselves challenge others reports.

We will refer to the individual taxpayers as 'parishioners', and interpret the amount P as the portion of the sum agreed to between the crown and the city that a particular parish has been assessed by the city leaders and/or worthy assessors. However, nothing in the model is altered if instead P is interpreted as the entire city's tax burden and N is the entire set of Parisian taxpayers[20]. We do not analyze any discussion among city leaders to determine parish assessments, nor the prior bargaining with the Crown over the city's total tax assessment. Thus, the task at hand is to collect the specified amount P from the members of this particular tax unit.

1. *The formal model*

As noted, the parish consists of n parishioners, indexed by $i = 1,2,...,n$ and we let $N = \{1,2,...,n\}$ denote the set of parishioners. Parishioner i has actual wealth w_i which is drawn from a continuous distribution f_i, with support $[a_i,b_i]$. The information (f_i, $[a_i,b_i]$) for each i is common knowledge, and we assume that each $a_i > 0$. The actual realization of each w_i is observed by a

[20] The tax-collection districts to which quotas were assigned did not always coincide with parish boundaries, as noted above, and they changed over time, but we use the term 'parish' here for brevity.

subset N_i of parishioners that includes i. We assume that the set $N_i \backslash \{i\}$ is non-empty for each i, so there is at least one parishioner other than i who knows the realization of w_i. The tax assessor(s) for the parish are members of the parish who volunteer for this role, and are subject to taxation themselves. They may or may not be members of N_i for any particular i, but they know each $[a_i,b_i],f_i$.

We specify a two-stage game. In Stage 1, nature draws the vector $w = (w_1,w_2,\ldots,w_n)$ from the independent distributions $(f_1,f_2,\ldots,f_n)$, the members of the sets $(N_1,N_2,\ldots,N_n)$ observe the realizations of the w_i, and then the tax assessor goes to each parishioner and gets a report from the parishioner of their wealth. This report is a value r_i from $[a_i,b_i]$. We assume that any report outside this interval would be known immediately by the assessor to be false, and so would trigger an immediate audit and censure, to be discussed below. Thus, parishioner i's strategy in Stage 1 is a function $\rho_i(r_i|w_i)$, which is a distribution over $[a_i,b_i]$, for each realization of w_i. This is parishioner i's *reporting strategy.*

We assume that the profile of realized reports $r = (r_1,r_2,\ldots,r_n)$ is observed by all parishioners (while only members of N_i observe each w_i). This captures the observations in the previous section that in those versions of the *tailles* for which we have detailed knowledge one's neighbors had an opportunity to observe the assessment on which each parishioner's tax liability is to be based[21].

At Stage 2, each parishioner i's pure strategy for any given vector r is a vector $c_i = (c_{i1},c_{i2},\ldots,c_{in})$ of *challenges* of the other parishioners' reports. Each c_i is an element of $\{0,1\}^n$, with $c_{ij} = 1$ meaning i challenges j's report, and 0 meaning he does not. A *mixed* challenge strategy for i is a vector $\gamma_i = (\gamma_{i1},\gamma_{i2},\ldots,\gamma_{in}) \in [0,1]^n$, so that γ_{ij} is the probability that i challenges j's report.[22] We allow for the possibility that parishioners not in N_j may also challenge r_j – whether they do or not

[21] For a taxpayer who knows how the T_i are calculated (see below) and his own tax, observing his fellow taxpayers' tax liabilities is equivalent to observing the assessment on which it is based. We adopt the convention that it is the assessment that is made public.

[22] More generally, a mixed strategy is a probability distribution over the set of all possible pure strategy vectors $c_i = (c_{i1},c_{i2},\ldots,c_{in})$. It will be apparent from what follows that mixed strategies arise in Stage 2 only when they have no payoff relevance, so there is no loss in considering only this subset of mixed strategies..

will be an equilibrium outcome. Each profile r of realized Stage 1 reports defines a sub-game in stage 2, and we let $\gamma_i(r)$ denote parishioner i's challenge strategy given r.

It is assumed that any challenge triggers a costly (to the authorities) and thorough audit of the challenged parishioner's report of her wealth, which reveals the true w_i with probability 1. We let $c^j = (c_{1j}, c_{2j}, \ldots, c_{nj})$ indicate the set of realized challenges (or not) of parishioner j's report, and let $\eta^j(c^j) = \max\{c_{ij} | i \in N\}$, which therefore takes a value of 1 if and only if *some* parishioner has challenged r_j.

The mechanism by which parishioners' realized reports and challenges determine each parishioner's tax liability, T_i, is

$$T_i = \frac{s_i(w_i, r_i, \eta^i(c^i))P}{\sum_j s_j(w_j, r_j, \eta^j(c^j))}, \text{ where:}$$

$$s_i(r_i, w_i, c^i) = \eta^i(c^i) \max\{w_i, r_i\} + (1 - \eta^i(c^i))\, r_i .$$

The value of the s_i function is the value for parishioner i's wealth that is used in calculating each parishioner's tax liability. It captures the role of challenges in determining whether parishioner j is audited (that is, whether *any* $c_{ij} = 1$) and, if he is, it indicates that he will be assessed either his actual wealth (as determined by the audit) or his original report, whichever is larger. (Not surprisingly, no parishioner reports $r_j > w_j$ in equilibrium.)

The formulation of T_i above has two features that are critical to the model. First, the total amount to be collected from the parish is guaranteed to be P, the quota that had been allocated to the parish by the city leaders. Second, if one's wealth assessment (their s_i value) rises, other things equal, one pays more tax, and if someone else's s_i rises, one pays less, other things equal. Any tax liability function with these properties will yield the results we lay out below. One could, for example, have the mechanism generate tax liabilities like those mentioned in the previous section; the poor paying a poll tax, middle income parishioner paying one rate on their w_i, and the rich paying a higher rate on their w_i. This more progressive system would have the poll taxes

collected from the poor subtracted from P, and the other parishioners' tax bills would be calculated as;

$$T_i = \frac{\theta(s_i)s_i()P^0}{\sum_{j\in N^0}\theta(s_j)s_j()},$$

where $\theta(s_i)$ = a ≤ 1 if $s_i < \bar{s}$ and $\theta(s_i) = b > 1$ if $s_i > \bar{s}$. Here, $\bar{s}$ is any chosen cutoff value, and the functions s_i remain defined as previously. P^0 is the quota that remains once the poll taxes paid by the poor have been subtracted from P, and N^0 is the set of non-poor taxpayers.

This formulation removes the poor from the challenge/audit aspect of the game, and so requires that the assessors are able to determine on their own whether a taxpayer who reports a r_i low enough to be classed as 'poor' is lying. The information on the assessors which we detailed in the previous section, coupled with the general difficulty of pretending to be very poor when one is not, suggests that this is not an unreasonable assumption.

We return to this alternative T_i tax mechanism later in the paper, but here we use the first, simpler formulation of T, and determine the properties of all Perfect Bayesian Equilibria[23] of the two-stage game just described, in which each player i's payoff as a function of the realizations $\boldsymbol{r}$ in Stage 1 and the realized Stage 2 challenges $\boldsymbol{C} = [\boldsymbol{c_{ij}}]$ is then:

$$V_i(r, C; w, P) = w_i - \frac{s_i(w_i, r_i, \eta^i(c^i))P}{\sum_j s_j(w_j, r_j, \eta^j(c^j))}.$$

In any system with the second of the two properties mentioned above, it is immediate that every parishioner has an incentive to reduce their tax burden, and that this in turn provides an incentive to under-report and choose a $r_i < w_i$. However, it also follows from the second property that parishioners have an incentive to challenge any under-reports by others that they know of.

[23] For a formal description of Perfect Bayesian Equilibrium, see Fudenberg and Tirole (1991), Section 8.2.

