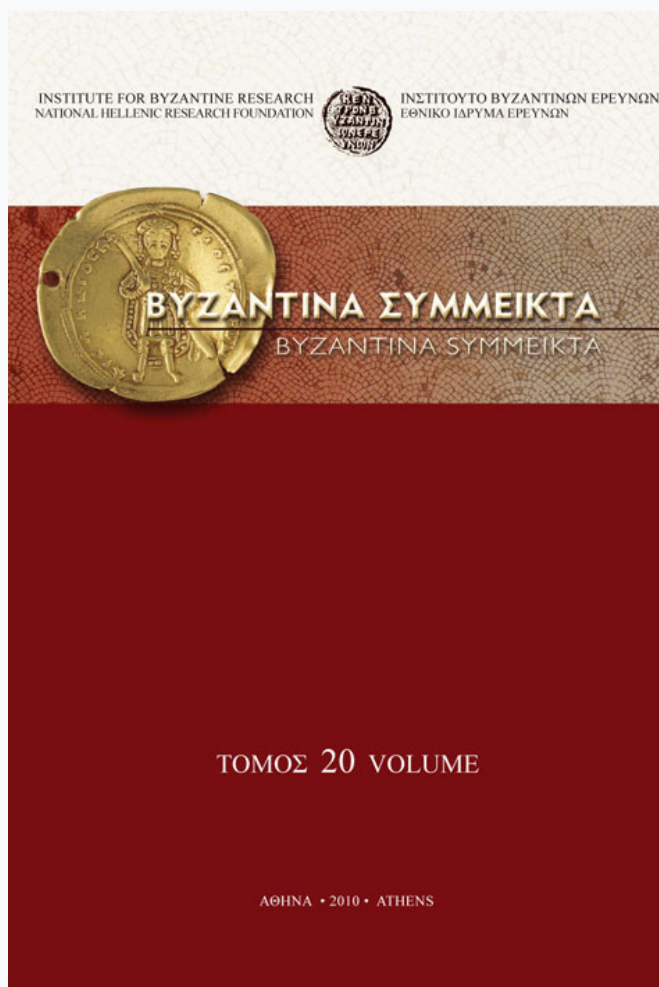


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Hierarchies and fractals: ecclesiastical revenues as indicator for the distribution of relative demographic and economic potential within the cities and regions of the Late Byzantine Empire in the early 14th century

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HIERARCHIES AND FRACTALS: ECCLESIASTICAL REVENUES AS INDICATOR
FOR THE DISTRIBUTION OF RELATIVE DEMOGRAPHIC AND ECONOMIC
POTENTIAL WITHIN THE CITIES AND REGIONS OF THE LATE BYZANTINE
EMPIRE IN THE EARLY 14TH CENTURY¹

Introduction

Prior research regards the time from the 11th century onwards as a period of general decline for the Byzantine Empire, culminating in the conquests of Constantinople in 1204 and 1453. However, studies in recent decades have made clear that the demographic and economic growth which began in the 9th century (after a period of economic, demographic and urban contraction from the 6th century onwards²), continued until the second half of the 13th century, especially in the regions of South-eastern Europe and Western Asia Minor³. In comparison to its provinces, the economic supremacy and the power of the imperial centre of Constantinople decreased⁴. At the same time, the enlarged economic potential of the periphery made it possible for the Byzantine elite to establish new power bases after the fall of Constantinople to crusaders in 1204 (Nicaea in Western Asia Minor, Epiros in Western Greece, Trabzon in North-eastern Asia Minor). From there the re-conquest

1. This study was undertaken as part of the Project “Patriarch Antonios IV. von Konstantinopel, 2. Amtsperiode” which is financed by the Austrian Science Fund (FWF; project P22269); project director is Prof. Otto Kresten (Vienna).

2. LAIOU – MORRISSON, *Byzantine Economy*, 38-49.

3. HARVEY, *Economic expansion*. LAIOU – MORRISSON, *Byzantine Economy*, 90-170.

4. LAIOU – MORRISSON, *Byzantine Economy*, 130-132.

of the capital succeeded in 1261. But despite the expulsion of “Latin” rule from Constantinople, the establishment of “Frankish” feudal states and colonies, such as the Italian city states of Venice and Genoa in the “Romania”, became a permanent fact. (Other colonies included those in Crete and other islands of the Aegean, and ports at the coasts of Greece, Asia Minor and the Black Sea). The latter phenomenon implied for Byzantium that the Empire was relocated from the centre of its own economic sphere to the periphery of a late medieval “World-system” dominated by the northern Italian trade centres. However, the presence of Venetian, Genoese and other Western merchants, not only in their overseas territories but also in all important seaports and cities which remained within the Byzantine sphere of power (partly since the late 11th century), brought further economic incentives for these regions. In the process, the distribution of economic potential within these provinces once more changed according to the interests of the Western merchants⁵. The relevance of formerly medium or minor urban settlements in the European provinces increased similarly for the Byzantine Empire, as it lost most of its territories in Western Asia Minor to various Turkish Emirates, among them the Ottomans, during the late 13th and early 14th centuries. Byzantium became a regional power in South-eastern Europe, with its most important provinces in Thrace, Macedonia and parts of the Peloponnese (all-together still more than 100,000 km², but certainly on a smaller scale than in previous centuries⁶). These areas were also affected by invasions, such as the raids of the Catalan Company, which devastated the Thracian and Macedonian regions in the years 1305 to 1309, and menaced by neighbouring Bulgaria and Serbia; they hence became the theatre of the Byzantine civil wars of the 1320s. At the same time, a certain demographic and economic contraction had already taken place. This, we can presume, was not only because of these external factors, but also partly due to the limits of the use of marginal land⁷. However, in the decades before a second

5. KAZHDAN, *The Italian*, 5-6, 20-21. LAIOU – MORRISON, *Byzantine Economy*, 138-146, 168, 201.

6. Cf. also LAIOU – MORRISON, *Byzantine Economy*, 167-168, on the “small-scale” economy of Late Byzantium.

7. LAIOU-THOMADAKIS, *Peasant Society*, 226, 254, 261. LAIOU, *The Agrarian*, 314-317. LEFORT, *Société rurale*, 167-200 (on the example of the village of Radolibos), and 229-247 (on the demographic developments in eastern Macedonia). LAIOU – MORRISON, *Byzantine Economy*, 169-170, 181-182. PAMUK, *Black Death*, 293.

wave of civil wars (which began in 1341), the Black Death⁸ and the permanent establishment of Ottoman Power in Europe (1352) destroyed all hope, a consolidation of Byzantine power in the southern Balkans still seemed possible. Focusing on this period in the early 14th century, our paper aims at illuminating the character of urban hierarchies and the relative regional distribution of demographic and economic potential in the territories then still under Byzantium's control. For this purpose, we will make use of original Byzantine sources on ecclesiastical administration and revenues, demonstrate their significance for our research question and, finally, analyse them with the help of two classical models of economic geography.

1. Ecclesiastical wealth in Byzantium

As it was in medieval Western Europe, the share of the church in the "national" wealth of Byzantium was significant. Its possessions included real estate in the countryside as well as in urban communities, ranging from single households and buildings to whole villages, whose *paroikoi* (dependent peasants) would pay their rent and tax to their ecclesiastical overlord⁹. Our documentation is especially rich for the great monasteries such as those on Mount Athos. The Megiste Laura, for instance, in 1321, was the owner of 185,000 *modioi*¹⁰ (c. 18,500 hectares) in Macedonia and on the island of Lemnos¹¹. While most bishoprics could not compete with this amount of property¹², very rich metropolitan sees did exist: according

8. KAZHDAN, *The Italian*, 21-22. Cf. also PAMUK, *Black Death*, for some of the long-term consequences of the 14th century plague epidemic, also for the regions of the Byzantine and Ottoman Empires.

9. HERMAN, *Abgabenwesen*, 435. On the status of the *paroikoi*, which became very common since the 10th century, cf. *ODB*, v. 3, entry *Paroikos*, 1589-1590 (M. C. BARTUSIS).

10. The *terminus modios* denotes several square measures (ranging from 888,73 to 1279,78 sq. m.) as well as measures of capacity (ranging from 11,389 to 17,084 liters, the latter figure for the most important *thalassios modios*) in Byzantium, cf. SCHILBACH, *Metrologie*, 59-67, 95-109. *ODB*, v. 3, entry *Modios*, 1388 (E. SCHILBACH – A. KAZHDAN), 1388. MORRISON – CHEYNET, *Prices*, 817.

11. LAIOU, *The Agrarian*, 350. SMYRLIS, *La fortune*, 55. LAIOU – MORRISON, *Byzantine Economy*, 173-174.

12. Since the Council of Chalcedon 451, every bishop had to entrust an *oikonomos* with the administration of the property of his bishopric. These *oikonomoi* can also be found in the Palaiologan period in metropolitan as well as in suffragan bishoprics, cf. DARROUZÈS,

to a charter from the year 1301, the possessions of the metropolitan of Monembasia in the Peloponnese included eight villages, two monasteries inclusive of property, houses in the city of Monembasia itself as well as manors, watermills and vineyards in 14 other villages in the surrounding area. The church of Monembasia also had the right to buy the harvest of kermes (*prinokokkion*), which were used as dyestuff, from various villages¹³. The metropolis of Ioannina in north-western Greece (Epiros) owned 9 and a half villages, farms, watermills and fishponds in more than 10 localities. It had the right to exact toll dues from several groups of *Vlachoi* (pastoral people, who spoke a Romanic language¹⁴), as well as Jews and, as we know from an imperial privilege dated June 1321¹⁵, it was entitled to hold a market. More modest were the possessions of suffragan bishoprics such as Stagoi in Thessaly (Metropolis of Larissa), which were enumerated in a chrysobull of Emperor Andronicus III of March 1336. They included the bigger part of the land and the revenues of the village of Kulbentzion (a part of the landed property there was estimated to be 1,000 *modioi*) as well as significant property in the village Palaiokeastron, including gardens and watermills, as well as three monasteries¹⁶.

Besides the income from immovable property, the bishop had the right to collect various levies from the laity, clerics and monks, which had been made mandatory in the 10th and 11th centuries. Such duties (*kanonika*) included tolls in cash as well as in kind, depending on the population of a village. Charges were also levied for obtaining the necessary marriage license and obligatory gifts on special holidays¹⁷. In addition to the *kanonikon* that

Ὀφφίκια, 101-103, 303-309. KRAUS, *Kleriker*, 203-260. PREISER-KAPELLER, *Episkopat*, XXXVII-XXXVIII. See also LEFORT, *Société rurale*, 315-342, and SMYRLIS, *La fortune*, 209-238, for information on the accounting in ecclesiastical institutions.

13. MM, v. 5, 161-165. DÖLGER, *Regesten*, no 2236. LAIOU, *The Agrarian*, 323.

14. Cf. also LAIOU, *The Agrarian*, 325-326, on animal husbandry in Epiros.

15. MM, v. 5, 84-87. DÖLGER, *Regesten*, no 2460; at the same time also the city of Ioannina itself received extensive privileges, cf. LAIOU – MORRISON, *Byzantine Economy*, 197.

16. MM, v. 5, 270-273. DÖLGER, *Regesten*, no 2825.

17. HERMAN, *Abgabenwesen*, 436-444, 460-462, 465-468, also on the sources for these tolls. According to a law of Emperor Alexios I Komnenos (September 1100, cf. RALLES – POTLES, v. 5, 280-281. DÖLGER, *Regesten*, no 1214b) from a village with 30 households for instance, the bishop should receive one hyperpyron, two silver coins, one ram, six *modioi* of barley, six *metra* of vine, six *modioi* of wheat flour and 30 chickens as *kanonikon* per annum.

was collected by the bishop from the priests of his diocese, members of the clergy had to pay certain dues on the occasion of their consecration by the bishop, despite several prohibitions on this matter¹⁸. A final, non-negotiable source of revenue was the annual *kanonikon* or *kaniskion* (in cash and in kind) from the monasteries which were under the jurisdiction of the bishop. Numerous conflicts over these rights, especially between local bishops and those monasteries which tried to evade the bishop's authority by subordinating themselves directly to the (more remote) Patriarch in Constantinople¹⁹, clearly demonstrate the relevance of these dues.

It is evident that, by means of these properties and tolls, the Byzantine ecclesiastical administration theoretically took a share of the economic output of almost the entire population of a bishopric, not only of those *paroikoi* living in the villages of the bishop. Thus, the size and amount of ecclesiastical property and income should allow for some conclusions on the economic potential of a certain region. This observation has already been made in many studies for the medieval West²⁰.

2. The dimension of ecclesiastical wealth and the contribution list of 1324

In contrast to Western Europe, we very seldom obtain concrete figures on the amount of ecclesiastical revenue from the byzantine sources. One has also to keep in mind that monasteries and bishoprics received revenues

The same law prescribes, that for marriages, the bridegroom was required to give one hyperpyron to the bishop, the bride a piece of drapery of 12 cubits length.

18. HERMAN, *Abgabenwesen*, 445-460. According to the law of Emperor Alexios I mentioned in note 17, an *anagnostes* (lector) was required to pay one hyperpyron for his ordination, a deacon or a priest three hyperpyra. This provision we also find in a regulation of Patriarch Nikolaos III Grammatikos (1086 or 1101. Cf. RALLES – POTLES, v. 5, 60. GRUMEL, *Regestes*, no 970), in which it is also prescribed that every priest should pay one hyperpyron per year to his bishop.

19. HERMAN, *Abgabenwesen*, 447-457. We do not possess a general regulation for the amount of the *kanonikon* of a monastery. In the *typos* of Emperor Michael VIII Palaiologos for the Monastery of Hagios Michael on Mount Auxentios (1261/1281) for instance, the annual *kaniskion* to the metropolitan of Chalkedon accounts for a value of three hyperpyra, in addition to three pounds of wax (cf. *Typika*, v. 3, 1218 [no 37]. DÖLGER, *Regesten*, no 2065).

20. See for instance, CAMPBELL, *Benchmarking*. See also EPSTEIN, *An Economic*, 37-38.

in cash as well as in kind²¹, as is illustrated in some regulations from the imperial charter for the church of Ioannina. As mentioned above, the Metropolis had the right to hold a market; half of the revenues from this market belonged to the metropolitan, while the other half to the clergy of the metropolis. The clergy also received annually 300 *modioi* (ca. 5,125 liters) of grain (*sitokrithon*), one barrel of wine and 50 hyperpyra²² from the revenues of the church²³.

From the late 13th and early 14th century, we have information on the annual revenues (*posotes*) of entire villages in various regions. However, these figures vary between 77.5 hyperpyra, 104 hyperpyra, 109 hyperpyra and 202 hyperpyra, 215 hyperpyra or 240 hyperpyra²⁴. A normal soldier at this time would receive a *pronoia* (a grant of a certain amount of tax revenues for his military service) with a *posotes* of 24 or 36 hyperpyra, a cavalryman of the great *allagion* of Thessalonike of 70-80 hyperpyra²⁵. Statistical evaluations of Byzantine charters, especially from the area of Macedonia, permit us to draw the conclusion that in the early 14th century the tax a *paroikos* paid to the landlord was usually estimated at one hyperpyron per 50 *modioi* of average quality cropland. This would be an average size for one household and theoretically represents 1/24 of the value of the land and c. 20 % of the total revenue²⁶. For the landlord, of course, there existed the possibility of

21. Cf. SMYRLIS, *La fortune*, 219-227, on «la commercialisation du surplus».

22. The Late Byzantine standard gold coin (hyperpyron, 4,55g) equalled at this time still the Italian ducat and florin. After 1350, one gold ducat equalled two hyperpyra, cf. MORRISSON – CHEYNET, *Prices*, 816-817.

23. MM, v. 5, 84-87. DÖLGER, *Regesten*, no 2460. An insight into the praxis of the provision of clergymen from the property of a metropolitan see provides the accounting records of a functionary of the church of Thessalonike from the period of metropolitan Symeon (1416-1429). He received various sums every month (two, three, five or six hyperpyra) from the income and rents of various realties of the metropolis, cf. KUGEAS, *Notizbuch*, 143-163, esp. 156-159 for an analysis.

24. DÖLGER, *Regesten*, nos 2023 (December 1279), 2392 (September 1317), 2357 (1315), 2357 (1315), 2208 (June 1298). Cf. also LAIOU-THOMADAKIS, *Peasant Society*, 65. MORRISSON – CHEYNET, *Prices*, 821.

