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Benchmarking the Middle Ages XV century Tuscany in European Perspective

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Benchmarking the Middle Ages.
XV century Tuscany in European Perspective

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Abstract: The article presents GDP estimates for XV century Tuscany, based on the 1427 Florentine Catasto, one of the best quantitative sources for the Middle Ages. In 1427, Tuscany was in per capita GDP (in real terms) only slightly above England and Holland; this gap is much smaller than the one resulting from the previous GDP figures, produced by Paolo Malanima, when fit into the Maddison project. Our analysis highlights a fundamental institutional difference, between Florence on the one side, and England and Holland on the other: the former was characterized by high extractive rates in favor of the capital city, to the detriment of the subdued cities and, most of all, of the countryside; and by subsequent market blockades. This may explain why previous estimates, partly based on the construction wages in Florence (within the 'privileged' economy), probably overestimated GDP. It may also explain the exceptional artistic blossoming of XV century Florence, despite only a small lead in average GDP. Our work thus helps to shed new light on the history of Renaissance Italy, put into a broader comparative context.

Keywords: Economic Growth, GDP, Middle Ages, Italy.

JEL Codes: O11, O43, O47, N13.

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1. Introduction

How wealthy – or poor – was pre-industrial Europe? Was it, until well into the 18th century, a backwater of the EurAsian economy, as some have maintained, or did it achieve a high level of GDP per capita already in the (late) Middle Ages? And how rich was the south compared to the north-west – did the Little Divergence (the increased economic performance of the North Sea area) already start in the late Medieval Period? And if this was the case, what are the reasons for the decline, perhaps starting already in the XV century, of Italy – probably at that time the most advanced part of Europe?

These are some of the questions we address in this reconstruction of the historical national accounts of Tuscany in 1427. It is based on one of the most detailed, extensive and probably reliable quantitative sources available for Medieval Europe, the Florentine Catasto of 1427, which has detailed information on the composition, the occupations and assets of all 61,123 households in Tuscany in that year. These data have been digitized by David Herlihy, who together with Klapisch-Zuber published an impressive survey of the demographic structure of the region on that basis [Herlihy and Klapisch-Zuber, 1978, 1985]. Other studies have followed making use of the incredible richness of the source, but it has not been used to systematically estimate the size and structure of the economy of Tuscany in this period. This is what this paper intends to do. The aim is to create an independent benchmark estimate of Tuscan GDP and its composition in that year – based on high quality sources – which will allow us to have a late Medieval benchmark for the historical national accounting of southern Europe. We can thus test the accuracy of current estimates of Italian GDP in the past, made by Paolo Malanima, but we can also properly compare Tuscany with two countries for which similar estimates are available, England and Holland. In this way, we can add a significant contribution to the debate about the evolution of the Tuscan economy in the late middle ages, in order to address the big question of why the comparatively rich economy of that region

did not evolve into a more advanced one, but actually fell behind England and Holland. As we will see, the two issues, to have a reliable and comparable GDP benchmark and to address the causes of Tuscany's relative decline, are closely related.

According to demographic and employment figures, following the Black Death and throughout the XV century Tuscany experienced an economic decline: its population recovered more slowly than the rest of the peninsula (and Western Europe), while there was no significant growth of manufactures [Herlihy and Klapisch-Zuber, 1985, pp. 77-78; Ginatempo and Sandri, 1990, pp. 128-136; Malanima, 2002, p. 366]. The same is true for the city of Florence, with respect to the other cities of the Centre-North of Italy [Del Panta *et al.*, 1996, p. 278]. To explain this stagnation, several explanations have been put forward. In broad terms, two competing views stand out. Some authors, such as Jones [1978], have stressed the role played by cultural factors: as in other pre-industrial societies, the urban elite increasingly leaned towards aristocratic values, and dismissed an entrepreneurial, more productive frame of mind. For this reason, profits were reinvested mainly in land, in art or in real estates. In this respect, what happened to Tuscany after the Black Death was an anticipation of a broader phenomenon observed in Italy in the XVI and above all in the XVII century [see among others Cipolla, 1974, p. 315; Malanima, 1982, pp. 105-106]. However, this cultural view does not explain why such a change of *weltanschauung*, if ever, did occur. According to Epstein [1991], institutional inefficiencies and blockades, as the result of the exploitation of the countryside by the capital city, hindered a further development of the Tuscan economy. In Epstein's argument, the over-exploitation of the countryside was, in turn, a consequence of the change in demographic conditions following the Black Death, which led the urban elites to significantly increase the tax burden over the rural areas, and to limit as a consequence the mobility of labour and capital [Epstein, 1993, 1994]. In some respects, this was a process similar to the one observed at the same time in Eastern Europe [Blum, 1957], or in the Roman world after the plague of the III century A.D. [Lo Cascio, 2012]. The difference is that in this case exploitation

and market immobilities did not come from the landowner or the imperial state, but from the elite of the powerful capital city, Florence, which ruled over the *contado* and the other cities too (which in turn ruled over their countryside).

The Epstein hypothesis implies that the mobility of labour and capital is frustrated, resulting in sharp differences in income per head and in productivity per worker (between agriculture and the countryside on the one hand, and manufacturing and services on the other hand). Thanks to our estimate of the size and structure of the Tuscan economy, this idea can now be tested. Were these differences in income and productivity between town and countryside much larger in Tuscany than in England and Holland in the same period, economies which were (in Epstein's view) much more integrated? The answer to this question is also relevant, as we will see, for explaining the GDP puzzle: why the GDP of Tuscan economy in the XIV century, as resulting from our reconstruction, was (in international comparative perspective) significantly lower than estimated by Malanima; even though Malanima's estimates are based on reliable figures of wages for the building sector (in Florence).

The paper is organized as follows. Section 2 discusses the available estimates of GDP for the Centre-North of Italy in the XV-XIX centuries in international perspective, that is within the framework of the Maddison project: it reviews the literature on Italian economic history and the debate about the divergence within pre-industrial Europe, thus introducing the Italian GDP puzzle. Section 3 presents the reconstruction of Tuscan GDP in 1427, based on the Florentine Catasto of that year. In Section 4, we analyze the size and structure of the Tuscan GDP, its composition and the shares going to wage and capital income respectively; by the light of this reconstruction, we enter the debate about the eventual decline of Tuscany in the decades following the Black Death. Section 5 puts our results in a broader comparative perspective, with England and Holland, and discuss their implication for understanding the Italian GDP puzzle, while Section 6 concludes.

2. Little or great divergence? The Italian puzzle

For the late Middle Ages and the Renaissance, the Italian peninsula, and the Centre-North in particular, has been widely regarded as one of the most advanced areas of Western Europe. According to the available GDP estimates, produced by Paolo Malanima, the Centre-North of Italy reached a per capita GDP of 1,486 international (Geary-Khamis) 1990 dollars as early as 1348, by the eve of the Black Death [Malanima, 2011]: this was well above the subsistence threshold, which at that period may have hovered around 250-300 international dollars [Bolt and van Zanden, 2014, p. 636]. The estimate is very high also in comparison to other European countries: in 1348 the GDP of the Netherlands would be 876 dollars, that of England 786, and even Spain, with an urbanization rate closer to the Italian one, would score a GDP of barely 907 dollars; Byzantium would be down to 580 dollars [van Zanden and van Leeuwen, 2012; Broadberry *et al.*, 2012; Álvarez-Nogal and Prados de la Escosura, 2013; Pamuk and Shatzmiller, 2011; Bolt and van Zanden, 2014, p. 635].[1] The most recent estimates of the Maddison project, in 2011 dollars (which also incorporate Malanima's figures) [Bolt, Inklaar, de Jong and van Zanden, 2017], confirm a similar, remarkable lead of the Centre-North of Italy in the mid-XIV century, in particular with respect to Holland and England (Table 1).

