# ESTIMATING THE FUNCTIONAL FORM OF ROAD TRAFFIC MATURITY

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**ABSTRACT**

It has been observed that older high traffic motorways experience lower traffic growth than newer ones (ceteris paribus). This phenomenon is known as traffic maturity in analogy with market maturity, a well known stage of products lifecycle. However, it is not captured through traditional time-series long-term forecasts, due to constant elasticity to GDP these models assume, leading to traffic overestimation. In this paper we argue that traffic maturity results from decreasing marginal utility of transport. The elasticity of individual mobility with respect to revenue decreases after a certain level of mobility was reached. In an aggregated approach, it conduces to decreasing elasticity of traffic with respect to economic growth. In order to find evidences of decreasing elasticity we analyse a cross-section time-series sample including 40 French motorways' sections and test for parameter variability. Both analysis show that decreasing elasticity can be observed in the long term. We then propose a decreasing function for the elasticity of traffic with respect to economic growth, which depends on the traffic level on the road. This model seems to well explain the observed traffic evolution and gives a rigorous econometric approach to time-series traffic forecasts.

KEY WORDS: traffic growth, traffic maturity, elasticity.

## 1. INTRODUCTION

The link, or coupling, between traffic and economic growth is a strong concept in transport and regional planning. In aggregated models of traffic forecast, individual mobility and revenue are represented by traffic and gross domestic product (GDP). Mobility generates traffic and we suppose that growth in GDP leads to growth in purchase power. In economics, this link is represented by an elasticity of traffic with respect to GDP, usually greater than one.

We can observe that older high traffic motorways experience lower traffic growth than newer ones (*ceteris paribus*). This phenomenon is known as traffic maturity in analogy with market maturity, a well known stage of products lifecycle. This phenomenon is not captured through traditional time-series long-term forecasts, due to constant elasticity to GDP these models assume. However, the observation of long traffic growth series put in evidence a growth deceleration in the long term.

In this sense we argue that the application of traditional models traffic forecast using time series with constant elasticity of traffic with respect to GDP, leads to high growth hypothesis leading to traffic overestimation. This paper aims to put in evidence a decreasing relationship between the traffic lever and the elasticity of traffic with respect to economic growth and proposes a new econometric formulation for the time-series traffic forecast which considers the elasticity of traffic with respect to GDP as a function of traffic level.

This paper is organized as follows: section 2 presents the stages of traffic growth and the traditional econometric approach. Section 3 proposes that traffic maturity is a direct consequence of the decreasing marginal utility of transport. Section 4 puts in evidence the decreasing of elasticity over the traffic lever using data from 40 cross-sections time series sample and applying statistic tests of parameters stability. Section 5 proposes the new model and shows the impact in long term forecasts. Section 6 briefly concludes the paper.

## 2. TRAFFIC GROWTH

In traffic forecast, whether for road, rail or air link, three growth stages are identified: the ramp-up, the traffic growth and the maturity. Ramp-up describes the delay traffic needs to reach its market share. The ramp-up period reflects the users' lack of familiarity with the new infrastructure and its benefits. It can also be due to reluctance to pay tolls or to information lags. The ramp-up period is characterized by a high traffic growth, from a level that is lower than expected as the equilibrium. In France, its duration ranges from some months to some years accounting in average for 18% of the traffic on the corridor (Nunez, 2005).

Induced traffic is the increment of new vehicle traffic resulting from a road capacity improvement. It represents the latent demand, excluding shifts from other modes or routes, changing in departure time and longer distances (which account for induced travels) and exogenous factors (as growth in population and economy). New trips to existing locations, trips that would not have occurred otherwise, are the purest form of induced traffic. (Goodwin, 1996; Mokhtarian and all, 2002; Nunez, 2005).

Once the short term impacts get over, the traffic evolution results from the growth in demand, which comes from the economic and population growths and the impact of monetary costs (toll, fuel and operating costs) on the route chosen and on alternative routes and modes.

After a certain level was reached, traffic grows slower, giving evidence that the need for transport was satisfied. Disregarded in transport, market maturity is nevertheless a main issue in new products market analysis, for which the life cycle is shorter and concurrence stronger than in transport sector. In the transport sector, this phenomenon has been recognized and studied at first in the air transport for tourism that (Department for Transport, 1997; Graham, 2000); the possibilities to go on holidays been constrained, we should expect traffic will not grow unlimitedly.

