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Cost-Benefit Analysis of the Community Patent

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Cost-Benefit Analysis of the Community Patent

Jérôme Danguy and Bruno van Pottelsberghe de la Potterie

Abstract

For more than 40 years, governments and professional associations have acted, voted or lobbied against the implementation of the Community Patent (COMPAT, officially called the EU Patent). The econometric results and simulations presented in this paper suggest that, thanks to its attractiveness in terms of market size and a sound renewal fee structure, the COMPAT would drastically reduce the relative patenting costs for applicants while generating more income for the European Patent Office and most National Patent Offices. The loss of economic rents (€400 million would be lost by patent attorneys, translators and lawyers) and the drop of controlling power by national patent offices elucidate further the observed resistance to the Community Patent.

KEYWORDS: patent systems, community patent, patenting cost, renewal fees, maintenance rate

Author Notes: The quantitative analysis presented in the present paper is inspired by analysis performed in the study "Economic cost-benefit analysis of the Community patent" (07.04.2009) authored by J. Danguy and B. van Pottelsberghe on behalf of the European Commission, and available on the following website: http://ec.europa.eu/internal_market/indprop/patent/index_en.htm#studies. The opinions expressed in this paper are those of the authors only and do not represent the ULB, Bruegel or the Commission's official position. The paper was presented at two conferences: the EPIP (Bologna, 24-25 September 2009) and the OECD-EPO conference on "Patent Statistics for Decision Makers" (Vienna, 7-8 October 2009). The paper was also presented in internal seminars/meetings organized by Bruegel, the European Council, the European Commission and several patent offices, including the EPO and the national patent offices of Denmark, Sweden, Finland, The Netherlands and the UK. The authors would like to thank these institutions and their representatives for their useful comments and remarks. Finally, we are grateful to G. de Rassenfosse, D. Guellec, D. Harhoff, K. Hoisl, A. Sapir, S. Farrow (the editor) and two anonymous referees for their helpful suggestions and comments.

1. The consequences of a fragmented European patent system

From a "European Union" perspective, the European patent system is highly fragmented. So far, as of February 2011, it has actually been a sum of 27 national patent systems, for more than 30 years. The only centralized dimension corresponds to the patent-granting procedure, composed of performing search reports, ensuring publication in due time, and performing substantive examinations and processing operations, which are all performed by the European Patent Office (EPO) on behalf of the 38 member states of the European Patent Convention (EPC), created in 1978. Once a patent is granted it must be upheld, managed and kept in force at the national level. This 'national' stage includes several validation and maintenance costs (frequent compulsory intermediation of local patent attorneys, validation fees, translation costs, renewal fees, litigation costs) that are essentially country-specific.[1]

This fragmentation, which does not occur in other large economies like China, Japan or the USA, reduces the effectiveness and attractiveness of the European patent system, particularly through its prohibitive costs and the economic incongruities it generates. The simulations developed by van Pottelsberghe and Mejer (2010), for instance, show that the drop in cumulated cost due to the London Agreement (which reduced the translation requirements of a patent's "description" section in 14 signatory countries) should not overshadow the still prohibitive costs of patenting in Europe, in both absolute and relative terms. Indeed, a patent enforced in 'only' six countries costs at least four times more than a patent filed in any other large economies. With renewal fees and translation costs that increase linearly with the geographical scope for protection, a patent targeting a large number of European countries can be up to 15 times more expensive than a US patent. These prohibitive costs indubitably affect the demand for patenting and reduce the accessibility to the system for small- and medium-size firms (SMEs).[2]

The negative effect of the fragmented system actually goes far beyond the prohibitive cost of patenting. Mejer and van Pottelsberghe (2011) show that heterogeneous national litigation expenses and practices induce a high level of uncertainty, easier 'parallel imports', and a *de facto* paradox of having an EU-level competition policy and examination process (performed by the EPO), while having national jurisdiction supremacies on patent issues. In this respect, the implementation of the Community Patent (COMPAT, officially called the EU

[1] See Guellec and van Pottelsberghe (2007) or van Pottelsberghe (2009) for more details on the patenting process within the EU, as compared with Japan or the USA.

[2] See de Rassenfosse and van Pottelsberghe (2007, 2009, 2011) and Harhoff et al. (2008, 2009) for empirical evidence on the fee elasticity of demand for patents.

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patent since the signature of the Lisbon Treaty) would not only reduce costs but would also improve the attractiveness and the effectiveness of the system, especially if it is associated with a unified European and EU Patents Court system (EEUPC).[3]

A natural question that therefore arises is why the COMPAT has not been implemented so far? Why is it still under heavy negotiation despite all of the expected positive impact it would have on the European patent system? For more than 40 years, many influential actors or lobby groups have been effective in barring the way to the COMPAT. Among them are lawyers specialized in patent litigations, patent attorneys, and translators.[4] In addition, some countries would like to see more languages than the three official ones (English, German and French).

Last but not least is the position of National Patent Offices (NPOs) and the EPO, which naturally strive to survive and tend to resist a project that may drastically change their working environment, and especially their budget and business model. The current system offers a win-win situation between the EPO and all NPOs, as half of the renewal fees on European patents received by NPOs are redirected towards the EPO, and accounts for about 25% of its budget. One could logically wonder, therefore, how the COMPAT would affect the renewal fee income of the NPOs and of the EPO. This budgetary issue has operational consequences and hence must be properly addressed.

The objective of this paper is precisely to answer this question by addressing three main issues associated with the potential consequences of the implementation of the COMPAT: (i) what would be the budgetary consequences in terms of renewal fees' income for the EPO and NPOs; (ii) what would be the implications for applicants in terms of absolute and relative fees; (iii) what would be the direct impact on major actors, including translators, attorneys, lawyers and the business sector.

The econometric results and simulations suggest that with a sound renewal fee structure, the COMPAT could generate more income for EPO and for nearly all NPOs than under the current status quo. It would at the same time substantially reduce the relative patenting costs for applicants. The loss of economic rents (€400 million would be lost by patent attorneys, translators and lawyers) and the

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[3] See Harhoff (2009) for a cost-benefit analysis of the implementation of a unified European litigation system for patent issues.

[4] Multiple parallel litigations and the monitoring of translation requirements secure real 'business' opportunities for patent attorneys and lawyers. For translators the COMPAT would be associated with far less translation requirements comparative to the current situation which requires a translation (of the claims section or the whole patent) in every country where the patent is enforced.

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drop of controlling power by national patent offices elucidate further the observed resistance to the Community Patent over the past 40 years.

The paper is structured as follows. Section 2 describes the econometric model that aims at understanding the determinants of the maintenance rate of patents and performs the simulations of renewal fees' income. The implications for the patent offices and on the patenting costs of the COMPAT are analysed in Sections 3 and 4, respectively. Section 5 presents the direct economic effects of the COMPAT for the most important actors of the system. Section 6 concludes, discusses the limitations of the results and underlines their policy implications.

2. Simulations of renewal fees' income

With the current system, the NPOs retrocede 50% of their renewal fee income generated by European patents to the EPO and keep the other half for themselves. Unfortunately NPOs rarely publish the importance of European patents for their yearly income, probably because it accounts for the lion's share, the rest being generated by national patents.[5] With the COMPAT there would be a centralized collection of renewal fees, most probably at the EPO. The EPO would then have to 'share' (assuming a status quo in the sharing of renewal fee income) the revenue generated by the COMPAT with the NPOs, with an appropriate distribution key between NPOs.

The natural resistance of (some) NPOs is related to the belief that they would see a drop in their revenue: this 'share' might be smaller than the amounts currently collected as 'independent offices', with the maintenance of European patents in each chosen (six on average) national jurisdiction. Whether this 'shared' revenue would be larger or smaller than the local revenue generated today with the traditional European patent is an issue that can be analyzed with simulations. The answer is not straightforward, as the total renewal fees income generated by the forthcoming COMPAT depends on three broad factors:

- the renewal fee structure of the COMPAT (what level of renewal fees? It is clear that with very high fees there would be relatively small use of it, and *vice versa*);
- the maintenance rate over time (which depends on the level of renewal fees and on other factors);

[5] According to the EPO 2008 financial statements (p.34), € 654 Million was generated by renewal fees (€327 for the EPO and the same amount for the NPOs). Relying on the actual distribution key (cf. Appendix Table F), the German patent office earned about €103 Million, and the French and UK patent offices had revenues of about €40 Million. As the 2008 annual report of the UKPO claims that the revenues generated by patents are of €49 Million (£39 Million), it can easily be deducted that national patents generate about €9 Million, or 'only' 23% of their total income.

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- the distribution key (how would the total renewal fees' income generated by the COMPAT be shared between NPOs?).

The methodological approach adopted to simulate the impact of the COMPAT on the renewal fees income of each NPO and of the EPO is composed of five main stages:

S1. Compute the total renewal fees income generated by a current 'average' European patent in the 27 EU NPOs;
S2. Understand the factors that influence the maintenance rate of patents in national jurisdictions;
S3. Select an 'acceptable' renewal fee structure for the COMPAT;
S4. From the results of (S2) and the chosen fee structures of (S3), simulate the maintenance rate of the COMPAT;
S5. From (S4) and (S3), compute the renewal fees' income generated by the COMPAT.

The simulations are performed "at the patent level" to make the conclusions independent from the relative substitution between the European patent and the COMPAT, and independent from any hypothesis on the total number of patents granted by the EPO. Questions such as "*what will be the share of patents granted by the EPO that follow the COMPAT route?"* would therefore not affect the results (if all the patents granted by the EPO opt for the current European patent, there would be no change to the current situation). What matters is therefore the difference in the renewal fees revenues generated by an average European patent and by an average COMPAT. The cumulated renewal fees' income generated by one current European patent over its entire life span depends on the number of countries it has been validated in, on the duration of the patent renewals in each of these countries – or its maintenance rate – and on the level of renewal fees. The total renewal fees' income generated by all the NPOs of the EU27 member states and of the EPO is VNPO (as defined in equations (1) and (2) below, it measures the income generated by one European patent "on average" over its entire lifecycle). For an average patent under the COMPAT, the main dimensions that matters are its maintenance rate and its renewal fees (as there is only one choice, the validation rate is automatically 100%). The distribution key will then define the income for each NPO.[6]

Three assumptions must be set before entering into the analysis. They are fairly acceptable and allow reducing the number of alternative dimensions that could be taken into account for the simulations. First is the assumption of "run-in period", which suggests that the renewal fees' income simulations are run "at equilibrium." The early changes in patenting behavior, and the required adaptation time to the new system are therefore not accounted for. This

[6] See Appendix Table A for a synthesis of the main factors explaining the renewal fees income under the two regimes (European patent and the Community patent).

assumption is equivalent to the practice that consists in considering the long run equilibrium of incoming flows of renewal fees, over the entire lifetime of patents.

The second assumption is that any patent starts to generate renewal fees income for NPOs from its 6th year onwards (up to its 20th year, depending on its maintenance rate). Before that, it is considered as a 'pending' application at the EPO. This assumption corresponds to the observed average delay before the decision to grant a patent at the EPO.[7]

The third assumption is the irreversibility choice that must be made by the applicant (remember that the two systems would co-exist). Once a patent is granted by the EPO, the applicant must choose between the current European patent format and the COMPAT. If an applicant opts for the latter it is not possible to later switch back towards the current European patent system, and *vice versa*. Allowing such a 'switching' system would simply induce a high complexity in both the simulation exercise and the tracking of what is actually going on in Europe.

These three assumptions (run-in period, 6th year grant, irreversible choice) and the patent-level methodological choice aim at assessing whether an average community patent (COMPAT) would generate more or less revenue than a current average European patent (EP) over its entire life span. Whatever the substitution degree between these two patents is, an actor (national patent office or the EPO) will be better off if the revenue it gets from one average COMPAT is higher than what he gets from one average European patent.

