Retail Ratios in the Netherlands, c. 1670 – c. 1815

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Version date: 12 April 2011

Comments welcome; please do not quote or cite.

Acknowledgements: We would like to thank Danielle Teeuwen for the collection of a substantial part of the data, Piet Lourens and Jan Lucassen for access to their Guilds Database, Jelle van Lottum for training and guidance on ArcGIS, and Jeremy Edwards for his advice on the econometric analysis and his comments on the paper.

Abstract: The Netherlands are thought to have pioneered an early modern ‘Retail Revolution’ which reduced the transaction costs of bringing market wares to wider social strata, facilitating the Consumer Revolution. This paper addresses open questions about this development using a commonly used quantitative benchmark – the ‘retail ratio’, defined as the number of retailers per 1,000 inhabitants. We present a large dataset of Dutch retail ratios and use them to show how the density of retailing in the Netherlands varied across space, over time, and with other local characteristics. We conclude by drawing broader implications of our findings for understanding the early modern Retail Revolution.
1. Introduction

Expanding market consumption is widely held to have fuelled European economic growth before industrialization. Between 1650 and 1800, a ‘Consumer Revolution’ is thought to have seen the middling sort spending lavishly on luxuries and the poorer strata buying cheap fashions and comestibles, while in a parallel ‘Industrious Revolution’ the growing demand for market goods motivated households to re-allocate time from leisure and household production to income-earning work.¹

The Consumer and Industrious Revolutions not only needed people to shift into market work and earn more spending money. They also needed the commercial sector to reduce transaction costs, bringing new market wares within the reach of wider social strata. During this period, it is argued, European retailing underwent unprecedented growth and change. Shops, stalls, hawkers, and peddlers proliferated alongside established merchants, lowering the transaction costs of indulging in new market wares. The number of retailers grew, products for sale diversified, and shopping practices changed significantly.²

The Netherlands, specifically the Dutch Republic, is widely regarded as the first European country to have experienced this explosive growth in retailing.³ Yet this view is based largely on indirect evidence such as probate inventories and on case studies of shop-keeping in particular localities.⁴ As a result, we still do not know precisely how the Dutch retail sector developed over time, whether the changes were as dramatic everywhere in the country, and how retailing varied with local and regional characteristics.

This paper addresses these open questions using a commonly used quantitative benchmark: the ‘retail ratio’, defined as the number of retailers per 1,000 inhabitants.⁵

¹ McKendrick, Brewer and Plumb (1982); Berg (1999); De Vries (2008).
² Shammas (1990); Mui and Mui (1989); Blondé et al. (2005); Stobart and Hann (2004); Blondé and Van Damme (2010).
⁴ Van Nierop (1953); Wijsenbeek (1987a); Streng (2001); Steegen (2006); Wijsenbeek (1987b); De Vries (1984); Kamermans (1999); Dibbits (2001).
⁵ Studies using this benchmark (or its reciprocal, the number of inhabitants per retailer) to examine the Consumer Revolution include Blondé and Greefs (2001), 207-29; Blondé and Van Damme (2006), 4, 18; De Munck (2010), 40; De Vries (2008), 170; De Vries and Van der Woude (1997), 581; Ogilvie
Some retail ratios for the Netherlands have been collected in earlier studies, but they cover only a small number of dates and localities, and are concentrated on urban centres and the province of Holland, so they provide only limited insight into retail development across the country as a whole during the period of the Consumer Revolution. We have collected and analyzed a much larger set of data on Dutch retail ratios. Our data span the period from 1639 to 1813 and include observations from the northern province of Friesland, the eastern provinces of Overijssel and Gelderland, the southern provinces of Brabant and Limburg, and – last but not least – the provinces of Holland and Zeeland in the west. Unlike many other data on retail ratios, ours do not focus primarily on cities, but also include numerous small towns, villages and hamlets, many of them located in the periphery rather than the economic centre of the country. We also seek to measure retail ratios more accurately, by including retailers who combined shop keeping with another occupation. We use these data to show how the density of retailing in the Netherlands varied across regions, over time, and with other local characteristics such as settlement size. The paper concludes by drawing the broader implications of our findings for the early modern Retail Revolution.

2. The Dataset

The dataset is based on occupational and demographic information derived from local tax registers and censuses for more than 900 Dutch localities during the period 1639-1813. From the original registers we were able to incorporate into the dataset information on year, locality, province, population size, number of household heads, number of female household heads, and number of traders. The number of traders was separated into different categories, to allow for analysis according to gender and by-employment. To the data extracted from the tax registers and censuses we added information on the presence of retail guilds, derived from the Database on Dutch Guilds 1200-1800 compiled by Jan Lucassen and Piet Lourens. Finally, all localities in the database were mapped using geographic information system software, from which geographical coordinates (corresponding to latitude and longitude) were

7 For an overview of the tax registers and censuses used to compile this dataset see Appendix.
8 When population numbers could not be derived from the original register we used Lourens and Lucassen (1997).
extracted and added to the database for use as independent variables in the econometric analysis.\textsuperscript{9}

Most estimates of retail ratios are based on primary occupation. However, historians analysing occupational structure in the pre-industrial Netherlands have found that retailing was very common as a by-employment, in both rural and urban areas.\textsuperscript{10} To obtain the most accurate estimate of retail ratios it was therefore crucial to include multiple occupations whenever these were documented. We recorded information on primary and subsidiary occupations separately, for two reasons. First, this made it possible better to distinguish between those engaged in full-time and part-time retailing. Second, not all registers mention more than one occupation. As we cannot know whether this arose from less accurate registration of occupations or from the actual absence of multiple occupations, we regarded it as essential to analyse our data in two ways – first with all occupations included (a ‘maximal’ measure of retailing) and then with only the primary occupation included (a ‘minimal’ measure).

In addition to casting our net more widely than usual, by including subsidiary occupations, we also used a broader definition of retailing. We took into account all persons practising a commercial occupation autonomously, i.e. excluding only those working as employees in businesses headed by others. We included, of course, anyone whose occupational descriptor referred explicitly to retailing, such as ‘winkelier’ (shop-keeper), ‘winkelhouder’ (shop-holder), ‘winkel’ (shop), and ‘-verkoper’ (a seller of a particular type of wares). But we also included anyone described as a wholesaler, such as ‘-koper’ (a buyer-up of a particular type of wares) or ‘handelaar’ (trader), and anyone described as ‘koopman’ or ‘koopvrouw’ (male or female merchant). The terminology used to describe traders differed chronologically and geographically across the early modern Netherlands. Whereas a large variety of occupational descriptors existed for traders in the large urban centres of Holland, a much narrower range was used in smaller provincial towns and rural areas. In tax registers from the eastern province of Overijssel, for example, we often only find traders registered as ‘koopman’ or ‘koopvrouw’ (male or female merchants), and from this alone we cannot establish whether that person engaged in retailing, wholesaling,

\textsuperscript{9} Localities were mapped using ArcGIS, from which geographical coordinates were then extracted.  
\textsuperscript{10} Slicher van Bath (1977), 181; Roessingh (1965), 232; De Vries and Van der Woude (1997), 602.
or a combination of the two.\textsuperscript{11} An additional reason to include all persons practising a commercial occupation is to facilitate future international comparisons: in a number of pre-modern European societies wholesalers and retailers were not recorded separately but were designated with an umbrella term for ‘traders’, a feature of archival sources which has led previous studies to include all traders in their calculations of retail ratios.\textsuperscript{12}

3. Characteristics of the Dutch Retail Ratio and its Determinants

In discussions of the early modern Retail Revolution, the Netherlands is regarded as being at the forefront of European development. The country not only had a wide and varied network of retail outlets as early as the late seventeenth century, but its retail sector was characterized by features considered to belong to ‘modern’ retail systems. Studies of Dutch retailing between c. 1670 and 1750 have shown that the country’s retailers were highly specialized, that shopping streets and neighbourhoods with dense concentrations of shops selling similar products were common, and that many retailers were selling new products such as printed cottons and ‘colonial beverages’ (coffee, tea, and chocolate) that became increasingly fashionable and widely desired in the course of the Consumer Revolution.\textsuperscript{13}

Previous research has also suggested that in the Netherlands large numbers of people were involved in retailing relative to the overall population. By the mid-eighteenth century, for instance, Amsterdam is estimated as having had 18-23 retailers per 1,000 inhabitants, and similar levels are observed for the cities of Leiden and Zwolle.\textsuperscript{14} Even higher retail ratios have been measured for the Brabant town of ‘s-Hertogenbosch in 1742 (37 per 1,000) and for towns in the province of Zeeland in 1807 (26.5 per 1,000).\textsuperscript{15} Nor were high retail densities limited to urban areas, as shown by some rural

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\textsuperscript{11} Van den Heuvel (2007) 31-34.
\textsuperscript{12} For early modern Europe more generally, see Ogilvie (2010), 302 (Table 2). On the use of umbrella terms for ‘traders’ (‘Handelsmann’, ‘Handelsleute’) in an early modern German context, see Ogilvie, Küpker and Maegraith (2011). For Dutch studies which include ‘merchants’ also as possible participants in retailing, see Kamermans (1999), 34; Harten (1971), 33.
\textsuperscript{14} De Vries and Van der Woude (1997), 581; Van den Heuvel (2007), 143.
localities in the province of Holland which had retail ratios as high as 26 per 1,000.\textsuperscript{16}

A recent comparison across 308 different early modern European localities found that the average retail ratio across 48 localities in the Netherlands covering the period 1639-1811 was a striking 22.9 per 1,000, significantly higher than the ratios observed for 190 localities in Germany, which varied between 3.7 and 7.7 per 1,000.\textsuperscript{17}

However, most of the Dutch observations in this comparison were for relatively large urban centres and for the province of Holland and thus do not accurately reflect retail density in the country as a whole.\textsuperscript{18} Indeed, the data available on retailing in areas of the Netherlands outside the core province of Holland point to a substantial variation in retail ratios, not only between urban and rural areas, but also across the country.\textsuperscript{19}

Unfortunately, many of these data are only available at an aggregate level and as a result provide little insight into local and regional variation, or into the factors that may have given rise to such variation.\textsuperscript{20} Here we broaden the analysis to the Netherlands at large, explore different definitions of the retail ratio, and investigate how retail density varied with other factors.

We collected 966 observations of retail ratios for different Dutch localities between 1639 and 1813. Not all observations had information on all the variables of interest outlined in the description of the dataset above, but three large data subsets proved suitable for analysis. The first consisted of 959 observations, for which full information was available on all variables of interest except for two: whether retailing was the primary occupation and the sex of the household head. The second subset consisted of 873 observations, for which full information was available on all variables, including whether retailing was the primary occupation, but not the head’s sex. The third subset consisted of 751 observations for which full information was

\textsuperscript{16} Van den Heuvel (2007), 143.
\textsuperscript{17} Ogilvie (2010), 302 (Table 2).
\textsuperscript{18} Retail ratios for scattered localities, regions and dates are reported in Kamermans (1999), 34 (Krimpenerwaard 1807 1.51 per 1,000 (shopkeepers only), 2.32 (shopkeepers and merchants)); Harten (1971), 33 (Zeeland 1807 rural areas 6.4, towns 26.5; total 13.9 (shopkeepers only) rural areas 8.9, towns 33.8, total 18.5 (shopkeepers and merchants)); Van den Heuvel (2007), 143 (Zwolle 1742 22 per 1,000; Leiden 1749 24 per 1,000; ’s-Hertogenbosch 1742 37 per 1,000, Graft 1748 21 per 1,000, Winkel 1742 26 per 1,000, De Zijpe 1742 12 per 1,000); De Vries and Van der Woude (1997), 581 (Amsterdam 1742 (estimate) 18-23 per 1,000); Slicher van Bath (1977), 170 (Overijssel 1795 10.25 per 1,000 (10.72 including by-employment)); Roessingh (1965), 228 (Veluwe 1749 5 per 1,000).
\textsuperscript{19} Harten (1971), 33; Slicher van Bath (1977), 170; Roessingh (1965), 228; Kamermans (1999) 34.
\textsuperscript{20} Another problem with the currently available rural data is that one cannot always be certain which types of traders are included – retailers only, retailers and wholesalers, retail by-employments, and so on.
available on all variables, including whether retailing was the primary occupation and head’s sex.

3.1. Measures of the Retail Ratio

Retail ratios varied considerably across early modern Dutch localities, as Table 1 shows. The ‘maximal’ retail ratio (which includes retail by-employments) varied from 0 to over 112 per 1,000 inhabitants, with a mean of just over 8 for the large data subset and just over 6 for the smaller data subsets. Even the ‘minimal’ retail ratio (which excludes by-employments) covered a very considerable range, from 0 to over 82, but unsurprisingly with a lower mean of around 5. For both measures of the retail ratio, the distribution was skewed toward the lower end of the distribution in all data subsets, as shown by the fact that the median was zero or nearly so. Even for the ‘maximal’ measure of the retail ratio, about half of all localities had zero retailers, and for the ‘minimal’ measure this rose to c. 55 per cent.

