# The Role of Intellectual Property Rights in Seed Technology Transfer through Trade – Evidence from U.S. Field Crop Seed Exports

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*Selected Poster prepared for presentation at the Agricultural & Applied Economics Association's 2013 AAEA & CAES Joint Annual Meeting, Washington, DC, August 4-6, 2013.*

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## Introduction

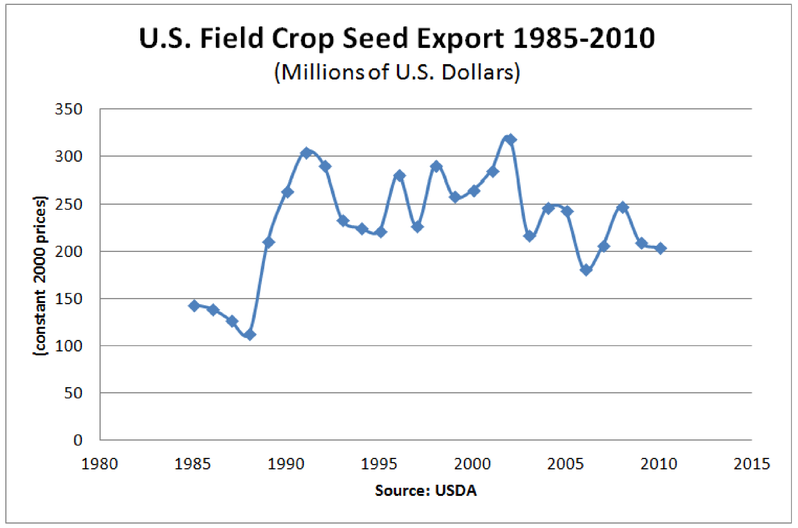
- **Research question:** How do country's IPRs affect U.S. (field crop) seed exports to this country?

- **Motivation:** Access to improved seed varieties is essential for feeding an increasing global population in a sustainable fashion.

  *IPRs* --- facilitate seed innovation and technology transfer, most valuable asset of the seed industry

  *U.S.* --- global leader in seed production and exporting

  *Field crop seeds* --- account for over 1/3 of planting seed exported, include major GM crops




**Top export destinations:** Mexico, Canada, Italy, France, Japan, Spain, Saudi Arabia, Greece, Austria, Netherlands.

## Literature Review

**Theoretical work** is ambiguous due to IPRs two countervailing effects on market access: market expansion vs. market power

**Empirical work:**

- *Yang and Woo (2006)*: apply linear dynamic model and find no significant effect of IPRs on U.S. aggregate seed exports;
- *Eaton (2009)*: uses quantile regression model but fails to detect significant effect of IPRs on U.S. and EU aggregate seed exports;
- *Galushko (2012)*: employs Heckman selection model and finds the effect of IPRs varies across different types of crops using U.S. seed export data.

## Data

- **Dataset:** Data: coverage/range - 134 countries over 26 years (1985-2010), but about half of the export values are zeros

- **Relevant international IPR treaties:**

  *UPOV* --- International Convention for the Protection of New Varieties of Plants

  *TRIPs* --- (WTO's) Trade related aspects of intellectual property rights

- **Variables of interest:**

  ***UPOV10*** =1 if country has signed up to 1978 Act, but not 1991 Act yet
  =0 otherwise

  ***UPOV01*** =1 if country has signed up to 1991 Act, but did not previously sign up to 1978 Act
  =0 otherwise

  ***UPOV11*** =1 if country has signed up to 1991 Act, and previously signed up to 1978 Act
  =0 otherwise

  ***WTO_TRIPs*** =1 if WTO member has implemented TRIPs
  =0 otherwise

  ***WTO_trans*** =1 if WTO member is given TRIPs transition period
  =0 otherwise

- **Control variables:**

  ***logGDP*** Represents economic size

  ***logCropProd*** Combined output of cereals, coarse grain, and oilseed crops; indicates market size

  ***FTA*** =1 if country has free trade agreement in force with U.S
  =0 otherwise

  ***growGM*** =1 if country grows genetically modified crops
  =0 otherwise

## Methodology

**Two-way fixed-effects models:**

$$Linear\ model: \quad \log(y_{i,t}) = \boldsymbol{x}'_{i,t}\beta + \alpha_i + \gamma_t + \varepsilon_{i,t}$$

$$Poisson\ model: \quad y_{i,t} = \exp(\boldsymbol{x}'_{i,t}\beta + \alpha_i + \gamma_t) + \varepsilon_{i,t}$$

## Results

| | Linear Fixed Effects | | | | Poisson Fixed Effects | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| VARIABLES | logseedIMP | logseedIMP | logseedIMP | logseedIMP | seedIMP | seedIMP | seedIMP | seedIMP |
| logGDP | 1.231** | 1.387** | 1.170** | 1.316** | 2.442*** | 2.796*** | 2.223*** | 2.600*** |
| | (0.548) | (0.538) | (0.549) | (0.539) | (0.739) | (0.709) | (0.832) | (0.819) |
| logCropProd | 0.316 | 0.280 | 0.310 | 0.271 | 0.456 | 0.423 | 0.259 | 0.235 |
| | (0.291) | (0.290) | (0.284) | (0.280) | (0.596) | (0.585) | (0.491) | (0.483) |
| FTA | 0.196 | 0.280 | 0.168 | 0.270 | -0.149 | -0.246 | -0.100 | -0.196 |
| | (0.329) | (0.300) | (0.335) | (0.303) | (0.246) | (0.197) | (0.242) | (0.202) |
| growGM | 0.174 | 0.0916 | 0.125 | 0.0484 | 0.474 | 0.489 | 0.453 | 0.465 |
| | (0.260) | (0.265) | (0.258) | (0.261) | (0.323) | (0.310) | (0.313) | (0.302) |
| UPOV10 | | 0.244 | | 0.173 | | 0.267 | | 0.267 |
| | | (0.233) | | (0.234) | | (0.288) | | (0.314) |
| UPOV 01 | | -0.663** | | -0.759** | | -0.307 | | -0.203 |
| | | (0.286) | | (0.296) | | (0.328) | | (0.393) |
| UPOV11 | | 0.369 | | 0.241 | | 0.982 | | 0.934 |
| | | (0.481) | | (0.485) | | (0.602) | | (0.620) |
| WTO_TRIPs | | | 0.881** | 0.924** | | | 1.203** | 1.078* |
| | | | (0.401) | (0.425) | | | (0.546) | (0.575) |
| WTO_trans | | | 0.433 | 0.470 | | | 0.852 | 0.705 |
| | | | (0.404) | (0.412) | | | (0.602) | (0.623) |
| Observations | 1,643 | 1,643 | 1,643 | 1,643 | 1,623 | 1,623 | 1,623 | 1,623 |
| Countries | 134 | 134 | 134 | 134 | 114 | 114 | 114 | 114 |

*Notes*: Cluster-robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

## Discussion

- ***WTO_TRIPs*** is found to have significantly positive impact on seed exports in both types of models, with its magnitude larger in Poisson models.

- Membership dummies have drawbacks

- Results also complicated by firm's FDI and licensing efforts, as exports are not only way to sell products and technology.

- For future research, we would also consider estimating both linear and nonlinear dynamic models, and

- How IPRs influence the mode of serving foreign markets

## References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- Galushko, V. "Do stronger intellectual property rights promote seed exchange: evidence from U.S. seed exports?" *Agricultural Economics* 43 (2012) supplement 59-71.