S1. Compute the total renewal fees income generated by an 'average' European patent in the 27 EU NPOs

For the national patent office of a country *i*, the renewal fees' income generated by a European patent depends on three main factors:

- The validation rate: the probability that the patent is validated in country *i;*
- The maintenance rate: the probability that it is maintained each year *t* for a maximum of 20 years *;*
- The level of renewal fees.

Equation (1) shows the total renewal fees' income ($VNPO_i$)[8] generated by an average European patent in the national patent office of country *i*:

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[7] Lazaridis and van Pottelsberghe (2007) and van Zeebroeck (2008), among others, provide evidence on this average duration.

[8] To be more precise, equations (1), (2), (3) should normally take into account a discount rate. However, since this discounting factor would impact in the same vein the revenues generated by a current European patent and those generated by the COMPAT, we decide – for the sake of simplicity – to ignore it.

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$$VNPO_i = \sum_{t=6}^{20} \pi_i (1-\delta_{it}) F_{it} \quad (1)$$

Where: π_i = The share of patents granted by the EPO which are validated in country *i*

δ_{it} = The drop-out (or depreciation) rate of the average patent in country *i* and year *t (i.e. the percentage of patents which are not renewed in the country)*

F_{it} = The renewal fees in country *i* and year *t*

According to equation (1), the budgetary value of an average European patent for country i is the sum from year 6 to year 20 (the maximum duration period) of the product of the validation rate (or validation probability), the maintenance rate (1-δ) and the level of the renewal fees. This amount can be divided by 2, as half of the revenue generated by an NPO is going back to the EPO and the other half is for the NPO itself (this 50/50 split will be accounted for in individual NPOs revenue simulations). Year 6 of the patent is taken into account for the start of the renewal fees' income computation.

Adding the cumulated renewal fees' income generated by the 27 member states of the European Union, as in equation (2), gives the total income (*VNPO*) generated by an average European patent over its life in the national patent offices of the European Union (and for the EPO).

$$VNPO = \sum_{i=1}^{27} VNPO_i \quad (2)$$

The value of a patent under the COMPAT can be measured with a similar formula, with the exception that it is by definition associated with a validation rate equal to 100% (the COMPAT only has one 'validation' possibility, otherwise it is not a 'COMPAT'). The total income generated by an average patent under the COMPAT (*VCOM*) is presented in equation (3).

$$VCOM = \sum_{t=6}^{20} (1-\delta_{ct}) F_{ct} \quad (3)$$

The major parameters are the maintenance rate of the COMPAT ($1-\delta_c$) and the structure of its renewal fees. The former parameter obviously depends on the latter: very high fees would reduce the maintenance rate (or increase the drop-out rate). The parameter (π) related to the probability of validation has disappeared because selection the COMPAT route does not lead to any subsequent choice, there is only 'one' COMPAT route, as illustrated in Figure 1. It compares the procedural routes followed by a European Patent and the COMPAT. First of all, it should be noticed that a small part of the current patents granted by the EPO are never validated in any country and fall into public domain as soon as the decision to grant is made by the EPO (Lazaridis and van Potteslberghe, 2007, estimated

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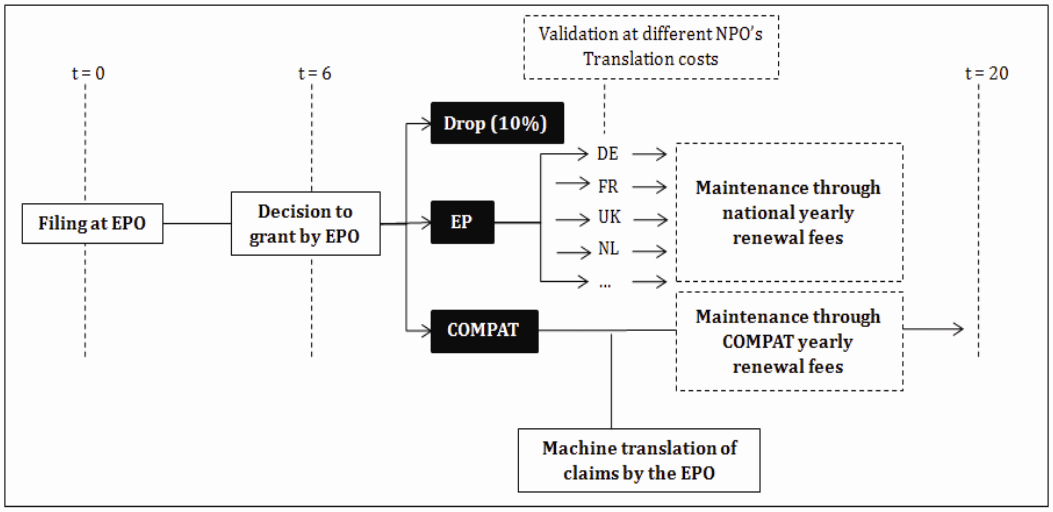
this share at 10%). These 'lapsed' patents do not generate any revenue in terms of validation or renewal fees, and are therefore not taken into account. As we work at the patent level (how much renewal fee revenue would be generated by one European patent or one COMPAT), early lapses do not affect the current simulations.

Figure 1. Procedural routes of European patent and COMPAT



Once a patent is granted, the inventor would choose between the European patent and the COMPAT. In the former case, he would have to validate the patent in all desired NPOs and pay the translation costs and validation fees. In the latter case, the translations would be taken in charge by the EPO (with an intense use of machine translations). After the grant, patents are maintained through the payment of yearly renewal fees (domestic renewal fees at NPOs for the European patent and a new fee schedule for the COMPAT route).

Figure 2 illustrates the differences observed across countries in the validation/maintenance rates of European patents over their lifetime.[9] Japan, with a large homogenous economy and relatively low renewal fees has the highest maintenance rate all along the life span of a patent. Within Europe, Germany, by far the largest and the richest country, has high validation/maintenance rates, similar to US or Japanese rates. After six years, 85 per cent of the patents granted by the EPO are enforced in Germany. This rate falls to 18 per cent for the patents with an age of 20 years. Finland, a smaller country, has much smaller

[9] For European countries the product of validation and maintenance rates is represented. The maintenance rates taken separately are pictured for a few European countries in Appendix Figure D.

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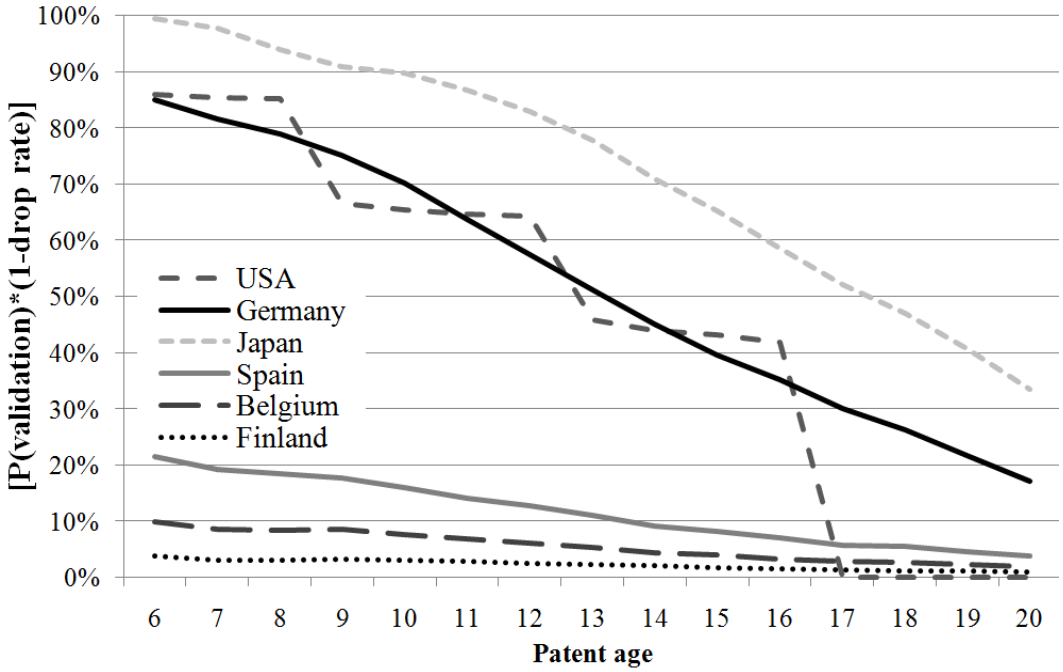
validation/maintenance rates, about 5 per cent of the granted patents, which falls to about 1 per cent after 20 years.

Figure 2. Validation/Maintenance rates of patents in selected countries



Source: own calculation from data provided by the EPO and NPOs and trilateral statistical report, see Appendix B and Appendix Table C for data source and computation.

The fact that Finland has a much smaller validation and maintenance rate than Belgium might as well be due to its particularly high renewal fees, which are nearly twice as high as in Belgium (cf. Appendix Table E). The simultaneous role of economic size and fees, amongst other variables, is evaluated in the next subsection. The maintenance rate for the US is dented because renewal fees must only be paid at three different stages in the life of a patent, confirming somewhat the important role played by renewal fees. From Figure 2 it is important to bear in mind that strong variations in maintenance/validation rates are observed across countries, and that the share of active patents continuously drops over time.

S2. Understand the factors that influence the maintenance rate of patents in NPOs

The maintenance rates presented in Figure 2 are a key factor for the calculation of the total revenue generated by one patent (for a given NPO or for Europe as a whole). Therefore, in order to simulate the revenue generated by an average patent

under the COMPAT, the factors that affect the observed maintenance rates must be understood and measured.

The model adopted to grasp the determinants of maintenance rate is designed according to the existing literature, logical considerations and intense interactions with national patent offices and patent professionals.[10] The earliest paper that focuses on renewal data of European patents is probably the one by Schankerman and Pakes (1986), who rely on renewal data to approximate the distribution of patent value and its depreciation rate. Several other studies (Cornelli and Schankerman, 1999, and Baudry and Dumont, 2009) argue and provide evidence that renewal fees have an impact on the decision to patent and to maintain a patent in force. Harhoff et al. (2008 and 2009) assess the determinants of validation behavior (at the aggregate country level and at the patent level) within the European patent system, with a particular focus on market size, distance between countries, validation fees, early renewal fees and translation costs. Van Zeebroeck (2008, 2009) investigates the strategic factors that affect the duration (or maintenance rate) of patents within Europe, with a patent-based approach. The author shows that European patents are validated in fewer countries over time but for a longer time frame. This duration is partly influenced by strategic factors, including the filing strategies adopted by applicants.

The model adopted in the present paper contributes to the literature by providing a first evaluation of the impact of renewal fees and other country-specific factors on the aggregate maintenance rate of patents across countries. The model is performed with a database composed of 15 European countries, the USA and Japan. The empirical model is presented in equation (4):

$$(1-\delta_{it}) = C + \beta\ GDP_i + \theta\ NPOAGE_i + \gamma\ IPI_i + \sigma\ PATAGE_t + \alpha\ F_{it} + \varepsilon_{it} \quad (4)$$

The dependent variable corresponds to the average maintenance rate of granted patents ((*1-δ*), or one minus the drop-out rate) enforced in country *i* at year *t* (t=6,…, 20). In other words, it is the share of patents that are renewed as a percentage of the total number of patents of the same cohort that were validated in the country. Fifteen years of renewals are therefore taken into account for each country. This variable is computed from the most recent information for each age-year of a patent (see Appendix B for a description of the methodology). For instance, the maintenance rate for the 20th year is taken for the patent cohort of 1987 (i.e., all patents filed in 1987 by the EPO) as the information for more recent cohorts is not yet available. The maintenance rate for the 10th year is taken from the cohort of 1997, and so on. This 20 year 'lag' for the 20th year of maintenance

[10] One should keep in mind that a structural model could also be used to understand precisely the mechanism through which all variables are related to each other. This is, however, outside the scope of this paper, and the reduced-form model is preferred for its convenience.