Differences in retail ratios among localities are likely to result from differences in other factors. For instance, the localities in the dataset varied greatly not just in their retail ratios but also in their dates of observation, their population sizes, and their geographical location. Perhaps the settlements with low or zero retail ratios had a low density of retailing because they were observed at earlier dates, included fewer large cities, were located in particular areas of the country, or had other features which deterred retailers or their potential customers. What values did these characteristics take for the localities in our dataset?

3.2. Population

Population size might be expected to increase retail density in several ways. First, larger settlements may have higher average incomes, increasing the demand for retailing, since Engel’s Law predicts that richer consumers will spend a higher share of their incomes on tertiary goods (such as retail services) than will poorer ones.21 Second, larger settlements may have a more extensive division of labour, creating a

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demand for retailers to reduce exchange costs between producers and consumers of
different goods. Third, larger settlements may function as central places for the
surrounding region, exchanging secondary goods and tertiary services for rural
primary products.\footnote{Christaller (1933).} Fourth, larger settlements may create economies of agglomeration
– positive externalities in the form of improved information flow, specialization,
division of labour, or the ability to attract more suppliers and customers than a single
producer could alone. On the other hand, large cities can also suffer from
diseconomies of agglomeration through congestion, pollution and other negative
externalities, as well as diseconomies of scale arising from competition, shortage of
labour, or lack of flexibility.\footnote{Fujita and Thisse (1996).} Furthermore, the Dutch countryside is also supposed to
have commercialized in this period, which may diminish the expected impact of
population size on retail ratio.\footnote{As pointed out by De Vries (2008), 93-5, 128.} On the whole, however, since the early modern period
saw the decisive shift from periodic fairs to continuous urban markets in Europe,
combined with rapid urbanization specifically in the Netherlands, we would expect
economies of agglomeration to have predominated over diseconomies in this period.\footnote{De Vries (1984).}

Previous studies of retailing have understandably focused mainly on large urban
centres.\footnote{The historiography of early modern retailing can be divided into two strands which unfortunately
show little overlap: some historians focus on stationary retailing, mainly in urban centres (for
examples, see footnote 26), while others focus on ambulatory retailing, mainly in rural areas and over
long distances (Spufford (1984); Oberpenning (1996); Fontaine (1996).} Not only were large changes in retailing (both an expansion of its size and
an alteration of its character) first observed in cities, but many of the sources that
provide an insight into the early modern retail sector are records of various retailers’
guilds. As these guilds were mostly found in large urban centres, the focus of the
historiography on retail growth has been on urban developments.\footnote{Examples are Stegeman (1991); Jongman (1951); Streng (2001); Steegen (2006); Van den Heuvel
(2007); Van den Heuvel (2008). Also several M.A. theses have been written on the basis of such guild
records: see Bot (1996); Peters (1987); Becker (n.d.). For the Southern Netherlands, see Blondé and
Greefs (2001); Van Aert (2007); Van Damme (2007).} Despite important
work on retail growth in rural areas of the Netherlands by Slicher van Bath,
Roessingh, De Vries, Van der Woude, Harten, and Kamermans, these findings have
not fully found their way into the wider debates on retail development in the Dutch

\footnote{22 Christaller (1933).} \footnote{23 Fujita and Thisse (1996).} \footnote{24 As pointed out by De Vries (2008), 93-5, 128.} \footnote{25 De Vries (1984).} \footnote{26 The historiography of early modern retailing can be divided into two strands which unfortunately
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records: see Bot (1996); Peters (1987); Becker (n.d.). For the Southern Netherlands, see Blondé and
Greefs (2001); Van Aert (2007); Van Damme (2007).}
Republic. This emphasis on urban retailing is reflected in the fact that the mean population size of the 308 European localities whose retail ratios were analyzed by Ogilvie was over 14,000 and the median was nearly 1,600. For the 48 Dutch localities in that dataset, the mean population size was 9,995 and the median was 2,134. Even though Ogilvie’s dataset did include some smaller Dutch localities, it focused primarily on urban centres and its findings may not apply to villages or even small country towns.

By contrast, as Table 1 shows, the localities in our Dutch dataset cover the whole range of population size from very small (a hamlet of 5 inhabitants) to very large (a city of 67,000). In the largest data subset, the mean population is c. 970 and the median 285; the smaller data subsets have means of 700-780 and medians of 216-265. In the largest data subset, one-fifth of localities have fewer than 100 inhabitants, two-thirds have fewer than 500, and over four-fifths have fewer than 1,000; in the smaller data subsets, the proportion of small localities is even higher.

This wide range of variation, and the inclusion of many small localities, enables us to go beyond existing literature to explore the development of retailing in both urban centres and the countryside. This is particularly important because the early modern period is supposed to have seen wider social groups, including rural ones, becoming involved in market production (as part of the Industrious Revolution) and in market consumption (as part of the Consumer Revolution). Did they also participate in the Retail Revolution? Our data enable us to explore this hypothesis systematically for the first time.

3.3. Time

Superficially it might seem obvious that retail density should also have increased as time passed. For one thing, economic growth and development in general would be expected to cause retailing to expand because of Engel’s Law, which predicts that as incomes rise people will spend a larger share of their income on ‘luxuries’ which include more secondary and (especially) tertiary products. Secondly, the early modern

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28 An exception is De Vries (2008), which connects it with the theory of the Industrious Revolution.
period in particular is supposed to have seen a Commercial Revolution, which would lead one to expect retail density to rise between the seventeenth and the nineteenth century. The early modern period saw the Dutch Republic acquiring colonies in the West and East Indies, which provided direct access to new consumables for which demand expanded over the seventeenth and eighteenth centuries. Studies of Dutch inventories show a growing tendency for durable products to give way to items with a much shorter lifespan, giving rise to a pattern of replacing household goods and clothing on a regular basis. This in turn is thought to have made fashion more important, in turn stimulating frequent purchases of goods and increasing demand for the services of retailers.

However, there are problems with this simple hypothesis of unidirectional expansion of retailing over time. For one thing, growing commercialization will not necessarily bring in its wake a proliferation in the number of retail establishments but may instead give rise to a countervailing development in which existing shops consolidate and expand in size rather than new shops entering the sector. This certainly happened to retailing in most European economies in the later nineteenth and early twentieth century, as small corner shops gave way to larger department stores. Our dataset does not cover this later period but it is not unthinkable that such phases of consolidation and rising scale also occurred earlier.

A second complication is that even if commercialization does involve expansion in shop numbers rather than in shop size, the pace of expansion may vary over time. Any economy will tend to experience phases of rapid commercialization followed by phases of slower growth or even stagnation, and then a return to expansion in some later period. We should not assume a uniform growth trajectory over time, even if over the very long term retailing expanded.

Features of the available archival sources on Dutch retail ratios give our dataset characteristics that preclude free selection of chronological break-points or time-phases. All but two of our data points are clustered in four ‘decades’ – the 1670s

29 De Vries (1974); Kamermans (1999); Dibbits (2001); Koolbergen (1983).
30 Lemire (1997); Shammas (1990); Van Damme (2007); Van Aert (2007); Blondé and Van Damme (2010).
31 Jefferys (1954); Mathias (1967); Alexander (1970); Schrover (2002).
(1673-1680), the 1740s (1735-49), the 1790s (1795-7), and the 1800s (1803-13). (The two observations falling outside these clusters date from 1639 and 1775.) Lacking a scatter of observations across the entire time span from 1673 to 1813 compelled us to define dummy variables for each ‘decade’ and then test for differences among the ‘decades’.

What would we expect to be the effect of time on retail ratios in the early modern Netherlands? The Dutch historiography provides us with interesting hypotheses to test in this context. The Netherlands is regarded as experiencing its economic ‘Golden Age’ from c. 1550 to c. 1650. Unfortunately we have only one observation during the ‘Golden Age’ itself, for the town of Zwolle in Overijssel in 1639. This isolated observation cannot readily be included in the regression analysis because it falls outside the four decadal clusters and we have no other localities observable during the Dutch Golden Age. The retail ratio in Zwolle was already quite high in 1639, at over 29 per 1,000. On the other hand, Zwolle was already quite large (over 8,500 inhabitants), nearly nine times the average settlement size in the sample and 30 times the median size. Perhaps equally important was Zwolle’s history as a member of the Hanseatic League: even though the importance of Zwolle and other eastern Dutch towns had declined over the sixteenth century as the commercial centre of the Netherlands moved to the cities of Holland, Zwolle remained an important regional trading centre throughout the early modern period.32 This single ‘Golden Age’ retail ratio of 1639 may thus be high simply because Zwolle was a relatively large urban centre with a distinctive commercial history.

The earliest period we can analyze systematically is the 1670s, nearly a quarter of a century after the Dutch Golden Age is thought to have come to an end. Interestingly, however, in recent micro-studies of retailing in the Low Countries the period between the 1670s and 1750s is regarded as one in which the expansion and diversification of retailing is supposed to have taken off.33 This raises several competing hypotheses. Would one expect retail ratios to be already quite high in the Netherlands in the 1670s because of the preceding century or more of Dutch economic expansion?

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Alternatively, would one expect the Netherlands to have already entered a period of slower commercial growth after the end of the Golden Age? Or thirdly, did the Golden Age only involve some types of economic expansion (e.g. in agriculture and long-distance trade) and did the most important phase of expansion in the retail sector still lie in the future, e.g. in the eighteenth century?

As far as development of retailing during the eighteenth century is concerned, our data permit us to analyse changes between the late seventeenth and the mid-eighteenth century (by comparing the 1670s with the 1740s), but also those occurring in the second half of the century (by comparing the 1740s and 1790s). The historiography on the Dutch eighteenth century is divided. On the one hand, micro-studies of particular places – mainly urban centres – and of particular segments of the retail trade – textiles and colonial grocires – find evidence that the retail sector continued to expand and develop. On the other hand, the Dutch economy as a whole saw slower growth or even stagnation between the end of the seventeenth and the end of the eighteenth century, as institutional structures became more rigid, high wage costs decreased competitiveness, and the commercial centre of Europe shifted away from Amsterdam towards London. Economic disruption was intensified in the 1770s and 1780s, with rising conflict between the Orangists (royalists) and the Patriots (democrats), the military and economic disaster of the Fourth Anglo-Dutch War (1780-4), and the Patriot Rebellion of 1785 resulting in Prussian military occupation. Given these countervailing forces, of growing general commercialization but decelerating growth and relative economic decline, the predictions to be derived from the secondary literature are ambiguous. Would one expect the density of retailing to continue to grow rapidly as a highly commercialized economy became more sophisticated even though its growth rate was decelerating, as has been argued by Blondé and Van Damme for the city of Antwerp in the neighbouring Southern Netherlands (present-day Belgium)? Alternatively, would one expect the density of retailing to stagnate along with economic stagnation, and if that was the case did it occur in the first or the second half of the eighteenth century?

35 Blondé and Van Damme (2010).
Finally, our data enable us to analyse retail density in the early nineteenth century, specifically the decade from 1803 to 1813, and to compare it with earlier periods. The historiography makes conflicting predictions about the Dutch economy between 1780 and 1813.\textsuperscript{36} On the one hand, the period saw severe disturbances to the established political order: French invasion and occupation in 1795, regime change and a new French Bonaparte monarch in 1806, direct incorporation into the French empire in 1810, and the Orangist invasion of 1813. These events might be expected to disrupt economic activity, reducing growth and stifling commercialization. On the other hand, the Napoleonic occupation in the Netherlands, as in German territories, saw a number of reforms such as abolition of guilds (including retailers’ guilds) and other institutional and legal barriers to economic participation.\textsuperscript{37} This form of disruption, insofar as it broke down entrenched privileges, removed barriers to entry, or created space for new commercial practices, might have enabled retail density to increase.\textsuperscript{38} Our dataset enable us to test these hypotheses about how Dutch retailing differed between this period and previous ones.

Fortunately our dataset contains a relatively large number of observations for each of the four time-clusters, as Table 2 shows. Even for the least well represented period, the 1670s, we have nearly as many observations (45) as had been previously gathered for the Netherlands across the whole early modern period (48).\textsuperscript{39} For the 1740s we have ten times as many observations, for the 1790s seven times as many, and even for the 1800s three times as many.

At first sight, looking just at the decadal averages, it might appear that retail ratios were already reasonably high in the 1670s (at a mean of 8.4 and a median of 2), but fell between then and the 1740s (mean 6, median 0), declined further up to the 1790s (mean 3.7, median 0), before rising spectacularly by 1803-13 (mean 23.8, median 21.4). But for one thing not all these period differences are statistically significant and, more seriously, they do not control for other variables such as population size or location in a particular province of the Netherlands. Unfortunately, the nature of

\textsuperscript{36} See, for instance, the differences in the assessment of the late-eighteenth-century and early-nineteenth-century Dutch economy by De Vries (1953), De Vries and Van der Woude (1997), and Buyst and Mokyr (1990) on the one hand; and by Van Zanden and Van Riel (2000) on the other.