25. DÖLGER, *Regesten*, nos 1994 (1272), 2394 (1317). BARTUSIS, *Army*, 157-190. MORRISSON – CHEYNET, *Prices*, 862. OIKONOMIDES, *The Role*, 1045. Cf. also *ODB*, v. 3, entry *Pronoia*, 1734 (M. C. BARTUSIS).

26. LAIOU-THOMADAKIS, *Peasant Society*, 159, 176-180, 256-257, 265. LEFORT, *Société rurale*, 25-62. LAIOU, *The Agrarian*, 329-333, 341-345. OIKONOMIDES, *The Role*, 1004, 1033-1034. LAIOU – MORRISSON, *Byzantine Economy*, 107, 178.

a higher yield through other arrangements like sharecropping and other forms of cultivation²⁷, which involved the division of output between him and the *paroikoi*. A vineyard of 15-20 *modioi* could therefore bring in as much as 200 *modioi* of wheat-growing land; its tax was calculated with one hyperpyron per 4-6 *modioi*. As Mark C. Bartusis has stated, “the true economic value of a *pronoia* grant exceeded its official *posotes* by a factor of at least two or three”²⁸.

These figures may give us an impression of the possible size of income from landed property, but even from our most detailed documents on the wealth of a bishopric (already mentioned above) we learn almost nothing about the *posotes*, the population or the amount of land of the villages which belonged to the church. Did the eight villages of the metropolitan of Monembasia bring in 400, 800 or 1,600 hyperpyra? The bishop of Stagoi's 1,000 *modioi* in the village of Kulbentzion could have yielded 20 hyperpyra per annum, twice that sum or even far less (if the land was of poor quality or not wholly cultivated).

For the early 14th century at least, we have some figures on the amount of income a bishop could obtain from a suffragan bishopric. In 1305, metropolitan Nikephoros Moschopoulos of Crete (where he could not reside because of the Venetian occupation of the island) was assigned an annuity of 200 hyperpyra out of the revenue of an unnamed vacant suffragan bishopric of the metropolis of Monembasia. The annuity served as compensation for the loss of payments Nikephoros had once received from the revenues of the vacant metropolis of Methymna (on the island of Lesbos). These revenues had been re-allocated to the Metropolitan of Sardeis. Presumably these revenues could not have exceeded those from Nikephoros' new source of income, otherwise he would not have accepted this arrangement²⁹. The deposed metropolitan of Philippi (in Macedonia) in 1339 was granted a payment of 100 hyperpyra per year from the revenues of the vacant bishoprics of Ioannitza and of Hyperpyrakion, both suffragans of the metropolis of Philippupolis (modern-day Plovdiv in Bulgaria), by the

27. LAIOU, *The Agrarian*, 349-350. OIKONOMIDES, *The Role*, 1003, 1046.

28. BARTUSIS, *Army*, 172-173. MORRISON – CHEYNET, *Prices*, 836, 839. OIKONOMIDES, *The Role*, 1034.

29. PAPADOPOULOS-KERAMEUS, *Μοσχόπουλος*, 215-223, esp. 217-219. LAURENT, *Regestes*, nos 1625, 1627.

synod in Constantinople³⁰. These sums assumedly represent that share of the bishoprics revenues of which a holder of the see could dispose after all necessary expenses for the clergy, the buildings, the liturgy, et cetera had been covered. They also give an impression of the amount considered sufficient for the sustainment of a metropolitan: 200 hyperpyra, for instance, approximately three times the *pronoia* of a heavy cavalryman of the Byzantine Army (see above).

For the Western church in the 14th century, a very important source for assessing the economic potential of dioceses and monasteries are the records (*libri obligationum*) on the various dues which all bishops and abbots had to pay once on the occasion of their recognition by the papacy in Rome, or Avignon³¹. The dues to be paid in each location, *servitium commune* and *servitia minuta* respectively, amounted to one third of the annual revenues if these were above 100 florins.

In the Byzantine church, bishops usually did not have to pay such dues to their metropolitans (or the metropolitans and archbishops to the Patriarchate)³². However, this changed in the early 14th century when the Patriarchate attempted to compensate for losses in revenues caused by the Turkish expansion in Asia Minor and by the devastations in the European provinces at the hands of the Catalans. Patriarch Niphon, the former metropolitan of Kyzikos, was the first who did this by directing revenues from metropolitans and archbishoprics to the Patriarchate. In 1310, Niphon had the synod granting him the revenues of his former eparchy of Kyzikos (which was actually one of the richest, as we will see), the archbishopric of Proikonnesos and the metropolis of Traianupolis with its suffragan bishopric Makre and the nearby monastery of Bera. In addition to these he was later granted revenues from the vacant metropolitan sees and archbishoprics of Thessalonike (the second largest city in the Empire), Berroia (in Macedonia), Maroneia, Philippupolis, Rhusion, Selymbria, Derkos (all five in Thrace) and the island of Lemnos. Our source does not give a sum for the revenues from this considerable number of churches, but Niphon obviously

30. *Register* II, no 121. DARROUZÈS, *Regestes*, no 2190.

31. HOBURG, *Taxae*, esp. x-xv. RENOARD, *Les relations*, 20-31. GUILLEMAIN, *Der Aufbau*, 53-62.

32. HERMAN, *Abgabenwesen*, 438.

exaggerated his zeal to balance the Patriarchate's budget. Opposition in the synod grew, and in 1314 he was deposed³³. But in July 1315, the synod once more had to assign two thirds of the revenues from the still vacant metropolis of Kyzikos to the new, more modest Patriarch John XIII Glykys for his lifetime. In addition, the Patriarch received the income of the vacant archbishopric of Proikonnesos, of the metropolis Philippupolis and of the metropolis Traianupolis and its bishoprics. Again, the document does not provide any information on the amount of these payments³⁴. However, to permanently deprive certain bishoprics of a genuine bishop for the benefit of the Patriarch's treasury was problematic from the point of view of canon law. Thus in September 1324, after John Glykys' death in 1319 and following the short term of office of Gerasimos I (1320-1321) and a two year vacancy on account of the first war between Emperor Andronicus II and his grandson Andronicus III, the synod decided on a more durable solution for the benefit of the new Patriarch Isaiah and his future successors. Because of the state of emergency in the Patriarchate, the members of the synod decreed that "those metropolises and archbishoprics, which are prosperous (*euporousai*) and capable" should each henceforth pay a fixed sum every year to the Patriarchate until its own revenues would become sufficient again³⁵. The document, which was copied into the Register of the Patriarchate of Constantinople, includes a list of the annual contributions of 33 metropolises and archbishoprics which were considered "capable" of supporting the Great Church; the total amount is 3208 hyperpyra (see table 1)³⁶.

33. Choumnos, Ἐλεγχος, 278-282. DARROUZÈS, *Regestes*, nos 2010, 2011. PREISER-KAPPELLER, *Episkopat*, LXIX-LXX.

34. *Register* I, no 4, l. 24-38. DARROUZÈS, *Regestes*, no 2032.

35. *Register* I, no 88, ll. 24-40. DARROUZÈS, *Regestes*, no 2119.

36. *Register* I, no 88, ll. 39-73. In the Greek text, the churches are of course listed according to their hierarchical rank, whereas here they are listed according to the amount of their payment.

Table 1: Contributing bishoprics from the list of September 1324, ranked according to their payment

Metropolis (M) or archbishopric (A)	Annual contribution to the Patriarchate in hyperpyra
Monembasia (Peloponnese) M	800
Herakleia and its suffragan bishoprics (Thrace) M	200
Kyzikos (Hellespont) M	200
Thessalonike (Macedonia) M	200
Serrhai (Macedonia) M	150
Philippupolis (Thrace) M	150
Adrianopel (Thrace) M	100
Ainos (Thrace) M	100
Berroia (Macedonia) M	100
Bizye (Thrace) A	100
Didymoteichon (Thrace) M	100
Mitylene (Lesbos) M	100
Philippoi (Macedonia) M	100
Proikonnesos (Sea of Marmara) A	72
Traianupolis and its suffragan bishoprics (Thrace) M	70
Lacedaimon (Peloponnese) M	60
Brysis (Thrace) M	50
Ganos (Thrace) A	50
Lemnos (Northern Aegean) A	50
Medeia (Thrace) A	50
Methymna (Lesbos) M	50
Palaiai Patrai (Peloponnese) M	40
Madyta (Thrace) M	36
Maroneia (Thrace) A	36
Melenikon ((Macedonia) M	36
Rhosion (Thrace) M	36
Xantheia (Thrace) A	36
Arkadiupolis (Thrace) (A in list, actually M)	24
Derkos (Thrace) A	24
Drama (Macedonia) A	24
Garella (Thrace) A	24
Lopadion (Hellespont) A	24
Kypsela (Thrace) A	16

This time, the members of the synod entitled the Patriarch to lay claim on a share of the revenues of churches which were not vacant; these churches also had to supply their own bishop with sufficient income³⁷. Unfortunately, the signatures of those present in the synod were not copied into the Register. However, we do have an attendance list for a synodal session from September 19th 1324³⁸. Among the names included in this list, we are likely to see those of the participants in the session who decided on the contributions to the Patriarchate: the metropolitans Athanasios of Kyzikos, Gregorios of Sardeis, Maximos of Nikomedeia, Theodulos of Chalkedon (*proedros* - administrator - of Maroneia), Ignatios of Adrianupolis, Theodosios of Melitene, Ioannikios of Pontoherakleia, Nikolaos of Prusa, Konstantinos of Pegai and Parion (*proedros* of Ganos), Gregorios of Antiocheia in Pisidia, Gregorios of Dyrrhachion (*proedros* of Selymbria), Malachias of Methymna and Archbishop Lukas of Derkos. To these we can add Dionysios of Mitylene, whose case was discussed in this session on September 19th. Thence, at least seven of those bishops affected by the new financial arrangements participated in its formation. Two of them, Theodulos of Chalkedon and Konstantinos of Pegai and Parion, whose churches had been damaged by the Turks, had already themselves received the right to administrate a church in the European parts of the Empire and to live from its revenues. As a result of the new financial arrangements they were required to share these revenues with the Patriarchate.

3. The bishoprics in the contribution list of 1324 and their economic relevance

The information we find in the Register of the Patriarchate leads us to enquire as to what further significance the numbers from the 1324 list might have for our research. First we must ask what quota of the total revenues of a bishopric these figures represent. Unfortunately, the document does not give any information concerning this matter. Similarly, we do not possess any figures for the total income of one of the churches on the list from this time. Thus, we have to look for other sources which can set these figures in a wider context.

37. Some of the bishoprics from the list may have been vacant at this time, but most of them were not, cf. the relevant entries in PREISER-KAPPELLER, *Episkopat*.

38. *Register* I, no 79, ll. 4-14. DARROUZES, *Regestes*, no 2117.

As mentioned above, the *servitia* of the Latin Church amounted to one third of the annual revenues of a bishopric. In the *libri obligationum* of the 14th century, we also find figures for Latin bishoprics, which had replaced Byzantine eparchies in Greece after 1204, as follows: the bishopric of Argos (Peloponnese) in 1311, 1325 and 1334 had to pay 100 florins to the Holy See (thus, its annual revenue was estimated at c. 300 florins); the bishop of the island of Kephallenia paid 100 florins in 1354; the archbishops of Kerkyra 300 florins in 1330, 1349 and 1350; the archbishops of Corinth the sum of 800 florins in 1307 and 1311; the archbishops of Crete 500 florins in 1334 and 1342; the archbishops of Dyrrachion 50 florins in 1344; the bishops of Methone (Peloponnese) 600 florins in 1311, 1322 and 1333; the archbishops of Nicosia on Cyprus, the richest Latin bishopric in the Eastern Mediterranean, 5,000 florins in 1312, 1333 and 1342; the archbishops of Patras (Palaiai Patrai on the Peloponnese) 1,000 florins in 1307, 1317 and 1337 (whereas his Byzantine counterpart, who resided in the small part of the diocese which had been re-occupied by the Byzantines, in 1324 could provide only 40 hyperpyra for the Patriarchate); and the archbishops of Thebes 500 florins in 1326, 1342 and 1351³⁹. These figures are comparable, in order of magnitude, to those at the top of the Byzantine list of 1324; but while the *servitium commune* was demanded on the occasion of the ordination of a new bishop every few years, the contribution to the Patriarchate was to be paid on an annual basis. Thus, one third of the annual revenues may be too high a basis of calculation for our figures. In order to decide if these figures give a trustworthy impression of the distribution of ecclesiastical income within the bishoprics, we have to look for further information on the economic potential of the churches on the list, region by region.

Peloponnese

It is surprising that instead of the second largest city of the Empire, Thessalonike, we find Monembasia in the Peloponnese at the top of the list of contributors to the Patriarchate. Also astonishing, but to a lesser degree, is the amount of Monembasia's payment obligation. As we have seen, the metropolitan was a rich landowner. Since the recapture of the city from the Latins in 1262, the see had become the most important ecclesiastical centre of the Byzantine dominion in the Peloponnese. The territory of the

39. HOBERG, *Taxae*, 13, 34, 42, 44, 48, 82, 86, 94, 374.

neighbouring older metropolitan sees of Lacedaimon and Palaiai Patrai, on the other hand, remained to various degrees under Latin occupation, which is reflected in their comparatively smaller contributions to the Patriarchate (60 and 40 hyperpyra)⁴⁰. At the same time, Monembasia became one of the most important trading centres of the Empire: its merchants were active in the entire Aegean and beyond despite the overwhelming commercial power of the Venetians⁴¹. In 1319, for instance, the value of the material damage to one ship from a Monembasia and its cargo was estimated at 2,200 hyperpyra. For another ship the estimate was 800 hyperpyra. These figures illustrate the relative wealth of merchants from the city in the 13th and 14th centuries, whose metropolitan obviously had his share of the economic potential of his bishopric⁴². As we have seen, the revenues of the neighbouring Latin archbishoprics of Patras and Corinth were of the order of magnitude of 3,000 and 2,400 florins. The income of the bishop of the important Venetian port of Methone (nominally a suffragan of Monembasia) was estimated at 1,800 florins; and in 1305, an unnamed vacant suffragan bishopric of the metropolis of Monembasia provided an annuity of 200 hyperpyra for the metropolitan of Crete (see above). Consequently, 800 hyperpyra (or c. 24.9 percent of the total sum) could very well reflect the wealth of the metropolis of Monembasia and its city, which had not been damaged by the Catalans or the civil war of 1321/1322.

Macedonia

The same cannot be said with regard to Thessalonike in Macedonia (ecclesiastical eparchy of Macedonia I, ca. 35,000 km²)⁴³, whose hinterland suffered from the Catalan Company as well as from the internal troubles of the 1320s. Similarly, “Thessalonike’s role in long-distance traffic began to decline as early as the second half of the thirteenth century”, and it was “relegated to a secondary role within the framework of trans-Mediterranean

40. KISLINGER, *Regionalgeschichte*, 66-72. PREISER-KAPPELLER, *Episkopat*, 286-297, with further literature.

41. LAIOU – MORRISSON, *Byzantine Economy*, 209-210. Cf. also H. KALLIGAS, *Monemvasia: A Byzantine City State*, New York 2009.

42. DÖLGER, *Regesten*, no 2423. KALLIGAS, *Monemvasia*, 885-886. MATSCHKE, *Commerce*, 786-787.

43. KODER, *Urban Character*, 183.

traffic”⁴⁴. Accordingly, the wealth of the second city of the Empire and its metropolis may have decreased compared to earlier times, for which we possess some references to the prosperity of the church of Thessalonike. In the 11th century, Metropolitan Theophanes of Thessalonike, for instance, was allegedly able to accumulate the huge amount of 3,300 *litrai* (= 237,600 hyperpyra) in more than ten years of office (c. 1027–1038)⁴⁵. After their conquest of the city in 1185, the Normans demanded 4,000 Hyperpyra as ransom for the metropolitan of Thessalonike on the pretext that his metropolis had an income of 100 *kentenaria* (= 72,000 hyperpyra)⁴⁶. All these figures may have been exaggerated, but they indicate an order of magnitude of revenues comparable to that of the wealthiest dioceses in the West such as Rouen in France or Winchester in England (36,000 florins per year each)⁴⁷. The turbulence of the late 12th and of the 13th century definitely reduced this wealth. However, to assume that the income of Thessalonike’s metropolis had shrunk so dramatically that it resulted in a contribution of only one quarter of that of Monembasia (almost equal to that of significantly less populated neighbouring metropolitan sees such as Serrhai) seems implausible. The relatively modest contribution may in fact reflect the importance of the city and its bishops who, especially in the 14th century, on several occasions demonstrated their willingness to fight for a special position within the framework of the Byzantine Church, even by claiming quasi-patriarchal titles⁴⁸. Accordingly, the metropolitan of Thessalonike could have negotiated a kind of “UK rebate” on the contribution to the Patriarchate.