The volume of traffic on a motorway can be assumed to depend on level of economic activity, on the monetary and time costs of the motorway and on those of the alternative route and modes, as well as on transport system characteristics. Monetary cost is defined as the sum of three components: toll, fuel price and other vehicle operating costs. Besides, given that demand for transport is a derived demand, other variables that have an effect on traffic should also be included in the equation. In this case, traffic volume in a specific motorway section is assumed to depend on the capacity of traffic emission and attraction of origins and destinations. The model can therefore be expressed as follows (Matas and Raymond, 2003):

$$T_{it} = \alpha_0 + \alpha_{1i} GDP_t + \alpha_{2i} FP_t + \alpha_{3i} Toll_{it}^M + \alpha_{4i} VC_{it}^M + \alpha_{5i} TC_{it}^M + \alpha_{6i} VC_{it}^C + \alpha_{7i} TC_{it}^C + \alpha_{8i} E_i + \alpha_{9i} A_i + \varepsilon_{it} \quad (1)$$

where:

$T_{it}$ = traffic volume at the motorway section *i* and period *t*
$GDP_t$ = level of economic activity in period *t*
$FP_t$ = fuel price in period *t*
$Toll^M_{it}$= motorway toll in section *i* and period *t*
$CE^j_{it}$= other vehicle operating costs, j=*M*, *C* refer to motorway and alternative modes, respectively
$CT^j_{it}$ = time costs in section *i* and period *t*
$E_i$ = emission factor in section *i*
$A_i$ = attraction factor in section *i*

However, in the context where this estimation takes place it can be safely assumed that other vehicle operating costs and time costs remain constant over time[1]. Thus, it is assumed that $VC_{jit}=VC_{ji}$ and $CT_{jit}=CT_{ji}$ for j= *M,C.* Nonetheless, the study has tried to capture the most significant changes in the network by using dummy variables. For example, the opening of a substituting or complementary freeway parallel to a motorway section is captured with a dummy variable that takes unit value since the opening year. Therefore, after substitution, we get:

$$T_{it} = \left[\alpha_0 + \alpha_{4i} VC_{it}^M + \alpha_{5i} TC_{it}^M + \alpha_{6i} VC_{it}^C + \alpha_{7i} TC_{it}^C + \alpha_{8i} E_i + \alpha_{9i} A_i\right] + \alpha_{1i} GDP_t + \alpha_{2i} FP_t + \alpha_{3i} Toll_{it}^M + y' Z_{it} + \varepsilon_{it} \quad (2)$$

where $Z_{it}$ is the vector of dummy variables which accounts for major changes in the network (interventions) and γ’ is the row vector of the corresponding coefficients. The advantage to use a panel data set is that this methodology permits to capture all the effects that remain fixed over time but are specific of the different toll sections using the so called *individual fixed effects*, $\alpha_i$,. Thus, the demand equation can be re-written as:

$$T_{it} = \alpha_i + \alpha_{1i} GDP_t + \alpha_{2i} FP_t + \alpha_{3i} Toll_{it}^M + y' Z_{it} + \varepsilon_{it} \tag{3}$$

where $\alpha_i$ captures the terms in brackets in equation (2). This equation is usually applied on the log-log form. This transformation reduces heteroscedasticity and gives a convenient interpretation of results, which can le read directly as elasticities. The equation becomes:

$$\ln(T_{it}) = \alpha_i + \alpha_{1i} \ln(GDP_t) + \alpha_{2i} \ln(FP_t) + \alpha_{3i} \ln(Toll_{it}^M) + y' Z_{it} + \varepsilon_{it} \tag{4}$$

The elasticity of traffic with respect to *GDP* in section *i* is $\alpha_1$ because:

$$\varepsilon_{T/PIB} = \frac{\partial T / T}{\partial GDP / GDP} \tag{5}$$

and then

$$\varepsilon_{T/PIB} = \frac{GDP}{T} \frac{\partial T}{\partial GDP} = \frac{\partial \ln(T)}{\partial \ln(GDP)} = \alpha_1 \tag{6}$$

Nevertheless, the appropriateness of the hypothesis that parameters remain relatively constant over time depends on the structural constancy of the estimated coefficients which results when recursive least squares are applied. If the coefficient displays significant variation as more data is added to the estimating equation, it is a strong indication of instability and the assumption of constant parameters does not hold.

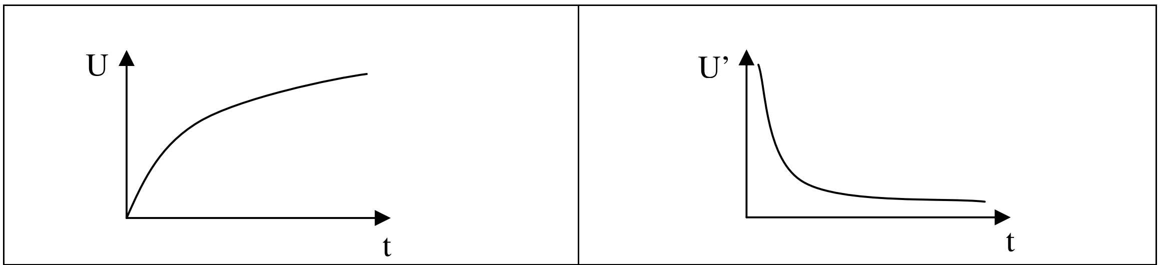
## 3. WHY DOES TRAFFIC GROW DECREASINGLY?

