

Institutional Environment and Transfer of Intellectual Property Rights:

An Econometric Study on French Foreign Licensing

Jean-François Sattin

(ATOM Paris 1)

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I. Introduction

Which institutions to protect intellectual property? This question was asked during the multilateral negotiations concerning the liberalization of trade (C.F. the TRIPS during Uruguay Round), and arouses a renewal of interest for the economists studying the international trade (FOSFURI [2000b], HELPMAN [1993]). This phenomenon coincides with the current explosion of the number of international technology transfers, which has accompanied the process of globalization, and with the emergence of strategies technologically directed in lots of firms.

The major role played by the institutional framework in the protection of contracts concerning intellectual property rights has been shown in a great number of economic studies (MARKUNSEN [1995], TEECE [1986] for example), as well as by almost all the managerial literature on this topics (RUBIN [on 1995], BYRNES [1992], GAUDIN [1993]).

Nevertheless, when it is a question of comparing the efficiency of the various institutional frameworks in this domain, we do not still have a reliable method allowing us to measure the strength of the protection offered to the contracting parties. The construction of such indexes has nevertheless a triple interest. It allows first of all to bring synthetic information - and so quickly usable to the practitioners of international trade. It so directly interests the legislator trying to create a legal environment facilitating the development of innovations. Finally, this information would be precious for the economist and politician because they would allow, by means of inter-country comparisons, better to understand the place and the impact of each institution in a given institutional system.

To generate such indexes, the best solution would doubtless consist in comparing the laws of the various nations concerned in a systematic way. The multiplicity of texts

and dimensions of rights framing licensing agreements makes this method very difficult to realize on a great number of countries.

The economists so developed others alternative methods to measure strength of the intellectual property rights. If we put aside the works that rely only on a single dummy variable and which focuses generally on an unique legal dimension hypothesized to be to be the most representative of the institutional protection (FERRANTINO [1993], BOSWORTH [1980]), the existing indexes can divided into two main families according to the methodology implemented to generate them.

The first group of indicators is based on the explicit existence of some number of legal texts judged as the most important by their authors. They rely also on *the offer of legal protection* in the studied countries. In this category, we can quote the indicators of RAPP AND ROZEK [1990], GINARTE AND PARK [1997], SEYOUM [1996] and OSTERGARD [2000]. These works incorporate inevitably a great part of subjectivity as into the choice of the selected institutional dimensions as at the level of the reserved procedures of aggregation, which can damage their representativeness.

The second group of indicators privileges On the contrary a more empirical method, and focuses on *the request of institutional protection* such as it can be expressed by the practitioners of international trade. This methodology seems to be superior to the previous one as it integrates into the analysis all of the various constituents of the institutional framework. However, the existing studies rely exclusively on works of inquiry with the practitioners of international trade (SHERWOOD [1997], LEE AND MANSFIELD [1996]), and so is often handicapped by the small size of the concerned

samples. Besides, they doubtless suffer from the traditional difference between the expressed choices and those effectively realized by the interrogated persons.¹

We propose here a new method allowing us to measure the national intellectual property rights and to test the validity of the various existing indicators. It consists in applying to a sample of international licensing agreements - where various nationalities are represented - the method usually used in labor economics to measure wage discrimination. Our method consists so in building indicators from an analysis of the ex-post choices of the contracting parties. It should allow us to override the cognitive bias encountered in the studies relying on inquiries, and should lead to more robust results. For what still constitutes in big part a pioneer work, we chose to focus on the existing relation existing between the choice of the mode of payment for the granted technology and the strength of the intellectual property rights, and to restrict us to the most active four countries in matters of international transfers of technology-i.e. Germany, the United States, and Great Britain. More exactly, our method consists in using regressions separated for each of these countries, and then in decomposing the observed variations in the frequency of various methods of payment in a part explained by the variations of the average characteristics of the sample, and in a residual part arresting the impact of the institutions.²³

1 This advantage is only marginally counterbalanced by a lack of indexes on the impact of every institution within a given institutional system, because it is always possible to find this information with inter-country comparisons.

2 An alternative method allowing to build indicators on the based on revealed preferences was developed in SATTIN [2000]

3 Which get back with France 90 % of royalties paid in the world (CLEGG and CROSS [2000])

This article is organized as follows. Our econometric model is detailed in section 2. The section 3 presents the data and the section 4 the empirical results. Ours results are discussed in section 5The section 6 concludes the paper.

II. The Econometric Model

Our objective is to build here indexes assessing the differences of the protection between the different institutional environments such as they can be felt by the various economic actors. In this purpose, we proceed to an analysis of the discrimination existing between contracts for various nationalities, such as it can be reflected in the observed choices of the mode of payment.

