

# Who Pays The VAT ?

Evidences of an hysteresis effect in the prices shifting under VAT variations

France 1995-2000

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## **Abstract**

We studied the incidence of commodity taxation. The point was to understand who pays this tax, the customers or the firms. Indeed, this tax is supposed to be paid by customers. But, through a demand's decrease on markets, it may also be paid by the companies. This question is obviously important for fiscal policies. First we made a survey of theories on the price shifting under tax rate variations, taking in account several imperfect market effects. Then, we used three French fiscal reforms in order to examine the real price shiftings. These reforms, who took place in 1995, 1999 and 2000, changed the VAT's rate for a selected number of goods, while this rate did not change for the others. We found that the price shiftings are very close to 100 % for labor-intensive services. Furthermore, the price shifting is smaller when more fixed capital is needed. We also demonstrated the existence of a hysteresis effect in the price shiftings, which are bigger upwards than downwards.

# 1 Introduction

The Value Added Tax has become one of the heaviest taxation way throughout Europe, while different kinds of commodity taxation take a more important place in other country fiscal systems. Not only these indirect taxes are quite easy to recover and provide important and regular resources - for example, the VAT is collected in France at the middle of each month, the taxed period being the previous month - but also these taxes are often considered as non distortive ones, which means that it would not change the economic agents' behavior, which would induce inefficiencies in the economy.

The way of thinking which implies that the distortions are tiny is just one of the possibilities. It actually implies that the variation of the good's quantities sold are very small, even if the tax is completely transmitted in the prices. In this case, the elasticity of the good demand has to be very low. One of the consequences of this hypothesis is that the tax is paid only by the customers. But on an opposite hypothesis, if the elasticity of the good demand is high, the producers must not increase the price completely, in order not to have a too strong decrease of the demand. If this situation occurs, it means that the firms would pay a part of the indirect tax.

To know who pays the taxes is not of small interest because it has a great influence on the fiscal policies. For example, the French government increased the VAT's rate from 18,6 % to 20,6 % in September 1995, thinking the VAT would only be paid by the customers, and therefore there would not be any risk of slowing the growth. We analyze in this paper the real consequences of this reform, showing that the tax is also paid by the firms. The opposition party, although it had contested the reform, did not revoke it when it got the majority at the parliament in may 1997. They argued the existence of an asymmetric shifting of prices, thinking that the firms, not constrained by competition, would only transmit the variations of VAT in the prices on the increase. What follows directly is that a price on the market is the result of the path of all the indirect taxes fixed on the good in its history.

Both those explanations are not enough to understand the price shifting. One important missing argument is that a price modification has an effect on demand, therefore the supply also varies when the price does. Indeed, modifications of the productions induce modifications of the marginal production costs, if the returns to scale are not constant. Under perfect competition hypothesis, output prices are equal to the marginal cost, and the

pre-tax prices vary if the VAT's rate does. Then, the price shifting is different from 100 %.

It is also far more complicated under imperfect competition hypothesis. Several kind of imperfections on the markets have been modelled to understand odd effects on the price shifting. For an example, it is logical that when the production costs increase, due to an increase of VAT's rate, the monopolistic power of the remaining firms on that market also increases. Indeed, the increase of the production costs may lead to a market restriction, which induces a decrease of the number of firms on this market. The price shifting may then be higher than in the perfect competition model, and even be higher than 100 %.

Katz & Rosen (1985) [13] studied the oligopoly case and found indeed that the prices may be over shifted. Stern (1987) [19] also studied the price shifting in an oligopolistic market, and found the same result as under monopolistic competition. The prices are full-shifted if the demand elasticity equals the supply elasticity, over shifted if it is inferior, and under shifted if it is superior. Finally, we can mention that Besley (1989) [3] studied the question of entry through the cases of increasing returns production technology. He found an over shifting of the prices if the demand function is concave and an under shifting if it is convex.

In the second section, we explain the models with more details and the main theoretical results. Following, we analyze the theoretical times for the price shifting. We look therefore at the different adjustment dynamics of the production plans. Actually, the point is to determine the differences between the time of the output quantity variations upwards and downwards. Indeed, it is easier to restrict the output than to increase it quickly. Then, we would see hysteresis effect in the middle run, it is the result of the fact that if we consider the prices given from the output by the inverse demand function, they do not vary symmetrically for an increase or a decrease of the tax' rate.

The rest of our study is mainly dedicated to an empirical work. We try to test the theoretical predictions through three natural experiences given by three fiscal reforms of the VAT's rate that occurred in France in the second half of the nineties. The data we used for the study is presented in the third section.

In the fourth section, we empirically test the price shiftings which occurred following the French fiscal reforms of 1995, 1999 and 2000. Thus, we observe only under shifted prices. Furthermore, the price shiftings are smaller when the sizes of the firms in the market are bigger or when more material capital is needed. Both fixed capital and big

structures of production make it more difficult to change quickly the output quantity. We also try to understand the differences between the price shiftings of a same good at the different reforms. The first argument we use is the non linearity of the demand and supply functions, which applies because the tax' rate variation size varies with the fiscal reform. We also note that this phenomenon may be explained by a hysteresis effect because of the different directions of the VAT's rate variations in the fiscal reforms used in the study.

## 2 A survey of the potential effects

In this second chapter, we analyze the different price dynamics that might be observed. Introducing a new commodity tax can influence the demand and supply of this good. A new equilibrium is established on the market, defining both the output quantities and the prices. Under perfect competition hypothesis, the price is the marginal production cost. The new equilibrium depends only on the previous equilibrium and the supply and demand elasticity (with possibly the substitution elasticities).

Furthermore, the determination of the new equilibrium is complicated if we consider imperfect competition effects. Indeed, the structure of the market can itself be modified by the modification of the tax.

In this section, we make a review of the possible adjustments in various structures of market.

### 2.1 The model under perfect competition

Under perfect competition hypothesis, the price is indeed the marginal cost of production, and it depends on the produced quantity, except in case of constant production costs. Under the classical hypothesis of perfect competition with increasing production cost, the price shifting is inferior to one. Considering tiny tax variations, the price shifting is given by the equation 1 after a simple trigonometric calculation.

$$x = \frac{\frac{\partial O}{\partial p}}{\frac{\partial O}{\partial p} - \frac{\partial D}{\partial p}} \quad (1)$$

In equation 1,  $O(p)$  is the firm supply function and  $D(p)$  is the customer demand function. The price shifting is equal to zero if  $\frac{\partial O}{\partial p} = 0$  or  $\frac{\partial D}{\partial p} = \infty$ . On the other hand, the prices are full shifted if  $\frac{\partial O}{\partial p} = \infty$  or  $\frac{\partial D}{\partial p} = 0$ . According to this theory the prices are often under shifted.

We can also add substitution effects in the demand function. Indeed, we only considered previously a richness effect : the good is less consumed when the price increases. Here, we also consider that increasing or decreasing the price of a good may influence the demand of others, by substitutions between two goods consuming when the relative price vary.

Still under perfect competition, we consider now that demand functions for the goods 1 and 2 ( $D_i(p_1, p_2)$ ) depend on the prices of the two goods. Equalities between demand and supply on the two markets after introducing a new tax  $\tau_1$  on the good 1 are the following :

$$D_1(p_1 + \partial p_1, p_2 + \partial p_2) = O_1([p_1 + \partial p_1][1 - \tau_1])$$

$$D_2(p_1 + \partial p_1, p_2 + \partial p_2) = O_2(p_1 + \partial p_1)$$

Developing on the first order in  $\tau$  and  $\frac{\partial p_i}{p_i}$ , then resolving the two equation system with two variables, we obtain equation 2.

$$x = \frac{\frac{\partial O_1}{\partial p_1}}{\frac{\partial O_1}{\partial p_1} - \frac{\partial D_1}{\partial p_1} - \frac{\frac{\partial D_1}{\partial p_2} \frac{\partial D_2}{\partial p_1}}{\frac{\partial O_2}{\partial p_2} - \frac{\partial D_2}{\partial p_2}}} \quad (2)$$

In case of no substitution at all, the result of equation 2 is the same as the one of equation 1. Then, the difference between the price shiftings with or without substitution effects depends on both the signs of  $\frac{\partial D_1}{\partial p_2}$  and  $\frac{\partial D_2}{\partial p_1}$ . Indeed, each may be positive or negative, because two effects are opposed. First, the richness effect, influencing the quotient to be negative. It is due to the fact that with no varying budget, an economic agent decreases his consumption of both the goods when the price of one increases. The opposite effect, the substitution one, comes from the fact that when the price of good  $i$  increases, the relative price of the good  $j$  decreases. This leads to an increase of the marginal utility of goods  $i$  and then to an increase of the consumption of good  $j$ .

