A long-memory time series analysis of weekly ticket sales in the Rotterdam Grand Theatre, 1860-1881.

Henk Gras*
Institute for Media and Representation
University of Utrecht

Philip Hans Franses†
Erasmus University Rotterdam

Marius Ooms‡
Erasmus University Rotterdam

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Abstract

Theatre historiography suggests that there has been a gradual change in audience behaviour in the period 1860-1914 in The Netherlands, where this change is towards a higher degree of receptivity of quality and taste. This would imply that ticket sales time series data show signs of long-memory. We test the gradual change hypothesis by fitting long-memory time series models for weekly ticket sales series for the Grand Theatre, Coolsingel, Rotterdam for the period 1860-1881. We find that, even after correcting for deterministic changes (due to changes in management) and for price effects, there is substantial evidence of long-memory. This finding holds for all ranks, expect for gallery. Hence, we find supportive evidence for the gradual change hypothesis.

Key words and phrases: Theatre ticket sales, gradual changes, long memory time series models

*Mailing address: Institute for Media and Representation, Kromme Nieuwe Gracht 29, NL-3512 HD Utrecht, The Netherlands, `email: henk.k.gras@let.uu.nl`

†Econometric Institute, Erasmus University Rotterdam

‡Econometric Institute, Erasmus University Rotterdam

1 Introduction

This paper contains the first of two empirical and quantitative investigations into the validity of an important hypothesis in theatre historiography in The Netherlands, concerning roughly the period between 1860 and 1914. This hypothesis concerns the recovery of the quality of the stage, that is, of plays and playing in Dutch theatres, in the period of 1860-1914, after a supposed steady decline in quality until about 1860-1870, see Gras and Franses (1998). A key aspect of this hypothesis is, hence, a gradual change from low to higher quality. We examine this hypothesis using time series observations on weekly ticket sales, concerning four ranks, for the Grand Theatre, Coolsingel in Rotterdam for the period 1860-1881. (1)

The reason for analyzing the hypothesis using time series observations is motivated by the following. If the gradual change hypothesis would be valid, it would imply a gradually higher quality of plays and performance, and, at the same time, that different audiences would have been attracted to the theatre. In other words, innovations in programming, that is, a different repertory with improved quality plays and players, would have established long-run effects on the mean and variance of theatre going. For example, plays one used to go to, were dismissed due to a shortage of interest, while new and higher quality plays were introduced which turned out to be successful. Translated in the language of time series analysis, see Franses (1998), one would say that innovations had a long-run, though not necessarily permanent, effect on the weekly ticket sales data. A useful time series model to describe such a long-run effect is called a long-memory time series model. In this paper we estimate the relevant parameters in such a model, and we examine if there is indeed a long-run effect of innovations. If there is, we take this as an indication that the gradual change hypothesis may not be rejected.

The outline of this paper is as follows. In Section 2, we elaborate on the narrative of recovery mentioned earlier. We mainly summarize the relevant literature. In Section 3, we examine the weekly ticket data that are available to us. We pay attention to possible structural breaks due to different managers and to changes in prices. In the same section we formally put forward our hypothesis. In Section 4, we provide some details of the time series model we use to empirically validate the hypothesis. We aim to avoid technicalities, and we refer to the relevant literature when appropriate. We also give the empirical results in the same section. Our main finding is that we find supportive evidence for the gradual change hypothesis, even after correcting for level shifts. In Section 6, we conclude with some remarks.

2 Literature

In this section we review the relevant literature, and we formulate our first conjectures concerning the key hypothesis.

2.1 Contemporary critical opinions

From about 1880 to 1910 a peck of theatre critics envisaged the recovery of the quality of the stage after about five decennia of decline. Among them were Rössing, Loffelt, Browne, De Meester, Haverkorn van Rijsewijk. The master narrative of theatre history helped to create reads like a fairy tale. Thalia and Melpomene were saved from their captivity in blood- and-thunder plays by daring men of taste and civilization. J.H. Rössing, a daily newspaper journalist, involved in several initiatives regarding the theatrical infrastructure after 1870, says, "around 1850 the decline of the stage was immense: an almost exclusive living on inferior or badly translated stage plays, a generation of players poor in education and civilization" (Rössing, 1910, p. 425). The Amsterdam theatre had fallen into an artistic coma, "the acting style was still fully based on the pathos and mannerism, originating from solemn tragedy" (Hunningher, 1932, p.142, echoing Rössing). The repertory of this most prestigious theatre in the country consisted of "foreign fare, translated into the Dutch of costermongers or cattle-dealers" (Dutch Stage, 1872, p.331).