\textsuperscript{37} Van Zanden and Van Riel (2000).


\textsuperscript{39} Ogilvie (2010), 302 (Table 2).
surviving archival sources mean that observations for particular decades are also clustered in particular Dutch provinces. Fortunately, however, for most decades we have been able to assemble at least some observations for several different provinces, providing enough variation to test for the effect on retail density of both time and space.

3.4. Space

This leads to the question of how retail density varied spatially. Hitherto the literature has focussed primarily on differences in retailing across national units, or even supranational ones such as German-speaking central Europe. Mui and Mui pointed out the relatively high retail ratios observed in early modern England, Blondé and Van Damme focussed on the high retail ratios found in cities of the Southern Netherlands in the eighteenth century, and Dutch historians emphasized the density of commercial occupations in urban centres of the early modern Dutch Republic. Ogilvie showed that retail ratios also varied significantly across different early modern European societies, even controlling for population size and date of observation, with significantly higher retail ratios in the north Atlantic region (England, Northern Netherlands, and Southern Netherlands) than in central Europe (a variety of German territories).

This raises the question of whether retail density also varied spatially inside territorial units. Previously reported Dutch retail ratios – such as the 5 per 1,000 observed in the Gelderland rural region of Veluwe or the 1.5 per 1,000 for the South Holland rural region of Krimpenerwaard – already suggest that there was at least some variation across regions of the Netherlands. The question is what precise form this variation took.

Our data enable us to explore such variation in two ways. The first is purely spatial: the latitude and longitude of the specific locality. Precise geographical coordinates show that the localities in our dataset are scattered across nearly the whole

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41 Ogilvie (2010), 302-04 (Tables 2-3).
geographical expanse of the Netherlands. Thus our localities vary in latitude between 53° 24’ N (Wierum and Paesens) and 50° 47’ N (Eijsden), and in longitude between 7° 0’ E (Losser) and 3° 35’ E (Vlissingen). The Netherlands extends geographically from its northernmost point at 53° 52’ 05” N to its southernmost point at 50° 45’ 05” N (a total distance of 312 km), and from its westernmost point at 3° 21’ 31” E to its easternmost point at 7° 13’ 14” E (a distance of 264 km). Our dataset thus covers almost the whole geographical extent of the country.

The Dutch historiography postulates a west-east economic gradient within the early modern Netherlands, according to which the economy became less commercialized as one moved from the North Sea coast in the west to the German border in the east. In the west of the country not only were urbanization levels higher, but both guild membership and access to town citizenship were open to wider groups of people. The historiography is less explicit about north-south differences, since the early modern Netherlands had some fairly rural and non-commercialized areas both in the far north (Drenthe) and in the south (Brabant). One would therefore predict a negative relationship between retail density and longitude (i.e., declining retail ratios as one moves eastward) and an indeterminate relationship with latitude (i.e., no special reason to expect retail ratio to change systematically as one moves from the north to the south of the country).

Our data also include an alternative spatial variable which combines pure location with territorial affiliation – namely, the province in which a town or village was located. It is not merely incidental that between 1581 and 1795 the Northern Netherlands were called the ‘United Provinces’ or (more officially) the ‘Republic of the Seven United Netherlands’. These seven provinces were Gelderland, Holland, Zeeland, Utrecht, Overijssel, Friesland and Groningen; in addition, there was an eighth province, Drenthe (too poor to pay federal taxes and therefore denied parliamentary representation), plus the so-called ‘Generality Lands’ (Brabant, parts of Limburg, and small areas of Zeeland and Gelderland) which were ruled by the central government and lacked parliamentary representation. As in most territorial

43 Lourens and Lucassen (2000).
44 Slicher van Bath (1977), 729.
confederations, each province of the Netherlands not only differed in geographical location but had, to a greater or lesser extent, a distinct history, economic trajectory, institutional framework, and identity.

We were able to obtain data on retail density and a number of potential influences on it for seven provinces, two in the west (Holland, Zeeland), two in the east (Overijssel, Gelderland), two in the south (Brabant, Limburg), and one in the north (Friesland). We split the province of Holland into the Noorderkwartier and the Zuiderkwartier (referred to as North Holland and South Holland) and analysed the two parts of the province separately.\textsuperscript{45} The only provinces missing altogether are Groningen in the far north, Drenthe in the far northeast, and Utrecht in the centre-west. However, for Brabant we had only three observations, all for the same locality (the town of ‘s-Hertogenbosch), and for Zeeland only five observations, all for the same year (1807). Lacking sufficient variation for these provinces led us to exclude them from the multivariate analyses. As Table 2 shows, we have a substantial number of observations for the six remaining provinces, with over 50 observations for even the least represented province (North Holland) and over 350 observations for Friesland. We are thus in a good position to explore the extent and nature of variation in retail density across these six Dutch provinces, which represent all geographical extremes of the country at large.

The Dutch historiography provides a rich but internally inconsistent basis for hypothesizing how provincial affiliation might affect retail density.\textsuperscript{46} One possibility is that inter-provincial differences will follow the negative west-east gradient already discussed, but in that case one would expect the longitude variable to be a more important influence on retail density than provincial affiliation. Another possibility is that spatial differentiation will be a function of coastal as opposed to inland location. This would partly follow the west-east gradient, but not fully, as both Friesland and Groningen are coastal provinces which lie in the eastern part of the country. A third possibility is that particular provincial institutions or path dependencies, such as the

\textsuperscript{45} The Noorderkwartier and Zuiderkwartier were two separate administrative entities within the province of Holland and correspond roughly to the current provinces Noord-Holland and Zuid-Holland which were formed in 1840.

\textsuperscript{46} At least four different systems of inter-provincial variation can be derived from the historiography on the Dutch economy between 1600 and 1815. Cf. Lourens and Lucassen (2000); De Munck, Lourens and Lucassen (2005); Horlings (1995); De Vries (1984).
historical dominance of the province of Holland, will have an effect on retailing that is independent of (or stronger than) location in a purely geographical sense. We therefore include province alongside longitude and latitude as potential explanatory variables in the multivariate framework.

3.5. Retailers’ Guilds

Commercial expansion is widely regarded as being connected with the existence of particular institutional structures. Some institutions lower the costs of trade (for instance by efficiently enforcing property rights and facilitating contract enforcement), while others increase such costs (for instance by enabling established traders to erect barriers to entry against potential competitors).\(^47\) In explaining variations in retail ratios we would like to obtain a measure of institutional differences across our observations.

One key institutional variable is the strength of retailers’ guilds. Guilds of retailers were widespread in early modern Europe, and were almost ubiquitous in some societies such as the German territories, where they erected formidable barriers to entry into retailing by low-cost practitioners such as women and migrants, or those wishing to practise retailing alongside another occupation.\(^48\) Retailers’ guilds also existed, although less universally, in more commercialized societies such as England\(^49\) and the North and South Netherlands.\(^50\) Micro-studies of the activities of Dutch retailers’ guilds suggest that although they were more liberal than craft guilds, they nonetheless erected barriers to entry, especially by low-cost practitioners such as women.\(^51\) On the other hand, there are studies which argue that guilds were beneficial for the economy because they provided training and quality guarantees creating trust between sellers and buyers.\(^52\)

\(^{47}\) For a discussion of these countervailing institutional influences on pre-modern commerce, see Ogilvie (2011), ch. 1.
\(^{48}\) Ogilvie (2010), 298-304; Ogilvie, Küpker and Maegraith (2011).
\(^{49}\) Walker (1985); Berger (1993).
\(^{52}\) For an excellent general summary of these arguments, see Epstein and Prak (2008); for the questions this raises in the context of the early modern Consumer Revolution, see De Munck (2008), 197, 201-02, 216, 224-5, 229, 231-2.
To examine whether the constrictive or facilitative effects of retailers’ guilds predominated, it is therefore of interest to explore whether the presence of a retailers’ guild in a particular locality was associated with a higher or lower density of retailing. We were able to obtain information on retailers’ guilds for all observations in our dataset: as Table 2 shows, a retail guild was present in the locality for 22 of our observations (2.3 per cent of the total dataset).

However, exploring the effect of guilds in a multivariate context encounters a serious econometric problem. This is caused by the fact that retailing may affect the existence of the guild as well as vice versa. On the one hand, retailers’ guilds had the potential to affect retailing density through their institutional activities – whether positively or negatively. On the other hand, retail density had the potential to affect the formation of guilds. First, a retailers’ guild was only likely to be formed when there was a sufficient absolute number of retailers in the locality to set it up. Second, one impetus to the formation of a retailers’ guild could be that there was a particularly high density of retailers relative to the local population of potential customers, creating an incentive for established retailers to erect institutional barriers to entry to prevent further competition for scarce customers.53 Furthermore, there might be underlying variables – e.g. the political economy of a particular locality or region – that affected both the presence of guilds and the presence of retailing.

Because causation is likely to go both ways between the presence of a retailers’ guild and the density of retailing, and because there may be relevant explanatory variables omitted from the model (the underlying causes of both retail ratio and guild presence), any variable registering the presence or absence of a retailers’ guild is likely to be correlated with the error term in the regression equation. In this situation, regression analyses generally produce biased and inconsistent estimates. Including ‘retailers’ guild’ in a regression in which ‘retail ratio’ is what we are trying to explain may lead to biased estimators for coefficients on that variable and on other variables, and to unreliable results in general. Ideally, what we need is an instrumental variable which has a strong correlation with the presence of retailers’ guilds but not with the retail ratio – a variable that could be expected to affect the retail ratio only via its effect on

53 Cf. the relationship between urbanization, economic growth and guild formation suggested by De Munck, Lourens and Lucassen (2005), 65-6.
the present of guilds. Unfortunately, the historiography on the determinants of the presence or absence of retailers’ guilds in the Dutch Republic is as yet not sufficiently developed to provide such a variable. For this reason, we were unable to include an instrumental variable for retailers’ guilds in our multivariate analyses. We therefore decided to run our regressions with and without the endogenous variable (presence of retailers’ guilds) in order at least to find out whether it was positively or negatively associated with the retail ratio and whether taking it into account significantly altered the estimated effect of other explanatory variables.

3.6. Female Household Headship

The same problem of endogeneity arises with female household headship. The historiography for both the Northern and the Southern Netherlands suggests a positive relationship between the proportion of households headed by females and the intensity of retailing in a locality. After textile production, retailing was the most common occupation for early modern Dutch women, especially in urban centres but also in a number of rural areas.

Again, the potential causal relationships go in both directions – although in this case they are uniformly positive. On the one hand, women may prefer to engage (or may be more productive) in retailing than in other occupations. Retailing was commonly advocated by contemporaries as a trade that was particularly suited for female heads of household. In addition, female household heads may be more productive in retailing than other activities because retailing can be more easily combined with household production (especially child care) than can agriculture or many crafts, more of whose tasks may need to be carried out in non-domestic locations. Women may be more productive in retailing because it requires communication and calculation skills rather than the physical (especially upper-body) strength required for farming, labouring, or heavy crafts. This effect may have even been stronger in the Dutch Republic than elsewhere in Europe as we know that Dutch women were relatively

well educated. Furthermore, early modern women may have favoured retailing over skilled manufacturing trades because although retail guilds did erect entry barriers which affected women, they were generally more lenient towards female membership than were craft guilds, which typically excluded females from apprenticeship and journeymanship. For all these reasons, if female headship is high for exogenous reasons (e.g. higher male mortality, differential male emigration, warfare, naval and military employment, etc.), then the resulting greater density of female household heads may lead to a greater density of retailing. On the other hand, however, if retailing is dense for exogenous reasons (e.g. better transportation and communication links, higher commercialization, better institutions, more favourable government policies), this may favour the establishment of female-headed households by making it more possible for women to earn a livelihood independently rather than working in households headed by males. Finally, exogenous factors may facilitate both female headship and retailing: more flexible institutions may enable women to support themselves independently in all occupations (not just retailing) and may enable all economic agents (not just women) to set up retail establishments.

These two-way causal links between retailing and female headship create the same econometric problems as already discussed in the context of the endogeneity between retailers’ guilds and the retail ratio. As with that endogenous variable, so too with female headship, it proved impossible to identify an instrumental variable that would be strongly correlated with female headship but not with the retail ratio so that one could be certain that its effect on retailing was exerted wholly via the female headship rate. This is largely because the determinants of female headship rates in historical (and modern) societies are still not fully understood, and seem likely to be affected by a wide variety of demographic, economic, and institutional variables. The historiography leads us to predict that female headship rates are influenced by occupational structure (e.g. by retail ratios) and also by other variables which affect retail ratios such as urbanization and the passage of time.

