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** LA POSTE

1.Introduction

Most of the studies on the cost analysis in Postal Economy concern the delivery part of the production process (see Bradley and Colvin 1993, Cazals et al. (1997, 2001, 2005a and b), Roy , 1999). In 2002, Cazals *et al.* presented an econometric analysis of a cost function for the postal counters network in France. In particular they derived cost elasticities for all counter activities performed in post office. Since 2002, this French network has faced major changes. First, customer habits have changed for different reasons and mainly because the consumption of mail has drastically decreased. In consequence, the public attendance of postal outlets has evolved. Second, a new territorial organization has been set up. Today, the network is divided in "sites" ("*TERRAIN*" in the French terminology) composed by a main office, some secondary offices and some partners who provides some postal services. These partners may be private stores or public municipal services. Moreover, this new organization is characterized by an important transformation movement with an increase of the number of partners replacing owned post offices.

The topic of this paper is to analyse with the new organisation the cost at the level of the « sites » and to compare this analysis to the one Cazals *et al.* in 2002 before the redefinition, reshaping of the network

We will also look at the impact on the cost of considering different aggregation of the outputs and our model considers a disaggregated model where the decomposition of the activity into front office and back office is realized. The impact on the cost of a variation of one input will have a direct effect due to the front office activity and an indirect effect through the impact on the back office. We also look at the role of the transformation of post offices into partners and a counter factual analysis may be used to measure the cost saving implied by these transformations.

Our paper is organized as follows. In Section 2, we present some description elements of the French post office network and its evolution since 2000. A general discussion about the econometric model is presented in Section 3. Empirical results are presented and discussed in Section 4 and the conclusion gives some future developments we have on our agenda.

2. The French post office network

The post office network distributes to the customers the products offered by the different businesses of La Poste (Mail, Financial Products and Parcels/Express) but also offers its own product like prepaid phone cards. The network is composed of 17000 offices which are either owned offices or partnerships. Partnerships could be established with local communities (*Agence Postale Communale*) or with local shops (*Relais Poste*). The accessibility of the network is set by the law as this network is a central element of two of the SGEI (Service of General Economic Interest). La Poste through its post office network is providing postal universal service and regional planning. Since the beginning of the 21st century, the French post office network has faced major changes.

Evolution of the network

The way customers use the network and buy the products has changed. Mail postage has declined, automats and ATM machine have been installed and people are more and more using multi-channel offers in particular by using internet.

In order to fulfil the legal obligations in this new economic environment, the post office network has adapted its local coverage via the *Terrain* project. The French territory has been divided in *Terrain*, where each *Terrain* is composed of a central outlet (owned by La Poste) and one or more related outlets (partnership outlets or owned offices). The central outlet ensures the governance of the related outlets like for instance staff reporting and management. In 2008, the network was composed of 3867 *Terrain*[a] which regroup the 17000 offices. On average, we found more than 4 offices in a *Terrain* and on average 60% of the offices belonging to a *Terrain* are owned by La Poste. However, the structure of a *Terrain* could vary as the following table shows:

[a] This number is not the final one. Indeed, in 2008 the Terrain project was not totally finished. In 2009, the total number of Terrain was around 3000.

Number of offices in a *Terrain*	Average number of owned offices	Average number of partnership
1	1,0	-
2	1,9	0,1
3	2,5	0,5
4	3,0	1,0
5	3,5	1,5
6	3,9	2,1
7	4,2	2,8
8	4,6	3,4
9	4,8	4,2
10 and more	6,2	6,3
Total	*2,9*	*1,5*

Table 1 : composition of a *Terrain*

For *Terrain* with less than 4 points, it appears that these points are almost exclusively owned by La Poste. By cons when it has more than 4 points, it appears that the number of partners increases gradually so that the number of partnerships is equal to the number of owned post offices in the latter classes (9 and 10 or more offices per *Terrain*). This partially reflects that the *Terrain* project is mainly characterized by a significant expansion of the number of partnerships as they are less costly for La Poste and generally more suited to the needs of the population, given their extended opening hours.

