

WELFARE IMPACTS OF CROSS- COUNTRY RESEARCH SPILLOVERS

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ISSUES

- **Advances in plant and animal genetics often have applicability outside country where research was conducted.**
- **Historically, firms who conducted successful research captured some of the international benefits by charging a premium for the improved input.**
 - **For example, rents from improved hybrid breeds and varieties can be captured by charging a premium for these seeds, and this premium can be maintained for many generations by controlling access to purebred parental lines. This premium pricing solution has had less relevance in breeds and varieties where commercial traits are passed on in retained seed and in offspring of commercial farm animals.**

ISSUES

- **Governments have attempted to stimulate private sector ag R&D by providing intellectual property rights (IPRs). But ability of countries to impose IPRs on farmers in other countries has not been universally accepted.**
- **In some instances, private sector has been willing to conduct research in response to incomplete IPRs afforded in one or two major markets.**
 - **For example, work on Roundup Ready© soybeans progressed because of IPR available in US domestic market and despite relative lack of IPR in other soybean growing countries. US farmers who planted Roundup Ready© seeds paid a technology fee to the developer of the technology, but this company was typically not able to collect technology fee from farmers in other countries.**
- **How do different IPRs across countries affect R&D and welfare in the presence of spillovers?**

OBJECTIVES

- **Develop a model to allow policy makers and those who design domestic and international mechanisms to protect intellectual property to determine who benefits from, and who should pay for associated research.**
- **Analyze welfare implications of IPRs in agriculture, when associated research has commercial application in more than one country/region.**

RELEVANCE

- **There has been a large reduction in R&D capacity in developing countries due in large part to a reduction in international funding. This suggests that these countries will rely more and more on research spillovers from more developed countries to remain competitive.**
- **Recent development of genetic use restriction technologies (GURTs) can be viewed as an extreme form of IPR, and this technology has received criticism from some less developed countries.**
- **It has recently become possible to trace in a legally acceptable way particular genetic improvements through to genetic lines sold by other companies. This scientific development has provided a much stronger legal basis for cross-country and cross-company IPRs.**
- **The topic of cross-country IPRs in agriculture continues to stimulate discussion and controversy at international bodies such as the World Trade Organization via the 1994 Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).**

MODEL OVERVIEW

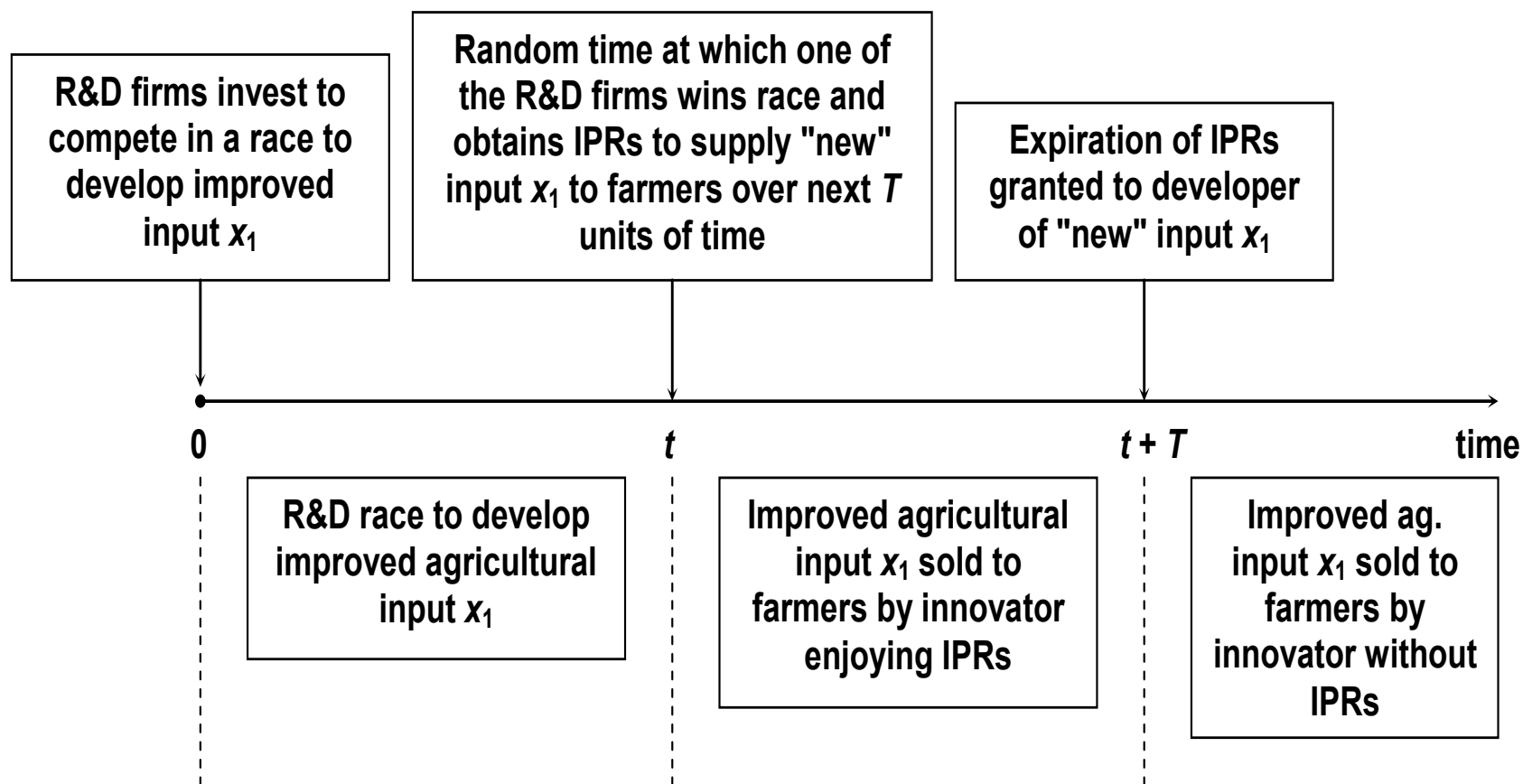
- Two countries/regions (e.g., **US** vs. **ROW**)
 - **US** provides IPRs on new technology
 - **US** IPRs provides incentives to R&D firms to develop new technology targeting US ag production
 - **SPILLOVERS**: New technology may enhance ag production in **ROW**
 - **ROW** may or may not provide IPRs