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rate will probably change over time but is the only available and reliable information.

The country-level explanatory variables include the gross domestic product (*GDP*)[11] in 2006, expressed in €; an indicator of the strength of the national patent system (*IPI*, which is computed by Ginarte and Park, 1997 and updated by Park, 2008); and the age of membership of the country in the EPC (*NPOAGE*, going up to a maximum of 31 years for the founding members). This latter variable aims at testing whether the countries that have been part of the EPC for a longer period also have higher maintenance rates, thanks to a learning and adaptive process. The age of a patent (*PATAGE*) is a variable that is constant across countries but varies over time to capture the life cycle of the patented technology. It is expected that the older a patent (hence the technology) is, the lower is its maintenance rate. Finally, one variable varies across countries and over the life cycle of a patent: the renewal fees (*F*). They are expected to have a negative impact on the maintenance rate. Table 1 provides summary statistics of the database. The sample of 17 countries was chosen over a larger sample because of data availability (there are currently 27 countries within the EU). As many countries have only recently joined the EPC, only small periods were available, with high standard deviations over time. Taking the 15 oldest EU member countries, added to Japan and the USA, allows us to assess the long term determinants of relatively 'stable' maintenance rate. It is worth noticing that including more countries in the panel did not change the results (results are available upon request). The maintenance rates are presented in Appendix Table C.

[11] As indicator of the size of countries, population was also tested and the econometric results were similar.

Table 1. Summary statistics of the database

		Min	Mean	Max	S.D.
Maintenance rates (%)	*t=6*	39	63	100	21
	t=10	28	49	90	19
	t=15	14	28	65	14
	t=20	8	13	33	7
GDP (in billion €)		34	1,463	10,496	2,526
Age of membership[a]		12	26	31	7
Fees (€)[b]	*t=6*	59	115	188	40
	t=10	118	285	902	195
	t=15	190	512	1,060	273
	t=20	270	770	1,940	442
IPI		4.14	4.55	4.88	0.19

a. For Japan and USA, we assumed the same age of membership as the oldest EPC member states.
b. The US fees must only be paid at three different stages in the life of the patent (€776 at 9th year, €1,964 at 13th year and €3,256 at 17th year).
Source: raw data provided by the EPO and NPOs, trilateral statistical report, Eurostat and Park (2008); see Appendixes C and E for further details.

The econometric results are presented in Table 2; they can be interpreted as follows. First, GDP, which reflects the market attractiveness or the wealth of a country, has a positive and highly significant impact on the maintenance rate. The countries with a higher GDP enjoy a higher maintenance rate. Looking at the standard errors, one may conclude that GDP is one of the two most important factors that influence the maintenance rate of European patents in a country. The second variable that plays a very significant role is the age of the patent. Its level of significance is as high as the level of significance of the GDP variable. The older a patent is, the lower its maintenance rate. This is true for all countries and follows the natural life cycle of a patented technology.

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Table 2. Estimated parameters of the "maintenance rate" model

Variable	(1)		(2)		(3)	
Intercept	0.229	***	0.536	***	-0.256	
	(0.041)		*(0.038)*		*(0.207)*	
GDP ('000 billion €)	0.104	***	0.072	***	0.064	***
	(0.008)		*(0.007)*		*(0.007)*	
Fees ('000 €)	-0.350	***	-0.112	***	-0.119	***
	(0.028)		*(0.027)*		*(0.026)*	
Age of membership	0.007	***	0.007	***	0.008	***
	(0.002)		*(0.001)*		*(0.001)*	
Age of the patent			-0.030	***	-0.029	***
			(0.002)		*(0.002)*	
Intellectual Property Index					0.172	***
					(0.044)	
Adjusted R-Square (%)	53.9		74.1		75.6	
Number of observations	243		243		243	

Source: cf. equation (4) in main text. The parameters are estimated with a heteroscedastic consistent estimator, over 17 countries and 15 years (unbalanced panel). The dependent variable is the maintenance rate, GDP is the 2006 gross domestic product; Fees stands for the national annual renewal fees (expressed in '000 €); Age of membership corresponds to the country's date of signature for the EPC membership, Intellectual property index comes from Ginarte and Park (1997)'s updated results for 2005, Park (2008). *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively; standard errors are in parentheses.

Then comes a country's age as a member of the EPC. The estimated parameter suggests that the longer the EPC membership, the higher the maintenance rate of a patent. This is the illustration of an adaptation phase to an advanced European system. De Rassenfosse and van Pottelsberghe (2007) also find that the 'older' EPC member states transfer a higher number of their national patent applications to the EPO. The Intellectual Property Index plays a positive and significant impact, suggesting that the countries with a stronger patent system (in terms of subject matter, enforcement quality, and reliability) will logically see higher maintenance rates than the countries with weaker patent systems.

Finally, a country's renewal fees have a negative and significant impact on the maintenance rate of patents. The higher the renewal fees, the lower are the maintenance rates in a country. This variable is highly significant, but less than the patent life cycle and GDP variables. A comparison of column (2) with column (1) shows that a sharp drop in the impact of patent fees occurs when the patent age is included simultaneously with the fee variable. This is due to the correlation between the two variables. Most NPOs have fee schedules which systematically increase with patents' age, witnessing the two forces that push a patent towards the public domain: time and costs.

According to the adjusted R-square, the four variables explain 76 per cent of the variance in maintenance rates over time and across countries, which is a fairly good approximation.[12]

Two methodological caveats, or implicit hypotheses, are worth noticing. The first one is related to the reliance on observed (past) maintenance rates. The twenty year maintenance rate of the patents granted today will most probably adapt to a different environment and might be smaller or higher than the ones observed today for the patents granted 20 years ago. This issue is clearly embodied into the degree of quality of the system (quality of applications and rigor of the examination process). If a patent office grants many patents of dubious quality one may expect a smaller maintenance rate, and vice versa. In this respect, van Pottelsberghe and van Zeebroeck (2008) show that the average quality or value of patents granted by the EPO has constantly dropped over the past 20 years, which is synonymous to validations in less countries for smaller period of time. The second implicit assumption is that the system is stable and therefore the determinants of maintenance rates and validation rates observed nowadays would be the same for the COMPAT, which actually consists in setting up a new system where the factors listed in Table 2 might actually have a differentiated impact.

S3. Select an 'acceptable' renewal fee structure for the COMPAT

The renewal fees structure functions as an important policy leverage in practice—more than a simple way to cover the operating costs of patent offices.[13] Scotchmer (1999) argues that the renewal fees mechanism works as a direct revelation mechanism of the private information owned by the applicant about his invention. For Baudry and Dumont (2006) renewal fees can be used as a policy tool to discourage low-value patents and to promote the diffusion of innovation at the end of patent life.

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[12] Two alternative methodologies have been used to assess the robustness of these estimates. First, the US and Japan were withdrawn from the sample. The estimates run on 15 European countries lead to very similar parameters and significance levels (results are available upon request). An important change is the parameter associated with GDP, which was much higher with this reduced sample (0.15 instead of 0.07). Since GDP is a key economic variable influencing the maintenance rate we decided to rely on the full sample for the simulations of the maintenance rate under the COMPAT, which is a conservative practice. The second test consisted in correcting the potential bias due to the fact that the dependent variable fluctuates between 0 and 1. A model was run with a transformed dependent variable ($y^*=\log(y/(1-y))$ that fluctuates between minus infinite and plus infinite. All the estimated parameters were of the same sign and significance.

[13] In particular, Gans et al. (2004) examines how imposing a self-funding constraint to a patent office can create distortions in fees.

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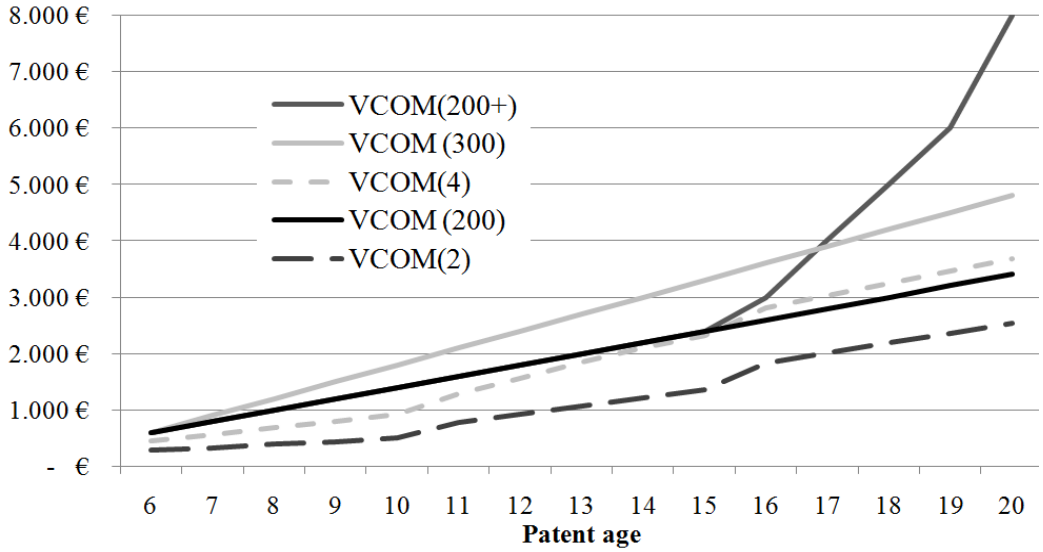
Different structures of renewal fees can be considered for the COMPAT. Four alternatives are presented in Figure 3. One approach consists in summing up the renewals fee of the 2 or 4 countries that are the most frequently designated under the current European patent system. They are respectively called VCOM(2) and VCOM(4). Such an additive fee structure was proposed in the European Council working document (EC, 2008, DG Internal Market). The document also suggests that the COMPAT renewal fees could correspond to the sum of up to eight countries' current renewal fees.

An alternative and somewhat simpler renewal fees schedule can be put forward. It would be composed of a starting fee of €600 on year 6 of the patent age and then a constant increment of €200 or €300 (or more) each additional year in the patent age. These fee schedules are respectively named VCOM(200) and VCOM(300). The proposed VCOM(200) is actually close to the sum of four countries' renewal fees, or VCOM(4). These two fee schedules seem to be the most appropriate. Indeed, van Pottelsberghe and van Zeebroeck (2008) show that the average geographical scope of protection for a 15 years old patent is of about 4 countries. Therefore the VCOM(200) or VCOM(4) fee structure correspond to what the business sector is currently paying. With VCOM(200), the applicant would pay a fee of about €3,300 to keep a patent enforced on its 20th year, against about €900 in Japan and the US.[14] With VCOM(300) the amount would be close to €5,000. The cumulated fees over time with VCOM(200) would be of €5,000 for 10 years and €30,000 for 20 years. An exponential version of the VCOM(200) fee schedule is also considered. This fee structure – called VCOM(200+) – is the same as VCOM(200) until the 15th year and then imposes a stronger increasing of fees (with €3,000 at year 16, €4,000 at year 17, €5,000 at year 18, €6,000 at year 19 and €8,000 at year 20).

[14] In the US a renewal fee of €3,256 must be paid on year 17 of the patent, which makes approximately a €800 per year from year 17 to year 20 (cf. Appendix Table E).

Figure 3. Possible fee structures for the COMPAT



Note: VCOM(2) and VCOM(4) correspond to the sum of the renewal fee structure of 2 and 4 countries, respectively. VCOM(200) and VCOM(300) characterize a fee structure that would start at €600 at year 6 and then add each year €200 and €300, respectively. VCOM(200+) is the same as VCOM(200) till year 15 and then increases exponentially to reach €8,000 at year 20.