After the Black Death and the recovery, by the early XV century the new estimates still portray the Italian Centre-North as the most advanced economy of Western Europe (see Table 1). By 1450, it would have reached an impressive per capita GDP of 1,826 (1990) dollars, 33% higher than the Netherlands, 70% than England. From such heights, however, it would have lost ground in the second half of the XV century and throughout the following one, not only in relative but also in absolute terms: the per capita GDP of Northern Italy reduced by 16% from 1450 to 1600 (1990 dollars), or by 11% from 1500 to 1600 (2011 dollars).

[1] If we compare these figures with Roman times – after accepting Maddison's estimates for the first century AD [Maddison, 2007, p. 54] – in 1348 England and Spain would have increased their per capita GDP by around 30% and 50%, respectively; Italy, which was already the most advanced province in Roman times, by 75% – or by around 50%, if we credit instead the estimate for the first century proposed by Lo Cascio and Malanima [2009].

However, according to the available estimates, during the XVII century it would have slightly increased: as a consequence, in 1700 Italy would still rank almost at the same level as England, and well above France, Spain, and Germany.

Table 1. *Italian GDP in international comparisons (XIV-XIX centuries)*

	Dollars of 2011					
	1350	1400	1500	1600	1700	1800
Centre-North of Italy	**1,461**	**1,687**	**1,477**	**1,314**	**1,423**	**1,314**
England/Great Britain	788	1,102	1,089	1,085	1,517	2,102
Holland	799	1,090	1,033	1,629	1,704	1,803
Belgium			1,597	1,730	1,496	1,585
France		1,235	1,165	1,107	1,165	1,223
Spain	1,267	1,144	1,181	1,246	1,137	1,280
Germany			1,221	860	1,001	1,051
Poland		1,086	1,122	1,176	1,104	977
Sweden	909	1,088	1,241	912	1,452	990
Turkey/Ottoman Empire	1,015	1,086	1,155		935	979
	Dollars of 1990					
	1400	1450	1500	1600	1700	1820
Centre-North of Italy	**1,751**	**1,826**	**1,533**	**1,363**	**1,476**	**1,511**
England/Great Britain	1,099	1,076	1,086	1,082	1,513	2,074
Holland	1,195	1,373	1,454	2,662	2,105	1,874
Spain	819	n.a.	846	892	814	n.a.
Japan	n.a.	527	n.a.	574	629	641

Sources: for the estimates in 2011 dollars, Bolt, Inklaar, de Jong and van Zanden, [2017] and the references therein cited; for the estimates in 1990 (Geary-Khamis) dollars, Bolt and van Zanden [2014] (and in particular Malanima [2011] for Italy, van Zanden and van Leeuwen [2012] for the Netherlands, Broadberry *et al.* [2012] for England, Álvarez-Nogal and Prados de la Escosura [2013] for Spain, Bassino *et al.* [2012] for Japan).

Such a picture, spanning through the XIV-XVIII centuries, looks at odds with a well-established literature. Most historians agree that Italy was at the peak of its grandeur in the second half of the XV century and the XVI; that is precisely when economic decline, according to the new estimates, began. The Florentine Francesco Guicciardini wrote his renowned *La Historia d'Italia* (*The History of Italy*) between 1537 and 1540. The book opens with a famous description of the

economic and social conditions of Italy at the eve of the XVI century: never before, Guicciardini argues in that famous overture, Italy had been so prosperous as in the years around 1490, thanks to the abundance of its agriculture production, as well as to the richness of its urban life [Guicciardini, 1968 (1561)]. It is true that, soon after, a troubled period began: from 1494 to 1559, on the Italian soil eight wars were fought between France and Spain, for a total of 41 years of fighting out of 65; they ended in the supremacy of Spain over most of the peninsula. Nonetheless, it is widely believed that the economic rise of Italy, and of the Centre-North in particular, was only temporarily disrupted by the wars, and quickly resumed once these were over: according to Carlo Cipolla, in the Centre-North from 1540 to 1580 agriculture, industry and commerce all reached their climax; those decades were, in Cipolla's words, the «Indian summer» (*estate di San Martino*) of the Italian economy [Cipolla, 1996, pp. 63-65].

Alternatively, however, it could be that the wars fought from the end of the XV century until the mid-VXI century, coupled with an increase of inhabitants during the XVI century, actually resulted into a decline of Italy's per capita GDP. At the present, population figures do not seem to support this explanation. In fact, the percentage rise of population in Italy was not higher than the one observed in the Netherlands and Britain – it was lower. According to Maddison, from 1500 to 1600 the Italian population increased by 25%, from 10.5 to 13.1 millions; in the same period, the population of the Netherlands increased by 58% (from 0.95 to 1.5 millions), that of Britain by 57% (from 3.9 to 6.2 million) [Maddison, 2006]. True, it is possible that the growth of the Italian population was higher: by 48% according to Lo Cascio and Malanima [2005], or by 50% according to Livi Bacci [1996] – that is from 9 to 13.3 millions or from 9 to 13.5 millions, respectively. But even so, this is still lower than the growth observed in the Netherlands and England. In short, these numbers suggest that the wars of the first half of the XVI century resulted into a slowdown of population growth in Italy, as compared to other parts of Europe; in order to have a negative GDP rate, we should record a slowdown in (the growth of) total output higher than the one

observed in population. It is difficult to tell that this was the case, from the literature at our disposal.

The new estimates of per capita GDP appear to be equally baffling if we compare the trends observed in the XVI and the XVII centuries. In fact, there is little doubt that the XVII century was a period of economic decline for Italy, and especially for the Centre-North, at least for what concerns industry and services; unlike the XVI one. Cipolla made this point as early as in 1952: at the beginning of the XVII century, the Centre-North of Italy was still one of the most advanced industrial areas of Europe, with an «exceptionally high standard of living»; by the end of that century, «Italy had become an economically backward and depressed area; its industrial structure had almost collapsed, its population was too high for its resources, its economy had become primarily agricultural». According to Cipolla, the decline occurred between 1600 and 1670. It was in these seven decades that, first of all, «the industrial structure of Italy collapsed» [Cipolla, 1952, p. 178]: it was true for the woollen industry in Venice, Florence, Milan or other towns of Lombardy; for the silk industry in Genoa or Pavia, as well as for a number of other industries, in several cities throughout the Centre-North; some industrial delocalization did take place, in favour of the countryside, but this was by far not enough to compensate for the fall in urban manufactures.[2] At the same time, also the maritime and banking services fell apart. The relative prosperity of Italy depended precisely on exporting textiles (mainly wool and silk) and international services such as banking operations and maritime transports: in both, the Italians were replaced during the XVII century by English, Dutch and even French competitors, all over Europe and the Mediterranean basin. By the end of the XVII century, not even domestic markets had remained for Italian crafters: Italy imported industrial goods from North-Western Europe, while exporting agricultural goods or raw materials such as oil, grains, wine and raw wool and silk [Cipolla 1974, p. 375]. Furthermore, we should consider that population, after decreasing due to plague epidemics, in the second half of the XVII century had returned to rise: in 1700 it could have been

