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Patent Cooperation Treaty (PCT)
Working Group

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SUPPLEMENT TO "ESTIMATING A PCT FEE ELASTICITY" STUDY

Document prepared by the International Bureau

INTRODUCTION

1.   At the seventh session of the Working Group, the International Bureau presented a study entitled "*Estimating a PCT Fee Elasticity*", which provided a first ever estimate of the overall fee elasticity of PCT applications, that is, how an applicant's choice on whether to use the PCT or the Paris route for filing patent applications abroad is affected by changes in the international filing fee[1]. It showed that universities and public research organizations (PRO) are more price sensitive than other applicants – even if all elasticity estimates suggested a highly inelastic fee responsiveness. As a follow-up, the Working Group asked the Secretariat to work with the Chief Economist to provide a supplementary study exploring the effects of possible fee reductions for universities originating in different country groups[2].

2.   This document presents the supplementary study requested by the Working Group at its seventh session. Using the same underlying patent family data and econometric approach, the study makes two contributions. First, it estimates separate fee elasticities for universities and PROs, depending on whether these types of applicants reside in developed or developing countries. Second, on the basis of these new fee elasticity estimates, it simulates how a hypothetical reduction in the fee level would affect PCT filing volumes and income.

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[1]   See PCT/WG/7/6.
[2]   See Summary by the Chair (PCT/WG/7/29).

NEW ELASTICITY ESTIMATES

3.   Relying on the same data and adopting the same econometric approach outlined in document PCT/WG/7/6 – henceforth referred to as "the earlier study" – one can estimate origin-specific fee elasticities for different applicant entities by interacting the fee variable with dummy variables for universities and PROs, as well as with dummy variables indicating developing and developed country origin.[3] Table 1 provides two different estimates implementing this approach. The first one – presented in column (1) – includes all the variables employed in the earlier study, except the unemployment rate. Exclusion of the unemployment rate leads to a larger estimation sample that includes more developing countries. The estimation results are comparable to the ones of the earlier study, except that the coefficients on the size dummy variables are not statistically significant. The interacted fee variables confirm that university and PRO applicants are more fee sensitive than other applicants. In addition, they show that universities from developing countries are more fee sensitive than universities from developed countries, whereas the coefficient estimates for PRO applicants are quite similar. All fee coefficients are statistically significant.

Table 1: Probit estimation results

	(1)	(2)
$\ln f_{ijt}$ * (University applicant) * (Developed country)	-0.157***	-0.118***
	(-7.86)	(-5.66)
$\ln f_{ijt}$ * (University applicant) * (Developing country)	-0.330***	-0.346***
	(-14.12)	(-13.27)
$\ln f_{ijt}$ * (PRO applicant) * (Developed country)	-0.130***	-0.085***
	(-6.55)	(-4.12)
$\ln f_{ijt}$ * (PRO applicant) * (Developing country)	-0.114***	0.066
	(-3.58)	(1.09)
$\ln f_{ijt}$ * (Other applicants)	-0.074***	-0.035*
	(-3.79)	
		(-1.73)
$\ln unemp_{jt}$		-0.106***
		(-12.86)
University applicant	1.309***	1.306***
	(50.86)	(49.78)
PRO applicant	0.680***	0.619***
	(29.99)	(26.74)
2 offices	-0.596	-0.700***
	(-1.08)	(-4.49)
3 offices	-0.244	-0.336**
	(-0.44)	(-2.16)
4 offices	0.066	-0.022
	(0.12)	(-0.15)
5 offices	0.289	0.200
	(0.52)	(1.28)
6 or more offices	0.595	0.505***
	(1.07)	(3.23)
$mkt_{j(t-12)}$	0.767***	0.768***
	(14.72)	(14.40)

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[3]   Developing countries are defined as the ones listed in *Official Notices (PCT Gazette) – 12 February 2015*; all other countries are defined as developed countries.

