CEIS TOR VERGATA
Centre for International Studies on Economic Growth

CEIS Tor Vergata
RESEARCH PAPER SERIES

Working Paper No. 27 July 2003

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CEIS Tor Vergata - Research Paper Series, Vol. 9, No. 27 July 2003

The Inflationary Consequences of a Currency Changeover: Evidence from the Michelin Red Guide

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July 2, 2003

Abstract

This paper examines the inflationary consequences of a currency changeover in a simple model of the catering market. It is shown that the change in cash denomination acts as a coordination device shifting the industry to a high-price equilibrium. Empirical evidence based on data from the Michelin Red Guide strongly supports the predictions of our model against competing explanations. A permanent change in relative prices has taken place in Euroland, with strong redistributional effects in favour of some segments of the catering sector.

1 Introduction

The introduction of the Euro notes and coins on 1st January 2002 to replace a number of national currencies has sparked off an intense debate on the economic consequences of the changeover. According to a conventional view, the change of currency should not have had any effects on relative prices, since money is simply a "veil". The main direct consequences of the changeover should have been the reduction in transaction costs associated to a variety of currencies in the European Union and the reorganization of the banking sector. The adoption of a common currency among a large number of European countries generates economies of scale and promotes a greater degree of efficiency in production. The reduction in price uncertainty would

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increase welfare through the improvements in the allocation of resources. Increased transparency of prices would also enhance competition both across and within countries. Of course, all these benefits would be greater the closer the member countries are to satisfying the requirements for an optimal currency area.

On the other hand, a much feared cost in the public opinion, often reported by the media, is the perception of generalized price inflation triggered by the currency changeover. Price increases in restaurants and in the service sector have indeed taken place following the introduction of the Euro. These increases have mainly been attributed to the dynamics of costs in the food sector due to inclement weather conditions (European Central Bank [March 2002] pp. 31-32; European Central Bank [April 2002], p. 19). It has been argued that "the extent of the cash changeover effect has been relatively limited, and should be temporary" (European Central Bank [July 2002] p. 22). Although price increases might have been una tantum with no substantial effect on the inflation rate, the change in relative prices may have been permanent.

This paper provides support for the layman's view that the changeover resulted in a permanent change in relative prices, and will have significant and long-lasting allocative and distributional effects. The switch from national currencies to the Euro has acted as a device that has led firms to co-ordinate their expectations on pricing behaviour. The exogenous change in cash denomination has thus shifted the industry to a higher-price equilibrium. In other words, the widespread concerns about possible generalized price increases in these industries associated with the introduction of the new currency have generated self-fulfilling inflationary expectations.

We analyse the issue of the inflationary consequences of a currency changeover by focusing on the catering market. The market for restaurant services is ideally suited to our purposes due to its characteristics of segmentation and imperfect information. Although multiple equilibria are in principle possible, the high-price equilibrium is the one to which agents will endogenously coordinate their expectations when the change in currency takes place. The model generates predictions that allow us to test the validity of our explanation focusing on the interactions between the structure of the market and price expectations.

We develop a theoretical model where restaurants can decide to specialize in a narrow segment of the market, or may try to attract broader categories of customers. Our approach enables us to verify our interpretation relative to alternative suggested explanations, such as: (i) increase in food cost due to bad weather, (ii) delayed and overdue adjustments of menus, or (iii) rounding-up of prices in the new currency. By looking at restaurants both inside and out-

side the Euro area, we can only test the validity of our predictions against (i). However, by also exploiting the heterogeneity across restaurants we are able to discriminate between our model and all the competing explanations.

Our empirical results are based on data from the Michelin Red Guide. They strongly support our expectation-driven view of price inflation following the changeover, against all competing alternatives. Hence, a permanent change in relative prices has occurred with the introduction of the Euro, with clear redistributional consequences.

The plan of the paper is as follows. Section 2 develops a theoretical model of the catering market. Section 3 discusses the inflationary effects of a currency changeover. Section 4 presents our econometric results. Section 5 concludes.

2 The Model

We develop a model of the catering sector based on imperfect information and market segmentation. We assume that restaurants attract two types of customers endowed with different information sets: regular customers who know the quality of a restaurant in advance ("Locals") and all other customers ("Tourists"). Restaurants differ both in the quality of their meals and in the probability to be visited by tourists. Establishments situated in more strategic locations are likely to attract more tourists than local customers.[1]

Quality is an exogenous characteristic of restaurants. These also differ in their capacity to be matched with uninformed customers. Our focus is on how restaurants' choice of whether to rip off or to be "honest" depends on the likelihood to be matched with uninformed consumers and on reservation prices. We show how strategic interactions between restaurants and customers eventually lead to multiple equilibria.

We treat quality as an "experience" characteristic of the good (Cooper and Ross [1984]). This implies that quality can be discovered only after consuming the good. Chan and Leland [1982] consider the problem of "search goods" (i.e. those goods where quality can be observed after bearing some information cost). Real world goods usually fall in between these two categories. Despite tourists being able to obtain *some* information on the quality

[1]Models with informed and uninformed consumers have been widely considered in the literature since Salop and Stiglitz [1977]; agents bear different costs in gathering information about prices while quality is not an issue. Cooper and Ross [1984] consider a model with heterogenous information where the entry of firms selling low quality goods at high price (ripoffs) may cause the uninformed consumers to exit the market.

of a restaurant, for instance by purchasing a tourist guide, the restaurant example resembles more the case of an experience good (von Ungern-Sternberg and von Weizsacker [1985]). The rationale for the private information of the Locals in our model thus comes from the assumption that they have "experienced" every restaurant at some point in time in the past, whereas tourists had not.