[2] To this decline there were some exceptions, as most noticeably the silk industries in Bolonia [Poni, 1990]. For a history of the Italian silk sector in this period, see also Battistini [2003].

at the same level as in 1600, or even higher [Livi Bacci, 1996; Lo Cascio and Malanima, 2005; Maddison, 2006]. Under these conditions, in order to have an increase in per capita GDP during the XVII century, we should record a significant increase in agricultural production. This is only partially confirmed by the ten-year series of agricultural production estimated by Federico and Malanima: according to them, from 1600 to 1700, in the Centre-North per capita agricultural output increased by a 6.0-7.8% range [Federico and Malanima, 2004, pp. 459-460]. During that same period, however, according to the available estimates per capita total GDP (including industry and services which declined, as far as we know) increased by 8.3%.

When moving to international comparisons, at a first glance we face similar puzzles. According to the available estimates, in broad terms, the Centre-North of Italy looks richer than what previously believed (following the pioneering Maddison's figures); when passing from the old to the new estimates, however, a similar gain can be observed also for England, the Netherlands and, to a much minor degree, for Spain. In any case, the result is that, still in 1700, according to Malanima the Italian Centre-North is now much closer to England, than to the rest of south-western Europe. Furthermore, in 1700 Spain, and even France actually (untouched by the revision of Maddison's figures), are closer to China and Japan than to the Centre-North of Italy (see again Table 1).

How tenable are these results? According to Robert Allen, a «great divergence» inside Europe did take place in real wages, in favor of England and the Netherlands between 1500 and 1750. In terms of welfare rations (earnings relative to the poverty line), by the first half of the XVI century building laborers in London, Amsterdam and Antwerp were already better off those in Florence and Milan; the gap increased during the XVII century and, by the end of that century, real wages in Amsterdam and London were almost twice those in Florence or Milan; one hundred years after, they were almost three times. Concerning building craftsmen the gap was less pronounced, but it was apparent, nonetheless, already in the XVI century; and it was bound to increase from the mid-XVII to the second half of the XVIII century; by that time, real wages in

London and Amsterdam doubled or more than doubled those in Florence or Milan. Actually, in terms of welfare rations Florence and Milan usually ranked below not only Paris, but also Valencia and Madrid, at least with respect to the living conditions of the laborers; the real wages of the craftsmen were slightly above Valencia and Paris, but below Madrid [Allen, 2001, p. 428]. On the basis of these figures, it seems improbable that in per capita GDP the Italian Centre-North would rank more close to England, than to France or Spain.

One explanation for these incongruities could be, plainly speaking, that the GDP series produced by Malanima are not reliable. Those series are obtained as the sum of the agricultural product [from Federico and Malanima, 2004] and the non-agricultural product. The agricultural product is estimated from the demand side, where typically consumption is calculated via the population, both the urban and non-urban wages, and some standard assumptions about the shares of agricultural consumption on wage, rent and interest, and about the shares of these three components on total income; in this case, the urban wages are from the 1285-1860 ten-year series of the salary of Florentine bricklayers, in the building sector; it is claimed that this series displays a good correlation with shorter ten-year series of the salary for building workers in Venice (1380-1790), Genoa (1500-1860) and Milan (1600-1860) [Malanima, 2002, pp. 417-422; Federico and Malanima, 2004, p. 441; Malanima, 2011, pp. 176-181]. At a first glance, it is the procedure used to estimate the non-agricultural product which appears to be the most questionable. For the years 1310-1861, Malanima estimates the non-agricultural product on the basis of the urbanization rate observed in that period and the relationship that, in the post-unification period (ten-year series from 1861 to 1936), the share of the product in industry and services, out of total output, had with the rate of urbanization: through a regression, a coefficient is calculated for the 1871-1936 years, which is then applied to the urbanization rate of pre-unification Italy. The result is then corrected in order to allow for the rural population not employed in agriculture; from 1310 to 1861, this is deduced from the magnitude it had in the first censuses of the Kingdom of Italy (1861-1901) [Malanima, 2011, pp. 181-185]. Such a procedure is subject to significant

margins of uncertainty; in particular, it should be noted (as the author himself acknowledges, at p. 184) that the productivity of industry and services for the period 1861 to 1938 (when Italy, at least from the 1890s, was living through an industrial take-off) is retropolated back to five and a half centuries of pre-industrial history; this may easily have led to an overestimation of the non-agricultural product, for modern and late-medieval Italy. And such over-estimation, along with possible casual fluctuations which may be due to the same reason (uncorrect proxy for the non-agricultural production), may explain the inconsistencies we observe.

And yet things are not so simple. When coming to international comparisons, in fact, the available GDP figures may be supported, rather than contradicted, by real wages. In terms of real wages, in fact, according to Malanima himself the rankings were different than what Allen suggests. The scholar published a response to Allen: Italian real wages were higher than the English ones in the XIV and XV century; and more or less equal in the XVI and XVII centuries. When comparing the two countries, for Italy Malanima uses a basket of goods and a consumer price index different from Allen's and, apparently, more accurate, because it incorporates more information (while it follows basically the same procedure). In addition, there are two more major differences. First, while Allen compares Florence and Milan with London, Malanima compares them with the wages from southern England; the reason is that London is an exceptional case (given its economic dynamism and the high rate of growth of its inhabitants, which has no parallels in any city of the Italian Centre-North) while, on the other side, according to Malanima Florence and Milan show real wages similar to those of other cities of the Italian Centre-North. Second, for Florence and Milan Malanima makes use of Italian nominal wages apparently more accurate than Allen's ones, especially for the XV century [Malanima, 2013].

In view of this, we may say that, as far as we know, the new estimates of real wages confirm those available of per capita GDP: both tell a story of a «little divergence» between the Italian Centre-North and England; rather than of a «great» one. It is worth noticing that Malanima's real wages are the same the

author uses to construct the wage index which is, in turn, the basis of his estimate of agricultural product and indirectly also of the non-agricultural one (which is calculated as a coefficient of the former): together with population and with the urbanization rate, these are the basic ingredients for the GDP calculation. In broad terms, it may be added that the international comparisons of real wages look more reliable than the international comparisons of GDP we have presented in Table 1.

To sum up, the available GDP figures for pre-industrial Italy portray a contradictory picture: on the one hand, they may overestimate Italy per capita GDP and, probably, they result into a deceptive long-run trend; on the other hand, they are in line with the available, accurate estimates of real wages upon which they are based, and these in turn do confirm the good position of Italy with respect to the North Sea area. For sure, to put one's trust only on long-run GDP series may be problematic – given the high number of assumptions involved – when it comes to international comparisons or to an in-depth analysis of specific historical periods. In these cases, the approach of long-run GDP series should be complemented by a different one: to produce GDP figures limitedly to a benchmark or to a period for which the best information is available, as a starting point for further checks and thorough comparisons. This is precisely what we aim to do in this paper. But it is not the only point we make: as we will see, in fact, to rely confidently on long-run series of specific sectors as a proxy of the larger economy also can be problematic, given institutional idiosyncrasies which may hinder the proper functioning of markets.

