The Veil of Money and Non-Neutralities of a Currency Changeover

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Abstract

This paper provides a theoretical discussion about the impact of a currency changeover on relative prices. The impact of the euro changeover in January 2002 was mostly transitory, that is, prices returned to their pre-changeover level after a few weeks, but in some industries, especially services, the impact appears to be persistent. While finding a consistent explanation for the transitory impact is straightforward, understanding the persistent impact is challenging. The persistent impact is one of those phenomena that puzzle at first but once we understand the particularities of the markets involved, the explanation is nearly obvious and can be explained by a standard economic argument.

- Keywords: currency changeover, prices, multiple equilibria, veil of money
- JEL classification: L11, L13, F33

1 Introduction

The euro changeover in January 2002 was not a "neutral" event but affected relative prices. The impact on the overall price level is small; on a more disaggregate level,

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however, the price movements are significant. Most prices returned to their pre-changeover level after a few weeks but some, especially services prices appear to have stabilized at a different (mostly higher) level. The impact differs widely across countries.

The euro changeover provides a nice opportunity to study the Ricardian thought experiment of a change in the unit of account. From a historical perspective, such an opportunity is rare. Currency changeovers often replace unstable currencies and thus have well-known real effects. The euro changeover in contrast was not associated with a change in monetary policy. The conversion rates had been fixed three years before and inflation in the years around the changeover was close to the European Central Bank's target of two percent.

This paper contributes to the existing literature (to be reviewed below) in two ways. First, the paper documents the impact using a data set that has not been described in the literature before and summarizes the findings of other studies. The impact is not random but follows certain patterns or regularities that this paper wants to expose. Earlier studies have discussed many of the patterns but some presented here will be new. Second, the paper provides a theoretical discussion about the effect on relative prices. Regarding the transitory impact, the paper reviews a number of explanations and argues that a seller's reputation as a fair trader plays an important part in how firms set prices at the changeover. The persistent impact on the other hand has not - I believe - been discussed theoretically before. The contribution of this paper is to show that once we leave the strict assumptions of a Walrasian world and allow for imperfect information and oligopolistic markets, the persistent impact can be explained by a standard economic argument.

One of the earliest documentations of a "changeover-effect" is a joint study by the Bundesbank and the German Statistical office (Bundesbank 2002 and Buchwald et al. 2002). The study analyses for a number of selected items how the introduction of coins and banknotes affected prices. The central banks and statistical offices of most euro-area countries published documentations on the impact.[1]

A number of studies questioned the quality of the officially released data and turned to different sources. Adriani et al. (forthcoming) and Gaiotti and Lippi (2008) use restaurant data assembled by the Michelin Red Guide and Parsley and Wei (2007) make use of the data collected by Mercer Human Resources for The Economist's Big Mac Index. A third source are the price data collected by the Economist Intelligence Unit (used by Dziuda and Mastrobuoni, 2008 and Ehrmann, 2008). An interesting aspect of the unofficial data is that they provide information about absolute price levels which is concealed in the official indices. Overall, the findings are similar to the ones that use officially released data. Indirect evidence from ATM withdrawals is used by Angelini and Lippi (2008) to study the changeover's impact on inflation in Italy.

Bundesbank (2004) is apparently the only documentation of a persistent effect of the changeover. The study constructs price equations on major cost components for a number of individual goods and services and finds that two years after the changeover a number of services prices are still above their pre-changeover trends.

In the case of restaurants, a natural explanation for a changeover effect is menu costs (Hobijn, Ravenna, and Tambalotti 2006, Gaiotti and Lippi 2005). The menu costs explanation has, however, a number of problems and later studies argue that the menu cost explanation cannot account for the patterns we observe. Dziuda and Mastrobuoni (2009), for example, argue that the reduced transparency of prices that comes with the introduction of new coins and banknotes was the culprit of the euro-related price increases. Their model has the interesting implication that less expensive goods should experience larger price increases. They and Ehrmann (2006) report evidence in favour of this prediction. Adriani, Marini, and Scaramozzino (forthcoming) studying the impact on restaurant prices argue that the changeover allowed restau-

[1] See for example Pollan (2002), Santos et al (2002), Alvarez and Gonzales (2004), INSEE 2003, Banco de Espana (2003) and European Central Bank (2003), Mostacci and Sabbatini (2008).

rant owners to coordinate on a higher price equilibrium. The related literature is discussed in more detail in later sections.

The paper is organized as follows. The next section describes the impact of the euro changeover on relative prices and shows the characteristics of the markets where we observe such movements and where those are absent. Section 3 discusses the impact and concluding remarks in section 4 close the paper.

2 Description of the Impact

This section describes the changeover's impact on the individual series of the CPI baskets. Not all euro-countries publish the entire basket and often the changeover coincided with a re-base which generally reduces the number of available series considerably. Two countries, Austria and Germany, publish the complete baskets and both re-based two years before the changeover. With 618 (Austria) and 686 (Germany) series, the CPI baskets of these two countries are remarkably detailed. The data are monthly, indexed and cover the 48 months from January 2000 until December 2003. Data collection takes place at around the 15th of each month.[2]

For Germany, Bundesbank (2004) estimates that "at most, a 0.3 percentage point contribution to the annual inflation rate for January 2002" can be ascribed to the changeover. In Austria, the changeover is not believed to have contributed to overall inflation (Pollan 2002). While we do observe some unusual movements in Austria, the large increases we observe in Germany are absent and a small number of increases is balanced out by a number of price decreases. Here it is important to mention that Austria required retailers and service providers to "dual price" (denoting prices in both the old and the new currency) for a number of months around the changeover. Germany abstained from such regulations.

[2] Covering only four years, the data set is unfortunately relatively short. Longer series are available from Eurostat's HICP series, but with less than 100 items, the HICP basket is significantly smaller concealing many interesting patterns.