MODEL OVERVIEW

➤ Timing Issues:

- At time 0, R&D firms invest resources to compete in a race to develop a more productive version of an existing farm input (e.g., seed, or breed).
- At random time t the “new” input is first obtained, ending R&D competition. First developer of “new” input is granted IPRs for T periods.
- IPRs expire at time $t + T$. Innovator's ability to charge monopoly prices is greatly restricted afterward.

Figure 1. Timing framework for the R&D analysis.



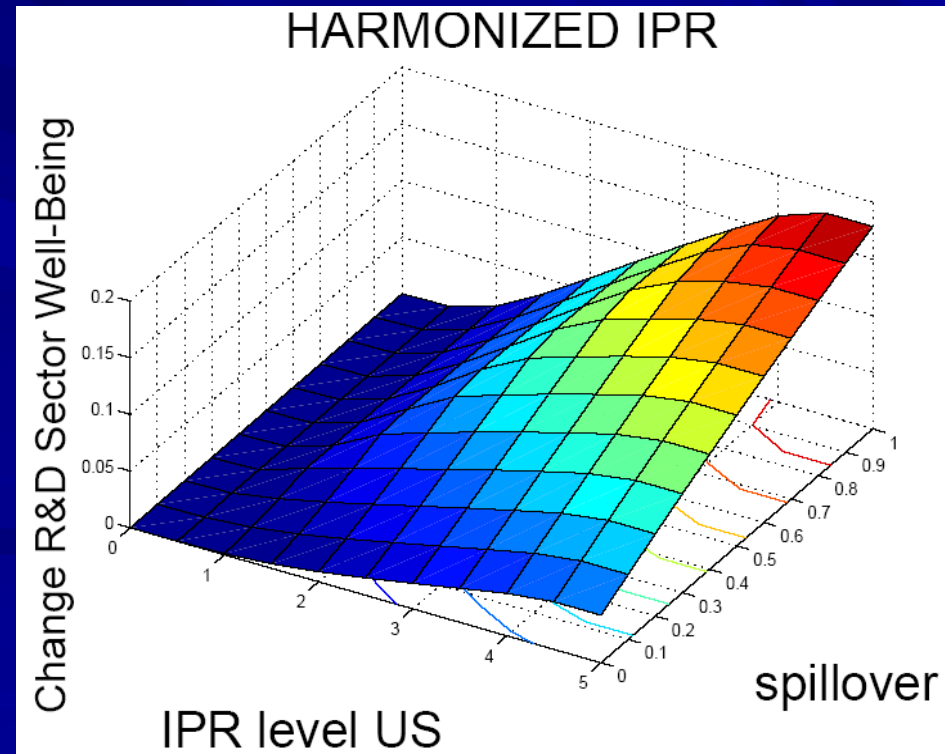
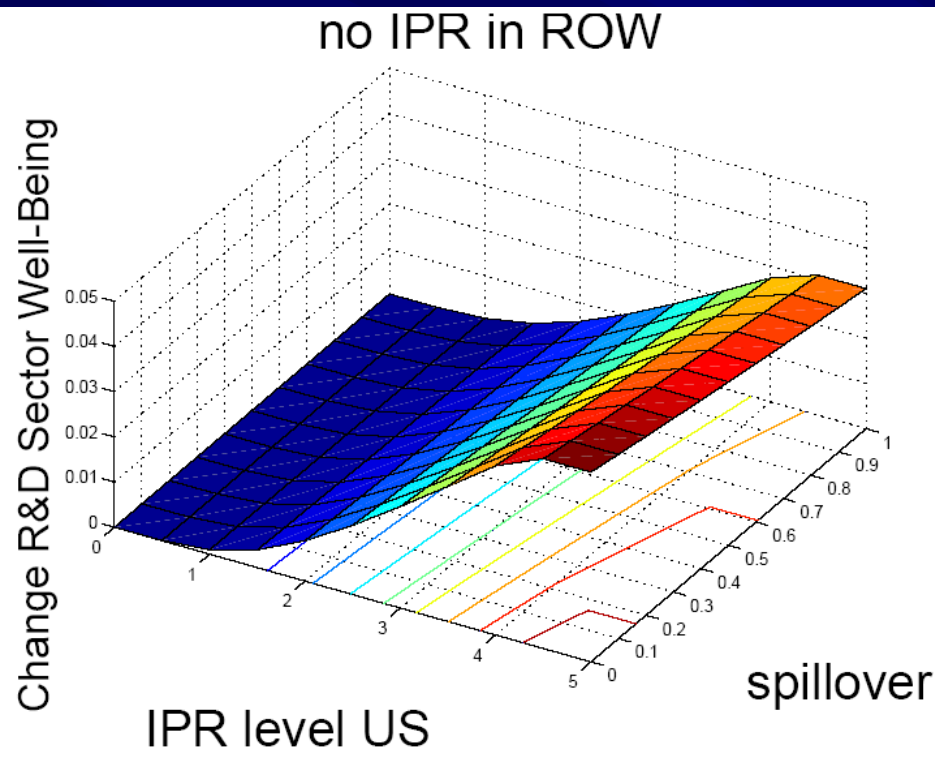
MODEL OVERVIEW

