Prospective payment, patient transfer and network effect: a dependent competing risks approach

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SUMMARY

As all hospitals financing systems, the prospective payment (PP) does not allow efficient management nor optimal practice of patient transfers. The rising trend of these transfers leads many experts to point out the need of *some mechanism and countervailing instruments to prevent that*. Based on a French natural experiment in obstetric, named *Perin@t*, this study aims to show empirically that these health networks provide relevant mechanism for real control of these transfers. Different duration models with *competing-risks* specifications are applied to tow main outcomes: parturient lengths of stay (*LOS*) and their tow *exit-states*, *on-site delivery* ant return to home *versus* medical *transfer* to another maternity. Four models are tested to address different bias sources: maternity disparities, pregnant heterogeneity, their unobservable component, functional form of each *exit-state frequency* and dependence between both *exist-states*. The results show that maternities cooperating within *Perin@t* network make fewer medical transfers which are reduced of 58.82% at least. In addition, the two *exit-states* are complementary and determined by different factors.

JEL Classification: C34; C51; I11; I18

KEY WORDS: network effect; patient transfer; non-parametric hazard; dependent competing *exit-states*; unobservable heterogeneity

1. INTRODUCTION

1.1. Patient transfers in PP

French hospitals are funded by PP based on the global endowment[1] since 1983 replaced in 2004 by the DRG system named Tariff per Activity (T2A). PP aims to reactivate competitive mechanisms in order to restore economic efficiency (Schleifer, 1985; Laffont and Tirole, 1993). Theoretical and empirical studies show that applied to hospitals it induces expected effects but also opportunistic behaviors, mainly quality adjustment and healthcare rationing (Newhouse, 1996; Becker *et al*., 2005; De Pouvourville, 2006; Busse *et al*., 2011). Expected effects are positive because of their impact on hospital efficiency in terms of cost saving (*1.1.1*) and activity increase (*1.1.2*). They are distorted by opportunistic strategies that can be used to achieve these objectives, mostly patient selection and consequently medical transfer and cost deferral between hospitals. Quality adjustment and healthcare rationing are opportunistic strategies with adverse impact on hospital efficiency and healthcare quality when patient selection is based on the trade-off between the forecast DRG tariff and anticipated costs of each patient severity level. Financial considerations lead each hospital to transfer critical patients towards other healthcare providers to fulfill the budget constraint implicit to exogenous tariff. These selection strategies have considerable influence on *LOS*, but also on the frequency and the timing of patient transfer (Newhouse and Byrne, 1988; Ellis and Ruhm, 1988; Ma, 1994; Ellis and McGuire, 1996; Elis, 1998). Duality was emphasized between two trends in Medicare, reducing *LOS* and increasing transfers (Newhouse, 2003).

1.1.1. Cost reduction of pathology, selection of patient or choice of his DRG? PP classifies each patient into homogeneous DRG and determines the reimbursement tariff independently of his costs. This cost-sharing rule incites hospital to manage patient costs with respect to exogenous tariff. This positive and desired objective can be achieved by developing different strategies, reducing *LOS*, streamlining of care, but also by opportunistic strategies as selection of inpatients as well as their DRG (Ellis and Ruhm, 1988; Franck and Lave, 1989; Elis, 1998; Newhouse, 1996; Miraldo et al., 2006; Busse *et al.*, 2006, 2011). These strategies are cumulative insofar as *LOS* may be reduced in two contradictory effect ways: by optimizing care path which increases healthcare quality and effectiveness, but also by controlling inpatient admissions. Admissions may be managed by targeting cheapest inpatients in each DRG (skimming), by using premature return home (Afrite *et al.*, 2009), and by transferring critical and costly cases to other healthcare services as post-acute care and rehabilitation, or to other hospitals (Newhouse, 2003). Patient selection and transfers (dumping) cause an efficiency loss and increase cost *in fine* if all these issues are taken into account. Costs saved individually in some hospitals will not be effective in aggregated costs at patient level, nor even at health expenditure level.