If the balance between the richness and substitution effects is the same for both the goods, the prices shifting is increased. Indeed, if the substitution effect is strong for both the goods, an increase of the tax rate on good  $i$  induce an increase of the demand of good  $j$ , then an increase of the price of goods  $j$ , which leads at the end to an increase of the demand and the price of good  $i$ .

On the other hand, if the reactions of the demands of both goods to a variation of the price of the other good are opposed<sup>1</sup>, the price shiftings are decreased. Indeed, in this case,

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<sup>1</sup>What may be interpreted as the existence of an essence good and a luxury good. Indeed, on one hand,

the demand of the good without tax variation increases - for the essence good for example. Then its price also increases. Demand of the luxury decreases another time to attenuate the essence good price increase effects. It follows that the substitution effects between the goods lower the price shiftings in comparison with the standard case<sup>2</sup>.

## 2.2 Effects of imperfect competitions

More than the substitution effects, other phenomenon influence price shifting. Until now, we followed the perfect competition rules to calculate price shifting, but some of these hypothesis may be argued. Several kind of imperfect market models have been described. In the cases of a monopoly or an oligopoly market for example, firms are not small enough to be considered as price takers. The introduction of increasing return to scale changes also the results of the perfect competition theory, one of the reasons is that it may induce problems of entry. From another point of view, Dixit and Stiglitz have presented the monopolistic competition model, in which each firm has a monopole power because of a diversification of the output.

Katz & Rosen (1985) [13] first noticed that the price shiftings may be superior to 100%. Their model follows the hypothesis of an oligopoly market, while they noticed that price shifting depends on the market's structure. Stern (1987) [19] also studied an oligopoly market. He demonstrated that the price shifting depends only on the ratio  $\frac{\frac{\partial O}{\partial p}}{\frac{\partial D}{\partial p}}$ , if it's superior to one, the price shifting will also be superior to one and vice versa. An isoelasticity leads to prices fully shifted. In the monopolistic competition case, the results are quite the same. To end this quick review, we notice that Besley (1989) [3] studied the question of entry. His model leads to results that also depend on the demand function. The prices are over shifted if it is convex and under shifted if it is concave.

Reading these papers, it seems that the prices shifting is bigger under imperfect competition than under perfect competition. It is a bit more complicated in fact, Delipalla & Keen (1992) [10] built a model that allows to calculate the price shiftings under Cournot competition or free entrance oligopoly. The result is that the price shiftings are bigger under free entrance oligopoly conditions than under the Cournot competition conditions if returns

if the price of the essence good increases, the consumption of the luxury good decreases to attenuate the decrease of the consumption of the essence good. On the other hand, if the price of the luxury good increases, its consumption decreases with substitution in consumption of the essence good.

<sup>2</sup>A symmetrical reasoning may explain a decrease of the essence good price shifting.

of scale are not too increasing<sup>3</sup>.

Each of these theories predicts that each shifting is possible, depending on the demand and supply functions. Then neither of them is really helpful to predict the price shiftings or to answer the question : who pays the VAT ? The precious information they give is only that the prices may be over shifted.

### 2.3 Output analysis

The fundamental conclusion of the previous section is that price shiftings under imperfect competition conditions are bigger than those under perfect competition conditions<sup>4</sup>. Another way of studying this question is to have an output analysis which shows single direction effects. In this section we consider that the prices are given by the supply through the inverse function of demand. That is why we study the supply and the effect on it. The first effect we try to understand is the output targeting of the firms, the second is the the output plan's flexibility, depending on the direction of variation.

We assume now that the output plan of a firm is not always the best for the owner of the firm. It means that some manager may target the sales turnover rather than the only benefits. This hypothesis would be observed in big companies, which are managed by persons who are not shareholders and are mainly interested in the prestige of the company, rather than in small ones, managed by the few shareholders who are interested only in the benefits.

We assume that the manager maximizes a utility function  $U(\pi, Y)$  depending on the profit  $\pi$  and the sales turnover  $Y$ . Facing the production cost function  $C(Y)$  increasing and convex and the demand function of the customers  $D(p)$  strictly decreasing, the maximization problem with the manager price taker is :

$$\max_Y U(\pi, Y)$$

$$U.C. : \pi = \frac{p}{1+t}Y - C(Y)$$

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<sup>3</sup>The marginal production cost not decreasing condition is enough, the complete condition is :  $C_{xx} > 0$  or  $C_{xx} < 0$  but  $|C_{xx}| < \lambda(1-t)|P_X|$ . Where  $t$  is the commodity tax,  $P$  the inverse demand function,  $C$  the production cost with fixed costs and  $\lambda = \frac{dX}{dx_i}$  is the anticipation of the other firm reactions.

<sup>4</sup>However, we must notice that the supply function in Stern (1987) [19] can not be compared with the one of the perfect competition model.

Then the first order conditions are :

$$\begin{aligned}\frac{\partial U}{\partial \pi} - \lambda &= 0 \\ \frac{\partial U}{\partial Y} + \lambda \left[ \frac{p}{1+t} - C'(Y) \right] &= 0 \\ \pi &= \frac{pY}{1+t} - C(Y)\end{aligned}$$

To make the calculation more simple, we choose a logarithm utility function :  $U(\pi, Y) = \log(\pi) + \sigma \log(Y)$ . With this one, the first two conditions give an implicit value of  $Y$  :

$$C'(Y) = \frac{p}{1+t} + \sigma \frac{\pi}{Y} \quad (3)$$

We first notice that in the case of  $\sigma = 0$ , which is the classical one, the output is fixed in order to have the marginal production cost equal to the after tax price. The second observation is - as the model was built for - that the production increases, and then the price decreases, when  $\sigma$  increases. Let us remember that  $\sigma$  is a scale that describes the importance of the sales turnover for the manager.

We now introduce the inverse demand function to eliminate the price in equation 3, then we differentiate it with a first order limited development, which gives us equation 4 :

$$\frac{dY}{dt} = - \frac{(1-\sigma)D^{-1}(Y)}{(1+t)C''(Y) - \frac{(D^{-1})'(Y)}{1+t} + \sigma \left[ \frac{C'(Y)}{Y} - \frac{C(Y)}{Y^2} - \frac{(D^{-1})'(Y)}{1+t} \right]} \quad (4)$$

Our hypothesis gives directly  $D^{-1} > 0$ ,  $(D^{-1})'(Y) < 0$ ,  $C''(Y) > 0$  and  $C'(Y) > \frac{C(Y)}{Y}$ <sup>5</sup>. It follows that if  $\sigma = 0$ , both the numerator and the denominator are positives, then  $\frac{dY}{dt} < 0$ . That is the result that under perfect competition hypothesis, the prices are under shifted<sup>6</sup>. If  $0 < \sigma < 1$ , the numerator and the denominator are still positives, then the prices are still under shifted. But we notice that the numerator decreases with  $\sigma$  and the denominator increases with  $\sigma$ . It means that the higher  $\sigma$  is the lower the output shifting is, then the price shifting decreases with  $\sigma$ .

This model predicts that we would find lower prices shifting on the market when a lot of firms are not managed by the shareholders.

Another analysis based on the output may be useful to understand the asymmetric price variations. Indeed, following the previous reasoning on the output quantity variations after

<sup>5</sup>This last inequality is true because  $C$  is convex and  $C(0) = 0$ .

<sup>6</sup>The output decreases when the tax rate increases, then the price increases because the inverse demand function decreases with  $Y$ .



a VAT rate modification, we are interested in the output shifting dynamic. The point is to explain some potential hysteresis effects, by considering the variation dynamic of the production plans. What we call hysteresis effects is the fact that the price shiftings are different upwards from downward. The main difference studied here lies in the lengths of the shifting time.