- **MARKET EQUILIBRIUM:** Solving model requires simultaneous equilibrium in three markets at all times:
 - R&D market.
 - Relevant input market.
 - World crop market.

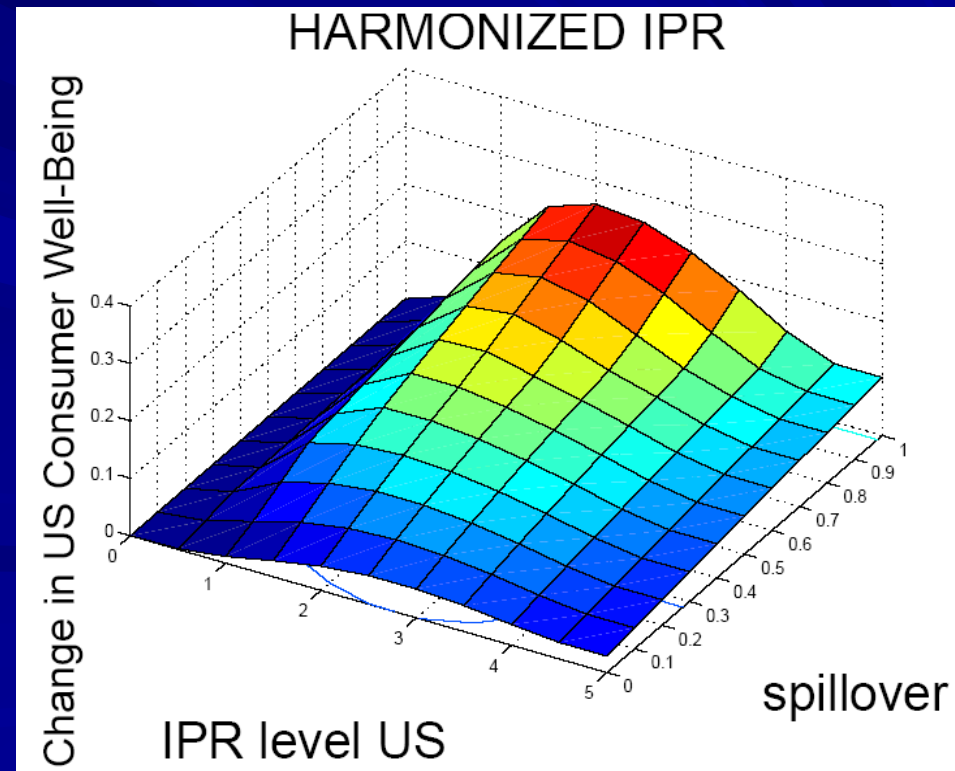
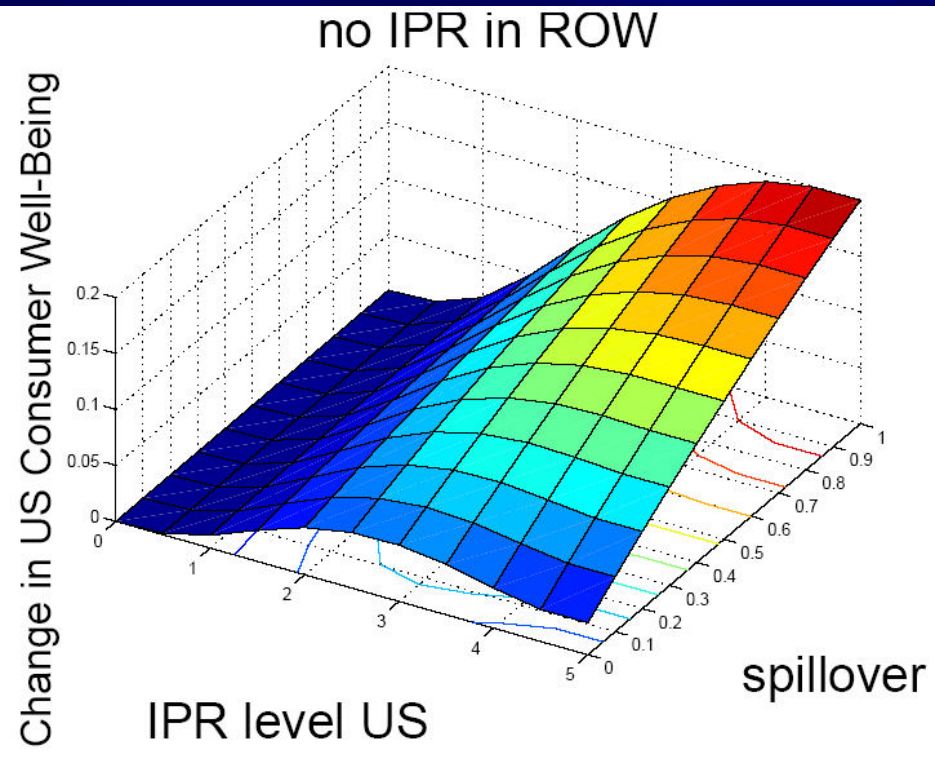
MODEL OVERVIEW

