

# The late 1970's bubble in Dutch collectible postage stamps

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## Abstract

Collectible postage stamp prices in the Netherlands witnessed a bubble in the late 1970's, while prices rapidly floored in the mid 1980's. We analyze 500 individual stamps prices (instead of a single index) to examine if the bubble could somehow have been predicted and whether there were early warning signals. Also, we study whether the characteristics of these stamps mediated the bubble and the price landing afterwards. Scarcity and initial price levels seem to have predictive value in various dimensions. Implications for recognizing bubbles in other asset prices are discussed.

Key words: Price bubbles; Philately; Postage Stamps; Forecasting; Positive feedback

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## **Introduction**

Speculative price bubbles seem to occur with regular frequencies in various economic markets. Such markets can concern financial markets, housing markets, but also other assets like modern art, tulips, metals, and internet-associated products can experience speculative bubbles, see Galbraith (1993), Garber (1990), Froot and Obstfeld (1991) and Smith et al (1988), to mention just a few of the many relevant references. It seems common consensus to assume that speculative bubbles sometime emerge and that in many situations there is not much to do against it. The prevention of price bubbles is believed to be difficult if not even impossible. At the same time, it does seem possible to design methods to diagnose if a price bubble is currently happening, and also early warning signaling methods can be designed, see West (1987) for an early method and Homm and Breitung (2012) for a recent evaluation of various testing methods. In the present study we also analyze with hindsight various characteristics of a speculative bubble, where our market of interest concerns collectible stamps in the Netherlands.

In a recent study, Dimson and Spaenjers (2012) document the investment performance of collectible stamps, in their case British postage stamps. Amongst other things, these authors show that, *ex post*, stamps seem to hedge against unexpected inflation, and that their long-run returns may sometimes outperform those of various financial assets, see also Veld and Veld-Merkoulova (2007). At the same time, these authors show that prices of collectible stamps have features that mimic those of financial assets. Taking this result somewhat further, collectible stamp prices may then also sometimes suffer from speculative bubbles, and it is this notion that is pursued in more detail in our present paper. Using a unique database, specifically compiled for this study, we analyze price patterns of 500 individual stamps for a period of thirty years, and we aim to indicate that much can be learned from these individual patterns, also in terms of signaling speculative price bubbles.

Due to a lack of systematically compiled data, only anecdotal evidence indicated that somewhere in the late 1970's there would have been a price bubble in Netherlands postage stamp prices. Our data analysis below will confirm this. Additional to price levels, we collect various properties of the individual stamps, like quantities issued and various qualities like series lengths and topical issues, and we use these properties to see if they mediate the speculative bubbles. Indeed, one would for example expect that the prices of scarce stamps take off earlier than more

common stamps, and also that for these scarce stamps the price levels at the peak are higher. If such results would be obtained, then this could suggest novel ways to signal or even forecast future speculative bubbles for similar assets, like modern art prints (Pesando, 1993).

Our basically data-driven empirical paper proceeds as follows. In the next section we outline the data collection and we present various statistical properties of the data. Amongst other things, we demonstrate that price bubbles seem heterogeneous across the 500 stamps, which provides some argument against using general indexes in favor of analyzing disaggregated data. Next, we present a range of regression models, which should elicit how the individual properties of the stamps mediate with the price bubbles. In the concluding section we summarize the main findings and we discuss implications for analyzing prices in other markets.

## **Data**

Since long time and each year, the Dutch Stamp Dealers' Association (with Dutch abbreviation NVPH) publishes a price catalogue with the prices of all Dutch stamps and their varieties. We will use the mint prices. Upon indication of one of these dealers, it was not possible to purchase past catalogues, as it so turns out that usually these catalogues are thrown away after a few years. We therefore decided to try to purchase past issues from individual collectors via various auction websites. It took quite some time to purchase all years, but after two months (during the fall of 2012) we managed to acquire the catalogues of 1971 to and including 1999. We did not extend the sample beyond that period, as a speculative bubble was observed for this sample. In contrast to studies like Cardell et al. (1995), we do not use auction prices but the (recommended) prices in the catalogues, as this allows us to study all stamps that were issued in a particular period.

Given that we only have the catalogues starting from 1971 onwards, we consider postwar stamps issued in 1945 until 1970. One reason not to include data prior to 1945 is that many collectible stamps in that period come with a variety of different prints, colors and misprints, and it is not easy to retrieve various properties for many of these stamps. We thus consider the stamps with numbers NVPH 428 to 937, which were issued from 1945 to 1970. We index the prices at 1971 = 1. The price level in 1971 was in Dutch guilders, and we used the relevant inflation data (source: Statistics Netherlands) to create real price levels (indexes). In total we

consider 500 stamps, which associate with the indicated NVPH numbers, where we took account of some renumbering (the numbers 821 to 826 and 864 to 867 ceased to be included in catalogues after 1973). For most stamps we can collect various features like quantity issued, although for 33 of the 500 information on those quantities is missing. Hence, we sometimes analyze 500 data on stamps, whereas in some regression models we are restricted to 467 data points.

We first analyze some average characteristics of the 500 stamps, and later on we will zoom in on stamp-specific characteristics. When we set all prices equal to 1 for 1971, we can create 500 indexes (corrected for inflation). We start with an analysis of the average price index, which is depicted in Figure 1. From Figure 1 we observe a steep growth in the period from 1971 to 1978, then a constant level peak period from 1978 to around 1982, and then a decline towards a rather constant level from 1987 onwards to 1999. The price bubble is clearly visible from the steep growth, that is, real prices on average increased from 1 to 2.3, a return of 230% in just five to six years. The average inflation-corrected return over the full sample is close to 50%, which is about 1.5% per year, a number that matches with the results in Dimson and Spaenjers (2012).

