Paper for EPIP Conference in Munich, 24/ 25 April 2003.
Session IB, 24/04/2003, 12 Noon.

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METHODS FOR FORECASTING NUMBERS OF PATENT APPLICATIONS AT THE EUROPEAN PATENT OFFICE.

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Summary:

Accurate forecasting of numbers of patent application filings is crucial for resource planning at the European Patent Office (EPO) and other patent offices. As a supranational office, the EPO usually attracts Subsequent Filings rather than the priority forming First Filings. This fact needs to be incorporated in forecasting models for EPO filings and a two stage mechanistic framework is proposed.

The forecasting methods that have been used routinely at the EPO have been: trend analyses; a transfer model that uses First Filings as an indicator of EPO filings one year later; and regular surveys of applicants to determine their future intentions. Controlling Office (CO) carries out the basic forecasting exercise on an annual basis as an input to discussions on the formation of the EPO Budget.

A Research Programme has been set up for the improvement of the patenting methodology. Five projects under the programme have achieved mixed degrees of success up to this stage. A new challenge for the forecasting team is to accommodate the need to make forecasts for each of 14 Joint Clusters, based on the different technical areas in which patent applications are made to the EPO.

The EPO participates in a Trilateral Statistical Working Group (TSWG), together with representatives of the Japanese Patent Office (JPO) and the United States Patent and Trademark Office (USPTO). This group examines and compares forecasting techniques, and seeks to find models for world-wide patent application patterns across borders. The EPO also has a duty to review or participate in more general studies of the patenting system, in order to advise EPO management on strategic issues regarding the environment of patenting.

I. Introduction:

Intellectual property rights are categorised as patents of invention, utility models, industrial designs, trademarks and copyrights. The method that is usually used to protect an industrial invention is the patent, which gives the holder a monopoly to exploit his invention for a limited period of time.

For patent offices the efficient planning of resource requirements means that forecasting future numbers of patent applications is an important exercise. The development of demand for patent rights is of interest as well to economists who seek to map patterns of technological development.

Patent filings at the European Patent Office (EPO) are a mixture of direct filings under the European Patent Convention (EPC) and designations of EPO in filings under the Patent Cooperation Treaty (PCT). In this paper various approaches to forecasting will be described that are in use by the Controlling Office (CO) at the EPO. Some methods are already in routine use while others are under consideration or being developed.

Firstly an abstracted two stage model will be described for the patenting process. Then current methods will be described together with an explanation of how the forecasts are reported and utilised within the EPO for workload planning and preparation of the office's budget. A research programme is in place by which the EPO is looking for improvements to its methods. New challenges will be described - a new planning procedure by technical areas known as Joint Clusters requires a more detailed approach to forecasting. Joint work with other patent offices leads to the possibility that simultaneous modelling of patenting flows across borders might lead to efficient forecasts at each office.

II. Forecasting demand at a supranational patent office:

The First Filing of a patent application is usually made in the inventor's home country. Then, depending on the expected returns from external markets, Subsequent Filings can be made abroad within one year which claim the priority of the first application. When patent protection is sought abroad in several countries for the same invention, the applicant is likely to want to use a supranational procedure rather than several national systems where he would have to replicate actions.

The EPO represents a supranational organisation that became operational in 1977 after ratification of the European Patent Convention (EPC). Its function is to offer a centralised patent granting procedure on behalf of its member contracting states. This system now allows companies or individuals to make a single application for patent rights in 27 EPC contracting states; and also allows an extension of rights to six other countries. (EPO Annual Report 2001).

The procedure from application to grant at the EPO is made up of successive phases, where the application for a patent is examined firstly with respect to

the state of the art (search), then to establish its novelty, inventiveness and industrial applicability (substantive examination).

First Filings are commonly considered as a reflection of efforts in innovative activity, while *Subsequent Filings* tend to measure to some extent the internationalisation and globalisation of world markets. As a supranational office, the EPO mainly attracts Subsequent Filings, although the proportion of First Filings has increased in recent years and stands at about 12% of all filings in 2002. It is tempting to extrapolate trends experienced in R&D expenditures and in First Filings at various offices to forecast levels of future EPO applications. However the forecasting problem is complicated by the existence of parallel patent systems in Europe. Applicants can use the national systems, the European system and / or the International System that has been established by the Patent Cooperation Treaty (PCT) (Bainbridge, 1992: WIPO, 1995). The PCT system is administered by the World Intellectual Property Organisation (WIPO), and is a supranational system covering over 100 countries and areas. The EPC area can be designated in a PCT application, and this in fact happens in over 95% of PCT cases. The EPO is licensed by WIPO to examine PCT applications designating the EPC area.

So an applicant can make an application at the EPO either by making a direct application to the EPO (*Euro-direct* Filing), or by designating the EPC area in a PCT application. The first stage of the PCT is entry into the PCT International Phase (*Euro-PCT-IP* Filing). The substantive examination of PCT applications at the EPC begins about two and a half years after entry into IP. This is known as entry into the PCT Regional Phase (*Euro-PCT-RP* Filing). The forecasting problem is specified in terms of Total filings as the sum of Euro-direct and PCT-IP applications, among which nearly 70% of Total filings are Euro-PCT-IP applications. Forecasting PCT-RP applications is done by applying a ratio to the PCT-IP forecasts.

Fig. 1 shows the essential aspects of the worldwide patent system. This system suggests a two-step approach to forecasting patent applications at the EPO.

1. Model A. Estimate numbers of First Filings (National, Euro-direct, Euro-PCT-IP) using a suitable multivariate macroeconomic model.

2. Model B. Estimate Subsequent Filings from the estimates of First Filings in Model A, assuming a time-lag of one year.

III. Forecasting methods in operation at the EPO:

In practice the EPO uses several methods in its regular effort to forecast the number of patent applications. *Trend analysis* is carried out mainly by using linear models but also by using some simple time series methods. Regression methods are also used to construct a *transfer model* that takes

into account the factors described by Model B above. There is also a regular *survey of applicants* to determine future filing intentions.

Trend analysis.

Forecasts are made by extrapolating observed trends. Simple regressions are taken over time of the historical yearly series. Linear, quadratic, order 3 polynomial and logistic (S shaped) models are systematically tested on series of various length. The selection criterion for an appropriate model is the goodness of fit of the model to the data.

Up to 1990 the overall numbers of filings at the EPO continuously increased. But there was an unexpected drop between 1990 and 1991. After that the series started to increase again and has since regularly outperformed the forecasts - but not in 2002 when there was an abnormally low growth in filings compared to the previous year.

Fig.s 2 and 3 show the annualised historical data and some of the trend projections made in early 2003 for years ahead to 2008. The problem with trend analysis is that the models can not easily deliver indications of future disruption of a recent trend. Some insurance for this is provided by fitting models back over many years of the available data, but this implies the assumption of an equilibrium trend that the process reverts towards after short period jumps. On the other hand, when models are fitted over recent history only, there is more responsiveness to current movements and the problem of under-forecasting an explosive growth phase are minimised.

In Fig. 2 the previous consensus forecast that was made in early 2002 is also shown, and it can be seen that in the new exercise a somewhat lower rate of future growth is predicted than was seen before. In Fig. 3 a cloud of trend projections is shown that corresponds to various modelling assumptions in terms of models and historical data lengths. In practice the process of finding a consensus largely consists of plotting a line through the densest area of the cloud. If formal confidence limits are calculated for any one projection method, these can be rather wide and possibly also incorrect because the detailed error structure of the data have not been taken properly into account in the formulation of the models.

Transfer model.

International patent law specifies that a Subsequent Filing for an invention should take place within one year of making a First Filing. In the transfer approach the numbers of EPO patent applications in a particular year are forecasted by using observed levels of worldwide First Filings that were made in the previous year. However, where the numbers of such First Filings are not reported by a National Patent Office, the numbers of Domestic National Filings (excluding PCT National phase) are taken as a proxy for First Filings.

Applications from EPC, Japan and the United States together account for about 90% of EPO applications. Additionally about 80% of worldwide First Filings are made in the three blocs (Trilateral Statistical Report, 2001). Annualised total numbers of First Filings (FFs) made in the three blocs are reported and extrapolated by trend analysis or by obtaining forecasts from the various patent offices (Fig. 4). Then the corresponding numbers of subsequent EPO patent applications (SFs) originating from these blocs are obtained. To achieve comparability, the bloc-wise FFs are re-assigned one year later to equate to the year in which they are likely to be quoted as priority references in the SFs. From each bloc, transfer ratios (TR) are calculated as:

$$\text{Transfer Ratio in year y } (TR_y) = \frac{\text{EPO Subsequent Filings in year y } (SF_y)}{\text{First filings in year y-1 } (FF_{y-1})}$$

The TRs alter slowly over time and have generally increased in recent years. The TRs are themselves extrapolated by trend analysis over the planning period (Fig. 5). From these projections, projected levels of EPO Subsequent Filings are calculated by reversal of the above equation ($SF_y = FF_{y-1} \times TR_y$).