- Other details of the model:
 - IPRs last for 20 years.
 - 5 R&D firms.
 - Same baseline production and consumption shares for **US** vs. **ROW** (50% each).
 - We look at different spillover levels (from 0 = no spillover to 1 = same effect in **ROW** as in **US**).
 - We look at different levels of IPR protection in **US** (from 0 = no IPR to ∞ = perfect IPR).
 - We look at 2 scenarios for IPR protection in **ROW**:
 - Scenario 1 = no IPR in **ROW**
 - Scenario 2 = harmonized IPR (i.e., same IPR in **ROW** as in **US**).

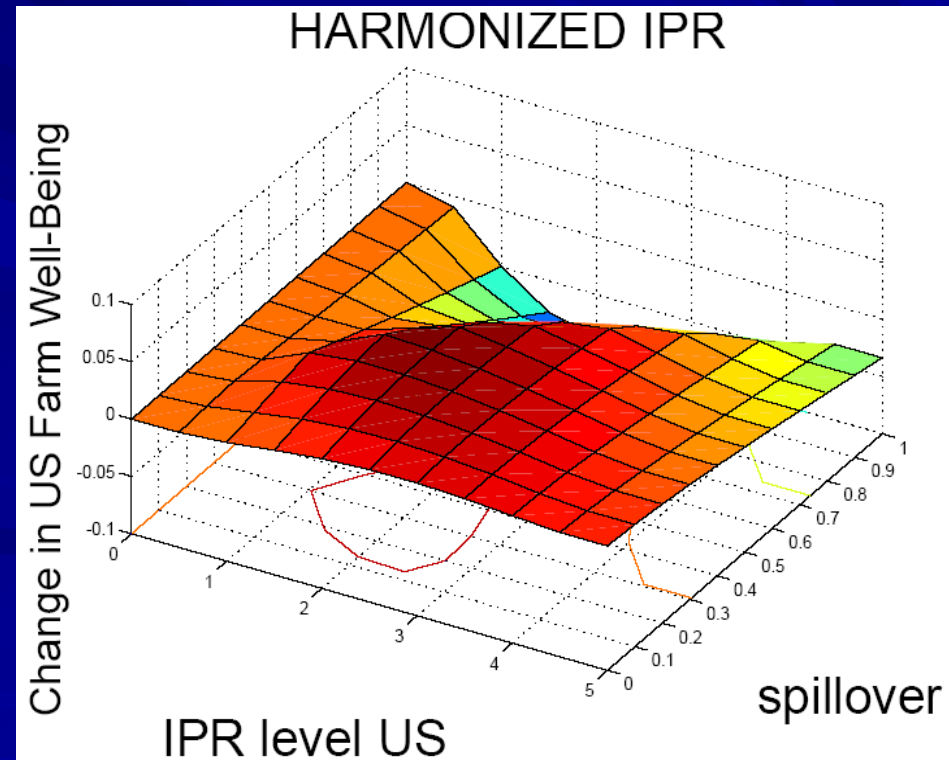
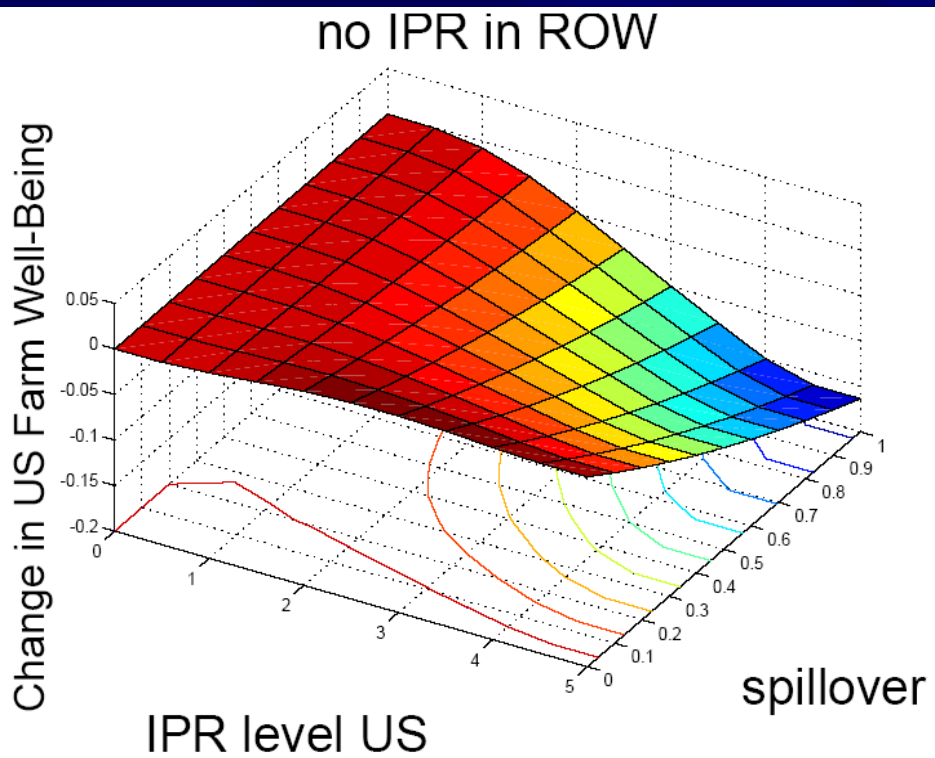
CHANGE IN R&D SECTOR WELL-BEING