The consumer theory, from its classic axioms, transforms preferences in utility. The law of decreasing marginal utility states that marginal utility decreases as the quantity consumed increases. In essence, each additional good consumed is less satisfying than the previous one. This law holds for most goods, and do so for transport. This principle supports the idea of decreasing transport growth since the utility of an additional travel depends on individual's mobility. Furthermore, time and money constraints limit transport possibilities.

New traffic comes from new users on the route or mode and from existent users making more or long trips. The traffic increment due to new users results from population growth as well as changes in land use and in locations of economic activities. Furthermore, reductions in transport costs as well as increases in user's wealth allow people to travel more and more often. This is particularly evident is the case of air transport sector, where price reductions due to competition in the last years had not only diverged users from other modes but also allowed less rich people to afford air travels.

For existent users, the reduction on generalized costs, increasing in wealth and reduction and flexibility in working time allow users to travel more often. The possibility of supplementary trips is however constrained by time (daily time and holidays) and money availability. Budget and time depend not only on transport itself but on time and money spent in all others activities. These constraints unequally affect different people and different population classes. A retired person is supposed to be more constrained by money than by time, inversely to a rich businessman.

In addition to budget and time constraints, there is the will to travel. We can reasonably suppose that the higher is the individual's mobility level, and the lesser will be his inclination or necessity to make one more trip. Despite of regular fluctuations in transport demand, i.e. seasonal peaks, it has been suggested (for example, by Thomson, 1974) that over time, there has been a remarkable stability in the demand for travel, with households, for example, on average making roughly the same number of trips during a day albeit for different purposes or by different modes. There may be more leisure travel, but there are fewer work trips and greater is now made of air transport and the motor-car at the expense of walking and cycle. It is suggested that this situation reflects the obvious fact that there is a limit to the time people have available for travel, especially if they are to enjoy the fruits of the activities at the final destinations (Button, 1993).




(a) a standard utility function. | (b) Decreasing marginal utility.

**Figure 1: Utility functions**

This phenomenon is formulated as the decreasing marginal utility of travel, which means that $U(t)>0$, $U'(t)>0$ and $U''(t)<0$, as represented in figure 1, where $U(t)$ is the utility of transport. The utility function and constraints compose the individual's utility maximization program, where individual make trade-offs between possible allocations of resources. Utility functions define choices which generate demand functions, from which elasticities can be derived. Elasticities give adimensional measures of sensibility of a variable with respect to another. Elasticities are then concise measures of preferences and reflect the sensibility to changes in a limited resources environment (figure 2).

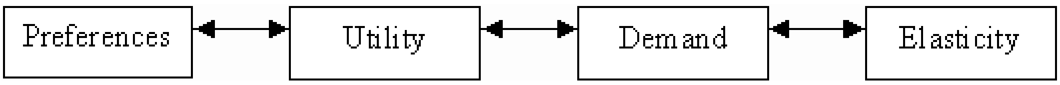



**Figure 2: From preferences to elasticity**

The ordinary or Marshallian demand function is derived from consumers who are postulated to maximize utility subject to a budget constraint. As a good's price changes, the consumer's real income (which can be used to consume all goods in the choice set) changes. In addition the goods price relative to other goods changes. The changes in consumption brought about by these effects following a price change are called *income* and *substitution* effects respectively. Thus, elasticity values derived from the ordinary demand function include both income and substitution effects (Gillen and al, 2004).

In this sense, the elasticity of individual mobility with respect to revenue decreases after a certain level of mobility is reached. In aggregated terms, the superposition of individuals behaviours results in an increment in traffic which is decreasing in the part of traffic generated by existing users and therefore for economic and population constant growth, globally decreasing.