More exactly, our decomposition leans on an extension of OAXACA's model in the situations of discrete and ordered choices (OAXACA [1973], YUN [2000]). Our econometric model suggests a latent model of the type :

$$U_{gj}^* = X_{gj} \beta_g + \varepsilon \quad \text{where } \varepsilon \rightarrow N(\mu ; \sigma)$$

Where X_{gj} means the vector of the characteristics of the transfer j , the contracting party being of nationality g and where β_g indicates the vector of the coefficients estimated on the sample g . The error term has a normal density of mean μ and of standard deviation σ , *parameters of which do not depend, by hypothesis, on the country on which is made the estimation*. In practice, the latent variable and continuous U_{gj}^* assessing the trust of the French partner was coded in our model from variable discrete PAY_{gj} in the following way :

$$PAY_{gj} = 0 \text{ si } U_{gj}^* \leq a_0$$

$$PAY_{gj} = 1 \text{ si } a_0 < U_{gj}^* \leq a_1$$

$$PAY_{gj} = 2 \text{ si } U_{gj}^* > a_1$$

Where a_0 and a_1 represent the thresholds of protection which incite the French partner to pass from a mixed payment to a fixed payment (a_0) and from a variable payment to a mixed payment (a_1).⁴

If we define $P_{g|\tau}$ the probability which $PAY_{gj} = \tau$, we obtain :

$$E(PAY_{gj}) = \sum_{\tau=0}^2 2 - \Phi\left(\frac{a_0 - \mu - X_{gj}\hat{\beta}_g}{\sigma}\right) - \Phi\left(\frac{a_1 - \mu - X_{gj}\hat{\beta}_g}{\sigma}\right)$$

From the asymptotic relation :

$$\overline{PAY_g} = 2 - \Phi\left(\frac{\hat{a}_0 - \mu - X_{gj}\hat{\beta}_g}{\sigma}\right) - \Phi\left(\frac{\hat{a}_1 - \mu - X_{gj}\hat{\beta}_g}{\sigma}\right) \quad \text{Where } \overline{X_g} = \frac{\sum_{j=1}^{n_g} X_{gj}}{n_g} \quad (1)$$

Let us consider henceforth two countries A and B. The difference between the empirical averages of variable PAY can spell simply from the relation (1).

$$\overline{PAY_A} - \overline{PAY_B} = -\Phi\left(\frac{\hat{A}_0 - \mu - X_{Aj}\hat{\beta}_A}{\sigma}\right) - \Phi\left(\frac{\hat{A}_1 - \mu - X_{Aj}\hat{\beta}_A}{\sigma}\right) + \Phi\left(\frac{\hat{B}_0 - \mu - X_{Bj}\hat{\beta}_B}{\sigma}\right) + \Phi\left(\frac{\hat{B}_1 - \mu - X_{Bj}\hat{\beta}_B}{\sigma}\right)$$

This identity is equal to the following one :

$$\overline{PAY_A} - \overline{PAY_B} = \left\{ -\Phi\left(\frac{\hat{A}_0 - \mu - X_{Aj}\hat{\beta}_A}{\sigma}\right) - \Phi\left(\frac{\hat{A}_1 - \mu - X_{Aj}\hat{\beta}_A}{\sigma}\right) + \Phi\left(\frac{\hat{A}_0 - \mu - X_{Bj}\hat{\beta}_A}{\sigma}\right) + \Phi\left(\frac{\hat{A}_1 - \mu - X_{Bj}\hat{\beta}_A}{\sigma}\right) \right\}$$

Relation supplies 3.1 to us a decomposition of the total gap between the two countries.

$$+ \left\{ -\Phi\left(\frac{\hat{A}_0 - \mu - X_{Bj}\hat{\beta}_A}{\sigma}\right) - \Phi\left(\frac{\hat{A}_1 - \mu - X_{Bj}\hat{\beta}_A}{\sigma}\right) + \Phi\left(\frac{\hat{B}_0 - \mu - X_{Bj}\hat{\beta}_B}{\sigma}\right) + \Phi\left(\frac{\hat{B}_1 - \mu - X_{Bj}\hat{\beta}_B}{\sigma}\right) \right\} \quad (3.1)$$

The first term of the right member estimates variation due to differences connected to the characteristics of the various present individuals in the sample within the same

⁴ The estimation of these thresholds sends back to the cut points in our regressions.

benchmark model (here that of the country A) ; whereas second term represents a conventional measure of the discrimination. It's interpreted here as the residual distrust among the contracting parties which is not explained by our model, and which results consequently from differences perceived by the French part at institutional level between two countries.⁵⁶