59 For a survey of this literature, see Ogilvie and Edwards (2001).
We were able to assemble measures of female headship for a large subset of our observations, as Table 2 shows. The localities in our dataset showed a wide range of female headship rates, ranging from a high of 37 per cent female household heads to a low of zero. The average female headship rate across the 751 observations for which information on this variable was available was just over 12 per cent, which is the range to be expected for a predominantly rural western European sample of settlements.\(^6\) However, given the probable two-way causality between female headship and retail density, we followed the same strategy as with retailers’ guilds, and decided to run our regressions with and without the female headship variable in order to find out whether it was positively or negatively associated with the retail ratio and whether taking it into account significantly altered the estimated effect of other explanatory variables.

4. Multivariate Analyses of the Dutch Retail Ratio

To explore how retail ratios in the early modern Netherlands varied across space and time while controlling for other potential influences, we carried out a series of Tobit regressions with the retail ratio as the dependent variable and population, date, province, latitude, longitude, retailers’ guilds, and female headship as explanatory variables. As already discussed, we used two different measures of the retail ratio – a ‘maximal’ measure including retail by-employments (giving rise to the regressions in Table 3) and a ‘minimal’ measure including only primary occupations (the regressions in Table 4). Primary occupations were fully recorded for only 873 observations, so the model for the ‘minimal’ retail ratio could only be estimated for this smaller data subset. Since the loss of 86 observations as well as the shift from ‘maximal’ to ‘minimal’ retail ratio could affect the results, a separate model was estimated for the ‘maximal’ retail ratio using that smaller data subset (in Table 3 Regression 2) in order to ensure comparability between the results for the two different definitions of the retail ratio.

Most of the observations (87 per cent) were regarded as extremely accurate, but we viewed a small number (12 per cent) as potentially under-estimating retail ratios and

\(^6\) For comparative data on female headship across other early modern European societies, see Ogilvie and Edwards (2001).
an even smaller number (less than 1 per cent) as potentially over-estimating them. Since these observations were unevenly distributed across time-periods and provinces, excluding them altogether would have created a data sub-sample incapable of registering important chronological and spatial influences. Instead, we tested for robustness by re-estimating all models on a dataset in which 1, 3, 5, and 10 points were progressively added to the retail ratios of the observations suspected of being under-estimates and were analogously progressively subtracted from the retail ratios of the observations suspected of being over-estimates. These robustness tests seemed appropriate given the orders of magnitude involved: the mean retail ratio was less than 8 per 1,000, fewer than 15 per cent of localities had retail ratios over 20, and fewer than 7 per cent exceeded 30. Neither separately nor in combination did these robustness tests alter the models estimated or the results of the hypothesis tests. This encouraged us to be confident that the possibly less reliable observations were not driving the results of the analyses.

Because of the substantial skew in the distribution of population sizes discussed above, population was measured using a logarithmic transformation to generate a more symmetric distribution. Given the chronological clustering discussed above, we measured date in terms of four decadal clusters – the 1670s, 1740s, 1790s, and 1800s. Space was measured in two ways: through the precise latitude and longitude of the locality; and through the province in which that locality was situated (Friesland, Gelderland, Limburg, Overijssel, South Holland, and North Holland). For retailers’ guilds, a dummy variable registered presence (1) or absence (0) of such a guild in the locality at that date. Female headship was defined as the percentage of independent households in the locality headed by women at that date. Female headship was fully recorded for only 751 observations, so the model including that variable could only be estimated for this smaller data subset. Since the loss of 208 observations compared to the full dataset as well as the inclusion of female headship as an explanatory variable could affect the results, two separate models were estimated using that smaller data subset, one including female headship and the other excluding it. This enabled us to see whether any differences compared to the regressions on the larger data subsets were caused by the inclusion of female headship or alternatively by the loss of observations.
In addition to these basic explanatory variables, we created a number of interaction terms to explore whether the effect of particular factors varied across space and time. A decade-province interaction term enabled us to examine whether the effect of time differed across provinces; a decade-population interaction term enabled us to investigate whether the effect of population differed across time; and a province-population interaction term enabled us to test whether the effect of population differed across provinces.

Table 3 presents the models estimated for the ‘maximal’ retail ratio (including by-employsments) while Table 4 presents those for the ‘minimal’ retail ratio (focussing solely on primary occupations). Table 3 reports four different models. Regression 1 is the model for the large data subset in which ‘minimal’ retail ratio and female headship are not fully recorded (and the latter is therefore excluded as an explanatory variable). Regression 2 is the model for the data subset in which ‘minimal’ retail ratio is fully recorded (for comparability with Table 4 Regression 1) but female headship is not fully recorded (and is therefore excluded as an explanatory variable). Regression 3 is the model for the data subset in which both ‘minimal’ retail ratio and female headship are fully recorded, and female headship can thus be included as an explanatory variable. Regression 4 is the model for that same data subset, but excluding female headship (for comparability with Table 1 Regressions 1 and 2).

Table 4 proceeds analogously for the ‘minimal’ retail ratio. Regression 1 is the model for the largest data subset for which ‘minimal’ retail ratio is fully recorded; female headship is not fully recorded and is therefore excluded as an explanatory variable. Regression 2 is the model for the data subset in which female headship is fully recorded and can thus be included as an explanatory variable. Regression 3 is the model for that same data subset, but excluding female headship (for comparability with Table 4 Regression 1).

4.1. Female Household Headship

We start by discussing female headship since it provides the sole motivation for analysing the smallest data subset of 751 observations (Table 3 Regressions 3 and 4, Table 4 Regressions 2 and 3). We can then shift focus to the regressions on the full
dataset (Table 3 Regression 1, Table 4 Regression 1) when we discuss all the other influences on retail ratios.

As discussed earlier, the historiography suggests a strong positive relationship between female headship and the retail ratio, although the causal link is acknowledged to run in both directions. We therefore explored the association between the female headship rate and the retail ratio in the regressions on the small data subset for which female headship was fully recorded, while acknowledging the problem that there are almost certainly two-way causal links between the two variables.

As Table 3 Regression 3 shows, there was indeed a significant association between female headship and the ‘maximal’ retail ratio. (Here and throughout, ‘significant’ means that a result is statistically significant at or below the 0.05 level; it does not refer to the magnitude of any effect.) Although this positive association between female headship and retail density was statistically significant, its magnitude was rather small. Assessed at the sample means of all variables, the elasticity of the retail ratio with respect to the female headship rate was only 0.20 – i.e., a 1 per cent increase in the female headship rate was associated with a 0.20 per cent rise in the retail ratio.

Female headship was also positively and significantly associated with the ‘minimal’ retail ratio, as Table 4 Regression 2 shows. This finding indicates that it was not just retail by-employment but also full-time retailing that favoured, or was favoured by, the existence of a larger proportion of households headed by females. However, the elasticity of the ‘minimal’ retail ratio with respect to female headship was even smaller, at 0.12.

This finding is consistent with a number of studies which have suggested that women were more likely to undertake retailing as a subsidiary than as a main occupation.61 The larger size of the association between female headship and the ‘maximal’ definition of the retail ratio is consistent with the idea that females may have adopted retailing as ancillary occupations, although deeper household-level analyses would be

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61 Roessingh (1965), 232; Slicher van Bath (1977), 181; De Vries and Van der Woude (1995), 602.
necessary to explore this occupation more thoroughly. Furthermore, it may simply be that a locality in which underlying factors facilitated retailing by-employments was also one in which the same factors facilitated female household headship.

4.2. Retailers’ Guilds

The variable registering the presence of retailers’ guilds also only emerges into statistical significance for the small data subset for which female headship was known. The retailers’ guild variable was included in the regressions despite the fact that there is probably two-way causation between the retail ratio and the presence of a guild. As it turned out, the inclusion or exclusion of this variable had no effect on the coefficients or standard errors of any other variables in the regressions, so it was retained in all regressions and is reported in all models in Tables 3 and 4. In all cases, it had a negative coefficient (i.e., the presence of a retail guild was associated with a lower retail ratio, holding all other variables constant). But in almost all cases, this coefficient was not significantly different from zero.

The exception was Table 1 Regression 3, in which female headship was also included in the model. In this model alone, the negative coefficient on retailers’ guild was statistically significant (although only at the 0.10 level). It is possible that controlling for female headship is what moved the retail guild variable into the borderline of significance. This speculation is lent some support by the fact that when female headship is removed from the model for this data subset (in Table 1 Regression 4), retail guild becomes insignificant (though its coefficient remains, as always, negative). We know that guilds affected women’s economic participation, including in retailing, so this may be why, once the effect of female headship on retail ratio is taken into account, the negative effect of guilds on retail ratio emerges into greater significance.

Overall, however, the presence of a retailers’ guild is not associated with a significant effect on the retail ratio one way or the other. This is not surprising, and may indeed be caused precisely by the fact that causation is likely to go both ways between the two variables. Thus on the one hand, retailers’ guilds may have been acting to reduce retail ratios by erecting barriers to entry; but on the other hand they were only likely
to be formed when established retailers felt that the density of retailers relative to the local population of customers had risen to a high level, creating an incentive to erect institutional barriers to prevent further competition. These opposing two-way influences between retail density and the presence of retail guilds may lie behind the absence of any significant statistical relationship between the two.

Unless and until we find a good instrumental variable for the effect of retailers’ guilds on retail density, this aggregate statistical analysis of their relationship must remain indeterminate. Investigations of the effect of guild institutions on retailing must instead be pursued through detailed micro-studies which analyse the activities such guilds engaged in – particularly the barriers to entry they erected – behind the sheer fact of their existence.

This consideration is the more important given that guilds in the same economic sector acted very differently in different Dutch towns. For one thing, guilds in cities of the western Netherlands were more flexible and more open to outsiders (migrants, women, Jews) than those in the eastern part of the country. Moreover, admission policies and practices of retail guilds could vary not only between towns, but within towns, with different retail guilds in the same town controlling entry very differently, with potentially very substantial – but various – effects on the size of the overall retail sector. Since the wide variability in admissions restrictions across different retailers’ guilds is borne out by detailed micro-studies, it is not surprising that a macro-level analysis encompassing both western and eastern parts of the country but solely registering a guild’s presence, and not its policies or activities, should fail to find a systematic statistical relationship with the retail ratio.

4.3. Population Effects by Province

The postulated east-west gradient for Dutch guilds raises the whole question of regional differences not just in retail density itself but in the factors that might be expected to affect it. One factor we expected to affect retail density was the

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population size of a locality. However, population size might have exerted different effects in different places and at different times.

We were able to deal with the question of time by including interaction terms between population and decade in preliminary analyses. In none of the regressions for either definition of the retail ratio or for any of the data subsets were the coefficients on these interaction-terms significant. This enabled us to conclude that the effect of population size on the retail ratio (no matter how it was defined) did not differ between the 1670s, the 1740s, the 1790s and the 1800s.

Space was a different matter. It turned out that the effect of population on retail ratios did differ significantly across provinces. This result emerged for both the ‘maximal’ and the ‘minimal’ definitions of the retail ratio, as shown by the coefficients on the province-population interaction terms in Tables 3 and 4. It also held true across all the data subsets – both the full data set and the two smaller data subsets for which multiple occupations and female headship could be considered. The universality of these inter-province differences in the population effect provides striking support for their robustness.

The most powerful effect of population size on retail ratio was in Overijssel, where it had a statistically significant, and positive, effect on the retail ratio. This effect was quite substantial, as shown by the fact that the elasticity of the ‘maximal’ retail ratio with respect to population size was 1.16, and the elasticity of the ‘minimal’ retail ratio was 1.42. In Overijssel, which (as Table 1 shows) had the lowest average density of retailing of any province, the size of a locality was a very powerful influence on the retail ratio. In so far as there were substantial concentrations of retailing in Overijssel, they were found predominantly in towns and cities.

The next most powerful effect of population was found in a group of intermediate provinces – Friesland, Gelderland, and Limburg – where the population effect did not differ significantly within the group. In these provinces, which Table 1 shows were characterized by intermediate average retail ratios, population still had a statistically significant and positive effect on retail density but one that was significantly smaller than in Overijssel and significantly larger than in North or South Holland. In this
group of provinces, the elasticity of the ‘minimal’ retail ratio with respect to population size was only 0.86, while the elasticity of the ‘maximal’ retail ratio was only slightly higher, at 1.02.

Population also had a significant and positive effect on the retail ratio in South Holland, but one that was in turn significantly smaller than in the ‘intermediate’ provinces. As Table 1 shows, South Holland had the second-highest average retail ratio of all provinces. Here, the elasticity of the ‘maximal’ retail ratio with respect to population was only 0.33; the elasticity of the ‘minimal’ retail ratio was hardly higher, at 0.59.