2. Equilibria of the game

A PBE of this game consists of:

1) A vector $\rho^e = (\rho_1,\rho_2,\ldots, \rho_n)$ of Stage 1 reporting distribution functions, where each $\rho_i(r_i|w_i)$ is a distribution function over $[a_i,b_i]$ for each realization of w_i.

2) A set of Bayes-Nash-Equilibrium Stage 2 challenge strategies for each possible $r \epsilon A \equiv \Pi^n_{i=1}[a_i,b_i]$, which we denote by $[\gamma_{ij}(r)]$. [24]

3) For each i, a set of beliefs, $\psi_{ij}(w_j|r_j)$, for each $j \varepsilon N$. This is a probability distribution over the value of parishioner j's actual wealth, for each possible report by j. If $i \in N_j$, then these beliefs attach probability 1 to the actual realization of w_j and if $i \notin N_j$, then $\psi_{ij}(w_j|r_j)$ is constructed from f_j and ρ_j using Bayes rule.

The strategies $[\gamma_{ij}(r)]$ in Stage 2 must therefore comprise a BNE for the given beliefs in 3), for any r.

This game, with the strategy spaces, payoffs, and sequence of moves described, will be referred to as the *basic tailles game.* This leads to our first result (all proofs are in the Appendix).

[24] We will assume that $\gamma_{ii}(r) = 0$, always. Although $\gamma_{ii}(r) > 0$ is possible in a PBE (if another parishioner is challenging i's report anyway, for instance), it never occurs when it can alter a payoff.

Proposition 1. *If the strategy profile $<\rho^e, \gamma_{ij}(r)>$ is part of a PBE of the basic tailles game, then:*

a) In Stage 2, parishioner i challenges j's report r_j with certainty ($\gamma_{ij}(r) =1$) if the probability that j is challenged by someone other than i is less than 1,

and either

i is in N_j, and $r_j<w_j$,

or

i is not in N_j, and i's beliefs attach positive probability to the event $r_j<w_j$.

Otherwise, $\gamma_{ij}(r)$ can take any value in [0,1].

b) Any profile $\{ \rho_i(w_{ij})\}$ of Stage 1 strategies such that the support of each $\rho_i(w_{ij})\}$ is a subset of $[a_i, w_i]$ can be part of a PBE.

Note that Part b) of the result implies that there are an infinity of possible PBE, including an infinite number in which there is Stage 1 under-reporting with positive probability – or even with probability 1. In any of these latter PBE, any parishioner *i* not in N_j believes that *j* might under-report, so a) implies that *some i* will certainly challenge r_j. Thus, part a) implies that any under-report is challenged with certainty, but the last sentence of part a) implies that a report can also be challenged when it is honest. Thus, there are an infinity of PBEs of the basic tailles game, which include challenges of honest reports, and individuals reporting almost anything in Stage 1.

To illustrate, we provide two examples of PBE of this basic *tailles* game.

Example 1:

In Stage 1, for every *i* and every w_i, the equilibrium $\rho_i(r_i|w_i)$ attaches probability 1 to $r_i = w_i$.

In Stage 2, if *i* is not in N_j , then $\gamma_{ij}(r)=0$ for all *r*. However, if *i* is in N_j, then

$$\gamma_{ij}(r) = \begin{Bmatrix} 1, \text{if } r_j < w_j \\ 0, \text{if } r_j \geq w_j \end{Bmatrix}$$

The beliefs for any set of realized reports when i is not in N_j, are such that i always believes $r_j=w_j$ for certain, while those in N_j of course know the true value of w_j . (Note that every r_j in $[a_j,b_j]$ occurs with positive probability in equilibrium.)

Thus, it is sequentially rational for an unknowing i to never challenge r_j. However, no j can increase its payoff by deviating from the above Stage 1 strategy by under-reporting in Stage 1, since all $k \epsilon N_j$ will challenge this with probability 1, so truthful reporting is an equilibrium strategy. This is an intuitively appealing PBE, in which knowledgeable parishioners are 'vigilant' about under-reporting, and the tax quota P is collected with no under-reporting, no challenges and no audits. However, behavior in this equilibrium is contrived, in that parishioners are in fact indifferent between reporting honestly and not, and uninformed parishioners are indifferent between challenging and not. The following PBE has a very different outcome.

Example 2: (For this example we assume that the set $N \backslash N_j$ is non-empty for each j, so there is someone who is ignorant of the realization of w_j for every j.)

In Stage 1 each $\rho_i(r_i|w_i)$ puts probability ½ on $r_i = w_i$, probability 0 on any $r_i > w_i$, and for all $r_i < w_i$, $\rho_i(r_i \mid w_i) = \dfrac{1}{2(w_i - a_i)}$.

The beliefs γ_{ij} for any i not knowledgeable about w_j are derived from this strategy using Bayes Rule, which means all such i attach positive probability to j under-reporting. In stage 2, $\gamma_{ij}(r) = 1$ for all r if $i \notin N_j$ and $\gamma_{ij}(r) = 0$ for all r if $i \in N_j$.

Here, parishioners report truthfully with probability 1/2, and randomize uniformly over $[a_i, w_i[$ with probability 1/2. A parishioner not in N_j then will have a strict incentive to challenge every r_j for certain if no one else does, since there is always a positive probability that j is under-reporting; in fact such parishioners always challenge with certainty in equilibrium. A parishioner in N_j will want to challenge r_j if they observe that $r_j < w_j$ and the probability someone else challenges j is less than 1, as stated in Proposition 1, but that probability will in fact always be 1 because of the challenge strategies of those not in N_j. Thus, it is sequentially rational for such an i to never challenge.

In this PBE, then, every parishioner under-reports with probability ½, but every report is challenged whether or not it is honest, and it is challenged by parishioners who don't know whether it is. Those who know that a report is false never challenge it. This guarantees that P is collected, but the authorities bear the cost of auditing every report, true or false. This equilibrium makes it hard to see how the *tailles* could be a low-cost method of taxation, as the data we present later suggests it was.

3. Lessons from modified games

Challenging the report of a parishioner j whose true w_j you don't know has no downside in this basic *tailles* game - even a parishioner who knows that a report is honest is indifferent about challenging it. Additionally, there is no downside to under-reporting, even if it will be challenged for certain, because a challenged under-report merely results in one paying the same tax one would pay by being truthful.

Two aspects of the basic tailles game are responsible for this multiplicity of equilibria, and the existence of costly and useless Stage 2 challenges, and these also appear to be at odds with the reality of the situation. First, there is no penalty incurred by a parishioner who is found after an audit to have under-reported his wealth, other than the upward revision of their tax liability. It seems improbable that parishioners were subject to no further sanction under these conditions, but it is the reason the Stage 1 PBE strategies can include under-reporting even though Proposition 1 implies that the continuation equilibria always include challenges of those under-reports. In addition, there is no sanction here against a parishioner who challenges a report by an honest parishioner, thereby inducing the authorities to undertake a costly and pointless audit. This is why parishioners are willing to challenge any report in a PBE (Proposition 1 doesn't require that $\gamma_{ij}(r)$ be zero in any continuation equilibrium).

We therefore develop a version of the game that takes account of these features by altering the payoffs to parishioners to be:

$$V_i(r,C;w,P) = w_i - \frac{s_i(w_i,r_i,\eta^i(c^i))P}{\sum_j s_j(w_j,r_j,\eta^j(c^j))} - \eta^i(c^i)h(w_i - r_i) - \sum_j c_{ij} f(w_j - r_j),$$

The functions *h* and *f* are designed to add the sanctions mentioned above to the game, and are defined as follows:

h(x)=0, if $x \leq 0$, and *h(x)=d >0*, if *x >0*.

and,

f(x)=0 if $x < 0$, and *f(x)=e >0*, if $x \geq 0$;

The function *h* inflicts a fixed cost of *d >0* on *i* only if his report is challenged and the resulting audit finds that he did under-report[25], while the function *f* inflicts a cost of *e>0* on *i* only if he challenges another parishioner's report and the ensuing audit reveals that the report was honest. The costs *d,e* can be financial, but they can just as well be thought of as (the monetary equivalent of) embarrassment, a flogging, or a loss of face. Most importantly, the amounts *d* and *e* can be arbitrarily small.