1.1.2. Activity or income increase? PP is calculated by multiplying quantity and fixed tariff for each DRG and summing on all inpatients. Each hospital must increase the quantity to expand his endowment. Quantity increase is an expected PP objective because it means increasing care supply and therefore better access to healthcare. It is positive if this increase affects all hospitals and the rising supply is accessible to every patient. However, it can be distorted by adverse effect of demand induction if each hospital selects admitted inpatients (*1.1.3. Quantitative induction*) and their DRG (*1.1.4. Qualitative induction*). Selection strategies and consequently patient transfers enable care providers to monitor their activity volume as well as its composition (*Case-mix*). Hospitals can then increase income without increasing activity.

[1] Profit hospitals are paid on fee-for-service basis before 2005.

1.1.3. Quantitative induced demand is an artificial activity increase that hospital may implement in several ways: by over-diagnosis patient condition in order to provide disproportionate care (*creaming*), by referring outpatient to inpatient hospitalization, and also by multiplying admissions of the same patient by dividing his *LOS* in several spells. Sparrow (2000) lists different abusive behaviors, Rogers *et al. (*2005) highlights significant increase of short care spells in *Payment by Result* British system (PbB) and Or *et al.* (2013) in T2A French system. PbR and T2A introduced the same year (2004) are not spared from McClellan's primary critique on DRG in 1997. They are PP applications that are not conform to its principle. Payment is not entirely prospective insofar as care providers have different possibilities to select DRG for each inpatient and therefore the level of reimbursement. Payment and cost are not therefore completely independent because of asymmetric information at several levels (healthcare provider is between payer and patient with a significant informational advantage on both), and mostly because of the multiplicity of procedures and their coding system. The paying agencies lack information on the patient severity and the multiplicity of medical procedures make possible to select less costly procedures as well as the better reimbursed (*up-coding* and DRG *drift*).

1.1.4. Qualitative induced demand is an activity increase by changing its composition (*Case-mix*). This is possible when patients are selected according to their ratio tariff/cost. Care access may be reduced to patient with the lowest cost if tariff cannot be manipulated within the same DRG and/or highest paid DRG if cost is incompressible. These strategies (*cream-skimming* and *skimping*) may hide behind hospital specialization and the quest for comparative advantage. PP affects hence the patient distribution between hospitals. It does not lead to general increase of all procedures in every healthcare structure. Providers can increase their activity on a discretionary basis by sorting profitable cases and transferring the least 'profitable' to other healthcare providers. Activity increase may result from two conflicting and hardly dissociable factors: the attractiveness of each hospital because of its care quality, but also patient transfers decided by other hospitals. The first is positive because it reflects PP expected quality competition, the second is not if transfers are based on tariff/cost criteria regardless of medical benefits.

Selective practices do not necessarily result in patient transfers witch makes these decisions difficult to observe and to measure statistically. Because failing to transfer the patient, health provider may decide alternatively to overprovide care by classifying him in a best paid DRG. For example, applying a caesarean section rather than vaginal birth, can earn up to €1000 more. Milcent and Rochut (2009) show that caesareans were more frequent in french for-profit hospitals. McClellan (1997) and Becker *et al.* (2005) state that expenditure increase in Medicare was accompanied by an increase of the most technical and expensive procedures as YHEC (2005) in the British experience and Nassiri and Rochaix (2006) in Quebec. The first quantitative assessment of the French experience notices increasing selective practices since the introduction of *T2A*, particularly in for-profit hospitals (Or *et al.*, 2013). Activity remained stable in this sector but with significant changes in its composition, whereas it increased significantly in non-profit hospital with severest cases mainly. More over, *in for-profit hospitals, an important increase of care sessions and ambulatory surgical stays were concomitant with drop in full inpatient hospitalization notably in obstetrics and medicine services,* in addition to *a rise artificially high in ambulatory.*

1.2. Instrument of transfer regulation

Due to the magnitude of patient transfers and the inability of financial incentives to manage it, Chalkley and Malcomson (2000) recommends to implement *some mechanism* and Becker *et al.* (2005) *countervailing instruments to prevent* and control abusive behavior. The only used instrument was the refinement of DRGs to homogenize classification according to some criteria such as severity and *LOS*. French nomenclature, tariffs as well as their calculation underwent several revisions to reach currently 2600 cases. However, DRG proliferation tendency is itself a limit of PP incentives. Large tariff schedule increases indirectly the link between cost and reimbursement and does not encourage costs savings. Payment becomes less prospective, yardstick competition between hospitals is weakened, or even canceled, mostly when hospitals tend to specialize.