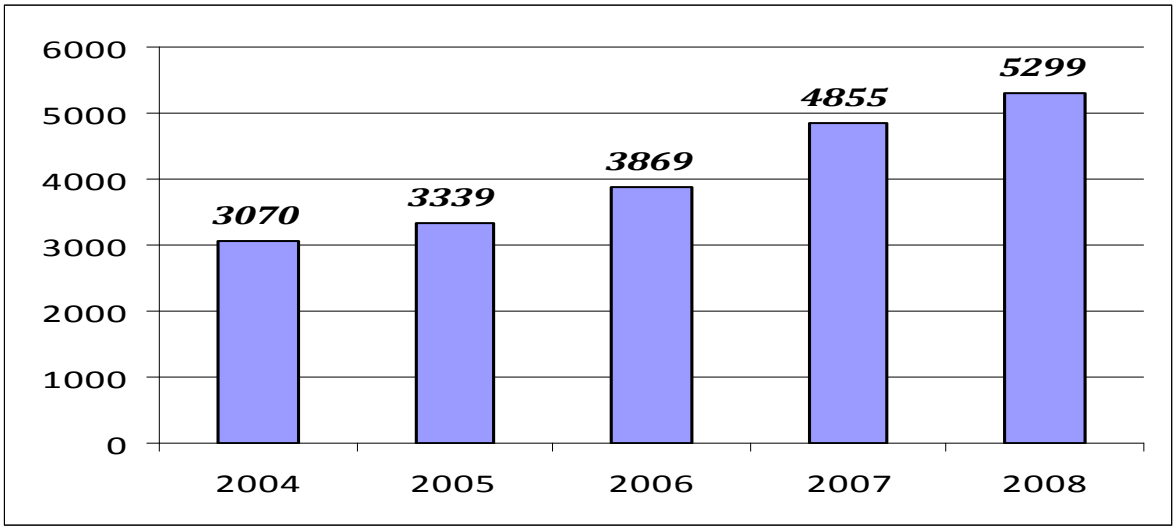


Figure 1 : evolution of partnerships

Between 2004 and 2008, more than 2200 owned offices have been transformed and replaced by partnerships. Geographically, the location of partnerships is more homogenous than it was in 2004 where the west of France was over represented.

Activities in post offices

There are different types of activities in a post office which are not all related to a particular business. Firstly, there is the activity carried out at the counter of the post offices which can be divided into:

- A *sales* activity that generates revenue: sale of postal products (like stamps or ready to post envelops) or of prepaid phone cards, money order
- A *financial services* activity - activities related to La Banque Postale, which does not generate a revenue – for instance: cash withdrawal, balance inquiry, deposit…
- An *after-sales* activity is an activity that does not generate revenues such as the collection at the counter.

All those front offices activities generate back office ones such as customer complaints or inventory management.. These activities are generally done by the central outlet for all the offices of the *Terrain*. In 2008, the front office activities represented more than 970 millions minutes of activity and back office ones almost to 670 millions.

Front office activities, traditionally carried out at the counter, are increasingly automated for financial or mail services (stamps sale, cash withdrawal, deposit check…). Also some of these operations can be performed in self-service areas. Moreover, La Poste network also offers in some post offices more complex financial services such as opening / closing of accounts, home loans or insurance products. More marginally, one can find also offices that realize part of the mail process (residual collection and initial preparation).

In this paper we will only focus on front and back office activities but undoubtedly taking into account those ‘extra’ activities (automats, loans…) open new research avenues.

3.The econometric approach

An econometric cost model is a relation linking the total production cost of a production unit during a given time period to a vector of outputs, a vector of input's prices and a vector of environmental variables. In our study on the cost of post offices our data set reduces to a single cross section and input's prices an identical for all the observation units. The main input is the labour and its price is determined by a national agreement and is identical for any

post office. It may be argue that the differences between seniority or qualification of the employees of post offices creates a specific price of labour for each office and that the capital price (essentially the building where the post office is located) varied between different locations. We have however decided to eliminate the prices of the productions factors in our study because these prices variability seems too artificial and because the substitution labour/capital is not the main objective of our analysis.

The main variables in the cost function are then the output vector. We may have two approaches in the output definition.

In a first approach the vector of outputs is constituted by goods and services provided to the consumers of the Post office. We may consider that the outputs may be stratified into sale activity, after-sales activity and financial service. If we regroup the outputs into a small number of variables (e.g. sale, after sale and financial services) we are faced to an aggregation problem because each of this output is composed by numerous different productions. The aggregation is realised thank to an evaluation (at the national level) of each activity by a number of minutes required for this activity. We use this common measurement of the different productions to do the aggregation and each output is then measured in "theoretical minutes".