A comparison of these COMPAT renewal fee schedules with the fees of the current European patent system can be done in absolute and relative terms (cf. van Pottelsberghe and François, 2009). Indeed, renewal fees might be twice as high in country A as in country B, but if the former is four times larger than in the latter (i.e., with a much larger market potential), the relative fee is actually cheaper in country A than in country B. For instance, if the COMPAT would apply the 'relative' fee structure of the German patent office to the whole EU economic area, the renewal fees would be much higher. In fact, the German fees start very low and end up at about €2,000 at the end of the patent life cycle. If the same 'relative' fee (i.e., same fee per capita or fee per GDP) is applied for the COMPAT, the renewal fee schedule would be quite prohibitive and reach €10,000 to €12,000 for the 20th year of protection. The renewal fee structure proposed with the VCOM(300) solution would end under €5,000, which is more affordable, but still more than twice as high as the absolute fee in Germany for the 20th year. Keeping in mind that the whole economic area covered by the COMPAT would be more than six times larger than the one currently covered by Germany, a VCOM(200) or VCOM(300) solution seems acceptable and corresponds to a good compromise between an absolute and a relative fee schedule. Probably a more convincing argument is related to what the business sector seems to be ready to pay. As mentioned here above, 15 year old patents are on average maintained

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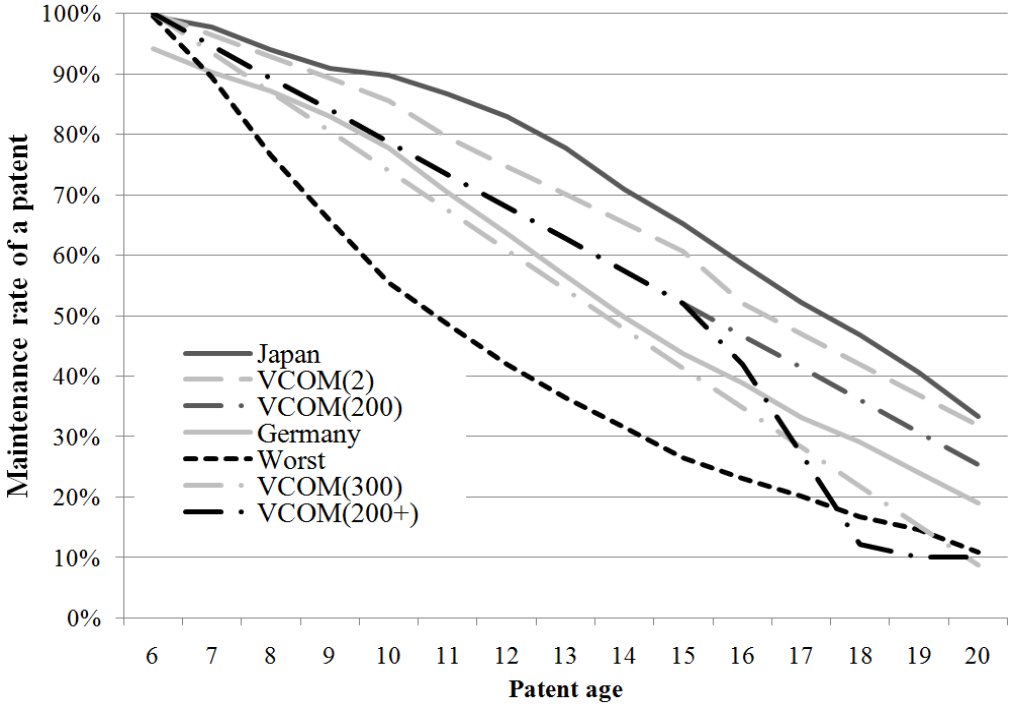
in four countries, which corresponds to VCOM(200). International comparisons of absolute and relative fees will be addressed in section 4.

S4. Simulate the maintenance rate of the COMPAT

With the estimated parameters presented in column (3) of Table 2, and the potential fee schedules presented above, it is now possible to simulate maintenance rates for the future COMPAT (cf. eq. (4)). The GDP of the EU27 economic area is straightforward to compute, the patent age is available as such, and the age of membership is supposed to be of 0 years (i.e. no experience, because it is a new system). It could be argued that an age of 30 years could be taken into account, because the 11 founding fathers account for a large economic area within the EU27. But this assumption would not substantially affect the simulations, and we opted for a conservative approach (so that the risk is to underestimate the revenues generated by the COMPAT). The only variable that might vary substantially, and is subject to 'political' negotiations, is the renewal fees structure of the COMPAT.

Figure 4. Simulated maintenance rate with the COMPAT



Note: The simulated maintenance rates for the COMPAT were normalized to 1 at the 6th year. The series for the Japan and Germany are actual series. The curve labeled 'worst' corresponds to a worst case scenario, with a high and fast drop-out rate.
Source: own calculation from EPO data and the Trilateral statistical report for the US and Japan, and from the estimated parameters presented in Table 2 (column 3) and in equation (4).

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The simulated maintenance rates under the COMPAT[15] are pictured in Figure 4. They vary according to the chosen renewal fee structure. Most simulations fluctuate between the actual Japanese and German maintenance rates, and are above the latter all along the patent life cycle. This high maintenance rate of the COMPAT is primarily due to the large geographical scope that would be covered by a single patent, which is more than five times larger than the German economy. Lower renewal fees, like VCOM(200) would logically induce a higher maintenance rate. The negative impact of fees is illustrated by the VCOM(200+) curve which decreases significantly from year 16 (corresponding to the exponential increase of renewal fees comparatively to the VCOM(200)).[16] In addition, a worst case-scenario is also considered. It is arbitrarily chosen with a higher drop-out rate – particularly in the first years of the patent life – than the simulated COMPAT ones.

S5. Compute the renewal fees' income generated by the COMPAT

With the simulated 'maintenance rates' of the COMPAT it is now possible to calculate the renewal fee income that would be generated by an average patent under the COMPAT and compare it with the renewal fee income generated by an average European patent. Figure 5 presents the average total renewal fees income generated by one patent over its life time. The renewal fee income (VNPO) is calculated as in equation (2) and depends on the number of countries in which the patent has been validated in and on the number of years it is maintained in each of these countries. The higher the number of countries (amongst 27 possible countries within the EU) and the longer the maintenance of the patent (with a maximum of 20 years from the priority date), the higher is the total amount of renewal fees' income generated by the patent. The first bar (in grey) presented in Figure 5 corresponds to the actual fees income generated by a current European patent granted by the EPO, a bit more than €11,000. This 'simulated' number is actually close to the observed renewal fees income observed in the NPOs and the EPO, which validates somewhat the approach adopted in this analysis.[17]

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[15] The represented maintenance rates are for an average COMPAT; they would be obviously higher for higher value patents. In the same vein, these simulations correspond to the scenario of patents of an average company. In reality, it is clear that some companies (electronic industry for example) actually validate their patent in only 2-3 countries whereas other industries validate their patents in all countries (pharmaceuticals, for instance; see van Pottelsberghe and van Zeebroeck, 2008).

[16] The simulated maintenance rate of VCOM(200+) was restricted at 10% for the last two years since it is generally accepted that at least 10% of patents stay in force for 20 years, whatever the level of fees.

[17] Over the past 10 years the EPO has granted about 50,000 patents a year. Therefore, multiplying this number by the average renewal fee income generated by one patent (for the EPO it would be

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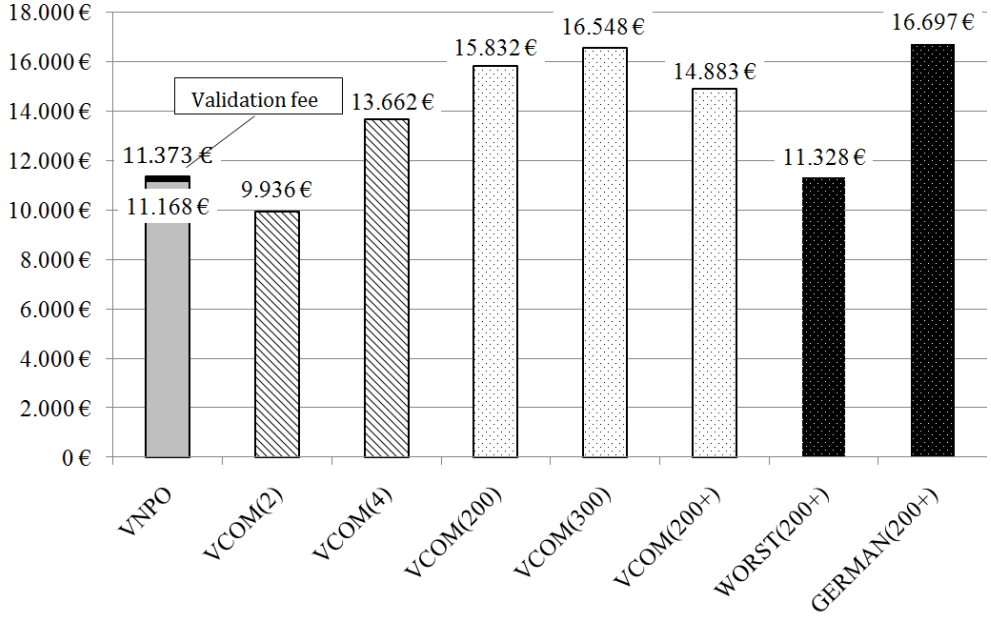
The total renewal fees income generated by the COMPAT would obviously vary with the level of fees, as illustrated in equation (3). According to the estimated parameters presented in Table 2 (column 3) (and hence the simulated maintenance rate of the COMPAT depicted in Figure 4), the revenue generated by the COMPAT would vary from nearly €10,000 with the VCOM(2) renewal fees schedule up to €13,600 with the VCOM(4) renewal fees schedule. With the simpler fee schedule put forward in this paper, it would vary around €16,000 (with the VCOM(200) and VCOM(300) fee schedules). Higher fees do not necessarily correlate with a higher revenue, due to the negative and significant fee elasticity of patents. This is illustrated by the VCOM(200+) renewal fees schedule, which generates less revenues than VCOM(200): too high fees decrease the maintenance rate to such an extent that they do not compensate for the increase in the drop-out rate. Renewal fees have a real 'dual' impact on the revenues generated by patents for the EPO and the NPOs.

Figure 5. Simulated total renewal fees' income under the COMPAT



Source: own calculation from the estimated parameters presented in Table 2, observed data on maintenance rates in national patent offices (see Appendix table C. and Appendix D.), different structures of fees illustrated in Figure 3 and simulated maintenance rates of Figure 4. GERMAN(200+) corresponds to the observed German maintenance rate with the VCOM(200+) renewal fees schedule.

€5,600 or half €11,168 for VNPO in Figure 5) would yield a total revenue for the EPO of about €280 Million. According to the EPO 2008 financial statements (p. 34), the EPO had revenues from national renewal fees from previously granted patents of about €327 Million, which is not too far from the simulated revenues.

The worst case-scenario maintenance rate was chosen arbitrarily as being lower than any observed maintenance rate in large countries (like Japan or Germany) and lower than the simulations based on the quantitative analysis. The VCOM(200+) renewal fee schedule paired with this 'worst' case maintenance rate generate about the same revenue as a current European patent.

In other words, the COMPAT would generate at least the same amount of cumulated fees' income than the current European patent, and probably substantially more, thanks to higher fees and higher maintenance rates. With our preferred VCOM(200) or VCOM(300) fee structure, the total income generated by one patent would be 150% higher than the current total income generated with the European patent. It is quite reassuring to reach the conclusion that the total renewal fees' income generated by a patent under the COMPAT could be substantially higher than the current cumulated renewal fees' income generated by a European patent in all NPOs. The key issue is now to assess to what extent the COMPAT would actually affect each NPO's income. This obviously depends on the adopted distribution key between NPOs, which is tackled in the following section.