The stage in The Hague, the royal residence, was in an even worse condition: "the stage there, had fallen so low, that before the reformation (...) common bourgeois seldom visited the theatre, and persons of quality and civilization looked down on the national stage with disdain" (Rössing, 1910, p.428). Here too the acting style was criticized: "convention, formality, mannerism, and affectation characterized acting and speech. Comedians resembled puppets rather than human beings" (Haverkorn, 1903).

Both Rössing and Haverkorn were convinced that the stage was raised out of its decline by efforts in which they both participated. The most important events were the foundation of the Dutch Stage League in 1870 and of the Society The Dutch Stage in 1876 (from 1881 onwards, Royal Society). The Dutch Stage League aspired after improvement of knowledge and a refining of taste in actors by founding a drama school (1874), and after the elevation of public taste, by founding a critical journal (The Dutch Stage, 1871). The Society The Dutch Stage developed out of the desire of the banker Schimmel to prevent graduates from the new drama school to smearch themselves with the blood-and-thunder reigning the stage (as he saw it). To reach his aim, he found support from another banker, Wertheim, and the lawyer Van Tienhoven, later to become mayor of Amsterdam. Time had come to translate plays into the Dutch of regents and bankers.

The reformers quickly boasted their success. In The Hague, Rössing noticed, "high society (...), even the nobility" showed itself at the performances of the Society The Dutch Stage. "All turned to the best," he adds, "when (...) H.M. Queen Sophie soon attended a performance of The Danicheffs." But that was, understandably, a play in the Dutch of – J.H. Rössing! (Rössing, 1910, p.428). Haverkorn, in his 1901 lecture to the actor Derk Haspels, declared "the sad times were gone, when the rabble had an influence in the Dutch stage. Persons of quality interested themselves in letters and fine art" (Haverkorn, 1901). Rössing also emphasized the role played by the new school system for the bourgeois classes, as a factor of importance in the elevation of public taste (Rössing, 1916, p.133, p.137).

The changes initiated by this movement led, according to themselves, to a change in the repertory. Rössing (1910, 1916) describes a success story in which the repertory was upgraded in three phases. The first was dominated by Schimmel. Schimmel himself, he concedes, wrote in the 'German' vogue (blank verse), but the French bourgeois drama (Scribe and Sardou) was pushed by him as the 'school of common sense' (Rössing, 1910, p.249). Schimmel fiercely opposed the stage's social commitment, or any educatory zeal, because it stood at right angles to his view that Art concerned everlasting values (Hunningher,1931, pp.166-167, Rössing, 1916, 77ff., 134ff.). Yet, socially committed drama stood central in the second phase, which saw the eclipse of Schimmel and the rise of Ibsen and German social drama, propagandized by honorable men like Rössing himself (Rössing, 1910, 431-33; 1916, 137ff.). In the third and final phase, French drama was finally overruled by German drama, while home-grown plays were in the ascendancy – at least, according to Rössing.

2.2 The historical master narrative

The early restoration view has largely been taken over by theatre historians in the twentieth century, many of whom were directly connected with the critical circles mentioned (Hunningher, 1932 and 1949; De Leeuwe, 1975; Erestein, 1996; Post, 1989, 1996a and 1996b). Hunningher echoes Haverkorn in his conviction that the 'gutter lost ground to quality street' because of the actions of the bankers of taste and civilization (Hunningher, 1931, p.140). Although he still sees too many efforts to please the uncivilized, he is firm in his conviction that only melodrama drew audiences from the lower classes (ibid, p.165), while the civilized (on the expensive seats), preferred 'classical' tragedy, drawing-room plays, and drama.

In 1975, De Leeuwe, who focused on Rotterdam, the city which is the object of analysis in this paper, sketched the context of Le Gras' ascendancy as a pre-naturalistic director in Rotterdam in the last three decades of the nineteenth century as an aspect of recovery. For him, the stage crisis, dated from 1840 onwards, had a socially determined character. Repertory and acting style became dominated by the sphere of interest of the lower middle classes, since the upper classes were no longer interested in Dutch-spoken drama, so, the troupes had to please the remaining lower middle-class audience. Le Gras' activities, De Leeuwe continues, came in the wake of the attempts of intellectual bourgeois, to regain the stage for their class (De Leeuwe, 1975, p.211, p.221). Here too, the notion is that more first-rank spectators entered the theatre (the idea of a 'return to quality'), and that this new elite audience had a preference for home-grown and such foreign drama, which was 'modern-realistic' ('naturalistic drama' in the stricter sense comprised).