In a second approach to the definition of the outputs we may introduce intermediary productions variables. Actually the production process may be decomposed into two activities: the front office and the back office. A change of the output level will have an impact on the cost which may be decomposed into a direct effect (variation of the front office activity) and an indirect effect through the variation of the back office activity.

In other words the relation $C = F(Y)$ (C measure the cost and Y the outputs) may be decomposed into $C = G(Y, B)$ when B is the back office quantity. To compare the two approaches we need to introduce a third relation linking back office to output $B = H(Y)$ and we have obviously $C = F(Y) = G(Y, H(Y))$.

An elementary computation shows that

$$\frac{\partial F}{\partial Y} = \frac{\partial G}{\partial Y} + \frac{\partial G}{\partial H} \cdot \frac{\partial H}{\partial Y}.$$

If the variables are in logarithms the derivatives are equal to elasticities and this equation show a decomposition of the cost elasticity to output $\left(\frac{\partial F}{\partial Y}\right)$ into a direct effect on the front office $\left(\frac{\partial G}{\partial Y}\right)$ plus an indirect effect through the back office $\left(\frac{\partial G}{\partial H}\cdot\frac{\partial H}{\partial Y}\right)$. The first component $\frac{\partial G}{\partial H}$ shows the impact of the back office on the cost and the second component $\frac{\partial H}{\partial Y}$ the impact of the variation of the production under the back office quantity. In these relations the *Y* may be a vector of outputs and *B* may be also a vector by sharing the back office activity into several components. However, in this paper we will only focus on the different type of front office activities.

The last category of variables which usually appears in a cost model is the environmental variables which measure a part of the heterogeneity of the production units. The unobservable part of the heterogeneity is introduced in the models by the random error terms. In our study we are focused on a particular type of environmental variables, namely the structure of the unit of observations. Let us recall that the units of observations are "site" which are composed of a main post office, some secondary post offices and some "partners" (stores or municipal services) which have a postal activity.

Different measurements of the costs may be used. We concentrated our analysis on the measurement of the cost by the total labor quantity used in the post office. The wage structure of the post office has then no impact and the cost of capital is not taken into account (this also justify that we don't introduce the input prices in our models).

The evolution of the technology may justified that the output vector may be segmented into two groups: the demand of good and services directly addressed to the counters and the demand addressed to automata (stamps sale or cash machine). This demand may be evaluated using the same units as the regular one but it has a specific impact on the cost and then may be introduced as a separated output.

The model we want to analyze may be then constituted by a cost function and several equations representing the relation between output and back office activities. All these relation may incorporate environmental variables. From this possibly very disaggregated model more aggregated relations may be constructed using the rule presented above.

Two issues should be discussed: the specification of the relations and the endogeneity question.

All our models are specified by linear log relations. This means that in our model the parameter may by directly interpreted as elasticities and that, in our model, the elasticities are constant (not depending on the output level or on environmental variables). This does not mean that in the real world elasticities are not varying across office but our model gives us the best approximation by a model with constant elasticity. The parameter we estimate may be view as the elasticity of the post office system at the actual production level. A quadratic specification would give us elasticities depending linearly of the variables of the model or a non parametric specification would permit a full flexibility. However the disaggregated level of the outputs and of the back office generates a large number of variables and an unrestricted quadratic model would be difficult to identify.

However we have done a step in the direction of the estimation of models with non constant elasticities by the introduction of stratified samples and by estimation of different models for each group of data. Then the elasticities becomes constant by group and not constant for the whole sample.

The second element we want to discuss is the endogeneity issue. In a cost function in a competitive environment, output level should be considered as possibly endogenous because it may be view as choosen by the firm in order to maximise its profit. This standard argument does not apply for the Post office network which is, at least for the mail services, not yet in competition. More generally La Poste has a universal service obligation it does not discriminate customers. We may then consider that the total final demand to a Post office is exogenous.