More precisely, we try to explain why it is more difficult - or why it takes more time - to increase the output quantity than to restrict it. First let us go back to the influence of the ability to change quickly the production plans on the price shiftintgs. With the perfect competition hypothesis in which the firms are price takers, the price is fixed on the market by the quantity of output through the customers' inverse function of demand. Then, with the production cost function given and increasing, a price decrease<sup>7</sup> leads to and is allowed by a decrease of the output, and a price increase leads to an increase of the supply.

After a fiscal reform increasing the VAT rate for example, the before-tax price decreases. Then, their supply as to decrease in order to decrease the production costs<sup>8</sup>. This decrease of the supply, in interaction on the market with the demand function, leads to a price increase, but the important point is that if the previous price was equal to the marginal cost, not decreasing the supply for the firms leads to deficit. That is why they decrease the production right after a tax rate increase. Another way of decreasing the production is closing the firm which can not evolve quickly enough. One last reason for this decrease is that it is not very difficult to produce less.

On the other hand, increasing the production is far more complicated and takes much more time. Increasing the output depends not only on the willingness of the manager. Restructuring the production process can take a lot of time. It may consist in buying new equipment or recruiting new workers. This means that the market can not always react instantly to a decrease of the VAT rate. If the quantity on the market does not increase instantly, the companies have no reason to decrease their prices quickly. Each firm will wait for the other firms to increase their production increase or for the creation of new firms before decreasing their prices. What follows logically is that the price decreases do not

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<sup>7</sup>This price decrease is here caused by a decrease of the customers' inverse function of demand. In this case, we consider the before tax price, then a increase of the tax rate leads to a decrease of the inverse demand function of the customers, assuming that this is a function of the before tax price.

<sup>8</sup>This reasoning takes place in a perfect competition model, in which the production costs increase the output quantity

come quickly after a tax rate decrease.

Here lies a hysteresis effect, because although markets can restrict their production quickly after a VAT rate increase, the symmetrical expansion of the production in case of VAT rate decrease is delayed.

## 2.4 A previous empirical study

After these theoretical views, and before beginning our empirical analysis of the three French fiscal reforms, it is important to note that an empirical study already exists on this subject. Besley & Rosen (1999) [4] elaborated a test on 12 goods in the United States between 1982 and 1990. There is no VAT in United States, but a lot of commodity tax on various levels. This situation leads to a lot of small modifications of the global indirect tax rate. It allowed them to make a double direction regression through the time and in different cities. Their regressions are explain by the equation 5 :

$$\ln(p_{i,j,t}) = \beta_{1,i}\tau_{i,j,t} + \beta_{2,i}C_{i,j,t} + CITY_{i,j} + TIME_{i,t} + \varepsilon_{i,j,t} \quad (5)$$

Where  $i$  represent the good and  $j$  the city and  $C_{i,j,t}$  the production costs. The parameter to follow is  $\beta_{1,i}$ . In their results, a lot of good prices are full-shifted, and the goods sold by supermarkets are over-shifted. They then conclude it is an evidence that the retail market is an oligopoly. They also found that the price shifting time is very short.

## 3 The data

As we say in the previous section, the number of strong hypothesis needed in order to know what a price shifting will be does not allow us to make predictions making only theoretical reasonings. That is in part why we built the following empirical study.

We know that the results depend mainly on the competition properties and the demand and supply elasticities. Usually, we do not have any of this knowledge before the empirical study, at that time we only have global information on the market structure. Nonetheless, this information is precious and reusable if we trust in the non modification of this market structure. It follow logically that our results will be useful for predictions in the case of small enough fiscal variations not to modify the market's structure. These remarks take account of a part of Lucas' critiques.

The empirical study consists in the analysis of three French fiscal reforms that occurred in the last nineties. Two of these fiscal reforms consist in a modification of the VAT' full rate. In August 1995, the full rate was increased from 18,6 % to 20,6 % and in April 2000 it was decreased from 20,6 % to 19,6 %. The third reform took place in a European experience on labor-intensive services. Following, the French VAT rate of the repair services for more than two year old habitations was decreased in September 1999 from the full rate to the reduce rate.

In our concern, the main data source is the prices of the goods concerned by the VAT reforms. In that purpose, we can use the long run price series built by INSEE. Thus we had had monthly series of 296 price indicators. We extracted from these 296 indicators the goods which represent the best the effect of the fiscal reforms. This means that we only chose indicators with the property that all the goods they represented had their VAT' rate affected in the same way by the fiscal reform.

Thus, we first chose the repair services for more than two year old habitations, which have been affected by both the fiscal reforms of 1995 and 1999. As reference for the fiscal reform of 1999, we chose the products for home repair<sup>9</sup>, whose VAT rate was not modified in 1999. Among the goods affected by the fiscal reforms of 1995 and 2000, we chose hairdressing services, restaurants and cafés' consumptions. As reference for these fiscal reform, we choose VAT reduce rate goods, health services and drugs.

## 4 The real price shiftings

The point of our study was to calculate the price shiftings of some goods, in order to tell apart, from all the objects that influence the price shifting, the ones which have a strong effect. As a summary of the second section, we can present three main effects on the price shifting. The first kind of effects is linked to the supply function. The price shiftings increase in the same way as the supply's elasticity. This elasticity is bigger if the labor-intensity is higher and the fixed capital level is lower. Furthermore, for companies whose mainly sell on out of the markets of the country concerned by the reform, these country's markets may be of low importance, and thus the supply elasticity in that country is high. The second kind of effects is linked to the competition structure, imperfect competition leads to higher

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<sup>9</sup>This price index includes the prices of paintings, varnish and wallpapers, articles of hardware, supply for do-it-yourself, wooden objects.

price shiftings, even superior to 100 %. The last kind of effects is linked to the strategy of the firm. The quest of high sales turnover leads to low price shiftings. Knowing the predominance of certain effects will enable us to predict price shiftings. This knowledge is both important to predict the fiscal earnings of a VAT reform and to know who pays the VAT, the customers or the firms.

As we said in the previous section, we used three French fiscal reforms, then we compared the properties of the reforms, the economic environment and the results in order to obtain sharper conclusions. First, we studied the European experience on labor-intensive services, which began in France September 1<sup>st</sup> 1999. The effect of this fiscal reform are easy to see because of the importance of the VAT variation, and therefore the importance of the effects on the economy. Indeed, at this time, the VAT rate for repair services for more than two years old habitations decreased from the full rate of 20,6 % to the reduce rate of 5,5 %.

Following, we studied two fiscal reforms modifying the full rate, and therefore a lot of different goods, but with very small variations. Indeed, the French VAT full rate increased from 18,6 % to 20,6 % July 1<sup>st</sup> 1995, then decreased from 20,6 % to 19,6 % April 1<sup>st</sup> 2000. On one hand, the fact that the VAT rate modifications has been very small allows us to consider that these variations were marginal and that they have not changed the markets' properties. On the other hand, it also made the results more difficult to observe.

#### 4.1 Labor-intensive services

The first variation we studied is linked to the European experience for the labor-intensive services. September 1<sup>st</sup> 1999, the VAT rate of the repair services for more than two year old habitations decreased from the full rate (then 20,6 %) to the reduce rate (5,5 %). The importance of the variation (the after tax price variation without any changes of the before tax price would be 12,6 %<sup>10</sup>) will be very useful to see the effects, but this may be too big decrease to allow the idea that nor the elasticities neither the market structure have been changed.