Restaurants and customers are matched through an exogenous Poisson process. The use of stochastic matching allows to capture typical departures of the catering sector from competitive markets such as the presence of monopolistic rents, price setting sellers and barriers related to the free entry of new firms in the presence of equilibrium profits.

At each point in time, a new cohort of Tourists of size γ arrives in town. Tourists remain in town until the match with the first restaurant occurs. We assume that each Tourist departs after the first match. There is also a constant unit mass of infinitely lived Locals.

Both customer-types want to maximise their surplus:

$$U(x_j) = v(x_j) - p \tag{1}$$

where p is price and $v(x_j)$ is the utility associated with a meal of quality x_j, $j \in \{L, M, H\}$. Locals can exploit private information in the sense that they always know in advance the quality of a given restaurant whereas Tourists learn it only after the meal. When a match occurs, the restaurant makes the customer a *take it or leave it* offer about the price of the meal. Thus, there is no bargaining or, put differently, the restaurant has all the bargaining power. We assume that the restaurant is not able to discriminate between locals and tourists (for instance, because it is required to display a menu before the meal).

When the offer is made, the customer can decide whether to accept it or decline it. Thus, whenever $v(x_j) \geq p$ the local will accept the offer.

The tourist does not know the quality in advance and, therefore, he must rely on expectations. His ex-ante utility is $E(v(x_j)|I_T) - p$ if he accepts and 0 if he refuses (I_T is his information set).

Restaurants are heterogenous in two characteristics: they are different in quality and in the probability to be spotted by tourists. The idea is that while locals can be assumed to spread evenly across all the restaurants in the town, Tourists are likely to find some places more easily than others. For instance, an airport restaurant is likely to attract more tourists than a restaurant in an industrial area. Let λ_i be the Poisson arrival rate of tourists for restaurant i. We assume that $\lambda_i \in [\underline{\lambda}, \overline{\lambda}]$ is uniformly distributed. The arrival rate of Locals λ is instead assumed to be constant across all the restaurants. In

order to have constant population we assume $\gamma = \overline{\lambda} - \underline{\lambda}$. This implies that the population size of Tourists is equal to 1 at any point in time.

Restaurants are also different in quality. There are top quality x_H, medium quality x_M and low quality x_L restaurants. Defining $\mathcal{X} \equiv \{x_H, x_M, x_L\}$, the space of restaurants is given by $\Omega = \mathcal{X} \times [\underline{\lambda}, \overline{\lambda}]$. Producing meals is costly and the unit cost depends on quality: $c(x_L) < c(x_M) < c(x_H)$.

2.1 Pricing Strategies

Since the restaurant cannot discriminate, per customer profits in the case of a Local must be the same as in the case of a Tourist. The only difference is under which conditions a Local or a Tourist will accept the offer. More precisely, a local will accept it only if the price does not exceed his reservation price $p_L^*(x_j) = v(x_j)$ whereas a tourist will accept it only if $p \leq E(v(x_j)|I_T)$ which implies a reservation price $p_T^* = E(v(x_j)|I_T)$. Given the Poisson nature of the process, a restaurant with per customer profits π, arrival rate of tourists λ_i and arrival rate of locals λ has a discounted value of profits at time zero equal to:

$$\Pi = \int_0^\infty e^{-\delta\tau} \sum_{s=0}^{\infty} \frac{(\lambda_i \tau)^s}{s!} e^{-\lambda_i \tau} s\pi d\tau + \int_0^\infty e^{-\delta\tau} \sum_{s=0}^{\infty} \frac{(\lambda\tau)^s}{s!} e^{-\lambda\tau} s\pi d\tau = \\ = \frac{\lambda + \lambda_i}{\delta}\pi \qquad (2)$$

where δ is the discount rate. In order to get both Locals and Tourists a restaurant of quality x_j should set a price $p = \min[p_T^*, p_L^*(x_j)]$. Therefore, profits per customer are $\pi = \min[v(x_j), p_T^*] - c(x_j)$. On the other hand, a restaurant could find it optimal to set a price that is capable to capture only Locals or only Tourists. Let s_{PR}, s_{RT}, s_{RR} be the strategies of restaurants dealing, respectively, with both Locals and Tourists, only with Tourists and only with Locals. For mnemonic purposes, let us call the types of restaurants associated with three strategies respectively: Popular Restaurants (PR), Restaurants for Tourists (RT) and Restaurants for Regulars (RR). The associated profits are:

$$\Pi_{PR} = \frac{\lambda + \lambda_i}{\delta} \left(\min[p_T^*, v(x_j)] - c(x_j)\right) \qquad (3)$$

$$\Pi_{RT} = \frac{\lambda_i}{\delta} \left(p_T^* - c(x_j)\right); \quad p_T^* > v(x_j) \qquad (4)$$

$$\Pi_{RR} = \frac{\lambda}{\delta}\left(v(x_j) - c(x_j)\right); \quad p_T^* < v(x_j) \tag{5}$$

Whenever a restaurant sets a price that is the minimum between the two reservation prices it sells to both groups. When instead it sets the maximum of the pair it only gets one group. Note that RR leave zero surplus to their customers. This is a result of the information rent they enjoy and of the assumptions on bargaining power. Since all their customers (Locals) know their quality, and RR know they know, this type of restaurants is able to appropriate all consumers' surplus.