The ranking of Serrhai metropolis appears more to scale (150 hyperpyra). Since the end of the 10th century, Serrhai was one of the more important cities of the Empire and even served as the temporary seat of royal power after its conquest by the Serbians in 1345. Ottoman tax registers from the year 1478/1479 inform us that at this time Serrhai had around 5000 inhabitants and that the revenues of the metropolis amounted to 5,435 *aspra* (c. 120.7 florins). Serrhai’s population was probably somewhat

44. JACOBY, *Foreigners*, 98-105. LAIOU – MORRISSON, *Byzantine Economy*, 206-207.

45. MORRISSON – CHEYNET, *Prices*, 869 (with sources).

46. MORRISSON – CHEYNET, *Prices*, 846 (with sources).

47. HOBERG, *Taxae*, 103, 133.

48. Cf. PREISER-KAPPELLER, *Episkopat*, 440-442, with further literature.

higher in the earlier 14th century, but the indicated sum of money certainly represents only a fraction of the metropolis' wealth before the calamitous events of the 14th century and the Ottoman conquest. Comparison with the amount of contribution in 1324 also demonstrates this⁴⁹. The neighbouring city of Zichnai was still a suffragan of Serrhai in 1324. It later became a metropolis itself and in 1479 had c. 2,500 inhabitants, with a total tax yield of 69,966 aspra (1,554.8 florins). The church of Zichnai, on the other hand, had revenues of only 1870 aspra (41.55 florins)⁵⁰.

Berroia, in Southwestern Macedonia, had been promoted to metropolis c. 30 years before the list of 1324. In c. 1309 the Catalans advanced as far as Berroia, but could not conquer the city. As we have seen, Berroia was among the bishoprics whose revenues were claimed by Patriarch Niphon, and the sum of 100 hyperpyra indicates that Berroia was one of the better-off churches⁵¹.

Much older than Berroia was the metropolis of Philippoi in Eastern Macedonia, which also contributed 100 hyperpyra. Philippoi's revenues were still sufficient to contribute to the Patriarchate, but its loss in rank in the *Notitiae Episcopatum*, the Byzantine lists of the ranking of bishoprics in the 14th century, indicates that the church was in decline in this period. Its rank and function were taken over by its former suffragan Christupolis. Interestingly, despite its climb to the rank of archbishopric (c. 1260) and metropolis (c. 1310) Christupolis is not among the contributors in 1324⁵².

A relatively young metropolis (since c. 1274) was Melenikon (modern-day Melnik in south-western Bulgaria), whose contribution of 36 hyperpyra indicates a different scale of wealth than those of the Macedonian churches we have hitherto examined⁵³. The same holds true for Drama, archbishopric since c. 1315 (and metropolis after 1341) and also in the eparchy of Philippoi, with its payment of 24 hyperpyra. The Ottoman tax register from 1478/1479

49. PREISER-KAPPELLER, *Episkopat*, 401-402. NASTUREL – BELDICEANU, *Les églises*, 272, 283-284 (also on the exchange ratio of aspra and florin at this period). HARVEY, *Economic expansion*, 199. LAIOU – MORRISON, *Byzantine Economy*, 198-199.

50. NASTUREL – BELDICEANU, *Les églises*, 273, 284-285. HARVEY, *Economic Expansion*, 199. PREISER-KAPPELLER, *Episkopat*, 487.

51. PREISER-KAPPELLER, *Episkopat*, 59-60.

52. PREISER-KAPPELLER, *Episkopat*, 87-88, 356-357.

53. PREISER-KAPPELLER, *Episkopat*, 258. POPOVIĆ, *Zur Topographie*, 107-119; IDEM, *Melnik*.

informs us that, at this time, Drama had around 1300 inhabitants with a total tax yield of 41,462 aspra (c. 921.4 florins); the income of the church amounted to 1,500 aspra (= 33.33 florins)⁵⁴. As this Ottoman tax document reveals, in 1478/1479 Drama had a fourth of the population of Serrhai and its church had about a fourth of the revenues of the larger metropolis; the contributions in our list of 1324 suggests that the ratio between revenues was 6:25 (24 to 150 hyperpyra). Altogether these comparison figures suggest that the contributions in the list of 1324 reflect differences in the revenues of the bishoprics.

In total, the bishoprics of Macedonia, one of the core regions of the Empire at this time, contributed 610 hyperpyra to the Patriarchate. When compared with the payment from Monembasia, this figure seems humble, but it may also suggest a reduced contribution of the church of Thessalonike.

Thrace

The other core Byzantine region, Thrace⁵⁵, is represented with more than half of all contributors on the list of 1324 (18 metropolises and archbishoprics) with a total amount of 1202 hyperpyra. This reflects the high density of metropolitan and archiepiscopal sees in this region which would further increase in the course of the 14th century, as the empire more or less shrank up to Thrace. There existed four eparchies: Europe (with the metropolis of Herakleia, c. 16,000 km²); Rhodope (Traianupolis, c. 12,000 km²); Haimimontos (Adrianupolis, c. 20,000 km²); and Thrace (Philippupolis, c. 28,000 km²). These four eparchies originally covered an area of c. 76,000 km², but large parts in the north were at this time under Bulgarian rule⁵⁶.

In 1324, the church of Herakleia still administered around one half of the territory of the eparchy of Europe; among its suffragans was the important seaport of Rhaidestos (two decades later itself upgraded to metropolis). This is reflected in its contribution of 200 hyperpyra to the Patriarchate (this sum came from the metropolis as well as from [all] its suffragans, as the

54. PREISER-KAPELLER, *Episkopat*, 98. NASTUREL – BELDICEANU, *Les églises*, 271, 282-283.

55. Cf. also LAIOU, *The Agrarian*, 326-328, on the importance of Thrace and Macedonia for the Empire.

56. SOUSTAL, *Thrakien*, 53. KÜLZER, *Ostthrakien*, 64.

document from the Register points out)⁵⁷. Herakleia proper may not have been able to contribute significantly more than neighbouring bishoprics without suffragans such as Bizye or Ainos (100 hyperpyra each), but this is guesswork. The same holds true for Traianupolis, whose payment of 70 hyperpyra is not spectacular, but was as well augmented by payments from its suffragans. In the document on the support for Patriarch John Glykys in 1315, we also see mention of the revenues of the metropolis Traianupolis and its bishoprics (see above). Even more specifically, the sources on Patriarch Niphon inform us that this financially efficient Patriarch claimed the revenues of the metropolis of Traianupolis as well as those of its suffragan bishopric Makre and the monastery of Bera near to the metropolitan see (see above, sect. III). Thus, we do not know if the contribution of Traianupolis was provided by all its suffragans (at this time five) or only by Makre, whose economic basis was at least sufficient enough to have it upgraded to metropolis after 1341⁵⁸.

The highest contribution within the eparchy of Rhodope comes from the metropolis of Ainos (100 hyperpyra), which the Catalans had laid siege to in 1307 without success. The wealth of Ainos, based partly on salt production and fishing, is well documented until Ottoman times. Since c. 1384 it even constituted an autonomous lordship under the Genoese family of Gattilusi; it was “surely representative of the medium-sized port city”, as Klaus-Peter Matschke has stated⁵⁹. The payments from the archbishoprics of Maroneia and Xantheia are significantly smaller at 36 hyperpyra each. The port of Maroneia had been plundered by the Catalans in 1307, and other sources from the 14th century indicate that the revenues of its church were not very high. However, in 1310/1313 revenues from Maroneia were granted to Patriarch Niphon⁶⁰. A similar picture is received for Xantheia (modern-day Xanthe in Greece), which had been promoted to the rank of archbishopric before 1310. The Catalans devastated the hinterland of the city in 1307. Information on the number of the clergy indicates a moderate level

57. PREISER-KAPPELLER, *Episkopat*, 140-141. Cf. also MATSCHKE, *Commerce*, 468, and LAIOU – MORRISON, *Byzantine Economy*, 135, on the importance of Rhaidestos.

58. PREISER-KAPPELLER, *Episkopat*, 252, 461-464.

59. SOUSTAL, *Thrakien*, 170-171. PREISER-KAPPELLER, *Episkopat*, 12-13. MATSCHKE, *Commerce*, 468.

60. SOUSTAL, *Thrakien*, 350-351. PREISER-KAPPELLER, *Episkopat*, 253.

of ecclesiastical revenues⁶¹. In 1305, the Catalans ravaged around the city of Kypsela. The lowest recorded contribution was provided by this ancient archbishopric. That its revenues were small even before this time is also evidenced by the fact that in 1285 Kypsela was temporarily united with the neighbouring metropolis of Rhusion (contribution of 36 hyperpyra) in order to provide sufficient income for one hierarch; and in 1330 the metropolitan of Melitene (modern-day Eski Malatya in South-eastern Turkey, where he had found no sufficient life-basis any more) received the administration of Kypsela only in addition to that of Ainos⁶².

We have also found considerable differences between the contributions from the rest of the bishoprics in the eparchy of Europe. 100 hyperpyra were provided by Bizye, the highest-ranking archbishopric of the Patriarchate and an important military, as well as administrative centre, since the later 13th century. Although the city and its environs had become a theatre of war in 1307, 1313 and 1322, after 1341 Bizye became metropolis⁶³. The significant seaports of Ganos (important for the trade of grain and plundered by the Catalans in 1306) and Medeia, both upgraded to archbishoprics a few years before 1324, contributed 50 hyperpyra each. Both cities later became metropolitan sees⁶⁴. Two cities, which had been promoted to metropolis already in the 11th century, made notably lower contributions. Madytos (a seaport in the south of the Gallipoli-peninsular, occupied by the Catalans in 1305) and Rhusion contributed 36 hyperpyra each. However, Rhusion (which had been combined with Kypsela in 1285, as we have seen) was another one of the churches whose revenues Patriarch Niphon had claimed in 1310/1313⁶⁵. This is also the case with the archbishopric of Derkos near Constantinople, which contributed 24 hyperpyra. The archbishopric of Garella (near Rhusion and Kypsela) and the metropolis of Arkadiupolis in the upcountry (which the document from 1324 erroneously listed as archbishopric) likewise contributed 24 hyperpyra. Thus, Arkadiupolis provides the smallest contribution of all metropolitan sees. As we know from other sources, great parts of the city

61. SOUSTAL, *Thrakien*, 501-502. PREISER-KAPPELLER, *Episkopat*, 482.

62. SOUSTAL, *Thrakien*, 330-311. PREISER-KAPPELLER, *Episkopat*, 210-211.

63. KÜLZER, *Ostthrakien*, 149, 290-292. PREISER-KAPPELLER, *Episkopat*, 67.

64. KÜLZER, *Ostthrakien*, 371-372, 520. PREISER-KAPPELLER, *Episkopat*, 127, 255. MATSCHKE, *Commerce*, 468.

65. KÜLZER, *Ostthrakien*, 502, 621. PREISER-KAPPELLER, *Episkopat*, 250, 386.

laid in ruins at this time. In 1317 as well as in 1329, the administration of Arkadiupolis was combined with that of the neighbouring archbishopric of Mesene (to provide sufficient income at least for one bishop), and after 1347 we do not find any metropolitans of Arkadiupolis in our sources⁶⁶.

If even those bishoprics that were barely self-sustaining had to contribute, then we may as well be surprised to find some better-off sees from Europe absent from the list of 1324; for example, the metropolitans of Aproi and Selymbria (whose revenues Niphon had claimed for the Patriarchate in 1310/1313) and the archbishopric of Mesene (which, as we have seen, was temporary combined with Arkadiupolis). In 1324, Aproi had a prominent metropolitan, Joseph, who was very active in the capital and was a favourite of emperors Andronicus II and III⁶⁷. This may indicate that the level of revenue of his church, which had been heavily devastated by the Catalans and had lost a significant share of its population, was not very inviting for residence. The absence from the list of 1324 could equally indicate that metropolitan Joseph was able to obtain an exemption from contributing to the Patriarchate because of his relations to the emperors. The absence of the important seaport of Selymbria (a metropolis since c. 1167) from our list is harder to explain. Although it had also been conquered by the Catalans in 1305 and in 1322 it was besieged during the first civil war of the Andronici, Selymbria remained a significant city, which later even served as imperial residence. In 1310/1313, Niphon had made use of the metropolitan's revenue. Since 1316, metropolitan Gregorios of Dyrrhachion, who could not reside in his city, administered Selymbria as *proedros*. Other *proedroi*, who like Gregorios, were even present in the synod in September 1324, were obligated to share their income with the Patriarch (see above)⁶⁸.

Only three metropolitan sees from the eparchy of Haimimontos are listed in the document of September 1324. The original metropolis of the entire province, Adrianupolis, remained one of the most important towns of the Empire until its Ottoman conquest in the 1360s and served as residence for Emperor Andronicus III, John VI Kantakuzenos and the Ottoman Sultans. The contribution of its metropolis (100 hyperpyra) is

66. KÜLZER, *Ostthrakien*, 265, 330-331, 377-378. PREISER-KAPPELLER, *Episkopat*, 47, 90, 133.

67. KÜLZER, *Ostthrakien*, 256-257, 530-531. PREISER-KAPPELLER, *Episkopat*, 44-45, 268.

68. KÜLZER, *Ostthrakien*, 636-637. PREISER-KAPPELLER, *Episkopat*, 398-399.

surprisingly not very high⁶⁹. The same holds true for Didymoteichon (100 hyperpyra), which had become metropolis in c. 1260. While Didymoteichon was also one of the most important imperial bases in the first half of the 14th century, a document from the Register dated June 1324 indicates a certain impoverishment of some of the metropolitan's clergy⁷⁰. As recently as December 1323, archbishop Gerasimos of Brysis had been promoted to metropolitan; his church contributed 50 hyperpyra to the Patriarchate. As we know from the description of metropolitan Matthaïos of Ephesos, who administered the bishopric from 1332 to c. 1337, Brysis represented the "type of the small country town, (...) that lived above all from agriculture and livestock breeding, but that also had a variety of artisans and merchants" (as Klaus-Peter Matschke has stated)⁷¹. Absent from our list for Haimimontos are the archbishoprics of Karabizye and of Nike. For both of these cities we have very little information and no documentation for an archbishop in Palaiologan times. Also absent are the archbishoprics of Mesembria and of Anchialos. The latter two were very important Black Sea-ports, also for Italian merchants; but both were presumably at this time under Bulgarian control⁷².

The eparchy of Thrace is represented by its single metropolitan see, Philippupolis (in 1341, its suffragan see of Lititza was promoted to metropolis) with a payment of 150 hyperpyra. Only a short time before, the city had been recaptured after a Bulgarian occupation in 1322-1323. The revenues of Philippupolis were not insignificant. They had been granted to Patriarch Niphon as well as to John XIII Glykys (see above). In the above-mentioned document we find additional information on the income of bishoprics in this eparchy. We can find evidence for the granting of an annuity of 100 hyperpyra for the deposed metropolitan of Philippi. The annuity issued from the revenues of the vacant suffragans of Ioannitza and Hyperpyrakion (or Perperakion) in 1339, which seems coherent with

69. SOUSTAL, *Thrakien*, 162-165. PREISER-KAPELLER, *Episkopat*, 4-5.

70. *Register* I, no 75. SOUSTAL, *Thrakien*, 240-242. PREISER-KAPELLER, *Episkopat*, 93-95.

71. SOUSTAL, *Thrakien*, 290-292. PREISER-KAPELLER, *Episkopat*, 70-71. MATSCHKE, *Commerce*, 469.

72. SOUSTAL, *Thrakien*, 175-176, 299, 355-357, 374-375. PREISER-KAPELLER, *Episkopat*, 31, 178, 265, 323.

the level of contribution from the metropolis proper⁷³. As in the case of Macedonia, our information on many bishoprics in Thrace corresponds with their relative ranking within the list of contributors.