The first way to understand what happened at that time is to look at the prices of the reparation services in more than two year old habitation around the time of the fiscal reform. Figure 1 shows these prices and those of the products for such reparations, which

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<sup>10</sup>This value is indeed the variation of the after tax rate price of the good without any change of the before tax price :  $12,5 \% = \frac{1,206-1,055}{1,206}$

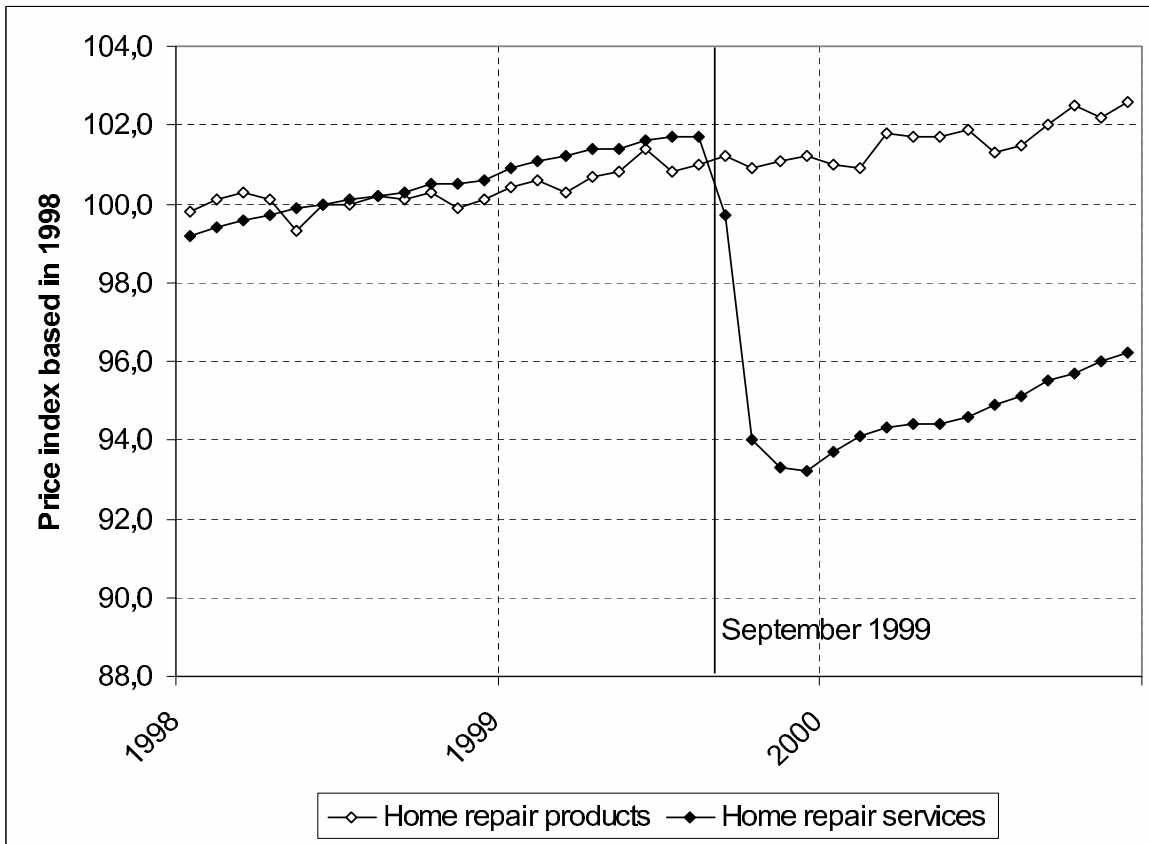


Figure 1: Prices around the 1999 French fiscal reform

were not been concerned by the fiscal reform and remained at the full VAT rate when the services VAT rate decreased to the reduce rate. We see immediately on this figure that the price decrease was strong and quick. Furthermore, we also note that the stabilization of around the new equilibrium - which can be observed in the fluctuations around the future inflation path - has been also very quick with very small fluctuations.

In order to measure the price shiftings, we calculate the difference of price changes between products and the services of repair for more than two year old habitations. Indeed these markets, whith purposes very close to each other, were not affected in the same way by the 1999 French fiscal reform. Moreover the inflation rate for these two prices in the year before the fiscal reform were strongly correlated :  $cor(services, products) = 79\%$ .

The point is to calculate the inflation rates for both goods, then to calculate the difference between them. The mean of this difference the year preceding the fiscal reform is  $-0,057\%$ . It is very small, and moreover it is far smaller than the standard deviation which is  $0,31\%$ . Table 1 shows the double differences, taking in account the fact that the inflation rate of

Month	September 99	October 99	November 99	December 99	January 2000	February 2000	March 2000
Cumulated price variations since the reform	2,16 %	7,70 %	9,72 %	8,94 %	8,14 %	7,57 %	8,30 %

Table 1 : Price shiftings for repair services for more than two year old habitations around the 1999 VAT's reform

Explicative variables	VAT variations	VAT variations 1 month delay	VAT variations 2 month delay	VAT variations 3 month delay
Coefficients	0,171 (0,011)	0,470 (0,011)	0,733 (0,011)	0,022 (0,011)
R <sup>2</sup>	99 %			
<b>Global price shifting</b>	<b>74 %</b>			

Table 2 : Price difference in difference regression on the VAT variations around the 1999 VAT's reform

both the products and the services for house repair are the same.

We stop our comparison in march 2000 because the VAT rate of the products for home repair has changed in April 2000. Indeed, this kind of goods which were taxed with the VAT full rate, saw this rate decrease from 20,6 % to 19,6 % on April 1<sup>st</sup> 2000.

We keep out of this table the number 8,3% as the final inflation difference between the services and the products for the reparation in habitations. Then we can calculate the price shifting that happened for the services :  $\frac{8,3\%}{12,5\%} = 66,4\%$ , we find here a price shifting around  $\frac{2}{3}$ . This number is altogether big enough to let us say that the price decrease were significant and far enough from 1 to show there has been modifications of the demand and supply of repair services for more than two year old habitations.

However, we must notice that this calculation is a bit poor. In order to have a more accurate level of the price shifting, we make the regression of the inflation rates of the prices of the repair services for more than two year old habitations on the variation rates of the VAT rates. Moreover, we add delays of the variation rates of the VAT rates to understand the shifting dynamic. The sum of the delay coefficients represents the total price shifting. In order to take account of the natural market fluctuations, we also add as explicative variables the inflation rates of the products for home repair, which means that we make this regression as difference in difference with the products for home repair as reference. The equation of this regression is explained in equation 6 and the results are shown in table 2.

$$\frac{p_t - p_{t-1}}{p_t} = \alpha + \sum_{i=0}^3 \beta_i \frac{VAT_{t-i} - VAT_{t-1-i}}{VAT_{t-1-i}} + f \frac{p_{prod,t} - p_{prod,t-1}}{p_{prod,t-1}} + \epsilon_t \quad (6)$$

First, we notice that this regression explains more than 99 % of the variance of the prices of the repair services for more than two year old habitation around the time of the French fiscal reform. We find here that the price shifting was 73 %, and the Fisher tests allow us to be sure that this price shifting has been superior to 65 % and inferior to 82 %. This result confirms what we said before, the price shifting was significant but significantly lower than 100 %.

In figure 2, we show the evolution of the prices of the repair services for more than two year old habitations, corrected from the natural inflation, based on the results of the regression.

This experience does not help us determine which of the effects described in the second section are the most important, because one unique good was studied. However, it is a good