North Holland, which Table 1 shows to have had by far the highest average retail density of any province, was also the only one in which population had no significant effect on either measure of the retail ratio. This finding is the more striking in that the North Holland localities in the dataset covered a wide range of population sizes, from less than 30 inhabitants to nearly 9,000. Despite this wide variation in population size, that variable exerted no significant effect on retail density in the province, suggesting that at the high level of commercialization observed in North Holland, dense concentrations of retailers had arisen even in small rural localities, to an extent not observed elsewhere in the country. This confirms that the remarkably high retail ratios found in earlier research for two rural settlements in North Holland in the mid-eighteenth century (Graft with 21 retailers per 1,000 and Winkel with 26 retailers per 1,000) were not exceptional.64

Spatial variables thus influenced how population size affected retail density. In the low-retail-density province of Overijssel, population affected retail ratio most strongly. In an intermediate group of provinces (Friesland, Gelderland, and Limburg), population exerted a medium-sized effect on the retail ratio. Even in South Holland, where average retail density was quite high, population still exerted a statistically significant positive effect on retailing, although only a mild one. But in the most highly commercialized province, North Holland, retail density did not depend on the population of the locality. An important aspect of the zone of high retail densities

observed in North and South Holland, therefore, was that it was characterized by much greater similarity in ratios between villages, towns and cities, as retailing spread out from urban centres into the countryside.

This large and significant effect of settlement size on retail density has a number of wider implications. For one thing, insofar as the positive effect of population size on retail ratio was caused by economies of agglomeration, these appear to have been more important in less commercialized provinces. In more commercialized provinces, agglomeration economies were less influential and in the most commercialized one – North Holland – they had no detectable effect. Even though, as De Vries has argued, many rural settlements in the Netherlands also commercialized in this period, in all provinces except North Holland, cities remained significantly more highly commercialized than smaller towns, and towns than villages.

These results support the idea that urbanization may have played an independent role in the commercialization of the early modern European economy. That is, when moving from low to intermediate levels of commercialization, simply increasing the number of large urban centres, or even enabling villages to expand into market towns, could enhance retail density. This might have been connected with economies of agglomeration, in which the larger number and range of producers and consumers in a particular location gave rise to enhanced opportunities to exploit the division of labour and gains from trade. One reason the Netherlands may have been so highly commercialized compared to many other parts of Europe at a relatively early date may simply have been its high urbanization.

4.4. Direct Effects of Spatial Variables

This raises the question of the direct effects of spatial variables on retail density. As discussed earlier, spatial factors could be measured in two ways – through purely locational coordinates and through province. In initial estimations of the regressions, latitude and longitude were included alongside dummy variables for the different provinces. In the presence of the province dummies, the coefficients on both latitude

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65 De Vries (2008), 93-5, 128.
and longitude were statistically insignificant, justifying their elimination from the model. This held true for both ‘maximal’ and ‘minimal’ definitions of the retail ratio and for all data subsets.

Nonetheless, given the hypothesis of a negative west-east gradient of Dutch commercialization advanced in the literature, it is worthwhile reporting that when province is not taken into account, longitude (though not latitude) emerges as a significant and negative effect on the retail ratio. That is, controlling for other factors, retail ratios declined significantly as one moved across the Netherlands from west to east, a striking confirmation of the more general hypothesis that the economy in the west of the country was more commercialized than that in the east. However, since all the spatial information contained in the coordinates of latitude and longitude was evidently included in the province variables (as shown by the fact that latitude and longitude were statistically insignificant in the presence of the province dummies), the former were eliminated from the model and the latter retained.

Five province dummies (Gelderland, Limburg, Overijssel, South Holland, and North Holland) are reported in Tables 3 and 4, with the sixth province, Friesland, as the omitted category. The coefficients on the five province dummies show the estimated effect of province on retail ratio (relative to Friesland) assuming that all other variables in the regression, including population, are set to zero. The effects on the retail ratio of moving from one province to another can therefore not be evaluated by inspecting the coefficients on the province dummies alone; instead, we need to take account of both these province-dummies and the province-population interaction terms in order to show the full province effects. We do this in Tables 5 and 6 by presenting the predicted effect of province on the retail ratio assessed at various population sizes and setting all other independent variables at their sample means. These predicted effects can be regarded as the pure effects of province on the retail ratio, i.e. controlling for all other explanatory variables in the regressions.

Table 5 (and Graph 1) show the predicted effect of province on the ‘maximal’ retail ratio (i.e., including retail by-employments), estimated on the basis of Table 3 Regression 1. These results show that a pure effect of province on retail density is moderately clearly visible for settlements with a small population size. However, for
most provinces this effect becomes progressively less clear and less statistically
significant as settlements increase in size. This is because, as we have just seen,
population increased retail ratios at differing rates in different provinces. The notable
exception is North Holland, which had a significantly (and substantially) higher retail
ratio than all other provinces at all values of settlement size.

The differing trajectories of these pure province effects on retail ratio can be seen in
Graph 1. Thus for settlements of 100 inhabitants (at the 20th percentile of our dataset)
and those of 200 inhabitants (at the 39th percentile), North Holland had a significantly
higher retail ratio than all other provinces and South Holland had a higher retail ratio
all other provinces except for North Holland, although the difference compared to
Friesland and Gelderland is of borderline significance. There was no significant
difference among Friesland, Gelderland and Limburg: this is consistent what we
found for the effect of population on retail density, which was indistinguishable
among these three provinces. For settlements of 100 inhabitants Overijssel, with the
lowest point estimate of retail ratio, is significantly lower not only than North and
South Holland but also (with borderline significance) than Friesland, the
‘intermediate’ province with the highest estimated retail density.

However, these pure province differences become progressively less significant and
less substantial as settlements increase in population size. By the time one gets to
settlements of 500 inhabitants (at the 67th percentile), there is still some evidence of
pure province effects but the differences are much less significant. Only North
Holland is still significantly and substantially different from all other provinces at this
settlement size. And by the time we reach settlements with 750 inhabitants (the 77th
percentile) or 1000 (the 84th percentile), the difference between North and South
Holland is only of borderline significance, although North Holland still has
significantly and substantially higher retail ratios than all other provinces.

For the ‘minimal’ retail ratio, shown in Table 6 and Graph 2, the pecking order among
the provinces at small settlement sizes is almost identical to the picture for the
‘maximal’ retail ratio. Again, North Holland maintains a significantly and
substantially higher retail ratio than all other provinces, and this continues up to quite
large population levels. The major deviation in the pure province effect for the
‘minimal’ retail ratio is that Friesland pulls ahead of the other ‘intermediate’ provinces as population size increases, and once it reaches settlements of 750 or 1000 inhabitants (the 77th and 84th percentile respectively) its predicted pure province effect is not significantly different from that of North Holland. Among the remaining provinces, the predicted value of the retail ratio at different values of population does not for the most part differ significantly by province. The only exception is for small settlements of 100 or 200 inhabitants (the 20th and 39th percentiles respectively) where Overijssel is significantly lower not just than North Holland but also than Friesland. Arguably this is testimony more to Friesland’s distinctively high retail ratios (in the ‘minimal’ definition) than to Overijssel’s distinctively low ones, although the fact that Overijssel consistently lies at or near the bottom of all provinces in retail density is consistent with what we know of the early modern Overijssel economy, which relied heavily on agriculture and proto-industrial textile production, giving rise to relatively low living standards for its inhabitants.66

The difference we observe in the position of Friesland compared to the other provinces when we look at a ‘minimal’ instead of a ‘maximal’ definition of the retail ratio is interesting for several reasons. First, the more standard ‘minimal’ definition of the retail ratio highlights the relatively commercialized nature of Friesland, which follows immediately after Holland in the density of its retailing and runs ahead of all other parts of the country. This is especially striking given Friesland’s rural character, reflected in the database by its mean settlement size of 350, significantly lower than any other province even including Gelderland (at over 450) and Overijssel (at over 620), and strikingly lower than Limburg (over 1,000), North Holland (over 1,300), and South Holland (over 2,700). For such a predominantly rural province, therefore, Friesland had an unusual density of retailers. This testimony to Friesland’s commercialized character is consistent with Jan de Vries’s research, which found that as early as the seventeenth century Friesland peasant inventories recorded numerous articles which peasants could not have fashioned by themselves and that by the eighteenth century the province’s agriculture had become highly commercialized and many inhabitants practised non-agricultural occupations.67

66 Slicher van Bath (1977), 729.
Second, the finding that Friesland moves down in the ranking of provinces when we use a ‘maximal’ definition of retail ratios taking account of subsidiary occupations suggests that in provinces such as South Holland, Gelderland and Limburg, combining retailing with other occupational activities was more common than in Friesland. This also fits with the findings of De Vries, who argued that in Friesland retailing and agriculture were not likely to be combined, in contrast with what historians observed for other Dutch provinces. Moreover, and perhaps as a result of this, a majority of Friesland’s retailers were relatively well-off shopkeepers who were able to earn a decent living by shop-keeping alone and were thus not part of an economically marginal group engaging in small-scale retailing to complement their household incomes.

Finally, the changing position of Friesland shows that whereas the more commonly used definition of the ‘minimal’ retail ratio is helpful for understanding the development of retailing, it does not yield a fully differentiated analysis. Analysing a ‘maximal’ retail ratio not only provides a more accurate picture of the true size of the retail sector, but also deepens our understanding of different patterns of retailing – in this case between regions in which retailing was predominantly a primary occupation (such as Friesland) and those in which it was also common as a by-employment (other provinces with ‘intermediate’ retail ratios). This approach may also shed light on the role of women in retailing in the various provinces of the Netherlands, given that a number of studies have suggested that subsidiary occupations reflected work undertaken by the wives of the male household heads recorded in tax registers and censuses.

These findings concerning the pure province differences in retail density raise two wider questions. First, these pure province effects show that Holland – particularly North Holland – occupied a very distinctive position in the retail landscape of the early modern Netherlands. Its retail density was significantly and very substantially higher than that of every other province, even South Holland. We know that this distinctiveness was not caused by settlement size, date, female headship or the

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68 Roessingh (1965), 232-36; Slicher van Bath (1977), 181.
70 Roessingh (1965), 232; Slicher van Bath (1977), 181; De Vries and Van der Woude (1995), 602.
presence of retailers’ guilds, since these are controlled for in the regressions. What, then, caused North Holland’s extraordinary retail density compared to all other provinces of the Netherlands?

Secondly, as we have seen, there is evidence that there are significant differences in retail density between provinces for small settlements. These cannot be dismissed as unimportant, since such small settlements made up a non-trivial share of localities in the early modern Netherlands: after all, settlements of 200 inhabitants lay at the 39th percentile of our data. But given that there were these significant pure province effects on the retail ratio for small settlements, what caused them? They cannot have been caused by population, date, female headship, or retailers’ guilds, since we have controlled for all these variables. What is it that meant that the differences between provinces of the Netherlands became less marked as one moved from smaller to larger settlements? In short, what was the underlying cause of this variation in retail density for small settlements, for which province is acting as a proxy variable? This open question must guide future research into the spatial determinants of retail density.

4.5. Time

This raises a final question. How did time affect the retail ratio, and did the effect of time also vary spatially across provinces? It was only possible to create meaningful interaction terms between time and space for North and South Holland because these were the only provinces with substantial numbers of observations from several different decades. In the regressions, the coefficients on those interaction-terms were not statistically significant, showing that the effect of time did not differ between either of those two provinces and the other provinces. This provided us with a basis for concluding that there was no evidence that the effect of time on the retail ratio differed from one province to another, and thus enabled us to concentrate on pure chronological effects across the entire data set.

Three decadal clusters (1670s, 1740s, and 1790s) are reported in Tables 3 and 4, with the fourth decadal cluster, 1803-13, as the omitted category. The coefficients on the three decade dummies show the differences in retail ratio between those decades and 1803-13, while differences among the other decades were explored through post-
regression hypothesis-testing. The effects of time on retail density, unlike the effects of space and population, differed considerably according to whether we focused on the ‘maximal’ definition of retail ratio (in Table 1) or the ‘minimal’ (in Table 2), and also varied somewhat according to which data subset was being analysed.

The results for the ‘maximal’ definition of retail ratio analysed for the largest dataset (Table 3 Regression 1), find that the retail ratio in the 1670s was significantly lower than in 1803-13, but that it did not follow a clear upward trend across the eighteenth century. The retail ratio rose significantly between the 1670s and the 1740s. However, it then stagnated between the 1740s and the 1790s: the average for the 1790s was actually lower than for the 1740s, although the difference was not statistically significant. The retail ratio then rose between the 1790s and 1803-13, but the rise again was not statistically significant. Thus between the 1670s and the early nineteenth century, the retail ratio in its ‘maximal’ definition increased, and the rise was statistically significant, but most of the growth took place between the 1670s and the 1740s. The remainder of the eighteenth century saw stagnation or, if anything, a slight decline, and even the recovery in the early decades of the nineteenth century was muted.