Asia Minor

Kyzikos is the only metropolitan see from Asia Minor on the list of 1324. In contrast to neighbouring churches such as Nicaea or Nicomedia, this important city and imperial base in the province of Hellespont had obviously been able to preserve a significant amount of income in the face of Turkish expansion. This is also illustrated by the allocation of its revenues to the Patriarchate in the times of Niphon and John Glykys. In 1328, Kyzikos could still serve as basis for Emperor Andronicus III; but after its conquest by the Turks in 1335, the relative prosperity of the church of Kyzikos came to an end. Its metropolitan Athanasios was granted first the administration of Brysis and then of Ganos in order to provide sufficient revenue for him⁷⁴. Lopadion, a former suffragan of Kyzikos, had been promoted to archbishopric in the 12th century and had been united with another suffragan, Melitupolis, between 1204 and 1261. Like its former metropolis, the church could still provide sufficient revenue to nourish a bishop, but the more humble contribution of 24 hyperpyra indicates a significantly lower level of income. In 1327, Lopadion was conquered by the Ottomans. Its last archbishop Hierotheos then had to reside in Garella in Thrace, which provided the same amount of contribution to the Patriarchate⁷⁵. The absence of other bishoprics from the area of Western Asia Minor, which in the 13th century had certainly been able to compete with the wealthiest churches in the European parts of the Empire, is not a big surprise. Although metropolitans such as Chalcedon or Nicomedia were not conquered until some years later, their bishops already had to reside in Constantinople most of the time or were dependent on the revenues of churches whose administration they had been granted (as we have seen above).

73. SOUSTAL, *Thrakien*, 336, 401-402. PREISER-KAPPELLER, *Episkopat*, 247, 362-363. *Register* II, no 121, ll. 13-15. DARROUZÈS, *Regestes*, no 2190.

74. PREISER-KAPPELLER, *Episkopat*, 212-213. Cf. also BELKE, *Bithynien*.

75. PREISER-KAPPELLER, *Episkopat*, 248-249. Cf. also BELKE, *Bithynien*.

The Islands

The occupation of many islands in the Aegean by Venetian or Genoese overlords is also illustrated in our list from 1324. The list only registers four bishoprics from islands then still under Byzantine control as contributors: the metropolitan sees of Mitylene (100 hyperpyra) and Methymna (50 hyperpyra) on the island of Lesbos (1,630 km²); and the archbishoprics of Lemnos (in the Northern Aegean, 50 hyperpyra) and Proikonnesos (in the Sea of Marmara, 72 hyperpyra). These churches seem relatively well-off in comparison with many bishoprics on the mainland. Methymna had also been a source of revenue (probably around 200 hyperpyra, cf. above fn. 29) for the metropolitans of Crete and Sardeis, as we have seen above (accordingly, 50 hyperpyra could represent ca. 25 % of the disposable income of the metropolis, but this is again guesswork). Two charters from the register of the Patriarchate (created at the time of our list) also name a significant number of monasteries from which the metropolitans of Mitylene and of Methymna were entitled to receive *kanonika*. For the 15th century, various sources estimate the population of the island to have been 20,000⁷⁶.

On the fruitful and densely populated island of Lemnos (476 km²), not only the archbishop, who administered the neighbouring island of Imbros, was able to find sufficient income. The great monasteries of Mount Athos (the Megiste Laura, for instance) owned a significant amount of property (more than 36 dependencies) on the island as well as the Patriarchate itself. As an entry in the Register from the year 1321 informs us, the Patriarchate, in addition, possessed the rights for 27 churches and monasteries (with their *kanonika*) and two villages on Lemnos. For the year 1470, a population of 6,000 is mentioned in a source⁷⁷.

The island-archbishopric of Proikonnesos had equally been a source of revenue for Patriarch Niphon as well as for John XIII Glykys. Its contribution of 72 hyperpyra is the second largest of all archbishoprics on the list⁷⁸. That the island bishoprics in general were relatively prosperous may also illustrate a later document from the patriarchal register regarding the island

76. Register I, no 80 (September 1324), and no 106 (April 1331). KODER, *Aigaion Pelagos*, 116, 209-213, 228-234. PREISER-KAPPELLER, *Episkopat*, 269-270, 275-276.

77. Register I, no 63. KODER, *Aigaion Pelagos*, 115, 205-209. PREISER-KAPPELLER, *Episkopat*, 241-242.

78. PREISER-KAPPELLER, *Episkopat*, 368-369. Cf. also BELKE, *Bithynien*.

of Chios (842 km²). This island (which was especially profitable due to its mastix-cultivation) fell under Genoese control between 1304–1329 and again in 1346. In 1365 the Genoese agreed with the Patriarchate on an annual payment of 150 hyperpyra (at this time c. 75 florins) as compensation for the rights of the Orthodox Church on Chios. At the same time, the Latin bishop established on Chios had to pay a *servitium commune* of 200 florins to the Papacy⁷⁹.

Missing Churches

As we have seen in various eparchies, not all bishoprics of which we know were under Byzantine control around 1324 are present in the list. The metropolis of Ioannina in Epiros, for instance, was already mentioned as a church with significant property; the city had been occupied by the troops of Emperor Andronicus II in 1318 and promoted to metropolis around the same time. However, the Byzantine hold on Ioannina remained uncertain until 1336, which may explain why the metropolis was not included in the list of contributors⁸⁰. The same holds true for the metropolis of Larissa in Thessaly (whose suffragan of Stagoi was mentioned above). In August 1318 the synod had allowed metropolitan Kyprianos to reside in his suffragan bishopric of Charmaina, since the political turbulences in the region did not permit him to stay in his city⁸¹. Apparently, only those churches under firm Byzantine control that could be expected to provide a yearly payment were included as contributors in the list.

4. The unequal distribution of contributions in the list of 1324

The list of contributors reflects the level of political control of Byzantium in its remaining territories. The relative scale of contributions seems coherent with other information regarding the income, economic potential and importance of many of the registered bishoprics. Many uncertainties arise, since the number of figures for comparison is small, or pertains to another church (the Latin toll lists) or to a period 150 years later

79. MM, v. II, 90-91 (mentioned in a patriarchal letter from the year 1387). DARROUZÈS, *Regestes*, nos 2473, 2810. KODER, *Aigaion Pelagos*, 144-148. PREISER-KAPPELLER, *Episkopat*, 80-82. HOBERG, *Taxae*, 35.

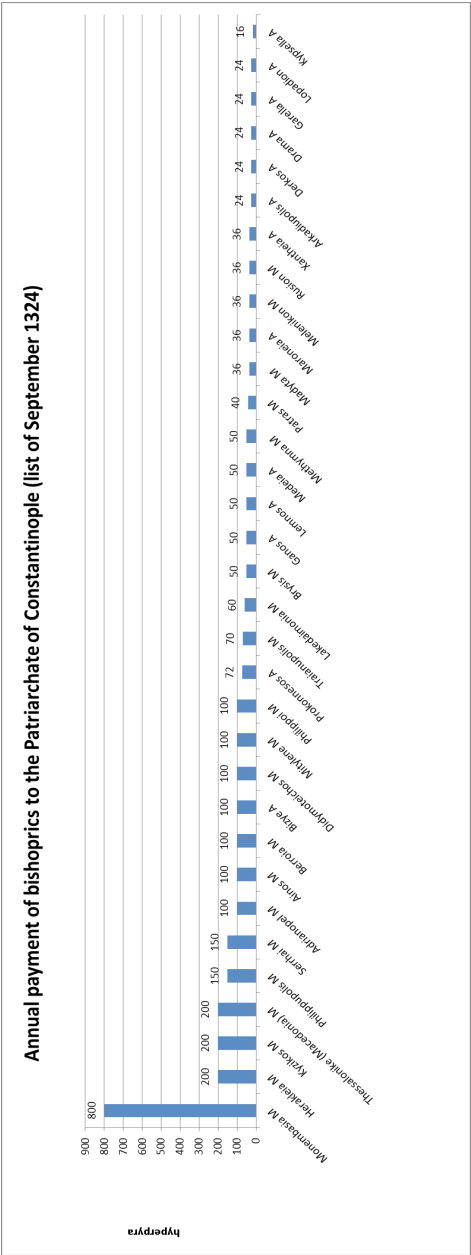
80. SOUSTAL, *Thrakien*, 165-167. PREISER-KAPPELLER, *Episkopat*, 165.

81. *Register I*, no 54. PREISER-KAPPELLER, *Episkopat*, 231.

(the Ottoman tax registers). It raises the question of whether or not there is any relation between the size of contribution and the economic potential of a bishoprics city and territory. On the one hand we have a rich city with a rich metropolis and a high payment (Monembasia) and on the other hand we have a still relatively rich city with a rich bishopric and a relatively small contribution (Thessalonike). One can therefore presume that, in our list, we could encounter relatively well-off cities with a relatively poor bishopric, whose share in the landed property and economic activity of its eparchy was modest. Likewise, we could encounter relatively poor cities with a relatively well-off bishopric, whose economic influence in the region was above average. The possibility of a “rebate” for Thessalonike also raises the question of whether every bishopric had to contribute the same share of its revenues. The assignation of payments to the various churches could well have been carried out in an arbitrary way.

However, our sources (few as they may be) suggest that the Patriarchate and the synod were well aware of the amount of revenues that could be expected from every metropolis and archbishopric. They obviously knew how much money Traianupolis, its suffragan Makre and the monastery of Bera could bring in and what amount of income two thirds of Kyzikos’ revenues represented. Unfortunately, these figures were not integrated in the preserved documents. Therefore we are not able to estimate, on average, what percentage of these revenues the contributions in the list of September 1324 stand for. We do, however, observe that they represent an order of magnitude of ecclesiastical revenues which seems realistic in comparison with the other figures we have. At the same time, the relative proportion of contribution is in congruence with the economic status of the various towns, as far as we are able to reconstruct it from other sources (see above). Therefore, since the distribution among the churches is definitely not arbitrary, we can also hypothesise that the ratios between the contributions reflect the relative wealth of a bishopric. Our ranking of bishoprics according to the size of their payment clearly demonstrates this (see figure 1).

Figure 1: Annual payment of bishoprics to the Patriarchate of Constantinople according to the list of September 1324



The contributions were arranged in groups, and bishoprics of comparable income were prescribed the same amount of payment. We also detect a certain relationship between the contribution of one rank class and the following. Leaving aside the exceptional contribution of Monembasia and the two other churches from the Peloponnese (which could dispose only of a fraction of their territory) we can identify the following scales of payment:

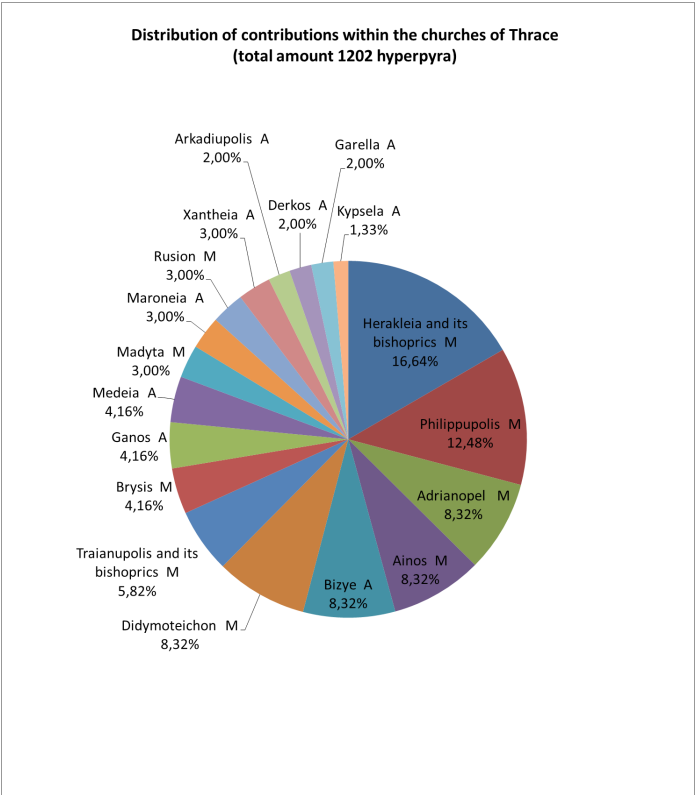
200
(x 0.75) = 150
(x 0.66) = 100
(x 0.7) = 70 (72 Proikonnesos)
(x 0.71) = 50
(x 0.72) = 36
(x 0.66) = 24
(x 0.66) = 16

The ratio between one class of contributions and the one above varies between 0.66 (two thirds) and 0.75 (three fourths) (with an arithmetic mean of 0.694). Accordingly, the amount of the contribution of a bishopric is related to its ranking within the totality of churches, which in turn results from an estimate on its revenues and from its grouping with bishoprics of a comparable income level. This is a strong indication that the contributions in the list of 1324 actually reflect the relative wealth of the recorded bishoprics in a realistic way. It also indicates that the distribution of income levels within the metropolises and archbishoprics reflects the relatively high amount of diversity we encounter in the list. Once again, excluding Monembasia and the Peloponnese, the arithmetic mean of all 30 contributions ranging from 200 to 16 hyperpyra is 76.9 hyperpyra (with a total amount of 2,308 hyperpyra and a standard deviation of 55.6). The smallest contribution (16 hyperpyra) represents 8 % of the amount in the highest rank class (200 hyperpyra).

In addition to the totality of samples, it also seems useful to look at a coherent territorial circumscription within the totality of our list. We will therefore examine the bishoprics in Thrace, which have a total contribution of 1202 hyperpyra and an arithmetic mean of 66.8 hyperpyra (standard deviation 49.487). These bishoprics also represent more than 50 percent of

all churches from our list (a total of 18). A depiction of the distribution of percentages of this total amount within the churches of Thrace illustrates very well that this diversity of income is also valid for this smaller sample (see figure 2).

Figure 2: Distribution of contributions to the Patriarchate of Constantinople within the churches of Thrace according to the list of September 1324



Thus, we can observe the obvious clustering of churches of comparable revenues in the same class of contribution. This phenomenon leads us to the idea that these contributions reflect the general distribution of economic (and demographic) potential in the bishoprics' areas. This is supported by the fact that the connection of a variate with the rank of an element within the totality is a well-observed phenomenon in the field of economics and economic geography.

5. The central place-theory of Walter Christaller and the contribution list of 1324

The clustering of quantitative characteristics of settlements of comparable size and their respective hinterlands in hierarchic rank-classes leads us to the classic model of the distribution of central places developed by Walter Christaller (1893-1969). This model came about as a result of the analysis of central places in Southern Germany in the 1930s. The concept was then refined in the following decades and is, despite frequent criticism, still one of the basic models for economic geography and “New Economic Geography”⁸². Christaller’s model has also been used for historic studies; in the field of Byzantine studies it was introduced by Johannes Koder in the 1980s⁸³.

Walter Christaller established a hierarchy of central places, where larger settlements would offer a greater variety of services (economic, administrative, and in our case also ecclesiastical) and goods and thus also supply and occupy a larger market territory. He constructed an idealised hexagonal network, at whose intersections the central settlements would sit, surrounded by a number of settlements of smaller size, which would have their own (smaller) hinterland and a number of dependent lower-ranking settlements, et cetera. With k , Christaller defined the sum of a settlement in one rank class and the number of dependent settlements in the rank class below. Furthermore, $1/k$ defines the ratio between the average population number of a settlement in a rank class and the average settlement in the rank class above. The distance (d) between adjacent central places at a given level is $k^{1/2}$ times that at the immediate lower level⁸⁴. One advantage of Christaller’s model is that its calculations not only include the central places but also their hinterlands. As we have seen, it is most probable that our figures from

82. Cf. FUJITA – KRUGMAN – VENABLES, *Spatial Economy*, 26-27. For a mathematical criticism of Christaller, cf. G. NICOLAS, “The so-called ‘Christallerian Model’”, January 2009. [www document], URL http://cyberato.pu-pm.univ-fcomte.fr/forums/files/WC_so_called_model_dbf0e.pdf (accessed on January 20th 2010).

83. KODER, Urban Character. IDEM, Land Use. Cf. also MITSIOU, Versorgungsmodelle. BINTLIFF, Market, 212-216, and most recently the studies of POPOVIĆ, Siedlungsstrukturen. IDEM, Melnik. IDEM, Flußtal.

84. RITTER, *Allgemeine*, 199-203. SCHÄTZL, *Wirtschaftsgeographie*, 72-84. BATTY – LONGLEY, *Fractal Cities*, 335-336.

1324 do not merely represent the income from the bishop's city, but also from its environs (property in and tolls from the villages around the city, et cetera). As a matter of fact, no medieval city can be understood without its hinterland, upon which it was dependent for necessary agrarian surplus, as well as other items such as firewood for provisioning the population and urban craft. Similarly, for its hinterland, the city fulfilled several market, administrative and (in our case) ecclesiastical functions; "evidently, city production embodied land"⁸⁵.