The Austrian and the German baskets contain roughly the same number of series and both countries follow the United Nation's Classification of Individual Consumption According to Purpose (COICOP). Nevertheless, for nearly half of the items it is not possible to find an exact equivalent in the basket of the other country. Some product categories that are detailed in one country are covered by only one or two series in the other. The Austrian basket, for example, contains two musical instruments while the German basket contains four. The restaurant sector is an example where the Austrian basket is more detailed. In the Austrian basket, the restaurant sector is represented by 33 items whereas in Germany there are only 17. The different emphasis reflects not so much different consumption patterns but may simply be explained by a different organizational approach.[3]

There are a number of difficulties that arise when describing the impact on prices. The first is that we do not know how prices would have developed had the changeover not taken place and we have to be careful not to link up any "suspicious" price change with the changeover when in fact both events are unrelated. A second difficulty is that there is no obvious path to follow when searching for patterns in the data. This means that, in principle, different researchers may find different patterns and it may well be that I have missed some. In addition, the specific regularities that arise depend on the composition of the basket. The regularities we observe in, say, Italy may not be the same as those observed in Germany. Nonetheless, I am confident that I have found the most important regularities and especially that independently of the specific price movements observed, we can identify the forces underlying the non-neutralities. The objective of the next subsections is to provide a qualitative description of the impact. The approach taken here does not allow the impact on individual series or on overall inflation to be estimated quantitatively but it allows certain patterns in the data to be exposed that help us to understand why a changeover may affect relative prices.

[3] The weights of musical instruments, for example, in the overall basket in both countries are nearly the identical.

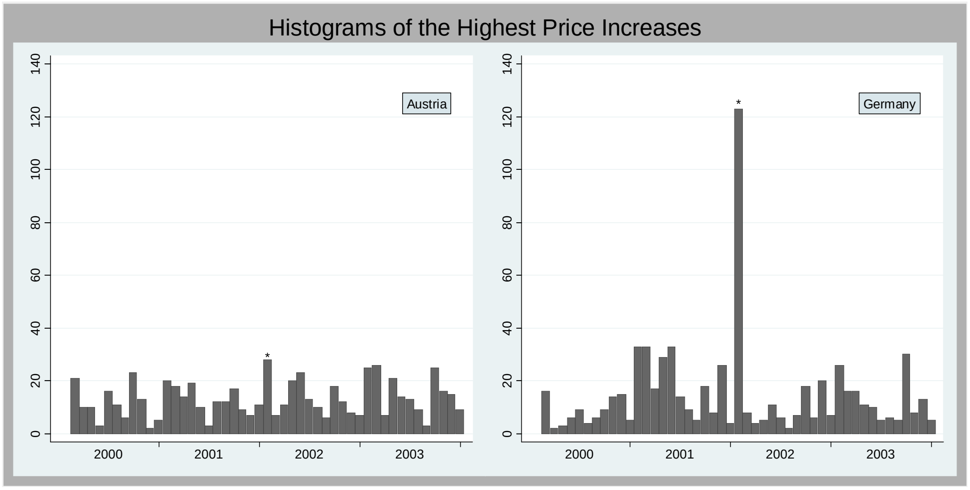

Figure 1: Histogram of the highest price increases in Austria and Germany. The vertical axis shows the number of series in the CPI baskets that have their highest increase in the month given on the horizontal axis. The changeover is denoted by an asterisk *.

This section starts with a few examples in order to motivate the more detailed studies that follow. Section 2.2 describes the impact in Germany and section 2.3 the impact in Austria. The persistence of the impact is studied in section 2.4.

2.1 A First Impression

The histograms in figure 1 give a first impression of the impact. The histograms show the number of series that have their highest increase in a given month. In Germany, the highest increase often occurs at the changeover while in Austria the changeover does not appear to have had a great impact.[4]

[4] A possible explanation for the different impact in Austria and Germany is the way the two countries regulated price setting (Eife and Schmidt 2009). Austria required firms to dual-price for five months around the changeover whereas Germany did not impose such obligations.

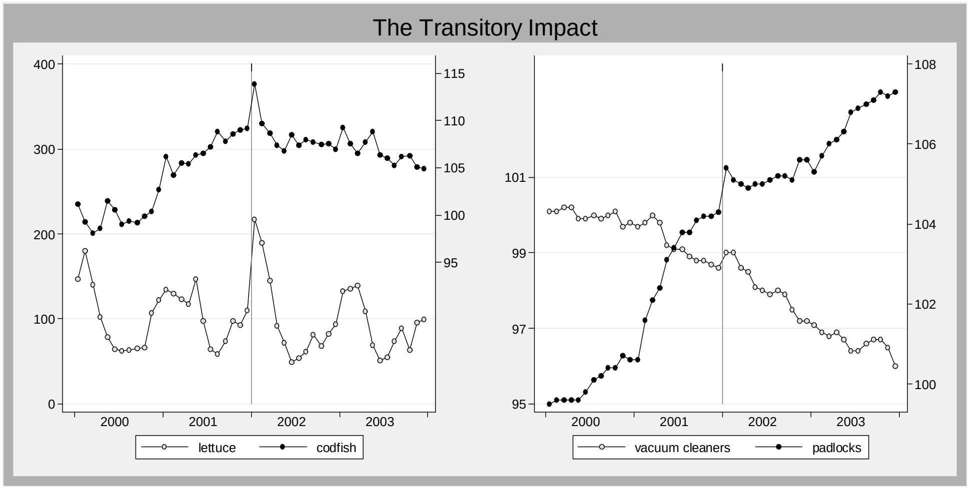

Figure 2: Four examples of items with a spike at the changeover. German data; the changeover is denoted by a vertical line.

Table 1: Fruit and Vegetables		
	Austria	Germany
lettuce	58%	98%
cauliflower	47%	71%
grapes	45%	58%

Table 1 shows inflation rates (month-on-month) of the three items that increased most in the Austrian basket. The items are lettuce, cauliflower and grapes. Interestingly, the same items increased by considerably more in the German basket. In general, fruit and vegetable prices are highly seasonal and it is not unusual to observe an increase or decrease in these indices by 30 or 40 percent from one month to the next.[5]

Most of the series that increased in Germany returned to their pre-changeover level within a few weeks. Figure 2 shows four examples; codfish, lettuce, padlocks and vacuum cleaners. The changeover is denoted by a vertical line. All four series display an upward spike at the changeover.