3. Implications for patent offices

Five distribution keys can be considered for the sharing of the total renewal fees' income generated under the COMPAT; they are presented in Table 3, with their strengths and weaknesses. The actual distribution key (which is the share of each NPO in the total income generated by all NPOs) would actually correspond to a skewed distribution, because it is highly biased in favor of large countries, and especially Germany. Applicants gradually reduce the number of countries for enforcement, and when they keep the patent 'alive' it is generally in the largest countries. Germany is frequently the last country in which a patent is kept enforced (see van Pottelsberghe and van Zeebroeck, 2008 and van Zeebroeck, 2008). Thanks to its large market Germany currently enjoys a large and more than proportional share of renewal fees' income generated by the average European patent, about 32%, whereas population, GDP and R&D shares in the EU are 'only' 17%, 20% and 27%, respectively.

The 'council proposal' weighting scheme (see EC, 2008) reflects the outcome of political negotiations and is quite complex, as it takes into account the countries' size, their languages and their innovation potentials. It is so complex that it is not easy to compute (especially ten years from now, should the criterion used still be the same?), and probably not a good communication pitch if the community patent is created.

The GDP or R&D weighting schemes are the simplest, fairest and most effective distribution keys. They are easy to compute and communicate, and

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actually reward countries with a high economic performance, which originates from innovative efforts. Catching up countries and dynamic economies would actually be rewarded by this scheme. An alternative weighting scheme would be related to the population size of countries. This would reward large countries, but not their innovation or economic performances and is therefore less appropriate.

Table 3. PROS and CONS of four alternative distribution keys

Distribution keys	Assessment
Actual distribution of NPOs' renewal fees' income	Skewed, large bias in favor of large countries, especially the largest (Germany)
"Council proposal" weighting scheme	Complex, not easy to compute and to communicate, takes into account the linguistic specificities.
Population weighting scheme	Bias in favor of large countries, unrelated to innovative efforts, easy to compute.
GDP weighting scheme	Fair, easy to compute and communicate, favors countries with a high economic performance
R&D weighting scheme	Fair, easy to compute and communicate, favors innovative countries

The relative differences observed between the five weighting schemes for a given level of revenue are illustrated in Appendix Table F. The choice of the distribution key has implications for the actual revenue sharing related to the renewal fees' income generated by the COMPAT. Some countries could lose and others could win, depending on the chosen key. Instead of analyzing cross country differences in distribution keys it is more relevant to consider the total revenue generated by an average patent, and then derive the revenue for each NPO, because a distribution key might be lower for a country, but the actual revenue higher due to a much higher total revenue generated by renewal fees.

This is illustrated in Table 4 (for the VCOM(200+) renewal fee schedule), and in Appendix Tables G and H (for the VCOM(200) and VCOM(300) renewal fees schedules, respectively), which show the renewal fees' income generated by an average patent under the current European patent system (where the income is generated by each NPO) and under the COMPAT, with a distribution key based on alternative weighting schemes.

It clearly appears that with the three renewal fees schedules, most of the NPOs would have a higher income with the COMPAT than with the European patent. This is due to the much higher total income generated by one patent (cf.

Figure 4). Smaller countries would actually largely benefit from the COMPAT, because they have a relatively low revenue with the current European patent, due to the very low validation rate.

Table 4 suggests that with the VCOM(200+) fee structure, the EPO would earn nearly €7,500 per patent granted, on average. Germany would have an income that fluctuates between €1,240 and €2,000; depending on the adopted distribution key, against a current revenue per patent of about €2,400. All other countries would benefit from an increase in their revenue thanks to the COMPAT. Appendix Tables G and H present similar figures but with alternative fee schedules (VCOM(200) and VCOM(300)). The conclusions remain the same, except that the revenues are even higher than with the VCOM(200+) fee schedule.

The relative differences between the renewal fee revenues generated by the European patent (VNPO) and those generated by the community patent (with VCOM(200+)) are presented in the last three columns of Table 4. The relative differences with the VCOM(200) and VCOM(300) renewal fees schedules are presented in Appendix Tables G and H, respectively. For instance, with the VCOM(200+) and the GDP distribution key, only Germany, Austria and Cyprus would have a lower revenue per patent. For Germany this is due to the loss of its leading position within the European patent system in terms of market size, whereas for Austria and Cyprus this is due to very high national renewal fees that generate a higher income than the COMPAT would generate with the VCOM(200+).

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Table 4. NPO's renewal fees income under EP and COMPAT with the VCOM(200+) renewal fee schedule

	VNPO	Level (€)				Relative net differences (%)			
	€	Proposed	GDP	Pop.	R&D	Proposed	GDP	Pop.	R&D
EPO	5686	7441	7441	7441	7441	31	31	31	31
Germany	2386	1957	1483	1236	2032	-18	-38	-48	-15
France	802	819	1155	953	1309	2	44	19	63
UK	597	729	1222	915	1175	22	105	53	97
Netherlands	332	551	345	246	320	66	4	-26	-4
Austria	227	424	164	125	218	87	-27	-45	-4
Italy	576	677	946	888	581	18	64	54	1
Spain	230	454	628	669	408	97	173	190	77
Sweden	111	260	200	137	405	135	81	23	265
Denmark	71	193	141	81	187	173	98	14	164
Belgium	88	201	202	159	206	129	130	81	135
Ireland	55	104	113	65	80	88	104	17	44
Finland	70	104	107	80	199	49	52	14	184
Portugal	31	127	99	159	54	302	216	406	71
Greece	21	112	136	168	42	424	539	690	98
Luxembourg	13	37	22	8	19	193	70	-41	53
Hungary	15	67	58	152	31	Δ	Δ	Δ	Δ
Cyprus	10	45	9	12	2	Δ	Δ	Δ	Δ
Estonia	5	52	8	20	5	Δ	Δ	Δ	Δ
Czech Republic	17	60	73	155	61	Δ	Δ	Δ	Δ
Romania	6	89	62	325	15	Δ	Δ	Δ	Δ
Slovakia	8	52	28	81	7	Δ	Δ	Δ	Δ
Bulgaria	6	60	16	116	4	Δ	Δ	Δ	Δ
Slovenia	4	30	20	30	17	Δ	Δ	Δ	Δ
Lithuania	1	52	15	51	7	Δ	Δ	Δ	Δ
Latvia	0	45	10	35	4	Δ	Δ	Δ	Δ
Poland	3	119	174	572	52	Δ	Δ	Δ	Δ
Malta	0	37	3	6	1	-	-	-	-

Note: Δ represents a large and positive difference due to recent EPC membership and/or small size.
Source: own calculation based on total renewal fees' income presented in Figure 5 and on distribution keys presented in Appendix Table F.

4. Implications for relative patenting costs

The first section underlines two types of failures induced by the currently fragmented patent system in Europe. First is the prohibitive cost of patenting, due to the cumulated national renewal fees that applicants must pay to keep their patent in force. Second are the incongruities generated by a system where national systems have the ultimate power to grant or unvalidate a patent and the high

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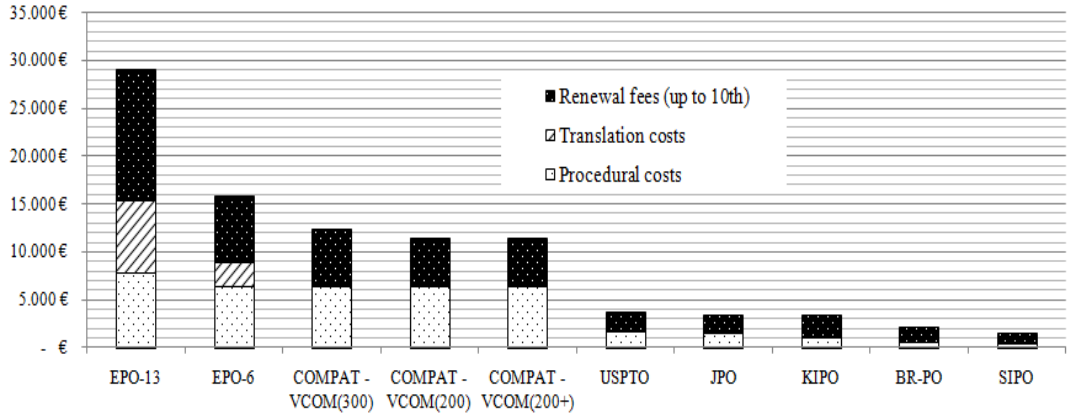
uncertainty that occurs when several parallel litigations take place. These two types of failure would vanish with the COMPAT.

Figure 6 shows that 10 years of protection with the COMPAT (with the VCOM(200+) fee schedule) would cost about €11,400 against €16,000 nowadays for a protection in 6 countries and nearly €30,000 for a protection in 13 countries. This must be compared with a total cost lower than €4,000 in all other large economic areas. It is worth noticing that the translation costs have disappeared for the cost of a COMPAT. This is due to the language arrangements put forward for the potential COMPAT.[18] Of the €4,600 reduction from the protection in 6 countries to the COMPAT, €2,600 comes from the drop in translation requirements, €200 is due to the drop in validation fees, and €1,800 comes from changes in the renewal fees structure.

Figure 6. International comparison of patenting costs with the COMPAT



Source: van Pottelsberghe and Mejer (2010) and own calculations for the COMPAT figures

These absolute numbers do not account for the market size covered by the patents. Doing so would logically put Europe in a much better situation, thanks to its market of about 500 million inhabitants. Figure 7 shows that 10 years of protection with the COMPAT (with the VCOM(200+) fee schedule) would cost about €23 per million capita (it is close to €28 in Japan), against €55 per million

[18] The envisaged language arrangements, as of February 2011 are: 1) the possibility to file patents in one of the three official languages of the EPO (French, German or English); 2) Then, if granted, the claims section must be translated into the other two languages; 3) a central (at the EPO) automated machine translation into all EU languages at no extra cost for applicants, for information purposes only, and with no legal effect; 4) For granted patents, and in case of litigation, official translations have to be secured by the patent holder (see Article 24a, Revised Proposal for a Council Regulation on the Community patent, Council Working Document 8588/09).

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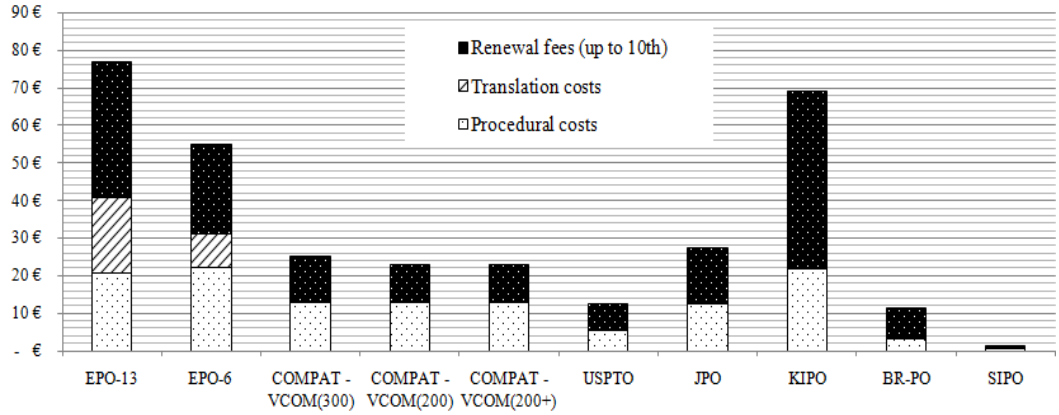
capita nowadays for a protection in 6 countries and €76 for a protection in 13 countries. In the USA one patent costs only €12 per million capita.