The variance across the 500 price indexes per year is presented in Figure 2. From Figure 2 we observe that the time-series pattern of the variance of the price indexes is very similar to the pattern of the average values in Figure 1. Hence, when prices increase rapidly, this does not seem to occur for all stamps in a similar way. This suggests that there are characteristics of the individual stamps that associate with average and variance levels in a different way. It may be that more scarce stamps witness more rapid price increases than stamps that were issued with larger quantities.

Figure 3 amplifies the impression already obtained from Figures 1 and 2 and that is that the average values and the variance are strongly related, almost with a straight line (and the associated  $R^2$  equals 0.98). This suggests that individual properties of stamps mediate price changes, and hence that a more detailed analysis can be insightful. As the time series data may have a unit root, we also consider an error correction model with one lag, and then the  $R^2$  obtains a value of 0.96 for the model in growth rates, supporting the impression of the close link between the two series.

Before we turn to the heterogeneity, we first zoom in on the price bubble period to see if there are any features of the data that elicit properties of that bubble. It is well appreciated that

price bubbles are associated with positive feedback. Usually, stationary time series data show negative feedback, that is, there is a tendency to return to the mean. Explosive non-stationary processes have positive feedback, that is, there is a tendency to divert from the mean, each new observation with a faster pace. Such positive feedback is then displayed by positive changes in price levels, and at the same time also positive changes (increases) in these positive changes. One may label the latter feature as positive acceleration. Hence, positive feedback may be observed when prices increase and at the same time these increases increase too. In Table 1 we present the number of stamps (out of the 500) for which, in particular years, price increases were positive (second column) and when changes in changes were positive (last column). Clearly, the years 1972 to 1978-1979 show many stamps with positive price changes and with positive acceleration. The joint occurrence of these two features is presented in Figure 4. Figure 4 shows that in some years the fraction of stamps with positive feedback in prices can be as large as 0.6 or 0.7. This occurs for the years 1976, 1977 and 1978, right before the price bubble appeared to burst. Hence such positive feedback might be an indicator of a current bubble and perhaps even of an upcoming burst. Such a burst is clearly noted from a sharp drop in positive feedback in 1979 and 1980, which is the period that prices did not change much, on average.

To further on the notion of positive feedback, we report some key estimation results for binomial probit models for current positive feedback on such feedback in the two years before. Table 2 shows the marked relevance of past positive feedback on future positive feedback in the bubble years 1975 to 1978, and a sharp drop in that relevance from 1979 onwards. The Likelihood Ratio test statistics obtain very high values for the first part of the sample, and many of these values turn out to be insignificant in later years. Also, the parameters for past feedback are positive and significant in the bubble years, and a downturn can be witnessed in 1979 where  $\text{Feedback}(t-1)$  is not relevant and  $\text{Feedback}(t-2)$  obtains a negative and significant parameter estimate. Hence, it seems that amplifying positive feedback can be noticed from graphs and models, and hence this should indicate that bubble-like phenomena were occurring in these years. We thus conclude that there was a bubble indeed. A formal test using statistical techniques like those in Homm and Breitung (2012) is hampered by the short sample. Below we will examine if specific characteristics of the stamps have any mediating role.

A final impression of the heterogeneity across the development of stamp prices is given in Figure 5. The histogram concerns the number of years (from 1971) onwards until the year

with the peak price. Evidently, there seem to be at least two clusters of stamps with similar properties. There is a large group of stamps which peak after 8 to 10 years and a group that peaks much later, around 23-24 years. It seems that the latter group is not to be associated with the price bubble, while members of the first group more likely are. Hence, Figure 5 clearly illustrates the heterogeneity across the 500 stamps. There seem to be various clusters of stamps that show differences in the time between the start of the sample and the year of the peak price. It is quite likely therefore that more than one regression model might be needed to describe these data. For that matter and for later purposes, we estimate a mixture of normal distributions for these data, where we allow these distributions to have different variances. We experiment with two and three such distributions, but find that with three clusters one of these clusters contains not enough observations. Hence, we stick to two normal distributions. The first is a normal distribution with estimated mean of 9.953 (and estimated variance 2.876) and the second is a distribution with estimated mean 23.076 (and estimated variance of 1.590). A by-product of this exercise is that each observation corresponds with an estimated conditional probability that it belongs to the first and in part (or fully) to the second distribution. We will use these probabilities to classify the data when we turn to regression models for the natural logarithm of the years to the peak, see Table 7 below.

## **Models**

In this section we present the results of a few regression models, which aim to elicit various features of the data in times of a bubble and otherwise. We first present the properties of the 500 stamps, and then we consider regression models to explain the peak price level and the time it took to obtain that level.

Table 3 presents a few characteristics of the 500 stamps. The minimum quantity issued is just over 200000, while the maximum number is over 900 million, and this range suggests an enormous diversity in the stamps. This can also be noted from the series lengths, which ranges from 1 to 24, and from the added price value (usually for charity reasons), which ranges from 0 to 37.5 cents. In most years, the Dutch Postal Services issued so-called children's stamps, for

which the additional fee was used for childcare charities. In sum, it seems that the data show much heterogeneity.