An important limit about the decomposition 3.1 results from the fact that it is not unique. Within the framework of linear models, we find so the problem of indexation which appears every time we try to compile heterogeneous goods estimated with two vectors of different prices. In fact equation supplies 3.2 to us another measure of the discrimination between the countries A and B.

$$\begin{aligned} \overline{\text{PAY}}_A - \overline{\text{PAY}}_B = & \left\{ -\Phi\left(\frac{\hat{A}_0 - \mu - X_{Aj} \cdot \hat{\beta}_A}{\sigma}\right) - \Phi\left(\frac{\hat{A}_1 - \mu - X_{Aj} \cdot \hat{\beta}_A}{\sigma}\right) + \Phi\left(\frac{\hat{B}_0 - \mu - X_{Aj} \cdot \hat{\beta}_B}{\sigma}\right) + \Phi\left(\frac{\hat{B}_1 - \mu - X_{Aj} \cdot \hat{\beta}_B}{\sigma}\right) \right\} \\ & + \left\{ -\Phi\left(\frac{\hat{B}_0 - \mu - X_{Aj} \cdot \hat{\beta}_B}{\sigma}\right) - \Phi\left(\frac{\hat{B}_1 - \mu - X_{Aj} \cdot \hat{\beta}_B}{\sigma}\right) + \Phi\left(\frac{\hat{B}_0 - \mu - X_{Bj} \cdot \hat{\beta}_B}{\sigma}\right) + \Phi\left(\frac{\hat{B}_1 - \mu - X_{Bj} \cdot \hat{\beta}_B}{\sigma}\right) \right\} \quad (3.2) \end{aligned}$$

The various studies that estimate the discrimination integrate this problem by defining a confidence interval, or by privileging a mode of decomposition on the other one. Let us notice however that the definition of a zone of too much widened uncertainty can affect also the identification of the direction of variation. It is then necessary to define a method of decomposition and a country pivot to be able to practice coherent comparisons among the various institutional environments.

Equations supply 3.1 and 3.2 to us only global gaps. It is however possible of linearise these identities to encircle the contribution of every characteristic. For example,

⁵ For some economists, these two decompositions define alternately discrimination and nepotism (C.F. KATZ [1998]).

due to an estimate on the normal law followed by a limited development, we end in the decompositions 4.1 and 4.2 ⁷:

$$\begin{aligned} \overline{\text{PAY}}_A - \overline{\text{PAY}}_B &= \frac{1}{\sigma} \left\{ (\overline{X}_A - \overline{X}_B) \hat{\beta}_A \left[\phi\left(\frac{\hat{A}_0 - \mu - \overline{X}_A \cdot \hat{\beta}_A}{\sigma}\right) + \phi\left(\frac{\hat{A}_1 - \mu - \overline{X}_A \cdot \hat{\beta}_A}{\sigma}\right) \right] \right\} \\ &+ \frac{1}{\sigma} \left\{ \left[\overline{X}_B (\hat{\beta}_A - \hat{\beta}_B) + (\hat{B}_0 - \hat{A}_0) \right] \phi\left(\frac{\hat{A}_0 - \mu - \overline{X}_B \cdot \hat{\beta}_A}{\sigma}\right) + \left[\overline{X}_B (\hat{\beta}_A - \hat{\beta}_B) + (\hat{B}_1 - \hat{A}_1) \right] \phi\left(\frac{\hat{A}_0 - \mu - \overline{X}_A \cdot \hat{\beta}_A}{\sigma}\right) \right\} + \omega \end{aligned} \quad (4.1)$$

$$\begin{aligned} \overline{\text{PAY}}_A - \overline{\text{PAY}}_B &= \frac{1}{\sigma} \left\{ (\overline{X}_A - \overline{X}_B) \hat{\beta}_B \left[\phi\left(\frac{\hat{B}_0 - \mu - \overline{X}_A \cdot \hat{\beta}_B}{\sigma}\right) + \phi\left(\frac{\hat{B}_1 - \mu - \overline{X}_A \cdot \hat{\beta}_B}{\sigma}\right) \right] \right\} \\ &+ \frac{1}{\sigma} \left\{ \left[\overline{X}_A (\hat{\beta}_A - \hat{\beta}_B) + (\hat{B}_0 - \hat{A}_0) \right] \phi\left(\frac{\hat{A}_0 - \mu - \overline{X}_A \cdot \hat{\beta}_A}{\sigma}\right) + \left[\overline{X}_A (\hat{\beta}_A - \hat{\beta}_B) + (\hat{B}_1 - \hat{A}_1) \right] \phi\left(\frac{\hat{A}_1 - \mu - \overline{X}_A \cdot \hat{\beta}_A}{\sigma}\right) \right\} + \omega \end{aligned} \quad (4.2)$$

Difference between model of linear decomposition (BLINDER [1973]; OAXACA [1973]) or the probit model (YUN [2000], EVEN AND MC PHERSON [1990]), and the equations above, lies in the value of the multiplicative terms. Indeed, the coefficients of equations 4.1 and 4.2 are here multiplied by densities of normal laws estimated at the average characteristics of the sample, *and estimated at the various cut points*.