Let us now compare the profits under the different strategies. In order to assess which is the optimal strategy, restaurants use their expectation on the Tourist's *average* reservation price $\overline{p}_T^*$:

$$\Pi_{PR} \geq \Pi_{RT} \Leftrightarrow \lambda_i \leq \frac{v(x_j) - c(x_j)}{\overline{p}_T^* - v(x_j)}\lambda \equiv \lambda_j^{RT}; \quad \text{if } v(x_j) < \overline{p}_T^* \text{ and } \; c(x_j) \leq \overline{p}_T^* \tag{6}$$

for $j = L,\ H,\ M$. This says that when $v(x_j) < \overline{p}_T^*$ there exists a cut-off value λ_j^{RT} for λ_i above which the restaurants will choose to neglect the Locals and only work with Tourists. In general, if $v(x_j) - c(x_j)$ is roughly constant or increasing in the quality, then the cut-off will be increasing in the restaurant's quality.

Proposition 1. *If profits per costumer $v(x_j) - c(x_j)$ are not sharply decreasing in x_j then low quality restaurants are more likely to become restaurants for tourists than other restaurants.*

It is useful to note that $p_T^* \in [c(x_L), v(x_H))$ and, therefore, for expectations to be consistent we also require $\overline{p}_T^* \in [c(x_L), v(x_H))$.

We can now show that a Tourist suffers an ex-post loss when he goes to a Restaurant for Tourists.

Lemma 1. *When a Tourist is matched with a RT he experiences a negative surplus.*

Proof. Suppose he does not, then Locals would also go to the RT. But then the restaurant is no longer a RT. □

A restaurant could also decide to become a Restaurant for Regulars. In this case it would set a price which is equal to $v(x_j) > \overline{p}_T^*$ and deal only with Locals thereby extracting all their surplus. It is straightforward to show that

if a restaurant prefers the RT strategy to the PR strategy, then it also prefers to be a PR rather than a RR. Consider the choice between being a Popular Restaurant and a RR:

$$\Pi_{RR} \geq \Pi_{PR} \Leftrightarrow \lambda_i \leq \frac{v(x_j) - \overline{p}_T^*}{v(x_j) - c(x_j)} \lambda \equiv \lambda_j^{PR}; \quad \text{if } v(x_j) > \overline{p}_T^* \text{ and } \quad c(x_j) \leq v(x_j) \tag{7}$$

for $j = \{L,\ M,\ H\}$. A restaurant i of quality j will become a restaurant for regulars if $\lambda_i \leq \lambda_j^{PR}$.

Proposition 2. *If profits for costumer $v(x_j) - c(x_j)$ are not sharply decreasing in quality x_j then top quality restaurants have more incentives to become restaurants for regulars.*

Popular Restaurants must charge a price that is not above the utility associated with their quality in order to attract both categories of customers. Thus, when both tourists and regulars are matched with a popular restaurant, they experience a non-negative surplus.

3 Currency Changeovers and Sectoral Inflation

In this section we discuss the possibility of multiple equilibria and its consequences on inflation. The individual tourist's payoff is affected both by the behaviour of the mass of tourists and by restaurants' strategies. If restaurants expect low reservation prices, the average quality of restaurants which find it optimal to deal with tourists is also low. Thus, Tourists' willingness to pay turns out to be low as well in a self-fulfilling fashion. On the other hand, if expectations are revised upward, the economy could jump to an equilibrium with high prices.

3.1 Equilibria

Assume that a Tourist can compute the average reservation price of the other Tourists and let $g(\overline{p}_T^*)$ denote the conditional quality function: $g(\overline{p}_T^*) \equiv E(v(x_j)|\overline{p}_T^*)$.

Definition 1. A Symmetric Perfect Foresight Equilibrium (SPFE) is a level of p_T^* such that $p_T^* = g(\overline{p}_T^*)$ and $p_T^* = \overline{p}_T^*$.

The equilibrium is "Perfect Foresight" since both the restaurateur and the individual tourist perfectly predict the tourists' average reservation price.

It is clear from the previous section that the expected quality is strongly discontinuous in the *average* reservation price. The strategy chosen by a restaurant of quality j crucially depends on whether $\overline{p}_T^* \lesseqgtr v(x_j)$. A taxonomic analysis of the possible equilibria is contained in Appendix. We show there how the function $g(\overline{p}_T^*)$ is characterised both by non-linearity and discontinuities which may generate multiple equilibria. The reason is the strategic interaction between the single Tourist, the mass of tourists and restaurants. The mass of Tourists affects the single Tourist's payoff by influencing the pricing strategy of restaurants. When restaurants expect a low reservation price $\overline{p}_T^*$, the average quality of restaurants willing to deal with Tourists is low. In fact, top quality restaurants have little incentive to charge a price capable to attract uninformed costumers. This, in turn, implies that Tourists, predicting such behaviour, will actually have a low reservation price. On the other hand, when expectations of high reservation price prevail, the equilibrium price will be high as well. It is important to note that a shift may occur without any change of aggregate quality in the economy. An example with two equilibria is reported in Fig. 1.