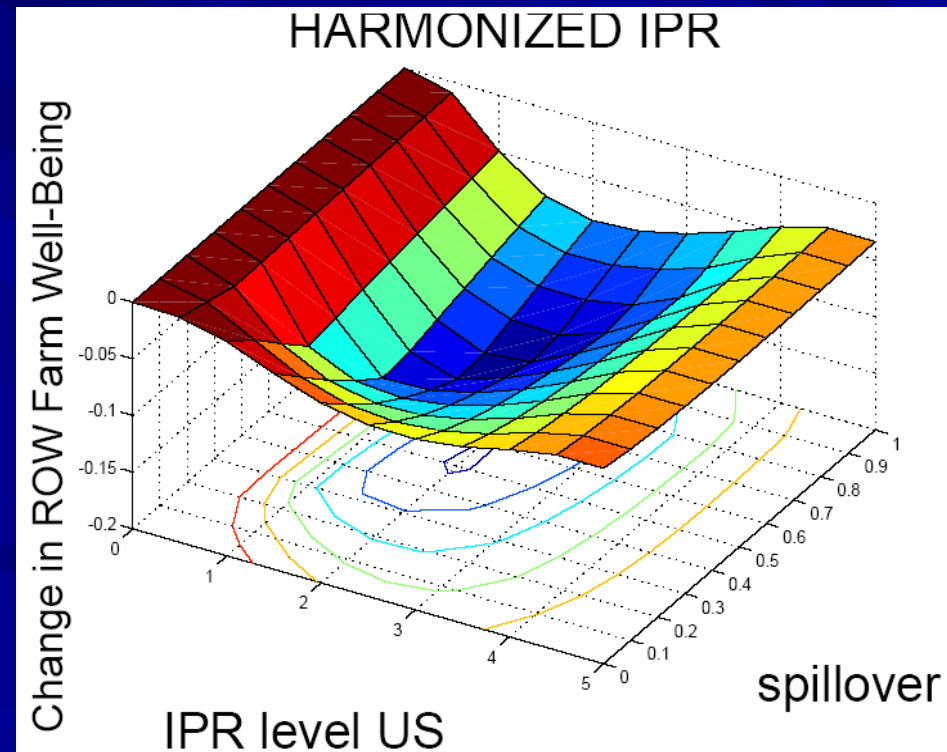
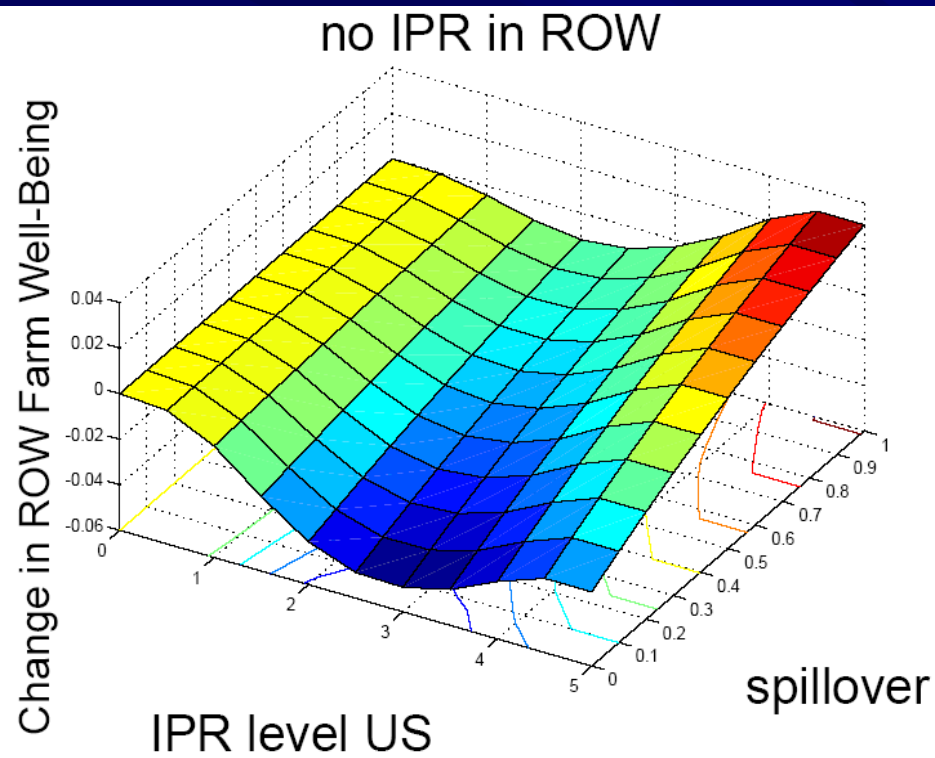
CHANGE IN CONSUMER WELL-BEING (US same as ROW)