It is possible for clients to make their First Filings at the EPO as well as in the national systems. This mainly occurs for EPC based applicants for whom the EPO is a likely alternative to a national office for a FF. It is necessary to correct the predicted SF_y values from each bloc in order to get forecasts for total EPO filings (TF_y). The proportion of First Filings among all EPO filings ($\%FF_y$) from a bloc is also projected by trend analysis (Fig. 6). Then,

$$\text{EPO Total filings in year y } (TF_y) = \frac{\text{EPO Subsequent Filings in year y } (SF_y)}{1 - \text{Proportion of EPO First Filings } (\%FF_y)}$$

At this point forecasts have been prepared for future filings at the EPO from each of the major blocs. But in order to forecast overall numbers of filings (OF_y), a further correction is made in order to allow for filings from other countries outside EPC, Japan and US. The weight of the three blocs among all EPO applications (TW_y) is also extrapolated, but this has declined at only a slow rate over the years and remains for the time being at a level of approximately 90%.

$$\text{Overall filings in year y } (OF_y) = \sum_{\text{blocs}} \frac{TF_y}{TW_y}$$

The results in terms of forecasts for overall filings are given in Fig. 7.

This method gives a pragmatic way to model the structure of the worldwide patenting system by exploiting the predictive power of the First Filings series. In the future it is hoped to develop the method further by using more

sophisticated methods of extrapolation (time series methods and multivariate analysis) and by taking account of further subdivisions of the data (such as the distinction between PCT and non-PCT filings, since PCT filings have a higher propensity for international transmission). Globalised versions of such filing flows models are also under consideration (see Section VI below).

Surveys of applicants.

Since 1996 the EPO has carried out an annual survey among its applicants to profit from information about their intentions towards filing patent applications (Andersen and Hingley, 2003, and previous reports). The selected applicants are asked to complete a mail questionnaire to give their intentions for filings in all major world patent systems for the current year and the following two years. Breakdowns of all filings types are asked for in terms of First and Subsequent Filings, and for the EPO species a breakdown is requested in terms of Euro-direct and Euro-PCT-IP filings. An option is provided for the respondent to give qualitative predictions (more/same/less), but most respondents do in fact seem happy to provide quantitative information.

Since 2001 the survey has been carried out on an expanded sample based on two groups:

1. Biggest Group. The largest 400 applicants at the EPO, in terms of the numbers of filings made during the previous year.

2. Random Group. A group of 2000 applicants obtained by simple random sampling of European patent applications, where the probability for an applicant to be selected for the sample is proportional to the number of applications made during the previous year.

The main purpose of the survey is to estimate a growth index of intended numbers of applications for the forecast horizon two years ahead. Different methods are used to estimate the growth indices for the two groups, and it is important to establish whether the projected behaviour of the biggest applicants is reflected in the overall population that is represented by the Random Group. Since the Random Group has been selected by statistical criteria, it is possible to ascribe confidence limits from this group to the resulting forecasts for overall filings by the population of applicants. Fig.s 8 - 10 show the main results obtained from the survey that was completed in 2002. The results from the Biggest Group (Fig. 8) are in reasonable agreement with the results from the Random Group (Fig. 9). An attempt was also made to compensate for the possible pessimistic views of the non-responders in the Random Group (Fig. 10).

Forecasting exercise of January 2003.

The forecasts that were made in early 2003, for Overall EPO filings by the various methods described above, are shown in Fig.s 3, 7 and 10. The forecasts show a reasonable degree of agreement and are being used as the basis for the current round of the EPO Planning process.

The forecasting operation is done in January each year as the first stage of the preparation cycle for the annual EPO Budget. Fig. 11 is a schema that shows the various stages in the cycle. A "Round Table" meeting takes place in January between the forecasting team in CO and planning officers from various EPO departments. The outcome of this meeting is a set of consensus forecasts that constitutes a "Basic assumptions" document for planning for consideration by the EPO Management Committee. After approval there, the revised document is discussed in May by the Budget and Finance Committee of the Administrative Council, and in June by the Administrative Council itself.

The EPO needs to forecast workload requirements for many downstream operations that take place during the granting procedure after patent applications have been initially filed. An example of one of these downstream quantities is the number of expected Euro-PCT-RP Filings as discussed in Section II. Other quantities include: workload requirements for search and substantive examination, numbers of final actions of various types, grant publications, special searches, oppositions, appeals, etc. After the approval of the Basic assumptions document by the Management Committee in February, the Planning Units and Controlling Office then cooperate to construct a detailed Medium Term Business Plan that includes the major downstream quantities. This is discussed iteratively with the Management Committee and is presented to autumn meetings of the Budget and Finance Committee and the Administrative Council. In parallel, the Finance Department constructs a Budget document that is consistent with the draft Medium Term Business Plan. It is only at the Administrative Council Meeting in December that the forecasts originally made in January are formally imbedded into the EPO Budget for the following year.

The lag between forecasting and Budget approval can cause problems if the perception of the patent application market changes during the course of the year. However the procedure is consistent with the international treaty requirements upon which the EPO is based. The forecasted scenarios can be fine-tuned during the course of the year as circumstances dictate, although there is a strong presumption to maintain the original headline forecasts unless clear discrepancies with reality have been identified. In CO and elsewhere, data collection, generation of alternative sets of forecasts and research into improvement of methods takes place throughout the year without constraints. Also the survey of applicants is organised, executed and analysed during the course of the year.

IV. Research Programme into the improvement of forecasting methods:

In 2001 the Office launched a programme to attract external researchers. After discussions with several external consultants, it was decided that the programme should concentrate on methodological improvements to forecasting. It was also decided to seek to attract researchers who were already actively working on areas that could be used for the EPO forecasting problem. Five modules were identified for implementation of the programme (Harhoff, 2001), although it was recognised that the modules represent a spectrum of activities and individual projects could examine aspects covering several modules.

A. Survey methods. Questionnaire design, sample design and selection, analysis of results.

B. Patent Filings at the firm level. Study of firms making large numbers of applications, data collection of prognostic variables such as R&D expenditures and harmonisation with results collected from EPO applicant surveys.

C. Patent filings at the Industry and National level. Study of effects of competition between firms on patenting behaviour, concordance between patent classifications and industrial classifications, advisability of pooling data across industries and across countries.

D. Patent Transfer models. Consideration of flows of filings between patent offices, extension of existing EPO transfer modelling approach to feasible multi-flow models, trade-offs betwen modelling direct national filings and PCT filings together or separately.

E. Time series models of aggregate filing data. Enrichment of existing techniques to include predictive models from related economic time series, identification of regressors, specification and estimation of suitable models.

In the initial phase of the programme a fixed funding limit was set for five years, within which five projects were selected. One of the projects has not been active and the Office is seeking to cancel the funding offer. The four active projects began in 2002 and are of different durations (three years, two years, one year and six months). The one year project, which studies microeconomic determinants of patenting behaviour, combines aspects of modules A, B and C but only began in late 2002. The other three projects are now briefly described.

1. Time Series analysis and forecasting. Module E.

Two time series approaches were used to forecast European patent filings: vector error correction models and dynamic linear models. The purpose was to address the question of whether disaggregation can lead to improved forecasts. An incidental aim was to investigate models and software solutions that could be used by the Office for forecasting. Parameters were estimated

on filings data from 1979 to 1994, and then out-of-sample forecasts were made for filings from 1995 to 2000.

This project has been completed. The conclusions were that there were some small benefits to be gained by aggregating forecasts over the main Blocs of residence of Applicants (EPC, Japan, US and the rest of the world). However no significant improvements in overall forecasting accuracy were found from aggregating over industries, as classified by the eight main Technical Units (A - H) of the International Patent Classification (IPC, 1994). A comparison was made of monthly filings data with annual data, and the monthly data were shown to provide greater accuracy for annual forecasts. The most effective modelling approaches was the dynamic linear model with monthly data in a mixture of univariate and multivariate modes.

2. International Patenting Costs: Aggregate and Sectoral Patterns. Module C.

A conceptual and empirical econometric model for explaining international patenting patterns is being built, with parameter estimation carried out using a general linear model regression approach rather than by time series analysis. The model focuses mainly on data for patent applications to the EPO, but also incorporates filings in other patent systems to some extent and various economic series that might have prognostic influence. In addition to modelling the overall number of European applications, the researcher has extended the model to predict numbers of designations in such applications by using a "gravity model" based on geographic distances between capital cities.

3. Time series methods to forecast patent filings. Module C,E.

Various time series approaches are being studied technically for their ability to forecast patent filings at the EPO, based on historical data on filings and R&D expenditures. The emphasis is on medium term forecasts for annualised data out to five years ahead, but short-term forecasts are also constructed using monthly data. The favoured time series methods are based on the Box-Jenkins approach, including exponential smoothing, seasonal ARIMA, ARMAX, GARCH and VAR. These techniques are older and somewhat better established than the ones considered in Project **1.** above, so it is interesting that both approaches are being pursued within the research programme.