A characteristic feature of the equilibria in this model is:

Proposition 3. *A simultaneous and coordinated revision in expectations of the tourists' reservation price may cause the price to jump from an equilibrium to another one.*

In the event of a jump from a low price to a high price equilibrium, restaurants will behave differently according to their market strategies. Let p_T^0 and $p_T^1 > p_T^0$ be two possible equilibrium prices. At some point in time t_0 the economy is in p_T^0. Assume that at time t_1 expectations are revised and the average reservation price jumps from p_T^0 to p_T^1. Restaurants for Tourists will always charge the higher price p_T^1. Popular restaurants will decide to charge p_T^1 as well. Other popular restaurants will increase their prices if p_T^0 was lower than the locals' reservation price and will leave prices unchanged otherwise. In addition, some restaurants which were charging $v(x_j) > p_T^0$ will find it profitable to charge the new price $p_T^1 < v(x_j)$, reducing thus their prices. Other restaurants for regulars will leave prices unchanged. The overall effect on the mass of popular restaurants after the jump is ambiguous. Thus, an important implication of this model is:

Proposition 4. *In the presence of a jump from a low to a high price equilibrium, restaurants will behave differently according to their strategies. In particular:*

1. *RT will increase their prices.*

2. *some PR will increase their prices, some will leave them unchanged, some will reduce their prices.*

3. *RR will leave prices unchanged.*

We conjecture that the introduction of the Euro may have worked as a coordination mechanism that allowed a switch from a low-price to a high-price equilibrium. The media may have played an important role in affecting expectations. Before the introduction, the main issue was the rounding up of prices converted in Euros from prices expressed in national currencies[2]. As soon as the euro replaced the old national currencies, reports by consumers' associations and other research institutions started to express concerns that sellers might increase their prices, exploiting consumers' difficulties in the conversion. The media massively covered such stories. This process may have worked as a device to coordinate expectations toward a high price equilibrium. Proposition 4 shows that Restaurants for Tourists are likely to increase their prices when facing such scenario. On the other hand, it is possible to argue that conversion difficulties are the same for both Locals and Tourists. By contrast, Locals are often regular customers. This implies that they are more likely to remember old prices - and compare them with the new prices after the conversion - than Tourists. Thus, restaurants dealing with Locals must necessarily be more cautious than other restaurants in raising their prices. The model predicts that Locals will accept an increase in price as long as they continue to experience a positive surplus which can be assessed *ex-ante*, since they know the quality. By contrast, tourists have much more difficulties to compare old prices with new ones, even when they have no problems with the conversion calculations. They also cannot rely on accurate knowledge about quality. Both these sources of imperfect information make their choice problematic. In other words, the daily warnings about price increases due to "difficulties in converting" caused the economy to shift to a high price equilibrium through a self-fulfilling mechanism.

We test the empirical implications of the model in the next section.

[2]A brief summary of the events leading to the introduction of the euro. In December 1998 fixed exchange rates between euro and national currencies were announced by the national central banks of the twelve countries joining the euro. Starting from January 1999, the euro became the official currency in these countries, although no notes were issued in euros. Since January 2002 notes in national currency started to be replaced by notes in euros. The replacement process was completed on different dates across the twelve countries.

4 Evidence

4.1 Data Description

We collect data from the Michelin Guide [2003 and 2002 editions] ("Main Cities of Europe") for six countries: Denmark, France, Germany, Italy, Sweden and UK. All the six countries have been long-standing members of the European Union. France, Germany, and Italy have adopted the EURO as a new national currency from 2002. Denmark, Sweden, and UK retained their national currencies. We consider restaurants for which observations are available for both the 2003 and 2002 editions. Despite euro notes having been introduced since January 2002, the 2002-2003 period is the most appropriate to capture the effect of the changeover on prices for several reasons. The guide is published by the end of March each year and some countries experienced a double currency regime for the first months of 2002. Furthermore, during 2002 some local authorities have kept prices under strict monitoring in order to avoid unfair rounding up.

We use the following dummies: EURO (which takes value 1 when the restaurant is in the euro area), RT (which takes value 1 if the restaurant is classified as a Restaurant for Tourists), PR (which takes value 1 if the restaurant is classified as a popular restaurant), RR (which takes value 1 if the restaurant is classified as for regular customers).

As noted in section 2, the determinants of a restaurant's strategy are: a) its capacity to attract Tourists (λ_i), b) its quality ($x_{i,j}$), and c) the expected equilibrium price ($\overline{p}_T^*$); a) and b) can be considered as exogenous characteristics of a restaurants while c) is clearly endogenous. The dummy variables are meant to capture the heterogeneity in the arrival rates. In order to classify restaurants, we use the description in the guide. Restaurants classified as Restaurants for Tourists must satisfy at least one of the following conditions: a) restaurants for which the description explicitly states their customers are mainly tourists, b) restaurants located in particular tourist areas, c) restaurants with a particular view, d) hotel restaurants. Restaurants classified as restaurants for regulars are: a) restaurants for which the description explicitly states their customers are mainly regulars, b) restaurants for which the description uses the expression "out of tourist routes" or another equivalent expression, c) restaurants with some rare speciality. Restaurants which: a) fall in both previous classes, b) fall in neither of the previous classes, are classified as Popular Restaurants, a residual category. Thus, we consider as PR all restaurants which do not have a clear bias towards Tourists or Regulars. The procedure used to build RR, RT and PR can reasonably be assumed as exogenous in our empirical analysis. It relies on the exogenous capacity to

attract Tourists rather than on restaurants' strategies.

We also consider the number of stars (which take the values 0,1,2,3 according to the quality of cuisine) as a proxy for quality. The dependent variable is the logarithmic price change for the interval 2002-03. The guide reports a minimum and a maximum price for each restaurant.