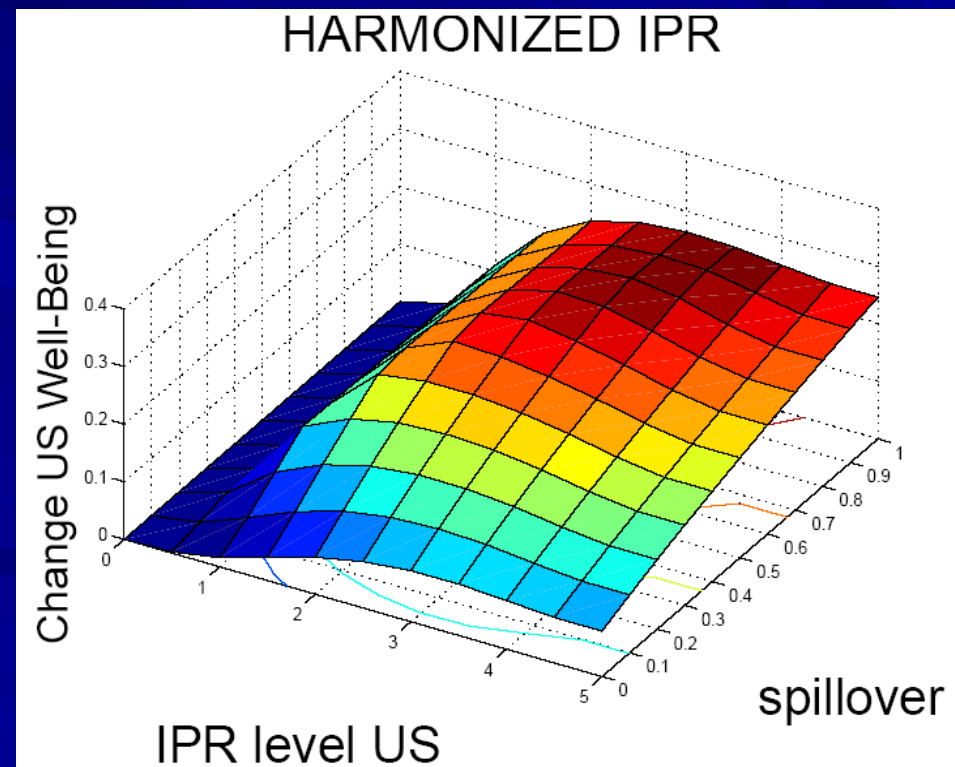
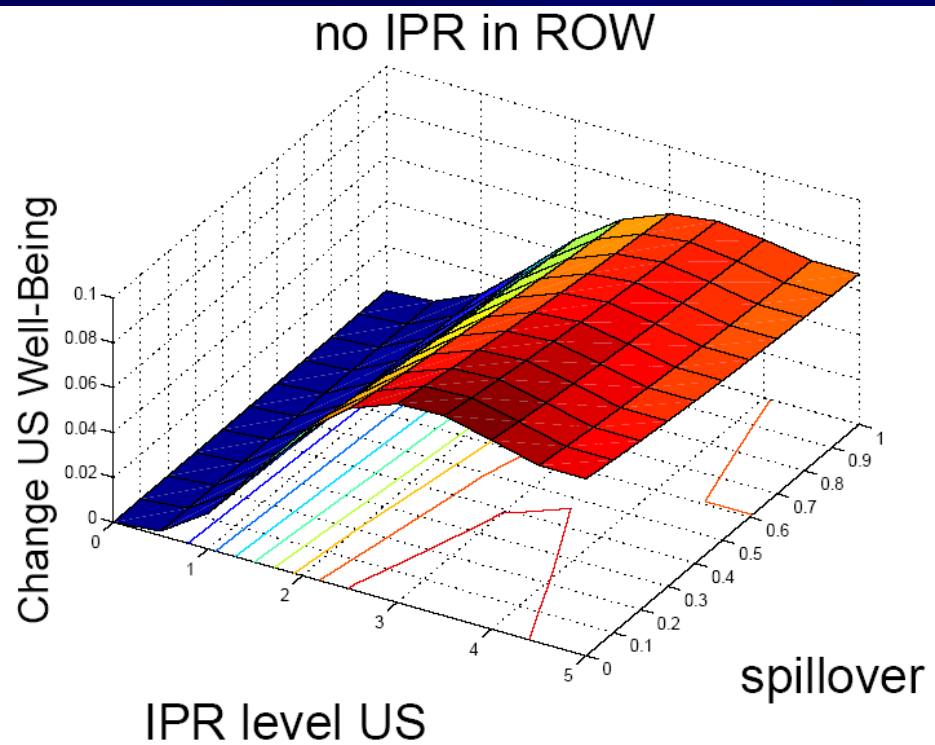
CHANGE IN **US** FARM WELL-BEING