2.3 Gradual changes

The general tendency in the dominant narrative, hence, is one of change. Change in the composition of troupes, in acting style, in repertory, in mise-en-scene, and directing plays. On the side of 'production', changes are assumed to have originated in changing taste and changing composition of audiences. As usual, however, such major developments in cultural history are largely assumed on the basis of narrative documents, giving the view of individual contemporaries, having their own agendas to write things down as we have them today. Dutch theatre historians, never too much occupied by criticism of primary sources, have largely copied the master text, created around 1900, by men involved in this process of recovery (Gras and Pratasik, 1997). They ignored some other critics, who were at that time already very skeptical about the main statements of critics like Rössing, or of the bankers of taste, like Schimmel. The Rotterdam critic Heijermans, father of the socialist playwright, in his virulent polemics with Schimmel c.s. printed in the Zondagsblad [Sunday Journal], denied for instance that the elite flocked back to the stalls and boxes, and hence, denied an elite support of the repertory mentioned above. To him, the failure of the elite to support civilized drama, kept melodrama going, which was unavoidable since the unsubsidized theatre managements needed to survive financially.

Such a state of affairs asks for a critical test of who was actually right. The narrative of recovery of the stage can partly be statistically tested while using the theatre archive of the Grand Theatre, Coolsingel, in Rotterdam (1853-1887) and the archives of the major drama companies in the Grand Theatre, Aert van Nesstraat (1887-1916). The question we will deal with here, is 'did gradual changes in theatre-going take place'? As indicated in the introduction, our approach will rely upon the use of a long-memory (fractionally integrated) time series model. Our analysis amounts to a first step in testing the hypothesis of a 'recovery' of the stage as historians tell us.

3 Data and hypothesis

In this section we discuss the available data, and we address some issues concerning level shifts due to changing prices, which may have an effect on the subsequent empirical analysis.

3.1 Data

The municipal archive of Rotterdam stores the archives of the Rotterdam Theatre Company, owners of the Grand Theatre, and of several of the drama and opera troupes, which acted as its principal players. These collections contain accounts of the ticket sales per rank per day, and of incoming coupons per rank per day, for the Dutch-speaking companies for the years 1853-1881 and 1885-1887 (MAR, GT, 121-135; 136-142; MAR, SEDDGO, 21-28). Due to the gap 1881-1885 we analyze the data up to 1881. (2)

Due to the fact that we analyze average rank occupation rates on a weekly basis, we also leave out the years 1853-1860, since they showed too many gaps.

(3) Still, the period 1860-1881 covers the transition from supposed decline to supposed recovery. Exact numbers of season tickets for Dutch-spoken drama per rank are missing for some seasons, but from 1860 onwards the amount of season tickets dwindled to a mere handful, because of the introduction of coupons, and in 1875 season tickets were abolished. The missing numbers have been ignored. Opera, however has to be left out of consideration at all, due to a gap of three years in the ticket sale accounts (1869-1872), and because of missing data of season tickets in the 1870s. For 1878 till 1891, the dissolution of the Rotterdam German opera, there are no accounts at all. Our analysis, therefore only takes into account Dutch-spoken drama by the principal troupes. We only take a look at opera to shed light upon the ticket sales for drama.

3.2 Changing management

For Dutch-spoken drama, the period under consideration clearly shows changes. These partly relate to changes in management. During this period three managements catered for Dutch-spoken drama: Jan E. De Vries (1860-61 to 1866-67, seasons numbers 88 to 94), Jan Albregt and Daan van Ollefen (1867-68 to 1875-76, seasons numbers 95 to 103) and Antoine Jean le Gras c.s. (1876-77 to 1880-81, seasons numbers 104-108). Seasons have been numbered from the foundation of the Grand Theatre in Rotterdam (1773-1774 = 1).