By following EVEN and MC PHERSON's procedure normalization, we can finally define the fraction of the difference in coefficients (EXP) explained by the j^e variable (EXPj) as follows:

$$\text{EXPj} = \text{EXP} \times \frac{(\overline{X}_A - \overline{X}_B) \hat{\beta}_{Aj}}{(\overline{X}_A - \overline{X}_B) \hat{\beta}_A} \quad \text{If the pivot is the country A} \quad (5.1)$$

6 Actually, this procedure of decomposition is usually used in a lot of domains. For example, in economy, the calculation of price indexes (Laspeyres and Paasche) or in management the calculation of gaps on cost (GERVAIS [1997]), recover from the same principle and are limited in the same way.

7 $\Phi(\lambda - X_g \cdot \hat{\beta}_g) \approx \Phi(\lambda - \overline{X}_g \cdot \hat{\beta}_g)$

$$\text{EXP}_j = \text{EXP} \times \frac{(\overline{X_A} - \overline{X_B}) \hat{\beta}_{Bj}}{(\overline{X_A} - \overline{X_B}) \hat{\beta}_B} \quad \text{If the pivot is the country B.} \quad (5.2)$$

III. The data.

The mobilized database results from the study of the licensing contracts listed in the Office of the International Technical Transfers of the French National Institute of Intellectual property (INPI). Indeed, according to the book IV of the French code of intellectual property, the French companies have to declare to the administration any contract concerning intellectual property past with a foreign entity. This making, obligation is made for them to give to the INPI a copy of the licensing agreement. Between 1904 and 1998, more than 60000 contracts were so registered among French residents and the companies of more than 130 different countries.

At first, we focused on the past licensing agreements of patent between French companies and the firms of German, Japanese, British and American nationalities, between 1994 and 1998. This corresponds to more than 2000 contracts in the starting point, but considering heaviness of the made coding only 422 contracts were incorporated in our study.

Every contract effectively integrated into our data bank must be indeed read in a meticulous way to track down the details of the contractual clauses. Every license is so arrested with about sixty of variable different, covering all the dimensions of the deal. Some information about the identity of the foreign partner (variables taille) was not however directly available in the INPI, and must be reconstituted ex post by means of the international books published by GRAHAM AND TROTMAN.

The selected contracts divide up so as to have more or less the same number for the various countries, with a small overrepresentation of the American contracts. Few controls were made here at the level of the distribution of contracts between the different sectors. Most of sector-based studies insist indeed on the nature more or less tacit of the resources transferred according to sectors (LEVIN AND ALII [1981]). This effect has been already arrested by our variable tacit and, we did not include of dummy sector-based in our regressions.

IV. The Econometrical Results

4.1. The payment formulae explanation

Our explanation of the payment formulae rests on a qualitative model of ordered choices. More exactly, we define here a variable PAY which takes value 0 if the payment for the granted technology is fixed, 2 if it is completely variable and 1 if it is about a mixed payment combining a fixed payment with royalties. This variable is then considered by means of a ordered probit on the explicative variable defined first.

The results are displayed in the table 3.

PAY	WHOLE SAMPLE	GERMANY	GREAT BRITAIN	UNITED STATES
tacit	-0.2248 (0.09654)**	-0.8966 (0.3133)***	-0.4062 (0.2890)*	-0.2738 (0.2884)
taille	-0.5057 (0.1054)***	-0.2570 (0.1799)	-0.6297 (0.1816)***	-0.5121 (0.1986)***
lienk	1.1621 (0.2076)***	1.3055 (0.3752)***	0.7684 (0.3451)**	1.3392 (0.3436)***
conant	0.8545 (0.1996)***	0.8074 (0.4044)**	0.9635 (0.4135)**	0.8496 (0.2888)***
restgeo	-1.0680 (0.2588)***	-0.7545 (0.4364)*	-1.6513 (0.4415)***	-0.7968 (0.4470)*
redmin	-0.2192 (0.1808)	-	-	-
recipro	0.2224 (0.2858)	-	-	-
CDT	0.1003 (0.1588)	-	-	-
Cut_1	-2.0103 (0.2044)	-2.1807 (0.3475)	-2.5768 (0.3789)	-1.7497 (0.3515)
Cut_2	-0.7252 (0.1725)	-0.9921 (0.2759)	-0.9466 (0.2779)	-0.5353 (0.3142)