Christaller established three principles: marketing principle, transportation principle and administrative principle. To each of these are assigned corresponding integer values for k of 3, 4 and 7. Thus $k = 3$, for instance, produces a series of 1 - 3 - 9 - 27 - 81 - 243 for the number of market areas and 1 - 2 - 6 - 18 - 54 - 162 for the number of central places in the succeeding rank-classes. The average population size of a settlement in a rank-class would be $1/3$ (0.33) of the average settlement in the rank-class above (since its market area would equal one third of the size of the market area of the higher ranking class; 100,000 - 33,000 - 11,000 - 3,700 - 1,200 - 400, for instance). The distance (d) between adjacent central places at a level would be $\sqrt[3]{3}$ -times that at the immediate lower level (40.5 km - 23.4 km - 13.5 km - 7.8 km, for instance). Yanguang Chen and Yixing Zhou have established the following formula for the calculation for the number of central places (N) at each rank (m) beginning with the second rank⁸⁶:

$$N_{(m)} = (k-1)k^{m-2}(1)$$

Johannes Koder used a k -value of 3 for his analysis of the distribution of cities in the early Byzantine Period. At the same time he integrated the studies of George William Skinner on central places in China into his study, thus establishing a hierarchy with three ranks: Central Market Town, Intermediate Market Town and Standard Market Town. Dependent on

85. KODER, Urban Character, 159-161. IDEM, Land Use, 161-168 (also on von Thünen's location theory). HARVEY, *Economic expansion*, 199-243. VAN DER WOUDE - DE VRIES - HAYAMI, The hierarchies, 5-214. MATSCHKE, Commerce, 479. BINTLIFF, Market. MITSIOU, Versorgungsmodelle. EPSTEIN, *An Economic*, 101-102. DITTMAR, Cities, 10-13, also for the citation.

86. CHEN - ZHOU, Reinterpreting, 346-347.

population density, Skinner calculated average distances (d) between central places in the various ranks and average maximum ways (w) to the next centre of a specific rank-class, which were sufficient for the provision of a territory with market places. Koder adapted his calculations for the Byzantine case and combined them with sources on the distribution of cities in the various provinces of the early Byzantine Empire. He paid particular attention to the *Synekdemos* of Hierokles, from the sixth century, and proposed the *Notitiae Episcopatum* as a further source. He assumed that all cities mentioned in these lists would have served as central places for their hinterlands. Koder then divided the territory of a province with the number of cities from the sources and thus calculated the average hinterland area (A) for each central place. Since Christaller's model proposed a hexagonal form for these market areas, Koder could also calculate the average w-values and d-values for each province (and thus the density of central places) using the following equation:⁸⁷

$$w = \sqrt{(A/3\sin 60^\circ)} \quad (2)$$

and

$$d = w\sqrt{3} \quad (3)$$

With regard to the sixth century provinces of Thrace, these calculations showed, as expected, a relatively high density of central places for Europe and Rhodope. The larger and less urbanised provinces of Thraciae and Haimimontos, however, had significantly higher values for w and d and thus a lower density of central places⁸⁸.

So how can we connect this model with our contribution list? As we have seen, the ratios for contribution size between the payment classes in the list of 1324 do not produce numbers which we would expect for classical Christaller distributions (0.33, 0.25 or 0.14 for k = 3, 4 or 7). Instead, we have values between 0.75 (this would be a k-value of 1.33) and 0.66 (k = 1.5) with an arithmetic mean of 0.694 (k = 1.44 or $\approx \sqrt{2}$). At the same time, we observe eight rank-classes of payment, not three rank-classes. As Koder himself has stated, as well as many other geographers, economists and

87. KODER, *Urban Character*, 161-173, 180-185. IDEM, *Land Use*, 169-181. MITSIOU, *Versorgungsmodelle*. Cf. also BINTLIFF, *Market*, 216-217.

88. KODER, *Urban Character*, 182-184.

historians, Christaller's model "may be distorted in dependence of the real shape of the landscape" and of many other factors. Chen and Zhou observed that even the hierarchies of central places which Christaller himself had determined in Southern Germany did not produce integer values of k but equally show a fractal dimension ($k = 2.59$ for the Munich hierarchy for instance)⁸⁹. But in our case, the model breaks down if we insert $k \approx \sqrt{2}$ in the above-mentioned formula (1) and calculate the number of settlements in the different rank-classes. The size of succeeding settlements indicated by the ratio of contributions is too large to integrate them into one rank-system of central places. For instance, we receive values smaller than 1 for the number of central places in rank-classes two to four, while our list registers four churches for the third contribution class in Thrace⁹⁰. Rather, we have to presume that churches of different contribution classes belong to the same rank of central places, as Koder's studies have already indicated. Settlements in different payment classes could nevertheless have possessed the characteristics of a Central Market Town for their respective hinterland. But did all churches mentioned in the list belong to the same rank of central places? That the ecclesiastical hierarchy obviously assigned churches of very different economic potential to the same hierarchical level of metropolitan see or archbishopric figure may illustrate figure 3. In this illustrated network⁹¹ of the bishoprics of the Thracian eparchies (Europe: white, Rhodope: dark grey, Haimimontos: light grey, Thrake: black), all metropolitans and archbishoprics are directly connected with the Patriarchate (Constantinople) and all suffragans are connected with their metropolis. For the churches which can be found on the contribution list, the amount of their payment is indicated with circles of corresponding size.

89. CHEN – ZHOU, *Reinterpreting*, 350-353.

90. James W. Fonseca indeed tried to modify the $k = 3$ hierarchy by a systematic bias of 1.85 in order to generate a $k = 1.618$ hierarchy which would converge to the rank-size-distribution of cities he had observed for the USA, but since he misinterpreted the $k = 3$ distribution for the number of market areas as a distribution for the number of settlements in the succeeding rank classes, his $k = 1.618$ hierarchy breaks down in a similar way if we insert this value of k in the formula of Chen and Zhou (this produces for rank 2 to 4 the settlement distribution: 0.681 - 1.14 - 1.92), cf. FONSECA, *Urban*, 49-52.

91. For possibilities on a further connection between central place theory, rank-size rule (see below) and network analysis, cf. RUFFINI, *New Approaches*.

We may at least identify possible thresholds for different rank-classes. If we presume, for instance, a $k = 3$ -system, as Koder did, we expect that the quantitative properties of the settlements of one ranks class equal one third of that of the class immediately above. As can be seen in table 2, the according distribution of contribution figures shows various possibilities for assigning elements from our list to very similar figures for the sequences of central place rank-classes if we insert the figures for our churches for the first rank. The same holds true for $k = 7$ and especially for $k = 4$ and $k = 2$ (which is not a classical Christaller-value of k), since the two latter are multiples of $\sqrt{2}$. This, as we have seen, is approximately the theoretical k -value for the arithmetic mean of the ratios between our payment classes (see tables 3-5).

Tables 2-5: Theoretical distributions of contribution amounts according to the model of central places with various values of k

$k = 3$									number of settlements
1 st rank	200	150	100	70	50	36	24	16	1
2 nd rank	66.7	50	33.3	23.3	16.7	12	8	5.3	2
3 rd rank	22.2	16.7	11.1	7.8	5.6	4	2.7	1.8	6
4 th rank	7.4	5.6	3.7	2.6	1.9	1.3	0.9	0.6	18

$k = 4$									number of settlements
1 st rank	200	150	100	70	50	36	24	16	1
2 nd rank	50	37.5	25	17.5	12.5	9	6	4	3
3 rd rank	12.5	9.4	6.25	4.4	3.1	2.3	1.5	1	12
4 th rank	3.1	2.3	1.6	1.1	0.8	0.6	0.4	0.25	48

$k = 7$									number of settlements
1 st rank	200	150	100	70	50	36	24	16	1
2 nd rank	28.6	21.4	14.3	10	7.1	5.1	3.4	2.3	6
3 rd rank	4.1	3.1	2	1.4	1	0.7	0.5	0.3	42
4 th rank	0.6	0.4	0.3	0.2	0.15	0.1	0.07	0.05	294

k = 2									number of settlements
1 st rank	200	150	100	70	50	36	24	16	1
2 nd rank	100	75	50	35	25	18	12	8	1
3 rd rank	50	37.5	25	17.5	12.5	9	6	4	2
4 th rank	25	18.8	12.5	8.8	6.3	4.5	3	2	4

As our figures fit in various distributions, one could now try to regroup adjacent settlements (also across the borders of ecclesiastical eparchies, since they were not valid for the civil administration any more) into central place-hierarchies. Still, all bishoprics in the list could also belong to the same rank of central places. Thus, we should look how many central places of equal rank are necessary to cover the territory of an eparchy. Using the *Notitiae episcopatum* as well as other sources, we can at least sum up the number of metropolitan sees, archbishoprics and suffragans for each eparchy. For Rhodope, we can identify 10 bishoprics, for Europe 28 (including Constantinople). Although some of these bishoprics cannot be located with security, we have evidence that they were all still functional in our period. With the method used by Johannes Koder (equations 2 and 3), we then calculate the average area (A) of city territory and the w- and d-values for the average distances between central places of highest rank. For Rhodope, we receive $A = 1,174 \text{ km}^2$, thus $w = 21.26 \text{ km}$ and $d = 36.82 \text{ km}$. For Europe, $A = 569.3 \text{ km}^2$, thus $w = 14.8 \text{ km}$ and $d = 25.63 \text{ km}$. At the same time Skinner and Koder, as mentioned above, have calculated average values for w and d for various population densities, sufficient for the provision of a territory with central places. If we presume a population density of 20 per km^2 , which according to Koder seems possible for the areas of Europe and Rhodope in the Late Byzantine period, the values for w and d are 23.4 and 40.5 respectively⁹². Using the equation (2) from above (with $k = 3$), the corresponding average city territory A equals $1,422.56 \text{ km}^2$ for a Central Market Town (1st rank), 474.2 km^2 for an Intermediate Market Town (2nd rank) and 158 km^2 for a Standard Market Town (3rd rank). Dividing the territories of Rhodope and Europe with these A-values, we detect that circa eight Central Market Towns (and 16 and 48 central places of the 2nd and 3rd rank respectively) were necessary to cover the whole of Rhodope while

92. KODER, Urban Character, 180-182. IDEM, Land Use, 174. IDEM, *Der Lebensraum*, 150-154 (for estimations of the population density).

circa 11 Central Market Towns (22 and 66 central places of 2nd and 3rd rank) were necessary for the entire province of Europe. Comparing these figures with our calculations for the actual number of bishoprics (= possible central places) in these two eparchies, it becomes evident that the margin for the postulation of rank distinctions between the central places in Rhodope (8 vs. 10) is small. In contrast, in the higher urbanised eparchy of Europe (11 vs. 28) it seems very probable that we can assign the possible central places (= bishoprics) to different ranks.

Thus, the churches from our list for Europe could belong to different central place ranks, and the differences between their contributions could be connected to Christaller's distribution of quantitative characteristics within the urban hierarchy. For the relatively highly urbanized territory of the Empire of Nicaea in Western Asia Minor in the 13th century, for instance, Ekaterini Mitsiou assumed that metropolitan sees and archbishoprics belonged to the category of Central Market Town while the suffragan bishopric (in most cases) belonged to that of Standard Market Town. The latter of these showed high conformities with Christaller's model as modified by Koder. Still, there also existed suffragans which we can assume served as higher ranking central places⁹³. Thus, the ecclesiastical rank of a settlement is not an absolutely secure indicator for its central place characteristics. At the same time, while there does exist a correlation in at least some cases, it is not certain that a promotion of a settlement within the church hierarchy has to be connected with an increase in its economic relevance as central place. This also becomes evident if we execute as standard OLS-regression of the 33 contributions from the list of 1324 on the ecclesiastical ranking within the totality (on a logarithmic scale; see fig. 4). When we do this, we receive a regression coefficient of -0.726, but as the value for the coefficient of determination R^2 (= 0.56) indicates, the correlation between ecclesiastical rank and the amount of contribution is not very strong (0.56 means that the differences in the hierarchical ranking can only explain 56 percent of the variations in the contributions). The outcome is similar if we remove the exceptionally high contribution of Monembasia from the list (fig. 5); the regression produces a coefficient of -0.667 and a value for R^2 of 0.65.

93. MITSIOU, Versorgungsmodelle.

Figure 4: Regression of contribution on ecclesiastical rank for all bishoprics from the list of September 1324

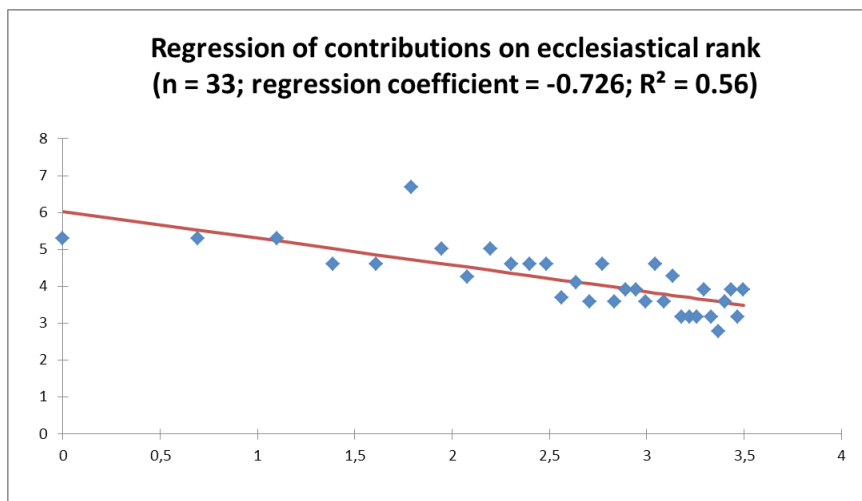
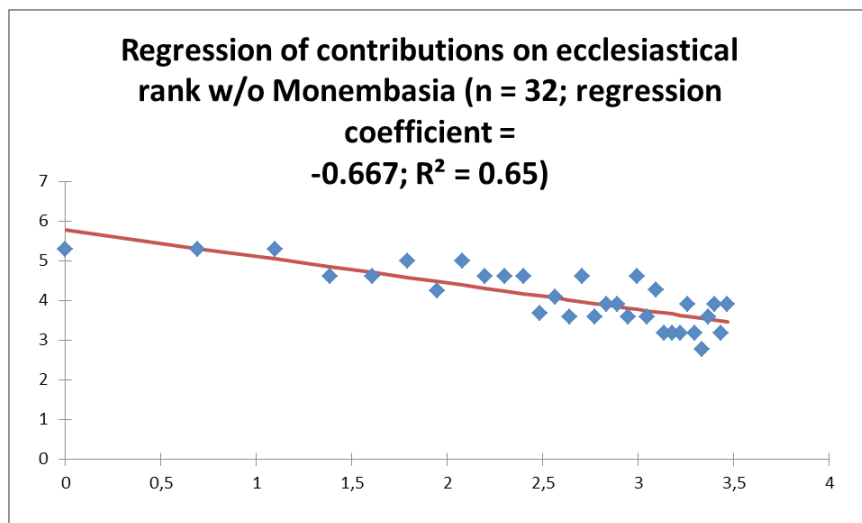


Figure 5: Regression of contribution on ecclesiastical rank for the bishoprics from the list of September 1324 without Monembasia



The parallels between the distribution of contributions from the list of September 1324 and distributions of quantitative characteristics of settlements according to Christaller may serve as indicator that these figures, at least partly, reflect the distribution of economic and demographic potential within a well-established model for an settlement system. Yet we cannot consider these similarities to be significant enough that we can assume that our list really delivers insight into a urban hierarchy of the Late Byzantine Empire at its various levels with security. To our advantage, there exists another model for the distribution of settlements, which also has strong empirical foundations.

6. “Zipf’s law” and the power law-distribution of the contributions in the list of 1324

This model of the distribution of settlements, which is almost as old as Christaller’s central places model, is the rank-size rule or the so-called “Zipf’s law” (named after George Kingsley Zipf, 1902-1950)⁹⁴. According to this model, the distribution of population within the cities of a region follows a power-law. In the classical Zipf-distribution, the second largest city would have one half of the population of the largest city, the third largest city one third of the population of the largest city, et cetera. This can be expressed with the formula:

$$P_{(r)} = P_{(1)} / r^Z \quad (4)$$

where $P_{(r)}$ is the population of the city of the r -ranked city within the totality of the sample, $P_{(1)}$ the population of the largest city, r the rank of the city (1, 2, 3, ...) and Z is a constant in the order of magnitude of 1 (in the “classical” Zipf-distribution $Z = 1$). Conventional is a logarithmic depiction of the rank-size distribution, thus we get the formula⁹⁵:

94. Cf. G. K. ZIPF, *Human Behavior and the Principle of Least Effort. An Introduction to Human Ecology*, Cambridge, Mass., 1949.