Tab. 1 reports descriptive statistics for our sample. ΔP^j is the logarithmic difference of the maximum price ($j = H$) or of the minimum price ($j = L$). The first two columns show a 3.6% (3.3%) average increase of the maximum (minimum) price for the whole sample. The increase, however, has been considerably higher for those countries which adopted the euro (4.8 and 4.3%) than for others (0 and 0.5%). Individual countries statistics are reported in Tab. 2. Italy, France and Germany are far above the average of non-euro countries. Standard deviation for euro countries is lower than for non-euro countries.

4.2 Estimates

We use OLS to estimate the following model:

$$\Delta P_i^j = \beta_0 + \beta_1 EURORT_i + \beta_2 EURORR_i + \beta_3 EUROPR_i + \\ + \beta_4 STAR1_i + \beta_5 STAR2_i + \beta_6 STAR3_i + u_i \qquad (8)$$

where $EURORT$, $EURORR$, and $EUROPR$ are the products of the dummy $EURO$ by RT, RR and PR respectively. The coefficients on these variables should be interpreted as the additional price change due to the interaction of the euro effect with the restaurant's capacity to attract tourists. $STAR1$, $STAR2$, and $STAR3$ are dummies which take the value 1 according to the number of stars awarded to the individual restaurant by the guide. Including these variables allows to control for quality.

We use this model to test the key implications of our theoretical model. *Proposition* 3 suggests the rejection of the null hypothesis:

$$H_0^a : \beta_1 = \beta_2 = \beta_3 = 0 \qquad (9)$$

In fact, β_1, β_2, and β_3 can be interpreted as the differences in price change between euro and non-euro countries. The sum of the three variables exactly replicates a dummy for euro-countries. The significance of at least one parameter would indicate a different rate of inflation for euro-countries reative to non-euro-countries. The alternative hypothesis is thus that one or more parameters are *jointly* different from zero.

We also test *Proposition* 4. The null hypothesis in this case is:

$$H_0^b : \beta_1 = \beta_2 \qquad (10)$$

It implies that the effect of the changeover is homogeneous among restaurants with different types of customers. By contrast, *Proposition* 4 suggests that in the presence of a jump the price change is higher for RT than for RR, while the price change for PR is ambiguous. Thus, the alternative hypothesis is that RT experienced higher price change than RR:

$$H_1^b : \beta_1 > \beta_2 \tag{11}$$

We also test the homogeneity between PR on the one hand and RR and RT on the other.

A consideration should be made. The guide selects restaurants on the basis of certain quality standards. This implies that our sample is biased toward quality restaurants. In other words, our sample does not include tourist traps. This suggests that we grossly *underestimate* the effect of the changeover.

Results are shown in Tab. 3. Estimates for the difference in maximum price and for the difference in minimum price are reported in the left and right column respectively. The coefficients of $EURORR$, $EUROPR$, are positive in both cases, but not significantly different from zero. The coefficient of $EURORT$ is remarkably high and implies that tourist restaurants in the euro area have increased their prices by about 6 percentage points more than non-euro restaurants. The coefficient for PR (β_3) is between β_1 and β_2, as implied by the theoretical model. The intercept, that should be interpreted as the price change of non-euro restaurants (with no stars), is not significantly different from zero, implying that prices remained roughly constant outside the euro area.

The bottom part of the Table reports direct tests for our implications. $\mathcal{F}_1$ is a F-test for H_0^a. The null hypothesis of an homogeneous restaurant behaviour inside and outside the euro area is rejected at 1 percent and at 0.1 percent confidence level for maximum and minimum price, respectively. This finding strongly suggests the presence of a jump from a low to a high price equilibrium after the introduction of the euro.

$\mathcal{T}_1$,$\mathcal{T}_2$, and $\mathcal{T}_3$ are t-tests for the hypothesis of a homogeneous price change across restaurants with different customers: $\beta_1 = \beta_2$, $\beta_1 = \beta_3$, and $\beta_2 = \beta_3$ respectively. $\mathcal{F}_2$ is an F-test for the joint hypothesis of homogeneity within restaurants with different customer-types: $\beta_1 = \beta_2 = \beta_3$.

The direct test for H_0^b is thus the one-sided test $\mathcal{T}_1$. The main prediction of Proposition 4 ($\beta_1 > \beta_2$) is strongly supported by the data in both cases at 5% and at 0.1% confidence level. The price change for tourist restaurants has been markedly higher than that for restaurants with regular customers. The difference between RT and RR within euro-countries is about 3% for

ΔP^H and 4% for ΔP^L.

Additional insights can be obtained by considering $\mathcal{T}_2$ and $\mathcal{T}_3$. $\mathcal{T}_2$ rejects the null $\beta_1 = \beta_3$ for the minimum price while $\mathcal{T}_3$ never rejects $\beta_2 = \beta_3$. This evidence is consistent with the model prediction of an ambiguous behaviour of Popular Restaurants in the presence of a jump. In this case, the behaviour of PR resembles more closely the strategy of Restaurants for Regulars than that of Restaurant for Tourists, at least for the maximum prices. Such consideration helps to explain the result on the test $\mathcal{F}_2$. In fact, $\mathcal{F}_2$ rejects the hypothesis $\beta_1 = \beta_2 = \beta_3$ only for the minimum price.