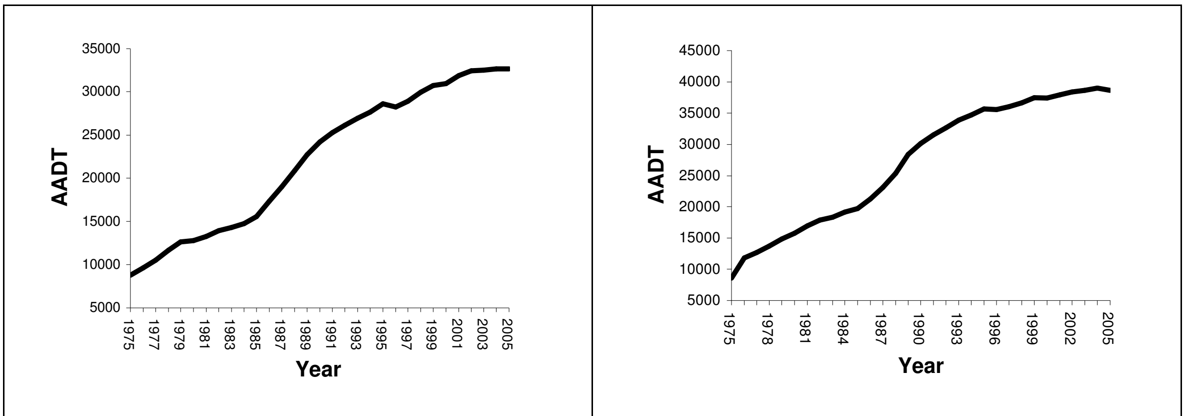
Congestion also constrains traffic growth. It has a double effect, first it physically limits traffic growth and second it reduces the generation of traffic by increasing the generalised cost. Nevertheless, traffic maturity must be isolated of congestion. Traffic maturity is a pure demand effect while congestion comes from the interaction of a level of demand higher then infrastructure capacity. We argue that maturity do not depends on supply (while traffic does). This argument is valid if we consider that congestion is limited to special periods (holiday departure) or a particular OD pair, affecting at the individual level, while our analysis focuses in a more aggregated level.

## 4. EVIDENCES OF DECREASING GROWTH

In order to find evidences of decreasing growth and decreasing elasticity we proceed to a three steps analysis. We first present the typical traffic evolution profile and observe the evolution of short term elasticity over time. We then proceed to a cross-section time-series study including 40 French motorways' sections and shows the ling between the elasticity and the traffic level. Finally, we test for the statistical stability of parameters on these sections using the CUSUM and the CUSUM$^2$ tests.

### 4.1 Traffic and elasticity evolution

The typical traffic evolution profile can be observed on the A10 motorway (section Blois - Château-Renault) open in 1974 and the A11 motorway (section Ablis - Chartes) open in 1972 (Figure 3). We can observe a period of strong growth until the end of the 80's and a globally concave evolution after then. This deceleration do not proves the maturity because it can results from an economic deceleration, an increasing in fuel costs or other factors, but gives reasons for a deeper analysis.



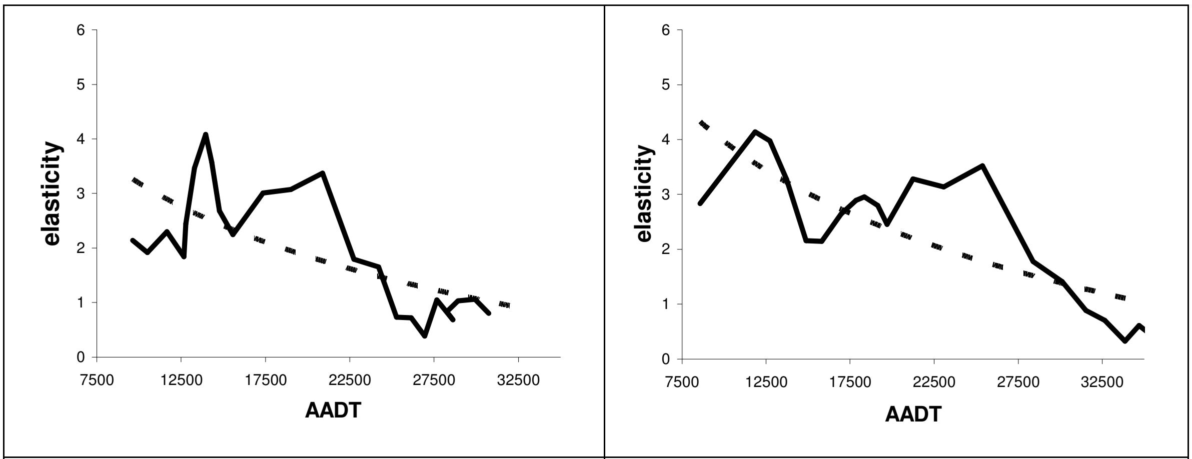

| (a) On the A10 motorway | (b) On the A11 motorway |
|---|---|

**Figure 3: Traffic growth**

The reactivity of traffic to economic growth can be observed through the short term elasticity. This analysis is clearly incomplete because it does not take in account all other factors affecting the traffic growth as showed in equation (4) but it allows to put in evidence the phenomenon of interest. This elasticity in defined as:

$$\varepsilon_{ct} = \frac{\dfrac{T_n - T_{n-1}}{T_{n-1}}}{\dfrac{GDP_n - GDP_{n-1}}{GDP_{n-1}}} \qquad (7)$$

Figure 4 shows the relation between this short term elasticity (3 years moving average) and the level of traffic on the A10 and A11 motorways. The exercise was repeated for a high number of sections, with similar results. Results suggest that the elasticity of traffic with respect to GDP tends to decrease as traffic level increases.



