Trade and Intellectual Property Rights in the Agricultural Seed Sector

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Abstract

The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) has continued to fiercely debated between North and South, particularly with respect to its provisions for the agricultural sector. Article 27.3(b) of the TRIPS Agreement requires WTO member countries to offer some form of intellectual property protection for new plant varieties, either in the form of patents (common in the U.S.) or plant breeder's rights (PBR). This paper analyses the effects of the introduction of PBRs in more than 100 importing countries on the value of exports of agricultural seeds and planting material from 11 exporting EU countries, including all principal traditional exporters of seeds. A gravity model, adapted for application to a specific sector, is estimated using panel data covering 15 years (1988-2002) of export flows in order to assess the effect of UPOV membership on seed imports. The results indicate that the introduction of a 'minimal' form of IPR protection for plant varieties, the 1978 UPOV Treaty, is not correlated with a significant increase in seed imports. Adoption of the broader scope of protection contained in the 1991 UPOV Treaty is actually correlated with a significant, though relatively small, decline in seed imports from European countries. Together this suggests that IPRs do little to 'kick-start' the inflow of technology, while a dynamic formulation of the model provides more support for state (path) dependence in this sector.

Introduction

Intellectual property rights (IPR) enterred the trade agenda with the negotiation of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) as part of the Uruguay Round leading to the creation of the World Trade Organization (WTO). The extent to which the introduction and/or strengthening of IPRs encourages trade remains ambiguous from a theoretical point of view (e.g. Fink and Primo Braga, 2005; Smith, 1999; Grossman and Lai, 2004; Grossman and Helpman, 1990). On the one hand, stronger IPRs could encourage trade as exporters of products vulnerable to being copied enjoy a market expansion effect. On the other hand, it has been suggested that stronger IPRs might improve the ability of exporters to exercise monopoly power in smaller and less competitive markets, resulting in higher prices and lower quantities. A second reason for a decline in trade is that stronger IPRs will encourage exporting companies to change their mode of serving the foreign market from exports to some form of foreign direct investment (FDI) or licensing of protected products. Given this theoretical ambiguity, the question is ultimately an empirical one.

Empirical studies of the effect of IPRs on trade have typically been undertaken at a fairly aggregated level involving trade in all goods and services, possibly disaggregated according to broad industry levels. Such studies have generally suggested that stronger IPRs may stimulate international trade in some specific sectors, while not in others.

One sector of particular interest in terms of WTO TRIPS negotiations concerns the agricultural plant breeding and seed sector. Article 27.3(b) of the TRIPS Agreement requires WTO member countries to offer some form of intellectual property protection for new plant varieties, either in the form of patents (common in the U.S.) or plant breeder's rights (PBR) which were first developed in Europe. PBRs are a sui generis form of IPR that can be seen as combining elements of both patents and copyright protection and which were perceived as better addressing some of the peculiar aspects of protecting biologically-reproducible material, such as plants, in a better manner than patents. PBRs have existed in many European countries for more than 40 years and the general requirements for such protection are enshrined in the International Convention on the Protection of New Varieties of Plants (UPOV Convention[1]). The UPOV Convention has been revised on numerous occasions, with the most relevant versions today being those of 1972 an 1991. Without going into details, the 1991 version offers the holder of a PBR far more exclusive rights than the 1972 version[2].

This paper assesses the effect of UPOV membership, as an indicator of the scope and strength of IPRs affecting the plant breeding sector, on exports of agricultural crop seeds from a number of European countries to more than 100 countries around the world.

Aside from the various papers mentioned in Fink and Primo Braga (2005), one recent paper by Yang and Woo (2006) has attempted a similar analysis on the seed sector. The principal difference is that Yang and Woo used data on seed exports from the United States to 60 importing countries while the current paper uses data on exports from 11 E.U. countries to 102 countries including the intra-E.U. trade (i.e. there are 91 countries recorded only as importers of seed from the E.U. and each of

[1] See http://www.upov.org
[2] See Eaton (2002) for an overview.

the 11 exporting countries is also an importer from the other 10 E.U. exporting countries). Furthermore, there are some other differences in the inclusion of IPR dummy variables (mentioned below).