95. Cf. FASSMANN, City-size, 4-5. DE VRIES, *Urbanization*, 85-87. LAXTON – CAVANAGH, The Rank-Size, 329-332. FALCONER – SAVAGE, Heartlands, 38-40. SMITH, Types, 20-22. FUJITA – KRUGMAN – VENABLES, *Spatial Economy*, 215-219. KUNINAKA – MATSUSHITA, Why does. DRENNAN – PETERSON, Comparing, 533-534. NEWMAN, Power laws, 1-2. CLAUSET – ROHILLA SHALIZI – NEWMAN, Power-law, 1-2. CAVANAGH, Settlement structure, 409-413.

$$\ln P_{(r)} = \log P_{(1)} - Z \log r \quad (5)$$

and

$$Z = (\log P_{(1)} - \log P_{(r)}) / \log r \quad (6)$$

On a double-logarithmic graph, the values of the Zipfian power law-distribution tend to group along a diagonal (see the examples below). This rank-size rule has been empirically studied in many regions throughout the globe for various time periods. Many cases satisfy Zipf's law very closely with values for Z around 1 (or to express a more simple way: "Zipf's Law is, in fact, empirical"), whereas in other cases rank-size distributions of populations of cities obey power-law behaviour, but have a different power exponent Z (values between 0.8 and 1.2 have been proposed as acceptable exponent for a distribution to be still considered "classic Zipfian")⁹⁶. A commonly accepted explanation for this phenomenon is still lacking. It most probably results from the complex interactions within the network of settlements and their hinterland which produce an uneven distribution of demographic and economic potential and a hierarchy of cities⁹⁷.

In most studies population figures were analysed with regard to Zipf's law, but for historical periods where we do not possess such data, other comparable quantities have been used. R. R. Laxton and W. G. Cavanagh, for instance, analysed settlement sizes for the area of the "Laconian Survey" on the Peloponnese (near ancient Sparta). This study is of particular interest for us, since it includes a survey of the settlement sizes in this area for the Middle and Late Byzantine period (c. AD 900-1500). For this time, in contrast to earlier periods, a value of the constant $Z \approx 1$ and a power law distribution of settlement sizes were found. Laxton and Cavanagh also present one concept, equally relevant for our sample, known as "primate distribution". The concept comes from earlier studies for the modification of the classical Zipf-distribution, where, on the basis of the classic rank-size

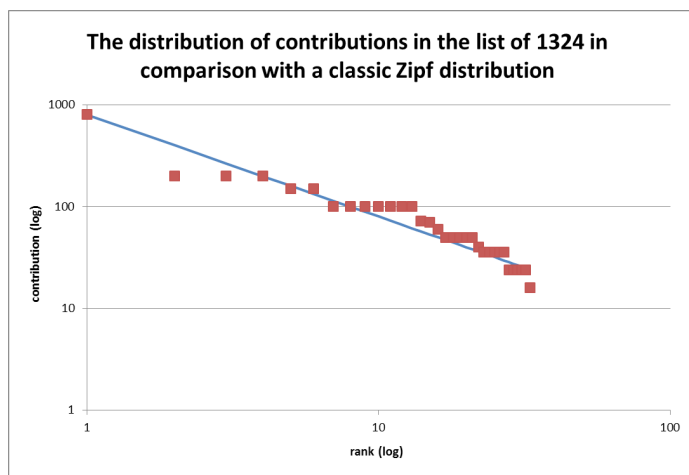
96. LAXTON – CAVANAGH, The Rank-Size, 332, for the citation. DE VRIES, *Urbanization*, 51-54. RITTER, *Allgemeine*, 217-218. PUMAIN, *Scaling*. KUNINAKA – MATSUSHITA, Why does. D. R. WHITE – N. KEJŽAR – C. TALLIS, Generative Historical Model of City Size Hierarchies: 430 BCE-2005, [www-Document] URL http://eclectic.ss.uci.edu/~drwhite/pub/paper_7_6city.pdf (with some modifications of the Zipfian distribution; accessed on September 8th 2009). DITTMAR, *Cities*, 2-7. GIESEN – SUEDEKUM, Zipf's Law. NEWMAN, Power laws, 7-8. EPSTEIN, *Freedom*, 96-101.

97. Cf. FUJITA – KRUGMAN – VENABLES, *Spatial Economy*, 215-219.

distribution, the first-ranking settlement is larger than one would expect in comparison with the other settlements. The opposite of this would be “convex distribution”⁹⁸. As already mentioned, for the Byzantine period in the Laconia survey area, $Z \approx 1$. For the Ancient Greek and Roman periods, the values of Z were all about 1.4, which indicates a higher inequality of the population distribution within the settlement system in this region⁹⁹.

In order to calculate a theoretical Zipfian distribution for our churches, we used our comparable quantities (the contribution figures) and inserted the value of 800, as contribution of the largest element of our sample, into the formula. In figure 6, we compare this Zipf-distribution (with $Z = 1$) with the actual distribution of payments in 1324 on a double-logarithmic scale.

Figure 6: The distribution of contributions in the list of 1324 in comparison with a classic Zipf distribution ($Z = 1$) (on double-logarithmic scale)

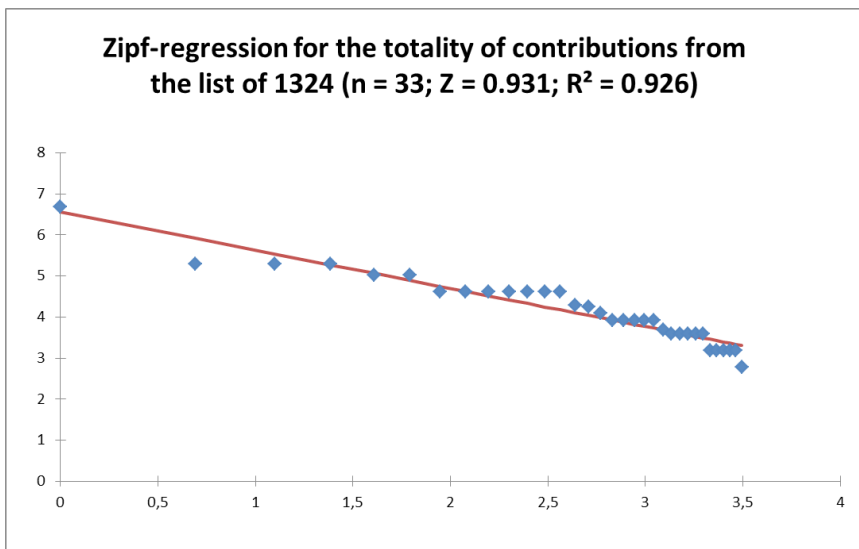


98. LAXTON – CAVANAGH, *The Rank-Size*, 332-339. Cf. also FONSECA, *Urban*, 23, 37-42 (also for an attempt to include the phenomenon of the primate city in a classical rank-size distribution). FASSMANN, *City-size*, 5-7. DE VRIES, *Urbanization*, 89-90. SMITH, *Types*, 22-24. RITTER, *Allgemeine*, 219-220. FALCONER – SAVAGE, *Heartlands*, 40-41. BATTY – LONGLEY, *Fractal Cities*, 47. DRENNAN – PETERSON, *Comparing*, 533-534. For the use of settlement sizes, cf. also A. MARZANO, *Rank-size analysis and the cities of Roman Spain and Britain: some preliminary considerations*, [www-document] URL http://oxrep.classics.ox.ac.uk/index.php?option=com_docman&task=doc_view&gid=31&Itemid=35 (accessed on 8 September 2009). For an analysis of a rank-size distribution in Byzantine Egypt, see RUFFINI, *New Approaches*. For the use of other comparable quantities, cf. also CAVANAGH, *Settlement structure*, 409-413.

99. LAXTON – CAVANAGH, *The Rank-Size*, 350.

As one would have expected, the actual distribution differs from a “pure” Zipf-distribution. In comparison with the values calculated with the Zipf-formula, many of our figures are too high. At the same time, the number of bishoprics of equal contribution is too big. But a standard OLS-regression for this distribution (see figure 7)¹⁰⁰ on log-scale produces a value for the Zipf-coefficient $Z = 0.93$, which is well within the interval for Z considered compatible with Zipf’s law. At the same time, Zipf’s model fits very well with our data (coefficient of determination $R^2 = 0.926$, which means that the Zipf-model can explain more than 92 percent of the variations of the values in the contribution list of 1324). On a double-logarithmic graph, the values from the list group along a diagonal in the typical form of a power law distribution (see figure 7).

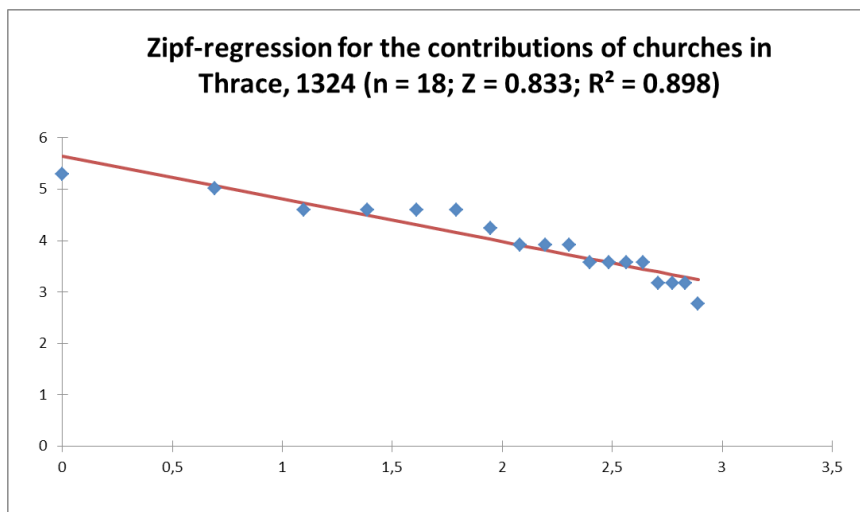
Figure 7: Zipf-regression for the totality of contributions from the list of 1324



We observe a greater divergence from Zipf’s distribution in the case of the 18 contributions from the churches of Thrace. However, the regression (fig. 8) produces a values for Z of 0.833 and the model again fits relatively well ($R^2 = 0.898$).

100. On this method, cf. FASSMANN, City-size, 11-13. DE VRIES, *Urbanization*, 87. For a discussion of the shortcomings of this regression method for the Zipf-distribution, especially for small samples, cf. FALCONER – SAVAGE, *Heartlands*, 41-44. DITTMAR, *Cities*, 8-10. NEWMAN, *Power laws*, 3-5. CLAUSET – ROHILLA SHALIZI – NEWMAN, *Power-law*, 4-7.

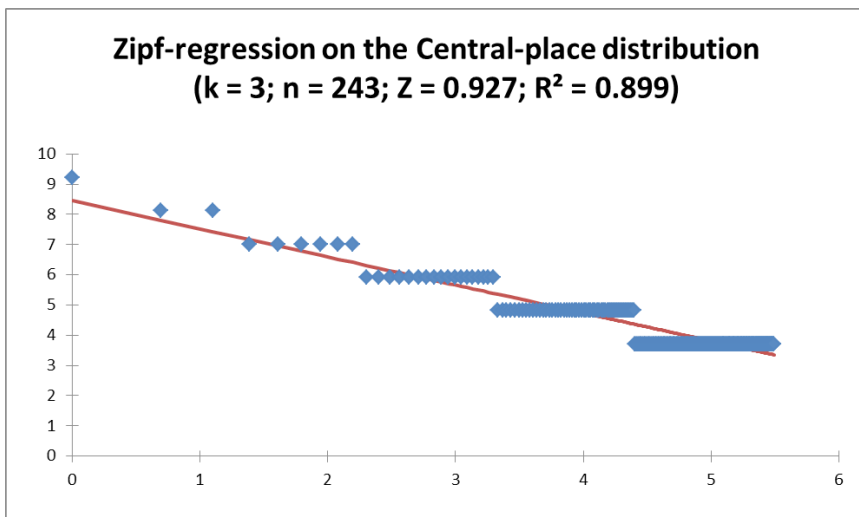
Figure 8: Zipf-regression for the contributions of churches in Thrace from the list of 1324



For our distributions of contributions, the discrepancies to classic Zipf are a logical consequence of the nature of our source, which did not register the contributions as a ratio of the distinct actual income of the bishopric but arranged churches of comparable wealth in the same payment-class. We can observe a similar phenomenon if we compare a distribution of settlement sizes according to Christaller's model of central places (with $k = 3$) with a classic Zipf-distribution. An OLS-regression on this distribution produces $Z = 0.927$ (relatively near to the value of Z for the totality of the contributions of 1324), with $R^2 = 0.899$, and the typical grouping of values along a diagonal in a double-logarithmic graph (fig. 9)¹⁰¹.

101. Cf. also BINTLIFF, *Catastrophe*, 420-422, esp. fig. 6 on 421.

Figure 9: Zipf-regression on the distribution of settlement sizes according to the Central-Place model ($k = 3$; highest ranking central place = 10,000)

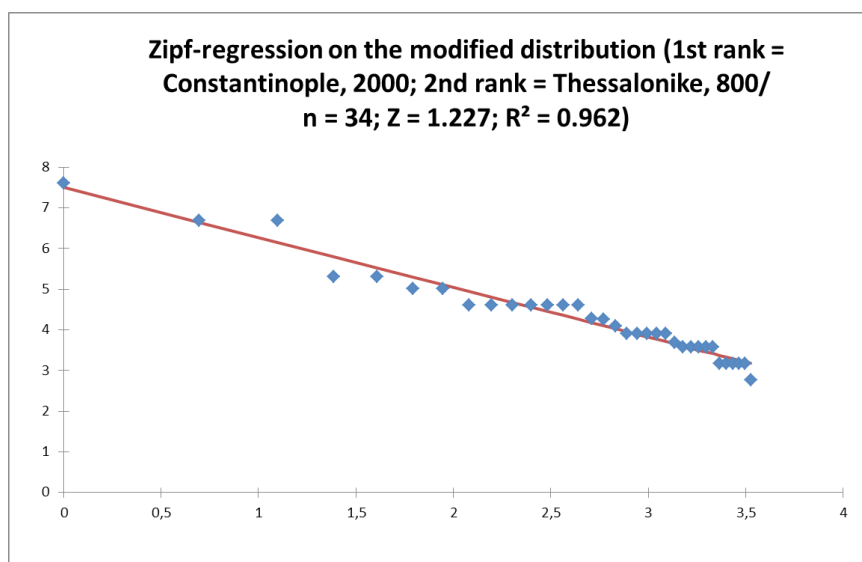


The values of R^2 indicate that Zipf's model can explain the distribution of contributions in the list of 1324 to a very high degree. This is an important argument for our hypothesis that these contributions reflect the relative wealth of the bishoprics and settlements with their hinterland on the list, since they follow the same pattern which has been identified for so many historical and contemporary settlement hierarchies.

However, Constantinople, the highest-ranking settlement in the Empire, as well as in Thrace, is definitely missing in our calculations. If Constantinople would fit into the classical Zipfian model, for instance the model for Thrace, we could simply extrapolate a figure for it from the figures for the lower ranking settlements – twice the figures of the second-ranking settlement (presumably the first-ranking in our list) or thrice the figure of the third-ranking settlement. However, as we know from our sources (despite the absence of actual figures), the Byzantine capital would feature a significantly higher multiple than two or three in relation to other Thracian settlements. We can presume that a Zipfian distribution which includes Constantinople will produce a “primate distribution”, where (as mentioned above) the biggest settlement is far larger in comparison than expected. In order to attempt to integrate Constantinople into our distribution, we must modify it so that we assume that the appropriate contribution for Thessalonike should be at

least as high as that for Monembasia (800 hyperpyra). Furthermore, we may assume that if Thessalonike = 800, the value for Constantinople could be 2.5 times higher (= 2000; according to population estimates for the two cities for our period)¹⁰². A regression on this modified distribution produces $Z = 1.227$ (with $R^2 = 0.962$; fig. 10): its “primate” character is obvious, but the distribution still shows the characteristics of the Zipfian power law pattern.