The exponential smoothing approach offers a way that the Office might be able to produce rolling forecasts on a more frequent seasonal basis than just once a year. The ARMAX approach is particularly interesting because it holds out the promise that accurate forecasts can be made by relating patent series to lagged R&D series. The EPO previously made an attempt to carry out a similar modelling exercise (Hingley, 1997).

Implementation of methods.

The EPO believes that further steps will need to be taken to convert the methodological results of the research programme into improvements in its routine forecasting procedures. An effort will be made to make detailed comparisons of the proposed methods on historical data to assess relative forecasting accuracy, and to build systems to calculate the favoured methods on an ongoing basis. It is not yet clear to what extent such systems can be fully automated, because forecasting has to adapt to circumstances and human decision making is an important component. The issue of data description and integrity is also an important issue that will continue to be addressed.

V. EPO planning within Technical Areas:

After an internal initiative in 2002 known as “Mastering the Workload”, the operational departments at the EPO have recently been reorganised according to 14 technical areas of patenting known as *Joint Clusters.* Fig. 12 shows the historical development of filings in each cluster, while Fig.s 13 and 14 show two possible groupings of Joint Clusters into *Superclusters* of related industries. A new challenge for the forecasting team is to accommodate the need to make forecasts for each Joint Cluster, in addition to the forecasts for overall filings and related parameters. It seems likely that, from a forecasting point of view, it may be better to analyse combinations of Joint Clusters rather than each one separately.

The EPO is in the process of setting up separate planning units per Joint Cluster with a responsibility to provide forecasts of developments in each area based on specialised knowledge of technical developments. Nevertheless, it is recognised that a central exercise to forecast total filings remains valuable, and that this should be harmonised with bottom-up forecasts made by each individual Joint Cluster planning unit via a process of consensus building. A harmonisation of forecasts by bottom-up and central approaches is then planned. This will replace the current policy where the detailed plans for EPO directorates may in some cases just be scaled down versions of the forecast projections for Overall filings.

It is too early to say how well this will work. The central forecasting methods in current use can not all be adapted easily to forecasting at the level of the individual Joint Cluster. Extrapolations and time series methods can be used, but in terms of statistical efficiency it may be more accurate to apply such methods centrally with terms introduced to distinguish the developments of the various Joint Clusters. The transfer method can not easily be applied because this requires data on priority forming First Filings for each Joint Cluster from each major filing bloc (EPC, Japan and US) - these data are not currently available either from the Trilateral partners or National Patent Offices in Europe. The Applicant Panel survey could be adapted to address specific groups of applicants regarding their applications in particular Joint Clusters, but this will necessitate an increase of the sample size and will also have

other implications for the survey design. A scale up will be considered for the 2004 survey.

VI. Trilateral forecasting activities:

The EPO Controlling Office participates in a *Trilateral Statistical Working Group (TSWG)*, together with representatives of the Japanese Patent Office (JPO) and the United States Patent and Trademark Office (USPTO). This group examines and compares forecasting techniques, and seeks to find models for world-wide patent application patterns across borders.

As with the EPO, the process of forming forecasts for budgetary purposes at the JPO and USPTO involves a certain amount of internal consensus building. However the Offices also research particular avenues to forecasting without necessarily using solely these methods for budgetary purposes.

The USPTO originally pioneered the use of *econometric models* for forecasting, including lagged time series of R&D expenditures and GDP as leading indicators, but tended to restrict the scope of independent variables in such models. Recent work there has concentrated on modelling PCT International Phase filings from US applicants based on a transfer model using US National Domestic filings as predictors. This is similar to the EPO transfer model, but also introduces lagged GDP terms in a simple time series based approach.

The JPO has used a production function based approach to modelling patent filings series. Domestic filings forecasts are modelled for levels of GDP, numbers of researchers and cumulative numbers of patent applications. Additionally some effort has been made to model outward flows of patents from Japan to the other major blocs.

The EPO looked at a *simultaneous equations based model* for international patent filings flows. The patenting flows between blocs depend on domestic filings in each bloc, the attractiveness of international markets and the trend towards globalisation of world trade over time. As a first step, two simple models were suggested. In the first, the filings flowing from one bloc to another are a function of the domestic filing in target and origin bloc (Fig. 15). In the second model, the filing flows are additionally dependent on the contra-flow of filings from the target bloc to the origin bloc, and the flow from the third bloc to the target bloc (Fig. 16). Initial tests have been made on this model but no firm conclusions have yet been drawn. For estimation purposes it is simpler to incorporate lagged terms for the independent variables, including perhaps a lagged term for the dependent variable itself. Seemingly unrelated regressions may be an appropriate estimation technique (Zellner, 1962; SAS Institute, 1993). But it is also interesting to ignore the lagged terms and to look at contemporaneous modelling terms. The resulting set of simultaneous equations has been solved, but the problem of fitting the model to the data will involve some non-trivial applications of nonlinear regression methods and has not yet been achieved.

A successful global forecasting model could be based on *patent families* data, in which individual priority forming First Filings are identified and associated with the resulting world wide filings originating from that priority (Fig.17). A patent family database is currently maintained by the Office by extraction from the publications database DOCDB (see, e.g. EPO, JPO, USPTO, 1992). The Office is participating in discussions within an OECD sponsored Patent Statistics Task Force on appropriate ways to define patent families and to distribute information on them to the research community beyond the patent offices.

At present all three trilateral offices are carrying out independent surveys of forecasting intentions amongst their applicants. There have been discussions at the TSWG as to whether it may be feasible to combine these independent surveys of filing intentions into a common world-wide survey. For the moment the three offices are maintaining their independent approaches, but are incorporating more questions on international filing behaviour and comparing results within the framework of the TSWG.

VII. Conclusions:

There are many ways to try to forecast future levels of patent filings. At a practical level, the EPO will continue to apply the simple techniques with which it is already familiar, to give routine forecasts to its own management for budgetary planning purposes. The phenomenon of filing for patents has macroeconomic and microeconomic facets, and it is a good idea to research these and to institute improved methods where possible. In the outside world there are a good number of studies where the patent series themselves are used as predictors for technological development. In a sense the patent filings forecasting operation involves running these kinds of studies in reverse, to see how indicators can be used to forecast the development of the patent series.

It is clear that the EPO should monitor outside studies on general aspects of the patenting system in order to find aspects of the studies that can be used to ease its own forecasting problem. It is also a good idea to look at the likely underlying developments in IP systems themselves to give early warnings of secular changes. The 25 year lifetime of the EPO up to now has been a lucky one, in which the growing forces of trade globalisation and liberalisation have presented a favourable wind for increases in the numbers of applications. The wind could change direction at some point, and if it does so then the existing forecasting techniques may not be particularly useful to delineate the consequent quantitative changes in numbers of patent filings. Another goal of the forecasting team is to provide scenario analysis of the consequences of optional changes that the EPO can advise on, such as changes to patent rules or levels of patenting fees.

The attempt to forecast future patent filings levels is always likely to remain a difficult process. It is easy to see that it will be beneficial to take account of the views of as many people as possible on future developments; from both

inside and outside the EPO, and from both users and observers of the patent system.

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Fig. 1

Worldwide patenting system, highlighting the involvement of the European Patent Office (EPO).