De Vries, 1860-1867, management 1

The first season considered here, 1860-61, marked an important change in Rotterdam theatre life. In that season the Rotterdam Theatre Society leased the accommodation to one single, new, organization, The Rotterdam Society for the Founding and Exploitation of Dutch Drama and German Opera. This was an initiative from an ambitious second rank composer and first rank music critic, William Thooft, taken over by Rotterdam's elite. In fact it boiled down to engaging the recently fired Amsterdam theatre manager Jan E. de Vries with his Dutch-speaking stage company (containing the best actors and actresses in the country), and involving him also in the management of a German opera company, to be founded. De Vries had shown great interest in German opera. Part of the Rotterdam elite was at that time annoyed to depend on the French opera troupe from The Hague, which was accused of only bringing second-rank casts to Rotterdam. They came to depreciate the 'stage communism' (as Thooft called it), which in fact had been operative from 1814 onwards. Rotterdam's elite seized the opportunity to found its own opera and stage company. De Vries, then, was formally manager of both the new Rotterdam German opera and the Dutch drama company. In fact, a committee from the Rotterdam elite, the board of the Rotterdam Society (etc.), managed the affairs of the opera. Interest in opera was initially much greater than that in drama, particularly on the first and second ranks. Even while the opera quickly lost its spell (except for the pit), De Vries did not succeed in drawing good audiences for Dutch-spoken drama. This was very frustrating for him. Two seasons before 1860, as a guest troupe, he had been massively successful in drawing audiences to drama. Now he not only lost them to the opera, and found himself continuously attacked. Patrons of the opera wanted to dissolve the Dutch-speaking troupe altogether. Others blamed De Vries for not attracting audiences due to his repertory. As the pit and the lower ranks were doing best at drama, De Vries surely had to take account of their tastes, although the accusations were largely unfounded. De Vries did try new Dutch plays and he was the first manager to be successful in giving plays in 'runs'.

Albregt and van Ollefen, 1867-1876, management 2

The decline of opera, which fell through the 50 per cent average house occupation rate in the season 1864-65, caused a crisis in the Rotterdam Society (etc.). An effort to gain support by having patrons sign for a three-year season ticket found a generous response, but did not help. At the end of the second 'guaranteed' season (1866-67), the opera was virtually bankrupt and only finished the final guarantee season on the purses of the committee, whose five members lost well over 30,000 guilders on a budget of about 150,000. Frustrated, De Vries left

Rotterdam September 1867.

His Dutch drama company was taken over by two of its actors, Jan Albregt, a famous comic actor, and Daan van Ollefen. After the disastrous 1867-68 season both the leases of the theatre and the relation between drama and opera changed. Both companies were now run independently from each other (Albregt and Van Ollefen for drama, the German music director Louis Saar for the opera). The drama company leased the theatre and subleased it to the opera. Albregt and Van Ollefen considered that they had to face fierce competition from the recently opened New Theatre, also at the Coolsingel, and that, perhaps, De Vries had failed to draw audiences because of the rather high prices. Shortly after their start, Albregt and Van Ollefen sharply reduced the prices, particularly in the pit and galleries, see also Table 1.

During the management of Albregt and Van Ollefen, the Dutch Stage League was founded, and their management got into trouble because of that. In Rotterdam they became the object of Heijermans' scorn, because they, to this critic's view, catered for bad taste (the drama's of Peijpers, a personal enemy of Heijermans), and installed a regime of nepotism. Outside Rotterdam, the troupe was considered the best stage company in the Netherlands. It was therefore that agents of the Dutch Stage League sought contact with the management (and doubtless with some Rotterdam elite protectors of the troupe, as Heijermans reasonably speculated), to combine playing the Rotterdam theatre with the prestigious City Theatre of Amsterdam. In fact Amsterdam took over the company, which, in view of the violent rivalry already traditional between these two cities, caused a Gorgonic howl at the river Meuse, directed by Heijermans' Zondagsblad.

Le Gras, 1876-1881, management 3

The results was that the troupe split into two. Part of the actors, led by Le Gras, by then already recognized as the best director, Van Zuylen and J. Haspels set up their own company in the New Theatre, where they found support of the citizens (600 of them formed a guarantee fund). After two years of stage war, in which political contests mixed up with esthetic conflicts, Albregt and van Ollefen - supported by the conservative press and cried down for bad taste by the liberal press (Heijermans) - definitively went over to Amsterdam. Le Gras c.s. then took over the Grand Theatre (1876-77). Though the criticism towards Albregt and van Ollefen with respect to the repertory is only partially correct (they tried to satisfy the demands of the Stage League, for instance for home-made drama), it is beyond doubt that Le Gras c.s. far more overtly intended to follow the League's line of taste. In fact they were forced to do so as well, since in all Dutch cities where the League's departments sponsored the stage companies, they also censured the repertory. This partially made Le Gras c.s. join in 1881 the Amsterdam-centred Society The Dutch Stage, as its Rotterdam department. Van Zuylen left the troupe, protesting that Le Gras precisely did what he had wished to avoid in 1874. The association with the Society was no success, and was dissolved at the end of the 1884-85 season. Note that Le Gras c.s. steadily raised the seat prices again, see Table 1.