[5]The 98 percent increase of lettuce is, however, remarkable. Data for lettuce are available for more than 10 years before the changeover and an increase of this size did not occur in other years.

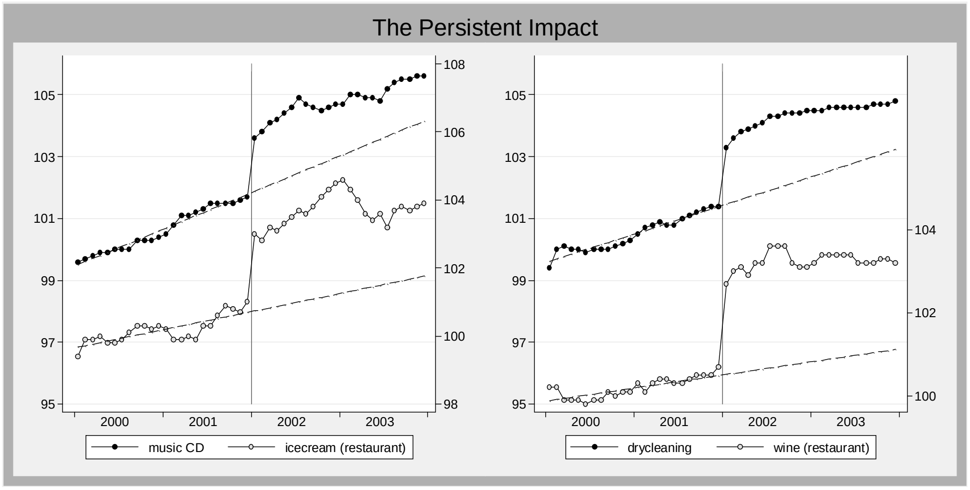

Figure 3: Four prices that increased persistently at the changeover (denoted by a vertical line). The dashed lines are linear projections using the first 24 observations.

As already mentioned above, there are indices where the impact is more persistent. Figure 3 shows four examples. The indices of music CDs, ice cream, dry cleaning services and wine increased at the changeover and appear to have stabilized at the higher level. The persistent impact is by and large restricted to the services sector. The CD series shown here is an exception.

In the Austrian basket, only few unusual price movements can be observed, something already suggested by the histogram above. Figure 4 shows four examples. Music CDs and wine in the left hand panel seem unaffected by the changeover. Compare this to the German series in figure 3. The right hand panel shows the indices of fast food and kebab. Fast food decreases significantly while kebab increased slightly at the changeover and decreased for a short period three months later.[6]

2.2 The Impact in Germany

When assessing the impact of the changeover, we have to take into account that some prices are more volatile than others. Observing an increase of 30 percent in vegetable prices, for example, is not unusual, while an increase of 2 percent in restaurant

[6] The "fast food" series (English term in the original) covers the mainly American fast food chains.

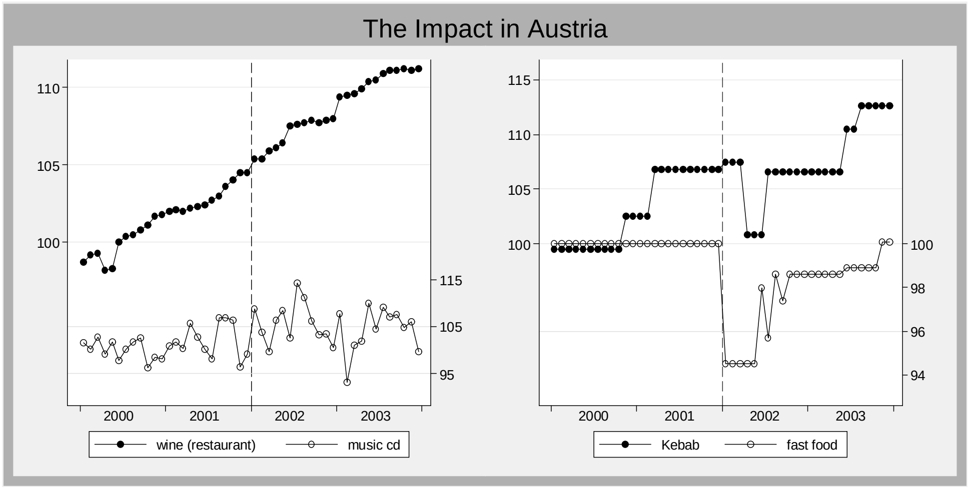

Figure 4: Four examples from the Austrian basket. The changeover is denoted by a vertical line.

prices is remarkable. In order make the price movements comparable, the indices are standardized using the z-score (standard score).[7]

Table 2: Unusual Price Increases in Germany

	obs	number of series with $z > 4$			median inflation
		2002:01	mean (January)	mean (sample)	2002:01 (in %)
whole basket	686	63	13.5	2.8	0.2
groceries	133	6	0	0.4	0.2
bread (not packaged)	5	5	0	0.1	1.2
bread (packaged)	4	0	0	0.1	0.3
services	70	29	1.5	0.4	1.1
services (standardized)	55	28	1	0.3	1.8
services (not stand.)	15	1	0.5	0.1	0.3
restaurants	17	14	0	0	2.1

[7] The z-score is defined as $z_i = \frac{x_i - \bar{x}}{s_x}$, where x_i is the observation at hand, $\bar{x}$ is the series' mean and s_x its standard deviation. By construction, the z_i's have a mean of zero and a standard deviation of one.

Table 2 shows unusual price increases at the changeover in Germany for the whole basket and for a number of sub-categories. The second column (obs) gives the number of observations in each category. Columns 3 to 5 provide information about the number of items that have a z-score above 4. Column 6 shows the median (month-on-month) inflation at the changeover for each category.

In a typical month, 2.8 series in the basket of 686 increase enough to have a z-score above 4. Some prices are seasonal so that this number rises to an average of 13.5 in January. At the changeover this number more than quadruples to 63. Most indices in the basket are unaffected by the changeover - even by different measures.[8]

Table 2 only considers price increases. Price decreases are observed but their number is smaller and they are generally less pronounced and would not be noticed with z-scores or a regression analysis. In the German basket of 686 items, three series have a z-score below -4; the January average is two series. Two interesting examples of price decreases are reported in sections 2.2.1 and 2.2.3.