3. The Catasto of 1427

The Catasto of 1427 is arguably the most famous source about the economy and society of the Late Middle Ages. It is the register for the wealth tax that was levied in Tuscany in that year (and following years), consisting of a detailed registration of the size and composition of all household and their taxable wealth. Wealth taxation had been the principle source of income of the Tuscan state, but in the period before 1427 there had been growing opposition against the *estimi*, which were evaded on a large scale by the rich. The 1427 Catasto changed this: a lot of effort was put into making detailed registers of all the possessions of the more than 60.000 households of the republic, which resulted in a drastic change in taxation at the expense of the rich [Molho, 1971]. A large staff of almost 100 clerks were employed by the city government to copy the original declarations submitted by the heads of households into large registers, to check their reliability making use of other sources at their disposal (such as registers of the public debt), and to calculate the tax assessment [Herlihy, 1985, pp. 21-22]. The registers of the tax have been studied intensively by historians; when other, independent sources were available (such as in De Roover's study [1963] of the Medici Bank), the reliability of the Catasto could be confirmed. Most famous is the detailed reconstruction of the demography of Tuscany by David Herlihy and Christiane Klapisch-Zuber [1978; 1985], which exploits the detailed demographic data of the Catasto and to this purpose digitized the available information of all households. This large dataset has since been used for various studies, including reconstructions of the inequality of income and wealth [Lindert, 2008], the role of the Jewish lenders, the rationale of dowries and the determinants of agricultural contracts by Maristella Botticini and co-authors (who also supplemented that dataset with information from the original manuscript or other sources) [Botticini, 1999, 2000; Ackerberg and Botticini, 2000, 2002; Botticini and Siow, 2003]; but no systematic attempt has been made to reconstruct the national accounts of Tuscany on this basis. Malanima, in his many studies of long term economic change in Italy in the early modern and

medieval period, has not made systematic use of the wealth of information that is on offer here. All these studies assume 1427 was a (more or less) normal year, in spite of the fact that a war (with Milan) was going on, and that the data of the Catasto are representative for Tuscany in the first half of the 15th century. The yields of the most important taxes town and countryside published by Molho [1971, 54, 61] confirm this.

The source has, however, also a few limitations. An important problem, which we will address first, is that only about half the heads of households report their occupations (or to be more precise, the digitized dataset has occupations for 49% of households). The clerks who ordered the information supplied to them by the households, were probably interested in occupations as extra source of information about the possible wealth of the household, but the occupation as such did not play a role in the tax assessment, explaining why they did not aim at registering this for all of them. In order to reconstruct the occupational structure of Tuscany, we have to try to find out what the 'missing' occupations were. Fortunately, we know much more about these households: how much wealth they owned (including cattle) and how large they were, which allows us to compare these households with no stated occupation with those with an occupation. This makes it possible, we think, to classify these households into either services, industry or agriculture – a more fine-tuned classification is not possible however. It is also likely that the 'no occupations' category in Florence is concentrated in other sectors than in the countryside. For this and related analyses we have split the Tuscan population in four groups: the capital city Florence (9,879 households), the small cities (Pistoia, Prato, Pisa, Cortona, San Gimignano, Volterra) (9,483), the Contado of Florence (26,926) and the rest of the countryside (14,835).

As a first step, we compare the average total assets per household of the 'no' group with that of the households with stated occupations. Table 2 below shows that in Florence the households of which no occupation is given are even richer than those in the services sector, and that the gap with the average wealth of households active in industry and agriculture is very large. 'No occupations'

households own on average fl 1,480, households in services come close (fl 1,223), other households are clearly much poorer (fl 197 for agriculturalists, but there are only a few of them, and fl 245 for people working in industry). Therefore, it seems safe to assume that the 'no' households were also active in the services sector. In the small cities things are more complex, and the average value of wealth of the 'no' group is in between services and industry. It is clear, however, that these households do not belong to the agricultural sector, as this sector is on average much poorer. Moreover, the number of animals per household (for which the Catasto also supplies data) is 0.9, much lower than that of agricultural households (who own 1.9 animals on average), and comparable with that of households in industry and services. We have therefore assumed that in the small cities the 'no' group should be distributed over industry and services, and for want of a better solution, we have split the group equally (without the no group, both sectors are of the same size, with 1,630 and 1,677 households). In the Contado and the rest of the countryside the 'no occupations' group is either almost as poor as the agricultural population (Contado) or even poorer (the extreme opposite of the situation in Florence itself, where the 'no' group was more wealthy than the other occupational groups). The number of animals they have per household, however, suggests that these are not 100% agricultural households (Contado: no occupations: 1.0; agricultural households: 1.4; Rest countryside: no occupations 1.4; agricultural households: 1.9). In that sense they look more similar to the non-agricultural households. Given these data, we have decided to allocate the no group over the three sectors according to the composition of the households of which the occupations are known. Perhaps we slightly overestimate the non-agricultural share in the labour force in this way, but it has no effect on the estimates of the level of GDP, and only a very small effect on its structure.

Table 2. *Average wealth per household in four regions and three economic sectors (in fl.)*

Value of all assets per household	Agriculture	Industry	Services	No stated occupation	Total
Florence	197	245	1233	1480	1026
Small Cities	107	200	508	243	265
Contado	55	130	204	63	68
Rest countryside	96	183	242	57	80
Total	70	208	731	290	257

The results of the calculations are shown in Table 3. They show that, on the basis of these assumptions, the structure of the labor force is still rather traditional: almost 60% is active in agriculture; in the countryside this is about 85%, in the cities this share is obviously very low. Services employ more people than industry. As we will see in the international comparison, the structure is very much like that of England in 1380 or 1520, which is striking as England is often considered to be relatively 'backward' in this period. Real GDP in Tuscany was much higher than in England, but this was not the result of a radical change in the structure of the economy.

Table 3. *Estimates of the structure of the labour force (heads of households)*

No. Households	Agriculture	Industry	Services	No.	Total	Agriculture	Industry	Services	Total
Florence	24	3139	2347	4369	9879	24	3139	6716	9879
Small cities	1078	1677	1630	5098	9483	1078	4226	4179	9483
Contado	11535	1207	1137	13047	26926	22364	2381	2181	26926
Rest countryside	5358	451	448	8578	14835	12735	1051	1048	14835
Total	17995	6474	5562	31092	61123	36201	10798	14124	61123
Share (%)	29	11	9	51		59	18	23	

The next steps in estimation of national income is to assign income levels to the occupational groups. Capital income estimates are based on the Catasto, which in the Herlihy dataset gives data for private investments (capital invested in commerce and industry), public investments (the public debt) and total capital. The value of real estate is the difference between total capital and the sum of private and public investments, and as residential buildings were exempted from taxation, real estate was dominated by land. The degree to which the Catasto is a reliable source can be checked by comparing the total sum of 'public investments' with what is known about the size of the public debt in this period. Molho [1971] estimated the public debt in the mid 1420s at 2.5 million florins, to which we should perhaps add half a million to get the level of 1427 (as these were years of large deficits). The Catasto gives as the value of public investments a total of fl 2.55 million for the citizens of Florence, and very small sums (in total fl 13,000) for the rest of Tuscany. Molho also presents estimates that about fl 200,000 of public debt was in the hands of foreigners. This comparison shows that the estimated public debt according to the individual tax returns of Catasto are very close to the level of public debt in the hands of the citizens of Tuscany according to the central administration of Florence. It is perhaps no mystery that the figure of the public debt of Catasto are relatively accurate, as the officials in charge of the operation also had access to the ledgers of the Monte, but still the close accordance between both figures enhances confidence in the source. Other forms of capital were more important, however: private investments came close to fl 5 million, real estate (except residential buildings) was about fl 8.5 million, and the total of capital assets fl 15 million. The Catasto assumed a yield on real estate of 7% per annum; interest on public debt was 5% [Molho, 1971], and we assume a 10% rate of return on commercial capital, bringing the average rate of return close 7% (as is assumed by the officials making the Catasto).