Number of observations	322	104	100	118
Pseudo R²	0.2080	0.2102	0.2488	0.2194

Table 3. Econometric results

All our models show themselves relatively robust and significant of one per cent level. Regressions concerning all the dataset explain about a quarter of the total variance, what makes them comparable in quality to estimations we can find in the econometrics of the discrimination (GRANQVIST [1998], LONGVA AND STROM [1998])

We verify indeed here the negative relation between the size of the contracting parties and the implementation of royalties underlined by YAGANAWA and WADA's [2000] and MONTALVO AND YAFSEH [1995]. The importance of the codification of knowledge, the sectorial institutions, and the capital links are besides confirmed by our study. The codification of knowledge seems to favor here the implementation of royalties, as well as the bundling. The membership of the contracting parties of the same sector has also a significant impact on the apparition of a variable payment. The implementation of a minimal royalty rate and the transfer of resources for the licensee to the licensor does not seem to have of clear impact on the choice of the mode of payment set up (model WS). Actually, the actual impact of a clause of minimal royalty depends strongly on the commitment of the licensee to respect the contract and does not allow the licensor to protect itself against all the contractual risk. Furthermore, the non-significance of the reciprocity of transfers can be explained by a great variety of underlying contractual situations. It is recognized for example that numerous licensing agreements are concluded to avoid infringement suits (LANJOW AND LERNER [1996]). In every case, these contracts shall contain in return rights on the patent of the licensee ; however the payment condition will be also influenced by the probability of rejection of patents by

courts. Many contracts integrate also patents which practically have no legal value, and which cannot constitute a guarantee for the licensor.⁸

Furthermore, we can notice that variable CDT is not significant, whereas the countries dummy take an almost identical value in the two regressions. The consideration of the intellectual property rights cannot be all the story, and this one must be assessed in connection with the other institutional dimensions, such as for example the contract law, the international law and the competition law, or still the cultural dimension (LEE AND MANSFIELD [1996]).

Some national disparities can be noted right now. The importance of the degree of codification of knowledge varies strongly according to the considered country. Coefficient associated in this variable being maximal for the French-German licenses, and reaching its minimum on the French-American contracts. In a similar way, the size of companies seems to have an importance more marked for the British French licenses than for the French-American contracts, while influencing little the choice of the mode of payments for the French-German licenses. The other variables allow us to contrast the British French licenses with the rest of the sample. In effects, the British licenses distinguish themselves by a lesser importance of links in capital, as well as by an importance increased by geographic limitations and previous relations with their partners.

⁸ It is case for about 4.3 % of the contracts of our sample.

4.2. The apprehension of the institutional framework

To begin, we shall base our study of the discrimination on the analysis of global gaps (equations 3.1 and 3.2). Every inter-country comparison was made according to the two types of possible decompositions. A fast analysis of the table 5 allows us to notice an important sensibility of the coefficients calculated in the choice of the mode of decomposition.

	TOTAL GAP	DIFFERENCE IN CHARACTERISTICS	DIFFERENCE IN COEFFICIENTS
Repository : GERMANY			
GERMANY - UNITED KINGDOM	0.1379	0.0601	0.0778
GERMANY - UNITED STATES	0.0975	-0.0174	0.1149
Repository : UNITED KINGDOM			
GERMANY - UNITED KINGDOM	0.1379	0.0556	0.0823
UNITED STATES - UNITED KINGDOM	0.0404	0.1025	-0.0620
Repository : UNITED STATES			
GERMANY - UNITED STATES	0.0975	0.0023	0.0952
UNITED STATES - UNITED KINGDOM	0.0404	0.0874	-0.0470

Table 5. The decomposition of the total gap.

The calculation of distances between two countries following every method allows to calculate extreme points of variation for our coefficients, the actual indication of discrimination being able to be in any state of cause only between these two borders. A rather strong hierarchy of the institutional executives appears from our analysis. The

French contracting parties seem indeed to privilege their German partners on their British partners, but distrust less these last ones than their American partners. The superiority of the German institutions on those present in the United States is besides established, verifying so the hypothesis of transitivity of the choices of the French partner. These results are displayed in the table3 below.

Discriminatory Gap (X 100)		COUNTRY 2		
		GERMANY	GREAT BRITAIN	UNITED STATES
COUNTRY 1	GERMANY	.	[7.78 ; 8.02]	[9.51 ; 11.49]
	GREAT BRITAIN	-	.	[4.70 ; 6.20]
	UNITED STATES	-	-	.

Table 6. The hierarchy of the institutional environment for the transfer of technology.

These results are rather robust in the choice of the reference country. The choice of Germany as country pivot inverts however hierarchy among the German and American institutional executives, and demonstrates the necessity of crossing estimations on several countries varying the repository to obtain substantial results.