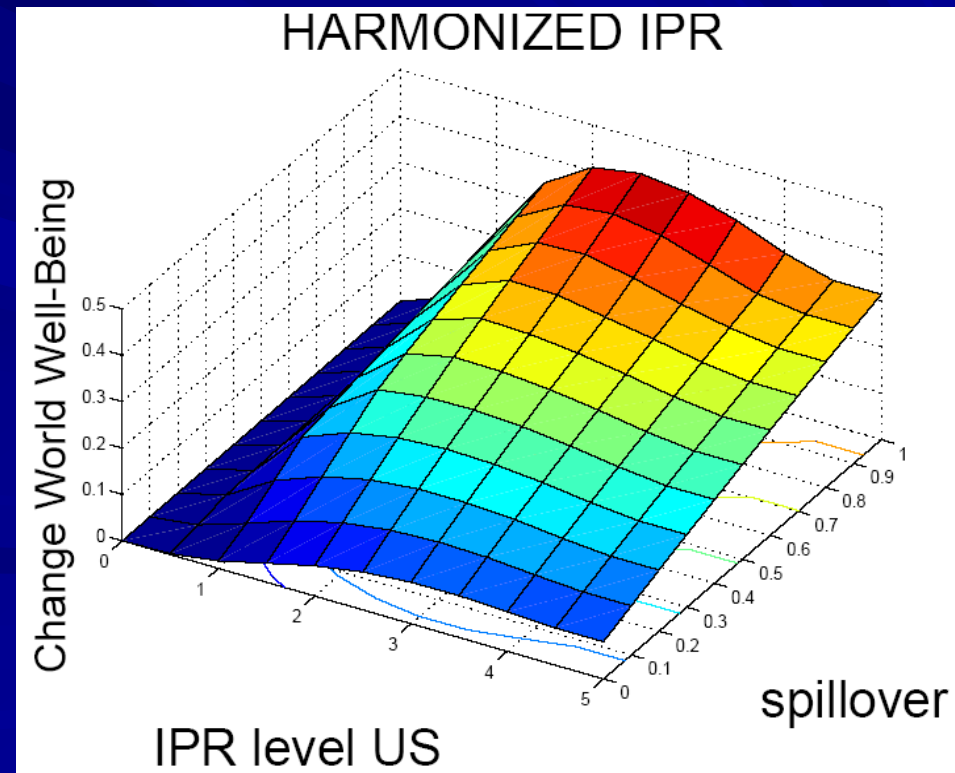
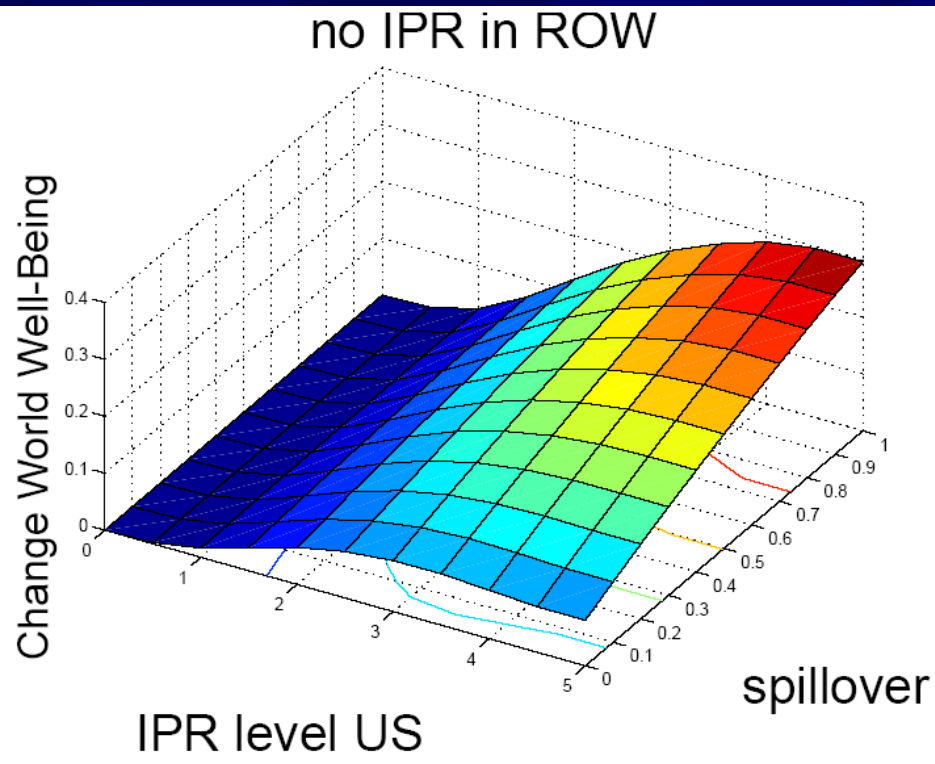
CHANGE IN ROW FARM WELL-BEING



CHANGE IN **US** WELL-BEING



CHANGE IN WORLD WELL-BEING



SUMMARY AND CONCLUSIONS

- **World welfare rises as spillover increases, and it increases up to an optimal point in the US IPR level.**
- **Relationship between WORLD welfare and US IPR level flattens and turns negative at high US IPR levels.**
- **From a world welfare standpoint, optimal US IPR level also increases as spillovers increase because spillovers magnify benefits of research.**

SUMMARY AND CONCLUSIONS

- **Consumers always gain from spillovers**
- **Consumers benefit from stronger US IPRs, up to a certain level.**

SUMMARY AND CONCLUSIONS

- **ROW farmers are always worse off when there are no spillovers.**
- **If there are spillovers, whether ROW farmers benefit from stronger US IPR levels depends on the extent of spillovers and whether ROW has IPRs or not.**

SUMMARY AND CONCLUSIONS

- **US farmers always lose with large spillovers, and gain with small spillovers.**
- **With intermediate spillovers, US farmers may gain the most if IPRs are harmonized.**
- **Whether US consumer gains offset US farm losses depends on the relative magnitudes of farm and consumption sectors in the US. When farm sector is similar or greater than consumption sector (i.e., when US is an exporter of the crop), farmer losses tend to exceed consumer gains as spillovers increase.**
 - **This calls into question the use of producer paid technology fees to fund and stimulate research, and suggests that some other mechanism be found to finance this research**

SUMMARY AND CONCLUSIONS

- **US farmers almost always lose but US consumers always gain from spillovers. Whether latter gains offset former losses depends on the relative magnitudes of farm and consumption sectors in the US. When farm sector is similar or greater than consumption sector (i.e., when US is an exporter of the crop), farmer losses tend to exceed consumer gains as spillovers increase.**
- **This calls into question the use of producer paid technology fees to fund and stimulate research, and suggests that some other mechanism be found to finance this research**