Table 4 presents various statistics on the price series over the years, and here the heterogeneity is illustrated even further. We will use the price level in the first sample year (1971) as one of the regressors later on, and from the first row of Table 4 we can see that there are substantial differences across price levels. In 1971 there were already stamps with price levels over 100 guilders, while the mean is just 1.985 guilders. To account for these skewed data, we will consider these 1971 prices after using the natural logarithmic transformation (“in logs”). To give an impression of after-bubble prices, we present the price levels of 1990, while other years in around that year give similar insights. After correction for inflation, we learn that price levels, on average, seem to have dropped from 1.985 to 1.658, and it seems that in particular the high-priced stamps showed most significant price landings.

The bubble price index value is 5.775, on average, with a median value of 5 years. The maximum bubble price is 35. Corrected for inflation, the maximum price level is 2.796 on average, which suggests a return of close to 280%, at the peak of the bubble.

Finally, Table 4 shows in the bottom panel that the median number of years for prices to peak is 11 years. This suggests that during the period after the burst of the bubble, that is during 1979-1982, some stamps only by then reached top price levels, while for other stamps this peak occurred earlier and for many it occurred much later. The burst of the bubble seems to take only 4 to 5 years, as the average number of years from peak to the lowest price is 4.86 years.

### **Modeling peak prices**

We first consider a regression model for the nominal price levels and after that we consider the same model for inflation-corrected price levels. Table 5 presents the estimation results to explain the nominal maximum price index value by an intercept, the quantity issued (after natural logarithmic transformation), the year the stamp was issued, a dummy variable if there was some added children’s benefit, the rank in the series and the size of the series, a dummy variable if there was another additional surplus value, and the price value of 1971 (after taking natural logarithms). The table contains a panel with all estimated parameters and their associated White-corrected standard errors and a panel where all insignificant parameters (at the 5%) are set at 0.

The deletion of irrelevant variables is carried using a stepwise procedure, where each time the parameter with the largest p-value is set at 0 (and hence the associated variable is dismissed).

If we consider the rightmost column of Table 5, we learn that stamps which were issued in larger quantities, which were issued more recently and which have a surplus for children's charity, have lower maximum price levels. At the same time, stamps in series with many items and higher initial price levels have higher maximum price levels. Otherwise put, more valuable, older and scarce stamps reach higher maximum price levels. The fit of the models in Table 5 is close to 0.25, which seems rather high for a cross section of data.

Table 6 not unexpectedly echoes the results in Table 5, where now the variable to be explained is the maximum price level after correction for inflation.

### **Modeling time to and from the peak**

Table 7 presents the estimation results, obtained in a similar way as above, for the regression model to explain the log of the number of years (1 added to avoid zeroes) in between 1971 and the year of the peak price. This table only documents the estimation results for the observations which are associated with the left-hand distribution in Figure 5, which are 305 observations. Interestingly enough, we would have expected similarly relevant variables as in Tables 5 and 6, but for this cluster only the quantity issued is significant. Hence, stamps that reach their price peak faster are the scarcer stamps, as quantity obtains a negative and significant parameter estimate.

Table 8 presents the results for the right-hand distribution of Figure 5 (162 observations) and here we see that again quantity is important, though with a smaller-sized parameter (than the one in Table 7). Interestingly, the initial price level of 1971 obtains a negative parameter, implying that initially higher-valued stamps (in that cluster) peak earlier.

Table 9 reports on the estimation results for two models for the number of years from the peak price to the lowest price. In other words, this is the time that it takes for the bubble to burst. A shorter time period means that price levels drop more rapidly. As the dependent variable can take zero values, we report on a regression model for years+1 and a censored regression model in the right-hand column of Table 9. Clearly, the parameters in both models obtain the same estimated signs and are also approximately similar in size. Zooming in on some of the key



variables, we learn from Table 9 that higher-valued, scarce and more recently issued stamps have a longer time in between peak and trough, while initially lower-valued and abundantly issued stamps witness rapid price drops after the bubble bursts. This is an indication that the latter type of stamps joins in the price bubble, but they are also the first to show sharp price landings. The rare and higher-valued stamps seem to suffer less from the price bubble. Table 10 presents the results for the same explanatory variable, where now only the stamps are included for which the price landing period is larger than 0, and there we obtain similar but somewhat less pronounced effects as in Table 9.

In Table 11 we present estimation results of binomial probit models to explain positive feedback (like in Table 2), where we now include only one lag of feedback, and we also include all the regressors as in the previous tables. To save space, we only report the estimation results for the variables “Quantity issued” and “Value in 1971” as these two variables appear to be most relevant. In the last two columns we present the hit rate and the Likelihood Ratio (LR) test for the joint significance of all variables. To start with these last two columns, we learn that the probit models have quite an accurate fit, while the LR test values are highest in the bubble years. During the bubble years 1975-1977 we also see that quantity and initial value obtain significant parameter estimates, suggesting the scarce and high-valued stamps also drive the positive feedback. In 1978 the quantity is still relevant, but in the year of the price burst the two variables turn out to be irrelevant.

Finally, as LeRoy (2004) indicates, for stamp prices to show a bubble, there must be a specific reason why such a bubble could occur. One such reason may be that the collection of stamps became very popular in the relevant years, and hence that demand for stamps suddenly increased. Anecdotal evidence does suggest this indeed and perhaps the graph in Figure 6 supports this. In this graph we depict the log of the numbers of issued new stamps since 1945, and it is clear that there is an upward trend from the mid seventies to the beginning of the eighties. The Dutch postal services recognized the increasing popularity of collecting stamps and started to sell in larger quantities. They also issued special themes and books, and, again, our anecdotal information is that many stamp collectors could not keep up the pace, also in terms of money, and after around 1985 stamp collecting became much less popular.