Several factors can contribute to explain the superiority of the Germanic institutional framework on the American and British institutions. Geographic and cultural estrangements between France and these various countries can increase in a significant way costs connected to the editorial staff and to the enforcement of the contract (HILL [1995] COEURDEROY AND MURRAY [2002]).

For example, German contract law is closer to our system inherited from the Roman right than can be other legal systems based on the common law. Germany distinguishes itself besides by the existence of courts specialized in disputes connected to intellectual

property, and by a very vast doctrine of equivalents. Cultural estrangement is translated also by a bigger inclination in the opportunism of the Anglo-Saxon contracting parties in license of technology (C.F. CASSON [1997] and KIM [2000] for the British licenses), as well as by a more frequent appeal to courts to solve conflicts.

Our results seems confirmed by the study of the other contractual clauses included in our data base. 44 % of the German licenses foresee clauses of retrocession, against 49.4 % for Great Britain and 53.7 % for the United States. Also, the German contracts are on average longer than the British and American licenses. The other clauses of guarantee concerning intellectual property allow especially to contrast the French-American contracts with the rest of the sample. So 46 % of the American licenses contain a clause obliging the graduate to indicate to the licensor all the infringement he knows about the granted DPI (against 42 % for Germany and Great Britain); and 20 % of the American contracts incorporate a clause of non-contesting by the concessionaire of the technology, against 13 % for Germany and 11 % for Great Britain

4.3. The analysis of differences in characteristics

Better to understand the part taken by every characteristic in the global gap, we proceeded to the linearisation of the gap in characteristic by taking French – German contracts as pivot. The frequency of the main variables of control is exposed in the table 4 on the whole sample, then country by country, whereas the details of the decomposition are reported in the table 5 below.

Empirical means	Whole sample	Germany	Great Britain	United States
Tacit	0.64286	0.59615	0.57	0.74576

Taille	0.94410	0.94331	0.92	0.96610
Lienk	0.31056	0.32692	0.24	0.35593
Conant	0.28882	0.27884	0.18	0.38983
Restgeo	0.09316	0.09615	0.1	0.08474

Table 2. The average characteristics of the sample.

STANDART : <i>GERMANY</i>	UNITED KINGDOM		UNITED STATES	
TOTAL GAP	0.0975	100	0.1379	100
ADJUSTMENT FOR CHARACTERISTICS				
Tacit	-0.1795	-189.9	-0.0084	-5.4
Taille	-0.0082	-8.2	-0.0017	-1.4
Lienk	0.0532	55.9	0.0342	27.3
Conant	0.1096	115.4	0.0210	16.0
Restgeo	0.0116	12.1	-0.0008	-1.9
DIFFERENCE IN COEFFICIENT	0.1149	113.9	0.0777	65.4

Table 7. The analysis of differences in characteristics.

The contribution of every variable aside in characteristic is much more marked for the United States than for Great Britain. In particular, the biggest inclination to be transferred tacit knowledge in the American contracts has, considering the importance of the coefficient associated to this variable in our estimation on the French-German licenses, a strong negative effect in the distance in characteristics. This impact is partially compensated with a more marked rely to intra-groups licensing and especially by a better follow-up of relations with the American partners. A contrario, individual distances are much less marked for the French - British licenses because average characteristics of

licenses spent with Great Britain get closer to those of the German contracts. The biggest inclination to resort to internal licenses and the more frequent existence of previous contracts explains with difficulty 40 % of the total distance for this country.

V. Discussion

Our method is built on the standard model of discrimination on labor markets. As such, the impact of the institutions is assessed through a residual component and is not so explicated directly. This can arouse some difficulties that must be mentioned.

One can so wonder about the aptness of the model used here to explain the payment formulae. It is clear that the importance of the assessed discrimination depends in a crucial way of the control variable included in our regressions. However, contrary to the notion of discrimination on the labor market, we can give an objective definition of the institutional framework (NORTH [1990]). Unlike the models of wage discrimination, we do not so risk to control here for variable which can be also viewed as a major sources of discrimination, and, actually, our model escapes in big part the criticism of subjectivity advanced against indicators based on the offer of legal protection. The choice of variable explained is not he either without ambiguity (CAIN [1986]). We chose to focus on the payment formulae, while we would have so indeed been able to base our research on the rights of audit for example. Let us note first of all that this problem exists also in labor econometrics (should we consider only the wage gaps?). Let us note then that the

payment formula appears to specialists as the central clause of any licensing agreement (GAUDIN [1993]). It is so justified that we privilege it in this first approach.⁹¹⁰

A second serious limitation in this type of model concerns then the return effects of the institutional framework on the characteristics of the studied contracts. Is it possible, for example, that it's the risks connected to the Japanese market, which impede the French small firms to enter in it, leading to an overrepresentation of big French companies? We can not be sure of it. However, it is a common problems in all the analyses which try to assess a residual factor; what does not prevent them from being always used in a extensive way in numerous domains.