2.2.1 Bread and Groceries

Grocery prices appear largely unaffected by the changeover.[9] Out of 133 series, six have a z-score above 4; more than one would expect in a typical January. However, five of these six are bread series. In total, the German basket contains nine different types of bread. Five of them increase while the other four are unaffected by the changeover. Interestingly, the term "package" in the series' definition appears only in the four unaffected types of bread. The five types of bread that increase are sold unpackaged.[10]

Price decreases are observed in the grocery sector but their magnitude is typically

[8] A different way to estimate the impact would be to regress inflation on a time trend and dummies as is done in section 2.4 or assuming some autoregressive process. The findings reported in table 2 are robust to different estimation methods.

[9] Grocery prices include series 1 - 154 in the German basket excluding fruits and vegetables.

[10] In Germany, bread is sold in both supermarkets and bakeries. Most bakeries are small, often family owned businesses. Some chains exist but are not the norm. The expression "packaged" in the series definition is a sign that the bread is sold in a supermarket. Bakeries sell bread unpackaged.

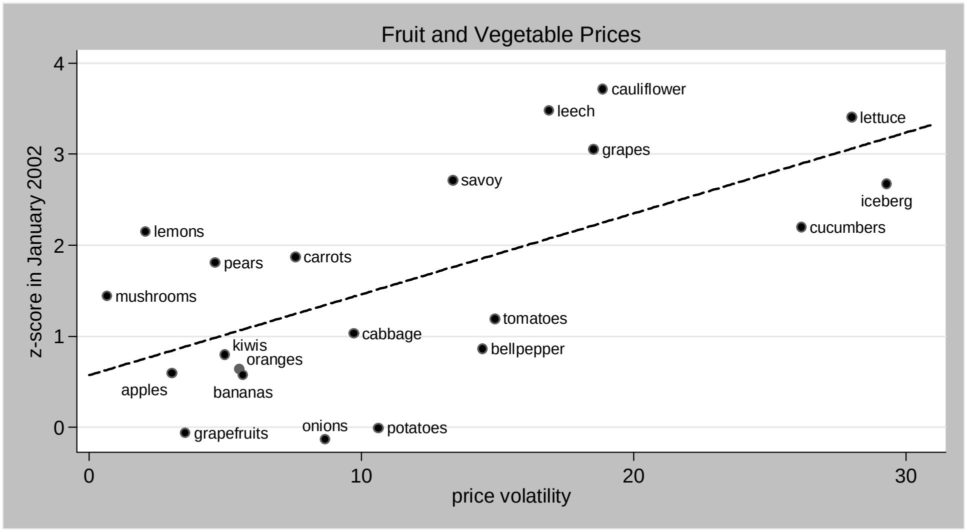

Figure 5: The impact of the changeover (measured by the z-score) increases with the volatility of an item's price (measured by its standard deviation). The slope coefficient is 0.09 with s.e. 0.025 ($t-$value $= 3.5$).

small and thus do not stand out in a statistical analysis. The following observation is nevertheless worth mentioning. During the changeover, some newspapers and TV stations ran price comparison studies in which they reported whether sellers increased or decreased prices when the new currency was introduced. Typical items included in these studies are milk, butter, sugar and coffee. The prices of all four items decreased at the changeover.[11]

2.2.2 Fruit and Vegetables

As table 2 has already suggested, many vegetable prices increased with the changeover but none rose enough to have a z-score above four. Still, a closer look at the vegetable sector is revealing. Figure 5 plots the z-scores against the index's standard deviation for all fruit and vegetables in the German basket. Interestingly, the lower an index's volatility the lower the impact. Note that the z-score controls for the overall volatility of a series and that volatile series are not more outlier-prone than other series so

[11] The z-scores in January 2002 are -3.83 (butter), -2.93 (sugar), -0.36 (ground coffee) and -0.95 (UHT-milk). Fresh milk increased slightly ($z = 0.01$).

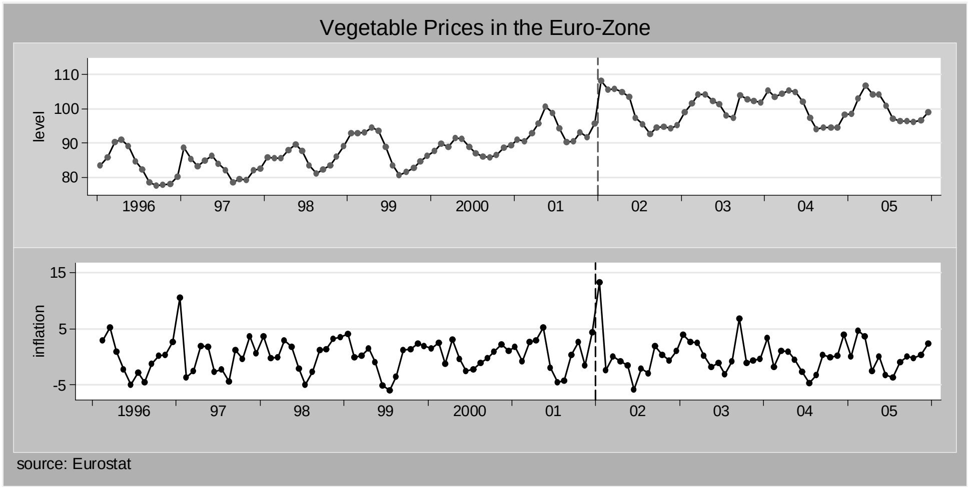

Figure 6: Vegetable prices in the euro-zone. The changeover is denoted by a vertical line.

that any relationship between the two variables should in principle be random. The significant upward slope suggests some influence from the changeover.

Another interesting observation is shown in figure 6. The upper panel shows the level and the lower panel inflation (month-on-month) of vegetable prices in the euro-zone for a period of ten years around the changeover (weighted average of all 12 countries participating in the changeover, data from Eurostat). Both the highest level and the highest inflation rate occur in January 2002. This, too, suggests some influence of the changeover.