3.3 Prices and capacity

The general tendency in the seat prices of Dutch drama was to increase the prices of first rank seats and lower those for pit and galleries. From 1860 onwards, prices of gallery seats dropped with about 60 per cent, those of first rank seats rose about 15 per cent. The most important rank, the pit, also benefited from the drop of prices, particularly during the management of Albregt and Van Ollefen.

Table 1 gives prices at the box office. Season tickets relatively meant a bargain and coupons, which were introduced in the 1862-63 season, often were slightly cheaper than box office tickets. As the administration of coupons was done by price, and not by rank, we had to take the ticket sales of same-priced ranks together.

During the twenty years over which our analysis runs, the seating capacity in the Grand Theatre also changed. Seating capacity between 1860 and 1881 is given in Table 2. Seating capacity changed in 1860, when the founders of the opera wanted to have stalls in the theatre, and thought it good to expand them, at the expense of the pit. From 1875 onwards even more banks from the pit were redefined and formed a parquet, at prices equal to the boxes. Seating capacity in the pit was approximately maintained, by arranging for 60 loose spare chairs in case of a full house. The tendency is one of minting money out of a better view, a tendency that took absurd proportions after 1887.

3.4 Gradual recovery

Upon examining the occupation rates, see Figure 1, we noticed that drama slowly but surely drew more first rank spectators. In fact, in 1876-77 the first rank's occupation rate for the first time since 1773 matched that of the pit. Le Gras at first drew more first rank spectators to drama than there were in the opera. Gallery audiences for drama hardly responded to lowering of prices, but pit audiences did. Le Gras c.s. succeeded in chasing their pit audience out of the theatre within three seasons.

Hence we can identify three causes of gradual change to have hypothetically been of influence in average rank occupation rates in Dutch-spoken drama, over the years 1860-1881. The first is the succession of managements in this period (De Vries, 1860-1867; Albregt and Van Ollefen, 1867-1876; Le Gras c.s., 1876-1881), where the first change of management coincides with the start of competition from the new theatre. The second is the development of prices (see Table 1), which almost concurs with the changes in management, but still is worth considering as an independent factor.

The third is a change of taste. Historiography suggests a gradual change due to the growing influence of the 'recovery movement', led by such organizations as the Dutch Stage League and the Society The Dutch Stage. This should have been a change in repertory, acting style, and mise-en-scene. This change largely corroborates the changing managements, De Vries being farthest away from 'reform', Le Gras being in the midst of it. Repertory indeed changed. De Vries largely staged plays continuing the tradition of drama of the first half of the century, yet, also initiated some innovation. Albregt and van Ollefen continued giving a mixture of old and new, though historiography credits them for innovations in acting style and repertory. Le Gras stands most firmly in the tradition of innovation. He is considered the first 'modern' director, and one who supported 'modern' well-made plays (Sardou, etc.) and home-grown drama. The acting style changed. If old-style actors were often cried down for shouting and sawing the air, the new-style one were notorious for whispering and dignified controlled movement.

The Rotterdam data also suggest a gradual change in the proportions of audiences per rank for opera and drama. Closer inspection of the Rotterdam production data reveals that there were, as regards drama, other changes in the period. The repertory system (every night another play; every star excelling in all genres) gradually gave way to a system of longer runs of plays, every play cast with actors most fitting the roles, interspersed by remakes of old plays – as it were, a mixed repertory system. This started with De Vries. The first runs of plays were that of the home-grown Emma Berthold (Cremer), and The Man with the Waxen Figures (Xavier de Montepin, both 1865-66) and Klaasje Zevenster, and adaptation of Van Lennep's novel (1866-67). All ran for more than ten performances in a row.

In short, theatre historiography suggests a gradual change in audience behaviour in the period 1860-1880. We might ask, whether this change affected all ranks. The prediction on the basis of theatre historiography would be that is was primarily a matter for the stalls and balcony and the gallery. When we analyze this gradual change, we should examine if it is robust against changes in management and changes in prices. In the next section, we put forward a time series model with exogenous variables, which can be useful for the quantitative analysis of the gradual recovery hypothesis.

4 A long-memory time series model

In this section we put forward a time series model for weekly ticket sales, where we allow for level shifts due to changes in management and for prices changes. In section 4.1, we first discuss the data and the variables included. Next, we briefly discuss some technical details of the time series model. To save space, we will refer to the relevant literature for further technicalities. Finally, we discuss the empirical results.