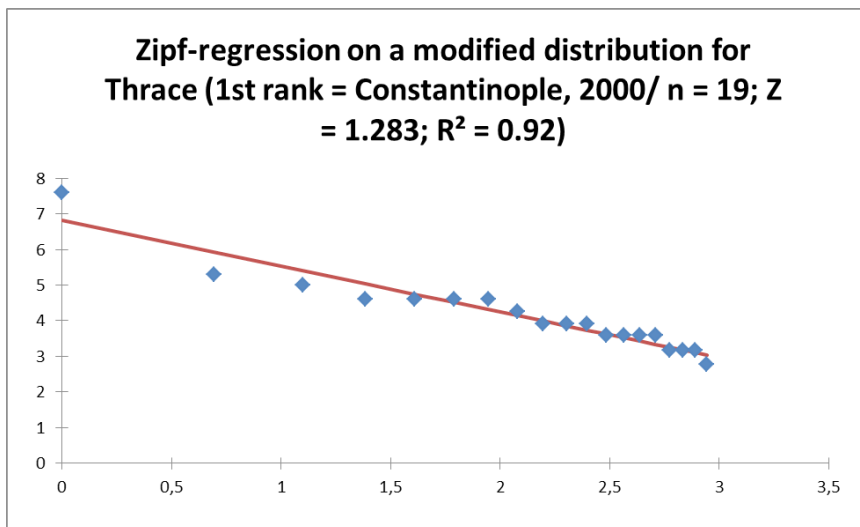
Figure 10: Zipf-regression on a modified distribution of contributions (1st rank = Constantinople, 2000; 2nd rank = Thessalonike, 800) from fig. 16



In addition, for our Thrace-sample we may insert Constantinople = 2000 on the first position and the 18 figures for the Thracian churches from our list. On log-scale, the regression produces $Z = 1.283$ ($R^2 = 0.92$). This diagram (fig. 11) also shows, as we have expected, a typical “primate distribution”; the largest settlement is far larger in comparison than the other elements of the urban system. Yet again we see the typical Zipfian power law pattern in the graph.

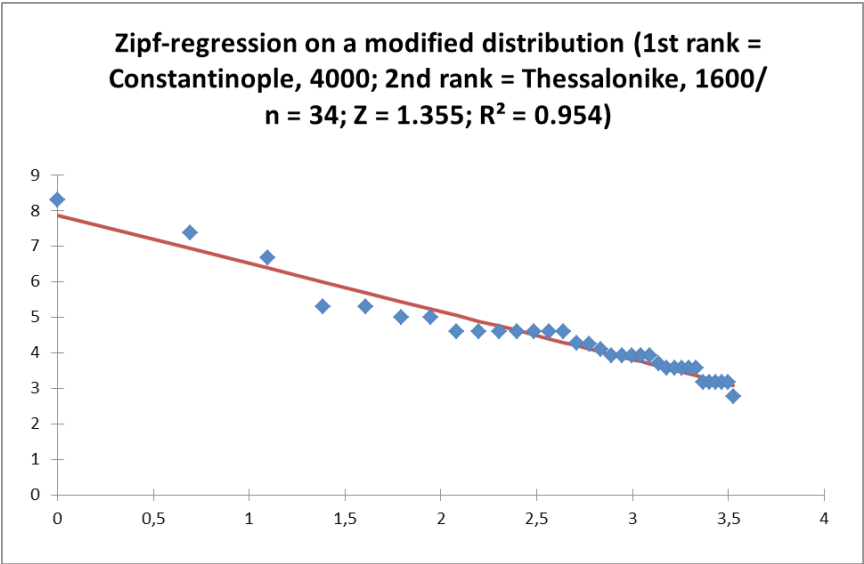
102. The estimates are 20,000 inhabitants for Monembasia, 40,000 inhabitants for Thessalonike, 100,000 for Constantinople, cf. MATSCHKE, *Urban Economy*, 465. LAIOU – MORRISON, *Byzantine Economy*, 131, 196.

Figure 11: Zipf-regression on the modified distribution of contributions from the churches of Thrace (1st rank = Constantinople, 2000)



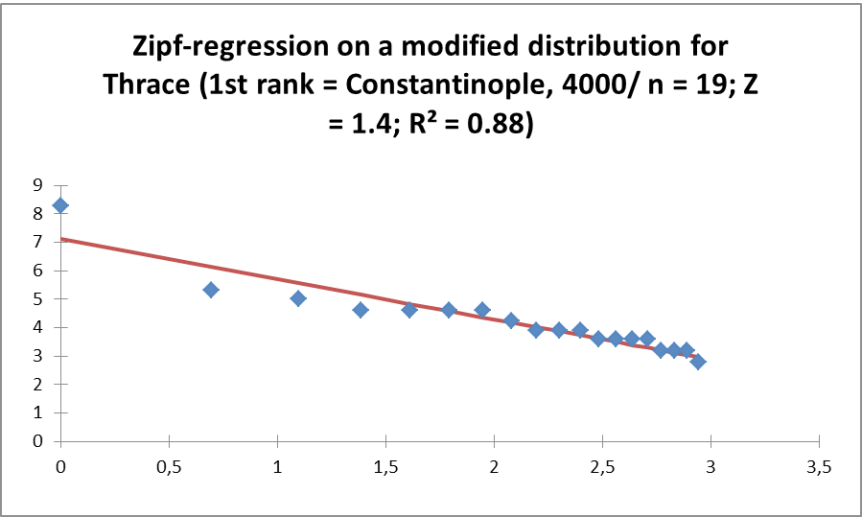
As we have expected, an entry of estimates for Constantinople and a modification of the contribution of Thessalonike produces primate distributions for the totality of the list of 1324 and especially for the Thracian sample. But even with these modifications, the Zipf-model fits very well with the distribution of contributions. The same holds true if, based on the assumption that Thessalonike could have contributed double the amount of Monembasia (according to the higher estimates for its population, see fn. 102), we insert Thessalonike = 1,600 and Constantinople = 4,000 into our list. The distribution of all contributions becomes even more primate: the regression produces $Z = 1.355$ (with $R^2 = 0.954$; fig. 12) and again the familiar diagonal pattern.

Figure 12: Zipf-regression on the modified distribution a modified distribution of contributions (1st rank = Constantinople, 4000; 2nd rank = Thessalonike, 1600) (on a double-logarithmic scale)



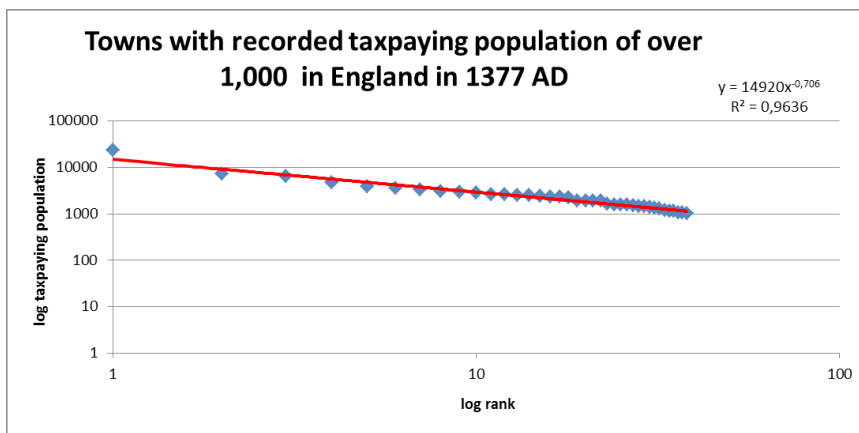
Of course, the same phenomenon occurs with regard to the Thracian sample if we insert Constantinople = 4000: the regression produces $Z = 1.4$ (with $R^2 = 0.88$; fig. 13).

Fig. 13: Zipf-regression on the modified distribution of contributions from the churches of Thrace (1st rank = Constantinople, 4000)



Thus, the use of our figures from the contribution list of September 1324 as a basis for a Zipf-regression clearly demonstrates the conformity of the distribution of contributions on provincial as well as supra-regional level, with distributions generally connected with settlement hierarchies, even despite the distorting effect of the formation of payment classes in our list. As further calculations indicate, the fractal values for the Zipfian coefficient (Z) found in our samples are also comparable to settlement distributions from other regions of Late Medieval Europe, both for a region with near-classical Zipf-distribution (Sicily, 1277¹⁰³, $Z = 0.964$; $R^2 = 0.984$) and for a region with a primate city (area of Florence, on the basis of the famous *catasto* of 1427¹⁰⁴, $Z = 1.0736$; $R^2 = 0.869$). We find a more equal distribution (with $Z = 0.706$; $R^2 = 0.9636$) for the number of taxpayers in towns (with a recorded taxpaying population of over 1,000) in England in 1377 (fig. 14)¹⁰⁵.

Fig. 14: Zipf-regression on the recorded taxpaying population in towns in England in 1377



Of particular interest, of course, is a comparison of the unmodified and modified distributions for the list of 1324 with distributions for former Byzantine territories. We executed a Zipf-regression for the European and

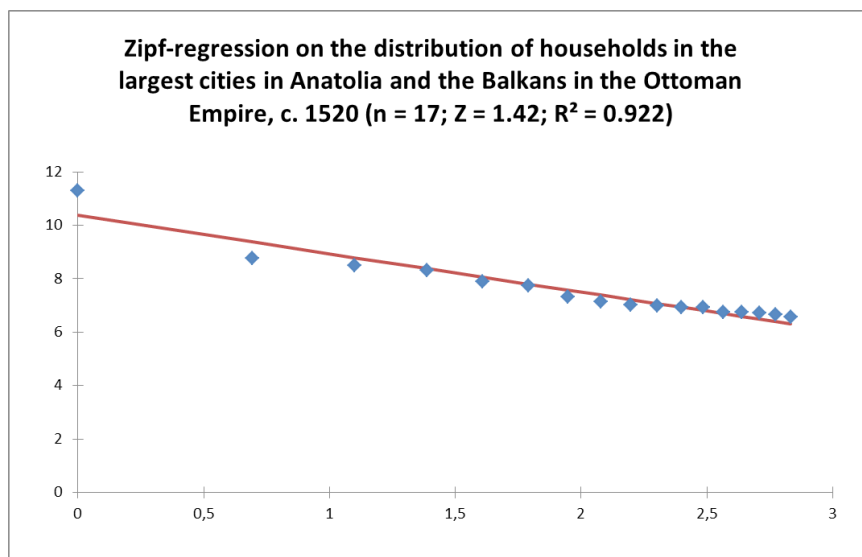
103. For the data, cf. EPSTEIN, *An island*, 71, and IDEM, *Freedom*, 97.

104. For the figures used, cf. HERLIHY, *Tuscans*, 58. Cf. also EPSTEIN, *Freedom*, 98-100.

105. On the basis of data from G. HARRISS, *Shaping the Nation. England 1360-1461* (The New Oxford History of England), Oxford 2005, 274.

Anatolian part of the Ottoman Empire using the numbers of taxed hearths for the 17 largest cities including Constantinople/Istanbul for the year 1520. At this time the cities had between 320,000 and 400,000 inhabitants, we used the lower estimate. The regression produced $Z = 1.42$ ($R^2 = 0.922$; figure 15)¹⁰⁶.

Figure 15: Zipf-regression on the distribution of households in the 17 largest cities in Anatolia and the Balkans in the Ottoman Empire, c. 1520 (on double-logarithmic scale)

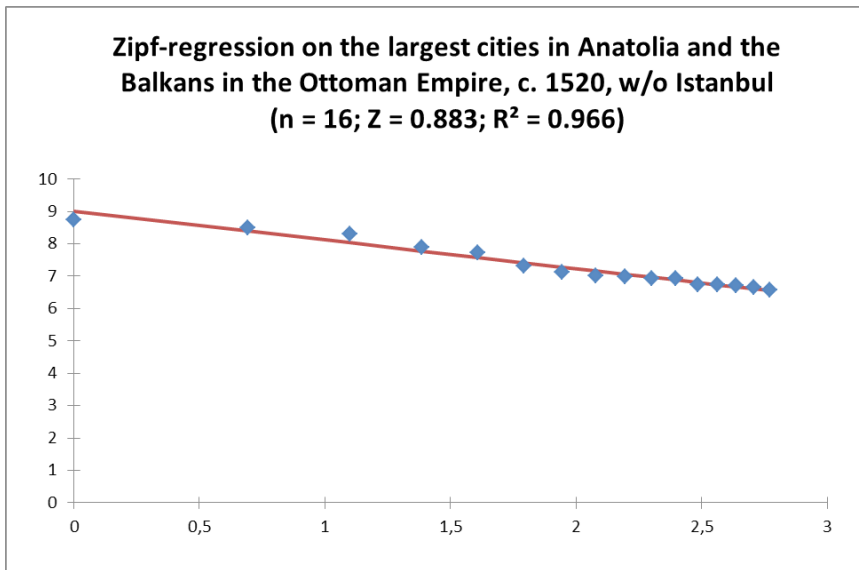


This Zipfian coefficient is above the values of Z we have observed for most of our unmodified and modified Late Byzantine samples. However, it is very near to the highly primate distribution- Z , which we obtained for our hypothetical regression using Constantinople = 4000 and the values for the Thracian churches (see above, fig. 13). In order to receive results comparable with our unmodified distributions, we removed Constantinople from the

106. Correlation coefficient = 0.95, coefficient of determination = 0.91, standard error = 0.431. For the figures used cf. İNALCIK, *An economic*, 257 (included in the sample are Istanbul, Bursa, Adrianople, Angora, Thessalonike, Athens, Tokat, Konya, Sivas, Nicopolis, Serrhai, Sarajevo, Monastir, Skopje, Sofia, Trikkala, and Larissa). For the estimates on the population of Istanbul, cf. F. BRAUDEL, *Das Mittelmeer und die mediterrane Welt in der Epoche Philipps II.*, v. I, Frankfurt am Main 1998, 511.

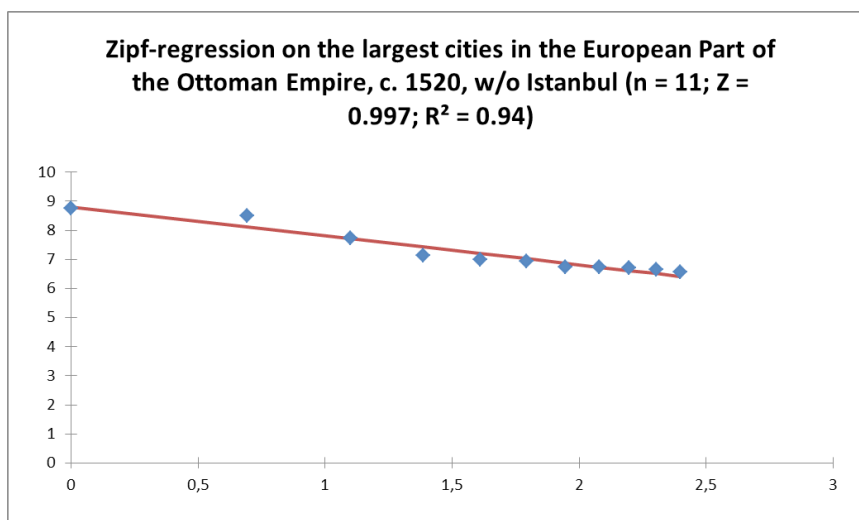
Ottoman distribution of 1520. The Zipf-regression then produced a value of $Z = 0.883$ (with $R^2 = 0.966$; fig. 16), which is very near to the results of our regressions on the unmodified contribution list of 1324.

Figure 16: Zipf-regression on the largest cities in Anatolia and the Balkans in the Ottoman Empire, c. 1520, without Istanbul



Finally, we compared only the 11 largest cities in the European part of the Ottoman Empire with each other, again without Istanbul, and executed a Zipf-regression on this distribution (fig. 17). We received a value of $Z = 0.997$ ($R^2 = 0.94$), an almost perfect classic Zipf-distribution and again very near to the results of our regressions on the unmodified distributions of contributions from the list of September 1324. Thus, the distribution of contributions of 1324 corresponds very well with the distribution of settlement sizes in former Byzantine territories from a later period, for which we possess more reliable data on the population of cities.

Figure 17: Zipf-regression on the 11 largest cities in the European part of the Ottoman Empire, c. 1520, without Istanbul



7. Conclusion: two models for the relative distribution of demographic and economic potential in the Byzantine Empire around the year 1324

The integration of the contributions from the list of September 1324 into the Christaller-distribution demonstrates that these figures can be partly connected with a well-established model for the analysis of the hierarchy of settlements and their hinterlands in a region. The implementation of Zipf-regressions illustrates that the distribution of our figures shows the same pattern as other quantities which have been used for the formation of a settlement rank-size hierarchy (population figures, settlement sizes, etc.). Of course, the relatively small size of our sample may limit the explanatory value of these results, but the examples in the study of Drennan and Peterson show that, although sample size very much matters, even smaller samples can be used to reconstruct a hierarchy of settlements¹⁰⁷.