Model

The usual gravity model is applied here to the specific product of seed exports. The model is described by (Anderson, 1979)[3]. The basic formulation here in a panel data setting is

$$y_{it}^{¿} = \boldsymbol{x}_{it}'\beta + \alpha_i + \varepsilon_{it} \quad i = 1,\ldots,N\ ;\ \ t = 1,\ldots,T \qquad (0)$$

where y_{it}* denotes a latent variable representing the logarithm of the value of seed exports (current value in thousand US$) that is not observed for the i^{th} country pairing. Variable y_{it} is observed and is related to the latent variable as follows:

$$\begin{aligned} y_{it} = y_{it}^{*} \quad & if \quad y_{it}^{*} > 0 \\ 0 \quad & if \quad y_{it}^{*} \leq 0 \end{aligned} \qquad (0)$$

Note that this is a censored (or corner solution) type of Tobit model, as exports will always be positive, but are zero in approximately half the observations (see below). Both the individual effect α_i and ε_{it} are i.i.d. over i and over t according to the normal distribution with zero mean and homoscedastic variances σ_α^2 and σ_ε^2 respectively. Furthermore, α_i is assumed to be independent of ε_{it} and also of $\boldsymbol{x}_{it}$ (for all i and t), the regressors, which is a typical "random effects" model. The static model parameters β, σ_α^2 and σ_ε^2 are estimated by conditional maximum likelihood.

In addition to the static model, a dynamic model is also estimated involving one-period lag on the logarithm of exports:

$$y_{it}^{*} = \gamma\, y_{i,t-1} + \boldsymbol{x}_{it}'\beta + \alpha_i + \varepsilon_{it} \qquad i = 1,\ldots,N;\quad t = 2,\ldots,T \qquad (0)$$

This allows a test for the presence of state dependence, in addition to unobserved heterogeneity.

Equation (1) is estimated as a random effects Tobit model using conditional maximum likelihood methods, which integrates out the unobserved heterogeneity variable α_i. Allowing for correlation between α_i and the regressors using fixed effects methods is not possible due to the importance of two time-invariant regressors in gravity models.

[3] More recently, (Anderson and van Wincoop, 2003) have proposed a modified unitary elastic specification of the gravity equation. An interesting extension would be to compare the results of this current paper with those obtained using Anderson and van Wincoop's alternative (newer) formulation. This and other possible extensions are discussed below in the concluding section.

The dynamic model in Equation (2) omits the first time period. This effectively ignores the initial conditions problem, as described by Heckman (1981) for the discrete dependent variable setting. Instead, use here is made of the results of Vella and Verbeek (1999) by assuming that the bias introduced by ignoring the first time period will be small with 15 time periods, or 'moderate' T (see also Verbeek (2004; p.380)). The assumption being made though is that y_{i0} is independent of α_i (Wooldridge, 2002; p.494)[4]. Conditional maximum likelihood is thus carried out for the panel comprising observations for $t = 2,...,T$.

Data

The exporting and importing countries are listed in Annex Table A.1 together with the year within the period 1988-2002 in which they became signatories of the respective UPOV Conventions. The list includes 11 exporting and importing E.U. countries plus 102 other countries, comprising major trading partners among OECD countries and economies in transition, as well as a wide range of developing countries from Africa, Asia and Latin America. This selection is based on those for which the coverage of trade statistics covers the period under investigation.

Data on seed exports for the period 1988-2002 (15 periods)was extracted from the COMEXT trade database using the Trade Statistics Analysis software developed by LEI. There is no single product classification grouping for seed and planting material; instead there are extended HS8 codes (8 digit Harmonized System codes for traded products) under each product grouping, such as maize or vegetables. In total, there were 64 separate seed product codes at HS8.

The regressors $\boldsymbol{x}_{it}$ are comprised of the following variables and summary statistics for are reported in Table 1:

l_gdp_x:	logarithm of GDP (million US$) of exporting country at time t[5]
l_gdp_i:	logarithm of GDP (million US$) of importing country at time t
l_dist:	logarithm of the distance in km between the two countries[6]
lang_off	dummy variable = 1 if the exporting and importing countries share a common official language, and 0 otherwise
l_land:	logarithm of the area of arable agricultural land in the importing country at time t
upov78	dummy variable = 1 if importing country was a signatory of the UPOV 1978 Convention and 0 otherwise[7]

[4] Wooldridge (2003) also proposes an alternative method to dealing with the initial conditions problem in nonlinear models that avoids such an assumption. This may be explored in future work.