We propose to reconsider cooperation between healthcare structures to address these competition adverse effects stirred up by PP. Reintroducing and supporting cooperation makes transfers more efficient because decisions will be taken collegially by linked hospitals according to patient medical condition. Health networks offer the framework for such cooperation, as telemedecine and teleconsultation (HAS, 2011). This empirical validation is based on a natural experiment initiated in France in 1999 (Decree 98-899) in obstetric which experienced an important organizational change. Three maternity levels were distinguished according to the staff and equipment to provide adequate care for severe cases (mother or child). Organizational change provided also pregnant medical follow-up through the healthcare system in order to orient mothers and newborns into institutions adapted to their medical condition, and to ensure the emergency referral *in utero* and during the postpartum period. To reinforce these objectives, the national program of telemedecine network named *Perin@t* was launched in 1999 enabling collegial decision-making between maternities. It gives tele-expertise opportunities using video conference and electronic exchange of medical data to organize real-time staffs between healthcare providers (*telestaff*) for prenatal diagnosis or collegial decision-making in pathological pregnancies. Using *ICT* and coordinated by the Regional Hospital Boards, it *contributed significantly to the development of the regional programs of the pregnancy and perinatal medicine video-conference* (Hazebroucq, 2003). It constitutes a relevant instrument to thwart hospital *financial incentive to structure admitting and referral arrangements* (Newhouse, 1989).

2. DATA

This empirical validation aims to estimate network marginal effect on two interrelated outcomes, the pregnant *LOS* and her *exit-state*, *on-site delivery* versus *transfer*. The network effect is measured by our variable of interest *NETW* constructed from the website of the annual statistical survey of healthcare facilities (SAE) of 2004, a dummy variable to identify maternities cooperating within *Perin@t.* Estimations take into account a set of factors characterising maternity disparities and their pregnant heterogeneity.

Data corresponds to pregnant women admitted in non-profit maternities during 2004.This year presents three points of interest. Firstly, it corresponds to the significant change in hospitals funding with T2A. Secondly, it falls just before the first High Authority guidelines on the monitoring of mothers and newborns. Finally, medical follow-up between maternities is not yet enough regulated and public authorities have just begun to promote networks (Perinatal Plan 2005-2007). The interest is that the estimated network effects on both outcomes are not biased by other concomitant measure or policy effects.

Data comes from several sources. *LOS* information is extracted from *MISP* and maternity disparities from SAE. Other information, such as DRG tariffs comes from the Official Bulletin while some others are calculated as the distance between maternities. We have 1,441 parturient stays in six public maternities including three which collaborate within *Perin@t* and admit over half of stays, 54.10% (Table I). This is in line with national statistics. Vilain(2011) shows that a large number of maternities were operating independently in 2003 to monitore parturient follow-up (62%) or their return home (45%).

(Table I)

Table I highlights three main remarks. Firstly, all stays last a week on average (7.22 days), a little less for transferred women (6.80 days). While weak, this difference means that transferred pregnant do not wait for transfer as long as women who give birth *on site*. Secondly, it is not because maternities cooperate in *Perin@t* that their parturients stay shorter. In fact, stays are relatively longer in these maternities. They are victim of their own success by attracting more severe cases requiring longer stays (as shown later). Finally transfers are less frequent (about half) and transferees *LOS* are shorter in these cooperating maternities.