The implementation of the two models affirms our hypothesis that ecclesiastical wealth also reflected the general economic and demographic potential of a city and its hinterland, since its distribution shows a high

107. CLAUSET – ROHILLA SHALIZI – NEWMAN, Power-law, 8. DRENNAN – PETERSON, Comparing, esp. 548. See also EPSTEIN, *Freedom*, 96-101, for the usage of even smaller samples for medieval Italy.

similarity with those patterns which are characteristic for settlement systems. These patterns have been empirically proved for many regions and for various time-periods, also for neighbouring late medieval Mediterranean regions and for middle and late Byzantine Laconia. The fractal dimension for the Zipfian coefficients we have observed are equally indicators for the connection between the figures from the contribution list of September 1324 and the distribution of economic and demographic potential among the regions of Late Byzantium, since the fractal quality of settlements systems in relative numbers, hierarchical composition and spatial extension has been established as a well observed fact in the last decades¹⁰⁸.

It is not so much the concrete figures that make the list of 1324 valuable for us, since we lack comparative figures to say more about the context of the list's content other than that the figures for the contributions of the churches match the order of magnitude of ecclesiastical income we find in other sources. What makes the document so valuable is the distribution and relative ratio it reveals. If we consider the distribution as representative for the demographic and economic potential of the bishop's city and its hinterland (as also our examination of other sources suggests, see above), it is in turn a strong indicator (besides the evidence from the Laconia survey) that the settlement hierarchies in the provinces of the Late Byzantine Empire followed the patterns which have been observed in other regions of medieval Europe (and further regions throughout history). This equally implies that we have to reckon with a distribution of settlement sizes and economic potential which shows a few larger settlements at the top levels and a long tail of medium and minor sized settlements of comparable size, as is illustrated by every power law graph or Christaller-distribution (which also can be connected with these power law patterns, as has been shown in various studies in the last years, see also above fig. 9¹⁰⁹).

The complete Ottoman distribution from 1520 may give us an impression of the character of Byzantium's urban hierarchy in those periods of its history when Constantinople's position within the Empire was as superior in

108. Cf. FONSECA, *Urban*, 13. BATTY – LONGLEY, *Fractal Cities*, 47-55, 336-368. CHEN – ZHOU, *The Rank-Size*. CAVANAGH, *Settlement structure*, 409-413.

109. DE VRIES, *Urbanization*, 88. FONSECA, *Urban*, 44-56. BATTY – LONGLEY, *Fractal Cities*, 51-55

economic and demographic matters as it was within the Ottoman Empire, whose Sultans reconstructed Constantinople's former glory and size. Our modifications and the comparison with the Ottoman distribution make clear how much the settlement hierarchy was influenced by the superior position of an imperial city such as Constantinople in Byzantine as well as Ottoman periods. The position of Constantinople was sustained by Emperors and Sultans with measures such as the constriction of foreign merchants to the capital or resettlements (as under Mehmed II after the conquest 1453)¹¹⁰.

The Zipf-distribution is also sometimes regarded as an indicator for the "balance" of urban systems¹¹¹. More critical in this respect is Jan de Vries who wrote: "The rank-size distribution is a blunt instrument with which to evaluate the process of growth and change in urban systems. The danger is great that these beguiling arrays will not simply be misinterpreted but also overinterpreted. (...) The adequacy of an urban system cannot be judged on the basis of an abstract standard or ideal"¹¹². Accordingly, recent studies often interpret the Zipfian model (with $Z \approx 1$) less as an "ideal" distribution of settlement sizes than as an indicator for settlement hierarchies and as an instrument of comparison for different settlement distributions, as we have done above¹¹³.

We could therefore propose our modified contribution lists (with Constantinople = 2000 and Thessalonike = 800 ["Model I"] and with Constantinople = 4000 and Thessalonike = 1600 ["Model II"], see fig. 10 and 12) as models for the relative distribution of demographic and economic potential within the settlements of the Byzantine Empire and their hinterland around 1324. For their visualisations we have once again chosen

110. OIKONOMIDES, The Role. LAIOU – MORRISSON, *Byzantine Economy*, 49-61. BINTLIFF, *Catastrophe*, 434. Cf. also FASSMANN, *City-size*, 18-21. SMITH, *Types*, 37-38, for this phenomenon in other regions and periods.

111. FASSMANN, *City-size*, 8-9 (on various interpretations of the rank-size rule). DE VRIES, *Urbanization*, 82-88. VAN DER WOUDE – DE VRIES – HAYAMI, *The hierarchies*, 2-3. SMITH, *Types*, 24-26. DITTMAR, *Cities*, 7, 30-31. GIESEN – SUEDEKUM, *Zipf's Law*, 2-5. NEWMAN, *Power laws*, 16-19, 21-24.

112. DE VRIES, *Urbanization*, 93.

113. Cf. DRENNAN – PETERSON, *Comparing*.

Figure 18: Visualisation of the first modified contribution list from September 1324 (Constantinople = 2000, Thessalonike = 800) as a model for the relative distribution of demographic and economic potential in the Byzantine Empire at this time (“Model I”; visualisation with the software PAJEK)

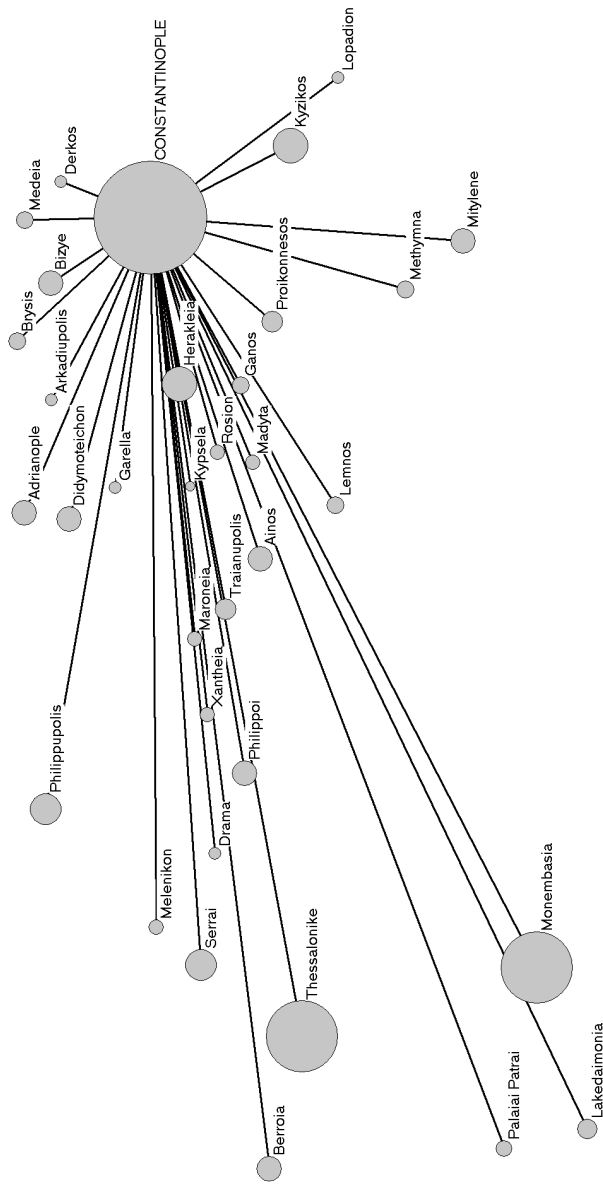
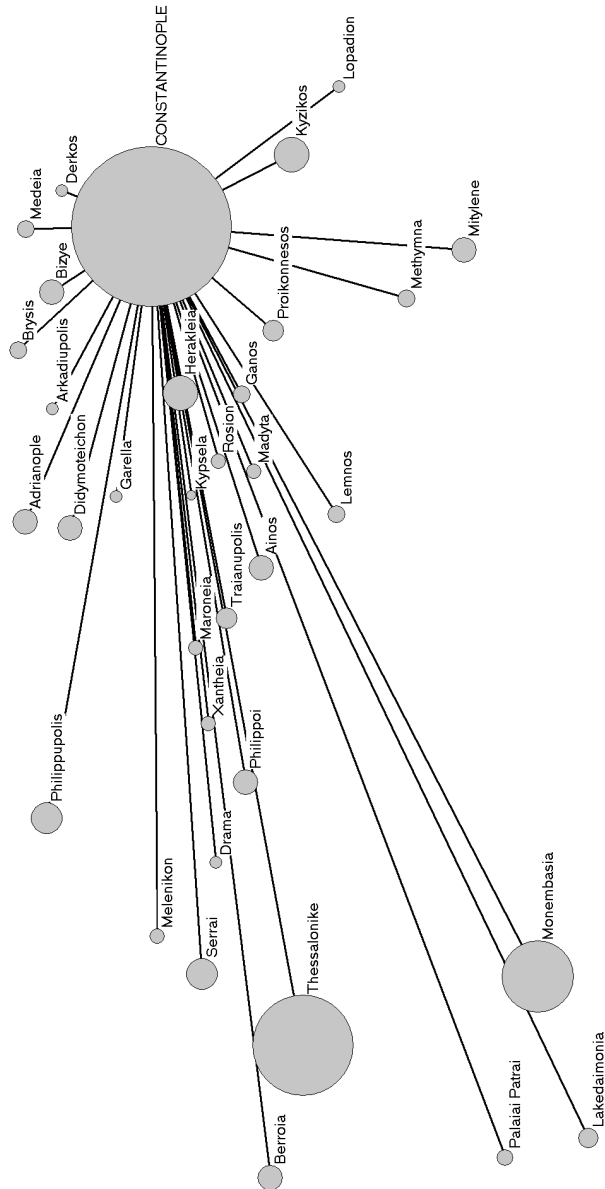


Figure 19: Visualisation of the second modified contribution list from September 1324 (Constantinople = 4000, Thessalonike = 1600) as a model for the relative distribution of demographic and economic potential in the Byzantine Empire at this time (“Model II”; visualisation with the software PAJEK)



the form of a network, in which all contributing churches are connected to Constantinople and the amount of their payment is indicated with circles of corresponding size (fig. 18 [“Model I”] and 19 [“Model II”]).

If we now try to combine our calculations for the models according to Christaller and Zipf, we use our estimate for the entire territory of the Byzantine Empire around 1320 (c. 100,000 km²) and divide it by our value $A = 1,422.56$ km² for a Central Market Town (for a population density of 20 per km²). Accordingly, we would need 70.3 Central Market Towns to cover the entire territory of the Empire. If we now fill in the population estimate of 100,000 for the largest city (Constantinople, see above fn. 102) in Zipf’s model and calculate with our value for $Z = 1.227$ (Model I) or 1.355 (Model II) (from the modified distributions in fig. 10 and 12), we receive a population distribution for the first 70 settlements ranging from 100,000 for Constantinople to 1,164 (I) or 1,054 (II) for the 70th settlement (fig. 20 and 21). Settlements 41 to 70 (I)/37 to 70 (II) are below 2,000 inhabitants, settlements 27 to 40 (I)/25 to 36 (II) below 3,000 inhabitants, settlements 17 to 26 (I)/ 15 to 24 (II) below 5,000 inhabitants and settlements 9 to 16 (I)/ 8 to 14 (II) below 10,000 inhabitants. Thus, the two models produce a majority of medium and small-sized cities within the order of magnitude we would have expected on the basis of our sources and later population figures from Ottoman times (see above, section IV, esp. Macedonia). The totality of urban population for these 70 settlements in Model I is 412,375, and 382,866 in Model II. If we compare this figure with estimates for the total population of the Empire at this period (2 to 3 million, if we assume a population density of 20 to 30 per km²)¹¹⁴, it would be near the upper border of the estimated range for urbanisation in pre-modern agrarian societies (10 to 25 %)¹¹⁵. Both models for the distribution of demographic and economic potential in the Late Byzantine Empire demonstrate their compatibility with our historical evidence for Byzantium and neighbouring regions, as well as with recent hypotheses on the “small scale” character of the Byzantine economy in this

114. Cf. LAIOU, *Human Resources*, 50-51.

115. DE VRIES, *Urbanization*, 91-92, also for a similar model. BANG, *Roman Bazaar*, 85-89. If we calculate with a population for Constantinople of only 50,000, we would of course receive a total urban population only around half that size (near the lower border of the estimated urbanisation range), with 75,000 around three quarters that size.

time (see above, fn. 6). Further studies and refinement of the models is of course necessary, but we consider them a useful starting point for some new kind of research into Byzantium’s economy and society.

Figure 20: Model distribution of population for the first 70 settlements (first rank = Constantinople; $Z = 1.227$) in comparison with a classic Zipf distribution (“Model I”)

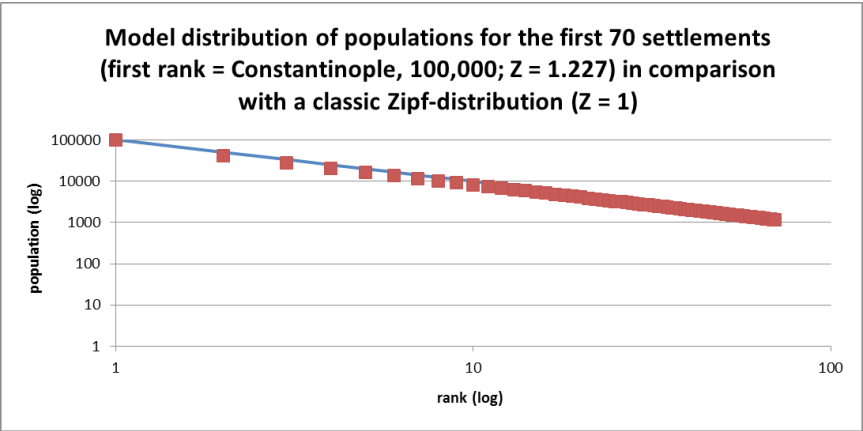
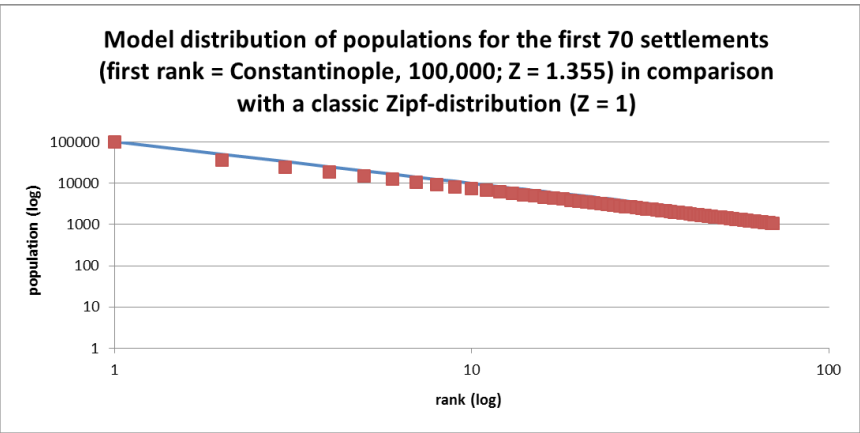


Figure 21: Model distribution of population for the first 70 settlements (first rank = Constantinople; $Z = 1.355$) in comparison with a classic Zipf distribution (“Model II”)



The analysis of the list of contributions to the Patriarchate of Constantinople from September 1324, a source so far somewhat neglected for the research on Byzantium's economy, may shed new light on the underlying correlations and dynamics of this Empire on the eve of its definite decline. To cite Alexander Kazhdan: "The Byzantinist nibbles his food from dispersed and isolated texts, sometimes documentary, sometimes narrative, often from Italian informants, and is doomed, by the character of his sources, to restrain from asking the questions that are natural for Italian counterparts" (of Byzantine cities)¹¹⁶. It is all the more important to analyse the existing evidence with every possible methodological instrument to receive as much insight into the structures and patterns of Byzantium's economy as possible.

116. KAZHDAN, *The Italian*, 3.

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HIERARCHIES AND FRACTALS: ECCLESIASTICAL REVENUES AS INDICATOR FOR THE
DISTRIBUTION OF RELATIVE DEMOGRAPHIC AND ECONOMIC POTENTIAL WITHIN
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CENTURY

Until now the source material has made it impossible to reconstruct the distribution of economic power and population within the Late Byzantine Empire on a large scale. Our new analysis of a list of financial contributions from 1324, which includes those from 33 bishoprics and the Patriarchate of Constantinople, connects this data with the economic performance of the respective town and its hinterland; we demonstrate that the distribution of contributions shows characteristics which are typical for settlement hierarchies and therefore can be used to create the first models for the relative distribution of demographic and economic potential in the Byzantine Empire at this time.