A rather different chronology emerges for this same ‘maximal’ definition of retail ratio within the smaller data subsets. For the multiple-occupation dataset (Table 3 Regression 2), the chronological development is very similar to that for the full dataset (Table 3 Regression 1), except that the rise between the 1670s and the 1740s is only of borderline statistical significance. This strengthens the impression of a long-term stagnation of retail ratios between the later seventeenth and the end of the eighteenth century.

This impression of long-term stagnation in retail ratios also emerges from the analysis of the female-headship data subset (Table 3 Regressions 3 and 4), which shows no significant difference in retail ratio between the seventeenth century and any part of the eighteenth century. However, the nineteenth century emerges as distinctively higher – not just than the 1670s but also than the 1740s and the 1790s. Once female headship is controlled for, the differences between the eighteenth and the nineteenth century appear to be more accentuated.
Of course, this change in emphasis might result from shifting to the smaller data subset rather than from controlling for female headship. This possibility can be investigated by comparing Regressions 3 and 4 in Table 3, since Regression 4 estimates the model for that data subset pretending that female headship is unknown. Doing so renders the difference between the 1740s and the 1800s of borderline statistical significance and the difference between the entire eighteenth century and the 1800s not significant. This implies that it is the act of controlling for female headship, rather than the choice of data subset, which brings to the fore the accentuated difference between the eighteenth century and the early nineteenth. We should be wary of placing too much weight on this finding, however, given that female headship is an endogenous variable and may be generating biased estimates.

Analysing the ‘minimal’ definition of the retail ratio, in Table 4, also gives rise to a chronology of long-term stagnation before the nineteenth century, a result that holds whether female headship is taken into account (Regression 2) or not (Regressions 1 and 3). Unlike with the ‘maximal’ retail ratio, there is no significant difference in retail ratio between the 1670s, the 1740s and the 1790s. But all three of these ‘early modern’ decades had retail ratios significantly lower than the 1803-13 period.

Thus if one focuses purely on primary occupation (as in the Table 4 regressions), and in so doing uses a comparable approach to most previous studies, one finds a definitive picture of long-term stagnation in the retail ratio between the 1670s and the 1790s, and then a significant upturn in the first decade and a half of the nineteenth century. By contrast, if one takes into account by-employed retailers (as in the Table 3 regressions), the retail ratio starts to increase (with borderline statistical significance, at least) between the 1670s and the 1740s, although it stagnates thereafter. Any dynamism in the retail ratio between the 1670s and 1740s thus seems to have involved an expansion in the number of individuals practising retailing as a by-employment with other occupations, but not necessarily more individuals practising retailing as their primary occupation.
This suggests that the transformation of the Dutch retail sector between c. 1670 and c. 1750, which is emphasized in the historiography,\textsuperscript{71} was predominantly an expansion of retailing as a by-employment. Moreover, it is likely that many of the new practitioners entering retailing in this period were not main household heads, usually married men, but rather wives or other family members, as postulated in Jan de Vries’ theory of the Industrious Revolution.\textsuperscript{72} This is confirmed by a recent in-depth study of the occupational identities of the hundreds of people who moved into tea- and coffee-retailing in the South Holland city of Leiden in the first half of the eighteenth century: not only were the majority of these new tea- and coffee-retailers married women, but most of them had husbands working outside retailing (mainly in crafts and proto-industry).\textsuperscript{73}

Any dynamism in the retail ratio between the 1790s and the 1803-13 period, by contrast, appears to have involved an expansion in the number of those for whom retailing was their primary activity. Because the development of Dutch retailing has been much less intensively studied for this period, it is more difficult to put this finding into context. The 1849 Dutch census shows that in the mid-nineteenth century the overall retail ratio for the Netherlands as a whole was very similar to its level in 1807, approximately 28 per 1,000.\textsuperscript{74} This suggests that between 1807 and 1849 Dutch retail ratios did not change significantly, implying that the first decades of the nineteenth century were indeed the period in which the most significant changes in retail density occurred over the almost two centuries between 1670 and 1850.

How can we explain this sudden increase in retail density in the first decade and a half of the nineteenth century? As mentioned earlier, one of the important transformations taking place in the economy of the Netherlands at this period consisted of the large and fundamental shifts in its institutional structure, one of the most striking being the dissolution of the guilds.\textsuperscript{75} Although the Dutch guilds were formally abolished in 1798, in some places in the Netherlands they retained their powers until 1818.

\textsuperscript{72} De Vries (2008).
\textsuperscript{73} Van den Heuvel and Van Nederveen Meerkerk (2010), 121.
\textsuperscript{74} Retail ratios for the Netherlands are calculated from the figures in Horlings (1995), 333 (Table 11.9), showing 28.6 per 1,000 in 1807 and 28.17 per 1,000 in 1849. For the province of Overijssel, Slicher van Bath (1977), 171, finds stability in retail density between 1795 and 1889.
\textsuperscript{75} Van Zanden and Van Riel (2000).
Nevertheless, even where they remained in control of certain segments of the economy, they were compelled to adopt alterations in their admission policies, generally resulting in more equal access for groups such as Jews and ‘strangers’ (non-locals) which had previously suffered from discriminatory policies.\textsuperscript{76} In addition, in 1806 a licence tax (patenten) was introduced with the explicit purpose of undermining the position of the guilds. This tax lowered the threshold of every occupation to the price of a licence and it has been argued that the result was to stimulate trade internally to the Netherlands.\textsuperscript{77} On the other hand, the direct impact on retailing of this shift from guild regulation to state licensing may have been muted by the fact that Dutch retailers’ guilds already imposed entry barriers lower than those of most craft guilds,\textsuperscript{78} and the patenten system actually introduced a license (albeit a very cheap one) to many localities which had previously had no retailers’ guilds.

The significant upturn in primary-occupation retailing in the first two decades of the nineteenth century may therefore derive not so much from the abolition of retailers’ guilds narrowly considered, as from the emergence of a more liberal general framework of occupational and geographical mobility permitting wider social groups to move into the retailing of craft wares previously reserved to guild masters or to engage in low-cost ambulatory selling whose costs and risks had previously been inflated by restrictions on ‘strangers’ (non-locals).\textsuperscript{79} The emergence of the interval between the 1790s and 1803-15 as the period during which the Netherlands experienced a significant rise in retail ratios opens up stimulating avenues for future research into both retailing and institutional change in these key decades.

5. Conclusion

An expansion in the retail sector is widely regarded as central to the Consumer and Industrious Revolutions between 1650 and 1800 – as the final link in the long chain of commercial practices which reduced the transaction costs of bringing the products of long-distance trade into the households of ordinary consumers. The Netherlands is

\textsuperscript{76} Van den Heuvel (2007), ch. 4.  
\textsuperscript{77} Horlings (1995), 290.  
\textsuperscript{78} Prak (1999); Van den Heuvel (2007).  
\textsuperscript{79} On the expansion of ambulatory trading in Zeeland in the early decades of the nineteenth century, see Harten (1971), 60 with n. 83.
supposed to have seen a particularly striking expansion of retailing in the early modern period, as smaller-scale shopkeepers, stallholders and itinerant traders proliferated alongside established merchants, and the number of retailers expanded relative to the population of potential customers.

But this outline narrative of the first modern Retail Revolution still has important gaps. Empirically, it has relied largely on scattered case studies, with no systematic measurement of the density of retailing over larger numbers of localities. Existing studies have also concentrated on urban centres and the province of Holland, which as the cockpits of early modern commercialization and consumerism may have been exceptional. Finally, in measuring retail ratios and therefore also the retail sector the historiography has focused mainly on those practising retailing as their primary occupation and has not taken into account the wider penumbra of – possibly less formal – traders offering retail services as by-employments alongside other occupations. This paper has sought to fill these gaps by collecting a much larger body of evidence on the density of retailing, both in its standard definition in terms of primary practitioners and in a broader definition which includes part-time retailers. It encompasses a wider array of Dutch regions, including smaller settlements as well as urban centres, and covering the entire period during which the Consumer Revolution is supposed to have occurred. It has also sought to assemble information on spatial, chronological, demographic, and institutional factors which might have influenced the density of retailing and its variation. The result has been to provide a more systematic but also a more differentiated picture of retail density across the entire landscape of the ‘first modern economy’.

Spatial factors strongly affected retail density. Different Dutch provinces showed significantly differing effects of population size on retail ratio. In Overijssel, the easternmost and least commercialized province, population size had the largest effect on retail density. In the westernmost and highly commercialized provinces, population size had little effect on retail density (as in South Holland) or none (as in North Holland). In provinces with intermediate retail ratios, population size had an intermediate effect on retail density. These findings cast interesting light on our understanding of the effect of urbanization and its associated agglomeration economies in the early modern period. In particular, they suggest that agglomeration
economies created by urban centres were much more important in zones of low than high commercialization. At the high levels of commercialization attained in the western provinces of the Netherlands by the later seventeenth century, retail density was high even in small settlements and was not so dependent on agglomeration economies created by large concentrations of rich consumers, information, or specialization. But even in the highly urbanized Netherlands, population did still positively influence retail density in most parts of the country, albeit differently in different provinces, testifying to the important role played by cities and towns in bringing lower transaction costs to early modern consumers.

There was also a direct effect of province on retail density, the magnitude of which varied with settlement size. The exception was North Holland, whose retail density was significantly and very substantially higher than that of every other province irrespective of settlement size. The other ‘pure’ province effects were clearest in small settlements (below the 40th percentile of population size) and became progressively less substantial and less significant as settlements increased in size. But at least among small settlements, South Holland emerged as having a distinctively high ‘maximal’ retail ratio, Friesland as having a distinctively high-intermediate ‘minimal’ retail ratio, and Overijssel as having a distinctively low retail density no matter how it was measured.

The retail landscape of the early modern Netherlands was thus highly differentiated both by the boundaries of individual provinces and into larger zones of relatively similar groups of provinces. This raises the question of the underlying causes of this strong spatial differentiation. Should greater emphasis be placed on differences among individual provinces, indicating a primacy of institutional or historical factors specific to each province? Or do the inter-provincial differences instead reflect geographical or ecological zones which are better proxied by province than by latitude, but which relate to hitherto unmeasured variables such as proximity to coast or canal routes (indicating lower transport costs) or soil quality (proxying wealth and thus effective demand for retailed luxuries)? This opens up new avenues for research incorporating additional provinces (Drenthe, Groningen, Utrecht) and additional local characteristics (transport links, agricultural productivity measures).
Compared to the strong and significant impact of space and population, time had a more muted effect on retail density. Dutch retail ratios were already fairly high in the 1670s, and did not experience any statistically significant increase between then and the 1790s. The eighteenth century saw a long period of stagnating retail ratios. Only after 1800 did retail density rise to levels significantly different from the later seventeenth century. Slight differences in chronology are visible between ‘maximal’ and ‘minimal’ retail ratios. The ‘maximal’ retail ratio (including by-employed retailers) experienced a statistically significant rise between the 1670s and the 1740s, but then stagnated or even declined up to the 1790s, before rising mildly up to 1803-13. In the 1800s, it was significantly higher than the 1670s, but not significantly higher than the eighteenth century. Thus it is the half-century between the 1670s and the 1740s that emerges as crucial in the expansion of by-employed retailing, followed by a long-term stagnation. By contrast, the ‘minimal’ ratio (including only full-time retailers) showed long-term stagnation from the 1670s to the 1790s, and only took off significantly between then and 1803-13. The key phase of expansion in full-time retailing should thus be dated to the Napoleonic period, suggesting that the institutional changes of that decade may have played an important role.

Unfortunately, reverse causation problems exist for the only available measure of such institutional influences on the retail ratio, the presence or absence of retailers’ guilds, so its effect could not be explored satisfactorily. In all analyses, the presence of retail guilds was negatively associated with the retail ratio, but in only one case (when female headship was taken into account) was this negative relationship statistically significant. It would therefore be unwise to place much weight upon it. Two countervailing influences may have been at work here. On the one hand, a higher density of retailers relative to the population of potential customers created incentives for established retailers to form guilds to protect their business, creating a positive association between pre-existing retail density and the presence of a guild to manage this density. On the other hand, such protective organizations by their nature sought to prevent retail density from rising further, creating a negative association between pre-existing retail guilds and any further increase in retail density. In combination, these two forces could cancel each other out, leading to the absence of any statistically significant association between the two. Unless and until a good instrumental variable
to register guilds’ effect on retailing can be devised, the statistical analysis of guilds’ impact on retailing will not be able to progress further.

More seriously still, the absence of any systematic relationship between retailers’ guilds and retail density may also arise from other considerations relating to the unavoidable aggregation involved in macro-level analyses. In particular there is the finding, which emerges strongly from micro-studies, that what matters is not so much the existence of something that calls itself a guild as what that organization does, particularly with regard to imposing and enforcing barriers to entry. The entrance policies of Dutch retail guilds could differ substantially between and even within towns, resulting in large differences in not only the make-up but also the size of guild membership, and hence the local retail density. But identifying an instrumental variable to measure the effect of guild policy is even more difficult than finding one to measure the effect of existence, creating an additional hindrance to progressing further with this question using aggregate approaches.