## Conclusions and implications

The empirical analysis in this paper leads to various conclusions. First, in studying price bubbles it may be insightful to examine the price patterns of all components and not just a single index. Specific properties of the 500 stamps seemed informative for the bubble period and also for the period right after the burst of the bubble. Second, we documented that scarce and higher-priced collectible stamps reach higher peak levels at the top of the bubble, whereas scarce stamps also reach this peak level faster, while the very same types of stamps witness a slower pace in times when price levels drop to trough values. For investment purposes, these stamps seem to be the best buy, although also these stamps show tremendous drops in value once the bubble is over.

At a more general level, we also obtained insights on the data properties at the time of the price bubbles. We saw that during the bubble the number of stamps with such positive feedback is over 50% or even higher, and this suggests that an analysis such as ours can be very informative about the current state of affairs. We also noted that properties of the stamps, like scarcity and initial price levels mediate the positive feedback, that is, these types of stamps substantially contribute to the price bubble. Other stamps are taken along in the upswing of prices, but once the bubble bursts, these stamps quickly lose their value.

An important implication of our study is that it pays off to look at the assets at a more detailed level, when analyzing price level conditions. Of course, a composite index can be useful too, but we showed that individual characteristics of the assets had a mediating and signaling role. This insight might be useful when analyzing bubbles in other markets. Typically, one analyzes the top-level prices of artists' works, but our results suggest that analyzing all works of these artists can be beneficial. The same holds true for the dot.com bubble, where perhaps some companies did not suffer as much as others did due to some specific features of these companies. Similarly, not all stocks may peak at the same time and the burst of a stock market bubble may be different for different stocks.

# Figures

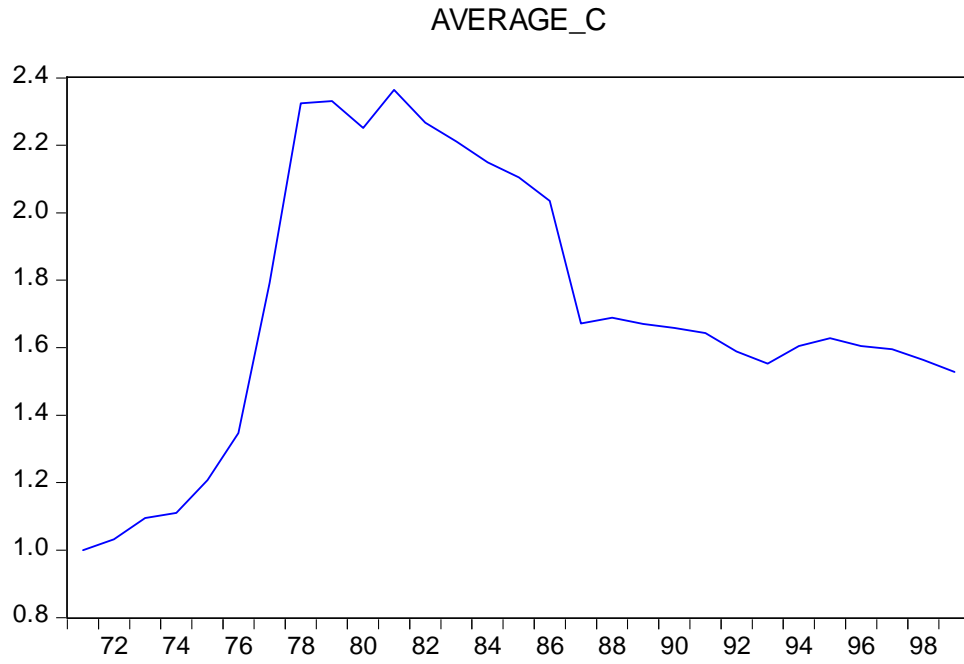


Figure 1:

The average of the index values (across 500 stamps), after correction for inflation, 1971-1999

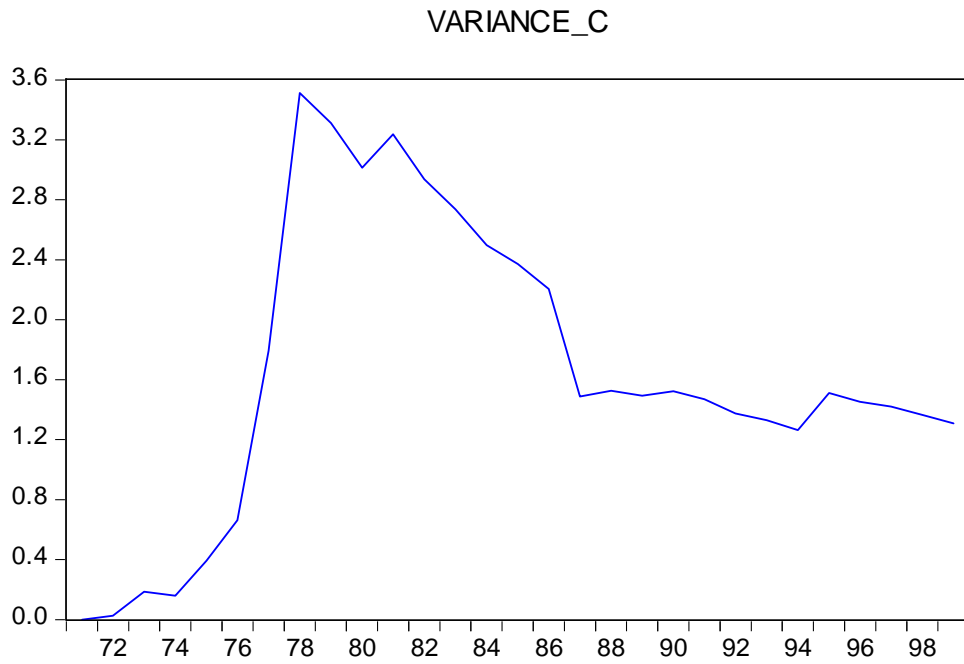


Figure 2:

The variance (per year) across the 500 index values, after correction for inflation, 1971-1999

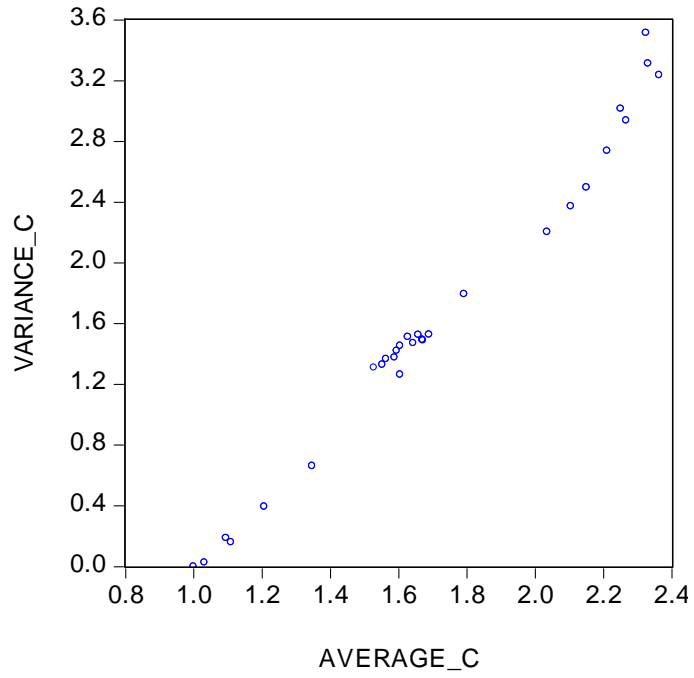


Figure 3:

The data points in Figures 1 and 2 in a scatter plot. Each dot represents a year

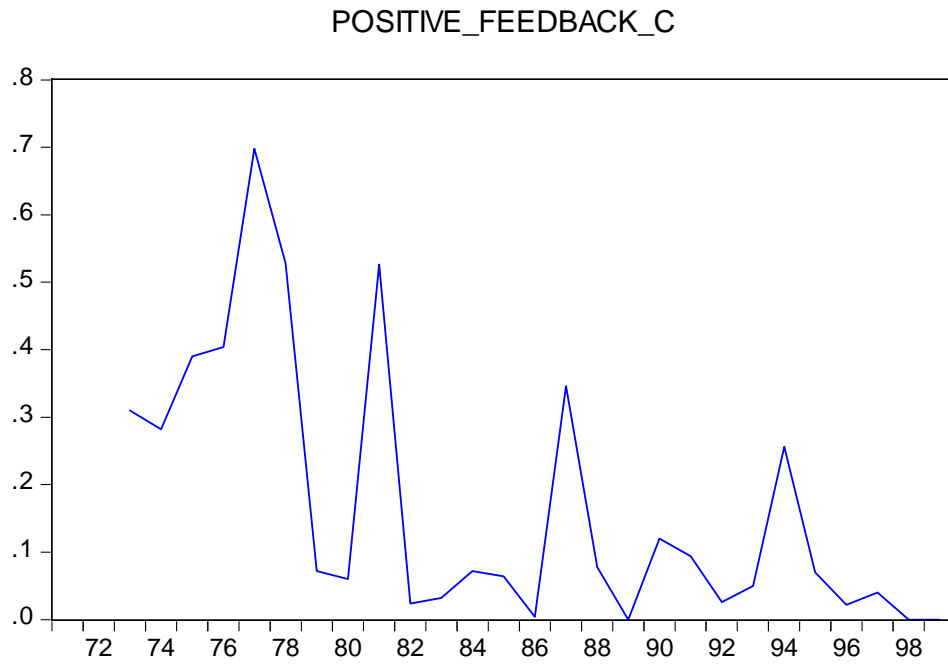


Figure 4:

Fraction of 500 stamps with a positive change in the index value and a positive acceleration (differences in changes is positive too), after correction for inflation, 1973-1999