[5] Data on GDP and land area is taken from the World Bank's World Development Indicators (WDI) Database, 2005 version.

[6] The distance measure and official language dummy variable are taken from the CEPII distance database: http://www.cepii.fr

[7] The UPOV dummy variables were compiled from information on the UPOV website (http://www.upov.org) and various other sources. For European countries, the dummy was set to 1 also at the point in time the country joined the Community Plant Variety office (http://www.cpvo.org) which administers the EC Plant Breeder's Right scheme which is UPOV 1991-compliant, if this happened to be earlier in time than when the country itself became a signatory to the UPOV1991

upov91_2 dummy variable = 1 if importing country was a signatory of the UPOV 1991 Convention as of time t and 0 otherwise.

λ_t yearly time dummies

Table 1: Summary statistics for variables

Variable	Mean	Std. Dev.	Min	Max
export[8]	1259.24	6396.89	0	142,039
l_export	2.45	3.14	0	11.86
l_gdp_x	12.79	1.17	10.50	14.72
l_gdp_i	10.06	2.26	4.72	16.16
l_dist	8.44	0.86	5.15	9.88
lang_off	0.11	0.32	0	1
l_land	7.75	2.01	0	12.13
upov78	0.25	0.44	0	1
upov91_2	.09	0.28	0	1
Observations:	15,855			

Estimation and Results

Table 2 presents the random effects (RE) estimates in Column (2) together with the estimates obtained from a pooled cross-section Tobit formulation in Column (1), which assumes $\alpha_i = 0$ and a regular normal distribution on the error term. The RE estimates generally accord with expectations from theory. Larger exporting economies (among the E.U. 11 in the sample) tend to export more seed, and importing countries with larger economies import significantly more. The elasticity of imports with respect to the importing country's GDP is estimated at 0.91, meaning that a 10% increase in GDP (measured in million U.S.$) corresponds to a 9% increase in seed imports (in thousand U.S.$). This may at first seem at odds with the declining importance of agriculture in share of GDP as economies grow and diversify, but is not surprising when one takes into account the diversification into higher-value horticultural crops that also takes place, which are typically more dependent on innovative and more expensive planting materials. The elasticity with respect to distance between the exporting and importing countries is negative and even stronger. The area of agricultural land in the importing country is correlated positively with seed imports. Comparing these results with those of Yang and Woo (2006) for U.S. seed exports indicates that the elasticities are relatively similar in sign and magnitude for the two variables, importer's GDP and distance (after correcting the results here for the probability of observing positive trade). However in none of the models estimated by Yang and Woo was the coefficient on the area of agricultural land significant.

Convention.

[8] Note there are 8402 out of 15855 zero observations (53.0%) for the dependent variable. For the zero observations, the conventional approach of taking logarithm of (exports + 1) was followed.

Table 2: Model Estimates (standard errors in parenthesis)

Variable	**Pooled Cross-Section Tobit** (1)	**Random Effects Tobit** (2)	**Dynamic Random Effects Tobit** (3)
l_gdp_x	1.54* (0.032)	1.27* (0.036)	0.291* (0.016)
l_gdp_i	1.02* (0.025)	0.912* (0.021)	0.153* (0.013)
l_dist	-2.00* (0.043)	-1.75* (0.038)	-0.152* (0.022)
lang_off	1.16* (0.108)	0.043 (0.097)	0.197* (0.052)
l_land	-0.003 (0.023)	0.111* (0.023)	0.002 (0.011)
upov78	0.120 (0.099)	0.073 (0.076)	-0.052 (0.047)
upov91_2	0.081 (0.137)	-0.156* (0.071)	-0.178* (0.064)
λ_1989	0.074 (0.195)	0.076 (0.092)	
λ_1990	-0.313 (0.194)	-0.248* (0.092)	-0.110 (0.089)
λ_1991	-0.343 (0.194)	-0.228* (0.092)	-0.076 (0.089)
λ_1992	-0.440* (0.194)	-0.314* (0.092)	-0.153 (0.089)
λ_1993	-0.290 (0.194)	-0.180 (0.092)	-0.127 (0.089)
λ_1994	-0.432* (0.194)	-0.256* (0.093)	-0.145 (0.089)
λ_1995	-0.818* (0.196)	-0.538* (0.095)	-0.267* (0.090)
λ_1996	-0.753* (0.195)	-0.452* (0.095)	-0.126 (0.090)
λ_1997	-0.409* (0.194)	-0.108 (0.094)	0.031 (0.089)
λ_1998	-0.443* (0.194)	-0.119 (0.094)	-0.175 (0.089)
λ_1999	-0.375 (0.194)	-0.036 (0.095)	-0.104 (0.090)
λ_2000	-0.237 (0.194)	0.111 (0.095)	-0.165 (0.090)
λ_2001	-0.276 (0.195)	0.098 (0.095)	-0.201* (0.090)
λ_2002	-0.325 (0.194)	0.067 (0.095)	-0.131 (0.090)
Constant	-12.5* (0.603)	-10.7* (0.594)	-5.13* (0.286)
l_lagexp			1.10*