The game which results from altering the payoffs of parishioners as above will be referred to as the *full tailles game*, and we have the following result.

Proposition 2: *The (essentially) unique PBE of the full tailles game has the following strategy profile* $<\rho(r),[\gamma_{ij}(r)]>$*:*

a) in Stage 2, for any r, and any pair i,j, we have that:

if $i \in N_j$, $r_j < w_j$ *and the probability j is challenged by another parishioner is less than 1 then i challenges* r_j *for certain*

if $i \in N_j$, $r_j < w_j$ *and the probability j is challenged by another parishioner is 1,then i can challenger* r_j *with any probability, and*

otherwise, $\gamma_{ij}(r) = 0$.

[25] Accounts from Toulouse indicate that an under-reporter would have the amount under-reported confiscated entirely; this would be a case in which the penalty *h* would be an increasing function of the under-report.

b) in Stage 1, for all i and all realizations of w_i, $r_i = w_i$ with probability 1.

The beliefs that support this equilibrium are that any i not in N_j believes that w_j is certainly equal to j's observed r_j.

The 'essentially' in the Proposition arises from the fact that a) allows a parishioner who *knows* another parishioner is under-reporting to adopt any challenge probability if another parishioner's challenge probability is 1. Thus, if some N_j has two (or more) members, and j under-reports, one member of N_j will challenge with certainty in the equilibrium continuation, while the others may do anything. All PBE of this game have the same outcome. All parishioners report honestly, and in any Stage 2 continuation equilibrium, the probability an honest report is challenged is 0, while the probability an under-report is challenged is 1. The beliefs that support this have any parishioner $i \notin N_j$ believing with certainty after observing any r that there is a zero probability that $r_j < w_j$, which is consistent with Bayes Rule because the reporting strategies are truthful. The only mixed strategies that arise in Stage 2 of the PBE arise if parishioner i *observes* an under-report by parishioner j, but the Stage 2 strategies of $N\backslash\{i\}$ are such that j will certainly be challenged by another parishioner.

In equilibrium the amount P is collected from the parish, because the tax-liability function is designed to guarantee that, and parishioner i's tax payment is *as if* he is paying the proportion $P/\sum_j w_j$ of his wealth in taxes; this is the effective tax rate on parishioners. The most important feature of this unique PBE of the *full tailles* mechanism, however, is that P is collected without any challenges or audits.

This result then implies that with (minimal) sanctions on under-reporting and false challenges, the *tailles* mechanism allowed each parish (and/or Paris as a whole) to collect its fixed quota with minimal administrative machinery. The next result shows how important is the informational structure of this game; that is, the fact that knowledgeable parishioners can condition their challenges on the actual reports made by their fellows.

Suppose then that the *full tailles game* were instead played simultaneously. That is, each i chooses a strategy pair $\rho_i(r_i|w_i),\gamma_i$, so the challenge probabilities are not contingent on observed values of other parishioners' reports; payoffs are as in the full *tailles* game. Parishioner i's beliefs about whether parishioner j is under-reporting are derived from what i knows about w_j and j's equilibrium reporting strategy, ρ_j. What then are the Bayes Nash equilibria of this *simultaneous tailles game*? We don't present a full characterization of the equilibrium set, but the next Proposition provides its important features.

Proposition 3: *The simultaneous tailles game has no Bayes-Nash Equilibrium in pure strategies. In particular, in any BNE, parishioners under-report with positive probability, while honest reports are challenged with positive probability and under-reports are challenged with probability less than one.*

In this simultaneous-move game, equilibrium challenge strategies must be best-responses to the reporting strategies of other parishioners, but parishioners do not observe the *realized* reports of others before choosing their challenges. This means that knowledge that parishioners in a N_j have about w_j gives them much less of an advantage in challenging r_j. Parishioners necessarily randomize between truthful and untruthful reports in equilibrium, since the best reply to a strategy of being always truthful is to never challenge and the best reply to a strategy of always lying is to challenge with certainty; and this renders either of these reporting strategies sub-optimal. This means that parishioners must be indifferent in equilibrium over all the reports they make with positive probability, and that in turn means challenging strategies must be mixed, also. These types of equilibria are familiar from the literature analyzing single-individual tax evasion and compliance as a principal-agent problem.[26] The implication of this is that in any equilibrium there will, with positive probability, be audits (some of which reveal under-reporting, and some of which necessarily - and wastefully - do not). It implies also that there will be unchallenged under-reporting of with positive probability. Although the equilibrium of this simultaneous-move version of the *taille* does again imply the required P is collected, the authorities would have to incur the costs of these audits. Further, it seems likely that the system would be seen as less legitimate, as some parishioners would be known, ex-post, to have gotten

[26] See, for example Reinganum and Wilde (1985, 1986)

away with under-reporting their wealth, while some others who had reported truthfully would find themselves nonetheless challenged and audited.

Proposition 3 makes it clear that the informational innovation in the *tailles* system – giving parishioners information about their fellow parishioners' reports and the opportunity to challenge them – was important in allowing the city leaders to collect the required amounts without endless challenges and audits.

More surprisingly, however, it is also true that even with this informational innovation, this tax collection could not be accomplished without unneeded audits in the absence of the other key feature of the *tailles* – the collection of a fixed amount of revenue. To demonstrate this, we compare the *tailles* to a system which is more akin to modern taxation systems, and does not have this property. Suppose then that after concluding negotiations with the Crown, the city leaders assessed a proportional tax on each citizen at some pre-determined rate, τ. (This rate could even vary across parishes.) A Parisian's tax burden would then be τw_i in principle, and the task at hand becomes that faced by the tax-collection arm of any modern state: to apply a given tax system to the reported tax base, and to deter individual under-reporting of that tax base.

That this renders total tax receipts uncertain is clear, but our point here is that it also impairs the ability of the authorities to collect those taxes without audits.

Thus, in what we will call the *basic tau game* the payoffs of the parishioners are:

$$V_i^{\tau}(r, C, w, \tau) = w_i - \tau s_i(w_i, r_i, \eta^i(c^i))$$

with $s_i()$ and $\eta_i()$ defined as before. Assume that parishioners choose their reports and their challenges in Stages 1 and 2, respectively, just as in the *tailles games*, and the informational and other assumptions are also the same. It is immediate that *any* challenge strategies can be part of any continuation equilibrium, because a challenge of r_j by i has no impact on i's payoff. Given that, the equilibrium reporting strategies of parishioners are determined solely by which strategies, if any, result in challenges. In particular, the strategy profile;

Each $\rho_i(r_i|w_i)$ attaches all probability mass to a_i in Stage 1, and
in Stage 2, $\gamma_{ij}(r) = 0$ for all r and for all i,j

is a PBE. (Stage 2 beliefs in the zero-probability event that some $r_j > a_j$ can be anything, since those beliefs don't alter the fact that there is no incentive to challenge any report.)

Further, if we add the same penalties for under-reporting and false challenges as we did to the basic *tailles* game, which alters the payoffs in this *full tau game* to

$$V_i(r, C; w, \tau) = w_i - \varpi_i(w_i, r_i, \eta^i(c^i)) - \eta^i(c^i)h(w_i - r_i) - \sum_j c_{ij} f(w_j - r_j),$$

then this same strategy profile is still a PBE, and results in the absolute minimum tax revenue being collected; $T = \tau \sum_i a_i$. This is because even with the sanctions for under-reporting and useless challenges, there is still no positive incentive for any parishioner to challenge a known under-report.