The value of residential buildings is not included in the Catasto, as it was not taxed, so a sum covering the income from rents of residential buildings should be added to this; following Lindert [2008] we assume that about 8 percent of income

consisted of house rent, but that this was higher in Florence (10%) and lower in the countryside (6%).

Having estimated total income from capital, we turn to wage income. Here estimates can be based on data on salaries and wages in Florence in the 1420s. Tognetti [1995] and Goldthwaite [1980] present data for various groups of workers. Assuming 200 days of work per year, annual wage income would be: for agricultural workers (*braccianti*) fl 26.7, for skilled craftsmen (*muratori*) fl 41 and for unkilled labourer (*manovali*) fl 19 (at an exchange rate of 82.5 soldi for the florin [Molho, 1971]). It is more difficult to estimate the income of a employee in services. Herlihy [1985, p. 21] mentions that the 78 clerks employed for compiling the Catasto earned 5 or 6 florins per month. Molho [1971, p. 116] gives similar wages (48 to 60 fl per annum) for employees of the Monte (similar salaries for clerks at the Medici Bank) [De Roover, 1963, pp. 44-45]. We have assumed a monthly wage of 5 florins (60 annually) to be the standard rate for a clerk. This is 50% more than a skilled craftsman in the construction industry, which is, given the scarcity of literacy in this period, a reasonable skill premium. All heads of households active in services are assigned the wage income of a clerk; workers in industry are given the wage of a muratori, and in agriculture that of an agricultural labourer.

We will on the whole make use of assumptions which do not lead to an underestimate of these incomes, as we compare our estimates with those of Malanima which, we believe, are perhaps too high. To make this case, we should not underestimate income levels. So we assume that all heads of households were employed during 200 working days per year, which, for the late Medieval Period, is probably rather high [Broadberry et. al. 2012 discuss estimates of the number of days worked of 165-180 for England in the late Middle Ages]. Moreover, we will also assume that wages earned in Florence (for which we have good data) can be used for estimating income levels in the small cities and the countryside as well.[3] Again, this is probably erring on the high side. Moreover, we have

[3] The problem is that we were unable to find data for wages earned in the countryside, which is probably related to the system of agricultural exploitation dominated by mezzadria in which wage labour is marginal; see for example Piccinni [2006].

assumed that other members of households except the head do work as well: in the poor households we assume a participation of women (for 100 days per year, earning 50% of an unskilled labourer); this concerns households active in agriculture and industry in both the cities and the countryside (see de Pleijt and Van Zanden 2017 for evidence of female wages, and Piccinni [2006] for female labour force participation in Tuscany). In the rich households in the cities we assume that servants are employed and earn the wage of an unskilled labourer.

Two population groups were no covered by the source: clergy and soldiers. Herlihy [1985, p. 25] suggested that there were about 6,000 members of the clergy in 1427; together with their servants the ecclesiastical population may have been 11,000. We assumed that they earned the same income, on average, as a clerk (60 fl per year). Herlihy [1985, p. 94] also gives an estimate of the capital assets of the Church (1.5 million), which can be used to estimate capital income of this 'sector' as well (again assuming a 7% yield on assets). In 1427 Florence employed about 12,000 soldiers, who earned about 14 fl per month during the fighting season, or in total fl 168,000 per month [Molho, 1971, pp. 13, 15]. Total military expenditure in 1427 was fl 446,700 [*Ibidem*, p. 61]; it is unlikely that income earned in this sector was more than 80% of this sum, because armies also needed supplies (such as food for the soldiers, horses and guns). We therefore estimated the total income in this sector at 80% of this sum, or fl. 357,000. This would imply that the 12,000 soldiers were active during only just over two months, or that the estimate of 12,000 soldiers is incorrect, or, perhaps the most plausible scenario (as 1427 was a year of warfare with Milan), that the army managed to earn quite some money in other ways (by living off the land, by ransoming people etc.). By far the highest incomes were probably earned in this branch: Molho gives estimates that condottieri earned from fl. 30,000 to fl 50,000 per year (p. 17), whereas the two Medici brothers, the richest merchants and bankers of the city, in the period 1420-1435 together earned fl 124,255, or about four thousand florin annually [De Roover 1963, p. 55]. It is therefore possible that we seriously underestimate the size of the military sector in this year (it is about 7% of GDP, which is not extremely high for a war year).

Table 4. *Estimates of size and composition of income in Tuscany in 1427*

		House-holds	Population	Total Wage Income	Total Capital Income	Total Income	Income per capita
Florence	Agriculture	24	96	640	456	1,096	11
	Industry	3,139	12,637	152,670	81,506	234,176	19
	Services	6,716	25,789	476,225	810,198	1,286,423	50
	Total	9,879	38,522	540,575	892,160	1,432,734	37
Small cities	Agriculture	1,078	6,037	34,137	12,131	46,267	8
	Industry	4,226	16,322	205,537	102,404	307,942	19
	Services	4,179	16,671	273,535	154,677	428,212	26
	Total	9,483	39,030	463,894	269,212	733,106	19
Contado	Agriculture	22,364	109,894	708,194	165,980	874,174	8
	Industry	2,381	10,767	115,814	30,307	146,121	14
	Services	2,181	8,465	130,846	39,159	170,005	20
	Total	26,926	129,126	831,127	235,446	1,066,574	8
Rest Countryside	Agriculture	12,735	55,784	403,278	107,839	511,116	9
	Industry	1,051	4,662	51,139	14,494	65,634	14
	Services	1,048	3,976	62,908	18,357	81,265	20
	Total	14,835	64,423	448,392	140,691	589,082	9
Total	Agriculture	36,201	171,811	1,146,248	286,406	1,432,654	8
	Industry	10,798	44,389	525,160	228,711	753,872	17
	Services	14,124	54,901	943,513	1,022,392	1,965,905	36
	Total	61,123	271,101	2,614,921	1,537,509	4,152,430	15
Clergy		6,000	11,000	360,000	105,000	465,000	42
Soldiers		12,000	20,000	357,360		357,360	18
Total		79,123	302,101	3,332,281	1,642,509	4,974,790	16.5

Adding up all these sums gives a total National Income of almost 5 million florins, or, with a population of close to 300,000, fl 16.50 per capita. This is national income at factor costs, to which should be added indirect taxes to get national income at market prices. The yield of the most important indirect taxes, the four gabelles, fluctuated a lot in the 1420s, but in 1427 a maximum level of fl 185,298 was reached. We estimated the total produce of indirect taxes at fl 250,000, as some of the smaller indirect taxes and those levied in the countryside

were not included in the statistics (Molho 1972: 45-59 for a detailed discussion). This raises the estimated income per capita to 5.225 million guilders, and fl 17.4 per capita.