These remarks underpin the positive impact of cooperation within network that we propose to measure: it is a relevant mechanism to control the intensity of transfers as well as their timing (*LOS*). Estimations take into account tow heterogeneity levels, between maternities of 6 Hospital Centers (*HC*) and between their inpatients with 240 parturients on average per maternity. Several factors are retained (Table II, III, IV) according to many empirical studies (Ellis and McGuire, 1996; Milcent and Rochut, 2009; Or *et al*, 2013).

Statistical statements in table II show that disparities between maternities are, if not equal, slightly lower than regional disparities. Our maternities seem more homogeneous according to many criteria: they have a smaller distance to the nearest highest (3th) level maternity and low average number of midwives, obstetric beds and days per obstetric bed. Also, variations of these factors are much smaller in our sample.

(Table II)

Table III and IV show that disparities are between parturients rather than between maternities. Firstly, age pyramid is young with slight difference between maternities: the average age is between 27 and 30 years in light of national statistics witch show an increase from 28.8 up to 29.3 years between 1994 and 2000. It does not vary much between maternities: only 5% of the total variation is between maternities. Secondly, between-maternities variations of parturient *complexity level* (*COMPLB*) represent only 8.07% of the total variation and, in each maternity, the level B is the most common among the transferred cases and the level A among non-transferred cases (respectively 46.9% and 62% of stays). Finally, *the number of significant associated diagnoses (NBASD)* varies from 2 to 3 points around an average of 4.25, these variations are much more within than between maternities (Within variations corresponds to 70% of the total variation). We also note that this *number* is higher in maternities connected within *Perin@t*, witch corroborates the observation derived from statistics on *LOS*: networked maternities are victims of their success in attracting the most difficult, elderly pregnant with multiple diagnoses.

(Table III)

Analysis of the *case-mix* confirms the homogeneity of the activity structure between maternities. Between-maternity variations represent only 9.20% to 12.99% of total variation in terms of all the factors in table IV, {*TARIFF*, *DURAV*, *COST*, *VARDRG*}, witch measure *T2A* financial incentives. We also note that the majority of transfers (83.67%) corresponds to *DRG* with a large *coefficient of cost variation* (exceeding 50%).

(Table IV)

The preceding list of factors is not exhaustive and all relevant factors are not available mostly because of measurement difficulties of all the risks faced by each parturient and all strategic decisions performed by decision makers in each maternity. Econometric specifications allow addressing these sources of unobservable heterogeneity and testing for a possible dependence between the two pregnant *exit-states*, *on-site delivery vs transfer*.

3. ECONOMETRIC SPECIFICATIONS

Exit-states are represented by $k=\{1,2\}$ and a dummy variable *d* taking 1 for the first and 0 for the second. Each issue may occur for every parturient after a length T_k. Both issues are competing. (T_1,T_2) are therefore two latent variables as only the decision which occurs first is observable and its duration *T*. This observation schema is characterized by the couple (T,d) where $T=Min(T_1,T_2)$ is the *LOS,* and $d=\mathrm{I}_{[T_1\le T_2]}$ indicating *exit-state* (Cameron and Trivedi, 2005). Each *exit-state k* is characterized by its marginal hazard depending on observable determinants of maternity disparities and parturient heterogeneity *X*, in addition of unobservable components represented by a random variable υ_k following a Gamma distribution with density $\pi(\upsilon_k)$, mean $E(\upsilon_k)=1$ and variance $\mathrm{var}(\upsilon_k)=e^{\theta_k}$. This hazard takes proportional form $h_k(t/X,\upsilon_k)=\upsilon_k h_{k0}(t)e^{-X\beta_k}$ measuring the instantaneous probability that any parturient benefits from the k^{th} issue at the t^{th} day according to her profile, maternity characteristics and unobserved heterogeneity (X,υ_k). The baseline hazard rate $h_{k0}(t)$ measures daily evolution of each *exit-state frequency*. Two most widely used functional forms are retained to overcome specification bias : the parametric Weibull form $h_{k0}(t)=\alpha_k t^{\alpha_k-1}$ with[2] $\alpha_k>0$ and variance $\sigma_k=\alpha_k^{-1}$ and the flexible nonparametric form where $h_{k0}(t)=e^{h_j}$ is the *piecewise constant hazard* for all *t* falling in the j^{th} spell $t\in(\tau_{j-1},\tau_j]$ with $j=\{1,...,J\}$ being the ***J*** different spells (Meyer, 1992). From survival function conditional only to observable heterogeneity factors $S_k(t/X)=\int_0^{+\infty}S_k(t/X,\upsilon_k)\pi(\upsilon_k)d\upsilon_k$, the joint transition process to both issues is identified according to copulas technic (Heckman and Honoré, 1989; Van den Berg, 2001; Nelson, 2006). $S(t,t/X)=S_1(t/X)S_2(t/X)[1+\lambda(1-S_1(t/X))(1-S_2(t/X))]$ is *Farlie-Gumbel-Morgenstern* (*FGM*) joint survival function where the parameter $\lambda=\tanh(\delta)$ measures the dependency intensity between the two *exit-states ceteris-paribus*. This joint survival function $S(t,t/X)$ corresponds to the probability that hospitalization continues beyond the t^{th} day. We deduce $\partial S(t_1,t_2/X_i)/\partial t_k\big|_{t_1=t_2=t_i}$ the i^{th} patient's probability (*frequency*) of *on-site delivery* (*k=1*) or to benefit from medical *transfer* to another motherhood (*k=2*) after t_i days, as well as the log-likelihood of the model:

$L(\beta_1,\beta_2,a_1,a_2,\theta_1,\theta_2,\delta)=\sum_{i=1}^{n}\sum_{k=1}^{2}d_{ki}\ln\left(\partial S(t_1,t_2/X_i)/\partial t_k\big|_{t_1=t_2=t_i}\right)$ wherer $d_{1i}=d_i$ and $d_{2i}=1-d_i$.

4. RESULTS AND COMMENTS

Four specifications are estimated by maximizing the likelihood using GAUSS6 software (Table V-VI). They differ according to whether *exit-states* are independent (*M1* and *M2*) or dependent (*M3* and *M4*), transition process are parametric (*M1*, *M2* and *M3*) or non-parametric (*M4*). Backward stepwise elimination is used to select relevant factors according to Student's bilateral test (Signification level> 90%).

[2] To be positive, the parameter is constrained in the likelihood: $\alpha_k=e^{a_k}$

Monthly fixed effects are introduced to measure within annual seasonality of each *exit-state frequency*. Only August seems to know (statistically) significant variations and only for *transfer*. Its parameter is negative (-0.9043) which means that medical *transfers* double during the summer. There is however no seasonality for *on-site delivery* as no monthly fixed effect is significant in the four specifications.

Before discussing our results on relevant factors **(4.4)**, the four models are compared to determine the most adequate specification and hence the implicit structure of each *exit-states frequency* (Table V) to answer three main questions : **(4.1)** Are these *exit-states* dependent? **(4.2)** Do they depend on unobservable factors? And finally, **(4.3)** what is their daily trend during the stay?

(Table V)

4.1. Independence between exit-states

Estimated dependency parameter δ* of *FGM* copula is not statistically significant whether the transition process is parametric *(M3)* or non-parametric *(M4)*. The two *exit-states* are therefore independent: the tow decisions of keeping a parturient to give birth *on-site* or transferring her toward other maternity are independent. Both are decided according to *LOS* and different factors.

4.2. Relevant unobservable factors

Comparison of the two relevant models addressing this question, (*M1)* and *(M2)*, confirms the presence of unobservable determinant factors on both decisions. The estimated parameter θ is statistically highly significant for both (> 98%).

4.3. Different daily exit- state frequency

The Weibull specification is parametric with a single parameter α_k which gives only average trend of the elasticity ($\partial \ln(h_k(t)) / \partial \ln(t) = \alpha_k - 1$) between each *exit-state frequency* and parturient *LOS*. The estimated α_k is positive, greater than 1 for both *exit-states* and lower for *transfer*, which means that the daily trend of *exit frequency* is increasing for both issues but weakly for *transfer*. According to the model *(M3)*, this elasticity is equal to 0.73% and 0.56% which means that *on-site delivery frequency* increases of 7.3% and *transfer frequency* of only 5.6% when stay lengthens of 10%.