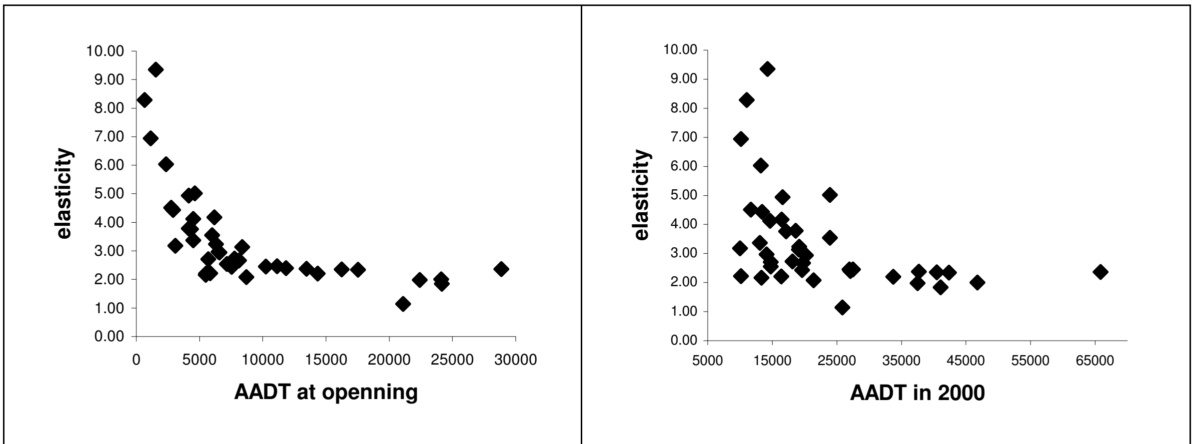

(a) On the A10 motorway | (b) On the A11 motorway

**Figure 4: Evolution of elasticity of traffic with respect to GDP over the traffic level**

**4.2 Cross-section time series analysis**

We specified a sample of 40 French motorway's sections with traffic series longer than 15 years, in different French regions and including all the main concessionaires (ASF, APRR, Cofiroute, SANEF and SAPN). We then applied the equation (4) in order to determine the (constant) elasticity of traffic with respect to GDP.

Plotting this elasticity ($\alpha_1$ in equation 4) over the traffic level at opening we can observe a clear decreasing tendency (figure 5a). Those sections with a high traffic at opening present a lower elasticity. This result is corroborated when the abscissa is the traffic in 2000 (an arbitrary year) as showed in figure 5b.




(a) traffic at opening. | (b) traffic in 2000

**Figure 5: Cross-section analysis of elasticities over the traffic level.**

In addition to the tendency, we can observe a reduction in dispersion from the opening date to 2000. This result is coherent with the proposed idea, i.e. low traffic motorways may be at different stage of growth, following local characteristics, but high level motorways are certainly in a more advanced stage of maturity and are less sensible to economic growth.

### 4.3 Testing for parameter stability

Proposed by Brown, Durbin and Evans (1975) the CUSUM and the CUSUM$^2$ test for the constancy over time of the coefficients of a linear regression model. These tests are based on recursive residuals (Greene, 1997). Suppose that the sample contains a total of $T$ observations. The $t$th recursive residual is the ex-post prediction error for $y_t$ when the regression is estimated using only the first $t$-$1$ observations:

$$e_t = y_t - x_t'\hat{\beta}_{t-1} = x_t'\left(\beta_t - \hat{\beta}_{t-1}\right) + \varepsilon_t \tag{8}$$

where $\beta_t$ is the vector of regressors associated with the observation $y_t$ and $\hat{\beta}_{t-1}$ is the least square coefficients computed using the first $t$-$1$ observations. The forecast variance if this residual is:

$$\sigma_{ft}^2 = \sigma^2 \left[x_t'(X_{t-1}'X_{t-1})^{-1} \cdot x_t\right] \tag{9}$$

Let the $r$th scaled residual be

$$w_r = \frac{e_r \sigma_{ft}}{\sigma} = \frac{\left(y_r - x_r'\hat{\beta}_{r-1}\right)}{\sqrt{x_r'(X_{r-1}'X_{r-1})^{-1} \cdot x_r}} \tag{10}$$

Under the hypothesis that the coefficients remain constant during the full sample period, $w_r \sim N[0, \sigma^2]$ and is independent of $w_s$ for all $s \neq r$. Evidence that the distribution of $w_r$ is changing over time weights against the hypothesis of model stability.