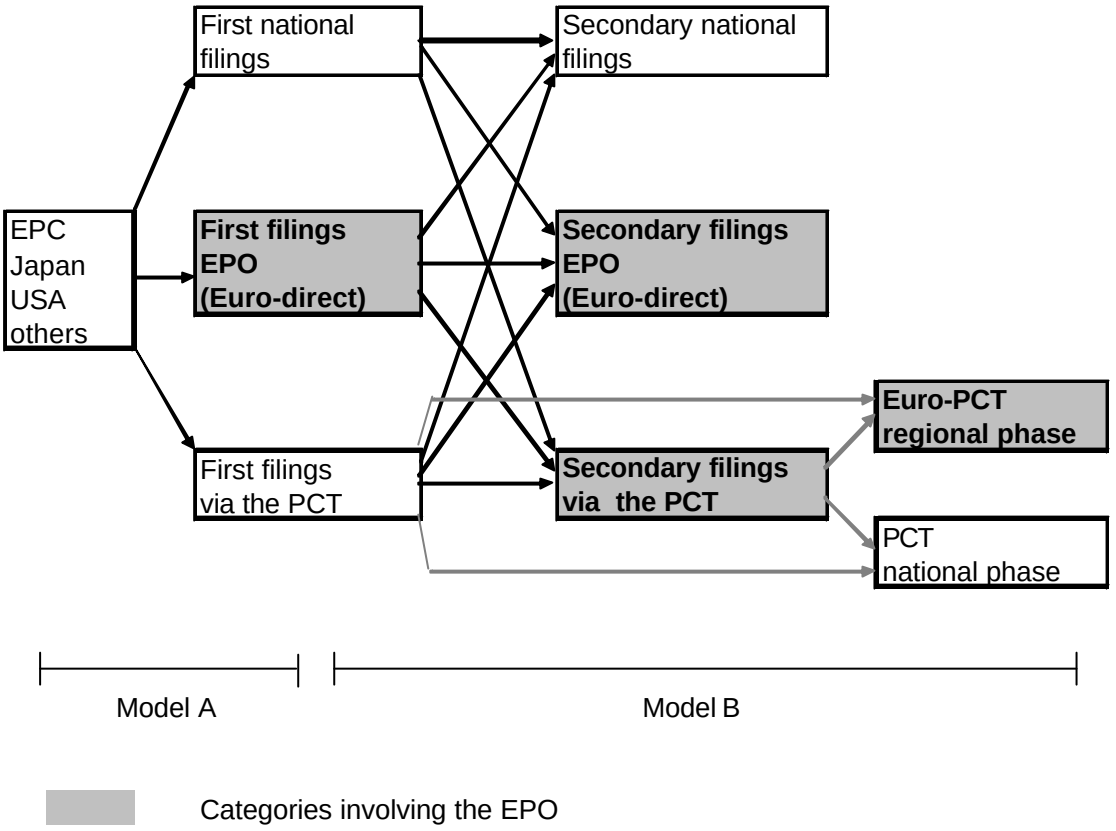


Fig. 2: Trend Analysis

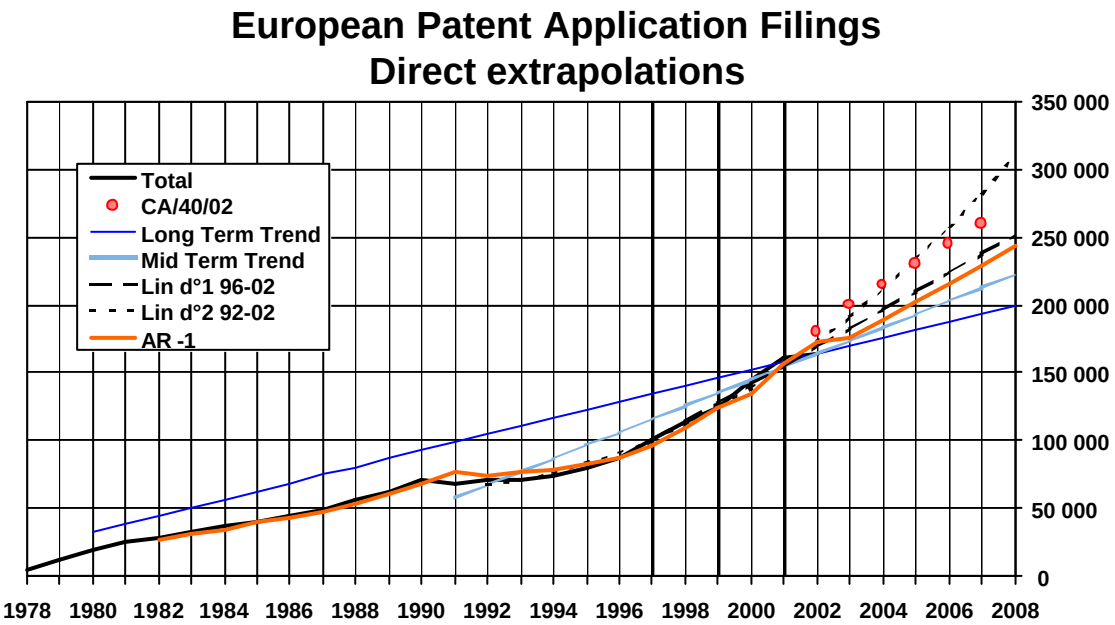


Fig. 3: Trend Analysis

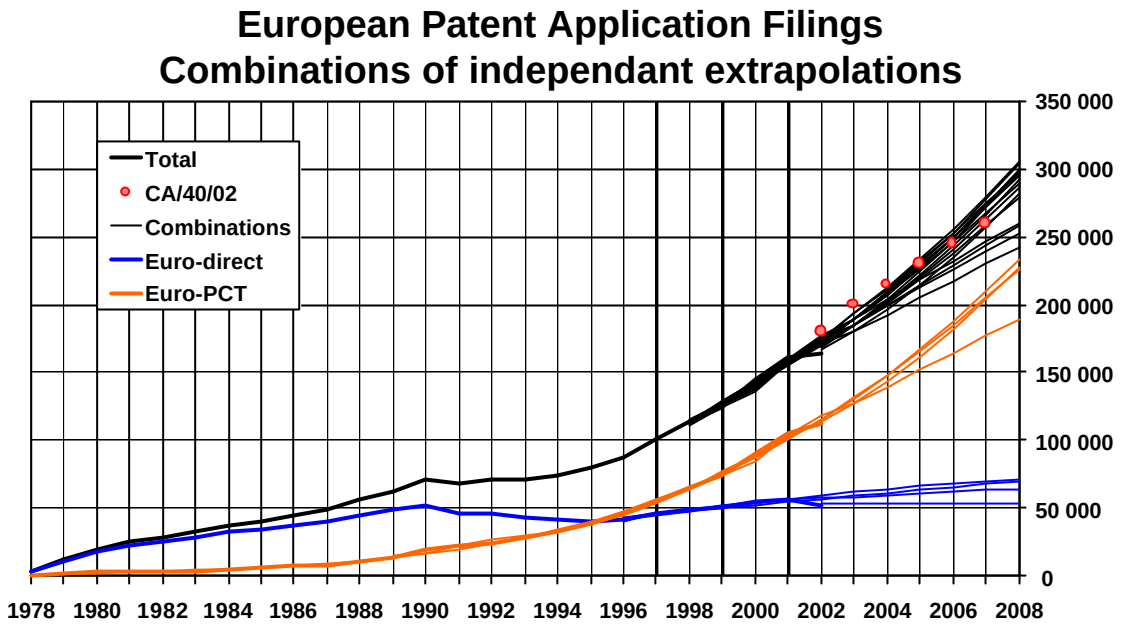


Fig. 4: Transfer Model

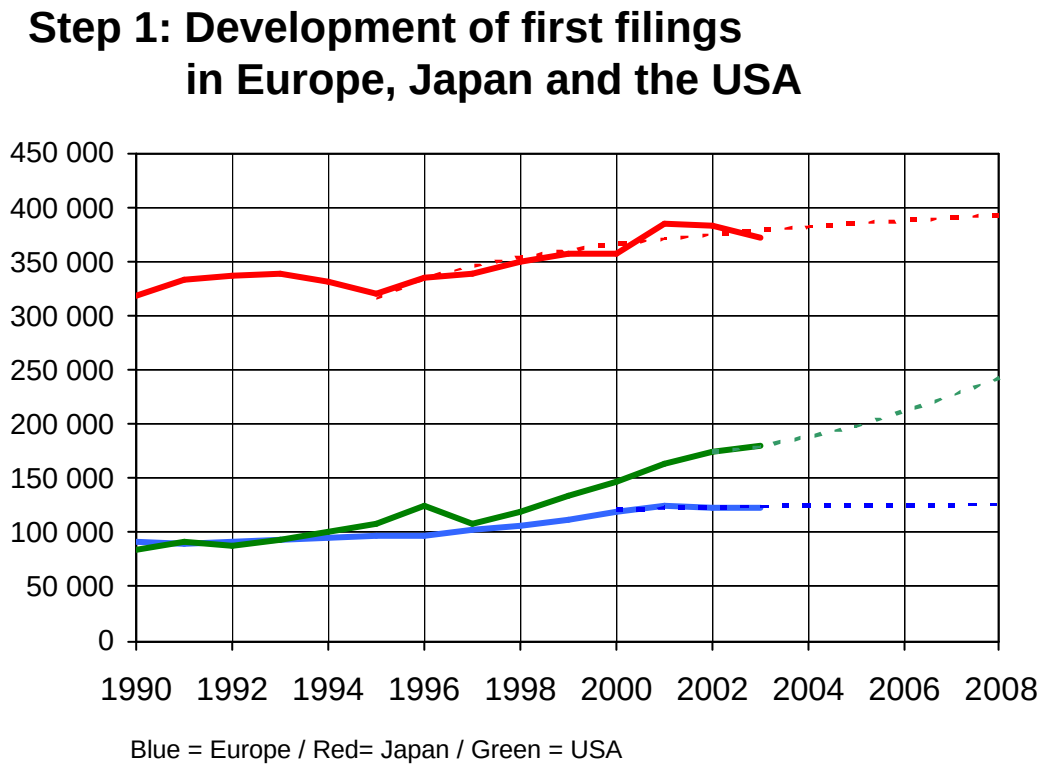


Fig. 5: Transfer Model

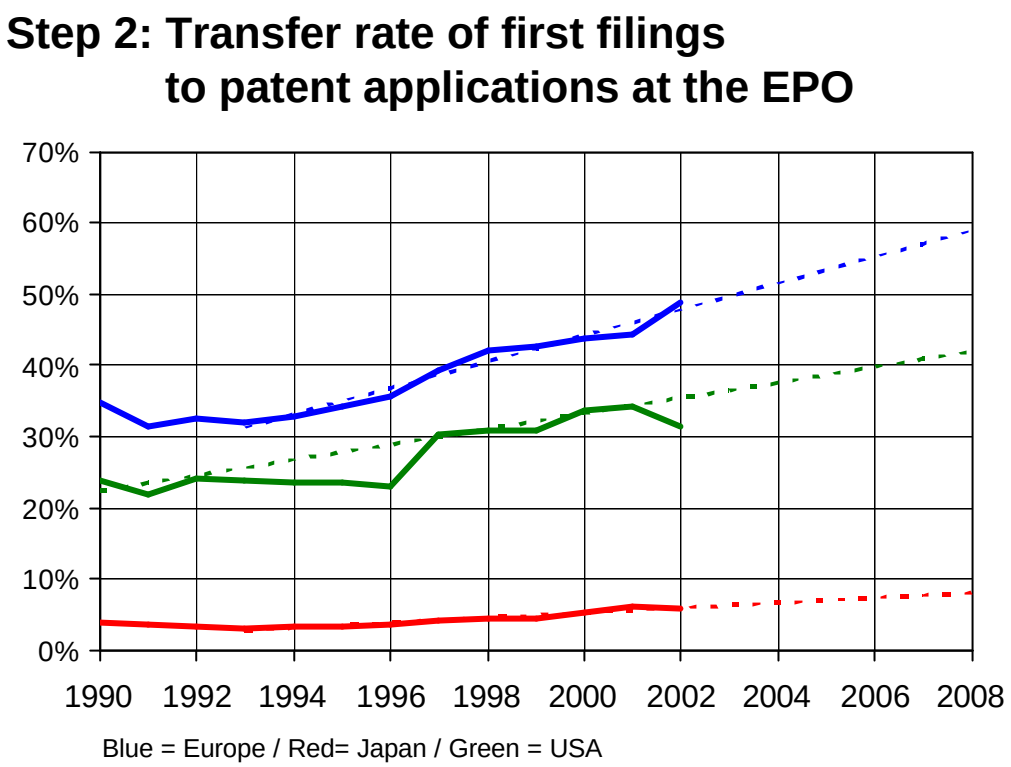


Fig. 6: Transfer Model