2.2.3 Services

The most interesting and most puzzling price movements can be found in the services sector. However, unlike in the case of bread where the expression "package" in the items' definitions allowed the series to be sorted, there is no obvious characteristic in the services sector that permits a similar separation and at first sight, the impact does indeed look random.

The impact is puzzling for two reasons. First, the size of the price changes is remarkable; z-scores above six are not unusual. Second, unlike in the case of, say, vegetables the increase in January is not accompanied by decreases in the succeeding months.

Before searching for patterns we need to clean the data. The German CPI basket contains 136 services. Of these, 50 are administered, that is, they are set by political or administrative decisions and will be dropped together with housing rents.[12] After cleaning the data, 70 series remain; most of them increase, a few decrease and around a third are unaffected by the changeover. Two factors appear to influence firms' price-setting decisions: the extent to which a service is "standardized" and the number of firms in the market.

The Degree of Standardization Reading the series' definitions in the CPI baskets, one often gets a fairly good idea of what a series is about and often one is able to tell how much one would be willing to spend on it. Restaurant services are good examples. In other cases, the services are more complex and more information is required to convey one's willingness to pay. Gardening or house decorating services are good examples. By their nature, these latter services are not as "standardized" as restaurant services. Regarding the impact of the changeover, it is interesting that the less standardized services are barely affected by the changeover. Table 2 shows that only one of the 15 non-standardized services has a z-score above 4 while more than half of the standardized services do.

The separation into standardized and non-standardized services is unambiguous in most but not all cases. In order to keep a necessary level of subjectivity, I follow the German and Austrian regulations that indirectly separate services along this line. As a rule, service providers are required to indicate selling prices. In fact, these rules are even stricter for services than for goods. Restaurants or hair dressers, for example, have to indicate prices well visible from outside the establishment so that customers can acquire information before entering. For more complex (less stan-

[12] Housing rents are unaffected by the changeover. Examples of administered prices are given in the appendix.

dardized) services, where such a requirement would be impractical, the regulations permit exemptions. Gardening services, parquet-laying or car spraying are examples. I refer to the services where the price-marking-order stipulates exemptions as "non-standardized".[13]

Market Structure Market structure is the second factor that appears to influence a firm's price-setting decision around the changeover. High z-scores are observed primarily in markets dominated by many smaller firms while larger firms are more likely to keep prices constant or reduced them.

Taking advantage of two characteristics of the data, there is a simple way to obtain information about the structures of the markets the indices comprise. First, with the exception of seasonal services (of which there are only a few), services prices are kept constant for between 12 and 18 months on average (Nakamura et al. 2007 and Altissimo et al. 2006). Services prices, thus, often increase or decrease in a stepwise manner; aggregating over many observations "smooths" the index. Second, in the data collecting process, the statistical offices take into account the structure of the markets covered by the indices. Smaller samples (less observation) are collected in markets with only few suppliers. As a result, indices covering markets dominated by a small number of firms typically display longer periods of constant prices while series where many observations enter tend to vary more over time.

Two examples illustrate this point. According to the German statistical office, several hundred observations enter the position "dry cleaning of a man's shirt" every month. For dry cleaning services, the statistical office reckons such a high number necessary to obtain a representative average for the whole country. The car-rental industry is a good example of a series where only few observations enter. The German

[13] Examples of non-standardized services is given in the appendix. Figure 7 gives example of standardized services. The only non-standardized service with $z > 4$ is veterinary services (worming treatment and vaccinations). I would have considered this service to be fairly standardized but the regulations permit exemptions not only for "complex" services but also for industries that are not allowed to advertise such as veterinary practices.

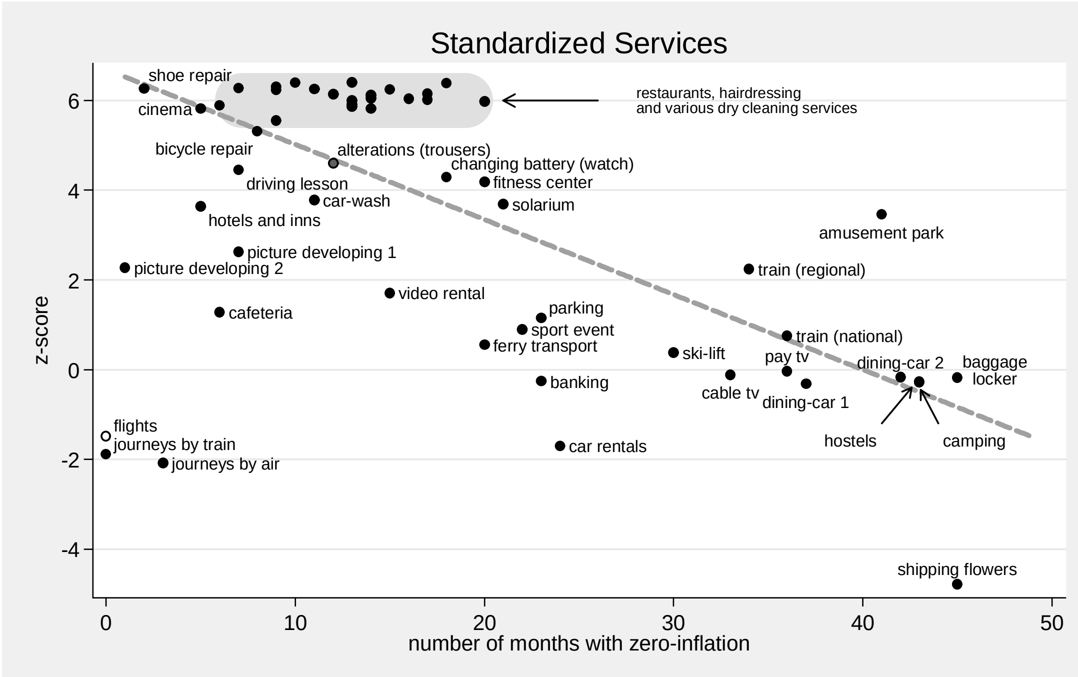

Figure 7: The figure plots z-scores against the number of months with zero inflation (an indicator of the size of the firms operating in these markets). The three seasonal services in lower left corner are not included in the regression.

statistical office considers the market share of the four biggest national suppliers large enough to be representative for the industry as a whole and disregards smaller firms. The index for car rental services displays several months with zero inflation whereas the dry-cleaning services vary almost every month in the sample.