Figure 7. International comparison of patenting costs per million capita

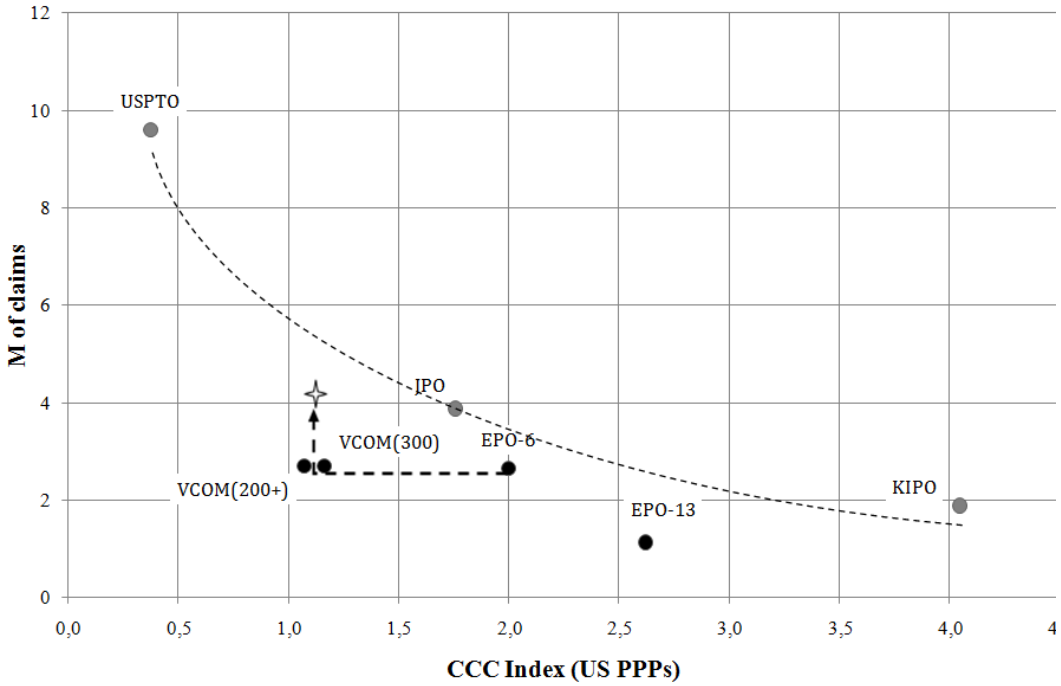


Source: van Pottelsberghe and Mejer (2010) and own calculations for the COMPAT figures

Finally, accounting for the size of patents (number of claims per patent) leads to less biased comparisons because applications at the USPTO are much larger (about 24 claims per patent) than their EPO counterparts (about 18 claims per patent). In Japan there are 'only' about 10 claims per patent.[19] The cost per claim per capita indicator put forward by van Pottelsberghe and François (2009) would place Europe (US purchasing power parity 1.2) between Japan (1.7) and the USA (0.4). Figure 8 suggests that the demand for patents (the millions of claims that were filed) in 2006 seems to be related to the relative fees, along a traditional demand curve.

[19] See Archontopoulos et al. (2007), van Zeebroeck et al (2009) and de Rassenfosse and van Pottelsberghe (2011) for evidence on the evolution of the size of patent applications in the three offices.

Figure 8. Relative patenting costs and the demand for patents



Source: own calculation from data presented in this paper and from van Pottelsberghe and Mejer (2010). The cost per claim per million capita is expressed in US PPPs, and includes the cumulated costs for up to 10 years of protection.

Existing studies aiming at evaluating the fee elasticity of demand for patents converge towards a value of about -0.3 (cf. de Rassenfosse and van Pottelsberghe, 2007, 2009, 2011). Therefore, the 45% decrease in relative prices due to the implementation of the COMPAT would induce a 14% increase (illustrated by the star in Figure 8) in the demand for patents at the EPO, everything else being equal otherwise.

In a nutshell, the COMPAT with a unified jurisdiction would reduce both the costs and uncertainty currently associated with the fragmented European patent system, while quality in the examination process would be held stable thanks to relatively high absolute renewal fees. The beneficial effects of the COMPAT (cost savings, construction of the single market, lower complexity) would make the patent system more accessible for SMEs and for universities in Europe. At the same time it would make the European market much more attractive for both domestic and foreign companies.

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5. Discussion of total impact

The cost consequences in absolute term – for 10 years of protection – are a drop of about € 4,600 per patent, due to the end of translation requirements (€ 2,600 per patent), the disappearance of validation fees (€ 200 per patent) and the change in renewal fees (as compared to a current protection in six countries, see Figure 5). In relative terms, a drop of 45% in the cost per claim per capita (because the market protection would jump from about 6 countries to a market of 500 million inhabitants) and an increase of about 18% in the demand for patent protection would be observed, everything else being equal. This increase in the attractiveness of the European patent system could generate additional new revenues for patent offices (on top of the simulations above): each patent under the COMPAT would generate more revenue than a current European patent, and there would be an increase in the number of patent applications.[20] But the financial impact goes far beyond the budgetary constraints of patent offices.

In his landmark "*Rational Ignorance*" paper, Mark Lemley (2001) adopted a simple analytical approach (an arithmetic model) to assess the cost-benefit of improving the quality of examination at the US patent office (USPTO). This section relies on a similar approach to draw a broad picture of the impact of the COMPAT on the financial flows associated with the main actors of the system. Based on the simulations results, it is indeed possible to assess the extent to which each major economic actor would be affected by the COMPAT.

Let us assume that 50,000 patents are granted each year by the EPO under the COMPAT and under the current European Patent system.[21] The impact of the COMPAT can therefore be assessed by comparing the situation before (with the current European Patents) and after the COMPAT – for each actor. The changes due to the COMPAT are illustrated in Table 5; they include changes in renewal fees, translation costs, intermediation costs and litigation costs.

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[20] Two forces could explain this increase in patent filings: (1) more attractiveness of the patent system and (2) longer maintenance rates due to higher expected returns for applicants (as a much wider market is covered by the patent).

[21] This number is taken for the exercise that consists in estimating the total savings and/or losses induced by the COMPAT. Remember that all of the simulations are done at the patent level. The total impact corresponds therefore to the multiplication of the cost/benefit figures by 50,000. This number could of course be smaller (i.e. due to the current financial crisis) or higher (due to the drop in relative costs and the improved attractiveness of the Community Patent) but the main message would be exactly the same. We are convinced that 50,000 is a conservative hypothesis, because the COMPAT would be much more attractive than the current system (in 2008 the EPO granted 59,819 patents).

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Table 5. Total impact by type of actors considering 50,000 patents (in € millions)

	EPO	NPOs	Business sector	Attorn. & transl.	Lawyers
Renewal fees[ε]	+88	+88	*-176*		
Designation fees EPO[α, β]	*-25*		+40	*-15*	
Validation fees NPOs[χ]		*-10*	+10		
Translation costs[δ]	*-20*		+149	*-129*	
Filing patent translation[α]			+60	*-60*	
Taking over representation[α]			+46	*-46*	
Intermediary cost for maintenance[α]			+20	*-20*	
Drop in parallel litigation (Harhoff, 2009) [ϕ]			+121		*-121*
Total	**+43**	**+78**	**+270**	***-270***	***-121***

[α] Based on the median cost corresponding to several patent attorney's fees (according to van Pottelsberghe and Mejer (2010), cf. Appendix Table I; 'designated states' and 'filing patent translation' were assumed to disappear completely while two third of 'taking over representation' and the 'intermediation costs for maintenance' were dropped; for the latter, the simulated maintenance rate of the COMPAT (VCOM(200+)) was taken into account); [β] €500 paid to EPO for designation of 6 countries; [χ] €200 per patent (own calculation, see Figure 5); [δ] €400 per patent for machine translation under EPO's budget and own calculation (see Figure 6); [ε] own calculation (see Figure 5 and Table 4); [ϕ] The amount reported corresponds to the lower bound of the estimates performed by Harhoff (2009).

Thanks to the COMPAT, the sharp reduction of several intermediation costs, patent fees and translation expenses would more than compensate for the increase in renewal fees (due to a higher maintenance rate). First, on average, a patent granted under the COMPAT would generate additional renewal fees of about €3,600 more than one average European patent, which leads – for 50,000 patents – to an additional revenue of €88 million for the NPOs and €88 million for EPO (see Table 4). Although this increase will be paid by the applicants (the business sector), one must keep in mind that it provides protection for a considerably larger market (cf. Figure 7 for a comparison of relative patenting costs, which are significantly lower for the COMPAT than for the EP). Second, designation fees at the EPO and validation fees at NPOs would disappear, which corresponds to a gain of €500 and €200 (see Figure 5) per patent, respectively. Third, there would be a loss for translators corresponding to a cost reduction of about € 2,600 (see Figure 6) on average per patent. On the other hand the EPO would have to bear the cost of processing the translations of incoming applications. This centralized approach, combined with the continuous improvement of machine translations, would probably cost a few hundred EURO

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per patent (say €400).[22] Fourth, patent attorneys would also lose their income for interacting with several NPOs. Based on the survey performed by van Pottelsberghe and Mejer (2010), we can evaluate this drop in intermediary costs at about €2,500 per patent, which is composed of different types of costs (designation, filing patent translation, taking over representation, and intermediary costs for maintenance). Finally, Harhoff (2009) evaluates the total savings from having a unified and integrated European Patent Litigation System and the drop of parallel litigation at €148 million (lower bound of his estimation) compared to the operating cost of a European Court of €27 million, which means a gain for the business sector of €121 million. In a nutshell, the COMPAT would lead to net savings of €250 million for the business sector. The EPO and the NPOs would earn, respectively, €43 million and €78 million, whereas attorneys and translators would lose €250 million and the drop in parallel litigation costs would be of about €121 million. In other words, nearly €400 million would switch from patent attorneys, translators and lawyers to patent offices and the business sector, while the relative cost of a patent would drop by about 45%.

6. Concluding remarks

This paper essentially aims to evaluate the main economic consequences of setting up the Community Patent (COMPAT, more recently called the "EU Patent") within the European Union. First, it simulates the renewal fees' income consequences for the European Patent Office (EPO) and the national patent offices (NPOs). Second, it measures the consequences for the business sector in terms of absolute and relative fees, and the budgetary impact for the major actors of the patent system.

Besides the simulation exercise, the present paper contributes to the economic literature on the patenting behavior of applicants. An econometric model explaining the observed maintenance rates of European patents in 17 countries over the past 20 years shows that five main factors play a significant role: the GDP size of a country, the age of the patent, the level of renewal fees, the strength of a country's patent system, and the length of time that a country has been a member of the European Patent Convention. The estimated impacts of these five variables allow us in turn to derive the maintenance rate of the COMPAT and hence the renewal fees income it would generate for patent offices.

The simulations show that the EPO and most NPOs would actually gain from each patent granted under the COMPAT if an 'appropriate' fee schedule is adopted. This is mainly due to a price effect (higher absolute fees) combined with

[22] It is assumed that the €400 would be paid to the business sector for securing machine translation services and solutions.

a size effect (a new market for technology of about 500 million inhabitants) which would lead to a longer duration of patents. The main office that might see a significant drop in its renewal fees income is the German Patent Office, which has historically benefited from its 'largest economy' status in Europe and hence generates above the expected validation and maintenance rates (Germany is the country where most patents are validated at grant, and where they currently remain valid for the longest period of time).

The broad budgetary or financial impact of the COMPAT goes far beyond the mere changes in the renewal fees' structure. The new centralized system would sharply reduce translation and intermediation costs, and the costs induced by parallel litigations with heterogeneous outcomes. Under the very conservative assumption of 50,000 patents being granted each year by the EPO (and the VCOM(200+) renewal fee schedule put forward in this paper), the COMPAT would result in total financial surpluses of €250 million for the business sector, €43 million for the EPO and €78 million for NPOs, compared to total losses of €250 million for patent attorneys and translators and at least €121 million for lawyers, due to a sharp fall in parallel litigations.