A further variable which emerges as significantly associated with retail density is female household headship. Again, there is reverse causation between the retail ratio and female household headship, so the effect of female headship on the retail ratio could not be explored satisfactorily. However, in all analyses we found it to be positively associated with the retail ratio, at a high level of statistical significance. This is consistent with the view, advanced in the literature, that female household heads had a type of human capital that made them highly productive in retailing occupations. But it is also consistent with the idea that retailing represented a type of employment that was particularly well suited to the formation and survival of female-headed households because it could be relatively easily combined with household production. A further possibility is that both higher female headship and higher retail density were simultaneously facilitated by underlying characteristics of particular localities – for instance, by institutional characteristics diminishing constraints on both female economic participation and entry into retailing. These competing explanations pose stimulating questions for future research into the precise characteristics of the individuals and households that acted as vectors of the Retail Revolution in the early modern Netherlands.
Finally, this study alerts us to two general considerations which may be helpful in future analyses of early modern retailing. First, it is important to analyse by-employed and full-time retailing separately. Although they have many characteristics in common, the Dutch evidence suggests that the trajectory of their expansion differed, with retail by-employments proliferating between the 1670s and the 1740s, but full-time retailing expanding between the 1790s and 1803-13. The two measures of retailing also varied spatially, particularly in Friesland, which emerges as a high-retail-density province when only full-time retailers are considered but as merely an intermediate-density province when by-employed retailers (more numerous in other Dutch provinces) are taken into account.

Second, although international comparisons have their place and have convincingly established countries such as the Netherlands (but also Flanders and England) as societies with relatively high average retail ratios in the early modern period, regional comparisons inside each country are also essential. Behind its high average density of retailing, the early modern Netherlands reveal a highly differentiated retailing landscape, with significant differences among different Dutch provinces and within those provinces between smaller and larger settlements. The spatial, demographic and institutional sources of this variation open up stimulating – indeed, indispensable – avenues for deeper research.


Christaller, W. (1933). *Die zentralen Orte in Süddeutschland: eine ökonomisch-


Northern Netherlands, c. 1580-1815. Amsterdam.


Lemire, B. (1997). Dress, culture, and commerce: the English clothing trade before the factory, 1660-1800. New York,


Sint Nicolaasgilde tijdens het ancien regime. Hilversum.


### Appendix: Tax Registers and Censuses Used to Compile Dataset of Dutch Retail Ratios

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<tr>
<th>Year</th>
<th>Province</th>
<th>Settlements</th>
<th>Document title</th>
<th>Reference</th>
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<td>Overijssel</td>
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<td>Volkstelling, Historisch Centrum Overijssel, 3.1, inv.nos. 5343-5344; 5346-5350; 5352-5356</td>
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<tr>
<td>1795</td>
<td>Overijssel</td>
<td>Vollenhove (all settlements)</td>
<td>Volkstelling, Historisch Centrum Overijssel, 3.1, inv.nos. 5360-62; 5366; 5368-5370</td>
<td></td>
</tr>
<tr>
<td>1796</td>
<td>Limburg</td>
<td>(Settlements belonging to municipalities of) Echt, Eijsden, Heerlen, Heythuizen, Maaseik, Meerssen, Oirsbeek, Roermond, Rolduc, Valkenbrug, Venlo, Weert, Wittem</td>
<td>Regionaal Historisch Centrum Limburg, 03.01, inv.nos. 1036-1037; 1039; 1041; 1047; 1049; 1053; 1055-1056; 1059-1062</td>
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<tr>
<td>1797</td>
<td>Holland (above IJ)</td>
<td>Krommenie and Krommeniedijk</td>
<td>Lijst der geregeld Contributien, Archief Zaanstad, Oud Archief, 0035, inv.no. 237</td>
<td></td>
</tr>
<tr>
<td>1803</td>
<td>Limburg</td>
<td>Maastricht</td>
<td>Tableau de la population de la ville de Maastricht, contenant le nombre, les noms, age, etat ou profession des habitants de la ville, le lieu de leur domicile, l'epoque de leur entrée dans la ville et les proprietaires des maisons, an XI (23 september 1802 – 23 september 1803), Regionaal Historisch Centrum Limburg</td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Region</td>
<td>Location</td>
<td>Description</td>
<td>Source</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>----------</td>
<td>-------------</td>
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<tr>
<td>1806</td>
<td>Holland (above IJ)</td>
<td>Beverwijk</td>
<td>Lijsten van afgegeven patenten</td>
<td>Noord-Hollands Archief, 3769, inv.no. 500</td>
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<tr>
<td>1807</td>
<td>Holland (above IJ)</td>
<td>Graft (including West- and Oost-Graftdijk and Noordeinde)</td>
<td>Patentregisters 1806-1812</td>
<td>Regionaal Archief Alkmaar, inv.no. 589-590</td>
</tr>
<tr>
<td>1807</td>
<td>Holland (below IJ)</td>
<td>Maasland, 2nd Quarter</td>
<td>Staten van de bevolking van gemeenten in het tweede kwartier</td>
<td>Nationaal Archief, 3.02.08, inv.no. 710</td>
</tr>
<tr>
<td>1807</td>
<td>Holland (below IJ)</td>
<td>Maasland, 1st quarter</td>
<td>Verzamelstaat houdende gegevens over burgerlijke staat, aantal kinderen, aantal personeelsleden, beroep, veestapel, bouw- en weiland – in eigendom of in huur – van de mannelijke inwoners van het eerste kwartier, de door hen te betalen belastingen en</td>
<td>Nationaal Archief, 3.02.08, inv.nos. 676; 683; 685-688; 691-693; 695-708</td>
</tr>
<tr>
<td>Year</td>
<td>Region</td>
<td>Location</td>
<td>Description</td>
<td>Reference</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>----------</td>
<td>-------------</td>
<td>-----------</td>
</tr>
<tr>
<td>1808</td>
<td>Brabant</td>
<td>Den Bosch</td>
<td>‘Volkstelling’</td>
<td>Database created by Elise van Nederveen Meerkerk</td>
</tr>
<tr>
<td>Year</td>
<td>Location</td>
<td>Town</td>
<td>Source Description</td>
<td>Archival Location</td>
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<td>------</td>
<td>------------------</td>
<td>-------------</td>
<td>----------------------------------------</td>
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<tr>
<td>1812</td>
<td>Holland (above IJ)</td>
<td>Wormer</td>
<td>Register van afgegeven patenten</td>
<td>Waterlands Archief, Archief van Wormer, inv.no. 309</td>
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<tr>
<td>1812</td>
<td>Holland (above IJ)</td>
<td>Zwaag</td>
<td>Lijst van afgegeven patenten</td>
<td>West-Fries Archief, 0689, inv.no. 168</td>
</tr>
<tr>
<td>1813</td>
<td>Holland (below IJ)</td>
<td>Capelle aan de IJssel</td>
<td>Patentbelasting 1812-1813</td>
<td>Gemeentearchief Rotterdam, 9, inv.no. 1221</td>
</tr>
</tbody>
</table>
Table 1: Descriptive Statistics for Continuous Variables in Regressions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Primary occupation not fully recorded, head's sex not fully recorded (n=959)</th>
<th>Primary occupation fully recorded, head's sex not fully recorded (n=873)</th>
<th>Head's sex fully recorded (n=751)</th>
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</thead>
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<td></td>
<td>mean</td>
<td>median</td>
<td>max</td>
</tr>
<tr>
<td>RR maximal all</td>
<td>7.88</td>
<td>1.68</td>
<td>112.38</td>
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<tr>
<td>RR minimal all</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Population</td>
<td>920.71</td>
<td>283</td>
<td>67000</td>
</tr>
<tr>
<td>Log of population</td>
<td>5.71</td>
<td>5.65</td>
<td>11.11</td>
</tr>
<tr>
<td>Year</td>
<td>1768.40</td>
<td>1749</td>
<td>1813</td>
</tr>
<tr>
<td>Latitude</td>
<td>491975</td>
<td>498048</td>
<td>601967</td>
</tr>
<tr>
<td>Longitude</td>
<td>173462</td>
<td>184476</td>
<td>265320</td>
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<tr>
<td>Female headship</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>RR max N. Holland</td>
<td>27.52</td>
<td>24.10</td>
<td>84.07</td>
</tr>
<tr>
<td>RR max S. Holland</td>
<td>17.99</td>
<td>15.91</td>
<td>92.59</td>
</tr>
<tr>
<td>RR max Friesland</td>
<td>4.77</td>
<td>33.91</td>
<td>6.89</td>
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<tr>
<td>RR max Gelderland</td>
<td>13.55</td>
<td>112.38</td>
<td>13.55</td>
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<td>RR max Limburg</td>
<td>4.43</td>
<td>82.95</td>
<td>10.92</td>
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<tr>
<td>RR max Overijssel</td>
<td>3.60</td>
<td>41.51</td>
<td>7.90</td>
</tr>
<tr>
<td>RR min N. Holland</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>RR min S. Holland</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>RR min Friesland</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>RR min Gelderland</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>RR min Limburg</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>RR min Overijssel</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Notes:
- RR max = 'maximal' retail ratio measured as number of retailers (including multiple occupations) per 1,000 population.
- RR min = 'minimal' retail ratio, measured as number of retailers (primary occupations only) per 1,000 population.
- Latitude and longitude are measured in ArcGIS geographical coordinates; see text for equivalents in terms of degrees (°), minutes (‘), and seconds (")
- Female headship is measured as number of female household-heads per 100 households.
Table 2: Descriptive Statistics for Categorical Variables in Regressions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Primary occupation not fully recorded, head's sex not fully recorded</th>
<th>Primary occupation fully recorded, head's sex not fully recorded</th>
<th>Head's sex fully recorded</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no.</td>
<td>%</td>
<td>no.</td>
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<tr>
<td>1670s</td>
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<td>4.7</td>
<td>45</td>
</tr>
<tr>
<td>1740s</td>
<td>478</td>
<td>49.8</td>
<td>476</td>
</tr>
<tr>
<td>1790s</td>
<td>298</td>
<td>31.1</td>
<td>298</td>
</tr>
<tr>
<td>1800s</td>
<td>138</td>
<td>14.4</td>
<td>54</td>
</tr>
<tr>
<td>Friesland</td>
<td>355</td>
<td>37.0</td>
<td>355</td>
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<tr>
<td>Gelderland</td>
<td>103</td>
<td>10.7</td>
<td>102</td>
</tr>
<tr>
<td>Limburg</td>
<td>118</td>
<td>12.3</td>
<td>117</td>
</tr>
<tr>
<td>Overijssel</td>
<td>181</td>
<td>18.9</td>
<td>181</td>
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<tr>
<td>North Holland</td>
<td>51</td>
<td>5.3</td>
<td>51</td>
</tr>
<tr>
<td>South Holland</td>
<td>151</td>
<td>15.7</td>
<td>67</td>
</tr>
<tr>
<td>Retail guild</td>
<td>22</td>
<td>2.3</td>
<td>19</td>
</tr>
<tr>
<td>N</td>
<td>959</td>
<td>100.0</td>
<td>873</td>
</tr>
</tbody>
</table>

Notes:
1670s = 1673-1680.
1740s = 1735-1749.
1790s = 1795-1797.
1800s = 1803-1813.
Retail guild: 1=present; 0=absent.
For the reasons discussed in the text, the regressions exclude 3 observations for Brabant (the same town in 1742, 1775, and 1808), and 5 observations for Zeeland (5 different towns in 1807).
Table 3:
Determinants of 'Maximal' Retail Ratio (Including Multiple Occupations),
Dutch Localities, 1673-1813, by Province