Such specification widely used in empirical validations is not flexible enough to highlight irregular trend changes. These frequencies are then reestimated non-parametrically in *(M2)* and *(M4)* with *piecewise* function. The major lesson drawn from the results in Figure 1 is that the tow *exit-states* have different temporal trend: *on-site delivery* reaches their maximum *frequency* after the 5th day of stay whereas *medical transfer* becomes more frequent after the 9th day. The model *(M2)* shows clearly a complementary relationship between the two *exit-states* as their hazard rates vary in opposite direction: until 5th day, *on-site delivery* increases sharply whereas medical *transfer* declines significantly. Beyond this day, mostly for parturient reaching their 9th day, the likelihood to benefit from a medical *transfer* increases strongly as the *on-site delivery* likelihood reduces critically. Such result confirms that medical *transfer* is an alternative to overcome difficulties with *on-site delivery*.

(Figure 1)

4.4. "Maternities" disparities and "Parturients" heterogeneity effects

(Table VI)

Tow preliminary remarks from the results. On the one hand, many explanatory variables are eliminated by *backward selection* as estimated parameters are not statistically significant. However, this does not mean necessarily that these variables are irrelevant. Parameters are not significant rather because of lack of variability of these variables. Indeed, section 2 shows that maternities and patients are homogeneous according to many criteria. They do not so present enough heterogeneity that allows identifying the effect. On the other hand, the estimated parameters have the same sign in the four models and their values do not differ significantly. Positive/negative parameter means a significant decrease/increase of *exit frequency*. Some factors have the same effect on both *exit-states*, while others are specific to each one. Some factors are inflating and others moderating because the first amplifies while the latter reduces these *frequencies* (Table VI).

(Table VII)

Inflating factors *MWEFT* and *CESEC* increase both *on-site deliveries* and *transfers*, whereas *Ln(COST)* and *VARC* enhance only *transfers*. Contrarily, moderating factors are specific to one *exit-state*: *DURAV* and *NBASD* reduce *on-site delivery* frequency, *COMPLB* and *OBSBED* alleviate *transfers*. This difference means that the tow decisions for each parturient, *on-site delivery versus transfer to another maternity*, are not determined by the same factors and thus are independent.

Finally, we move back to the aim of these estimations: the impact of the interest factor *NETW* representing cooperation within *Perin@t* network. Indeed, this cooperation has the same and decisive effect on both issues. Regardless of the econometric model and its functional form, *NETW* is a moderating factor of the tow *exit-state frequencies*. Furthermore, the parameter values show that this dampening effect is stronger on medical *transfer*. Values given by all the estimated models are very significant and vary from 0.89 to 2.61 for *transfer* and only from 0.29 to 0.77 for *on-site delivery*. This corresponds to odds ratio between 0.07 and 0.41 for the first and between 0.46 and 0.75 for the second. These empirical results prove that medical *transfers* are less frequent between maternity hospitals cooperating within *Perin@t* network: transfers decrease from 58.82% up to 92.62%.

5. CONCLUSION

The main result of this empirical analysis is that *Perin@*t network help to reduce significantly parturient medical transfers between maternity hospitals. Estimations prove that 58.82% of parturient transfers at least could be preventable. These transfers become unnecessary providing substantial monetary and non-monetary costs-saving for maternities and parturient women. This result tends to validate the idea that cooperation within health networks constitutes a relevant mechanism to control and regulate patient transfers between different healthcare providers. The implicit idea is that, if these increasing transfers are an adverse effect of financial incentive fuelled by yardstick competition underlying prospective payment, health networks give relevant *mechanism to prevent that* because of the cooperation encouraged between different healthcare providers.