4. National Income and Its Distribution

Several dimensions of the structure and distribution of income are worth further analysis. To begin with, the Florentine republic was characterized by large regional differences in income level. The average citizen of Florence earned fl 37, more than double the regional average, and four time the income level of the average inhabitant of the countryside, who had an average income of about 9 florins. Because we have assumed that wage levels in the countryside were the same as in the capital city, real income differences must have been even higher. Part of the difference is explained by the fact that the citizens of Florence specialized in services with high levels of income. When we look at income gap between the services and agriculture in Tuscany as a whole, we find indeed a similar – huge – 1-to-4.5 difference (average income in services is 36 florins, in agriculture 8 florins) (Table 4). This difference is partly related to the fact that a large share of the agricultural land was in the hands of Florentine citizens, which obviously added to their income and lowered income levels in agriculture. On the basis of the value of real estate of Florentine citizens this income transfer from agriculture to services can be estimated to be about fl 350,000, adding almost seven florins per capita to the income level of the people in services (and lowering incomes of the peasantry with 2 florins per head). Of the total income from land rent of fl 600,000 (about 12% of GDP) more than half was channeled into the coffers of people active in services, and some fl 85,000 to people active in industry. Or spatially: about fl 300,000 of land rent flowed to the inhabitants of Florence, contributing 20% to the income earned in the capital city.

Related to this is the striking difference between the structure of the labour force, dominated by agriculture, and of income, in which services have by far the

largest share. To the estimates of the occupational structure of the heads of households presented in Table 2 must be added that these data do not yet incorporate the 6,000 members of the clergy and the 12,000 soldiers. Moreover, women and servants, estimated very tentatively, should be included in the labour force as well. Including these groups leads to a somewhat more modern occupational structure (Table 4), in which the share of agriculture falls to 57% of the population (and even less in terms of its share in the occupations of heads of households). However, the structure of income earned by households is dramatically different, with households active in services claiming 50% of wage income and 69% of capital income, whereas agriculturists only get one third of wage income and one-sixth of capital income (this is after the transfer of about half the land rent to people active in services). In short, the Tuscan economy is characterized by extreme disparities in productivity and income levels, on top of which there is a dramatic drain of land rent from the countryside to the capital.

Another striking feature of these estimates is that industry is so small, representing about 15% of income and employment. This contrasts with the picture of the Florentine economy as to a large extent based on textiles – woolen and increasingly silk – as the main export commodity. Part of the explanations is related to one of the problems with the classification of the Herlihy dataset. It is not possible to make a clear distinction between the merchants and the weavers active in these branches – they are grouped together in one group (or actually two groups: wool manufacturer & merchant and silk merchant & silk weaver), which have been classified as being part of the services sector. But a large part of the employment and value added of this sector should be counted as industrial. We can even check the consistency of the Catasto data with independent estimates of the size of this sector presented by Goldthwaite (2009)[4]. On the basis of his estimates total value added of the wool and silk manufacture and trade can be estimated at close to fl 300,000 (wool: fl 263,000 and silk: fl 29,000). On the basis of the Catasto the income of households which are either silk or wool

[4] Goldthwaite [2009, pp. 278, 294] gives estimates of the value added of the wool sector for 1425-1430 which have been used, and for silk for 1436; silk output was growing rapidly in these years, and we used estimates of annual silk output [from Corti and Da Silva, 1965] to get an estimate for 1430 (no annual data available for preceding years).

manufacturers or traders can be estimated at fl 298,500 (fl 167,500 labour income and fl 131,000 capital income). The similarity is striking, but also a bit suspect, as we have not taken into account the 'no occupation' households, some of which may also have been active in this branch. Accepting these estimates implies that the textile industry produced about 6% of GDP (5% wool, less than 1% silk). Adding this to the share of industry in GDP increases this share to 21% (and the share in employment to 18%).

Income consisted of two thirds wages, and one third capital income. These shares are similar to those estimated for 1510/14 Holland (capital income 31%) [Van Zanden, 2002], 1700 Britain (less than two thirds labor income, including also non-wage income, more than one third capital income) and 1820 France (70% labor income and 30% capital income). This similarity adds to the credibility of our estimates. Over time, for both Britain and France the share of capital decreased: down to the 20% threshold, which was reached in the former by 1970, in the latter by 1980; from those years on, the shares slightly rose in both the countries [Piketty, 2014, pp. 200-201]. In XV century Tuscany, total value capital assets amounted to 22 million florins, or 4.45 times the national income. These figures are not staggering. In Britain, national capital (including agricultural land) was worth 7 times the national income in 1700; it decreased in the first half of the twentieth century, down to 2-3 times the national income, and rose again since 1950: it was slightly above 3 times in 1970 and is now between 5 and 6 times the national income. For France, we have a similar trend and slightly higher figures. In Germany, in 1870 the capital/income ratio was about 6.5 and then followed once again a similar trend, at a lower level [*Ibidem*, pp. 26 and 116-117]. To sum up, in XV century Tuscany the capital/income ratio was below the one in XVIII century England and France; however, the shares of income going to capital and wage were similar (and similar to early XVI century Holland too). This means that, in relative terms, the share going to capital was higher in XV Tuscany, than in XVIII century England and France. In these two countries, also the shares going to capital in the 1970s-1980s years were higher than in the XVIII century, but lower, nonetheless, than in XV century Tuscany. If

our estimates are reliable, in the very long run – from the Middle Ages to modern times – in some cases the share of income going to capital may have decreased, rather than increased.

But above all, our results support the thesis that XV century Florence was a special case, even by Medieval standards, as argued among the others by Epstein [1991]. Following the Black Death, and roughly until the 1430s, the city government strongly increased taxation over the Contado [Epstein, 1994a]. Unlike other Italian regional states (Milan, for instance [Chittolini, 1979]), in Tuscany Florence did not face serious non-urban opposition, coming from seigneurial power in the countryside. Once the rival towns were subdued, the city government was free to reorganize the economic and fiscal relationships inside the regional state in an extractive manner: to draw income from the countryside as well as from the subdued towns [e.g. Brown, 1982], towards the elite of the capital city. However, at the local level in many cases economic and fiscal structures were left untouched, as long as they did not harm the interests of the Florentine's government: these in turn favored the elites of the other towns, to the detriment of their countryside laborers [Epstein, 1991]. As a result, regional economic integration was relatively low, exploitation high, with most of the income going to capital (mostly land) rather than to wages (including sharecrop).

In broad, comparative terms, our results therefore confirm the view that the relative decline of the Tuscan economy, in the decades following the Black Death, was not due to a change in the elites' culture towards aristocratic values [Jones, 1978; but see also Romano, 1972]. Rather, the changing economic conditions as a consequence of the Black Death (lower demographic pressure) led various groups to take advantage of the evolving institutional structure with the aim of exploiting more heavily the countryside laborers, to the benefit of the urban rentiers [Epstein, 1996, 2000].