	(1)	(2)
Technology field fixed effects	*Yes*	*Yes*
Origin fixed effects	*Yes*	*Yes*
Time fixed effects	*Yes*	*Yes*
Observations	1,153,970	1,128,006
Log-likelihood	-600,361.95	-586,451.81

Note: z-statistic in parentheses; ***,**, and * indicate statistical significance at 1, 5, and 10 per cent, respectively.

4.　　Column (2) presents the estimation results when including the unemployment rate. The results change in three respects. First, several of the size dummy variables are now statistically significant – in line with expectations and with the results obtained in the earlier study. Second, except the fee coefficient for university applicants from developing countries, the estimated fee coefficients are smaller in size. Third, the fee coefficient for PROs from developing countries is not any more statistically significant and even takes on a positive sign. However, this is due to the smaller estimation sample, which only relies on 78 PRO patent families originating in developing countries, of which 90 per cent had a PCT equivalent.

5.　　Overall, the estimation results in column (2) are bound to be more reliable. Given the strong correlation between the fee level and the business cycle through the exchange rate – as explained in the earlier study – it is important to control for the unemployment rate in the estimation. The analysis that follows will therefore rely on these estimation results. However, it will not further consider the filing behavior of PROs from developing countries separately. This is partly because the results in column (1) suggest a similar fee responsiveness as the one observed for developed country PROs and partly because of doubts of having correctly identified PROs in the dataset.[4]

6.　　Table 2 presents the marginal effects associated with the probit coefficient estimates obtained in column (2) of Table 1.[5] One can interpret these marginal effects as percentage probabilities of opting for the PCT or, alternatively, as changes in the PCT market share resulting from changes in the explanatory variables. Dividing the marginal effect estimates on the fee variables by actual PCT market shares for different applicant groups then yields elasticity estimates with respect to PCT filing volume – as shown in Table 3.[6] The results suggest that the fee elasticity for university applicants from developing countries is four times as large as the one for university applicants from developed countries – which, in turn, is twice as large as the fee elasticity for other applicants. Interestingly, the PCT market share for universities from developing countries is substantially lower than that for universities from developed countries – pointing to unrealized potential for developing country universities to use the PCT system.

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[4]　　As explained in the earlier study, the identification of university and PRO applicants relies on a keyword-based search algorithm, which is bound to be more reliable for universities than for PROs.

[5]　　These marginal effects were computed using the "margins, dydx(*variable*)" command in STATA.

[6]　　The elasticity estimates presented in Table 3 rely on the actual PCT market shares in the estimation sample, rather than the full sample unconstrained by data availability on other variables in the econometric model. In the case of university applicants from developing countries, the number of observations in the estimation sample is less than a fifth of than in the full sample. However, the market shares in the two samples are similar. In addition, the coefficient estimate on the fee variable for developing country universities proved robust to different estimation samples – not only the one presented in column (1) of Table 1, but also a specification that relied on nominal instead of real fees for which the estimation sample was closer to the full sample shown in Table 3.

Table 2: Marginal effects associated with probit estimates

$\ln f_{ijt}$ * (University applicant) * (Developed country)	-0.035***
$\ln f_{ijt}$ * (University applicant) * (Developing country)	-0.102***
$\ln f_{ijt}$ * (Other applicants)	-0.010*
$\ln unemp_{jt}$	-0.312***
University applicant	0.384***
PRO applicant	0.182***
2 offices	-0.206*
3 offices	-0.099**
4 offices	-0.007
5 offices	0.059
6 or more offices	0.148***

Note: the marginal effects shown relate to the coefficient estimates of the corresponding variables in column (2) in Table 1; the marginal effects for other variables are suppressed here.