Variable	Pooled Cross-Section Tobit	Random Effects Tobit	Dynamic Random Effects Tobit
	(1)	(2)	(3)
			(0.007)
σ_ε	3.78 (0.034)	1.59 (0.014)	1.69 (0.015)
σ_α		2.75 (0.034)	0
Loglikelihood	-25,025 Pseudo R^2 0.15	-17,891	-16,767

Notes: * indicates significance at 5% level.

Comparing the RE tobit model with the pooled tobit model in column (1), some differences can be noted. The dummy variable for the exporting and importing countries sharing an official language is no longer significantly positive in the RE model, indicating this variable may have been capturing some of the unobserved heterogeneity in the pooled model. Conversely, the area of agricultural land is significantly correlated with seed imports only after the unobserved heterogeneity has been taken into account. A likelihood ratio test of the H0 of the restricted model in pooled form against the alternative hypothesis of the RE model is rejected with a test statistic of 14,000. The amount of variance accounted for by unobserved heterogeneity is equal to $\rho = \sigma_\alpha^2 / (\sigma_\alpha^2 + \sigma_\varepsilon^2) = 0.75$ (s.e. = 0.005).

Of particular interest here, of course, are the estimates on the two IPR variables indicating membership of the two relevant versions of the UPOV Convention. In the pooled model, neither of these coefficients is estimate. In the RE model, the estimated coefficient of 0.073 for the UPOV78 dummy variable is positive but does not differ significantly from 0. On the other hand, the coefficient of the UPOV91 variable is significantly negative at the 95% level. This means that introducing a 'minimal' IPR system for plant varieties in the form of UPOV78 is not correlated with a significant increase in seed imports. The negative sign for the UPOV91 might be explained by decisions of seed companies to shift seed production to foreign countries once IPRs have been strengthened through foreign direct investment (FDI) such as joint ventures. It is for this reason that Maskus (2005) argues for the need to combine data on trade with FDI in looking for effects of IPRs. Unfortunately, data on FDI in the seed sector (or even seed production figures in importing countries) are not collected by statistical offices and thus could not be obtained for this study. This seems likely when one also considers that very few developing countries have become signatories of the UPOV91 Convention during the study period. On the other hand, the ambiguous results for the UPOV78 Convention, which was adopted by a number of countries (see Annex) confirm the more anecdotal evidence from conclusions from interview-based surveys that a PBR system is neither necessry nor sufficient to encourage trade in seed.

The marginal effects associated with the UPOV dummy variables are calculated in the tobit and RE tobit model as $E[y \mid \boldsymbol{x}_j = 1] - E[y \mid \boldsymbol{x}_j = 0] = \Phi(\boldsymbol{\beta}'\boldsymbol{x}_i/ \sigma)*\boldsymbol{\beta}_j$ (for dummy variable j and given left-censoring at 0). Given the log-linearisation of the gravity model, elasticities can be derived from these marginal effects as follows: $(\exp[\Phi(\boldsymbol{\beta}'\boldsymbol{x}_i/\sigma)*\boldsymbol{\beta}_j]-1)*100$. For the RE model, this yields the following values (with 95% confidence intervals) for the UPOV78 and UPOV91 dummies respectively: 3.5% (-3.5%, 11.0%) and -7.1% (-12.9%, -0.8%). Thus, it can be seen that the 95% confidence interval for the elasticity of seed imports to a country adopting UPOV78 compliant PBR encompasses both negative and positive effects (illustrating that the coefficient was not significant). If a country that goes on to become a member of UPOV91, this is associated with an expected decline in seed imports from (other) E.U. countries of up to 12%.