Figure 7 plots the z-scores against the number of months with zero inflation in the sample of 48 months. A clear negative relationship between the two variables appears. High z-scores tend to be observed in industries whose indices vary more over time. Information provided by the German statistical office confirms that for indices to the right of the figure significantly fewer price observations are collected than for indices to the left.[14]

[14] The German statistical office collects price data of only one company in the case of shipping flowers, hostels, dining car 1 (beverages), dining car 2 (meals), national train tickets and pay-TV. Observations of a small number of firms enter the indices of car rentals, banking, cable TV and regional trains. A large number of observations is collected in the case of restaurants, dry-cleaning or hair-dressing services - industries that are typically provided by small, often family-owned businesses.

2.3 The Impact in Austria

In Austria, the impact of the changeover is significantly weaker than in Germany but not entirely absent. 14 of the 618 series in the basket have a z-score above four which is a little less than one would expect in a typical January. Vegetable prices increase but in general by less than in Germany and the positive relationship between z-score and volatility we found in Germany (figure 5) is absent. In the case of services, we do observe some increases but compared to Germany only few. Looking only at standardized services, no relationship appears between the z-scores and the number of months with zero inflation. In the restaurant sector we observe two significant increases and one significant decrease (fast food with $z = -5.5$).

Table 4: Unusual Price Increases in Austria

	obs	number of series with $z > 4$			median inflation
		2002:01	mean (January)	mean (sample)	2002:01 (in %)
whole basket	618	14	16	3.5	0.1
groceries	117	0	0	0.9	0.3
bread	6	0	0	0	0.3
services	87	4	2.5	0.5	0.6
services (standardized)	72	2	1	0.4	0.6
services (not stand.)	15	2	1.5	0.1	0.5
restaurants	32	2	0	0.1	0.6

2.4 The Persistence of the Impact

Figure 3 suggests that some of the price increases are more persistent than others. This section studies in which industries we observe persistent increases and where the impact is only transitory. I estimate the persistence of the impact with the following model.

$$\pi_t = \beta_1 + \beta_2 d_2(i) + \beta_3 d_3(i) + u_t, \tag{1}$$

where π_t is the inflation rate of a single item (no system approach) in period t. The first dummy, $d_2(i)$, takes the value 1 in month i and zero otherwise. The second dummy, $d_3(i)$, takes the value $\frac{1}{11}$ in the eleven months subsequent to i. The index i runs from 1 to 36.

Consider the case where $i = 24$. In this case, $d_2(i)$ captures the impact of the changeover. If, for example, the price of an item increases with the changeover, the coefficient β_2 will be positive. In case the price returns to its pre-changeover level, inflation will be below trend in some of the months following the changeover. This second effect will be captured by $d_3(i)$. Testing whether the impact was persistent, I test whether the sum $|\beta_2 + \beta_3|$ is significantly different from zero. If the price returns by the end of 2002, the impact will be called transitory, otherwise persistent.[15] Estimation is by OLS with a 5 percent significance level.

[15] The choice of 11 months was made so that the test can be run for 2000, 2001, and 2002 separately ($i = 12,\ 24$, and 36). There is some arbitrariness in this choice, but eleven months seem long enough for transitory increases to level off.

Table 5: The Persistent Impact in Germany

H0: $\beta_2 > 0$ and $|\beta_2 + \beta_3| = 0$

	observations	persistent increase		
		2002 : 01	mean	
			January	sample
all items	686	51	22.5	10.5
services (all)	70	29	1.5	0.4
services (standardized)	55	28	1.5	0.3
restaurants	17	14	0.5	0.1
services (not stand.)	15	1	0.0	0.1

Table 3 summarizes the estimation results. For 51 of the 686 series, I cannot reject the hypothesis of a persistent increase. This is more than twice the January average of 22.5. Again, it is the service sector that is surprising. All 28 services that increase (see table 2) do so persistently. Overall, the additional persistent increases we observe in January 2002 are almost entirely due to standardized services. Increases in the other sectors are mainly transitory.

In Austria (no table shown), unusual persistent price increases are nearly absent. In the basket of 618 series, 12 increase persistently according to the model above which is slightly less than the January average of 13.

The statistical design of equation (1) is weak and using the same model for all items without taking into account input prices, I am imposing strong assumption on the data. My only defence is that the sole purpose of the exercise is to expose certain patterns and that with more than 1500 items in the two countries a more detailed analysis would be difficult. Bundesbank (2004) estimates the persistent impact for a number of selected items taking into account wages, producer prices, rents and other input prices. Several services appear above their pre-changeover trend even two years after the changeover. Something already suggested by figure 3.

3 Discussion

The "non-neutralities" raise several questions. I start this discussion by reviewing a number of possible explanations.

Menu Costs A possible explanation for the price-movements is that changing prices is costly. As a result of these "menu costs", firms will postpone price adjustments in the run-up to the changeover and anticipate price adjustments originally planned later. This behaviour then leads to a "jump" in prices and at first glance, the increase in restaurant prices seems to support the menu costs explanation. There are, however, two difficulties with this argument. First, menu costs should be a universal phenomenon and not be restricted to certain countries or certain types of restaurants as we have seen in the data.

A second difficulty is that the effect of menu costs on prices should be transitory. Analyzing whether the impact is transitory or persistent leaves, of course, room for interpretation but an uncomplicated way to test the menu costs hypothesis is to study the months around the changeover. Menu costs can only explain a jump in prices if the jump is accompanied by periods of reduced inflation (Eife 2009). Using micro-data Hoffmann and Kurz-Kim (2006) do not find evidence of firms postponing in the run-up to the changeover and in the case of restaurant prices, Bundesbank (2004) argues that inflation in the twelve months before the changeover is unusually high instead of unusually low as the menu costs explanation would require.