It is worth noticing that our results are also in line with the figures for XV century Tuscany coming from historical, coeval sources. In 1440, just a few years after the Catasto, Lodovico Ghetti proposed an estimate of Florentine product, in order to achieve an ambitious reform of the tax system [Rutenburg,

1988]. Unfortunately the original calculations by Ghetti – which according to the author were based on highly detailed, and reliable, information – were lost; only the final report survived [in Roscoe, 1816, Appendix I]. From that, for what concerns the methodology we may guess that Ghetti's estimations are based on production, rather than on consumption. According to the author, in 1440 the total product of the Florentine republic amounted to 4.69 million florins: 1.03 million florins from manufactures (that is, major, middle and minor guilds, which also included some tertiary professions, and related services), 2.08 from agriculture, 1.29 from food manufactures, 240 thousands from other activities (soldiers, beggars, prostitutes), 50 thousands from judges, knights and similar. This figure is then divided by a population that Ghetti assumes to be about 4 hundred thousands, significantly higher than the one reported in the Catasto (302,101): the per capita product would be 11.7 florins, much lower than ours (16.5). However, Ghetti's population estimate is very rough: it is apparently based on the view («It seems to me, and it is said that»)[5] that there are 80 thousand voluntary soldiers in Florence, then on the assumption of four more inhabitants (women, children, old), on average, for each voluntary soldier. If we take instead the (more reliable) Catasto's figure for the population, we have a per capita income of 15.5 florins, almost the same as ours; the slight difference can be due to the fact that Ghetti's calculations, as usually in pre-modern sources, may have underestimated the service sector. In any case, Ghetti's figures are below ours: it seems improbable that our results underestimated Florentine per capita GDP; rather, it is more plausible that the previous available GDP figure for the Centre-North of Italy [Malanima, 2011] overestimated it, as we will argue below.

[5] In the original XV century Italian: «Et intorno a questo che a me pare, et per alcuni intendenti si dicie, che la città di Firenze, col suo territorio, facci huomeni ottanta mila di guardia» [Roscoe, 1816, Appendix I, p. iv].

5. International Comparisons

How wealthy was Tuscany in 1427 compared with other parts of Western Europe? The comparison with England is rather straightforward. The study by Broadberry *et al.* [2012] has produced series of nominal GDP per capita, which for convenience can be transformed in an estimate of the value of GDP in grammes of silver (2.02 pound sterling at 212 grammes per pound). The same can be done with the estimate for Tuscany in 1427 (17.40 florins at 30.1 grammes of silver per florin). We also compare with Holland in these years; however, we do not have a time series of Holland's GDP in nominal prices at our disposal, but have reflated the available real GDP per capita series with an index of the cost of living (based on Van Zanden 2005) (see Table 1). In nominal terms Tuscany has the highest GDP per capita, followed by Holland and England (92% and 79% of the Tuscany level respectively). These nominal values have to be corrected for differences in purchasing power. Bob Allen [2001] has estimated the costs of a standardized consumption basket for these years (and on the basis of the Holland price data, we have extended the Amsterdam series back to 1400). His data suggest that, contrary to what usually is the case (namely that regions with high levels of income also have a high price level), the cost of living in Tuscany was about 80% of that of England; prices in Holland would be about 8% higher than in England. According to the alternative set of estimates of the costs of a similar basket of consumption goods by Malanima [2013], prices in Tuscan are slightly higher than in England. Ironically, when we use the Allen PPPs the difference in GDP per capita is more or less consistent with Malanima's work (Tuscany is about 58% richer than England), but applying the Malanima estimates of the PPPs leads to a much lower gap (of about 20%). For Holland we do not have the alternative Malanima PPPs; making use of the Allen-style PPPs results in a level of GDP per capita that is 8% higher than the English level and 32% lower than Tuscany in the same year.

Table 5. *GDP of Tuscany in comparison with England and Holland*

	England 1423/32	Tuscany 1423/32	Holland 1423/32
GDP pc in local currency	2.02	17.4	20.1
Silver weight	212.38	31.1	24.9
GDP pc in grammes of silver	429	542	500
PPP consumption basket			
Allen	1	0.80	1.08
Malanima	1	1.05	
This study	1	1.06	1.11
Real GDP pc			
Allen PPPs	100	158	108
Malanima PPPs	100	120	
This study PPPS	100	119	105

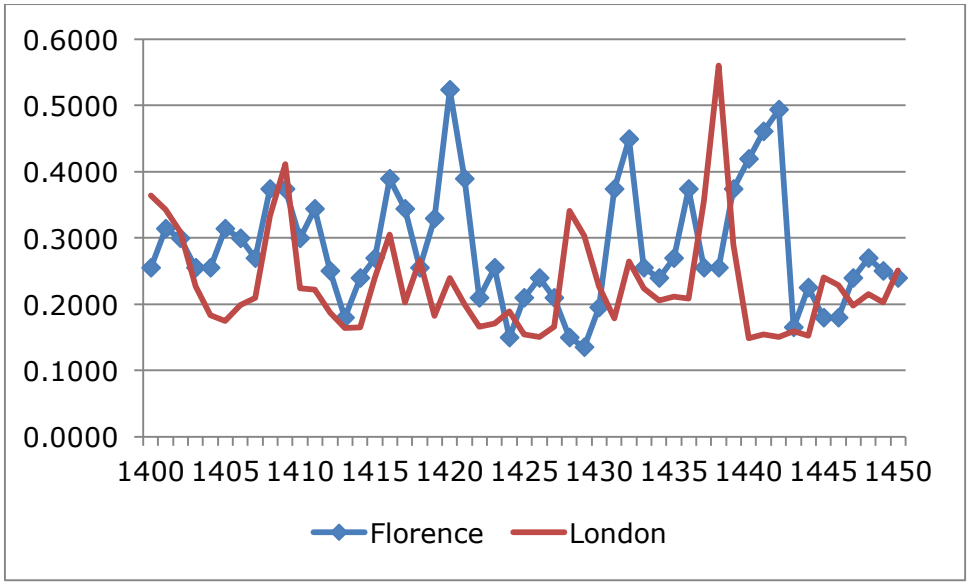
Sources: see the text.

What can be said about the plausibility of these two alternative PPPs – Malanima's and Allen's? We can easily compare the price of the most important foodstuff, wheat. Figure 1 presents the data for London and Florence, showing that usually London prices were below those in Florence, but in the second half of the 1420s there was a peak in London prices and a through in Florentine prices. Utrecht prices, not shown here, were almost always higher than the other two cities, as the Netherlands in this period developed in a large net importer of wheat and rye from abroad (from Northern France initially, later on from northern Germany and the Baltic). Textile prices collected by John Munro also suggest that prices in England may have been lower than those in Italy, consistent with the fact that England was a major exporter of textiles to the Mediterranean, including Italy [Munro 2011]. Other food prices show a mixed picture: English butter [Clark 2007] was 23% more expensive than Tuscan olive oil (average for 1400-1450) [Tognetti, 1955]; Holland butter prices were only a few percent cheaper [Van Zanden, 2005]. Beer prices per litre in London were, according to the data collected by Allen and Tognetti, 27% of the wine prices in

Tuscany, but in the budget estimates put together by Allen one litre of wine equals 2.7 litres of beer [Allen 2001], which would still make English beer cheaper by a margin of 28% (again average prices 1400-1450). If we tentatively weight these four prices (wheat 40%, textiles, butter/oil, beer/wine each 20%) we can estimate that relative prices in England are 6% lower than in Italy, close to the PPPs calculated by Malanima. Prices in Holland were about 11% higher than in England.