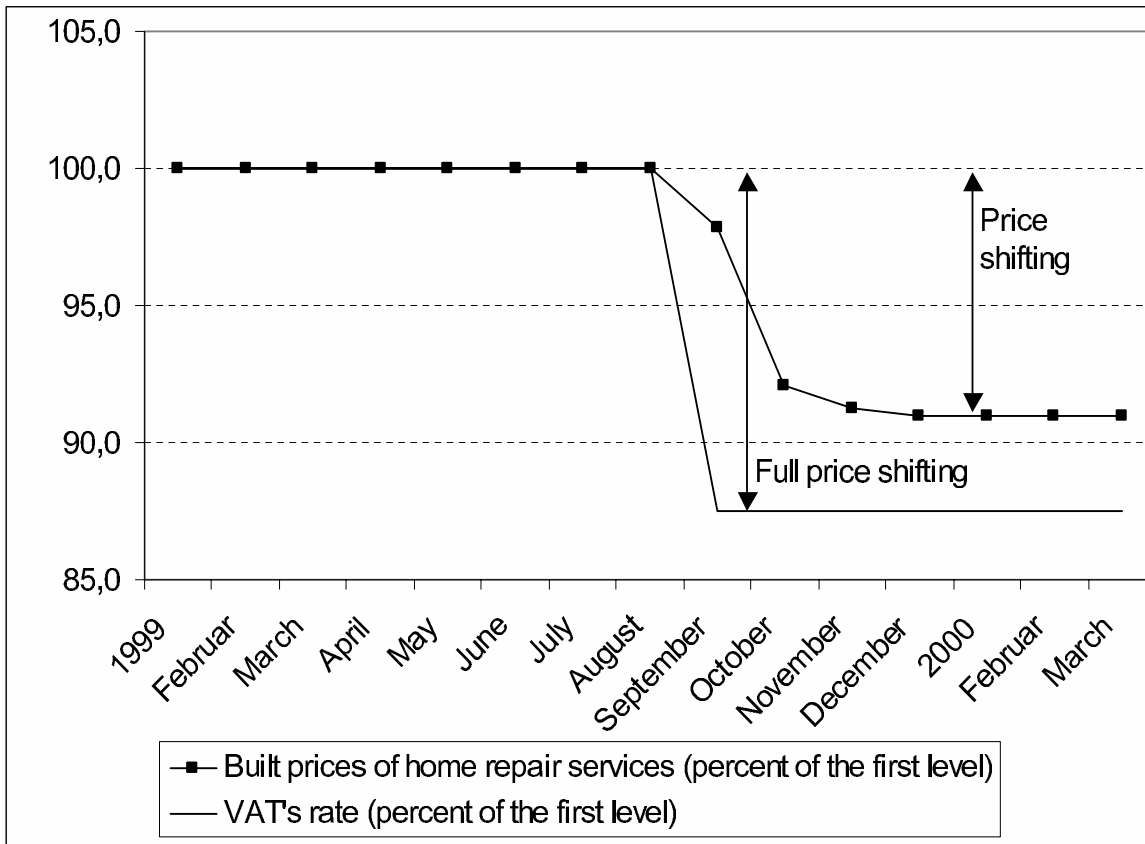


Figure 2: Natural inflation corrected prices around the 1999 French fiscal reform

illustration of price shiftings because of the importance of the VAT decrease. We can also interpret the results with our theoretical knowledge. Viewing equation 1, we may say that the price shiftings should have been very close to 100 %. Indeed, these services, provided mainly by very small firms, need very few fixed capital and quite only workers with little qualification. According to the idea that workers with little qualification are easy to find, the supply elasticity of the prices of reparation services is very high, and then these prices should be fully shifted.

Furthermore, taking into consideration the substitution effects is another reason to think that the price shifting should have been closer to 100 %. Indeed, an important black market for such services exists. It would be logical to think that these two markets are very substitute, and that  $\frac{\partial D_{black}}{\partial p_{legal}}$  and  $\frac{\partial D_{legal}}{\partial p_{black}}$  are both strictly positive. What follows from equation 2 is that these substitution effects increase the price shiftings, which can even be higher than 100 %.

This relatively small price shifting might give some information about the demand func-



tion of home repair services, which elasticity is surely very high. This hypothesis can be confirmed by looking at the activity on the market. Indeed, if supply and demand elasticities are both very high, a strong VAT rate decrease should have lead to an important increase of the activity.

#### 4.2 Increase of the VAT's full rate in 1995

The previous section, with the analysis of a big VAT rate variation, allows us to understand the mechanisms of price shifting. However this fiscal reform is not enough to answer our questions about the relative importance of the effects presented in the second section. Indeed, one unique good was studied, not allowing us to compare different price shifting on different kinds of markets. Now, we will talk about two others French fiscal reforms which concerned much more kinds of goods. First, on August 1<sup>st</sup> 1995, the VAT full rate increased from 18,6 % to 20,6 %. Thus, this French fiscal reform concerned all the goods taxed with the VAT full rate, that is the majority..

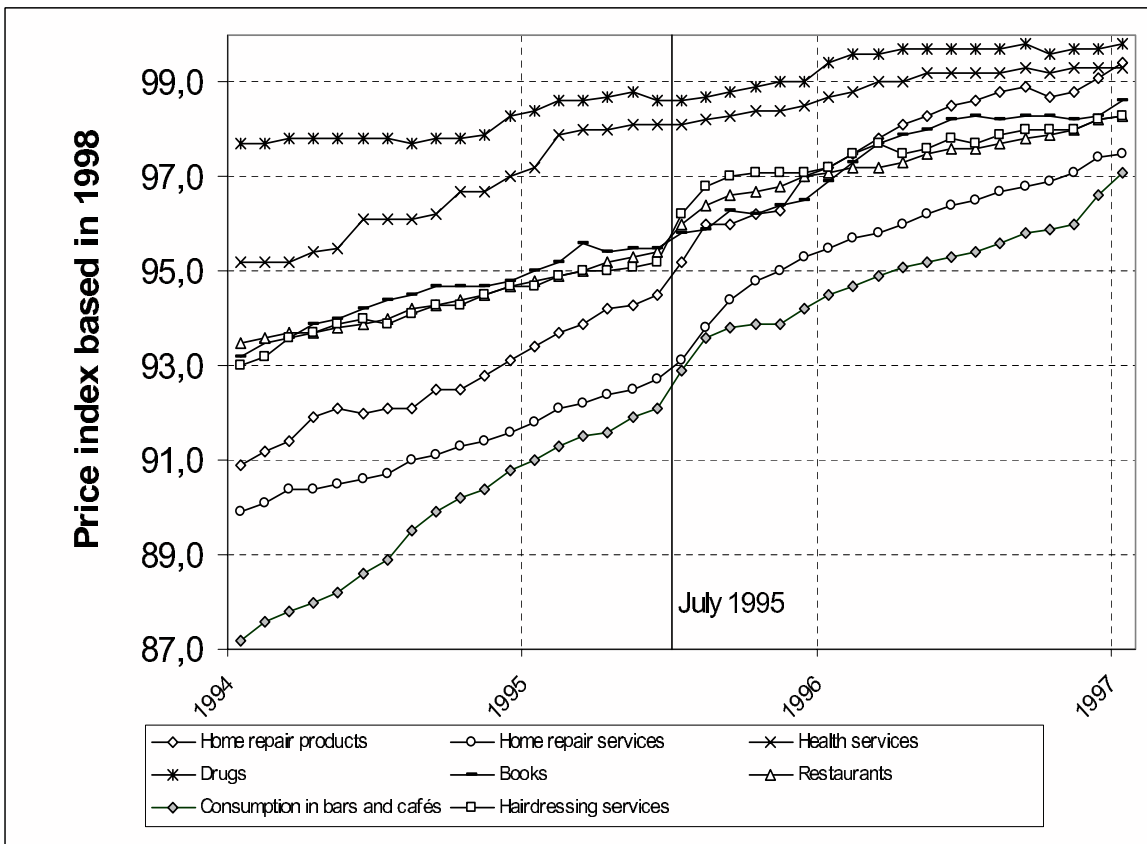


Figure 3: Prices around the 1999 French fiscal reform

First, just like in our study of the 1999 reform, we directly looked at the prices evolutions of the goods we chose to work on, as presented figure 3. As we have already mentioned, we chose to study the services and products for home repair, in order to compare with both goods and to compare with the results we already had for the 1999 French fiscal reform. It is for sure interesting to compare these goods produced for the same market, in a view of understanding the production structure influence on the price shiftings. We also studied hairdressing services, it was part of the sectors allowed to benefit from the European experience on the labor-intensive services. Because there is still a discussion about the decrease of the restaurant services VAT rate from the full rate to the reduce rate, arguing that it belongs among the labor-intensive services, it was also interesting to study it. We finally compared the reactions of this market with the ones of the consumptions in bars and cafés. These markets are quite similar, but with the notable difference that the bars and cafés sector is closed<sup>11</sup>.

In addition, we observe some other price index of goods which VAT rate did not changed. Indeed, health services, drugs and books are taxed with the VAT reduced rate. However, health services' price index is very closely correlated with to the negotiations between doctors and CNAM<sup>12</sup>, and is therefore independent from economic events and can not be used as reference.

Looking at figure 3, we easily see around the time of the VAT reform an increase of prices of the goods concerned by the VAT increase, whereas nothing happens for the prices of the goods taxed with the reduce VAT rate. Thus, we observe a translation of the inflation path just at the time of the reform, and it is very viewable because of the speed of the transition, which seems to have occurred in only two months.