Currency Changeover as Coordination Advice Explaining the persistent impact, it is sometimes argued that a currency changeover may serve as an advice allowing firms to coordinate on a higher equilibrium. This argument as such begs the question why firms have not coordinated on the higher equilibrium before. Arguing that in the run-up to the changeover, prices had somehow been in disequilibrium is unsatisfying. Nonetheless, the persistence of the impact suggests a change in equilibria and I will come back to this argument when I discuss the persistent impact.

Changeover Costs In the run-up to the changeover, trade associations often complained about the additional costs the changeover was inflicting (training employees, new cash registers or printing new price tags) and argued that prices would have to rise to cover these costs. From a theoretical point of view, it is difficult to follow this argument and I would not have mentioned it here if it were not for the possibility that such moaning serves as a signal. The additional costs the changeover imposes on firms are likely to be independent of the amount sold and, thus, best interpreted as fixed costs. As long profits are non-negative, all benchmark pricing models posit the independence of prices from fixed costs and it seems reasonable that retailers would have raised prices long before if they had had the market power to do so - independently of any additional fixed costs brought about by the changeover.

Attractive Prices and Rounding Consumer goods are typically sold at attractive prices such as 1.99 (sometimes called psychological prices). In the services sector, round prices with a zero-ending are more common. A changeover forces firms to search for new pricing points. In Germany, for example, the percentage of prices considered "attractive" decreased from 80 percent in December 2001 to 40 percent in January (Bundesbank 2004).

Rounding may explain why the price of some specific item in a specific shop increased or decreased at the changeover but is not sufficient to explain why an index changes as we should expect some prices to increase and other to decrease leaving the average unaffected. In addition, the fact that attractive prices are a nearly omnipresent phenomenon makes it difficult to explain the patterns we have seen in the previous section. Attractive prices will, however, play an important role in the mechanism I propose for the persistent impact.

Money Illusion An interesting argument is money illusion. In experiments, individuals have been shown to suffer from money illusion but the data in the previous section neither reveal evidence in favour nor against it. Money illusion is a violation of the homogeneity postulate, the prediction that demand and supply functions are homogeneous of degree zero in prices. In order to say something about money illusion, we would need information about quantities. Without this information we could at most argue that some firms believed that consumers would suffer from money illusion not that they actually do.

3.1 The Transitory Impact

A changeover creates profit opportunities. Depending on the type of good and on the specific market environment, it may be optimal to increase or decrease prices. Probably the more obvious action is to raise prices and take advantage of the "confusion" that comes with the introduction of new coins and banknotes and the changing of all nominal prices. A consumer's situation at a changeover is similar to that of a tourist travelling in a country with a different currency. In the literature, various names are used for this phenomenon. Dziuda and Mastrobuoni (2009) talk about a reduced price transparency and Ehrmann (2006), having in mind that consumers could in principle overcome the confusion but decide not to pay the extra costs, refers to consumers as being "rationally inattentive". The inattention temporarily raises firms' market power (Gaiotti and Lippi 2008).

This argument has two interesting implications. First, it is a simple explanation for the different impact in Austria and Germany. By making dual pricing obligatory, Austria reduced the confusion and thus firms' ability to take advantage of the changeover. A second implication is that profiting from the changeover is easier the less expensive a product. Ehrmann's term "rational inattention" nicely illustrates this point. Consumers can calculate the correct conversion and compare old with new prices but especially for low-value items, this may not be worth the effort.

Both Dziuda and Mastrobuoni (2009) and Ehrmann (2006) find evidence in favour of this hypothesis. Prices of less expensive goods are more likely to be raised at the changeover.

Not all prices of low-value items increased and some firms even reduced their prices, so there must be some other "force" that pushes prices downward. Raising prices and taking advantage of the changeover bears the risk that some customers find out. In the case of a tourist, who is unlikely to return anyway, the "risk" is simply a forgone selling opportunity but in situations where buyers and sellers interact repeatedly a firm may put off its regular customers. A firm may, thus, damage its reputation.

With the reputation argument we can explain price reductions.[16] By lowering prices, a firm signals that it does not want to profit from the reduced price transparency. This in turn may win new customers or increase the bond with old ones. Moreover, the risk of damaging one's reputation is lower the more difficult it is to detect price increases. Seasonality, for example, helps to disguise a firm's "profiteering" which could explain the positive relationship between z-scores and volatility in figure 5.

The mechanism discussed so far explains a number of the observed patterns but does not explain the difference between packaged and unpackaged bread (table 2). As argued in the footnote on page 10, the term "packaged" in a series' definition is a sign that the bread is sold in a supermarket. Unpackaged bread is likely to be sold by a small, independent bakery. Though only anecdotal, the bread data point at a broader pattern described by Ehrmann (2006) and Dziuda and Mastrobuoni (2009) who argue that a firm's decision at the changeover is affected by the structure of the market it operates in. At the changeover, prices are less likely to increase when the item is sold in a supermarket or chain store than in "mid-priced stores".

[16] My usage of the term "reputation" differs from the reputation literature (e.g. Tadelis 2002) where the unobserved dimension is a good's quality. Reputation as a "fair trader" is in some sense less tangible than a good's quality but seem equally relevant.

A possible explanation for this phenomenon is media coverage. People's worries that prices would rise with the changeover and the resulting media interest in the subject provided a nice opportunity for publicity, good as well as bad. A firm that is likely to appear in the media, because of its size for example, is unlikely to raise prices and may use the opportunity to seek publicity by lowering prices. A small bakery on the other hand is unlikely to find its name in a media report. The argument that a firm's size influences the probability of appearing in a media report seems plausible. Reporting that a large supermarket chain used the changeover to raise prices sells more newspapers than the story of a small bakery.[17]

3.2 The Persistent Impact

The explanation for the persistent impact will be presented in three steps. In the first step, I argue that the markets where we observe persistent price changes are prone to collusive behaviour. The second step discusses how a changeover "destabilizes" equilibria and in the third step I present possible explanations for the direction of the price changes.