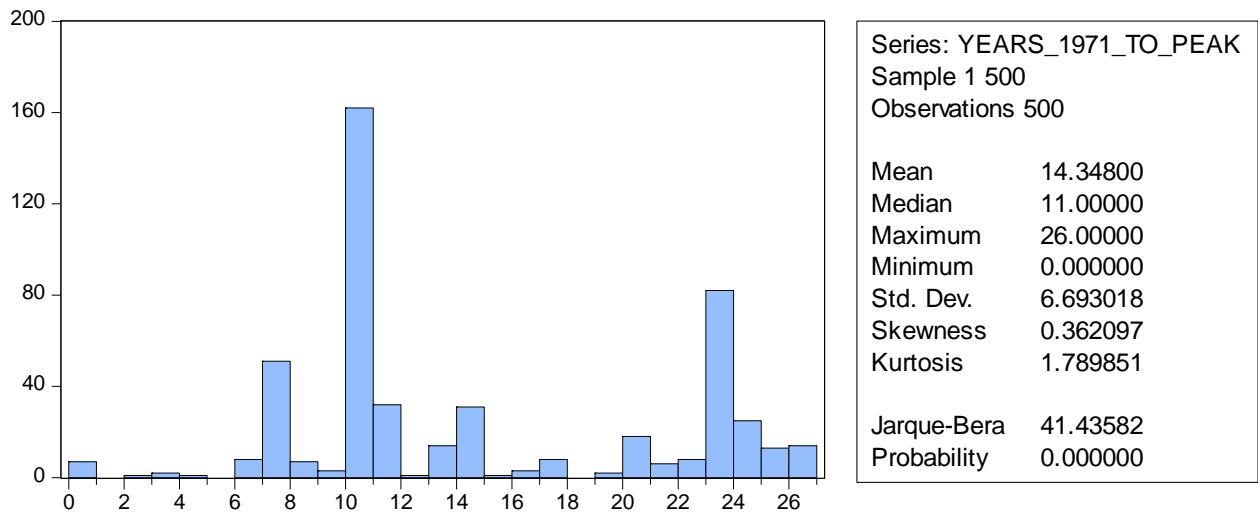


Figure 5: the number of years from 1971 to the peak value of the price

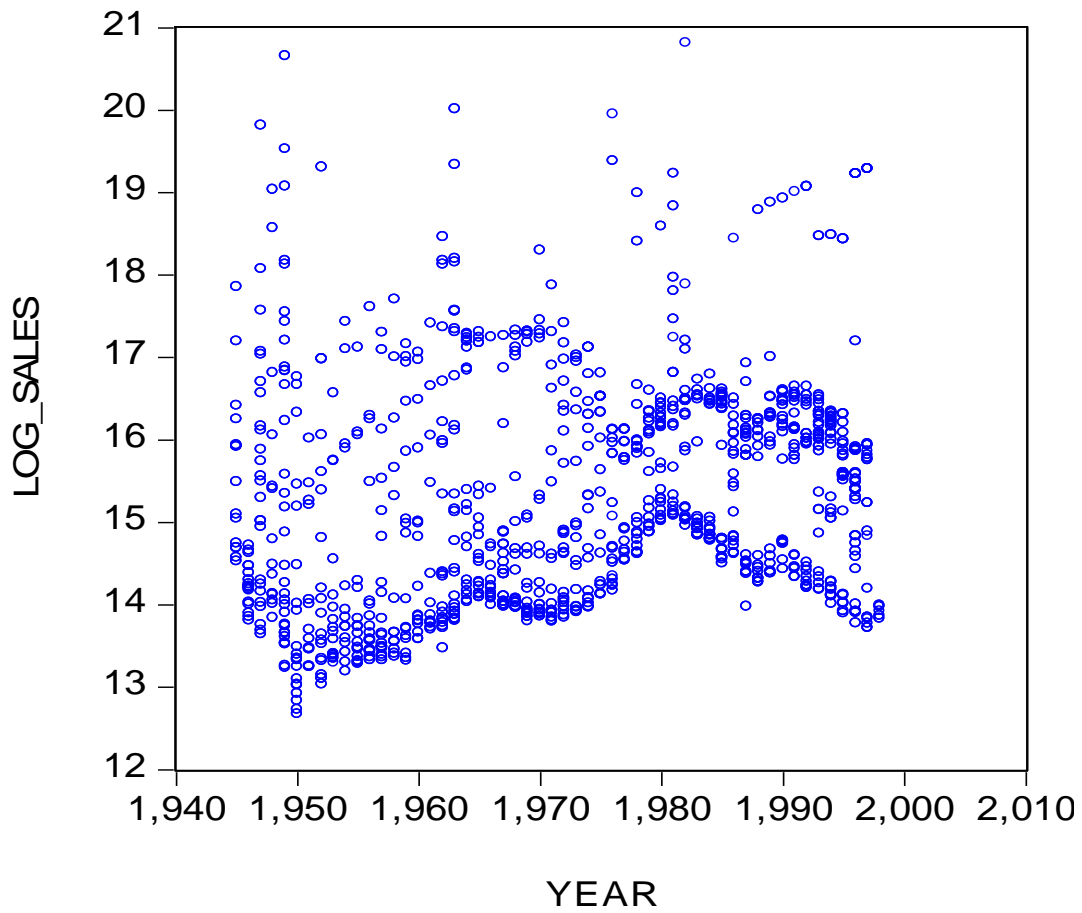


Figure 6: The natural logarithm of sales (in units) versus the year of issue.



## Tables

Table 1: Number of stamps (per year) with positive changes in price and with positive differences in changes

Year	$P(t)-P(t-1) > 0$	$P(t)-2P(t-1)+P(t-2) > 0$
1972	234	NA
1973	255	321
1974	227	145
1975	249	363
1976	292	364
1977	381	457
1978	343	354
1979	195	180
1980	89	49
1981	290	460
1982	63	191
1983	20	426
1984	51	43
1985	41	447
1986	2	378
1987	173	192
1988	43	343
1989	0	1
1990	60	61
1991	70	64
1992	24	417
1993	25	445
1994	135	157
1995	37	356
1996	13	27
1997	20	28
1998	0	480
1999	0	0

Table 2: Estimation results for binomial probit models (sample size is 500) to explain current positive feedback (1 and no positive feedback is 0) by positive feedback the year before and the year before that. LR denotes the value of the Likelihood Ratio test for the joint significance of these two variables. NA associates with a perfect fit or with only zero values for the regressor. (boldface values are significant at the 5% level)