The point is now to determine the value of this translation, and therefore the price shifting for each good. In that way we calculate the inflation's increases in table 3. This calculation has to be done with a control using the inflation trend (Simple Difference) or the inflation of a good which VAT's rate had not changed (Difference in Difference). As reference for the difference in difference calculation, we chose the price index for drugs.

Knowing the inflation increase due to the VAT rate increase, we can calculate the price

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<sup>11</sup>There is licences of bars numbered from I to IV, where licence I just allows to sell non alcoholic drinks, and more and more kind of drink are allowed to sell the bigger the number of the licence is. Actually, Paris' prefecture of police force declared that it does not provide any new licence from II to IV.

<sup>12</sup>Caisse Nationale d'Assurance Maladie, French health social security.

	August 95		September 95		October 95		November 95		December 95		Price Shifting	
	SD	DD	SD	DD	SD	DD	SD	DD	SD	DD	SD	DD
Home repair services	0,23 %	0,33 %	0,78 %	0,89 %	1,22 %	1,33 %	1,44 %	1,56 %	1,45 %	1,57 %	86 %	93 %
Home repair products	0,48 %	0,59 %	1,06 %	1,17 %	0,80 %	0,92 %	0,75 %	0,87 %	0,60 %	0,72 %	36 %	43 %
Restaurants	0,49 %	0,60 %	0,77 %	0,88 %	0,85 %	0,96 %	0,81 %	0,93 %	0,78 %	0,90 %	46 %	54 %
Consumptions in bars & cafés	0,60 %	0,71 %	1,09 %	1,20 %	1,04 %	1,15 %	0,88 %	0,99 %	0,61 %	0,73 %	36 %	43 %
Hairdressing services	0,94 %	1,05 %	1,46 %	1,57 %	1,56 %	1,68 %	1,56 %	1,68 %	1,46 %	1,58 %	87 %	94 %

Table 3 : Price variations after the 1995 VAT's reform

SD : Simple difference : inflation less mean of inflations before the reform

DD : Difference in difference : inflation less drugs inflation, less mean of the differences between the inflations of the product studied and drugs before the reform

shifting for each good. The price shifting also shown in table 3 is the ratio of the inflation increase on the inflation increase that would happen in case of no change of the before tax price :  $\frac{1,206-1,186}{1,186} = 1,68\%$ .

Both calculation methods provide similar results. As in the previous subsection, we can obtain more accurate results with difference in difference regressions, but we can already make a few comments. First, we notice that labor-intensive services have price shiftings very closely one to another's, and significantly superior to other's kinds of goods' price shifting. It seems to confirm one of the effects presented in the second section, which is that the price shiftings are higher when the labor-intensity is stronger.

In order to get more information from this experience, we made regressions. First we made as in the previous section a difference in difference regression taking the drugs inflation rate as reference (NC). Afterwards, we made another regression adding controls for the production costs. Indeed, production costs, and especially intermediate consumption prices, may vary at the time of a tax shock. The choice of the production costs and the construction of the controls are explained in appendix A. The results of this regression following equation 7 are presented in table 4.

$$\Delta Prix = \alpha + \sum_{i=0}^3 \beta_i \Delta VAT_{t-i} + f \Delta Prices_{drugs} + g \Delta Costs + \epsilon_t \quad (7)$$

First, we must notice the significance of these regression.  $R^2$  are very high - except for reparation products it is always superior to  $\frac{2}{3}$  - and all the coefficients for 0 or 1 month delay are significative.

Our previous thoughts about this fiscal shock are confirmed. Indeed, the price shiftings of the labor-intensive services are closer to 100 % than others. This means that hairdressing services prices react as the ones of the repair services for more than two year old habitations, which is a precious information since it implies that hairdressing services should benefit from the same European experience as the repair services. This confirms the effect of the labor-intensity on price shiftings. Provided that it is easy to find labor with low qualification, labor-intensive services can answer to an increased demand with little costs, and therefore the increase of the before tax price at the time of a decrease of the VAT rate is small. This leads to high price shiftings.

In addition, we can study at the same time cafés' and restaurants' price reactions. One can argue that there exist a crucial difference between these two sectors, which is that

Explicative Variables	VAT's variations		VAT's variations 1 month delay		VAT's variations 2 month delay		VAT's variations 3 month delay		R <sup>2</sup>		Price Shifting	
	NC	C	NC	C	NC	C	NC	C	NC	C	NC	C
Home repair services	0,143 (0,058)	0,152 (0,073)	0,328 (0,058)	0,329 (0,059)	0,261 (0,058)	0,261 (0,059)	0,133 (0,058)	0,132 (0,059)	67 %	67 %	86 %	87 %
Home repair products	0,318 (0,107)	0,336 (0,141)	0,355 (0,107)	0,344 (0,112)	-0,144 (0,107)	-0,137 (0,110)	-0,020 (0,105)	-0,025 (0,109)	44 %	45 %	51 %	52 %
Restaurants	0,307 (0,034)	0,405 (0,058)	0,177 (0,034)	0,172 (0,034)	0,053 (0,034)	0,052 (0,032)	-0,009 (0,036)	0,010 (0,032)	79 %	84 %	53 %	62 %
Consumptions in bars & cafés	0,361 (0,087)	0,504 (0,109)	0,286 (0,086)	0,273 (0,066)	-0,034 (0,087)	-0,010 (0,059)	-0,097 (0,087)	-0,090 (0,062)	50 %	78 %	52 %	68 %
Hairdressing services	0,560 (0,082)	0,512 (0,105)	0,297 (0,082)	0,269 (0,084)	0,050 (0,082)	0,067 (0,082)	-0,011 (0,079)	-0,015 (0,083)	66 %	69 %	90 %	83 %

Table 4 : Difference in difference regression of price variations on VAT's rate variations around the 1995 French fiscal reform

NC : Difference in difference regressions without control

C : Difference in difference regressions with controlling by the production costs, as explained in Appendix A

the cafés' sector is closed. It seems that this separation is not significant because a high proportion of commercial establishments provide both services. Moreover, the number of cafés and restaurant is very high in France<sup>13</sup>, so far the limitations of the bar licences is not constraining.

Studying this services, we first notice that controlling by the production costs is very important. Indeed we see a strong increase of the percentage of variance explained by the regression when introducing these controls. Furthermore introducing these controls gives far bigger price shiftings as results. It is easily understandable when one knows that some intermediate consumptions were also concerned by the fiscal reform. Thus - because the



Figure 4: Natural inflation corrected prices around the 1995 French fiscal reform

price shiftings of these intermediate consumptions is inferior to 100 % - their before tax price decreased when their after tax price increased, and then the cafés and restaurants - which

<sup>13</sup>The reason given by Paris prefecture for no more deliver any bar licences from II to IV is that the number is already too high. There existed more than 13 000 bars and restaurants in Paris in 2001, which means that this is the kind of commerce the most present in Paris.

buy their intermediate consumptions without VAT - had cheaper intermediate consumptions after the reform. Not taking in account this fact would have lead us to under-estimate the price shiftings.

The cafés and restaurants price shiftings are medium, as one can easily see in figure 4. It is also a confirmation of the effect of the capital intensive structure of the economic sector. Indeed they are labor-intensive services, according to some asking for an European agreement for the reduction of their VAT's rate as for other labor-intensive services. But it is required to possess one goodwill, and it usually costs much<sup>14</sup> and a lot of investments might be done for the equipment or the decoration. Thus the fixed capital required in this economic sector is also quite important. The restaurants and cafés have then a medium capitalistic structure. Finding that their price shiftings are medium is a confirmation of the capital effect.

The case of products for home repair is different because most of the effects that we describe in section 2 might occur. First, this kind of production needs a lot of fixed capital, which would induces a small supply elasticity.

But the previous effect is balanced by the fact that most of the companies producing this kind of goods are international ones. Therefore, French market does not represent to them the majority of the sellings. The international marketing allowed them to change significatively their French sellings, which means that the French supply elasticity for this output is big.

Furthermore this products for home repair are mainly sold by the retail oligopoly. According to the results that we presented in section 2, this situation should lead to a high price shifting.