4.1 Data and variables

We have weekly ticket sales data for the seasons 1860-1861 until 1880-1881, with season numbers 88 to 108, concerning performances of Dutch Spoken drama at the Grand Theatre in Rotterdam. The ticket sales translate into occupation rates, denoted as $z_{i,t}$, where i is an index for the rank, and t for time. We have ticket sales for rank 1 (balcony and stalles), rank 2 (boxes and parquet), pit, gallery (including amphitheatre), and the house, hence i runs from 1 to 5. To introduce some symmetry into the data, we apply the following transformation,

$$y_{i,t} = log(z_{i,t} + c_i), \tag{1}$$

where we take $c_1 = 0.05$ and $c_2 = c_3 = c_4 = c_5 = 0.10$, and where log denotes the natural logarithm.

As an additional variable we have $q_{i,t}$, which denotes the price index for rank i, where we set 1860=100. We also transform this price index, that is, in the sequel we will use

$$p_{i,t} = \log(q_{i,t}) - \overline{\log q_i}, \tag{2}$$

where $\overline{\log q_i}$ is the in-sample mean of $\log(q_{i,t})$. Next, the three different management boards are represented by $1 - 0$ dummy variables, denotes as $d_{k,t}$. More precise, $d_{1,t}$ is 1 for 1860-1867 (seasons 88-94) and 0 elsewhere, $d_{2,t}$ is for 1867-1876 (seasons 95-103) and 0 elsewhere, and $d_{3,t}$ is 1 for 1876-1888 and 0 elsewhere. We use the same management variables for each rank.

As the weekly occupancy rates show signs of seasonality, we introduce a few seasonal variables. These variables are based on a week index $j(t)$ which starts at 1 at the beginning of each theatre season and ends at 32 for the last week of each season. There are 7 such seasonal variables. We use the same seasonal variables for each rank, but the effects of the variables are different across ranks. (4)

4.2 The model

The most suitable model for the present purposes turns out to be an autoregressive model for a possibly fractionally integrated time series variable, where we include additional explanatory variables. For further reference we abbreviate this model as ARFI-X. The autoregressive (AR) part of the model should account for possible short-run and seasonal dynamics. The fractional integration (FI) part can take account of long-memory properties of the data. This approach has been introduced in Granger and Joyeux (1980) and in Hosking (1981), and there are several recent studies in economics, finance, and political science, where this model class has been successfully applied. The explanatory variables are included in the model in order to make sure that apparent long-memory properties are not due to neglected variables. For example, Bos, Franses and Ooms (1999) find that taking account of level shifts (like the management dummies in our case) can reduce the evidence of long-memory.

Some preliminary analysis indicated that we should account for autoregressive effects at lags 2 and 32, where 32 corresponds with the observation in the same week in the previous theatre season. In time series notation, the ARFI-X model can now be summarized as

$$(y_{i,t} - x'_{i,t}\beta)(1-L)^d(1-\phi_2 L^2 - \phi_{32}L^{32}) = \varepsilon_t, \tag{3}$$

where L denotes the familiar backward shift operator defined by $Ly_t = y_{t-1}$, ε_t is an independent and identically distributed normal random variable with mean zero and variance σ^2. The AR part of the model concerns $(1-\phi_2 L^2 - \phi_{32}L^{32})$, the X part is $x'_{i,t}\beta$, and the long-memory part is $(1-L)^d$, where d is called the long-memory parameter. The vector $x_{i,t}$ contains eleven variables, that is, three management dummies, seven seasonal variables and a price variable $p_{i,t}$.

To estimate the parameters we use the modified profile likelihood method, proposed in Doornik and Ooms (1999) and Doornik (1998). Other asymptotically first order equivalent estimation methods like maximum likelihood gave similar results, and the results are not reported here. The empirical strategy we follow is that we first estimate the parameters of (3) and then subsequently delete insignificant variables. We do however always retain the long-memory parameter d, that is, we do not set it equal to 0 even though it can be insignificant. This is simply because this is the focal parameter of our analysis, which is to be interpreted as providing evidence for or against our gradual change hypothesis. Indeed, when d differs from 0, and is also not equal to 1, we have evidence in favor of our hypothesis.

4.3 Empirical results

The final estimation results are summarized in Table 3. Price is important for all ranks but for gallery. This result hardly comes as a surprise as the gallery price remained relatively stable, whereas that of the pit (which influences the result of the house most) shows the largest fluctuations.