This exercise should obviously be taken with a touch of caution, both for its reliance on an econometric model that leads to a simulated maintenance rate and its voluntary failure to take stock of other positive or negative effects of the COMPAT. It is worth noticing that no – or very few – patent offices had foreseen the sharp drop in revenue due to the 2008 crisis, providing evidence of the actual complexity of performing budgetary planning in this field. The methodology adopted in the present paper does not grasp the whole set of factors that might influence the revenue of a patent office, especially regarding the future quality of applications and/or granted patents. In addition, a normative approach is missing. We do not tackle the question of what kind of community patent would be best for Europe; the simulations were indeed performed under the constraints of the current patent systems and under the conditions set by political negotiations related to fees and translations. One important condition relates to the 50/50 split between national patent offices and the EPO. Nothing, however, precludes the reader to dream of an alternative redistribution scheme of the EPO 'surplus'. It could, for instance, be used to reduce entry fees (renewal fees would contribute to cover examination costs), or to fund basic research projects in universities (igniting a virtuous cycle whereby monopolistic rents would support the creation of new ideas), or to further improve the quality and accessibility of patent information, or a mix of these three proposals.

One cannot deny that the COMPAT is implicitly associated with a potential loss of power and control by NPOs, a risk which might well be more influential than the budgetary surpluses that are to be made through its implementation. Despite a potentially strong increase in their revenue, NPOs

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might still tilt towards anti-COMPAT lobbies. The same argument can also be put forward with the EPO under the COMPAT regime, which would sooner or later fall under more stringent control by the European Parliament or the European Commission. Would higher revenues compensate for a reduction in its 'freedom to operate'? These budget-and-control balances, jointly with the substantial financial losses of patent attorneys, translators and lawyers, are key factors that somewhat elucidate the observed successful resistance to the COMPAT over the past 50 years. These institutions or lobbies benefit to a large extent from the currently fragmented system and from controlling it.

Despite the fact that nearly €400 million would switch from patent attorneys, translators and lawyers towards patent offices and the business sector, policy makers should strategize far beyond a mere budgetary/economic analysis. If innovation is the ultimate target, and if one believes in the stimulating role played by patent systems, we must be aware that, in its current set up, the European patent system does not meet its own agenda, but rather the ones of those who control it. What matters first and foremost is that the COMPAT would drastically simplify the system, reduce the uncertainty currently associated with the fragmented system and make it attractive for companies (domestic and foreign), and less incongruous for SMEs and universities; it would give some motion to the invisible hand, with undoubtedly large benefits for the business sector in general, and for high-tech entrepreneurs in particular.

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Appendixes

Appendix Table A. Main factors explaining the fees-related income of patent offices

	European patent	COMPAT
Validation	- Validation rate in each NPO	- nr
Maintenance	- Maintenance rate in each NPO	- Maintenance rate of COMPAT
Fees	- Renewal fees of each NPO	- Renewal fees of the COMPAT
	- nr	- Distribution key towards NPOs

Appendix B. Measurement method for maintenance rates

The dependent variable, of the model analyzed in this paper (eq. 4), corresponds to the maintenance rate of granted patents ($(1-\delta)$, or one minus the drop-out rate) enforced in country i at year t (t=6,…, 20). 15 years of renewals are therefore taken into account for each country. As it is illustrated in the following tables (representing the cases of Germany and Belgium), these maintenance rates were computed as the share of patents still in force at the end of each patent year, the denominator being the total number of patent validated in the country.

Appendix Table B1. Maintenance rates computation - Germany

Filing year	Grant		Patents still in force at the end of the patent year					
			6	7	8	9	10	
…	…	…	…	…	…	…	…	…
1996	44663	…	43228	41376	39055	36431	33943	…
1997	47147	…	45557	43721	41439	39032	36613	…
1998	49313	…	47336	45470	43266	40931	38658	…
1999	49466	…	47071	45289	43139	40895	0	…
2000	50655	…	47724	45753	43609	0	0	…
2001	45829	…	43114	41373	0	0	0	…
2002	38298	…	35556	0	0	0	0	…
…	…	…	…	…	…	…	…	…
Maintenance rates (%)			94	90	87	83	78	…

Source : Raw data provided by the EPO and National Patent Offices, own computation.

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Appendix Table B2. Maintenance rates computation - Belgium

Filing year	Grant		Patents still in force at the end of the patent year					
			6	7	8	9	10	
…	…	…	…	…	…	…	…	…
1996	18539	…	14993	12909	10678	8998	7783	…
1997	19371	…	15534	12917	10678	9158	7982	…
1998	20553	…	15614	12996	10961	9365	8280	…
1999	24340	…	16139	13252	10862	9307	0	…
2000	29909	…	17585	13705	11080	0	0	…
2001	27972	…	14902	11270	0	0	0	…
2002	23885	…	10868	0	0	0	0	…
…	…	…	…	…	…	…	…	…
Maintenance rates (%)			53	46	45	46	41	…

Source : Raw data provided by the EPO and National Patent Offices, own computation.

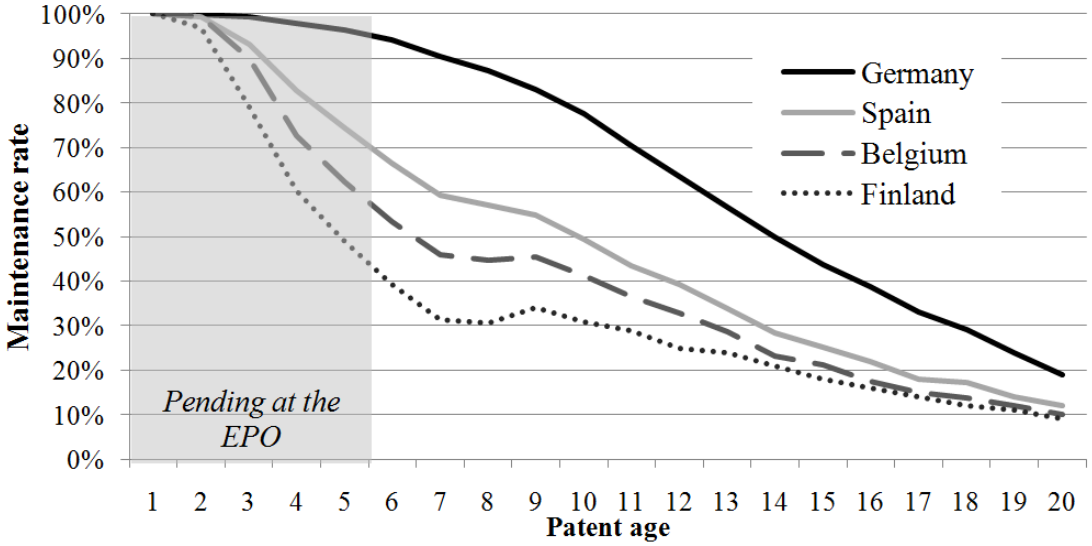
In other words, maintenance rates were measured as the number of patents still in force at the end of the patent year divided by the number of patents of the same cohort that were validated in the country. It can be noticed that '*diagonal-1*' data (highlighted in grey on the above tables) was preferred because the more recent data seems to be biased due to the lack of the most recent information.

Appendix Table C. Maintenance rates and validation rates for the entire database

	Maintenance rates (%)															Validation rates (%)
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Germany	94	90	87	83	78	70	64	57	50	44	39	33	29	24	19	90
France	90	85	80	75	69	62	55	48	42	37	32	27	25	21	17	78
United Kingdom	87	82	78	74	69	62	55	49	42	38	33	27	25	21	17	73
Netherlands	56	51	51	50	46	42	37	33	28	25	22	19	16	14	11	24
Austria	50	43	42	43	38	34	30	26	22	19	16	14	12	10	8	17
Italy	75	70	67	64	60	54	49	43	37	33	29	24	24	20	17	48
Spain	67	59	57	55	49	44	39	34	28	25	22	18	17	14	12	32
Sweden	52	44	43	43	39	35	31	28	23	20	17	14	13	11	9	19
Denmark	43	35	33	36	33	30	27	23	19	18	15	13	12	11	9	11
Belgium	53	46	45	46	41	37	33	29	23	21	18	15	14	12	10	19
Ireland	47	37	35	40	36	33	29	25	21	19	19	16	13	11	9	11
Finland	39	31	31	34	31	29	25	24	21	18	16	14	12	11	9	10
Portugal	46	35	32	34	30	28	25	22	18	16	14	12	11	9	9	8
Greece	40	30	29	32	28	26	24	21	17	15	12	11	11	9	9	6
Luxembourg	44	32	27	32	28	26	22	20	15	14	12	11	11	9	9	6
USA	86	85	85	67	66	65	64	46	44	43	42	-	-	-	-	100
Japan	100	98	94	91	90	87	83	78	71	65	59	52	47	41	33	100

Note:The maintenance rate corresponds to the share of patents still in force at the end of the patent year and the validation rate is the share of granted EPO patents validated in EPC contracting states in 2006.
Source: data provided by the EPO and National Patent Offices, own calculation

Appendix Figure D. Maintenance rates over the entire patent's lifetime



Source : Raw data provided by the EPO, own calculation

Appendix Table E. Other variables in the database

	GDP (in billion €)	Age of membership	IPI	Renewal Fees (€)														
				6*	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Germany	2322	31	4,50	130	180	240	290	350	470	620	760	910	1060	1230	1410	1590	1760	1940
France	1807	31	4,67	150	150	150	150	150	300	300	300	300	300	600	600	600	600	600
United Kingdom	1913	31	4,54	86	111	136	160	185	210	234	259	284	308	333	370	407	444	494
Netherlands	540	31	4,67	185	220	280	340	400	500	600	700	800	900	1000	1100	1200	1300	1400
Austria	257	29	4,33	675	270	270	270	500	500	500	850	850	850	1400	1400	1400	1400	1400
Italy	1480	30	4,67	190	120	170	200	230	310	410	530	600	650	650	650	650	650	650
Spain	982	22	4,33	328	103	129	154	179	217	255	292	330	368	420	469	520	570	620
Sweden	313	30	4,54	413	143	169	201	238	238	285	301	322	349	375	402	428	455	476
Denmark	220	18	4,67	328	215	241	275	308	342	375	409	443	483	523	563	603	644	684
Belgium	317	31	4,67	85	100	125	145	170	195	220	250	290	330	370	410	455	500	545
Ireland	177	16	4,67	184	150	176	194	220	242	265	285	311	335	356	382	408	438	468
Finland	167	12	4,67	465	200	235	265	300	350	400	450	500	535	585	645	705	755	805
Portugal	155	16	4,38	135	98	114	137	172	201	228	275	321	366	412	458	504	549	595
Greece	213	22	4,30	370	84	98	114	134	154	184	214	242	272	322	358	392	430	472
Luxembourg	34	31	4,14	59	74	89	104	118	130	145	160	175	190	205	220	235	250	270
USA	10496	31	4,88	-	-	-	776	-	-	-	1964	-	-	-	3256	-	-	-
Japan	3485	31	4,67	88	269	269	269	902	902	902	902	902	902	902	902	902	902	902

* for European countries, the validation fees (D. Harhoff et al. 2008, p 14) are included in the renewal fees for year 6
Source: Eurostat, data provided by the EPO and Park (2008), and National patent offices websites.