The last effect on this market might be caused by the fact that the companies' targeting might not be to maximize their present profit, but also the future ones. In that view, it can be interesting for them to keep high sale turnovers at the shock time. According to the turnover targeting model developed in section 2.3, this leads to a decrease of the price shifting.

The results of the regression indicate that the price shifting for the products for home repair is quite low : only 52 %. We can conclude from that result that the sale turnover targeting and the capitalistic's settings influence the price shiftings more than the two other

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<sup>14</sup>The goodwills are usually sold at a price approximatively equal to the the yearly turnover.

effects.

### 4.3 Decrease of the VAT full rate in 2000

We already studied a huge decrease of a single good VAT's rate in section 4.1 and a small increase of a lot of ones in section 4.2, which provides us information about the real intensity of the effects that we presented in section 2. The point of the present section is to test the symmetrical properties of the variations. We explained in section 2.3 that a hysteresis effect might occur, caused by the asymmetrical production plan's variations. Now, we want to know if it implies viewable effects or if it is just marginal effects.

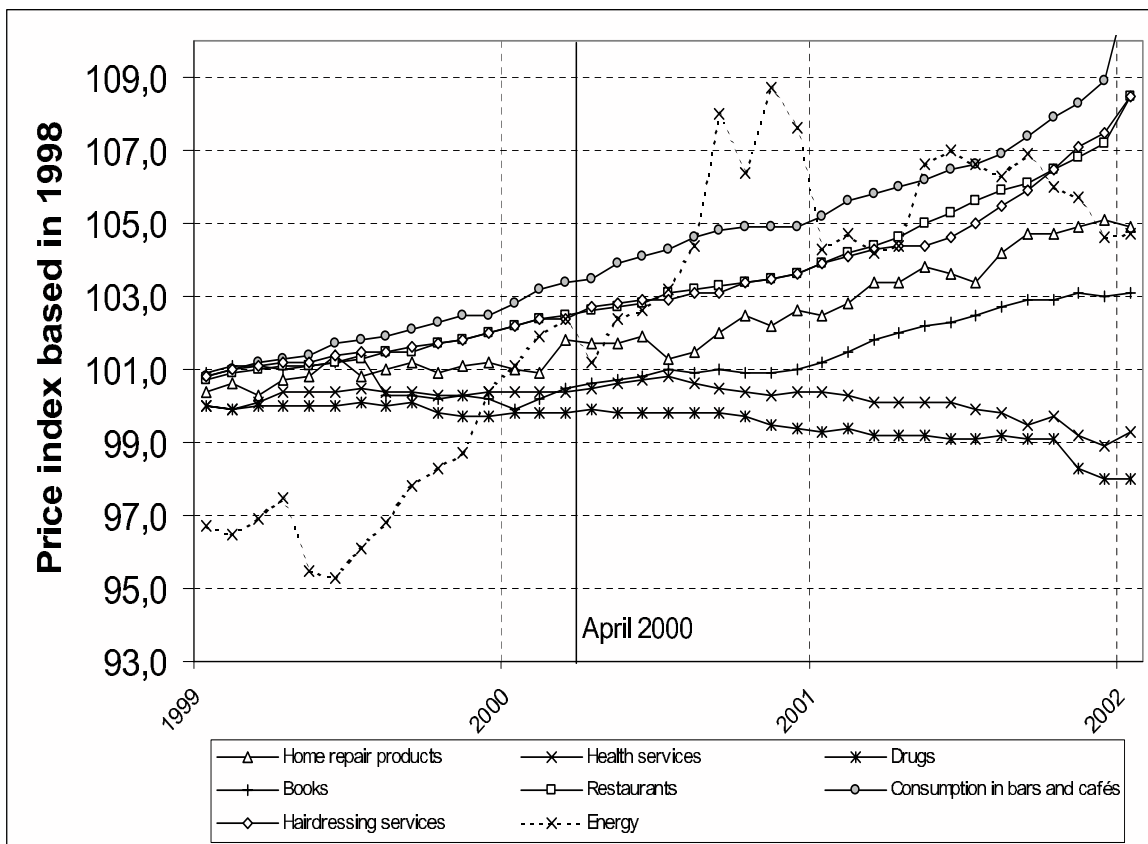


Figure 5: Prices around the 1999 French fiscal reform

In order to test it, we use the French fiscal reform that happened on April 2000, when the VAT full rate decreases from 20,6 % to 19,6 %. It is important to know that this experience is far less limpid than the previous ones. Indeed the VAT's rate only decreased of 1 %, which represent a very small decrease of half the level of the 1995's increase. Furthermore, at the time of the reform, a huge increase (relatively to its trend) of the energy prices



Explicative variables	VAT's variations		VAT's variations 1 month delay		VAT's variations 2 month delay		VAT's variations 3 month delay		R <sup>2</sup>		Price shifting	
	NC	C	NC	C	NC	C	NC	C	NC	C	NC	C
Home repair products	0,326 (0,429)	0,366 (0,436)	0,202 (0,421)	0,181 (0,421)	-0,032 (0,400)	-0,008 (0,400)	0,915 (0,424)	0,927 (0,421)	15 %	22 %	141 %	147 %
Restaurants	0,069 (0,125)	0,100 (0,164)	0,108 (0,124)	0,120 (0,135)	0,089 (0,125)	0,082 (0,134)	-0,146 (0,125)	-0,156 (0,136)	16 %	21 %	12 %	15 %
Consumptions in bars & cafés	0,121 (0,168)	0,211 (0,205)	-0,192 (0,167)	-0,168 (0,173)	0,024 (0,171)	0,012 (0,171)	0,024 (0,171)	0,025 (0,179)	10 %	21 %	-2 %	8 %
Hairdressing services	-0,183 (0,181)	-0,103 (0,178)	0,103 (0,181)	0,075 (0,174)	0,091 (0,178)	0,095 (0,173)	0,209 (0,180)	0,192 (0,173)	20 %	32 %	25 %	26 %

Table 5 : Difference in difference regressions of price variations on VAT's rate variations around the 2000 VAT's reform

NC : Difference in differences regressions without control

C : Difference in differences regressions with controlling by the production costs, as explained in Appendix A

happened and the working time law had was being installed with reductions of the social contributions.

It is indeed very hard to see any price's shock on figure 5, which shows the price index at the time of the 2000 VAT's reform. However, we can not conclude with so few information that there was no price variations, because the price decreases might had been hidden by an increase of the production costs or of the inflation trend.

We made then difference in difference regressions as in previous section, with the drug price's index as reference with controls using the production costs as explained in Appendix A. Regressions follow equation 7 in section 4.2 and the results are presented in table 5.

First, the results give us the confirmation of the very disturbed environment in which the reform take place. The  $R^2$  are indeed very small, which means that our explicative variables are not enough to explain the price's variations. We made other regressions with more delays, but it neither does not work. Our opinion is confirmed looking at the Fisher Tests for coefficients. We Test the sum of VAT's rate delays' coefficients, and we can say as a result that there is a huge set of price shiftings that can not be rejected.

Concerning the products for home repair, Fisher statistic  $F(1, 28)$  took the value of 2,76 for a price shiftings equal to 0, 0,28 for a fully price shifting and 0,37 for a double price shifting. The 5 % limit of rejection for this test at 4,20. None of the previous price shiftings can be rejected. Thus it is not possible to trust the over-shifting found as result of the regression.

Products	Price shifting tested	Test Statistic	Statistic's value	Rejection's limit
Restaurants	0,6	$F(1,25)$	2,56	12 %
Bars and Cafés	0,7	$F(1,26)$	2,90	10 %
Hairdressing	0,9	$F(1,28)$	3,15	9 %

Table 6 : Fisher Tests for price shiftings Found for the 1995 VAT's reform

Moreover, as we look at figure 5, we note that important price increases occurred on June 1999, on March September and October 2000, on March August and September 2001. On the other hand important price decreases occurred on March and July 1999, on July and November 2000, on June and July 2001. Then, the price decrease which induces this big price shifting in 2000 had happened during the same month - July - in 1999 and 2001. Thus the huge price shifting found can not be taken in account.

