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Franses, Philip Hans

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Estimating the stock of postwar Dutch postal stamps*

Philip Hans Franses†
Econometric Institute
Erasmus University Rotterdam

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Abstract

This paper seeks to find an answer to the question: "How many stamps are still around, given that we know their prices at issue, the current price and the amount then issued?" For this purpose, I develop a simple statistical model, the parameters of which are estimated for over 1000 postwar Dutch stamps. One finding is that some stamps are very scarce, that is, less than 100 copies must be around.

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†Econometric Institute, Erasmus University Rotterdam, P.O. Box 1738, NL-3000 DR, Rotterdam, The Netherlands, email: franses@few.eur.nl

1 Introduction

In this paper I put forward a statistical model that can be used to estimate how many postal stamps are, or better must be, around amongst collectors. One possible use of this model is that it allows to examine the fairness of quoted prices at auctions. Indeed, imputing an observed quoted price into the model results in an estimate of the current, but unobserved, stock of that particular postal stamp. Domain-specific knowledge can then be used to evaluate the reliability of this estimate. The model is calibrated using data for over 1000 Dutch postal stamps that have been issued since World War II, but it can naturally be considered for stamps of other countries, or for collectors' items like banknotes, coins, copies of paintings and perhaps other items of art.

The model requires three ingredients. The first is the price of the stamp when it was issued. Conveniently, the price is printed on each postal stamp. At the time of issue, this price was the same for all individuals. Also, postal stamps can either be used for sending postal mail or for collection. Except for misprints all issued stamps have the same quality, and preferences for certain stamps over others issued at the same time do not exist. The second ingredient of the model is the amount of stamps that were issued. Often, stamps come in series with a certain theme (summer, anniversaries). Each series usually contains a stamp with a value that, at that time, equals the price for sending a regular letter. Usually, more of these particular stamps are issued.

The third, and very important, ingredient of the model is the current price of the stamps, either fresh (not used) or stamped (used). Each year the average current prices are reported in a catalogue, which is available to the general public. These prices reflect a consensus value and are set by informed traders and collectors. These prices concern regular versions of these stamps, so misprints, rare prints or special envelopes are not taken into account. Also, all stamps are assumed to be of good quality. This is a relevant feature of stamps, in contrast to products like old cars or early vinyl recordings, where quality might decrease over time due to its usage. Indeed, used stamps could have been used only once.

With these three components, and a few assumptions about the functional form of the model, it is possible to estimate the current stock of (even rare) postal stamps. In Section 2, I discuss the model. In Section 3, I present the data and the estimation results. Section 4 concludes with a concise discussion of the findings.

2 The model

Consider a postal stamp i, with $i = 1, 2. \ldots, N$. Denote the face value of the stamp at the time of issue, which is equal to its price which then had to be paid for it, as $p_{i,0}$. The issued quantity at that time is denoted by $q_{i,0}$. Finally, the current price is equal to $p_{i,1}$, as it appears in a most recent philately catalogue. Obviously, the unobserved variable of interest here is $q_{i,1}$, which is unknown, and it is unlikely that it can ever be observed.

It seems reasonable to assume that $q_{i,1}$ is a fraction of $q_{i,0}$, with an upper bound fraction 1 (more likely for very recent stamps) and a lower bound 0 (perhaps more likely for very old stamps). Below we will see that aspects of the stamps other than age may also effect this fraction.

One way to describe this relation is to assume that

$$q_{i,1} = \frac{\exp(X\beta)}{1 + \exp(X\beta)} q_{i,0}, \tag{1}$$

where X contains an intercept and variables like time, type of stamps, the amount issued, and so on.

The second component of the model concerns the relation between price and quantity, which, due to the latency of $q_{i,1}$, is most conveniently written as

$$\log p_{i,1} - \log p_{i,0} = \mu + \gamma(\log q_{i,1} - \log q_{i,0}) + \varepsilon_i, \tag{2}$$

where log is the natural logarithm, and with μ capturing inflation and other common factors concerning philately, and with γ measuring the price elasticity and ε_i is assumed to be a normal error term.

Dividing both sides of (1) by $q_{i,0}$, taking logs, and then after substituting (1) in (2), one obtains the final model specification

$$\log p_{i,1} - \log p_{i,0} = \mu + \gamma(X\beta - \log(1 + \exp X\beta)) + \varepsilon_i. \tag{3}$$

The parameters of (3) can be estimated using non-linear least squares (NLS).

3 Post World War II Dutch postal stamps

In this section I consider model (3) for Dutch postal stamps that have been issued in the years 1945 to and including 2001 (May), covering 1413 different stamps. All information is based on the Special Catalogue 2002 of the NVPH (ISBN 90-73646-33-2). Prices in Dutch guilders are converted into euros, using the standard conversion rate (2.20371).