Again, it is clear that one advantage of the *tailles* system was that it removed uncertainty from the level of revenues collected by the city, but the agreement on a fixed sum also played a key role in providing the individual taxpayer incentives that allowed the system to work without the need for extensive auditing of their reports. This point can be pushed further. It is possible to further augment this full *tau* game so that it has a unique PBE which collects the amount $\tau \sum_i w_i$ from parishioners without audits. One such augmented game gives parishioners the payoffs

$$V_i^{\tau}(r, C; w, \tau) = w_i - \varpi_i(r_i, w_i, \eta_i(c^i)) - \eta_i(c^i)\sigma \max\{0, w_i - r_i\} + \sum_j c_{ij}\left[[\sigma - \tau]\frac{\max\{0, w_j - r_j\}}{K(c^j)} + f(w_j - r_j)\right]$$

Here $f()$ is as defined before and $\sigma > \tau$ is a 'penalty tax rate' paid on any under-reported earnings that are detected by an audit. These extra taxes of $(\sigma - \tau)(w_i - r_i)$ are not collected simply as a deterrent[27]; they are divided up among all the parishioners who challenged i's under-report, to

[27] This is the role they serve in the seminal Allingham and Sandmo(1972) model, as well as in modern income tax systems.

give them an incentive to challenge an under-reporter. In the last term of this payoff function, $K(c^j)$ is the number of i for which $c_{ij} = 1$, so the first term in the bracket [] is the monetary 'reward' given to any parishioner who challenges an actual under-report. This tax-penalty system – or something like it – is necessary to provide an incentive to challenge false reports that is already built into the *tailles* mechanism. It can then be shown that the *augmented tau game* with these parishioner payoff functions also has an essentially unique PBE with the same strategies as in the unique PBE of the *full tailles game*.

However, note that if this augmented *tau* mechanism is to be credible to taxpayers, it requires the city leaders to put in place the administrative capability to collect the penalty taxes and distribute them to challengers, *in addition* to the capability to conduct audits of challenged parishioners. Finally, note that a challenger of an under-reporter here can be seen by his fellow citizens to be acting only in his own interests, whereas a challenger in the full *tailles* game is acting to reduce the tax liability of all his fellow parishioners, other than the under-reporter. To the extent that there is a social stigma attached to 'informing on' a fellow citizen, we would argue that the latter mechanism would serve to minimize it.

V. Further considerations

We have argued that the *tailles* taxation mechanism used in Paris from 1292 to 1313 had distinct advantages for both the crown and the city. It eliminated uncertainty in tax revenues for the crown, and avoided arousing civil unrest, which would surely have been desirable for both the crown and the city leaders. Administrative and enforcement costs for the crown were clearly negligible, due to the devolution of these tasks to the city, and the theoretical results of the previous section indicate that its built-in incentives allowed the city to minimize its costs, also. In this section we analyze additional issues raised by the theoretical results above.

Intimidation and collusion

The result in Proposition 2 comes from a model in which parishioners are assumed to behave non-cooperatively, and the only strategies available are reporting and challenging. In particular, there is no consideration of the possibility that the tax collector might, by virtue of his position,

intimidate any parishioners who know his true w_i into not challenging him. More generally, this assumes there are no `bullies' – parishioners who can intimidate their fellow parishioners into not challenging their reports. That this was in fact the case in medieval Paris is certainly made more likely by the fact that the nobility and the clergy – the two groups whose members would surely find it easiest to intimidate potential challengers – were exempt from paying the *tailles*. As to tax assessors and collectors under-reporting themselves and employing intimidation to deter challenges, we cannot definitively rule this out. However, recall that the lower tier of assessors/collectors were residents of the parishes in which they worked, making both lying and intimidation difficult. Recall also that, as shown in Table 4, the upper tier of assessors came from the wealthiest groups, which is also the class from which the city governors were drawn. The city was governed by a mayor (the *prevot de marchands*) who was appointed by the king from the merchants' corporation that received the privilege of governing the city. He was aided by only 4 officials – the *echevins* – also drawn from the city's economic elite.[28] Information from the tax rolls shows that the *echevins* and their families were drawn from the top 5% of the tax payment distribution.

Recall that any taxpayer *j*'s tax liability T_i in the full *tailles* system is decreasing in the assessment (i.e., in the s_i) of any other taxpayer. Also, however, the size of the impact on j's tax liability of a change in s_i is increasing in s_j. That is, the negative derivative $\partial T_j/\partial s_i$ becomes more negative as s_j increases. Thus, being among the highest taxed, the governors and high-level assessors had the greatest stake in the functioning of the mechanism and in particular, the pursuit of wealthy tax evaders. Further, the city governors served short terms and rotated frequently, and we have cited data from Bove (2004) that indicates their assessments didn't fall when they took office.

This doesn't rule out the possibility of a collusive arrangement among the highest-taxed citizens designed to lower their payments. That is, the model doesn't encompass the possibility of a group of wealthy citizens (or any other group) agreeing to mutually under-report and to not challenge one another. Notice, however, that this can work only if the group that undertakes it is 'informationally self-contained'; the group must be sure that there is no one outside the group

[28] Bove (2004) pp. 55-70.

that has information about one of them that would allow for a challenge. Such an outsider challenge of even one group member's false report could bring down the entire group, as the challenged member would then lose his incentive to stick to the agreement.

Administrative costs

Our argument that the *tailles* collected the agreed-upon revenues at low cost has so far been based on the model's result that the threat of challenges and audits and (small) sanctions was enough to eliminate the need to act on those threats. In addition, we have data that suggests the costs were quite low. For the *taille* of 1313 we have a detailed list of the direct costs of collecting the *taille*. The person in charge of the collection was Jehan de Montreuil, one of the assessors elected by the city government, who received 10 *livres* for his efforts[29]. Other expenses included supplies, such as paper, parchment, binding of the books etc., totalling 33 *livres*. Salaries of clerks and sergeants totaled 120 *livres*. Most clerks and sergeants were employed for 170 to 177 days. Interestingly, 40 *livres* were deducted against an expenditure associated with sending the *prevot* and other *prud'hommes* to the *Parlement* at *Pontoise* to bargain with the king. The total expenditure was about 200 *livres* which represented about 1.5% of the amount collected. As a comparison, the US IRS estimates administrative costs on all the taxes it administers at 0.6% of taxes collected, in an environment in which there is substantial legally mandated information reporting by taxpayers and by third parties (e.g., employers and financial institutions).[30] Moreover, according to a report done by the OECD (2004), administrative costs as a percentage of net revenues collected for OECD countries in 2002 ranged from a low of 0.42% for Sweden to a high of 1.76% for the Netherlands. This makes the achievement by the Parisian authorities look pretty impressive.

That recorded direct administrative costs were low does not imply that there were no challenges and re-assessments, as the model predicts. The absence of any disputes in the historical record

[29] It is clear that the task of assessment was not considered a full time job, as the compensation for the assessor (10 *livres*) was lower than that of the sergeants or clerks that worked full time during the collection of the tax and received between 15 to 17 *livres*. Other than the head assessor, other assessors were not paid.
[30] Slemrod (1996) estimated the cost of compliance incurred by taxpayers in the US to be 10% of taxes paid.

cannot prove definitively that none occurred, but we do have some indirect evidence that the city government did not deal with many cases that required (costly) legal procedures.