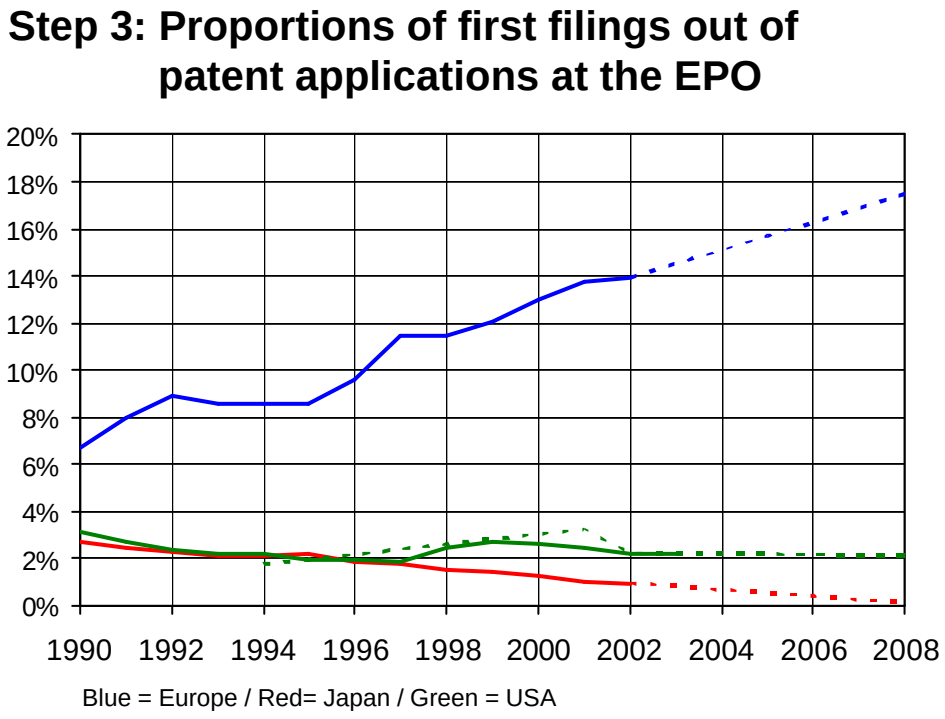


Fig. 7: Transfer Model

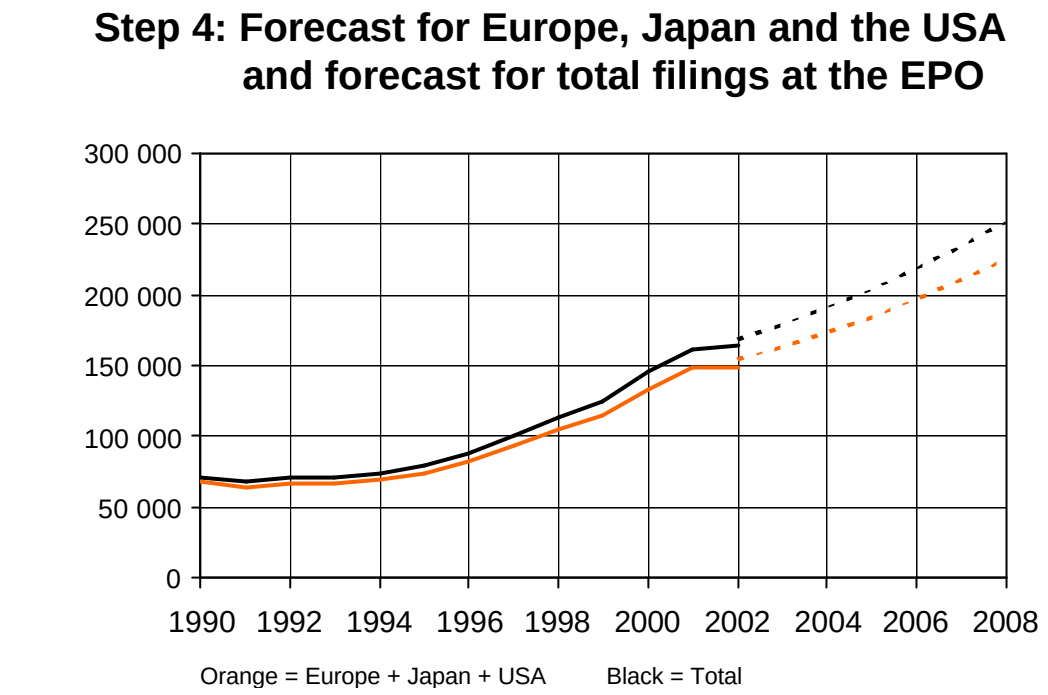


Fig. 8: Surveys of applicants

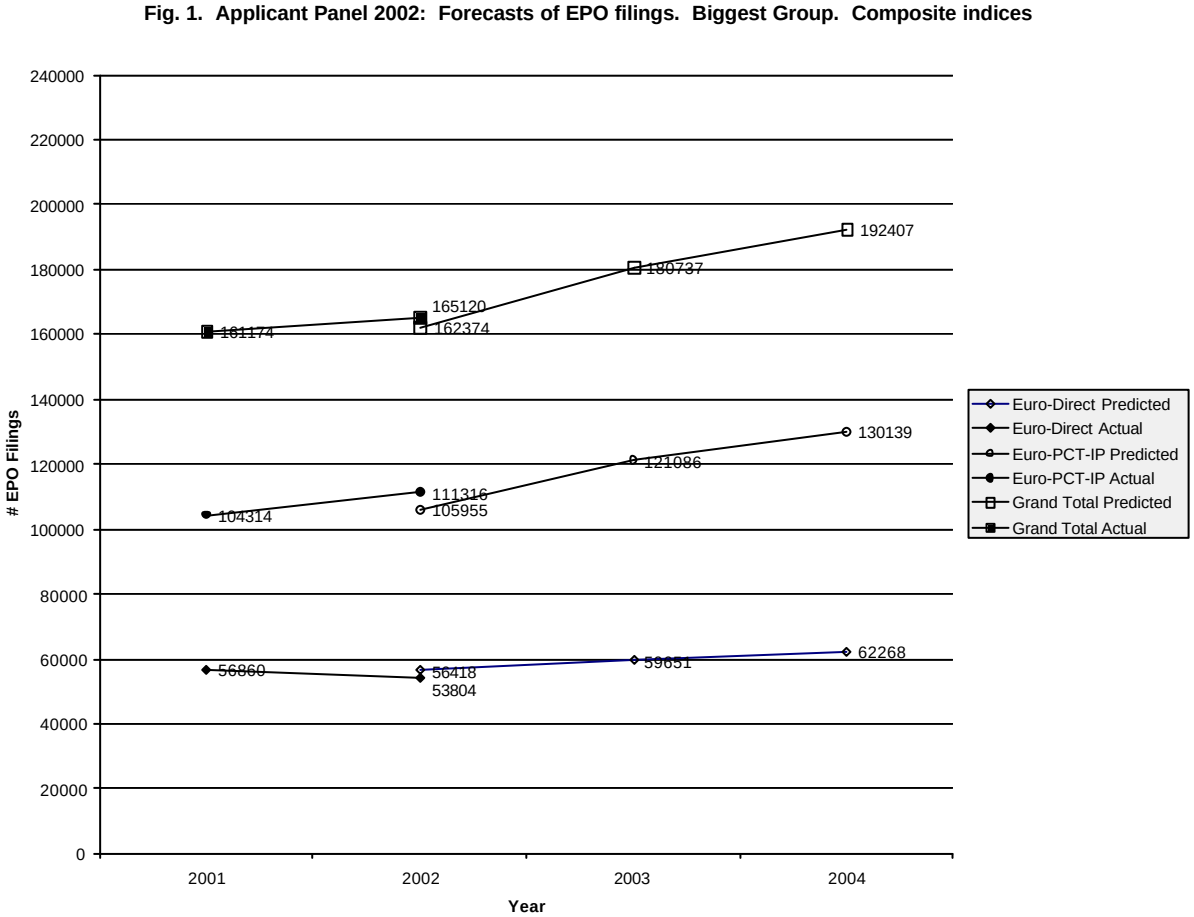


Fig. 9: Surveys of applicants

Fig. 2. Applicant Panel 2002: Forecasts of EPO filings. Random Group. Q indices. Analysis of logarithmic transformations.