The possibility of state dependence was examined with the dynamic version of the model, including a one period lag of the logarithm of seed imports as a regressor in Equation (3) above. This is motivated by the possibility that past history in trade in seeds plays a role in explaining current trade. For example, a company exporting seeds typically incurs considerable search (transaction) costs to identify trustworthy importers and distributors. There may be factors, other than those taken into account in the extended gravity equation, that influence where and how such partners are found. And once found, exporting companies have an interest in maintaining and further developing such business partners.

Despite the simplistic assumptions made by ignoring the initial conditions problem, the results in Column (3) of Table 2 provide evidence of state dependence. The coefficient on past exports, which is significant at 5% level, exceeds one, but the marginal effect of this variable is approximately 0.58. Thus, current imports of seeds may be largely determined by previous history of imports, indicating a form of path dependence which may be little influenced by IPRs. In particular, the UPOV78 variable is no longer significant in the dynamic model.[9] These considerations mean that a dynamic formulation and proper treatment of the gravity model may imply revisiting the underlying theoretical basis for the model, which is static in nature. The explanatory power of such a model may be quite limited, a priori, if dynamic aspects concerning economic growth and growth in trade cannot be included. Relying on the static verson only implies that we have a model that partly explains relative levels in trade, but not one that explains how trade reached those level. Addressing stationarity and cointegration may also require further consideration of other factors that can be used to explain trade in one particular crop sector.

Conclusions

From a policy perspective, it is important to emphasise that, based on a static model, this paper finds no evidence that improvements in IPRs for the plant breeding sector seem to be associated with increases in the imports of agricultural seeds from the principal E.U. exporters. Indeed, the data and model estimates indicate that seed exports decline moderately on average for countries that have become signatories to the UPOV91 Convention. As debates concerning the WTO TRIPS Agreement continue among countries of the North and South, it will be interesting to monitor and revisit this issue in the near future given that an increasing number of developing countries have recently signed and begun implementation of the UPOV91 Convention. But these recent developments are not included in the data set and there is a possibility that the effects of new IPR systems take one or more years to be seen

[9] . While it may be possible to test formally for nonstationarity using procedures such as those proposed by Im, Pesaran and Shin (2003) or Levin, Lin and Chu (2002), it is not immediately clear whether such procedures are applicable to observed data from a censored or corner solution latent variable. For both of these tests, Stata commands (IPSHIN and LEVINLIN) have been written and are available for download.

as implementation can be slow and companies in sectors with protected technologies typically adopt a wait-and-see attitude to develop confidence in the system. Such an effect could be assessed with the current dataset with the use of lagged values of regressors.

The results here are similar in terms of overall conclusions to those of Yang and Woo (2006), who examined exports of seed products from the U.S. But they found a positive relationship in a static linear model and this then disappeared in the dynamic formulation of their model, suggesting state dependence in seed exports. Yang and Woo did conduct the test for stationarity of Im, Pesaran and Shin (2003) and report that the null of nonstationarity of seed exports was rejected against the alternative hypothesis that the time series of exports to some of the countries are stationary. A few points are relevant in comparing their results to those here. Yang and Woo selected a sample of countries for which there are generally exports and thus appear to have omitted countries for which there was little or no imports of seeds from the U.S. This allowed the use of a linear model, as opposed to the censored regression employed here, but may involve a form of selection bias. Furthermore, the omission of countries for which there is little or no trade in seeds does not allow one to control fully for the influence of factors that determine when such trade is initiated. Ideally though, the U.S. and E.U. data could be combined into one analysis that would also account for observed and possibly unobserved heterogeneity between these exporters.

Various extensions to the model here are possible, some of which have been mentioned above. The discussion on the results of the dynamic model suggest a revisiting of the gravity model. Aside from exploring dynamic implications, one aspect of the manner in which unobserved heterogeneity is incorporated is somewhat unsatisfactory. In the analysis here, the individual observation unit in the panel is a specific pairing of exporting and importing countries. But this ignores any unobserved heterogeneity among importing (or exporting) countries that is related only to that country and not to the paired exporting (or importing) country. Such correlation among the pairings is not taken into account in the basic random effects model estimated here (see, for example, Baltagi et al., 2003), but will be included in the next revision.