The city government had legal jurisdiction over matters related to the city governance. The municipal court – the *parloir* – was convened to settle legal disputes related to the privileges of the city. Le Roux and Victor (1846) transcribed the *livre de parloir*, that includes legal disputes and testimonies before the municipal court. While historians agree that the full document did not survive the ages (Bove, 2004), the coverage for the years 1285 to 1320 seems to be more complete than for other periods. We searched the court records for any dispute related to the collection of the *taille*, and could find only one case, related to the *taille* of 1308 raised to pay the traditional tribute to the king on the occasion of the marriage of his daughter Isabel. This suggests that legal disputes arising from the administration of the *taille* were rare.

The court case involved a *lombard* (Italian banker or moneylender) by the name of Raimbaut (Romband) who apparently refused to pay his assessment for 1308. The court ruled that since he enjoyed the privileges of a burgher in the past he should pay the tax assessed on him. This ruling was probably not an outcome of a typical attempt to evade taxation. Italian moneylenders enjoyed a royal privilege of money lending (practicing usury). In 1282 the French king declared that the Italians will contribute to the city taxes. Since then, the *lombards*, as they were called, participated in the *taille*, without enjoying the privileges of citizenship. They appear in separate lists in the tax rolls of 1292 to 1300, but these special list no longer existed in the tax roll from 1313 we analyzed. Apparently, sometime after 1300 the king revoked the royal decree of 1282 and the Italians were taxed directly by the crown rather than by the city.

Our friend Raimbaut was one of a relatively small number of Italians that were citizens and were included in the regular tax units.[31] From the tax rolls we found that he paid 75 soldi in each of the tax years 1298, 9 and 1300 and lived in the second ward of St Huitace. It seems that when the king decided to change the tax status of the Italian aliens and they were no longer taxed by the city, Raimbaut thought it advantageous to try and change his tax status from a citizen to an alien and thus evade taxation. However, the fact he was a citizen made it possible for the city court to try him and force him to pay. In their sentence, they reminded Raimbaut that he enjoyed

[31] In 1300 there were only 25 Italians recorded as regular citizens versus 127 Aliens.

the privileges of a burgher in an extraordinary way – since usury was forbidden for subjects of the crown and burghers of the cities.[32] Therefore, he could not now behave opportunistically and opt out of his tax obligation.

This court case, the only one found in the years 1292-1313, suggests that evasion by citizens of the city was probably very low, if not inexistent. There was limited scope for changing tax status after becoming a citizen. Indeed, only a foreigner, an Italian moneylender, who potentially had an outside option of joining his alien compatriots, was trying to evade his tax assessment. At the same time it is worthwhile to note that Raimbaut's tax assessment put him in the top 5% of tax taxpayers – exactly the sort of wealthy taxpayer that our analysis suggests will be challenged by his neighbors.

Civil unrest and progressivity

We noted above the claim that the tailles system was adopted partly to avoid the civil unrest that was sometimes sparked by other means of taxation in medieval and early modern Europe, and that the regressivity of other, indirect taxes was a trigger for such unrest. The mechanism analyzed in detail in Section IV results in proportional taxation, but we also described a variation of it which would work the same and result in a progressive 'tax bracket' structure. So was the actual *tailles* progressive, or at least, not regressive?

Wolfe (1972) highlights the principle that in taxes based on repartition, such as the *tailles,* "Le fort portent le faible." – the wealthy should carry the poor. While information on income or wealth is not included in the tax rolls we have, the information on tax payments suggests that this principle operated. Table 5 shows the share of tax revenues contributed by the economic elites. It is clear that the principle was not an empty one. The top percentile of taxpayers (taxpayers here being ranked by the size of their tax payments) paid between 20 and 30 percent of the tax obligations of the city and the top decile accounted for between 60 to 75 percent of the tax.

[32] The text reads: pronunciatum fuit contra ipsum quod ipse talliam a civibus parisiensibus sibi impositam a tempore quo fuit adeptus privilegium burgensium parisiensium solvet tanquam burgense parisiense. Et nichilominus solvet terminis assignatis financiam quam fecit antequam factus fuisset burgensem cum gentibus nostris, quia contra prohibitionem domini regis mutuaverat sub usuris sub regno. Le Roux and Victor (1846) p. 171.

Without information on wealth and income, we cannot say how progressive this is, but if having the highest-taxed citizens carry most of the burden of a tax prevents civil unrest, it is clear the *tailles* accomplished this.

Indirect evidence of success

There is other evidence that the use of taxes based on repartition was regarded as a success, and the most convincing is the fact that it was used often. As mentioned in Section III, variations of the Parisian *tailles* system were used throughout France in the years leading up to the period we study, and continued to be used into the 16th century. Beyond that, in England the Lay Subsidies imposed by the crown were converted from the standard tax rates system to a *taille*-like mechanism in 1334[33] - this importation from France seems a particularly sincere form of flattery of the *tailles*.

VI. Conclusions

In this paper we documented and analyzed the *taille* - a mechanism for collecting taxes in medieval Paris. Our analysis demonstrated that this tax system was remarkably successful, and that its success derived from the fact that it was based on two critical principles: a) partition of a fixed tax liability among taxpayers and b) a process that revealed each taxpayer's claimed tax liability to their neighbors. This resulted in a tax collection game in which taxpayers have an incentive to challenge false claims by others, which in turn induces truthful reporting, resulting in an efficient tax assessment and collection procedure. We provide evidence from the Parisian *tailles* levied between 1292 and 1313 and other historical records that indicates that these royal taxes were collected from the Free City of Paris at a remarkably low cost, without violence and with limited recourse to legal action against tax evaders.

Research into why tax mechanisms like the *taille* that were efficient and used successfully for centuries virtually disappeared is beyond the scope of this paper. However, there is some contemporary evidence that suggests that one feature of the *taille* retains some currency. Lenter, Shackelford and Slemrod (2003) note that the confidentiality of tax return information has not always been a feature of the US tax system, and that there are a variety of developed countries

[33] Glascock (1975).

(including Norway and Sweden) in which tax returns are currently, to a large extent, publicly available. It has been claimed by a variety of commentators[34] that such public disclosure will improve compliance. However, it appears that the basis for this claim about compliance lies in a belief that publication will make both individuals and corporations less likely to engage in tax avoidance, presumably because knowledge of such behavior will result in the disapproval of fellow taxpayers and – for corporations - potential customers.

Whatever the merits of such arguments in favor of disclosure, they are quite different from what we have argued made the Parisian *tailles* so effective, which was the deterrence of misrepresentation due to a fear of challenges by fellow taxpayers. We noted in the Introduction that contemporary tax authorities do attempt to encourage taxpayers to report on those they believe to be evading taxes, but we know of no data that documents the frequency with which this actually occurs or how effective it is in terms of generating additional tax revenues (and not generating false challenges.) In any case, our analysis of the *tailles* mechanism implies that two elements are key if public disclosure is to deter misrepresentation. First, the tax must be designed to collect a specified sum (or, as in our augmented tau game, the tax authority must put in place the machinery to reward appropriate challengers), and second, it must be that *some* other taxpayer is in a position to use their own knowledge of their neighbor's business along with their disclosed tax liability to make a challenge. However, in a modern economy the widespread adoption of mandatory third-party reporting has made it much more likely that the tax authority knows more about any single taxpayer's income and wealth then do any of the taxpayer's fellows. That being said, for specific taxes levied on small groups of mutually knowledgeable payers, the *tailles* still has something to recommend it, and there is evidence that US legislators agree.