However, the other markets studied was not disturbed as much. Indeed, the Fisher's Tests said that price shiftings' values found for the 1995 VAT's reform can be rejected at the 10 % limit. The results of these tests are presented in table 6. We can therefore conclude that even if we can not say what had been the April 2000 price shiftings, we know that they had been inferior to the July 1995's ones. We show on figure 6 the comparison between the natural inflation corrected price variations that occurred in 2000 and the ones that would occurred if the price shiftings had been the same as for the 1995 fiscal reform.

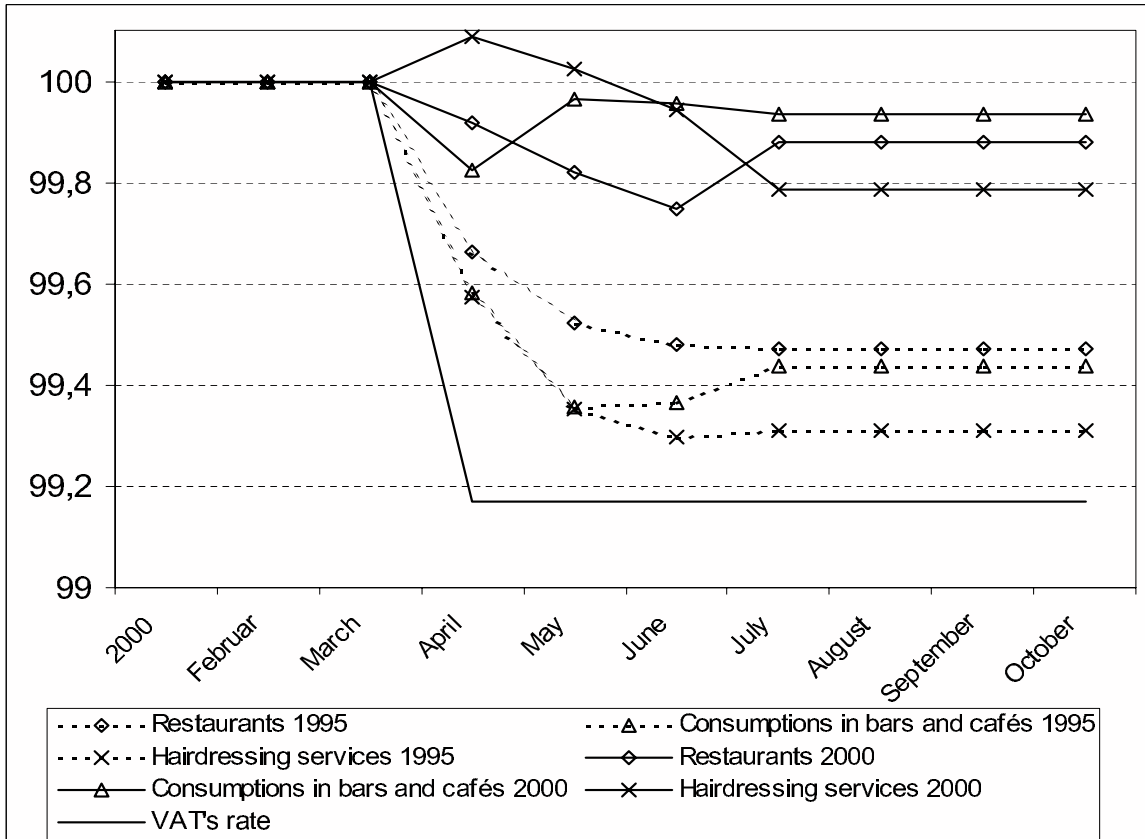


Figure 6: Natural inflation corrected prices around the 2000 French fiscal reform

These results confirm our hypothesis about the existence of a hysteresis effect on the price shiftings. But several other explanations should not be forgotten. Actually, the level of the reforms that we compare had not been the same. The 1995 VAT's increase had been twice the 2000 VAT's decrease. Then, non linear supply or demand functions could explain the asymmetry between both variations.

Some important restructuring needs occurred when production's variations are big, but can be avoided if production's variations are small enough. This can explain the fact that

the supply function is not linear. Burnside, Eichenbaum & Rebelo (1993 & 1995) [5][6] explained the avoiding of the restructuration needs by modifications of the production factors' use. But this would lead to bigger price shiftings when the VAT's rate variation is smaller, which is the opposite of what we found.

Ehrenberg & England (1990) [12] explained the fact that the demand function is not linear by psychologic arguments. To our concern, if the demand function is convex, the demand elasticity is bigger when the price's change is smaller and then, according to equation 1 the price shiftings are smaller when the VAT's rate variations are smaller.

## 5 conclusion

We presented four market's properties that can influence the price shiftings. We tested these effects through the French fiscal reform that changed VAT's full rate on July 1995. We found that two properties have strong effects and that the two others are dominated.

First, the capitalistic production's structure has a huge effect. Indeed, the price shiftings are bigger when the labor's part in the production process is more important. In the opposite, the price shiftings are smaller when the fixed capital's part in the production process is bigger. Therefore, despite the 1999 VAT's decrease from the full rate to the reduce rate induces an important price decrease for the repair services for more than two year old habitation, a similar VAT's decrease would induce smaller restaurants' price decrease.

We also presented the effect of the marketing targeting. According to the study of the 1995 reform, it seems that this targeting has as a consequence that the price shiftings are smaller when there are more big companies on the production's sector.

On an other hand, two other effects seem to be dominated. First, we thought that the fact that a big part of the products for home repair are produced by international companies would increase the price shifting, what did not occur.

We also thought that unperfect competition would increase price shiftings. It would be viewable in the products for home repair's price reactions. But this market had a very small price shifting - around  $\frac{1}{2}$  - because of the predominance of the capitalistic structure effect and the sales turnover targeting effect.

Finally, we proved by the 2000 VAT's reform study the existence of asymmetrical price shiftings. This confirms our theory about the asymmetrical ability to change production

plans, which leads to a hysteresis effect in the price shiftings after a VAT's reform. It is easier for firms to decrease their output than to increase it. Therefore, increasing price shiftings after a VAT's rate increase are bigger than decreasing ones after a VAT's rate decrease.

We saw in this study the VAT's incidence on prices, and therefore we understood who pays the VAT. We know that the price effects happen with output changes. In order to understand the VAT's incidence on the output and therefore the real fiscal earnings of a VAT's reform, it will be interesting to study the same fiscal reforms with an output point of view.

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# Appendix

## A Modelling the production costs

In order to have more accurate regressions, we control for the prices of inputs, which represents a part of the production costs. Indeed, a variation of the production costs induces a modification of the supply of the firms and therefore of the goods' prices. Actually, we must note that all the calculations that we made in the second section about price shiftings would have been the same considering production costs variations instead of VAT rate variations. For the experiences we consider here, we only want to understand the prices reactions to VAT rate variation, thus we have to control for the productions costs.

There are two main kinds of production costs. First, the rental costs for the firm locations and the energy costs. This part concerns quite all the production sectors. The second part is the intermediate consumptions. This is very interesting for our concern. For sure, when VAT rate increases for example, if intermediate consumption VAT rate is changed and we do not control for this, we will under estimate the prices shifting. Indeed, knowing that prices are often under shifted, a VAT rate increase leads to an increase of the after tax prices, but also to a decrease of the before tax prices. Therefore, and because French firms pay their intermediate consumptions at before tax prices, some firms may have a diminution of their production costs when the VAT rate increases, which leads us to under estimate the prices shifting if not considering this effects.

Table 7 shows what are the representant of the production costs we use for control in each regression.

	Home repair services	Home repair products	Restaurants	Consumptions in bars & cafés	Hairdressing services
Habitation rental	NO	YES	YES	YES	YES
Energy	YES	YES	YES	YES	YES
Drinks	NO	NO	YES	YES	NO
Food	NO	NO	YES	NO	NO

Table 7 : Production costs of the studied goods

For the energy and the location costs, we use the INSEE price index for the energy on one hand, and for the habitation rental on the other hand.

For the intermediate consumptions, we also use the INSEE prices index for the food



on one hand, and for drinks - with and without alcohol - on the other hand. For drinks with alcohol, we compiled from the INSEE prices index the series of the before tax prices. Indeed, the VAT rate of this kind of drinks, which is full rate, has changed in 1995 and 2000 with the reforms we studied.