Of course, this validation is incomplete. Avoided patient transfers has other advantages and benefits, some of them are not measurable, such as reducing geographical inequalities, decongestion of certain technical platforms, and increasing care access. However, these avoided transfers and networks used assume additional costs of different nature and sometimes non-monetary, such as organizational costs. It remains then to quantify all these benefits and costs in order to implement cost/effectiveness or even cost-efficiency analysis of these mechanisms.

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Table I: *LOS, NETW* and *exit-states*

		Transfer		***Home***	**Total**	
		Frequency	**Mean *LOS* (σ)**	**Mean *LOS* (σ)**	***Frequency***	**Mean *LOS* (σ)**
NETW	**1**	**2.1%**	5.31 (6.87)	7.52 (6.13)	**54.10%**	**7.47** (6.15)
	0	**5%**	7.52 (5.85)	6.89 (4.82)	**45.90%**	**6.92** (4.87)
Total		**3.4%**	6.80 (6.22)			7.22 (5.60)

Table II: Maternity disparities (sample *vs* regional data)

	Variable		Mean(σ)	
			Sample	Brittany
Human resources	***MWEFT***	*Number of midwives (Equivalent Full Time)*	**14.25** ***(6.78)***	16.71 *(15.14)*
Equipment	***OBSBED***	*Number of obstetrics beds*	**31** **(9.21)**	33 (17.45)
Specialization	***LEVMAT***	*Maternity level : LEVMAT = 1 if maternity of level II; 0 otherwise*	**4/6** **66.67%**	11/19 57.90
	CESEC	*Percentage of cesarean deliveries*	**18.63** ***(2.73)***	16.95 *(2.91)*
Volume activity	***DELEVR***	*Childbirth number per delivery room*	**373.70** ***(127.03)***	344.29 *(129.46)*
	DAYBED	*Number of days per obstetric bed*	**243** ***(47.36)***	252.28 *(49.15)*
	EMERG	*Number of emergency admissions*	**24014** ***(11268)***	23000 *All over France*
Hospital environment	***DIST***	*Distance to the nearest 3th level maternity*	**37 *kms***	45 kms (*Median*)

Table III: Parturient heterogeneity

	Variable		Average (σ)	% of between-maternity variat.
Biography	***AGE***	*Age*	27.68 *(5.42)*	5.03%
Severity level	***COMPLB***	*COMPLB=1/0, if/not DRG complexity level is B*	24% *(0.4702)*	8.07%
	NBASD	*Number of significant associated diagnoses*	4.25 *(2.80)*	29.06%

Table IV: Financial incentives

Variable		Average *(Standard deviation)* From the 1era to the 6th maternity 1era	2nd	3th	4th	5th	6th	Sample	% of the variation between-maternities
TARIFF	*2004 rates in €*	2,325 *(791)*	2,904 *(877)*	2,859 *(779)*	3,258 *(813)*	2,883 *(817)*	2,723 *(939)*	**2,904** ***(877)***	11.73
DURAV	*Average duration of DRG in days (2004)*	5.88 *(1.38)*	6.82 *(1.7)*	6.69 *(1.42)*	7.48 *(1.76)*	6.77 *(1.55)*	6.48 *(1.79)*	**6.82** ***(1.7)***	9.20
COST	*National scale of costs in € in 2004*	2,036 *(726)*	2,562 *(808)*	2,519 *(711)*	2,889 *(759)*	2,541 *(750)*	2,392 *(859)*	**2,562** ***(808)***	11.56
VARDRG	*Coefficient of variation of the DRG cost (in %, 2004)*	69.9 *(35.79)*	44,74 *(30.78)*	48.08 *(32.35)*	38,56 *(24,37)*	46.07 *(30.96)*	58.60 *(31.33)*	**48.90** ***(31.43)***	12.99

Table V: Model comparison (*Level of Student statistical significance between brackets)*