This implies that GDP per capita in Tuscany was, in real terms, only about 20% higher than in England, and only 13% higher than in Holland. Needless to make the point that these results are very different from the estimates of the Maddison project so far, according to which Northern Italy was at least 50% more wealthy than England and Holland.

Figure 1. *Wheat prices in London and Florence in grammes of silver per litre, 1400-1450*



Source: Tognetti [1995], Allen [2001]

The international comparison points at a much smaller gap in terms of GDP per capita between Tuscany on the one hand and England and Holland on the other, than proposed by the Malanima series as they fit into the Maddison framework. This is a surprising result, as it seems to conflict which what we

know about the material culture of Tuscany versus England and Holland. Florence was the centre of the Renaissance, and its culture was characterized by very high levels of spending by the city elite, the driver of the florescence of the arts on this period. In the XV century neither Holland nor England achieved a comparable level of material culture, although neighboring Flanders may have come somewhat closer.

To explain the paradox we have to turn to the comparison of the relative productivity or income in the various sectors of the economy (Table 6). Remember that Epstein [1991, 1993, 1994] argued that the immobility of factor markets due to institutional inefficiencies hindered the process of structural transformation of the Tuscan economy. Table 6 shows that he had a point: the differences between agriculture on the one hand and industry and services on the other hand in Tuscany were much larger than in England and Holland. In particular the Holland economy is characterized by very small disparities, reflecting the well-functioning labour and capital markets of the region, and the underlying well developed institutional framework [De Vries and Van der Woude, 1997; Van Zanden *et al.*, 2012]. It is perhaps also significant that in England it is the manufacturing sector which has the highest productivity (which perhaps pre-shadows the development into the 'first industrial nation'), whereas in Holland the services sector (dominated by international services) is the most productive. Tuscany fits the second pattern, but the gap between services and agriculture is much more extreme than in Holland or England. And it is most likely that these estimates still underestimate the differences within the Tuscan economy, as they are based on the doubtful assumption that wages in the cities and in the countryside are the same!

Table 6. *Relative productivity/income of agriculture, industry and services in late Medieval economies*

	Tuscany: income per head	Tuscany: output per head	England 1381	England 1522	Holland 1514
Agriculture	53	67	80	71	80
Industry	113	113	150	165	103
Services	213	167	109	104	136
Total	100	100	100	100	100

Source: see the text.

Table 6 also points to another part of the explanation of the paradox: in Tuscany contrasts between city and countryside are exacerbated by the large income streams from agriculture to the cities (and in particular Florence). This increases the income of the urban elite – which spends it on the conspicuous consumption that gives rise to the Renaissance – and depresses rural incomes. The fragmented structure of the Tuscan economy that is evident from Table 6, also helps to explain why the Malanima estimates may overstate the level of GDP in these years. The ultimate basis of these estimates are the series of the real wages of urban construction workers in Florence, which are part of the 'privileged' part of the economy. When economies are integrated, urban wages can reflect output and income in large parts of the economy – including the agricultural sector, where, in principle, labourers have the option to become an urban wage worker. In such economies the real earnings of the unskilled labourers in the cities are linked to the (marginal labour) productivity of agriculture; and, of course, the urban wages of the capital city are linked to the wages of the other cities. In fragmented economies where labour and capital is immobile, such assumptions do not hold: real wages in the cities will tend to overestimate income and productivity in the countryside; and real wages in the capital city will tend to overestimate income and productivity of the entire urban sector.[6] The result is that GDP estimates based on the demand approach, and on

[6] In Malanima's reconstruction, as mentioned the Florentine bricklayers' wages are used to proxy the urban wages of the entire Centre-North of Italy. For our period of concern, the only possible comparison is with Venice – arguably another exceptional case – since the other available series (Genoa, Milan) only begin later on (in 1500 and 1600, respectively): from 1380-90 to 1490-1500, when the comparison is

wages series from the capital city, will have the tendency to overestimate the level of GDP per capita. This is not only relevant for understanding the Tuscan case (and the paradox outlined above), but looks as an important conclusion for similar work on other 'fragmented' economies (compare Deng and O'Brien [2016]).

6. Conclusions

In this article we have produced GDP figures for the Tuscan economy in the late Middle Ages, based on highly reliable sources, in particular the Florentine Catasto of 1427. Our work provides support for the institutional explanation about the performance of the Tuscan economy in that period, and sheds new light on the history of Renaissance Florence with respect to other regions of the Western world. At the same time, it suggests a possible solution for the 'puzzle' of Italian GDP in pre-industrial times – that is, for the fact that the available GDP series [Malanima, 2011] are based on reliable sources, but turn out to be high by international standards and in contrast with some well-known historical facts about the Italian economy in the XIV-XVII centuries. The institutional interpretation for the Tuscan economy in the late Middle Ages and the suggested solution for the GDP puzzle are mutually consistent, helping to put this crucial part of Europe into a broader comparative context.

According to our estimates, by the early XV century Tuscany was in per capita GDP, in real terms, only slightly above England (maybe less than 20%), and smaller less above Holland (maybe around 13%); this gap is much smaller than the one resulting from the previous available GDP series, produced by Paolo Malanima for the Italian Centre-North, when fit into the Maddison project.

Our results point to a fundamental institutional difference, between Tuscany on the one side, and England and Holland on the other. As suggested in pioneering works by Epstein [1991], the former was characterized by high

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possible, the Pearson correlation coefficient between the ten-year bricklayer series of Florence and Venice is barely 0.448 [our calculations from the data in Malanima, 2002, pp. 418 and 420].

extractive rates in favor of the elite of capital city, to the detriment of the subdued cities and, most of all, of the countryside. This led to underdeveloped markets for labor and capital in the countryside, which sharply contrasts with what we know about Holland and England, where mobility of labour and capital was much higher. In Tuscany, these blockades to market functioning in turn resulted into very low productivity in agriculture, slow transformation (high share of labor in agriculture) and, possibly, lower demographic and economic growth. The high extractive rate by the capital elite also brought about a very high income per head in industry and above all in services, as compared to agriculture, even higher than the one observed in output per head. This may also explain why, in spite of a small difference in per capita GDP, Tuscany boasted a much richer material culture with respect to England and Holland, as testified by the florescence of the arts in the capital city at that time: the exceeding income was invested in beauty.

The peculiarity of Tuscany's institutional pattern – which arguably stood out also with respect to other Italian territories, such as Lombardy and Sicily [Epstein, 1993] – also helps to explain why the Malanima series may have overestimated Italian GDP for that period: they are partly based on the real wages of the construction workers from the capital city, which may not be a good proxy of the entire urban sector, for a fragmented economy where labour and capital were immobile as Tuscany was; let alone for the entire Centre-North of Italy. This conclusion may be a useful result for other 'fragmented' economies as well: cautiousness is warranted when it comes to extend hypotheses through time and space, institutional idiosyncrasies having to be properly considered.

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