The Obama administration's health care reform bill (H.R. 3590) employs one revenue raising mechanism that is precisely that of the Parisian *tailles*. That bill imposes a fixed annual tax on US pharmaceutical companies that is calculated in much the same way as was the *tailles*. [35]

[34] Lenter, et al (2003) provide many examples of this claim being made.
[35] The Patient Protection and Affordable Care Act (H.R 3590); Title IX- Revenue Provisions of the bill SEC. 9008. IMPOSITION OF ANNUAL FEE ON BRANDED PRESCRIPTION PHARMACEUTICAL MANUFACTURERS AND IMPORTERS.
http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_bills&docid=f:h3590enr.txt.pdf

These companies are collectively liable for a fixed tax of $2.3 Billion per year, with each year's total payment divided among the firms on the basis of their sales for the year. Similar taxes are imposed on medical device manufacturers ($2 Billion in total) and health insurance providers ($6.7 Billion), and the portion each company pays is calculated similarly. This is a situation in which the information structure we showed to be important for the *tailles* is clearly present; each of these firms has an incentive to understate its sales in order to reduce its share of the total tax liability, and each firm has a clear incentive to challenge any under-reporting of those figures by its rivals. Small amounts of universal under-reporting by all firms in the group has no impact on anyone's tax liability due to the fixed sum being collected, and it seems very likely that these firms know enough about their rivals that any serious under-report by any firm would be detected and challenged by the others.

VIIa. Data Sources:

Geraud Hercule, (1837), *Paris Sous Philippe le Bel*, Paris.

Michaelsson Karl, (1951), *Le Livre de la Taille de Paris l'an 1313*, Goteborg

Michaelsson Karl, (1958), *Le Livre de la Taille de Paris l'an 1296*, Goteborg

Michaelsson Karl, (1962), *Le Livre de la Taille de Paris l'an 1297*, Goteborg

A.N. KK 283 (tax rolls for 1298,9,1300)

VIIb. References

Allingham, M.G. and A. Sandmo, (1972), "Income tax evasion: A theoretical analysis", *Journal of Public Economics,"* 1, pp. 323-338.

Bandyopadhyay, S. and K. Chatterjee (2010), "Crime Reporting: Profiling and Neighbourhood Observation," *The B.E. Journal of Theoretical Economics*:10: no. 1 (Advances).

Baumol, W. J., (1971), "Economics of Athenian Drama: Its Relevance for the Arts in a Small City Today", *The Quarterly Journal of Economics*, Vol. 85, No. 3, pp. 365-376

Besley, T. and S. Coate, (1995), "Group lending, repayment incentives and social collateral", *The Journal of Development Economics*, 46, pp. 1-18

Biraben, Jean-Noël, (1964), La Population de Toulouse au XIVe et au XVe siècles, *Journal des Savants*, Volume 4, Numéro 1 pp. 284 - 300

Bourlet, Caroline, (1992), "L'anthroponomie a Paris a la fin dun XIIIeme siècle d;après les rôles de la taille de la règne de Philippe le Bel," In Bourin Monique and Pascal Chareille, eds. *Genèse Médiévale de l'anthroponomie moderne II/2: persistances du nom unique. Désignation et anthroponomie des femmes. Méthodes statistiques pour l'anthroponomie. Etudes d'anthroponomie médiévale, IIIe et Ive rencontres, Azay-le-Ferron, 1989-1990*.

Boutaric, Edgard, (1861) *La France sous Philippe le Bel*. 1861 . reprint by Slatkine Megariotis reprints Geneve, 1975.

Bove, Boris , (2004), *Dominer la ville*, Paris, éd. du CTHS.

Cazelles, Raymond , (1994) *Nouvelle histoire des Paris*, Hachette.

Challet, Frédéric, la taille et les consuls à Saint-Vert, http://saint.vert.free.fr/taille.html

Chander, P., and L. L. Wilde, (1988), "A General Characterization of Optimal Income Tax Enforcement", *Review of Economic Studies* 65, pp. 165-183.

Cohn, Samuel K, (2006), *Lust for Liberty: The Politics of Social Revolt in Medieval Europe, 1200–1425*, Harvard.

DeLong, J Bradford, and Andrei Shleifer, (1993) "Princes and Merchants: European City Growth before the Industrial Revolution," *Journal of Law and Economics* 36 no. 2, pp. 671–702.

Denisart, Jean-Baptiste, (1771, *Collection de décisions nouvelles et de notions relatives à la jurisprudence actuelle*. Vol 1. Paris

Descimon, Robert (1989). "Paris on the Eve of Saint Bartholomew [1571]: Taxation, Privilege, and Social Geography," in Philip Benedict, ed., *Cities and Social Change in Early Modern France*, pp. 69-104.

Desportes Pierre, (1977), *Reims et le remois aux XIIeme et XIV siecles*, Thesis, Universty of Lille, two volumes.

Dubois Henry, (1984) Population et fiscalité en Bourgogne à la fin du Moyen Âge. In: *Comptes-rendus des séances del'année... - Académie des inscriptions et belles-lettres*, 128e année, N. 4, pp. pp. 540-555.

Duby, Georges, (1980), *Histoire del France Urbaine*, vol. 2.

Farr, James R. (1989). "Consumers, Commerce and the Craftsman of Dijon: The Changing Social and Economic Structure of a Provincial Capital, 1450-1750," in Philip Benedict, ed., *Cities and Social Change in Early Modern France*, pp. 134-173.

Favier Jean, (1970), *Les contribuables Parisiens a la fin de la guerre de cent ans*, Paris

Fehr, E. and S. Gachter, (2000), "Cooperation and Punishment in Public Goods Experiments", The *American Economic Review*, 90(4), pp. 980-994.

Flickinger, R. C., (1918), *The Greek Theater and Its Drama,* Chicago: University of Chicago Press.

Follain, Antoine and Gilbert Larguier (2000), "La taille se ses équivalents de la fin du moyen âge au XVII siècle: Programme de recherche. " *Études et documents XII -CHEFF – 2000*, pp. 379-99.

Fossier, Lucie., (1988), "l'artisanat parisien a la fin du XIIIe d'après les rôles de taille" Critique d'une source, " *Mélange de l'Ecole Française de Rome, Moyen Age -temps modernes* 100 :1 pp. 125-135.

Fudenberg, D. and J. Tirole, (1991) *Game Theory*, The MIT Press, Cambridge, Mass.

Glasscock, Robin E, (1975), *The Lay Subsidy of 1334,* Oxford University Press, British Academy Records of Social and Economic History II.

Herlihy, David and Christiane Klapisch-Zuber, (1978), *Les Toscans et leur familles*, Paris.

Herlihy David, (1995), *Women, Family, and Society in Medieval Europe : Historical Essays, 1978-1991*, Providence, R.I. : Berghahn Books.

Knez, M., (2001), "Firm-Wide Incentives and Mutual Monitoring at Continental Airlines" *Journal of Labor Economics*, vol. 19, no. 4

Le Roux, De Lincy and Antoine-Jean Victor, (1846), "Livre de Sentences du Parloir aux Bourgeois," in *L'Histoire de l'hôtel de ville de Paris*. Vol 1 and Vol 2 Appendix 2, pp. 99-176.

Lemarchand, Guy, (2008), "Antoine Follain, Gilbert Larguier (dir.), L'impôt des campagnes, fragile fondement de l'État dit moderne. XVe- XVIIIe siècle. " *Annales historiques de la révolution française* no. 352. pp.2-4.

Lenter, D, D. Shackelford and J. Slemrod (2003), "Public Disclosure of Corporate Tax Return Information: Accounting, Economics, and Legal Perspectives", *National Tax Journal,* 56(4), pp. 803-830.

Luchaire, Achille, (1892), *Manuel des institutions Francaises periode des Captiens direct*. reprinted 1979 by Megariotis reprints Geneve

Luchaire, Achille, (1911), *Le communes francaises a l'epoque des captien directs* (reprinted 1977)introduction par Louis Halphen Slatkine Megariotis reprints Geneve.