The catalogue provides information on $p_{i,1}$, $p_{i,0}$ and $q_{i,0}$, where $p_{i,1}$ concerns prices for either fresh or used stamps. Additionally, the variables in X can be the number of the stamp (as a measure of recency), any surplus value (usually for charity purposes), a dummy variable for a children's series, the amount of stamps within a particular series, the rank of a stamp with that series, whether the stamp value corresponds with the regular price of sending a common letter, the number of days of issue, and the time (in days) to the end of validity for actual use. For the latter variable there turn out to be many missing observations (as many stamps can still be used), and hence this variable is not included in further analysis. For most variables, one would expect to find a positive effect on the decay factor, and hence on the change in price, as they either would imply a heavier use and a higher value for collectors. The sample concerns 1413 stamps. However, for only 1006, I can obtain full information on all relevant variables. To facilitate the process of NLS parameter estimation, all variables are taken in deviations from their mean.

The estimation results appear in Table 1. This table only reports the parameter estimates that are significant at the 1 per cent level as there are many observations. Clearly, all parameters obtain the expected sign, except perhaps the series size and the duration of issue. The R^2 of the models for fresh and used stamps are 0.841 and 0.853, respectively, which suggests an exceptional fit for a cross-sectional database.

With the parameter estimates, I compute the decay factors as in (1), as well as the estimated values of $q_{i,1}$, see Table 2. As could be expected, the spread of the decay factor for fresh stamps is larger than that of used stamps. This is also

reflected in the estimates of the remaining stock. Apparently, for some stamps only little stock exists, although one should of course discount for parameter uncertainty.

If one would take the estimates of $q_{i,1}$ as given, then the four stamps (their numbers), which according to the model and the resultant parameter estimates must be most rare, are given in Table 3. Interestingly, I find that about the same stamps, out of two particular series, are the most rare, either new or used. Figures 1 and 2 give pictures of these two series.

4 Discussion and conclusion

Even though collecting stamps is enjoyed worldwide by millions of individuals, surprisingly little research has been done towards understanding aspects of philately. I could trace two studies which relate amateur stamp trade with a particular type of auctions, see Thiel and Petry (1995) and Luckin-Reiley (2000). Furthermore, an interesting ethnological study appears in van de Grijp (2002).

Despite the active amateur trade, nowhere could I find any study of price-setting behavior of fresh and used stamps. Obviously, the officially quoted price must reflect an estimate of what informed individuals believe is the quantity available. This quantity is not observed, but with a few assumptions it is possible to get an estimate of the remaining stock of each stamp. For observations on over 1000 stamps, I found that stamps belonging to two particular series must be most rare. Although the point estimates lie within confidence regions, it seems safe to conclude that of the rarest Dutch stamps there are less than 100 around. Intriguingly, this estimate cannot be matched with actual data, but what could be done is comparing the model estimates with those obtained from interviewing informed traders.

Other further research topics concern an analysis of similar data for other countries and an evaluation of panel data. Indeed, the present analysis was based on the 2002 catalogue, but looking at data from catalogues of other years could shed light on dynamic patterns in the price-setting of stamps.

Table 1: Sample size is 1006. All parameters are significant at the 1 per cent level

Variable	Parameter	Standard error
Unused stamps		
Price elasticity	-0.555	0.138
Recency	0.008	0.002
The amount issued	1.31	0.288
Charity surplus	34.272	7.968
Children's series	0.429	0.167
Series size	-0.162	0.059
Rank within series	0.152	0.055
Duration of issue	-0.018	0.004
Used stamps		
Price elasticity	-15.607	1.403
Recency	0.001	0.00007
The amount issued	0.269	0.015
Charity surplus	0.706	0.268
Rank within series	0.053	0.006
Duration of issue	-0.002	0.0004
Regular letter value	0.215	0.028

Table 2: Properties of the decay factor and the remaining stock

	Mean	Median	Maximum	Minimum
Unused				
Decay factor	0.549	0.723	1.000	0.00015
Remaining stock	8.968E06	2.036 E06	2.370E08	60
Used				
Decay factor	0.858	0.884	0.976	0.642
Remaining stock	1.082E07	2.831E06	2.310E08	215143

Table 3: Smallest amount left (rounded)

	Number	Amount
Unused		
	557	60
	551	66
	556	103
	552	113
Used		
	560	215142
	557	216693
	558	248412
	551	266793

Figure 1: Series with stamps 550 to 555

Figure 2: Series with stamps 556 to 560

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