Table 3: Market shares and elasticity estimates

	Full sample		Estimation sample		
	#obs	PCT share	#obs	PCT share	Implied elasticity
University (developed country)	24,754	0.865	20,730	0.861	-0.040
University (developing country)	3,609	0.675	453	0.620	-0.164
Other applicants	1,342,593	0.492	1,092,352	0.489	-0.021

Note: the elasticity estimates rely on the actual PCT market shares in the estimation sample.

SIMULATION OF VOLUME AND INCOME EFFECTS

7.   One can use the elasticity estimates presented in Table 3 to simulate how hypothetical fee reductions would affect filing volumes and income. Tables 4 and 5 present such simulation exercises for universities from developing and developed countries, respectively. The first segment of each table presents actual filing and income figures from 2008 to 2014, along with the implied average fee. The other segments then calculate the number of additional filings, the average fee payment, and the income effect – both in absolute terms and relative to total PCT income – for hypothetical fee reductions of 10, 25, and 50 per cent.

8.   The econometric model imposes a log-linear functional form on the impact of the PCT fee. In other words, it assumes that a 20 per cent fee change will have double the effect of a 10 per cent fee change, and half the effect of a 40 per cent fee change. This assumption may be especially questionable for large fee changes that exceed historical experience. (For this reason, Tables 4 and 5 do not present simulation results for hypothetical fee changes exceeding 50 per cent). In particular, a fee reduction of 90 per cent –corresponding to the reduction currently offered to applicants from least-developed countries and natural persons from certain other countries – is not included.

Table 4: Hypothetical fee reductions for universities from developing countries

Actual performance

	Number of PCT filings	Income from those filings (in CHF millions)	Implied average fee (in CHF)
2008	552	0.771	1,396.74
2009	674	0.918	1,362.02
2010	1,024	1.296	1,265.63
2011	1,336	1.609	1,204.34
2012	1,282	1.693	1,320.59
2013	1,460	1.806	1,236.99
2014	1,694	2.305	1,360.68

10 per cent fee reduction

	Number of additional filings	Average fee (in CHF)	Income effect (in CHF millions)	Income effect (as % of total PCT income)
2008	9	1,257.07	-0.066	-0.03
2009	11	1,225.82	-0.078	-0.04
2010	17	1,139.06	-0.110	-0.05
2011	22	1,083.91	-0.137	-0.06
2012	21	1,118.53	-0.144	-0.06
2013	24	1,113.29	-0.154	-0.06
2014	28	1,224.62	-0.196	-0.07

25 per cent fee reduction

	Number of additional filings	Average fee (in CHF)	Income effect (in CHF millions)	Income effect (as % of total PCT income)
2008	23	1,047.55	-0.169	-0.07
2009	28	1,021.51	-0.201	-0.10
2010	42	949.22	-0.284	-0.14
2011	55	903.26	-0.353	-0.16
2012	53	990.44	-0.371	-0.14
2013	60	927.74	-0.396	-0.16
2014	69	1,020.51	-0.505	-0.17

50 per cent fee reduction

	Number of additional filings	Average fee (in CHF)	Income effect (in CHF millions)	Income effect (as % of total PCT income)
2008	45	698.37	-0.354	-0.16
2009	55	681.01	-0.421	-0.20
2010	84	632.81	-0.595	-0.29
2011	110	602.17	-0.739	-0.34
2012	105	660.30	-0.777	-0.30
2013	120	618.49	-0.829	-0.33
2014	139	680.34	-1.058	-0.36

Note: the number of additional filings relies on the fee elasticity estimate presented in Table 3; the average fee in the simulation scenario applies the hypothetical fee reduction to the actual average fee presented in the first table segment.