The use of the time-invariant distance variable constrains the panel data analysis to a random effects assumptions on the unobserved heterogeneity. As the distance variable is meant to represent the general cost of trade between any two countries, in particular transport costs, it might be possible to combine distance with annual unit transport costs, or fuel costs, which will vary over time. This could also perhaps allow the application of semi-parametric techniques (such as by Charlier, Melenberg and van Soest, 2000), although the advantage of relaxing the distributional assumptions concerning the relationship between α_i and $\boldsymbol{x}_{it}$ would have to be weighed against the disadvantage of not being able to calculate average partial effects, which are of interest from the IPR policy perspective.

A final issue concerns the estimation of gravity equations for specific product sectors. The formulation in the current paper adds only one variable (area of arable land), in addition to the usual regressors in gravity models, to account for this specific product and others may be possible. Furthermore, alternative formulations of the gravity model have recently been proposed and could be worth exploring (see Anderson and van Wincoop, 2003). For example, Santos Silva and Tenreyro (2006) demonstrate the possible bias of a tobit specification using a logarithmic transformation, as compared to estimating a poisson model. Helpman et al. (2007) argue that in cases where there are many ‘zeros’ between trading partners, then a two-tiered sample selection (Heckit) model should be estimated to allow for different factors affecting the presence of trade between two partners, from those affecting the scale of trade. These issues, as well as the dynamic issues mentioned above, are being explored in ongoing revisions of the analysis.

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Annex

Table A.1 Exporting and Importing Countries including UPOV membership during the period 1988-2002

Country (* indicates also exporter)	**Year became signatory to UPOV78**[a]	**Year became signatory to UPOV91 or CPVO**[a]
Belgium/Luxembourg*	<1988	1991
Denmark*	<1988	1995
France*	<1988	1995
Germany*	<1988	1995
Greece*		1995
Ireland*	<1988	1995
Italy*	<1988	1995
Netherlands*	<1988	1995
Portugal*	1995	1995
Spain*		1995
United Kingdom*	<1988	1995
Albania		
Algeria		
Angola		
Argentina	1994	
Australia	1989	2000
Austria	1994	1995
Bangladesh		
Benin		
Bolivia	1999	
Brazil	1999	
Bulgaria		1998
Burkina Faso		
Cambodia		
Cameroon		
Canada	1991	
Cape Verde		
Centr. African Rep.		
Chile	1995	
China	1999	

Country (* indicates also exporter)	Year became signatory to UPOV78[a]	Year became signatory to UPOV91 or CPVO[a]
Colombia	1996	
Congo		
Costa Rica		
Cyprus		
Djibouti		
Ecuador	1997	
Egypt		
El Salvador		
Equat. Guinea		
Ethiopia		
Finland	1993	1995
Gabon		
Gambia		
Ghana		
Guatemala		
Guinea		
Guinea Bissau		
Guyana		
Honduras		
Hong Kong		
Hungary	<1988	2002
India		
Indonesia		
Iran		
Israel	<1988	1996
Ivory Coast		
Japan	<1988	1998
Jordan		
Kenya	1999	
Lebanon		
Libya		
Madagascar		
Malawi		
Malaysia		
Mali		
Mauritius		
Mexico	1997	

Country (* indicates also exporter)	Year became signatory to UPOV78[a]	Year became signatory to UPOV91 or CPVO[a]
Morocco		
Mozambique		
Nepal		
New Zealand	<1988	
Nicaragua	2001	
Nigeria		
Norway	1993	
Panama	1999	
Paraguay	1997	
Peru		
Philippines		
Poland	1989	
Romania		2001
Saudi Arabia		
Senegal		
Singapore		
South Africa	<1988	
South Korea	2001	
Sri Lanka		
Surinam		
Sweden	<1988	1995
Switzerland	<1988	
Syria		
Tanzania		
Thailand		
Togo		
Tunisia		
Turkey		
Uganda		
Uruguay	1994	
Usa	<1988	1999
Venezuela		
Vietnam		
Zambia		
Zimbabwe		

Notes:

a. Blank indicates that country has not signed the relevant UPOV Convention.