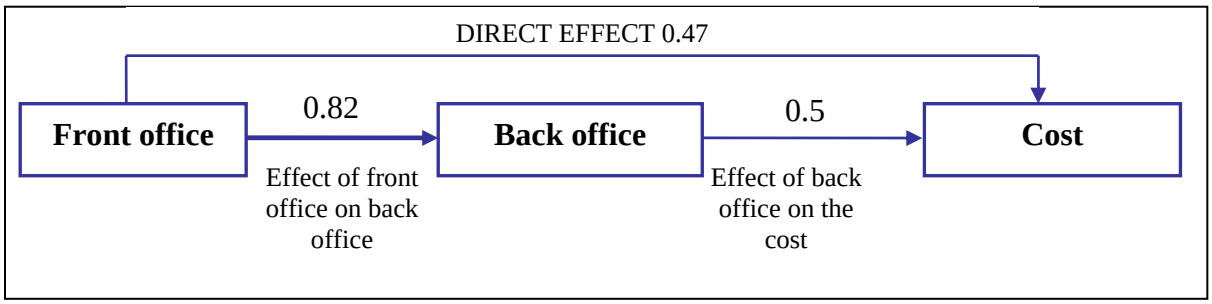
This assumption is not so obvious for the other variables which are present in our models. Indeed the cost model of a Post office may depends on unobserved heterogeneity elements which determine jointly the total cost but also the choice to use automats and the status of the different offices (own post office for La Poste or partner). The level of back office may be also view as possibly endogenous (in that case this means that the residual of the equation $Y = G(Y, B)$ and $B = H(Y)$ are not independent). If we allows the dependence between residuals the model becomes non identified. So exogeneity of the back office level may be view as an identification condition. An interpretation of this assumption is that we consider that the rule of the determination of the back office level as a function of outputs does not

change if we use our model for predictions. It would be also interesting to model the decision to put automata in a Post office as an endogenous decision and to consider that this variable create a possible endogenous selection mechanism.

4.Data and results

The cost is measured by the total labour quantity measured by the number of Fill Time Equivalent (FTE) operating in a "Terrain". Each FTE corresponds to an agent working 35 hours a week (full time job). The outputs and the back office quantity are measured by time spend by agent to do many operation. Each operation of an office (whatever its type) is listed in a database. A time standard is associated to each type of operation. Those standards are periodically review, new timing are frequently done. With this information we have the total time spend by agent to realize all the operations in the office. All variables used in our models concern year 2008. We present results with several groups of output[b].

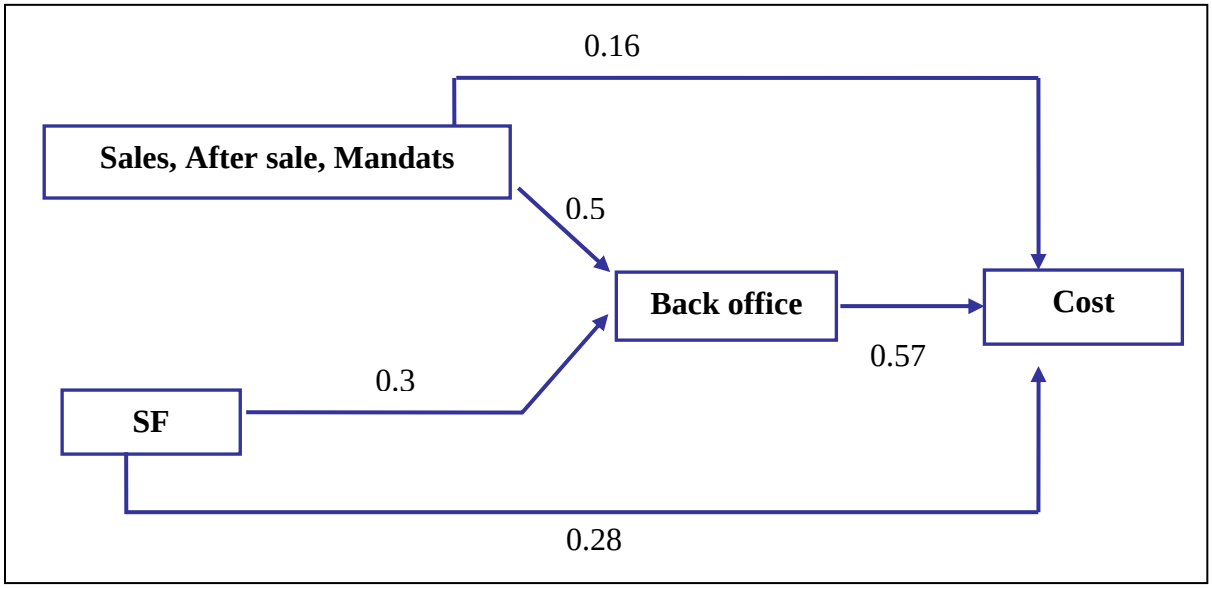
Let us first consider a single output model. The results may be summarized by the following graph:



The parameters are estimated by OLS in log linear models and correspond to elasticities. The total eslasticity of the cost to the front office product is equal to 0.88 (0.47 + 0.82 × 05). The increasing return to scale derived from this result is less important then in the 2002 study (the elasticity was .8).