	(M1)		*(M2)*		*(M3)*		*(M4)*	
Log-likelihood	-2.85544		-2.52641		-1.86087		-2.681	
Exit-states relation	Independent		Independent		Dependent		Dependent	
δ*					7 *(0.570)*		5.99 *(0.509)*	
Exit-states	*Home*	*Transfer*	*Home*	*Transfer*	*Home*	*Transfer*	*Home*	*Transfer*
Unobserv. Heterog.	Non		Yes		Non		Non	
θ			0.5541	1.915				
			(0.000)	*(0.0175)*				
h(t)	Weibull		Weibull		Weibull		Piecewise constant	
a	-0.548	-0.3159	-1.6856	-0.5985	-0.5465	-0.4449		
	(0.0000)	*(0.0013)*	*(0.0000)*	*(0.0007)*	*(0.0000)*	*(0.0000)*	*Graph 2*	
[$\alpha = e^{-a}$]	[1.730]	[1.3715]	[5.3957]	[1.8194]	[1.7272]	[1.5603]		

Table VI: Relevant factors

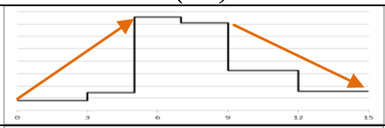
			(M1)		(M2)		(M3)		(M4)	
			Home	***Transfer***	***Home***	***Transfer***	***Home***	***Transfer***	***Home***	***Transfer***
NETWORK EFFECT		***NETW***	**0.7727** ***(0.0000)***	**2.6066** ***(0.0000)***	**0.5952** ***(0.0000)***	**1.1499** ***(0.0744)***	**0.4461** ***(0.0000)***	**0.8871** ***(0.0007)***	**0.28800** ***(0.0078)***	**1.3443** ***(0.0023)***
Maternity disparities	Human resources	*MWEFT*	-0.0270 *(0.0000)*	-0.0810 *(0.0032)*	-0.0364 *(0.0001)*	-0.0922 *(0.0186)*	-0.0160 *(0.0000)*	-0.0646 *(0.0002)*	-0.0100 *(0.0103)*	-0.0885 *(0.0022)*
	Financial incentives	*VARC*		-0.0514 *(0.0000)*		-0.0543 *(0.0000)*		-0.0269 *(0.0000)*		-0.0403 *(0.0001)*
		DURAV	0.5074 *(0.0000)*		0.6001 *(0.0000)*		0.2895 *(0.0000)*		0,1204 *(0.0000)*	
		LN(COST)	-2.2996 *(0.0000)*				-1.3124 *(0.0000)*			
	Equipment	*OBSBED*		0.0440 *(0.0053)*		0.0501 *(0.0153)*				
	Specialisat.	*CESEC*	-0.1090 *(0.0000)*	-0.3087 *(0.0001)*			-0.0616 *(0.0000)*		-0.0533 *(0.0059)*	
Parturient heterog.	Severity level	*COMPLB*		2.0352 *(0.0008)*		2.0335 *(0.0060)*		1.0502 *(0.0018)*		1.5651 *(0.0042)*
		NBASD	0.0987 *(0.0000)*		0.3408 *(0.0000)*		0.0558 *(0.0000)*		0.0554 *(0.0159)*	
Seasonality		*AUGUST*		-0.9043 *(0.0331)*						
Constant			19.9453 *(0.0000)*	13.2019 *(0.0000)*	4.9041 *(0.0000)*	8.8283 *(0.0000)*	11.3971 *(0.0000)*	5.9407 *(0.0000)*		

Level of Student statistical significance between brackets

Table VII	Inflating factors				Moderating factors				
Issue	*MWEFT*	*CESEC*	*VARC*	*lnCOST*	*NETW*	*DURAV*	*NBASD*	*COMPLB*	*OBSBED*
Home	+	+	*N.S*	*N.S*	-	-	-	*N.S*	*N.S*
Transfer	+	+	+	+	-	*N.S*	*N.S*	-	-

N.S: Parameter is not statistically significant

Figure 1: Daily trend of each exit state frequency, Return *home* & Medical *transfer*

Issues	*(M2a)*	*(M4)*
Home		
Transfer