If we follow our empirical strategy, it appears that for two series (pit and house) we can collect the management dummies into a single intercept term. Notice that these dummies and intercept should be interpreted against the seasonal terms that are also included. The managements are a relevant factor in theatre going, but for neither pit nor house the three managements mentioned can significantly be distinguished from each other. The three management dummies have a strong and distinguishable impact on rank 1, rank 2 and gallery. Hence, the different acting troupes and their style/repertory are of importance in theatre going. It is interesting though that the effect of management change on the first rank is relatively large (large differences between dummies) as compared with the other ranks. This seems in line with the narrative of recovery, which put De Vries furthest from elite taste, and Le Gras as closest.

To save space, we abstain from presenting the results for the seasonal variables, because the interpretation of the parameters is not of relevance for the present purposes. The results in Table 3 show that there is a long-term dynamic seasonal effect for all five series, that is, the autoregressive parameter at lag 32 is significant for all series. Short-run dynamics do not appear relevant for rank 1, rank 2 and pit. The overall significance of long-term dynamics indicates a non-negligible effect of audience loyalty.

The most interesting result, however, is that the long-memory parameter d is significantly different from 0 for four of the five series (at the 1% significance level), and this parameter is approximately equal to 0.2 for these series. Only for the gallery data, we find no evidence of long memory. In sum, we find supportive evidence for our gradual change hypothesis for rank 1, rank 2, pit and the house. The gallery did not partake in this change. Hence any evidence for gradual changes for this rank is caused by changes in management and prices.

It most be kept in mind though that the gradual change hypothesis is only supported for the period 1860-1881. The ticket sales data of 1887-1916 (1881-1887 contains a four year gap), a period also highly relevant for the narrative of recovery, show no evidence of long memory at all. So, when the accommodation was adapted to the standards of the discourse of recovery (a bourgeois temple of the Muses replacing the old 'barn' at the Coolsingel), the effects of innovation of quality disappeared. This, to be sure, has perhaps much to do with the structure of the ranks in the new theatre, which contained far too large first ranks, and admitted the lower-rank audiences from the back door to ranks where acoustics were very unfavourable.

5 Conclusion

Theatre historiography suggests that there has been a gradual change in audience behaviour in the period 1860-1914 for Rotterdam towards a higher degree of receptivity of quality and taste. The suggestion of historiography would imply that ticket sales time series data show signs of long memory. We tested the gradual change hypothesis for the Grand Theatre in Rotterdam, 1860-1880, by fitting long-memory time series models for weekly ticket sales data. We found that, even after correcting for changes in management and price effects, there was substantial evidence of long-memory. This finding held for all ranks, except for one.

Hence, this paper documents supportive evidence for the gradual change hypothesis for the years 1860-1880, but not for the period up to 1916 (when the data series end). Also, it must be stressed that the validation of the gradual change hypothesis is not yet a general validation of the recovery narrative of Dutch theatre history, which is also specific about which particular plays and authors drew the first rank audiences back into the theatre. To test this, more analysis is needed, and this is left for further research.

6 Endnotes

(1) We also inspected weekly tick sales for the Grand Theatre, Aert van Nesstraat, 1887-1916, but these data did not fulfill the preconditions for a comparable analysis of the data for 1860-1881.

(2) We did analyze, though, the years 1885-1887 to see if our model to be developed below yields adequate out-of-sample forecasts. Detailed results can be obtained from the authors.

(3) As stated in the introduction, the ticket sales data for 1887-1916 did not fulfill the preconditions for a long memory time series analysis.

(4) The seasonal variables are defined as follows. The seasonal pattern is approximately constant in the first 10 weeks, hence we take $s_{1,10,t} = I_{(j(t)<11)} - (10/32)$ as the first seasonal variable, where I_a denotes an indicator variable which has a value 1 if the argument a is true, and 0 otherwise. Calendar effects give a bit of a 'ragged pattern' at the end of the calendar year (Christmas), captured by five separate dummy variables $s_{l,t} = I_{j(t)=l} - (1/32)$, where $l = 11, 12, \ldots, 15$. Finally, from week 16 onwards there seems to be a steady decline towards the end of the season. We describe this pattern by a seasonal constant and a trend, that is by $s_{16,32,t} = I_{(j(t)>15)} - (17/32)$ and $r_{16,32,t} = I_{(j(t)>16)} * (j - 24)$, respectively.

Table 1: Theatre Coolsingel, 1860-1879, prices per rank at the start of the season (September): Drama

rank	1860	1861	1867	1876	1879(2)	1879(9)
balcony	200	200	150	175	200	200
stalles	200	200	150	175	200	200
boxes	100	125	100	125	125	135
parquet	–	–		125	125	135
pit	75	100	50	75	75	80
amphitheatre	50	60	35	40	40	40
gallery	30	30	25	30	25	25

[1] Source: ticket sale accounts.