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Appendix Table F. Four potential 'Distribution Keys'

	Actual*	Proposed*	GDP**	Population*	R&D**
Germany	31.6%	26.3%	19.9%	16.6%	27.3%
France	13.1%	11.0%	15.5%	12.8%	17.6%
United Kingdom	11.6%	9.8%	16.4%	12.3%	15.8%
Netherlands	8.0%	7.4%	4.6%	3.3%	4.3%
Austria	6.7%	5.7%	2.2%	1.7%	2.9%
Italy	8.6%	9.1%	12.7%	11.9%	7.8%
Spain	5.4%	6.1%	8.4%	9.0%	5.5%
Sweden	3.6%	3.5%	2.7%	1.8%	5.4%
Denmark	2.6%	2.6%	1.9%	1.1%	2.5%
Belgium	2.5%	2.7%	2.7%	2.1%	2.8%
Ireland	1.4%	1.4%	1.5%	0.9%	1.1%
Finland	1.3%	1.4%	1.4%	1.1%	2.7%
Portugal	1.1%	1.7%	1.3%	2.1%	0.7%
Greece	0.9%	1.5%	1.8%	2.3%	0.6%
Luxembourg	0.5%	0.5%	0.3%	0.1%	0.3%
Hungary	0.2%	0.9%	0.8%	2.0%	0.4%
Cyprus	0.2%	0.6%	0.1%	0.2%	0.0%
Estonia	0.1%	0.7%	0.1%	0.3%	0.1%
Czech Republic	0.1%	0.8%	1.0%	2.1%	0.8%
Romania	0.1%	1.2%	0.8%	4.4%	0.2%
Slovakia	0.1%	0.7%	0.4%	1.1%	0.1%
Bulgaria	0.1%	0.8%	0.2%	1.6%	0.1%
Slovenia	0.1%	0.4%	0.3%	0.4%	0.2%
Lithuania	0.0%	0.7%	0.2%	0.7%	0.1%
Latvia	0.0%	0.6%	0.1%	0.5%	0.1%
Poland	0.1%	1.6%	2.3%	7.7%	0.7%
Malta	0.0%	0.5%	0.0%	0.1%	0.0%

Source: *EC (2008), ** Eurostat 2006 (million €), and own computation. These four alternative distribution keys could be used to redistribute the revenues generated by the COMPAT renewal fees towards the national patent offices.

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Appendix Table G. NPO'S renewal fees income under EP and COMPAT with the VCOM(200) renewal fee schedule

	VNPO	Level (€)				Relative net differences (%)			
	€	Proposed	GDP	Pop.	R&D	Proposed	GDP	Pop.	R&D
EPO	5686	7916	7916	7916	7916	39	39	39	39
Germany	2386	2082	1578	1315	2162	-13	-34	-45	-9
France	802	871	1229	1013	1392	9	53	26	74
UK	597	776	1300	973	1250	30	118	63	110
Netherlands	332	586	367	262	340	77	11	-21	2
Austria	227	451	175	133	232	99	-23	-42	2
Italy	576	720	1006	945	618	25	75	64	7
Spain	230	483	668	711	434	110	190	209	88
Sweden	111	277	213	145	430	150	92	31	288
Denmark	71	206	150	86	199	190	111	22	180
Belgium	88	214	215	169	219	143	145	93	150
Ireland	55	111	121	69	85	100	117	24	53
Finland	70	111	114	85	212	58	62	21	202
Portugal	31	135	106	169	57	327	236	438	82
Greece	21	119	145	179	45	457	580	740	111
Luxembourg	13	40	23	8	21	211	81	-37	63
Hungary	15	71	61	161	33	Δ	Δ	Δ	Δ
Cyprus	10	47	10	13	2	Δ	Δ	Δ	Δ
Estonia	5	55	9	21	6	Δ	Δ	Δ	Δ
Czech Republic	17	63	77	165	65	Δ	Δ	Δ	Δ
Romania	6	95	66	345	16	Δ	Δ	Δ	Δ
Slovakia	8	55	30	86	8	Δ	Δ	Δ	Δ
Bulgaria	6	63	17	123	4	Δ	Δ	Δ	Δ
Slovenia	4	32	21	32	18	Δ	Δ	Δ	Δ
Lithuania	1	55	16	54	7	Δ	Δ	Δ	Δ
Latvia	0	47	11	37	4	Δ	Δ	Δ	Δ
Poland	3	127	185	609	56	Δ	Δ	Δ	Δ
Malta	0	40	3	6	1	-	-	-	-

Note: Δ represents a large and positive difference due to recent EPC membership and/or small size.

Source: own calculation based on total renewal fees' income presented in Figure 5 and on distribution keys presented in Appendix Table F.

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Appendix Table H. NPO'S renewal fees income under EP and COMPAT with the VCOM(300) renewal fee schedule

	VNPO	Level				Relative net differences (%)			
	€	Proposed	GDP	Pop.	R&D	Proposed	GDP	Pop.	R&D
EPO	5686	8274	8274	8274	8274	46	46	46	46
Germany	2386	2176	1649	1375	2260	-9	-31	-42	-5
France	802	910	1284	1059	1455	14	60	32	81
UK	597	811	1359	1017	1306	36	128	71	119
Netherlands	332	612	384	274	355	85	16	-17	7
Austria	227	472	183	139	243	108	-19	-39	7
Italy	576	753	1052	987	646	31	83	71	12
Spain	230	505	698	743	454	119	203	223	97
Sweden	111	290	223	152	450	161	101	37	306
Denmark	71	215	156	90	208	203	120	27	193
Belgium	88	223	225	177	229	154	156	102	161
Ireland	55	116	126	72	89	109	127	30	60
Finland	70	116	119	89	221	65	69	26	216
Portugal	31	141	110	177	60	347	251	462	90
Greece	21	124	151	187	47	482	611	778	120
Luxembourg	13	41	24	8	22	225	89	-34	70
Hungary	15	74	64	169	35	Δ	Δ	Δ	Δ
Cyprus	10	50	10	13	2	Δ	Δ	Δ	Δ
Estonia	5	58	9	22	6	Δ	Δ	Δ	Δ
Czech Republic	17	66	81	172	68	Δ	Δ	Δ	Δ
Romania	6	99	69	361	17	Δ	Δ	Δ	Δ
Slovakia	8	58	32	90	8	Δ	Δ	Δ	Δ
Bulgaria	6	66	18	129	5	Δ	Δ	Δ	Δ
Slovenia	4	33	22	33	19	Δ	Δ	Δ	Δ
Lithuania	1	58	17	57	7	Δ	Δ	Δ	Δ
Latvia	0	50	11	38	4	Δ	Δ	Δ	Δ
Poland	3	132	193	636	58	Δ	Δ	Δ	Δ
Malta	0	41	4	7	1	-	-	-	-

Note: Δ represents a large and positive difference due to recent EPC membership and/or small size.

Source: own calculation based on total renewal fees' income presented in Figure 5 and on distribution keys presented in Appendix Table F.

Appendix Table I. Value of external (patent attorneys) expenses associated with a patent application, its prosecution and its validation and maintenance in six countries, as of August 2008

	Average	Median	Min	Max
PRE-FILING				
Prior art search and draft	8,125	8,125	5,000	11,250
PROCEDURAL (up to grant)				
Designation states	363	300	190	520
Representation	2,325	2,200	1,740	3,500
+ 10h of attorney's work	5,056	5,000	4,240	6,000
+ 20h of attorney's work	7,556	7,500	6,740	8,500
POST-GRANT				
Taking over representation	1,884	1,380	840	3,600
Filing patent translation	1,275	1,200	900	1,800
Maintenance (6th-10th year)	2,560	2,520	2,400	2,880

The cost of translation is not accounted for, as it constitutes a separate cost category in our analysis.
Source: van Pottelsberghe and Mejer (2010), from raw data provided by 11 patent law firms.

References

Archontopoulos E., D. Guellec, N. Stevnsborg, B. van Pottelsberghe de la Potterie, and N. van Zeebroeck. 2007. When small is beautiful: Measuring the evolution and consequences of the voluminosity of patent applications at the EPO, *Information Economics and Policy*, 19(2), pp. 103-132.

Baudry M. and B. Dumont. 2006. Patent Renewals as Options: Improving the Mechanism for Weeding Out Lousy Patents, *Review of Industrial Organisation*, 28, pp. 41-62.

Baudry M. and B. Dumont. 2009. A Bayesian Real Option Approach to Patents and Optimal Renewal Fees, LEMNA Working Paper 2009/09.

Cornelli F. and M. Schankerman. 1999. Patent Renewals and R&D Incentives, RAND *Journal of Economics*, 30(2), pp. 197-213.

de Rassenfosse G. and B. van Pottelsberghe de la Potterie. 2007. Per un pugno di dollari: A first look at the price elasticity of patents, *Oxford Review of Economic Policy*, 23(4), pp.588-604.

de Rassenfosse G. and B. van Pottelsberghe de la Potterie. 2011. On the Price Elasticity of Demand for Patents, *Oxford Bulletin of Economics and Statistics*, forthcoming.

de Rassenfosse G. and B. van Pottelsberghe de la Potterie. 2009. A Policy Insight into the R&D-Patent Relationship, *Research Policy*, 38(5),pp. 779-792.

https://doi.org/10.2202/2152-2812.1030 Published online by Cambridge University Press

EC. 2008. European Council working document 8928/08, made available by the European Commission (DG Internal Market).

Gans J.S., S.P. King and R. Lampe. 2004. Patent Renewal Fees and Self-Funding Patent Offices, *Topics on Theoretical Economics*, 4(1), Article 6.

Ginarte J.C. and W. G. Park. 1997. Determinants of patent rights: A cross-national study, *Research Policy*, 26(3), pp. 283-301.

Guellec D. and B. van Pottelsberghe de la Potterie. 2007. The Economics of the European Patent System, Oxford University Press, Oxford, 250 p.

Harhoff D. 2009. Economic Cost-Benefit Analysis of a Unified and Integrated European Patent Litigation System, Final Report, Tender No MARKT/2008/06/D, 84 pages.

Harhoff D., K. Hoisl, B. Reichl and B. van Pottelsberghe de la Potterie. 2009. Patent Validation at the Country Level – the Role of Fees and Translation Costs, *Research Policy*, 38(9), pp. 1423-1437.

Harhoff D., K. Hoisl and B. van Pottelsberghe de la Potterie. 2008. Languages, Fees and the International Scope of Patenting, CEPR Discussion Paper 7241.

Lazaridis G. and B. van Pottelsberghe de la Potterie. 2007. The riguour of EPO's patentability criteria: An insight into the "induced withdrawals", *World Patent Information*, 29(4), pp. 317-326.

Lemley M.. 2001. Rational Ignorance at the Patent Office, *Northwestern University Law Review*, 95(4).

Mejer M. and B. van Pottelsberghe de la Potterie. 2011. Economic incongruities in the European Patent Systems, *European Journal of Law and Economics*, forthcoming DOI: 10.1007/s10657-011-9221-3.

Park W.G.. 2008. International Patent Protection: 1960-2005, *Research Policy*, 37(4), pp.761-766

Schankerman M. and A Pakes. 1986. Estimates of the Value of Patent Rights in European Countries During the Post-1950 Period, *The Economic Journal*, 96(384), pp. 1052-1076.

Scotchmer S. 1999. On the Optimality of the Patent Renewal System, *RAND Journal of Economics*, 30(2), pp. 181-196

van Pottelsberghe de la Potterie B. 2009. Lost property: The European patent system and why it doesn't work, Bruegel Blueprint, 72 pages.

van Pottelsberghe de la Potterie B. and D. François. 2009. The cost factor in patent systems, *Journal of Industry, Competition and Trade*, 9(4), pp. 329-355.

van Pottelsberghe de la Potterie B. and M. Mejer. 2010. The London Agreement and the cost of patenting in Europe, *European Journal of Law and Economics*, 29(2), pp. 211-237.

van Pottelsberghe de la Potterie B. and N. van Zeebroeck. 2008. A brief history of space and time: the scope-year index as a patent value indicator based on families and renewals, *Scientometrics*, 75(2), May, pp. 319–338.

van Zeebroeck N. 2008. Long live patents: the increasing life expectancy of patent applications and its determinants, Working Papers CEB 08-040, Université Libre de Bruxelles, Centre Emile Bernheim (CEB).

van Zeebroeck N. 2009. From patent renewals to applications survival: do portfolio management strategies play a role in patent length?, Working Papers CEB 09-028, Université Libre de Bruxelles, Centre Emile Bernheim (CEB).

van Zeebroeck N., B. van Pottelsberghe de la Potterie, and D. Guellec. 2009. Claiming more: the increased voluminosity of patent applications and its determinants, *Research Policy*, 38(6), pp. 1006-1020.

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