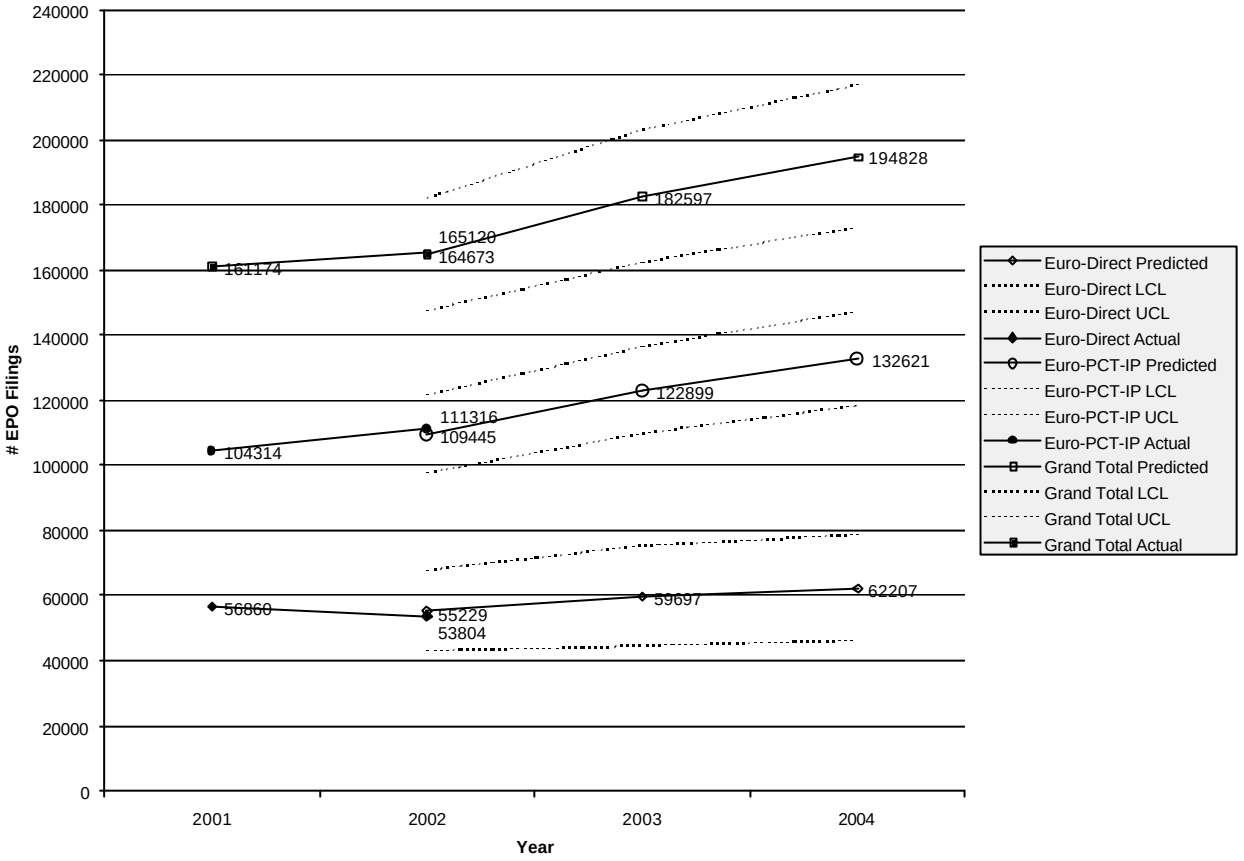


Fig. 10: Surveys of applicants

Fig. 3. Applicant Panel 2002: Forecasts of EPO filings. Random Group. Q indices. Analysis of logarithmic transformations, incorporating a non-response correction.