The CUSUM test is based on the cumulated sum of the residuals:

$$W_t = \sum_{r=K+1}^{t} \frac{w_r}{\hat{\sigma}_w} \tag{11}$$

where:

$$\hat{\sigma}_w{}^2 = \frac{1}{T-K-1} \sum_{r=K+1}^{t} \left(w_r - \overline{w}\right)^2 \tag{12}$$

and

$$\overline{w} = \frac{\sum_{r=K+1}^{t} w_r}{T-K} \tag{13}$$

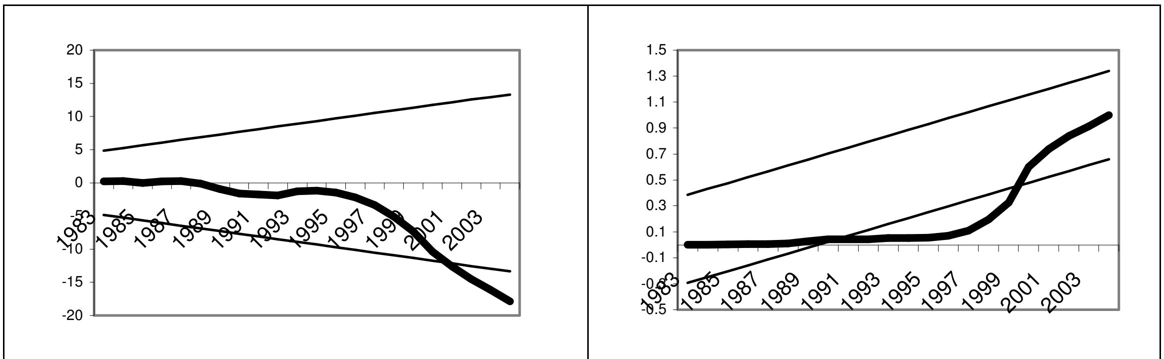
Under the null hypothesis, $W_t$ has a mean of zero and a variance of approximately the number of residuals being summed (as each term has variance 1 and they are independent). The test is performed by plotting $W_t$ against $t$. Confidence bounds for the sum are obtained by plotting the two lines that connect the points $\left[K, \pm a(T-K)^{0.5}\right]$ and $\left[K, \pm 3a(T-K)^{0.5}\right]$. Values for $a$ that corresponding to 95 and 99 percent are 0.948 and 1.143, respectively. The hypothesis is rejected if $W_t$ strays outside the boundaries.

An alternative similar test is based on the squares of the recursive residuals. The CUSUM of squares (CUSUM$^2$) test uses

$$S_t = \frac{\sum_{r=K+1}^{t} w_r^{2}}{\sum_{r=K+1}^{T} w_r^{2}} \tag{14}$$

Since the residuals are independent, each or the two terms is approximately a sum of chi-square variables each with one degree of freedom. Therefore, $E[S_t]$ is approximately $(t-K)/(T-K)$. The test is carried out by constructing confidence bounds for $E[S_t]$ at the values of $t$ and plotting $S_t$ and these bounds against $t$. The appropriate bounds are $E[S] \pm c_0$, where $c_0$ depends on both $(T-K)$ and the significance level desired. As before if the cumulated sum strays out the confidence bounds, doubt is cast on the hypothesis of parameters stability.

We applied both tests in the sample described earlier. Results are shown in table 1 where 0 represents the validity of the null hypothesis (constancy of parameter) and 1 indicates that coefficients do not remain constant during the full sample period at 95% of significance. Figure 6 shows graphically these tests results for the section 40. The CUSUM test indicates parameter variability in 18 sections while in the CUSUM$^2$ test the hypothesis of stability was rejected in 29 cases. In a total of 35 of the 40 sections, one or another test indicates variability in parameter.




(a) CUSUM test | (b) CUSUM$^2$ test

**Figure 6: CUSUM and CUSUM$^2$ tests on the section 40.**

## 5. A FUNCTIONAL FORM FOR DECREASING ELASTICITY

Precedent results lead us to consider a variable relation between traffic and economic growths by an elasticity depending on the traffic level, it means rewriting (5) as a function of traffic.