[b] Only partial results are given here. Detailed results (including all the usual tests) are available upon request to the authors.

Let us now consider a decomposition of the product into financial services and other services (sale, after sale and mandats). The previous graph is decomposed into and leads to a total elasticity (0.16 + 0,25 + 0,57 (0,5 + 0,3)) of the same value as in the single product case.



A decomposition of first product into sale and after sale lead to an insignificant effect to the after sale product.

Segmentation of the *TERRAIN*

In first step, we do regressions with the same segmentation used in 2002 but results are not significant. Indeed, the models tested have all low R^2. So we define a new segmentation based on 'non postal' data.

An ascending hierarchical classification of *Terrain* was made using external data. The population living within the *Terrain* and the number of companies 1 to 9 employees located *in the Terrain. Those two variables are then considered as explanatory variable. We obtain 3* classes of *Terrain*

	Total number of *TERRAIN*	Average population	Average number of firms of less than 9 employees
Class 1	1981	8916	183
Class 2	1103	18952	478
Class 3	663	30960	849

Table 2 : statistics on classes

which could be described as follows (see also table and figure below):

i) First, class 1 the *Terrain* is mainly located in rural areas, with low population and few companies 1 to 9 employees

ii) Second, class 2 is an intermediate class.

iii) Third, class 3 the *Terrain* is located in urban areas, highly populated and with a high level of economic activity (important number of companies with less than 9 employees).

In the following table we report the share in the total number of *Terrain* and the share in the total activity of each class.

	% of TERRAIN	% of total front office activy
Class 1	53%	16%
Class 2	30%	34%
Class 3	18%	50%

Table 3 : share of activity and of *Terrain* by classes

One can observe that our classification follow the 2002 segmentation in the sense that it ranks *Terrain* by their activity.

The following figure illustrate that class 1 and 2 are relatively homogenous. Nevertheless this gain in homogeneity is not observed for Class 3 because Class 3 represents *Terrain* located in urban areas and many *Terrain* of these areas are not yet achieved *Terrain*. Indeed one big office located in these areas can account for one *Terrain* even if it has not the geographical characteristics of a *Terrain*. This explains why some heterogeneity can appear towards variables as the population or the number of firms of less than 9 employees.