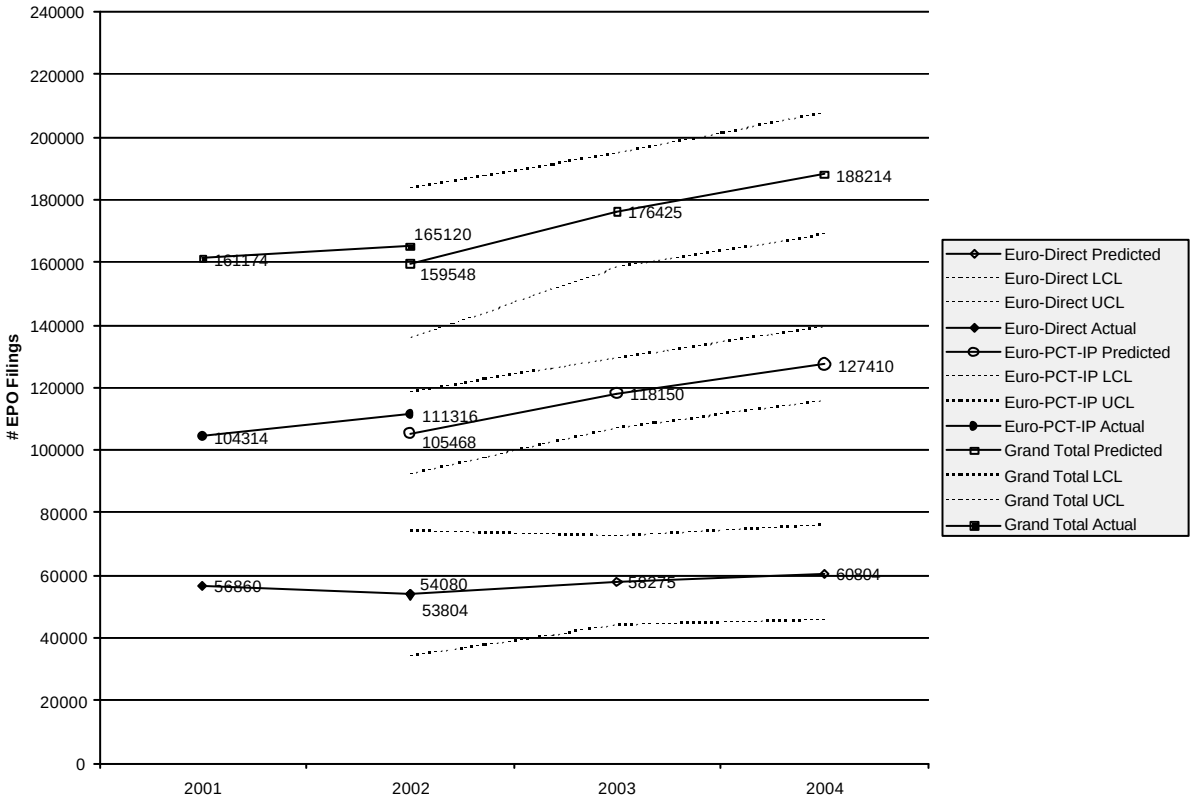


Fig. 11: Forecasting exercise of January 2003

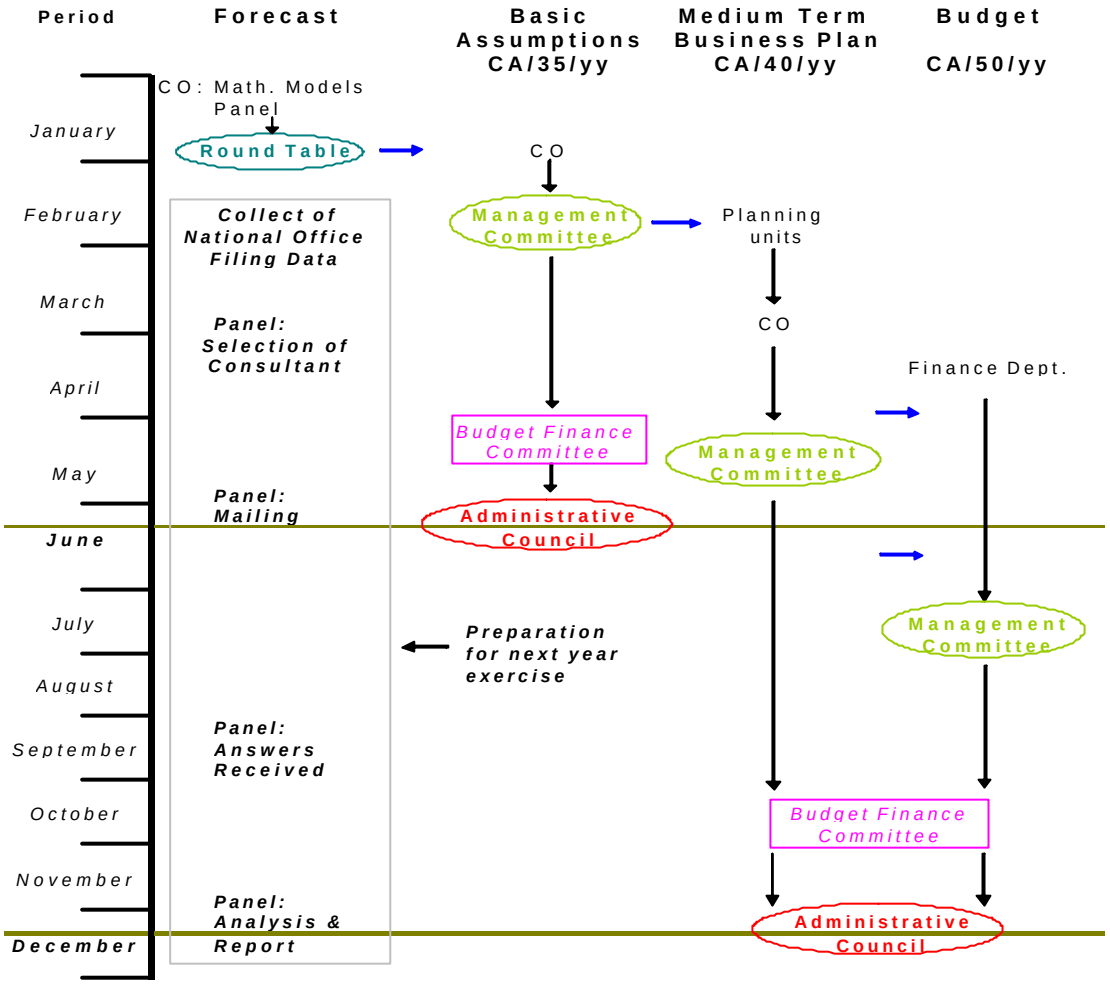


Fig. 12: EPO planning within Technical Areas

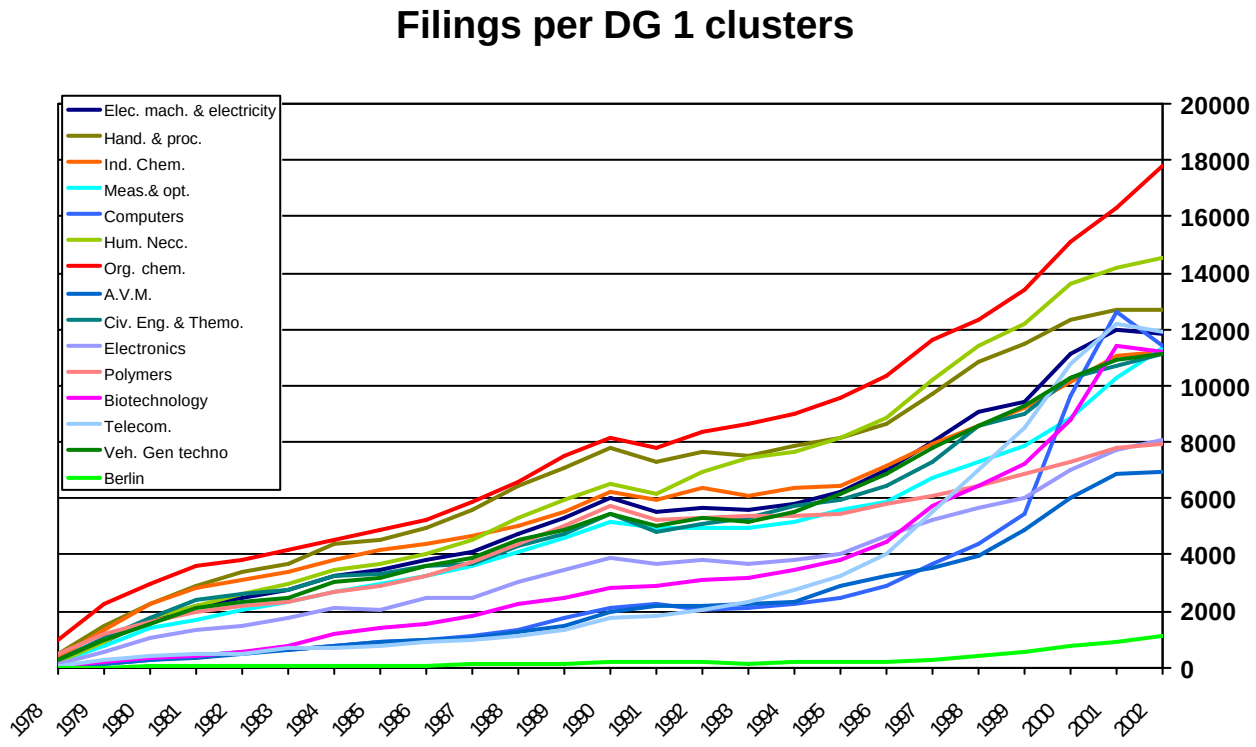


Fig. 13: EPO planning within Technical Areas

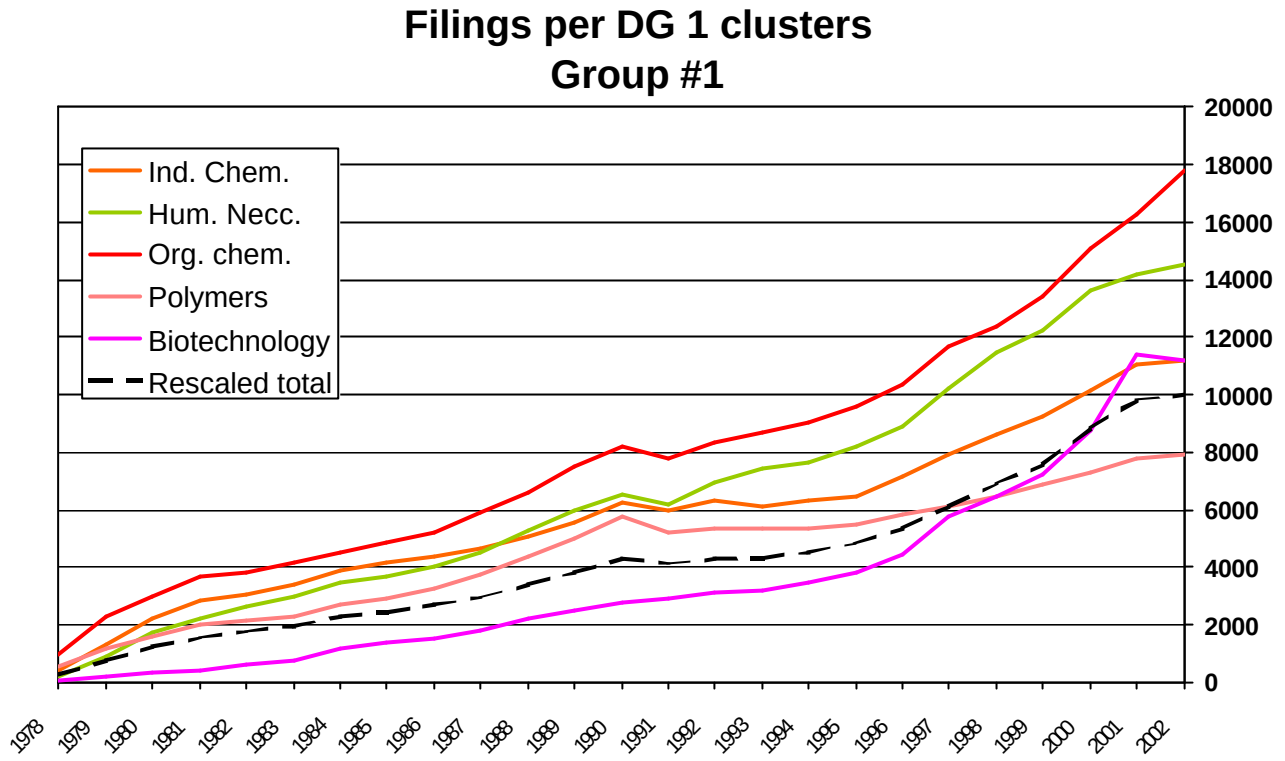


Fig. 14: EPO planning within Technical Areas

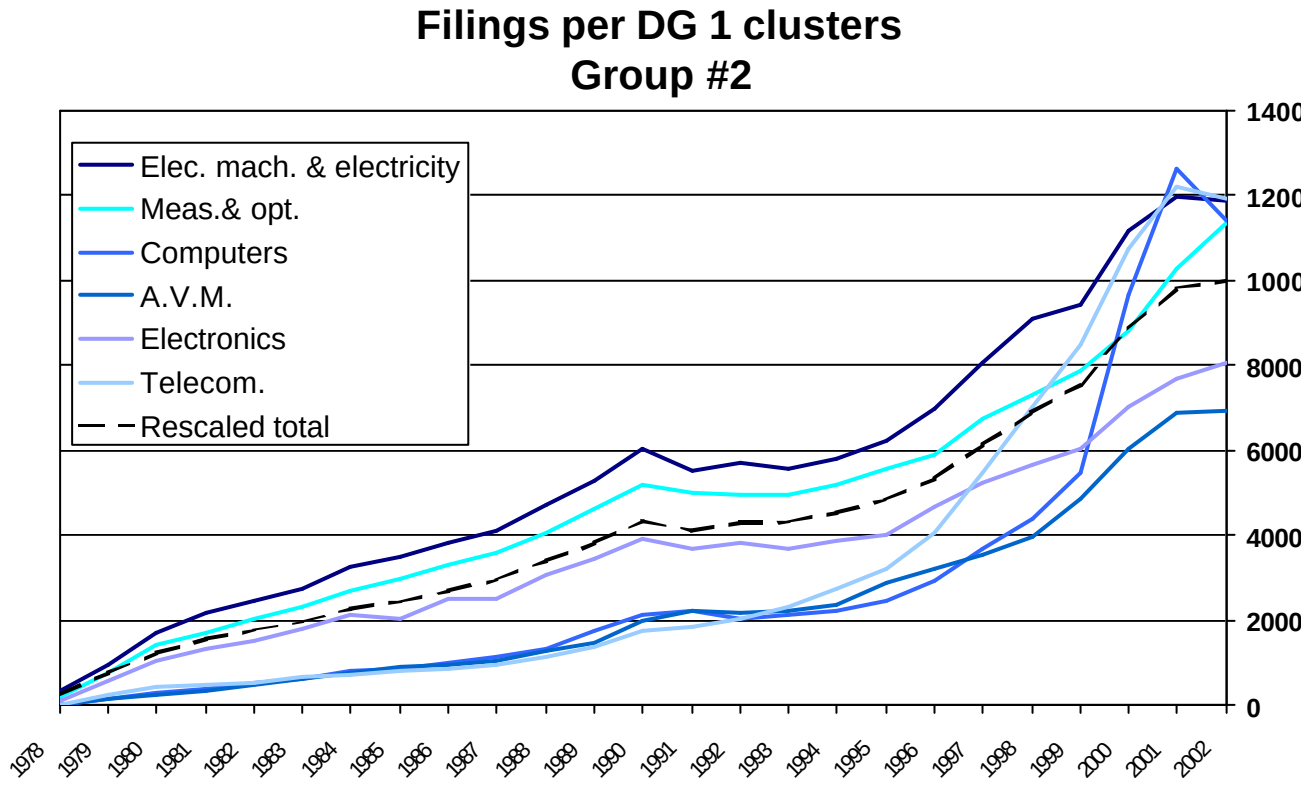
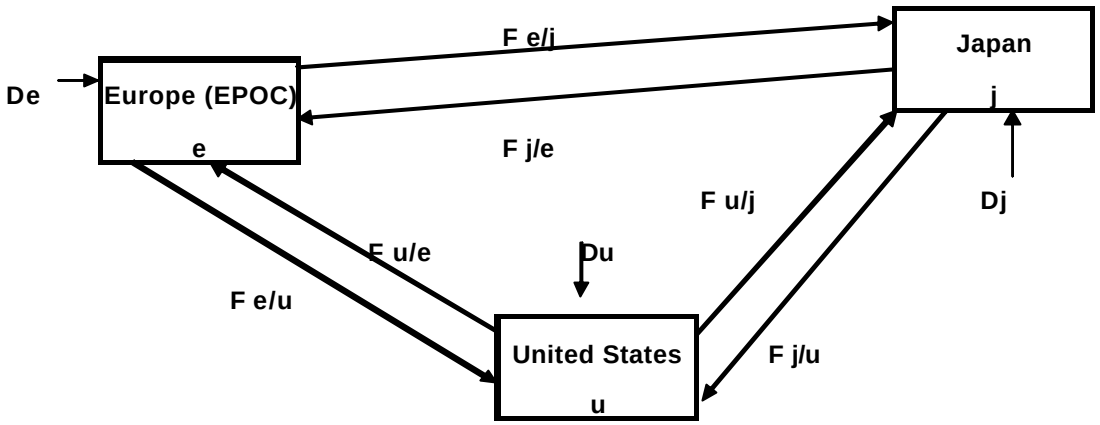


Fig. 15: Trilateral forecasting activities

Formulating a model for flows between blocs.



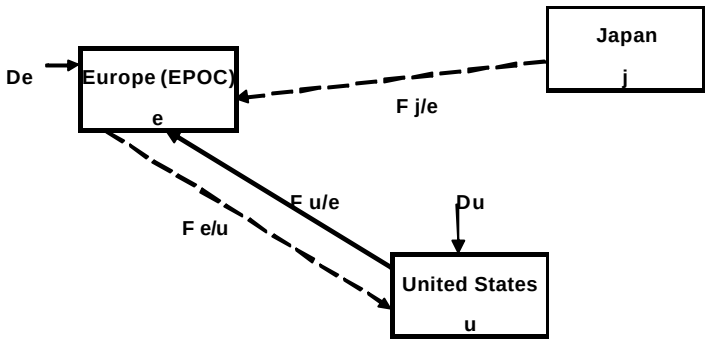
Formula

1	F u/e	=	a1	+	b1 . Du	+	c1 . De	
2	F u/j	=	a2	+	b2 . Du	+	c2 . Dj	
3	F j/u	=	a3	+	b3 . Dj	+	c3 . Du	
4	F j/e	=	a4	+	b4 . Dj	+	c4 . De	
5	F e/u	=	a5	+	b5 . De	+	c5 . Du	
6	F e/j	=	a6	+	b6 . De	+	c6 . Dj	

Fig. 16: Trilateral forecasting activities

Formulating a model to allow contemporaneous contributions from other flows.

Autoregressive model for Formula 1.



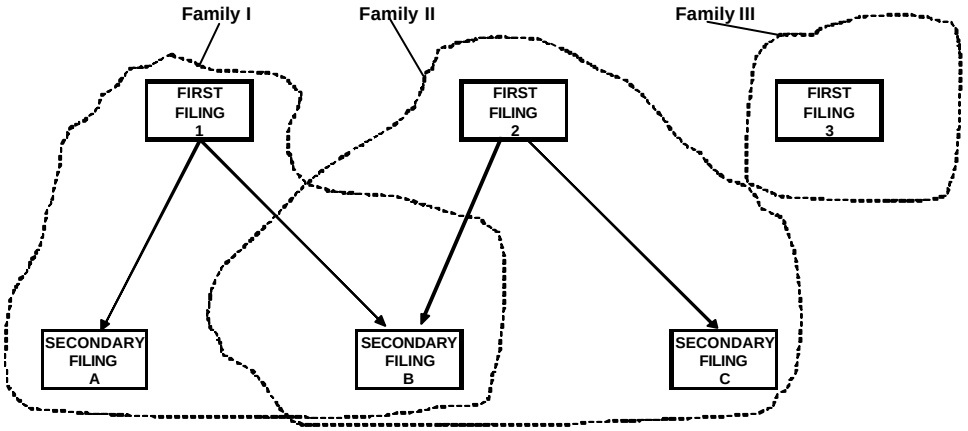
Formula

1	F u/e = (a1 + b1 . Du + c1 . De) + e1 . Fe/u + f1 . Fj/e
2	F u/j = (a2 + b2 . Du + c2 . Dj) + e2 . Fj/u + f2 . Fe/j
3	F j/u = (a3 + b3 . Dj + c3 . Du) + e3 . Fu/j + f3 . Fe/u
4	F j/e = (a4 + b4 . Dj + c4 . De) + e4 . Fe/j + f4 . Fu/e
5	F e/u = (a5 + b5 . De + c5 . Du) + e5 . Fu/e + f5 . Fj/u
6	F e/j = (a6 + b6 . De + c6 . Dj) + e6 . Fj/e + f6 . Fu/j

Solve system of simultaneous equations to obtain nonlinear expressions for each F as a function of the D terms.

Fig. 17: Trilateral forecasting activities

Patent families



Characteristics of families:

1. **Date and location of first filing.**
2. **Whether or not the first filing has been published.**
3. **Date and location of all secondary filings in the family.**
4. **In how many blocs has the first filing been quoted as a priority filing by other members of the family.**
5. **Routes of filings for all applications (e.g. National, PCT, EPO).**
6. **Technical areas covered by the invention.**