Year	Parameter estimates (and standard errors)		LR test
	Feedback (t-1)	Feedback (t-2)	
1975	<b>0.438 (0.127)</b>	<b>0.341 (0.124)</b>	18.13
1976	<b>0.307 (0.118)</b>	<b>0.566 (0.128)</b>	30.16
1977	<b>0.646 (0.132)</b>	<b>0.723 (0.135)</b>	62.87
1978	<b>0.635 (0.130)</b>	<b>0.384 (0.120)</b>	44.29
1979	0.090 (0.176)	<b>-0.412 (0.179)</b>	5.224
1980	0.209 (0.321)	<b>0.621 (0.204)</b>	10.62
1981	-0.177 (0.238)	<b>0.568 (0.230)</b>	6.783
1982	<b>-0.702 (0.294)</b>	NA	6.840
1983	NA	<b>1.054 (0.361)</b>	13.64
1984	0.602 (0.373)	NA	2.394
1985	-0.113 (0.354)	<b>0.678 (0.376)</b>	3.013
1986	NA	0.940 (0.534)	2.661
1987	NA	-0.195 (0.243)	0.654
1988	0.168 (0.170)	1.493 (0.893)	3.471
1989	NA	NA	NA
1990	NA	1.315 (0.217)	36.22
1991	0.143 (0.227)	NA	0.389
1992	-0.092 (0.430)	<b>0.544 (0.284)</b>	3.379
1993	0.273 (0.522)	<b>0.717 (0.248)</b>	7.816
1994	-0.361 (0.307)	0.586 (0.355)	4.084
1995	-0.265 (0.214)	-0.315 (0.466)	2.041
1996	<b>1.095 (0.328)</b>	<b>0.552 (0.282)</b>	12.02
1997	NA	0.187 (0.358)	0.258
1998	NA	NA	NA
1999	NA	NA	NA

Table 3: Characteristics of 500 postage stamps (the variables with an \* only have 467 observations)

Variable	Mean	Median	Minimum	Maximum
Quantity issued*	14054509	1545392	205700	9.36E+08
Quantity issued (in logs)*	14.847	14.251	12.234	20.657
Amounts with series	6.528	5	1	24
Additional price (in cents)	3.978	3	0	37.500
Children's benefit	0.26	0	0	1
Rank within series	3.766	3	1	24

Table 4: Characteristics of the prices of 500 postage stamps in the sample 1971-1999 (the variable with an \* only has 297 observations)

Variable	Mean	Median	Minimum	Maximum
Value in 1971	1.985	0.750	0.050	120.00
Value in 1971 (in logs)	-0.190	-0.288	-2.996	4.787
Value in 1990	3.996	3.333	0.417	20.00
Corrected for inflation	1.658	1.383	0.173	8.297
Value in 1990 (in logs)	1.125	1.204	-0.875	2.996
Corrected for inflation	0.246	0.324	-1.755	2.116
Maximum price index	5.775	5	1	35
Corrected for inflation	2.796	2.332	1	12.599
Years to peak price index	14.348	11	0	26
Years from peak to lowest price	4.86	5	0	19
Years from 1971 to lowest price*	18.178	16	3	28

Table 5: Regression of nominal maximum price index value on various explanatory variables  
(estimated White-corrected standard errors in parentheses)

Variable	Full model	Final model
Intercept	51.837 (8.627)	51.439 (8.324)
Quantity issued (in logs)	-0.085 (0.026)	-0.087 (0.023)
Year	-0.025 (0.004)	-0.025 (0.004)
Children's benefit	-0.154 (0.059)	-0.153 (0.058)
Rank in series	-0.005 (0.015)	
Size of series	0.030 (0.010)	0.028 (0.008)
Additional price	0.129 (0.691)	
Value in 1971 (in logs)	0.080 (0.027)	0.074 (0.024)
Adjusted R <sup>2</sup>	0.254	0.257

Table 6: Regression of maximum price index value (*after correction for inflation*) on various explanatory variables (estimated White-corrected standard errors in parentheses)

Variable	Full model	Final model
Intercept	40.676 (7.766)	39.004 (7.483)
Quantity issued (in logs)	-0.070 (0.023)	-0.074 (0.021)
Year	-0.020 (0.004)	-0.019 (0.004)
Children's benefit	-0.168 (0.054)	-0.158 (0.053)
Rank in series	0.010 (0.014)	
Size of series	0.015 (0.010)	0.020 (0.007)
Additional price	0.315 (0.629)	
Value in 1971 (in logs)	0.099 (0.025)	0.107 (0.022)
Adjusted R <sup>2</sup>	0.249	0.251

Table 7: Regression of the log of the number of years (+1) in between 1971 and the year of the peak price on various explanatory variables (estimated White-corrected standard errors in parentheses), for the observations belonging to the left-hand-side normal distribution in Figure 5 (conditional probability > 0.5)

Variable	Full model	Final model
Intercept	9.885 (5.937)	3.208 (0.362)
Quantity issued (in logs)	-0.067 (0.031)	-0.059 (0.026)
Year	-0.003 (0.003)	
Children's benefit	-0.075 (0.058)	
Rank in series	0.020 (0.016)	
Size of series	-0.024 (0.015)	
Additional price	-0.059 (0.372)	
Value in 1971 (in logs)	-0.013 (0.027)	
Adjusted R <sup>2</sup>	0.028	0.034