VI. Conclusion

This article highlight the lack of substantial institutional indicators in transfer of technology, then attempted to resolve this problem by mobilizing the econometrics of the discrimination to analyze the actual choices of the contracting parties. We were able to establish a robust classification of the protection offered by German, British and American institutional environments to protect the transfers of intellectual property rights . The perspectives of searches opened with this paper are of two orders. First of all, factors all conditioning the choice of the payment formulae were not certainly identified. A vast field of research opened these last years which should allow to improve our empirical results. Then, in spite of the importance of the data required, our method seems to us promising. Indeed, it is not limited to technology transfers, and is easily reusable to

9 C.F. BLINDER [1973] for a study of the sensibility of the decomposition in the inclusion of variable news.

study numerous phenomena where the institutional framework conditions the choice of the economic agents.

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ANNEX : The Payment Formulae of the Licensed Technology.

The theoretical background.

In spite of the empirical observation that payment formulae rely more often on royalties than on fixed fee in technology licensing (ROSTOKER [1984], TAYLOR AND SILBERSTON [1973] , DEGAN AND HORTON [1997]), the theoretical literature has refused during a long time to consider the specificity of the transfers of knowledge, preferring rather to privilege models of interaction between the licensor and the potential licensees under shape of games which concluded inevitably to the superiority of the fixed payments on variable payments, at the same time for the licensor and for the licensee (KATZ AND SHAPIRO [1986], KAMIEN AND TAUMAN [1986], KAMIEN OREN & TAUMAN [1992]).

Three lines of arguments have been developed by the economists to resolve this paradox. First of all, some studies have looked for an answer in the market configuration of the final good (WANG [2000], MUTO [1996], MARJIT [1990]). Briefly, according to these authors, the choice of a variable payment by the licensor is explained in complete information by its will to limit the output of the licensee on an oligopolistic market where he intervenes also. Although relatively robust in a theoretical ground, the limits of these models are still to define. We will just notice here that this cannot be all the story because our sample, while going out of this scenario because it is restricted on cross-border contracts, include also a not unimportant part of variable payments.¹¹

On the contrary, explanations based on the imperfection of the technological markets seem to be more convincing (CAVES CROCKELL AND KILLING [1983]). Indeed opportunistic behavior can emerge easily on both sides on such markets.

¹¹ For a criticism of WANG's model, see FOSFURI [2000A]

Opportunistic licensees, for example, can make ex-post actions that, while profiting to them, have a negative impact on the wealth of the licensor (poor quality control, breach of secrecy, cumulative research from the granted technology, etc.). Also, once the concluded contract, the licensor can choose not to transfer all the agreed knowledge (defective technical assistance, etc.) because such a transfer is expensive and risky for him. Finally, the risk aversion of the partners, the nature of public good of transferred knowledge, as well as the ignorance of the real value come to strengthen the risks of opportunism for the partners. Indeed, the licensee can refuse to pay cash a knowledge he can hardly estimate the real value. But once transferred the information, the potential licensees can refuse to pay the inventor for the grant of the successful technology. (ARROW [1962]).

In this perspective, the agency theory and the transaction cost theory propose two explanations partially alternative for this empirical paradox. The first one emphasizes especially on the antiselection problems and view the method of payment as a mode of revelation of the information for the partners (BEGGS [1992], GALLINI AND WRIGHT [1991], MACHO-STADLER AND ALII [1996]). On the contrary, for the neo-institutional theory, the payment scheme will depend also strongly on the capacity of the licensor to protect ex post the transferred technology, and will result finally from an arbitrage between the costs of measure for the licensee ex ante and costs of the opportunism ex-post, in a perspective of minimization of the transaction costs (BESSY BROUSSEAU AND SAUSSIÉ [2000]). So, any things equal, the choice of a fixed payment obliges the licensee to invest some resources to estimate the value of the patent under license, whereas appeal to a variable payment possesses an desincitative effect on

the licensee, and obliges also the licensor to bear the costs of monitoring the actions taken by the licensee of the granted technology.¹²

The specification of the variable of control

To assess in the residual the capacity of various national institutional structures to protect the technology transferred, we have to control in our model for the all variable susceptible of impacting on the actual choice of the mode of payment and *which are not part of the legal or cultural environment*.