More surprising is the role of quality. The model predicts that low quality restaurants are on average more likely to deal only with tourists. By contrast, Tab. 3 shows that 2 and 3 stars restaurants have increased their prices significantly more than the others. However, this effect is not conditional on the introduction of the euro. A joint test for equality of coefficients inside and outside the euro area (not reported) could not reject the hypothesis at any common level of significance(p-value 0.753 for high price and p-value 0.486 for low price). Thus, the effect of top quality restaurants seems to be homogeneous among European countries regardless of the adoption of the new currency. A possible explanation is the occurrence of bad weather which caused an increase in food cost within Europe. Since high quality restaurants tend to consider different varieties of products as imperfect substitutes, they have a more limited choice of ingredients than other restaurants. Thus, in the event of an increase in food price, they are not able to choose those varieties which have been less affected by the weather. Hence, an increase in food cost might have affected top restaurants more than low quality restaurants.

The robustness of our results to the introduction of additional explanatory variables has also been tested. We estimated the model allowing for heterogeneous strategies (RR, RT and PR) also within non-euro countries. However, coefficients do not seem to differ outside the euro area. The results shown are also robust to the introduction of the number of forks awarded to the individual restaurant. The number of forks (which takes values 1,2,3,4,5 according to the venue's luxury and comfort) is a quality indicator more easily observable for customers than the quality of cuisine, and never results significant.

5 Conclusions

The introduction of the euro has had inflationary consequences on the service sector and in particular on the catering market. Restaurant prices have registered marked increases in all countries belonging to the euro zone. Far

from being a neutral monetary reform, the adoption of a common currency has acted as a coordinating device, shifting the industry to a high-price equilibrium.

The theoretical predictions of our model of the catering market with multiplicity of equilibria are strongly supported by empirical evidence based on data from the Michelin Red Guide. The occurrence of abnormal price increases in countries belonging to the Euro area confirms the validity of our interpretation against popular alternative explanations such as increases in costs driven by bad weather.

The marked price increases in restaurants in tourist locations would seem to indicate the superiority of our theory also over the suggested justification in terms of rounding-off of prices in the new currency or overdue and delayed adjustment of menus.

The increase in the price of meals should not be regarded as a transitory blip destined eventually to revert back. Higher prices are here to stay unless an unlikely massive coordinated boycott by customers takes place.

Impressive as it is, the quantitative relevance of the phenomenon found in our empirical analysis is surely underestimated. Our results are, in fact, based on a sample of selected and reliable restaurants. The Michelin Red Guide is arguably one of the best and most exacting Restaurant guides in the world, where the truly bad tourist traps would never find place.

In conclusion, we must be prepared to accept the idea that there has been a permanent and significant change in relative prices in Euroland, with long-lasting redistributional effects in favour of the catering sector.

A Symmetric Equilibria

Let us consider the possible cases:

1. $c(x_L) < p_T^* \leq v(x_L) < v(x_M) < v(x_H)$.
2. $c(x_L) < v(x_L) < p_T^* < v(x_M) < v(x_H)$.
3. $c(x_L) < v(x_L) < v(x_M) \leq p_T^* < v(x_H)$.

First case: $p_T^* \leq v(x_L)$

It is immediately possible to show that a Tourist will never be in the case $p_T^* < v(x_L)$. Since the lowest possible quality is $v(x_L)$, for $p_T^* < v(x_L)$ it always holds $p_T^* < E(v(x_j)|\overline{p}_T^*)$. In other words the Tourist is refusing too many profitable meals and would be better off with a higher reservation price. Thus, we can rule out this case. The case $p_T^* = v(x_L)$ is a bit more complex:

Lemma 2. *The case $p_T^* = v(x_L)$ is a SPFE if and only if $c(x_M) \geq v(x_L)$.*

Proof. Assume $c(x_M) \geq v(x_L)$ and assume also that $v(x_L) \neq E(v(x_j)|v(x_L))$ in presence of $p_T^* = v(x_L)$. This can happen only in the case that some medium or high quality restaurants are selling at p_T^*. But, if $c(x_M) \geq v(x_L)$ they are making non-positive profits and would be better off by dealing only with Locals. Thus, the equality $p_T^* = v(x_L) = E(v(x_j)|v(x_L))$ must hold. Assume instead that $c(x_M) < v(x_L)$, then, by the expression for λ_M^{PR} there is a non-zero fraction of medium quality restaurants that is dealing with tourists. Thus, it must be $E(v(x_j)|v(x_L)) > v(x_L) = p_T^*$. □

Second case: $v(x_L) < p_T^* < v(x_M)$.

This is a more interesting case. In this case we have that $\lambda_L^{RT} - \underline{\lambda}$ low quality restaurants become PR (if they set $p = v(x_L) < p_T^*$ and $\overline{\lambda} - \lambda_L^{RT}$ become RT (by setting $p = p_T^* > v(x_L)$). Furthermore, $\lambda_M^{PR} - \underline{\lambda}$ medium quality restaurants become RR whereas $\overline{\lambda} - \lambda_M^{PR}$ become PR. The same applies for high quality restaurants. As for the restaurants, the Poisson nature of the process implies a discounted utility for a Tourist from a restaurant i of quality j equal to $\frac{\lambda_i}{\lambda_i+\delta} v(x_j)$. Thus, the expected quality given $\overline{p}_T^*$ is:

$$g(\overline{p}_T^*) = \theta \left(\int_{\underline{\lambda}}^{\overline{\lambda}} \frac{\lambda_i}{\lambda_i + \delta} v(x_L) d\lambda_i + \int_{\lambda_M^{PR}}^{\overline{\lambda}} \frac{\lambda_i}{\lambda_i + \delta} v(x_M) d\lambda_i \right) + \\ + \theta \left(\int_{\lambda_H^{PR}}^{\overline{\lambda}} \frac{\lambda_i}{\lambda_i + \delta} v(x_H) d\lambda_i \right) \qquad \text{(A.1)}$$

where $\theta \equiv 1/(\overline{\lambda} - \underline{\lambda})$. Note that the expression above depends on $\overline{p}_T^*$ through λ_M^{PR} and λ_H^{PR} which are just linear transformations of $\overline{p}_T^*$. Let denote them respectively:

$$\lambda_M(\overline{p}_T^*) \equiv \lambda_M^{PR} = \frac{v(x_M) - \overline{p}_T^*}{v(x_M) - c(x_M)}\lambda$$

and

$$\lambda_H(\overline{p}_T^*) \equiv \lambda_H^{PR} = \frac{v(x_H) - \overline{p}_T^*}{v(x_H) - c(x_H)}\lambda$$