Table 5: Hypothetical fee reductions for universities from developed countries

Actual performance

	Number of PCT filings	Income from those filings (in CHF millions)	Implied average fee (in CHF)
2008	8,740	12.209	1,396.91
2009	8,965	12.204	1,361.29
2010	9,186	11.630	1,266.06
2011	9,786	11.789	1,204.68
2012	10,517	13.887	1,320.43
2013	10,437	12.910	1,236.95
2014	10,638	14.474	1,360.59

10 per cent fee reduction

	Number of additional filings	Average fee (in CHF)	Income effect (in CHF millions)	Income effect (as % of total PCT income)
2008	35	1,257.22	-1.177	-0.52
2009	36	1,225.16	-1.176	-0.56
2010	37	1,139.45	-1.121	-0.54
2011	39	1,084.21	-1.136	-0.52
2012	42	1,188.39	-1.339	-0.52
2013	42	1,113.25	-1.245	-0.49
2014	43	1,224.53	-1.395	-0.48

25 per cent fee reduction

	Number of additional filings	Average fee (in CHF)	Income effect (in CHF millions)	Income effect (as % of total PCT income)
2008	87	1,047.68	-2.961	-1.30
2009	90	1,020.97	-2.959	-1.40
2010	92	949.54	-2.820	-1.36
2011	98	903.51	-2.859	-1.30
2012	105	990.33	-3.368	-1.31
2013	104	927.71	-3.131	-1.23
2014	106	1,020.45	-3.510	-1.20

50 per cent fee reduction

	Number of additional filings	Average fee (in CHF)	Income effect (in CHF millions)	Income effect (as % of total PCT income)
2008	175	698.46	-5.982	-2.62
2009	179	680.65	-5.980	-2.83
2010	184	633.03	-5.699	-2.74
2011	196	602.34	-5.777	-2.63
2012	210	660.22	-6.805	-2.64
2013	209	618.47	-6.326	-2.49
2014	213	680.30	-7.092	-2.43

Note: the number of additional filings relies on the fee elasticity estimate presented in Table 3; the average fee in the simulation scenario applies the hypothetical fee reduction to the actual average fee presented in the first table segment.

9.	Reflecting the higher value of the elasticity estimate, PCT filings from universities in developing countries are more responsive to fee reductions *in relative terms*. However, due to substantially higher actual filing volumes, the absolute number of additional filings induced by any given fee discount is higher for universities from developed countries. For the same reason, the income effect of any given fee reduction is substantially larger for universities from developed countries.

10.	Reflecting the elasticity estimates and actual filing volumes, fee reductions for universities from developing countries are more "cost effective" at generating additional filings. For example, in 2014, a fee reduction of 25 per cent for developing country universities would have induced 69 additional filings, at an "income loss" of 0.5 million Swiss francs, whereas a 10 per cent fee reduction for developed country universities would have induced only 43 additional filings, at an "income loss" of 1.4 million Swiss francs.

CONCLUSION

11.	This supplementary study has provided separate fee elasticities for universities and PROs from developing and developed countries. In the end, only the elasticity estimate for universities turned out to be meaningfully different depending on the origin of applicants. On the basis of the fee elasticities estimated, the study then simulated how hypothetical fee reductions would affect PCT filing volumes and income.

12.	All fee elasticity estimates continue to suggest a highly inelastic response of applicants to fee changes. Accordingly, the additional filing volume generated by hypothetical fee reductions remains relatively small. However, a fee reduction for universities from developed countries would have a noticeable effect on income – reflecting the losses which would be incurred due to the fee reductions being applied to the high existing filing volumes from these entities.

13.	While the elasticity estimates are statistically significant, robust to different specifications of the econometric model, and accord with intuition, they should still be treated with caution, for at least two reasons. First, the underlying econometric model captures the choice applicants face between the Paris route and the PCT routes towards international patent filing. It ignores that the level of the PCT fee might affect applicants' decision on whether to file for patent protection internationally to begin with. If the fee mattered for this decision, the elasticity estimates presented here would underestimate the likely filing response. Second, as noted in paragraph 8, above, the assumptions used in the model become questionable for estimating the number of additional filings, and the effect on revenue, for large fee changes that exceed historical experience.

> *14.	The Working Group is invited to take note of the contents of the present document.*

[End of document]