. The nature of transferred resources

The form under which is transferred the licensed knowledge, as well as transfers of others resources, seems to influence significantly the choice of the payment formulae. The importance of the degree of codification of transferred knowledge, for example, was recently underlined by some authors (ARORA [1996] CHOI [2001] BESSI AND ALII [2000], ANNAND AND KHANNA [2000]), as conditioning at the same time the antiselection and the opportunism of the licensee. Indeed, some knowledge is not codified in the patent, or that they are not directly codifiable (dexterity, etc.), or that the inventor prefers for strategic reasons not to codify them. The transmission of tacit knowledge is generally irreversible for the licensor. In these circumstances, for BESSI AND ALII [2000], the costs of measure of the licensee should be weak by comparison with the costs of monitoring for the licensor and we should notice an overrepresentation of the fixed payments on variable payments. This point seems confirmed by the study of DAVIS [

¹² These costs are far from being unimportant. TEECE [1977] for example evaluate the costs bound to the editorial staff of a licensing agreement at on average 19 % of the total profits of the transfer.

1977], but is besides countered with the inquiry led by TAYLOR AND SILBERSTON [1973] on British licenses.¹³¹⁴

. The characteristics of the contracting parties

According to GAUDIN [1993] and CLEGG and CROSS [2000], the belonging of the partners on the same industrial group must impact on the choice of the mode of payment. First of all, because within such groups, the protection of the technology is not crucial. Indeed, there is no risk for the licensor to create another competitor, and conflicts relevant to the opportunism of the licensee can be settled easily at the level of the management board. Then because the signing of a licensing agreement can be a convenient means to repatriate profits generated by the foreign subsidiaries. In this context, relying on a royalty rate has less chance to wake the suspicion of the administration of the host country.

Also, we can suppose that the existence of previous contracts between partners influences significantly the payment formulae. Indeed, contracts concerning radically different technologies and led eventually without problem should normally incite the licensor to revise the beliefs on the probability of apparition of opportunism from the licensee. Besides, according to BESSI AND ALII [2000], the existence of several another contracts not ended can protect the transfer. Every contract standing as a bond for every other, the cost for the opportunist partner will be significantly reinforced. Finally, the existence of preliminary contracts generally stretches out option contracts or secrecy agreements connected to the technology licensed. This can involve the renewal of a more

13 Referring to ARROW [1962], most of the previous studies supposed that transferred knowledge was totally codified.

14 According to ARORA [1996], this practice was usually used in chemical industry until the 1960's to make unusable information revealed in the patent.

former contract. In these circumstances, it is possible that tacit knowledge mentioned in the license had already been transferred (with remuneration) during the previous agreement, while being mentioned in the license to settle ex post this transfer.¹⁵

To en up, YAGANAWA AND WADA [2000] and CAVES CROCKELL AND KILLING [1983] showed the importance of the risk aversion of partners. This one is supposed to be negatively correlated in their financial resources, these last ones being confidentially approximated by the size of the firm. Big companies can indeed diversify their activities and possess generally a better knowledge of the characteristics of available technologies on the market. Furthermore, big companies risk less by definition to meet a liquidity constraint leading to the implementation of a royalty rate. Nevertheless, BEGGS [1992] notes that the impact of the size on the determination of the method of payment is not very clear. This reserve seems justified by AULAKH and ALII's [1998] works, which do not find statistically significant relation between these two elements.

. The others variable of control

When technology is integrated into a factory due to the work of engineering of the licensor, the production capacities of the installation and the risks of diversion of the technology are limited. The licensor can however demand a fixed fee based on the maximal capacity of the factory. He saves so expenses connected to the audit of the accounting of the licensee.

The integration of a clause guaranteeing an annual minimal payment for the licensor can be equivalent to the implementation of a fixed payment spread year by year

¹⁵ If such is not case, it is not very probable that the licensor will takes the risk to deal another licensing agreement with this partner !

or mixed (fixed price more royalties). To get the impact of the institutional framework, we should also control this variable.

The construction of the various explicative variables included in our model is detailed in the table 1 below.

Variable	Definition
tacit	Variable varying from 0 to 3 as the license foresees a supply of knowledge, a technical aid and the training of the staff of the licensee provided that this last one does not take these costs at his expense.
taille	Variable varying from 0 to 2 as the number of party that employ more than 500 employee increase
lienk	Variable dichotomous equal to 1 if there is a link in capital among the contracting parties
conant	Variable dichotomous equal to 1 if the contract mentions past relations
restgeo	Variable dichotomous equal to 1 if the license is limited to a precise geographic site
redmin	Variable dichotomous equal to 1 if the contract foresees the payment of a minimal annual royalty
recipro	Variable varying from 0 to 3 as the license foresees or not IPR's transfers or the supply of standard input to the licensor by the licensee
CDT	Variable dichotomous equal to 1 if the licensor is French

Table A. The variable of control