Imposing symmetry ($p_T^* = \overline{p}_T^*$) and the equilibrium condition $g(\overline{p}_T^*) = p_T^*$ we obtain:

$$\begin{aligned} p_T^* = \theta a_0 v(x_L) + \theta a_1 (v(x_M) + v(x_H)) + \\ + \theta v(x_M) \left(\delta \ln(\lambda_M(p_T^*) + \delta) - \lambda_M(p_T^*)\right) + \\ + \theta v(x_H) \left(\delta \ln(\lambda_H(p_T^*) + \delta) - \lambda_H(p_T^*)\right) \end{aligned} \tag{A.2}$$

where:

$$a_0 \equiv \overline{\lambda} - \underline{\lambda} - \delta \ln(\overline{\lambda} + \delta) + \delta \ln(\underline{\lambda} + \delta)$$

and

$$a_1 \equiv \overline{\lambda} - \delta \ln(\overline{\lambda} + \delta)$$

and the right hand side in (A.2) is clearly nonlinear in p_T^*.

Third Case: $v(x_M) \leq p_T^* < v(x_H)$ In general, $v(x_M) = p_T^*$ is not an equilibrium unless for particular values of the parameters. Consider what happens if $p_T^* > v(x_M)$. In this case, again $\lambda_L^{RT} - \underline{\lambda}$ low quality restaurants become PR and $\overline{\lambda} - \lambda_L^{RT}$ become RT. Moreover, $\lambda_M^{RT} - \underline{\lambda}$ medium quality restaurants become PR and $\overline{\lambda} - \lambda_M^{RT}$ become RT (thus, if the price is high enough, also medium quality restaurants become RT). Finally, $\lambda_H^{PR} - \underline{\lambda}$ become RR and $\overline{\lambda} - \lambda_H^{PR}$ become PR[3]. The expected quality for a Tourist is:

$$\begin{aligned} g(\overline{p}_T^*) = \theta \left(\int_{\underline{\lambda}}^{\overline{\lambda}} \frac{\lambda_i}{\lambda_i + \delta} v(x_L) d\lambda_i + \int_{\underline{\lambda}}^{\overline{\lambda}} \frac{\lambda_i}{\lambda_i + \delta} v(x_M) d\lambda_i \right) + \\ + \theta \left(\int_{\lambda_H^{PR}}^{\overline{\lambda}} \frac{\lambda_i}{\lambda_i + \delta} v(x_H) d\lambda_i \right) \end{aligned}$$

and, using the same notation as in (A.2), the equilibrium is:

$$\begin{aligned} p_T^* = \theta a_0 (v(x_M) + v(x_L)) + \theta a_1 v(x_H) + \\ + \theta v(x_H) \left(\delta \ln(\lambda_H(p_T^*) + \delta) - \lambda_H(p_T^*)\right) \end{aligned} \tag{A.3}$$

[3]Note that the cutoffs λ_L^{RT} and λ_H^{PR} are different from the previous case since p_T^* is now higher.

and, again, the expected quality is nonlinear in the price. When the price $\overline{p}_T^*$ which is expected to prevail is lower than $v(x_M)$ the relevant function is that in (A.2). When $\overline{p}_T^* \geq v(x_M)$ the relationship (A.3) holds.