Table 2: Rank and house capacity, Grand Theatre, Coolsingel, 1860-1881.

rank	1860-1863	1863-1875	1875-1881
balcony	118	118	118
stalles	32	64	64
boxes	219	219	219
parquet			42
pit	305	305	263
amphitheatre	175	175	175
gallery	275	275	275
house	1124	1156	1156

[1] Source: MAR, GT, 106-108, MAR, MAA, 3802.

Table 3: Estimated coefficients in the ARFI-X models for weekly ticket sales.

variable	Rank 1	Rank 2	Pit	Gallery	House
d	0.20^{***}	0.18^{***}	0.22^{***}	0.12	0.17^{***}
Management 1	-1.49^{*}	-1.01^{***}	–	-0.83^{***}	–
Management 2	-1.31^{***}	-0.76^{***}	–	-0.85^{***}	–
Management 3	-0.65^{***}	-0.69^{***}	–	-0.92^{***}	–
Log own price	-1.43^{*}	-0.96^{**}	-0.63^{***}	–	-0.55^{***}
Lag 2	–	–	–	0.12^{***}	0.08^{**}
Lag 32	0.09^{**}	0.12^{***}	0.09^{**}	0.06^{*}	0.09^{**}
Intercept	–	–	-0.47^{***}	–	-0.55^{***}

*** Significant at the 0.01 level, ** at the 0.05 level, * at the 0.10 level

[1] The total number of observations is 672. The models and the variables are discussed in detail in Section 4.2. Lag 2 and 32 correspond with ϕ_2 and ϕ_{32} in (3). The d parameter is the long-memory parameter of interest.

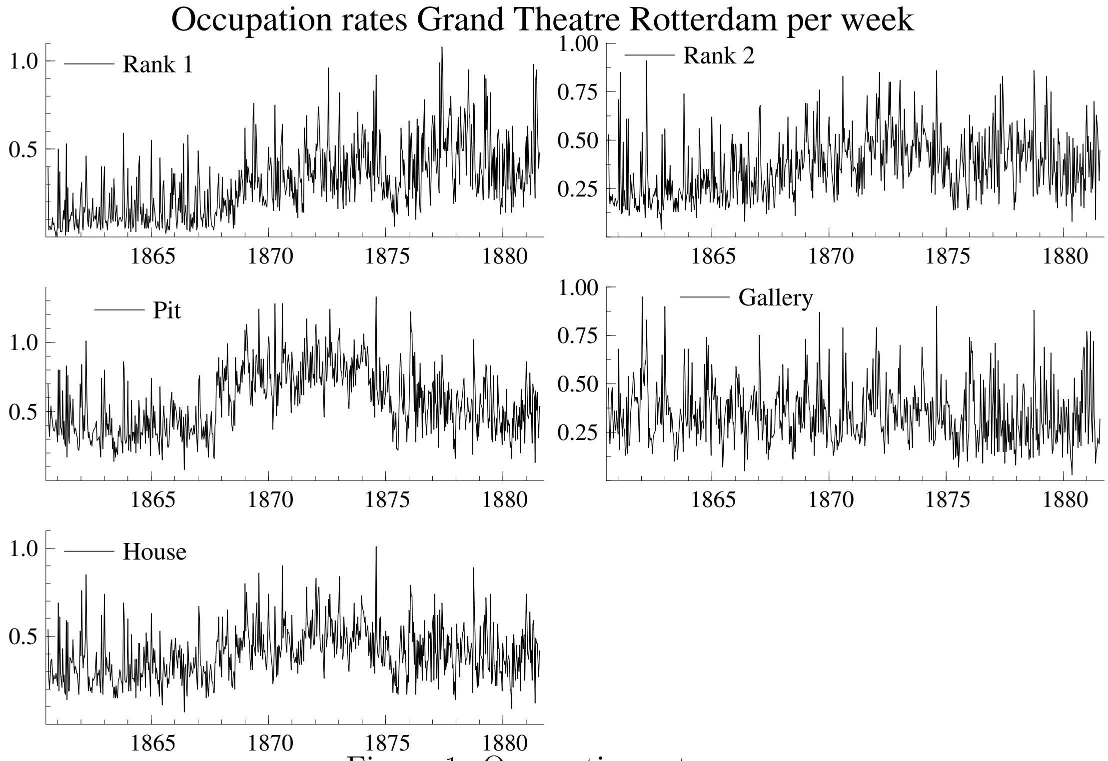

Figure 1: Occupation rates

7 References

7.1 Archives

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