Ma, C-T. (1988) "Unique Implementation of Incentive Contracts with Many Agents". *Review of Economic Studies* vol. LV, pp. 555-572

Moore, J. and R. Repullo, (1988), “Subgame Perfect Implementation”, *Econometrica*, Vol. 56, No. 5, pp. pp. 1191-1220.

Myles, G.D., and R. A. Naylor, (1996), “ A model of tax evasion with group conformity and social customs”, *European Journal of Political Economy*, vol. 12, pp. 49-66.

OECD Committee on Fiscal Affairs, (2004) *Tax Administration in OECD Countries: Comparative Information Series*, Organization for Economic Cooperation and Development.

Philippe de Beaumanoir - Salmon, Am. (éd.). *Coutumes de Beauv*aisis. Paris, 1899

Reinganum, J.R. and L.L. Wilde, (1985), “Income tax compliance in a principal-agent framework”, *Journal of Public Economics* vol. 26, pp. 1-18.

Reinganum, J.R. and L.L. Wilde, (1986), “Equilibrium verification and reporting policies in a model of tax compliance”, *International Economic Review* 27, pp. 739-760.

Rigaudière, Albert , (1982) Saint-Flour, ville d'Auvergne au Bas Moyen Âge , Universite de Rouen, pp. 170-172.

Rigaudière, Albert, (1989), « Connaissance, composition et estimation du moble à travers quelques livres d'estimes du Midi français (XIVe -XVe siècles) ». In: *Les cadastres anciens des villes et leur traitement par l'informatique. Actes de la table ronde organisée par le Centre d'histoire urbaine de l'École normale supérieure de Saint-Cloud avec la collaboration de l'École française de Rome et du Centre national de la recherche scientifique (Saint-Cloud, 31 janvier - 2 février 1985).* Rome : École Française de Rome, pp. 41-8.

Rigaudiere, Albert, (2002), "Les origines médiévales de l'impôt sur la fortune. In I' impôt au Moyen Age L'impôt public et le prélèvement seigneurial fin XIIe – début XVI siècle Le droit d'imposer", *Colloque tenu a Bercy le 14, 15, 16 Juin 2000*. Comite pour l'histoire économique et financière de la France Paris. Vol 1. pp. 227-287.

Slemrod, J. (1996), "Which is the simplest tax system of them all?" in: Henry Aaron and William Gale, eds., *Economic Effects of Fundamental Tax Reform* (The Brookings Institution, Washington, D.C.)

Slemrod, J, (2007), "Cheating Ourselves: The Economics of Tax Evasion", *Journal of Economic Perspectives*, 21(1), Winter, pp. 25–48

Slemrod, J, and S. Yitzhaki, (2002), "Tax Avoidance, Evasion and Administration", Chapter 22 of *The Handbook of Public Economics*, Volume 3, North Holland, New York, NY.

Wolfe, Martin, (1972), *The Fiscal System of Renaissance France*, Yale University Press, New Haven

Wolff, Phillipe, (1956) *Les Estimes Toulousaines des XIV et XV Siècles*, CNRS, Toulouse

A.1 – Tables

Table 1

Number of tax payers in Parisian tax rolls

Year	Number of taxpayers
1292	14566
1296	5703
1297	9930
1300	10656
1313	6352
Total	36551

Table 2
Professions of Assessors compared with professions in tax roll

	Data from tax roll		Data from Assessor list	
profession	**Average tax**	**Taxpayers**	**Average tax**	**Assessors**
changer	6.11	37	8	6
draper	5.49	94	11	6
spice merchant	3.31	79	4	2
firewood merchant	3.22	53		
tanner	3.00	31	1	1
wholeseller	2.29	159	6	4
saddler	1.99	67	4	1
hotelier	1.80	111	1	1
butcher	1.46	79	4	5
tavernier	1.30	678	2	1
goldsmith	1.27	271	7	3
Merchant	1.12	24	6	7
Grain merchant	1.06	18	3	1
boot maker	1.00	53		
baker	1.00	144	4	4
fishmonger	0.92	102	7	2
seaman	0.85	49		
harness maker	0.82	51		
Sargent	0.62	237		
used clothes merchant	0.60	191	1	4
weaver	0.60	368	2	5
candle maker	0.60	71		
skinner	0.59	368	9	2
agent	0.56	65		
crate maker	0.56	56	1	1
belt maker	0.53	161	2	2
tailor	0.51	157		
barber	0.44	121		
barrel maker	0.44	96		
pastry maker	0.44	58		
buckle maker	0.44	77	2	2
shoe maker	0.43	284	1	3
carpenter	0.38	116		
builder	0.36	138		
fuller	0.34	85		
oven guard	0.34	83		
wine merchant	0.27	81		
food merchant	0.27	267		
porter	0.26	119		
longshoremen	0.24	59		
footwear	0.18	179		
tailor women's clothes	0.17	149		

Table 3
Years of known economic activity of tax assessors

Years Active	Assessors
1292	1
1292-7	1
1292-9	1
1292-00	31
1292-13	8
1296-00	7
1296-13	7
1297-00	1
1298-00	1
1300	2
1308-13	1
1313	3
?	2
Total	66

Table 4
Rank of assessors in the tax distribution

Rank in tax distribution	Assessors
0.5%	3
1.0%	6
5.0%	27
10.0%	8
20.0%	15
30.0%	1

Table 5
Share of the elites in the taxes collected

Rank in tax distribution	Assessors
0.5%	3
1.0%	6
5.0%	27
10.0%	8
20.0%	15
30.0%	1
?	6

A-2: Proofs of Propositions 1 - 3

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At Stage II of the game, after observing the set $r = (r_i)_{i=1}^n$ of realized Stage I reports, each parishioner i chooses a vector $(\gamma_{ij}) \in [0,1]^n$ of probabilities of challenging each other parishioner, with $\gamma_{ii} = 0$ always. The Stage I reports determine the node of the game at Stage II, and, coupled with the priors f_i, the Stage 1 strategies $\rho_i(r|w_i)$ determine each parishioner's beliefs about the realized wealth of parishioners whose w_j they don't observe, denoted as $\psi_{ij}(w_j|r_j, \rho_j)$.

The payoff function for parishioner i in the basic tailles game is:

$$V_i^T = w_i - \frac{s_i\left(r_i, w_i, \eta^i[c^i]\right) P}{\sum_{j\in N} s_j\left(r_j, w_j, \eta^j\left[c^j\right]\right)}$$

with

$$s_i\left(r_i, w_i, \eta^i\left[c^i\right]\right) = \left[1 - \eta^i[c^i]\right] r_i + \eta^i[c^i] \max\{r_i, w_i\}$$

where $\eta^i\left[c^i\right] = \max\left\{c_{ji} | j \neq i\right\}$.

It is clear then that the value of V_i^T is increasing in the value of any s_j for $j \neq i$ and decreasing in the value of s_i.

Given any Stage 2 strategy profile γ, let $\mu_{i-j}(\gamma)$ be the probability that some parishioner other than i is challenging j's report. Note that this is between 0 and 1, but is 1 only if *at least one* other parishioner is challenging r_j with probability 1, and is 0 only if *all* other parishioners are challenging r_j with probability 0.

Proof of Proposition 1:

i) Given the Stage 1 strategies (ρ_j) of a PBE, suppose that realizations r in the supports of these strategies have been observed, and let $\gamma'(r)$ be the Bayes-Nash equilibrium strategies in Stage 2 of the game following these realizations, with parishioner i's beliefs about w_j being given by $\psi_{ij}(w_j|r_j, \rho_j)$.