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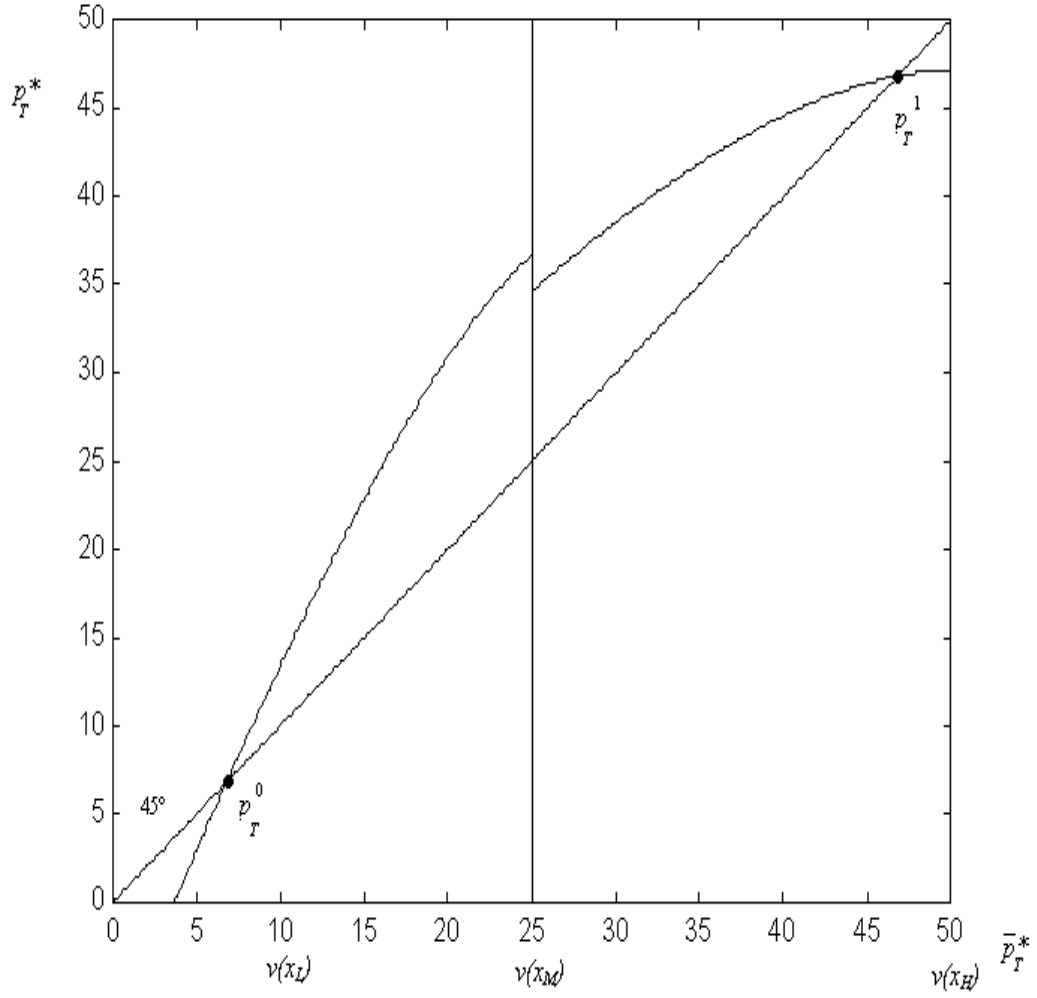
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Figure 1: Multiple Equilibria



The figure shows the possibility of multiple equilibria. It is based on the following set of parameters:

$v(x_L)$	10	$c(x_L)$	1	$\overline{\lambda}$	1
$v(x_M)$	25	$c(x_M)$	5	$\underline{\lambda}$	0.3
$v(x_H)$	50	$c(x_H)$	7	λ	1
δ	.8				

Table 1: Descriptive Statistics

	All Sample		Euro		Non Euro	
	ΔP^H	ΔP^L	ΔP^H	ΔP^L	ΔP^H	ΔP^L
Mean	0.036	0.033	0.048	0.043	0.000	0.005
S.d.	0.158	0.161	0.145	0.129	0.186	0.227
Min	-1.099	-1.374	-1.099	-0.624	-0.726	-1.374
Max	1.264	0.951	1.264	0.951	0.645	0.681
Obs.	746	746	552	552	194	194

Notes:ΔP^H is the logarithmic difference of the maximum price between the 2003 and the 2002 editions. ΔP^L is that is the logarithmic difference of the minimum price.

Table 2: Country Averages

Country	ΔP^H (S.d.)	ΔP^L (S.d.)	Obs.
Denmark	-0.076	-0.001	11
	(0.242)	(0.272)	
Sweden	-0.019	-0.014	28
	(0.157)	(0.269)	
UK	0.009	0.009	155
	(0.186)	(0.217)	
Italy	0.056	0.055	155
	(0.169)	(0.134)	
France	0.053	0.051	216
	(0.151)	(0.135)	
Germany	0.035	0.025	181
	(0.113)	(0.115)	

Table 3: OLS estimates for Equation (8)

	Dependent Var.	
Variable	ΔP^H	ΔP^L
EURORT	0.062*	0.060*
	(0.018)	(0.019)
EURORR	0.031	0.017
	(0.016)	(0.018)
EUROPR	0.036	0.021
	(0.019)	(0.021)
STAR1	0.021	0.024
	(0.016)	(0.014)
STAR2	0.039*	0.048*
	(0.016)	(0.015)
STAR3	0.053*	0.044*
	(0.021)	(0.017)
cons	-0.003	0.001
	(0.014)	(0.017)
R^2	0.035	0.035
$\mathcal{F}_1 : F_{(3,739)}$	3.93**	6.06***
p-value	(0.008)	(0.000)
$\mathcal{F}_2 : F_{(2,739)}$	2.23	7.17***
p-value	(0.108)	(0.001)
$\mathcal{T}_1 : t_{739}$	2.09*	3.73***
p-value	(0.018)	(0.000)
$\mathcal{T}_2 : t_{739}$	1.40	2.38*
p-value	(0.161)	(0.018)
$\mathcal{T}_3 : t_{739}$	0.36	0.28
p-value	(0.719)	(0.784)

Notes: The table reports OLS estimates for Equation (8) with heteroscedasticity robust standard errors (in parentheses). Number of observations = 746. The left (right) column shows results when logarithmic difference in the maximum (minimum) price is the dependent variable. Tests for the following hypotheses are reported:
$\mathcal{F}_1$: $EURORT = EUROPR = EURORR = 0$.
$\mathcal{F}_2$: $EURORT = EUROPR = EURORR$.
$\mathcal{T}_1$: $EURORT = EURORR$ against $EURORT > EURORR$ (one-sided).
$\mathcal{T}_2$: $EURORT = EUROPR$ (two-sided).
$\mathcal{T}_3$: $EUROPR = EURORR$ (two-sided).
* = 5% significant. ** = 1% significant. *** = 0.1% significant.