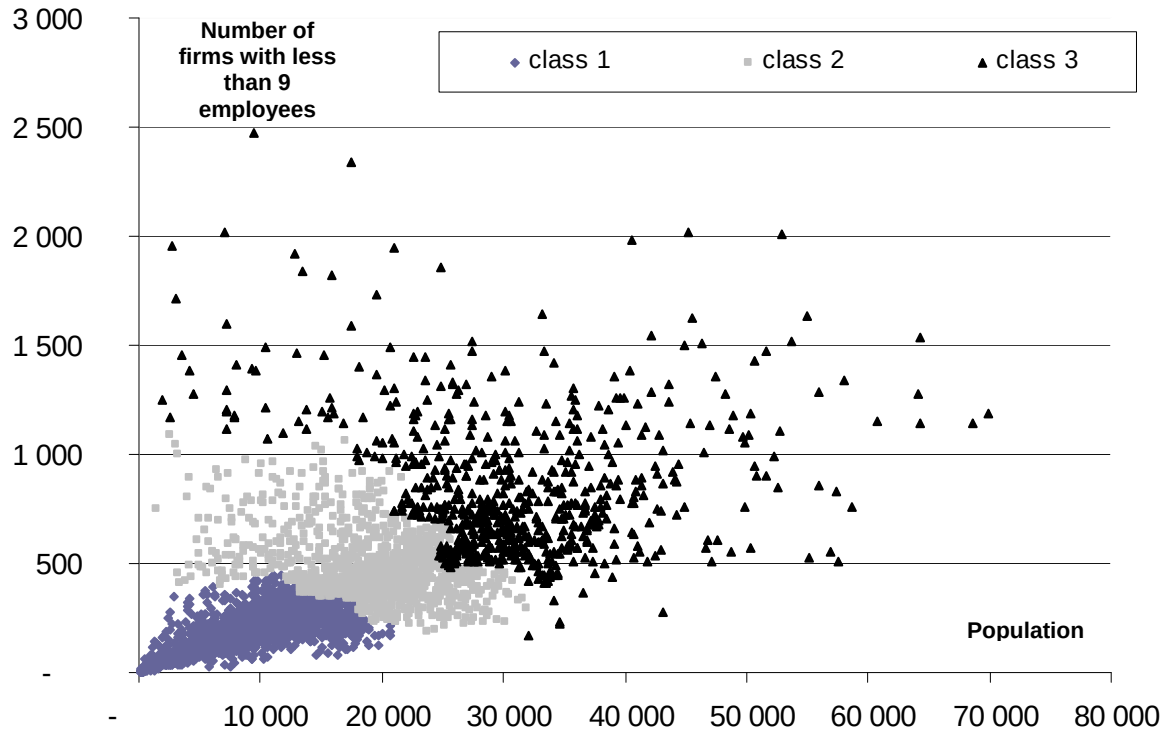


Figure 2 : segmentation of the *Terrain*

For each class, we have regressions in order to obtain the total effect of each type of front office activity without taking into account the back office.

	Class 1 (small)	Class 2 (medium)	Class 3 (Large)
Sales	0.38	0.61	0.56
After Sales	*(non significant)*	0.07	0.09
Financial Services	0.43	0.34	0.28
Sum	0.81	1.02	0.93

Table 4 : estimations of elasticities for each class of *Terrain*

Class 2 presents constant returns to scale, Class 1 presents increasing returns to scale as class 1 but more important. Compare to the 2002 study, our results are slightly different. Indeed Cazals *et al.* show that constant returns to scale were concerning large post offices. This difference could be explained by the fact that all the offices in the class 3 have not yet been organized in *Terrain* and that for class 2 this new organization has improve efficiency.

Impact of transformation

A number of owned offices have been transformed into partnerships during the last year. In terms of national planning and cost reduction, the impact of those transformations is very relevant. So, we estimate a cost model where we add the number of owned offices and the number of partnerships (introduced in nominal value and not in log in the models) within a *Terrain* as explanatory variables. We don't report the results related to the decomposition of the cost function into front and back office activities.

The fact that the parameter of partnerships is smaller than the parameter of owned offices, means that transformation (at the margin) will decrease total cost of *Terrain*. We obtain the following results:

R^2=0.84	***Cost* elasticity**
Front office activities	0.88
Number of owned offices	0.005
Number of partnerships	- 0.006

Table 5 : impact of the number of post offices

Adding an owned office in a *Terrain* increases the cost whereas adding a partnership has a negative effect. This result is not very surprising as we have here a restricted measure of the cost as we only consider labour. As people working for partnerships are not La Poste's employee, adding a partnership might lead to a reduction in La Poste working force as part of the output will be produced in this new partnership.

In order to correctly measure this effect, more research has to be made, maybe by measuring the cost more precisely or using an appropriate sample of the *Terrain*. For instance, by excluding 'sites' that are not fully organized as a *Terrain* should and by restricted the analysis to *Terrain* with a number of offices sufficiently important. In that sense, using the data of 2009, will probably improve the quality of our results. Moreover, using the number of partnerships might create an endogeneity bias as there probably exits exogenous variables (different for each *Terrain*) that explain the implementation of a partnership. For instance, the labour or the housing cost vary across the French territory.

5. Future works and concluding remarks

This paper presents some preliminary results on the cost function of La Poste network observed by sites. We have seen the impact of each class of input on the cost and the model decomposes this impact in a direct one and an indirect one through the back office activity of each component of the network. The role of some environmental variables is also exhibit thanks to a stratified estimation.

All the estimated models should be interpreted as "reduced form" models where the internal choices of the management of post offices are not explicit. In order to analyse this component of the cost model, choice models of management decisions (level of back office, implementation of ATM, transformation of a post office into a partner…) should be incorporated in the cost equation in order to endogenize some variables.

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