<table>
<thead>
<tr>
<th>Variable</th>
<th>Regression 1</th>
<th>Regression 2</th>
<th>Regression 3</th>
<th>Regression 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Primary occupation not fully recorded, head's sex not fully recorded</td>
<td>Primary occupation fully recorded, head's sex not fully recorded</td>
<td>Head's sex fully recorded</td>
<td>Head's sex assumed not fully recorded</td>
</tr>
<tr>
<td>(n=959)</td>
<td>(n=873)</td>
<td>(n=751)</td>
<td>(n=751)</td>
<td>(n=751)</td>
</tr>
<tr>
<td>Log pop Friesl., Gelderl., Limb.</td>
<td>10.187*** (1.025) 4.859*** (0.386)</td>
<td>9.735*** (1.086) 4.225*** (0.358)</td>
<td>8.870*** (1.105) 3.629*** (0.349)</td>
<td>9.741*** (1.153) 4.015*** (0.357)</td>
</tr>
<tr>
<td>Log pop Overijssel</td>
<td>13.849*** (1.622) 6.606*** (0.689)</td>
<td>13.473*** (1.642) 5.847*** (0.616)</td>
<td>12.322*** (1.604) 5.042*** (0.555)</td>
<td>13.431*** (1.703) 5.537*** (0.598)</td>
</tr>
<tr>
<td>Log pop South Holland</td>
<td>4.094*** (1.242) 1.953*** (0.589)</td>
<td>5.304*** (1.093) 2.302*** (0.449)</td>
<td>6.539*** (1.372) 2.676*** (0.523)</td>
<td>6.366*** (1.400) 2.624*** (0.543)</td>
</tr>
<tr>
<td>Log pop North Holland</td>
<td>-2.630 (2.194) -1.254 (1.055)</td>
<td>-2.580 (2.184) -1.120 (0.960)</td>
<td>-1.973 (2.953) -0.807 (1.215)</td>
<td>-0.850 (3.046) -0.350 (1.259)</td>
</tr>
<tr>
<td>1670s</td>
<td>-20.122*** (3.294) -5.460*** (0.462)</td>
<td>-18.929*** (3.903) -4.520*** (0.433)</td>
<td>-23.277*** (4.995) -4.472*** (0.400)</td>
<td>-20.304*** (4.866) -4.377*** (0.473)</td>
</tr>
<tr>
<td>1790s</td>
<td>-10.862 (6.914) -4.622* (2.624)</td>
<td>-11.571 (7.339) -4.477* (2.546)</td>
<td>-20.674* (11.823) -6.358** (2.816)</td>
<td>-21.841* (12.490) -6.721** (2.961)</td>
</tr>
<tr>
<td>Gelderland</td>
<td>-1.437 (2.300) -0.664 (1.035)</td>
<td>-1.355 (2.245) -0.569 (0.917)</td>
<td>-0.729 (2.200) -0.293 (0.873)</td>
<td>-0.394 (2.254) -0.555 (0.874)</td>
</tr>
<tr>
<td>Limburg</td>
<td>-8.391 (6.857) -3.332 (2.196)</td>
<td>-7.231 (7.869) -2.630 (2.339)</td>
<td>0.336 (9.168) 0.139 (3.830)</td>
<td>6.314 (9.727) 3.112 (5.569)</td>
</tr>
<tr>
<td>North Holland</td>
<td>100.421*** (14.774) 90.697*** (14.088)</td>
<td>96.851*** (14.592) 86.279*** (13.778)</td>
<td>87.704*** (18.400) 78.074*** (17.735)</td>
<td>87.340*** (18.829) 77.632*** (18.177)</td>
</tr>
<tr>
<td>Retail guild</td>
<td>-2.471 (3.552) -1.104 (1.467)</td>
<td>-4.424 (3.913) -1.668 (1.240)</td>
<td>-6.551 (5.113) -2.128* (1.237)</td>
<td>-5.453 (5.283) -1.868 (1.440)</td>
</tr>
<tr>
<td>Female headship</td>
<td>n/a n/a</td>
<td>n/a n/a</td>
<td>n/a n/a</td>
<td>n/a n/a</td>
</tr>
<tr>
<td>Constant</td>
<td>-49.811*** (7.913) -46.661*** (8.366)</td>
<td>-46.661*** (10.840) -36.518*** (10.051)</td>
<td>-39.180*** (11.051)</td>
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</tr>
<tr>
<td>Pseudo R-sq</td>
<td>0.1117</td>
<td>0.1132</td>
<td>0.1173</td>
<td>0.1106</td>
</tr>
</tbody>
</table>

Notes:
Variable definitions as in Tables 1 and 2.
Tobit regressions. Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.
Marginal effect is effect on the mean value of the dependent variable conditional on the dependent variable being either strictly positive or zero. For dummy variables, marginal effect (dy/dx) is for discrete change of dummy variable from 0 to 1.
Table 4:
Determinants of 'Minimal' Retail Ratio (Including Primary Occupations Only),
Dutch Localities, 1673-1813, by Province

<table>
<thead>
<tr>
<th>Variable</th>
<th>Regression 1</th>
<th>Regression 2</th>
<th>Regression 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Primary occupation recorded, head's sex not fully recorded</td>
<td>Head's sex fully recorded</td>
<td>Head's sex assumed not fully recorded</td>
</tr>
<tr>
<td></td>
<td>(n=873)</td>
<td>(n=751)</td>
<td>(n=751)</td>
</tr>
<tr>
<td>Coefficient</td>
<td>(std err.)</td>
<td>Coefficient (std err.)</td>
<td>Coefficient (std err.)</td>
</tr>
<tr>
<td>Log pop Friesl., Gelderl., Limb.</td>
<td>9.133*** (0.846)</td>
<td>8.567*** (0.880)</td>
<td>9.229*** (0.868)</td>
</tr>
<tr>
<td></td>
<td>(0.265)</td>
<td>(0.261)</td>
<td>(0.257)</td>
</tr>
<tr>
<td>Log pop Overijssel</td>
<td>12.70*** (1.468)</td>
<td>11.911*** (1.458)</td>
<td>12.679*** (1.483)</td>
</tr>
<tr>
<td></td>
<td>(0.521)</td>
<td>(0.477)</td>
<td>(0.494)</td>
</tr>
<tr>
<td>Log pop South Holland</td>
<td>5.263*** (1.014)</td>
<td>6.017*** (1.277)</td>
<td>5.897*** (1.321)</td>
</tr>
<tr>
<td></td>
<td>(0.391)</td>
<td>(0.458)</td>
<td>(0.478)</td>
</tr>
<tr>
<td>Log pop North Holland</td>
<td>0.159 (2.146)</td>
<td>0.513 (2.871)</td>
<td>1.273 (2.930)</td>
</tr>
<tr>
<td></td>
<td>(0.854)</td>
<td>(1.064)</td>
<td>(1.088)</td>
</tr>
<tr>
<td></td>
<td>(0.521)</td>
<td>(0.426)</td>
<td>(0.507)</td>
</tr>
<tr>
<td>1740s</td>
<td>-10.111** (4.213)</td>
<td>-18.553** (7.545)</td>
<td>-15.571** (7.524)</td>
</tr>
<tr>
<td></td>
<td>(1.841)</td>
<td>(4.058)</td>
<td>(3.849)</td>
</tr>
<tr>
<td></td>
<td>(1.798)</td>
<td>(2.238)</td>
<td>(2.310)</td>
</tr>
<tr>
<td>Gelderland</td>
<td>-4.789*** (1.796)</td>
<td>-4.311** (1.785)</td>
<td>-4.861*** (1.807)</td>
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<tr>
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<td>(0.528)</td>
<td>(0.508)</td>
<td>(0.498)</td>
</tr>
<tr>
<td>Limburg</td>
<td>-10.076* (5.972)</td>
<td>-2.556 (7.307)</td>
<td>1.418 (7.580)</td>
</tr>
<tr>
<td></td>
<td>(1.242)</td>
<td>(2.217)</td>
<td>(3.119)</td>
</tr>
<tr>
<td></td>
<td>(1.474)</td>
<td>(1.753)</td>
<td>(1.835)</td>
</tr>
<tr>
<td>South Holland</td>
<td>19.485** (9.603)</td>
<td>3.221 (13.546)</td>
<td>10.530 (13.435)</td>
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<tr>
<td></td>
<td>(7.996)</td>
<td>(6.217)</td>
<td>(8.802)</td>
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<tr>
<td>North Holland</td>
<td>68.062*** (14.441)</td>
<td>62.277*** (17.924)</td>
<td>62.491*** (18.250)</td>
</tr>
<tr>
<td></td>
<td>(13.695)</td>
<td>(17.331)</td>
<td>(17.655)</td>
</tr>
<tr>
<td>Retail guild</td>
<td>-2.735 (3.649)</td>
<td>-3.842 (4.771)</td>
<td>-3.134 (4.956)</td>
</tr>
<tr>
<td></td>
<td>(1.161)</td>
<td>(1.255)</td>
<td>(1.408)</td>
</tr>
<tr>
<td>Female headship</td>
<td>n/a</td>
<td>0.328** (0.100)</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>n/a</td>
<td>(0.038)</td>
<td>n/a</td>
</tr>
<tr>
<td>Constant</td>
<td>-41.201*** (6.738)</td>
<td>-33.956*** (9.143)</td>
<td>-36.259*** (9.148)</td>
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<tr>
<td></td>
<td>(9.143)</td>
<td>(9.148)</td>
<td>(9.148)</td>
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<tr>
<td>Pseudo R-sq</td>
<td>0.1193</td>
<td>0.1216</td>
<td>0.1178</td>
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</table>

**Notes:**
As for Table 3.
Table 5: Predicted Effect of Province on 'Maximal' Retail Ratio at Different Population Levels

<table>
<thead>
<tr>
<th>Province</th>
<th>Population = 100 (20th percentile)</th>
<th>Population = 200 (39th percentile)</th>
<th>Population = 500 (67th percentile)</th>
<th>Population = 750 (77th percentile)</th>
<th>Population = 1000 (84th percentile)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted value 95% Conf. Interval</td>
<td>Predicted value 95% Conf. Interval</td>
<td>Predicted value 95% Conf. Interval</td>
<td>Predicted value 95% Conf. Interval</td>
<td>Predicted value 95% Conf. Interval</td>
</tr>
<tr>
<td>Friesland</td>
<td>2.12 0.82 3.43</td>
<td>4.34 2.21 6.47</td>
<td>9.18 5.69 12.67</td>
<td>12.02 7.86 16.17</td>
<td>14.25 9.61 18.89</td>
</tr>
<tr>
<td>Gelderland</td>
<td>1.80 0.36 3.25</td>
<td>3.80 1.36 6.23</td>
<td>8.29 4.21 12.37</td>
<td>10.99 6.13 15.85</td>
<td>13.14 7.71 18.56</td>
</tr>
<tr>
<td>Limburg</td>
<td>0.75 -0.24 1.74</td>
<td>1.83 -0.12 3.78</td>
<td>4.73 0.95 8.51</td>
<td>6.70 1.99 11.40</td>
<td>8.36 3.00 13.72</td>
</tr>
<tr>
<td>Overijssel</td>
<td>0.45 -0.20 1.11</td>
<td>1.62 -0.14 3.38</td>
<td>5.78 1.46 10.11</td>
<td>8.90 3.20 14.60</td>
<td>11.59 4.92 18.26</td>
</tr>
</tbody>
</table>

**Note:**
Based on Table 3, Regression 1.
Assessed at the sample mean of all other independent variables and at the value of logpop corresponding to the given population size.
<table>
<thead>
<tr>
<th>Province</th>
<th>Population = 100 (20th percentile)</th>
<th>Population = 200 (39th percentile)</th>
<th>Population = 500 (67th percentile)</th>
<th>Population = 750 (77th percentile)</th>
<th>Population = 1000 (84th percentile)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted value 95% Conf. Interval</td>
<td>Predicted value 95% Conf. Interval</td>
<td>Predicted value 95% Conf. Interval</td>
<td>Predicted value 95% Conf. Interval</td>
<td>Predicted value 95% Conf. Interval</td>
</tr>
<tr>
<td>South Holland</td>
<td>2.30 -0.59 5.19</td>
<td>3.56 -0.06 7.18</td>
<td>5.84 1.33 10.35</td>
<td>7.08 2.21 11.95</td>
<td>8.05 2.94 13.15</td>
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<td>Friesland</td>
<td>1.86 0.64 3.07</td>
<td>3.98 1.96 5.99</td>
<td>8.66 5.44 11.88</td>
<td>11.39 7.64 15.13</td>
<td>13.52 9.41 17.63</td>
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<tr>
<td>Gelderland</td>
<td>0.93 0.11 1.75</td>
<td>2.27 0.68 3.86</td>
<td>5.71 2.71 8.72</td>
<td>7.93 4.24 11.63</td>
<td>9.75 5.57 13.94</td>
</tr>
<tr>
<td>Limburg</td>
<td>0.38 -0.17 0.94</td>
<td>1.09 -0.20 2.38</td>
<td>3.29 0.36 6.22</td>
<td>4.90 1.06 8.73</td>
<td>6.30 1.80 10.80</td>
</tr>
<tr>
<td>Overijssel</td>
<td>0.17 -0.12 0.46</td>
<td>0.82 -0.20 1.84</td>
<td>3.85 0.73 6.96</td>
<td>6.42 2.10 10.75</td>
<td>8.75 3.56 13.94</td>
</tr>
</tbody>
</table>

**Note:**
Based on Table 4, Regression 1.
Assessed at the sample mean of all other independent variables and at the value of logpop corresponding to the given population size.
Graph 1: Predicted 'Maximal' Retail Ratio, by Province
Graph 2: Predicted 'Minimal' Retail Ratio, by Province

- Friesland
- Overijssel
- S Holland
- Gelderland
- Limburg
- N Holland