Let $i \notin N_j$, so that i has not observed r_j, and has beliefs $\psi_{ij}(w_j|r_j, \rho_j)$ regarding the value of w_j, and attaches probability $\phi_{ij}(r_j, \rho_j)$ to the event $r_j < w_j$. Then i's choice of γ_{ij} can have an impact on his expected payoff only through the value of s_j, which, if $\phi_{ij}(r_j, \rho_j) > 0$ and $\mu_{i-j}(\gamma') < 1$ is increasing in γ_{ij},so it must be that $\gamma'_{ij}(r) = 1$. However, if either of these conditions is not satisfied, that is, if either $\phi_{ij}(r_j, \rho_j) = 0$ or $\mu_{i-j}(\gamma') = 1$, then i's expected payoff in period 2 is does not vary with γ_{ij}, because $s_j() = w_j$ with certainty.

If $i \in N_j$ then i's expected payoff is increasing in γ_{ij} if $r_i < w_i$ **and** $\mu_{i-j}(\gamma') < 1$, so that it must be that $\gamma'_{ij}(r) = 1$. Otherwise, if $\mu_{i-j}(\gamma) = 1$ or $r_j = w_j$, then i's expected payoff is again independent of γ_{ij}.

This proves i) of the theorem.

ii) A ρ_i which attaches a positive probability to any $r_i > w_i$ is dominated by reporting $r_i = w_i$ with probability 1, because if the realization of $\rho_i > w_i$ it follows from the definition of s_i that $s_i() = r_i$ with probability 1 in any Bayes-Nash equilibrium in Stage 2, so this will not be true of any ρ_i in a PBE, thus implying that the support of each ρ_i will be a subset of $[a_i, w_i]$. Given this fact, then i), of the Proposition and the assumption that $N_j \backslash \{j\} \neq \phi$, implies that the payoff to i from any ρ_i with that support is the same, since i) implies that any report $r_i < w_i$ is challenged with probability 1, and so yields the same payoff as reporting $r_i = w_i$. Thus, any $\rho_i()$ with such a support can be part of a PBE.

■

Proof of Proposition 2:

The payoff to a parishioner in the full tailles game is:

$$V_i^T = w_i - \frac{s_i\left(r_i, w_i, \eta^i[c^i]\right) P}{\sum_{j \in N} s_j\left(r_j, w_j, \eta^j\left[c^j\right]\right)} - h(w_i - r_i)\eta^i[c^i] - \sum_{j \neq i} c_{ij} f(w_j - r_j)$$

with h and f as defined in the text.

Consider first the Stage 2 Bayes-Nash challenge strategy $\gamma_{ij}(r)$ of some $i \in N_j$, following the realization r of Stage 1 strategies $[\rho_k(r_k|w_k)]$. It must be of the following form:

$$\gamma_{ij}(r) = \begin{cases} 1, \text{ if } r_j < w_j \text{ and } \mu_{j-i}(\gamma) < 1 \\ 0, \text{ if } r_j = w_j \\ \text{any } \gamma_{ij} \in [0,1], \text{ otherwise} \end{cases}$$

The first requirement follows from that fact that i's expected payoff is increasing in γ_{ij} if he knows $r_j < w_j$ and there is any chance j will not be challenged. The second requirement follows from that fact that challenging under these circumstances does not change i's tax liability but will cost him the penalty e for challenging an honest report. Thus, the only time a member of N_j is indifferent about challenging r_j is if $r_j < w_j$ and it is certain that r_j will be challenged by someone else. The reason for this is the introduction of the penalty e for challenging a truthfully reporting challenger.

This implies that the probability that any report $r_j < w_j$ in Stage 1 is challenged in the continuation equilibrium in Stage 2 by someone is 1.

This in turn implies that in Stage 1, no PBE strategy $\rho_j()$ can attach positive probability to any $r_j < w_j$, since such a report is challenged with certainty, and so is dominated by reporting $r_j = w_j$, due to the added penalty d that is incurred for being caught under-reporting in an audit.

Thus the Stage 1 strategies must attach probability 1 to $r_j = w_j$, which in turn means that the only possible Stage 2 strategies $\gamma_{ij}(r)$ in any continuation equilibrium is the one above, if $i \in N_j$, whereas if $i \notin N_j$, it must be that

$$\gamma_{ij}(r) = 0$$

since i's beliefs must be such that $\phi_{ij}(r_j, \rho_j) = 0$. Any challenge of j reduces i's expected payoff in Stage 2, since i is certain any challenge will not change his tax liability but will cost him the penalty e.

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Proof of Proposition 3

The game is now as follows. Each parishioner chooses a reporting strategy $\rho_j(r_j|w_j)$, simultaneously with choosing a challenge strategy $[\gamma_{ji}]$. The payoff functions are as in the full tailles game, and members of each N_j know the realization of w_j, but the strategy pair $\langle \rho_j(), [\gamma_{ji}] \rangle$ chosen by each j must be a best-response to the strategies of other players. $[\gamma_{ji}]$ can no longer be conditioned on knowledge of any r_k, and the equilibrium concept is now that of a Bayes Nash equilibrium, in which each parishioner again calculates expected payoffs using the strategies of their opponents and (for any $i \notin N_j$) the priors over w_j for each j.

We first show that the BNE cannot involve ρ_j that are purely truthful. That is, it cannot be true for any j that $\rho_j(r_j|w_j)$ puts probability one on $r_j = w_j$ for all w_j. Suppose, by way of contradiction, that this is the case. Then every $i \in N$ must choose $\gamma_{ij} = 0$ as part of their equilibrium strategy, since any challenge of j will only incur the cost e. However, this implies that parishioner j can profitable deviate from the truthful ρ_j and report a_j with probability 1 for every realization of w_j.

Suppose, alternatively, that for some j, ρ_j has the property that for all w_j, $\Pr\{r_j < w_j|\rho_j, w_j\} = \lim_{x \to w_j} \int_{a_j}^{x} \rho_j(r_j|w_j)dr_j = 1$. That is, the probability that j reports $r_j < w_j$ is 1. Then it must be that γ is such that the probability that j is challenged is 1. This, however, implies that the posited ρ_j cannot be part of a BNE, since a purely truthful strategy for j yields a higher payoff. Thus, it follows

that for each j, a BNE strategy must include a ρ_j which is honest with positive probability and dishonest with positive probability.

Now, suppose that for some j and some realization w'_j, it is true that $\rho_j(r_j|w'_j)$ is such that $\Pr\left\{r_j < w'_j|\rho_j, w'_j\right\} > 0$. We claim that it cannot be the case in a BNE that γ is such that $\Pr\left\{\eta^j[c^j] = 1|w'_j\right\} = 1$. Suppose, bwoc, that this is the case. Then it must be that either $\gamma_{ij} = 1$ for some $i \notin N_j$ or that $\gamma_{ij}(w'_j) = 1$ for some $i \in N_j$. If the first is true, then in fact j's strategy must be purely truthful, which we know cannot be true in a BNE. If the second is true, then j's BNE strategy must be such that in fact $\Pr\left\{r_j < w'_j|\rho_j, w'_j\right\} = 0$, a contradiction. Thus, in any BNE no under-report can be challenged with probability 1.

Suppose instead that for some j and some realization w'_j, $\rho_j(r_j|w'_j)$ is such that $\Pr\left\{r_j = w'_j|\rho_j, w'_j\right\} > 0$. Can it then be that $\Pr\left\{\eta^j[c^j] = 1|w'_j\right\} = 0$? Suppose this is true, bwoc, so that it must be true that $\gamma_{ij} = 0$ for all $i \notin N_j$ and that $\gamma_{ij}(w'_j) = 0$ for all $i \in N_j$. This then means that j can increase his payoff by deviating to a strategy ρ^0 such that $\Pr\left\{r_j = a_j|\rho^0_j, w'_j\right\} = 1$, a contradiction.

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