Table 8: Regression of the log of the number of years (+1) in between 1971 and the year of the peak price on various explanatory variables (estimated White-corrected standard errors in parentheses), for the observations belonging to the right-hand-side normal distribution in Figure 5 (conditional probability > 0.5)

Variable	Full model	Final model
Intercept	1.463 (1.799)	3.333 (0.047)
Quantity issued (in logs)	-0.014 (0.004)	-0.012 (0.003)
Year	0.001 (0.001)	
Children's benefit	-0.034 (0.016)	-0.041 (0.012)
Rank in series	-0.000 (0.002)	
Size of series	0.005 (0.001)	0.005 (0.001)
Additional price	-0.231 (0.278)	
Value in 1971 (in logs)	-0.013 (0.004)	-0.012 (0.004)
Adjusted R <sup>2</sup>	0.183	0.192



Table 9: Regression of the log of the number of years in between the year of the peak price and the year of the trough on various explanatory variables (estimated White-corrected standard errors in parentheses)

Variable	Years + 1	Tobit model
Intercept	-47.50 (14.01)	-84.07 (23.54)
Quantity issued (in logs)	-0.119 (0.040)	-0.232 (0.072)
Year	0.026 (0.007)	0.045 (0.012)
Children's benefit	-0.303 (0.100)	-0.473 (0.174)
Rank in series	0.065 (0.032)	0.139 (0.048)
Size of series	-0.046 (0.017)	-0.123 (0.035)
Additional price	3.977 (1.014)	4.497 (1.982)
Value in 1971 (in logs)	0.146 (0.053)	0.267 (0.094)
Adjusted R <sup>2</sup>	0.223	
Scale parameter		1.470 (0.070)

Table 10: Regression of the log of the number of years (+1) in between the year of the peak price and the year of the trough on various explanatory variables (estimated White-corrected standard errors in parentheses), given that number of years > 0 (sample size is 277)

Variable	Full model	Final model
Intercept	-6.929 (7.491)	-12.39 (6.231)
Quantity issued (in logs)	-0.084 (0.035)	-0.088 (0.027)
Year	0.005 (0.004)	0.008 (0.003)
Children's benefit	-0.052 (0.061)	
Rank in series	0.051 (0.028)	0.045 (0.019)
Size of series	-0.005 (0.022)	
Additional price	0.842 (0.640)	
Value in 1971 (in logs)	-0.028 (0.038)	
Adjusted R <sup>2</sup>	0.105	0.109

Table 11: Selective results from binomial probit models to explain of positive feedback (positive change and change in the change is also positive): Parameter estimates for Quantity issued (in log) and Value in 1971 (in logs), the estimated hit rate and LR test statistic for the joint significance of all variables as in Table 10 plus one-year lagged feedback (boldface parameters are significant at the 5% level).

Year	Quantity issued	Value in 1971	hit rate (%)	LR test
1974	-0.049 (0.063)	<b>0.230 (0.074)</b>	68.52	71.08
1975	<b>-0.174 (0.056)</b>	<b>0.162 (0.078)</b>	72.59	112.8
1976	<b>-0.110 (0.062)</b>	<b>0.362 (0.082)</b>	70.02	113.1
1977	<b>-0.237 (0.061)</b>	<b>0.419 (0.089)</b>	73.88	136.5
1978	<b>-0.243 (0.070)</b>	0.004 (0.080)	69.59	118.6
1979	-0.003 (0.161)	-0.043 (0.178)	73.88	63.60
1980	<b>-0.504 (0.164)</b>	<b>-0.422 (0.179)</b>	67.67	32.57
1981	0.072 (0.054)	<b>0.325 (0.072)</b>	62.31	40.30
1982	-0.286 (0.276)	-0.680 (0.357)	76.81	23.80
1983	<b>0.314 (0.104)</b>	<b>0.482 (0.108)</b>	73.23	24.32
1984	<b>0.168 (0.079)</b>	<b>0.405 (0.100)</b>	70.02	45.96

## References

Cardell, N.Scott, John L. Kling and Glenn Petry (1995), Stamp returns and economic factors, *Southern Economic Journal*, 62, 411-427.

Dimson, Elroy, and Christophe Spaenjers (2011), Ex post: The investment performance of collectible stamps, *Journal of Financial Economics*, 100, 443-458.

Froot, Kenneth A. and Maurice Obstfeld (1991), Intrinsic bubbles: The case of stock prices, *American Economic Review*, 81, 1189-1214.

Galbraith, John Kenneth (1993), *A Short History of Financial Euphoria*, New York: Viking

Garber, Peter M. (1990), Famous first bubbles, *Journal of Economic Perspectives*, 4, 35-54

Homm, Ulrich and Joerg Breitung (2012), Testing for speculative bubbles in stock markets: A comparison of alternative methods, *Journal of Financial Econometrics*, 10, 198-231.

LeRoy, Stephen F. (2004), Rational exuberance, *Journal of Economic Literature*, 42, 783-804.

Pesando, James E. (1993), The market for modern prints, *American Economic Review*, 83, 1075-1089.

Smith, Vernon L, Gerry L. Suchanek, and Arlington W. Williams (1988), Bubbles, crashes, and endogenous expectations in experimental spot asset markets, *Econometrica*, 56, 1119-1151.

Veld, Chris. and Yulia V. Veld-Merkoulova (2007), Portfolio diversification benefits of investing in stamps, *Journal of Alternative Investments*, 10, 56-61.

West, Kenneth D. (1987), A specification test for speculative bubbles, *Quarterly Journal of Economics*, 102, 553-580.