First, recall that the persistent impact was almost entirely restricted to standardized services such as restaurants, hair dressers or dry cleaners. These services have a number of interesting characteristics. Being standardized they are fairly easy to substitute. Should a consumer be unhappy with his supplier it is in most cases not difficult to find a competitor supplying a comparable service. Also, price visibility is high. As discussed in section 2.4, these service firms have to post their prices well visible from outside the establishment, often in shop windows. Third, the number of competitors is relatively small. Consider a coffee shop. There are hundreds of coffee shops in a city but a coffee shop at the airport does not compete with one

[17] The price reductions of goods that typically appeared in price comparison studies organized by some newspapers and TV stations (see the footnote on page 11) is another example of the effect of the media on price setting.

in the city center. The relevant market of these firms is small with a "manageable" number of competitors. The market structure is best described by a local oligopoly. For standardized services in general, an oligopolistic market structure seems a typical feature. In addition to the three characteristics above, services by their nature are not storable, not easy to transport and lumpiness and infrequent product purchases are difficult to imagine.

Readers familiar with the industrial organisation literature might recognize that nearly all the characteristics above are listed in Scherer (1980) as factors facilitating collusive behaviour among firms. The visibility of prices makes communication via prices uncomplicated so that collusion may in fact be only tacit. If we assume in addition that firms in these markets interact repeatedly and that the final stage of the finite game is unknown (or assuming an infinite game right away), any price between marginal costs and the monopoly price can be justified as an equilibrium price. This multiplicity of equilibria is the first "ingredient" of the mechanism I propose but is, clearly, not sufficient by itself.

Second, a changeover may destabilize the equilibrium firms have coordinated on. Consider a coffee shop that sells coffee for a price of 3.20 German Marks before the changeover. Converting this price at the official exchange rate of 1.95583 Marks per Euro yields a price of around 1.64 Euros. If the firm prefers round prices, it can either round up or down to the next attractive price. Rounding down to 1.60 implies a price reduction of 2.2 percent and rounding up to 1.70 implies a price increase of 3.7 percent. With this example I want to make two points. First, for the individual coffee seller increases or decreases of several percentage points are not unusual; the practice of using attractive prices forces sellers to change prices in relatively large steps. Second, a price change from, say, 1.64 to 1.70 is not a change from an equilibrium price to another equilibrium price, but from a price that, due to the changeover, lost its equilibrium status to a price that only gained an equilibrium status with the changeover. In this sense, one may speak of a "destabilization" of markets in which goods are sold primarily at attractive prices.

In sum, the particular characteristics of standardized services suggest that collusion in these markets is a frequent phenomenon. The question as to why firms have not coordinated on the higher (or lower) equilibrium before can be explained by the practice of pricing at attractive prices. This custom restricts the number of available equilibria (though not necessarily the range) and the changeover obliterates the set of equilibria and creates new ones. The explanation, however, does not explain why some firms round up and others down. This takes me to the third step.

Third, regarding the direction of the change, I will argue that reputation and media coverage are again plausible explanations. Reporting that a large fast food company has raised prices sells more newspapers than the story of a small independent restaurant. On the other hand, the fast food company, knowing about the likelihood of appearing in the news, may seize the opportunity to receive good publicity by lowering prices (see figure 4). A different argument, independent of the media, is that consumers may be more sympathetic when a small restaurant rounds prices up than when a larger chain does so.

The last question we have to address is whether the collective rounding up we observed in some sectors in Germany is the result of a tacit understanding or whether there was an explicit agreement among firms. Rees (2002) provides an example of ice cream sellers in Munich who admitted phoning each other up to check that the new prices would stick. It would not be surprising to observe similar incidences in other places as well but it is also conceivable that firms, possibly sending signals (see page 3), coordinated on the new equilibrium by purely tacit understanding.

4 Concluding Remarks

I conclude the paper by returning to the metaphor in the paper's title, the veil of money. The changeover's impact on relative prices is a clear violation of the neutrality prediction of our benchmark models. The assumptions underlying the neutrality prediction are, however, rather strict. The goal of this paper was to show that standard economic arguments can account for the non-neutralities once we leave the Walrasian world and allow for imperfect competition and imperfection information. Imperfect information opens the way for phenomena such as seller's reputation and, more distant, the practice of attractive pricing.

A changeover creates profit opportunities – something that would be difficult to imagine in a world of perfect information. Depending on the type of good and the specific market environment, increasing and decreasing may be optimal. By increasing prices, a firm can take advantage of the "confusion" that comes with the introduction of new coins and banknotes and the changing of all nominal prices. Taking advantage, however, bears the risk that a seller damages his reputation as a fair trader. Other firms may lower prices hoping to profit from the publicity that such a move might bring.

The profit-creating argument can account fairly well for the transitory impact but for the persistent impact, a different explanation is necessary. The persistent impact is almost entirely restricted to the services sector and the paper argues that specific characteristics of services combined with the practice of attractive pricing provide an explanation. Services have a number of interesting characteristics that suggest that (tacit) collusion in these markets is frequent and we may expect firms to coordinate on any price between marginal costs and the monopoly price. This multiplicity of equilibria, however, is restricted by the custom of attractive pricing, which leaves only a finite set of "focal points". Converting prices at the changeover eliminates the old set and creates a new set of potential equilibrium prices.[18]

[18] This multiplicity of equilibria predicted by the theory is difficult to document in the data. If we

In sum, the changeover's impact on relative prices is interesting and surprising but on the whole, the impact is small. An impact on the aggregate price level is barely noticeable and more importantly, the impact seems to be restricted to countries that failed to make dual pricing mandatory. We may conclude, therefore, that despite the observed non-neutralities, the veil of money is a useful and for most purposes apt metaphor.

A Literature

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accept the explanation made here, the movements in services prices provide nice evidence for the multiplicity and thus offers an additional explanation for the dispersion of consumer prices (see for example Baye Morgan Scholten 2006).

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B Examples of Administered Services

Public transport and public housing are typical administered prices. In addition to these, the following prices are considered administered in Austria and Germany: theater and opera tickets, a number of insurance fees, medical care, lawyer and funeral fees, Kindergarten fees and certain types if schooling.