To take in account the asymptotically decreasing put in evidence, we propose the following formulation:

$$\varepsilon_{T/GDP}(T) = \frac{\partial T / T}{\partial GDP / GDP} = k.T^{\gamma} \qquad (15)$$

where $k$ is a positive constant and γ is a negative constant. The parameter γ may be interpreted as the elasticity of the -elasticity of traffic with respect to GDP- with respect to traffic level, since:

$$\varepsilon_{\varepsilon_{T/GDP}/T} = \frac{\partial \varepsilon_{T/GDP}}{\partial T}\frac{T}{\varepsilon_{T/GDP}} = \gamma.k.T^{\gamma-1}.\frac{T}{kT^{\gamma}} = \gamma \qquad (16)$$

The differential equation (16) is separable and its solution (for γ≠0) is:

$$T = (-\gamma.(K.\ln(GDP)+c))^{-\frac{1}{\gamma}} \qquad (17)$$

Where $c$ is the constant from the integral. Assuming that this relation holds for the first period ($T_1$, $GDP_1$) and both $T_1$ and $GDP_1$ are normalized to one then $T$ becomes:

$$T = (1-\gamma.K.\ln(GDP))^{-\frac{1}{\gamma}} \qquad (18)$$

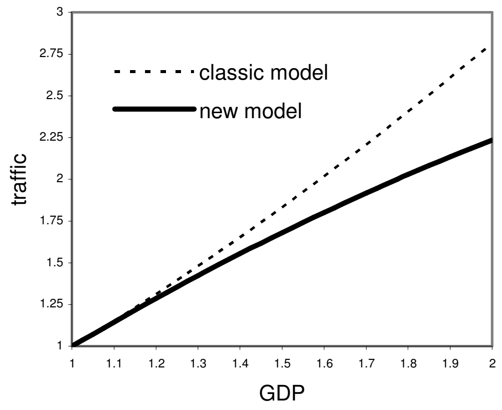
The equation (4) can be therefore rewritten as:

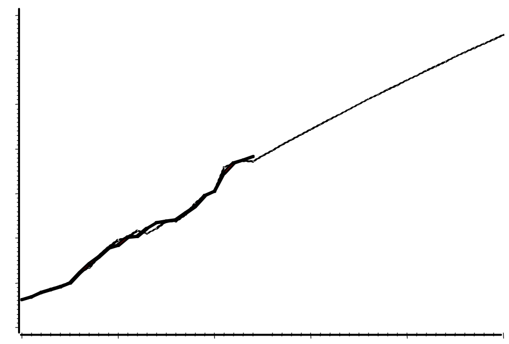
$$\ln(T_{it}) = \alpha_i - \frac{1}{\gamma}\ln(1-\gamma.K.\ln(GDP_t) + \alpha_{2i}\ln(FP_t) + \alpha_{3i}\ln(Toll_{it}^{M}) + y'Z_{it} + \varepsilon_{it} \qquad (19)$$

This approach sets up an intrinsic relation between the traffic level and its reactivity to economic growth, as wanted; it allows for a good representation of the phenomenon and a good interpretation of results at the cost of introducing a non-linearity in the traffic growth equation.

**5.1 Impact on long-term forecasts**

Consider the hypothetical case in figure 7a where initial traffic is normalized at 1, reference level of GDP is 1, the constant elasticity is 1.5 and γ=-0.5. We can see that in the short term results from both models are very close. As the GDP increases the difference becomes more important; the classic model presents a globally convex profile while the new model produces a concave evolution.



| (a) hypothetical example | (b) application to the A7 motorway |
| --- | --- |

**Figure 7: Application of the new model.**

This approach was applied in a large scale forecast traffic until 2030 to the main French private motorways (one example is given if figure 7b). Results presented a very good adjustment and reproduce the observed (and expected) deceleration of growth. The distribution of $\gamma$ in this forecast is given if figure 8. The average gamma is -0.6.

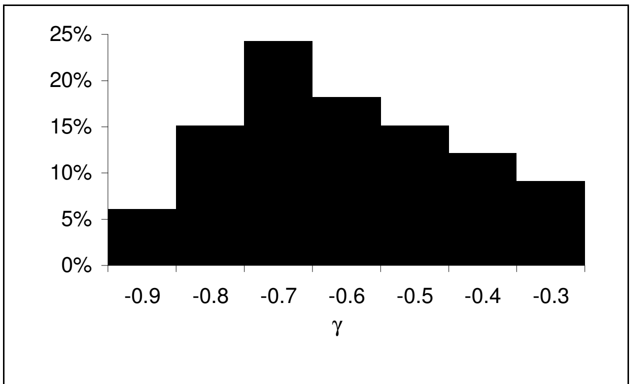



**Figure 8: Histogram for $\gamma$.**

This method is however very data greedy. If no information on parameters in inferred, a quite long data series is need to calibrate the model but it confers a significant advantage in terms of results for very long term forecasts for which the constant elasticity seems to be an unrealistic and overoptimistic hypothesis.

## 6. CONCLUSIONS

In this paper we have put in evidence the decreasing of the elasticity of traffic with respect to GDP, which characterises the traffic maturity and have shown that the hypothesis of constant elasticity assumed by classic models is unrealistic and leads to traffic overestimation.

A new model of decreasing elasticity is proposed setting up an intrinsic relation between the traffic level and its reactivity to economic growth. This model allows for a good representation of the phenomenon, a good interpretation of results and gives a rigorous econometric approach to time-series traffic forecasts, at the cost of introducing a non-linearity in the equation. In the short term the model results are closer to that given by the classical constant elasticity model; in the long term, where classic models tend to produces linear or convex profiles, this model reproduces the observed concavity. This model allows for a better interpretation of the coupling between traffic and economic growth, and a better long-term forecast.

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**Table 1 : Summary results**

| section | serie's lengh | CUSUM | CUSUM$^2$ | CUSUM OR CUSUM$^2$ | Constant elasticity | Traffic at oppening | Traffic in 2000 |
|---|---|---|---|---|---|---|---|
| 1 | 15 | 1 | 1 | 1 | 6.03 | 2362 | 25862 |
| 2 | 15 | 1 | 0 | 1 | 2.97 | 6494 | 41069 |
| 3 | 16 | 0 | 0 | 0 | 2.22 | 5835 | 16456 |
| 4 | 17 | 1 | 0 | 1 | 9.35 | 1532 | 13324 |
| 5 | 19 | 0 | 0 | 0 | 5.02 | 4630 | 23902 |
| 6 | 19 | 0 | 1 | 1 | 8.29 | 662 | 11053 |
| 7 | 20 | 1 | 1 | 1 | 6.94 | 1138 | 14280 |
| 8 | 21 | 0 | 1 | 1 | 3.13 | 8370 | 13232 |
| 9 | 22 | 0 | 1 | 1 | 1.15 | 21090 | 37675 |
| 10 | 22 | 0 | 1 | 1 | 1.84 | 24164 | 19638 |
| 11 | 22 | 1 | 0 | 1 | 4.17 | 6177 | 23941 |
| 12 | 22 | 1 | 1 | 1 | 2.16 | 5499 | 19158 |
| 13 | 22 | 1 | 1 | 1 | 2.37 | 13456 | 14660 |
| 14 | 22 | 1 | 0 | 1 | 2.44 | 7541 | 46751 |
| 15 | 22 | 0 | 0 | 0 | 3.55 | 6002 | 40465 |
| 16 | 22 | 0 | 1 | 1 | 3.23 | 6296 | 21412 |
| 17 | 22 | 0 | 1 | 1 | 4.12 | 4505 | 13405 |
| 18 | 22 | 0 | 1 | 1 | 2.00 | 24111 | 11676 |
| 19 | 22 | 1 | 0 | 1 | 2.35 | 16252 | 20200 |
| 20 | 22 | 1 | 0 | 1 | 2.08 | 8709 | 19115 |
| 21 | 22 | 1 | 1 | 1 | 4.43 | 2917 | 14100 |
| 22 | 22 | 0 | 0 | 0 | 4.51 | 2768 | 17151 |
| 23 | 22 | 1 | 1 | 1 | 2.94 | 6565 | 42360 |
| 24 | 22 | 0 | 1 | 1 | 3.76 | 4332 | 33737 |
| 25 | 22 | 1 | 1 | 1 | 2.34 | 17540 | 10174 |
| 26 | 22 | 0 | 1 | 1 | 2.20 | 14332 | 37502 |
| 27 | 22 | 0 | 1 | 1 | 1.98 | 22402 | 14745 |
| 28 | 22 | 0 | 1 | 1 | 2.55 | 7162 | 10016 |
| 29 | 22 | 0 | 1 | 1 | 3.18 | 3074 | 10165 |
| 30 | 22 | 1 | 1 | 1 | 2.67 | 8130 | 19766 |
| 31 | 22 | 0 | 1 | 1 | 3.37 | 4496 | 13083 |
| 32 | 22 | 0 | 1 | 1 | 2.73 | 7777 | 18147 |
| 33 | 22 | 0 | 1 | 1 | 2.71 | 5700 | 14744 |
| 34 | 22 | 0 | 1 | 1 | 2.40 | 11834 | 27084 |
| 35 | 22 | 1 | 1 | 1 | 2.36 | 28854 | 65844 |
| 36 | 22 | 1 | 1 | 1 | 2.46 | 11130 | 26940 |
| 37 | 22 | 0 | 0 | 0 | 3.78 | 4146 | 18613 |
| 38 | 22 | 1 | 1 | 1 | 2.45 | 10236 | 27469 |
| 39 | 22 | 0 | 1 | 1 | 4.94 | 4159 | 16611 |
| 40 | 22 | 1 | 1 | 1 | 2.21 | 5507 | 16399 |
| **total** | | 18 | 29 | 35 | | | |