SPS Measures and the Hazard Rate of Agricultural Exports: A Discrete-Time Approach

Xin Ning[1], Jason Grant[2], Everett Peterson[3]

[1]Ph.D. Candidate, Department of Agricultural & Applied Economics, Virginia Tech, Blacksburg, VA 24061, Email: xning@vt.edu
[2]Associate Professor & Director, Center for Agricultural Trade, Department of Agricultural & Applied Economics, Virginia Tech, Blacksburg, VA 24061, Email: jhgrant@vt.edu
[3]Professor, Department of Agricultural & Applied Economics, Virginia Tech, Blacksburg, VA 24061, Email: petrsone@vt.edu

Selected Paper prepared for presentation at the 2018 Agricultural & Applied Economics Association Annual Meeting, Washington, D.C., August 5-August 7

SPS Measures and the Hazard Rate of Agricultural Exports: A Discrete-Time Approach

[1]Xin Ning, [2]Jason Grant, and [3]Everett Peterson

[1]Ph.D. Candidate, [2]Associate Professor and Director, [3]Professor
Center for Agricultural Trade, Department of Agricultural and Applied Economics,
Virginia Tech

Selected Paper Presentation at the 2018 AAEA Annual Meeting
Washington, D.C., August 5-August 7

ERS ECONOMIC RESEARCH SERVICE United States Department of Agriculture

USDA Office of the Chief Economist United States Department of Agriculture

VIRGINIA TECH

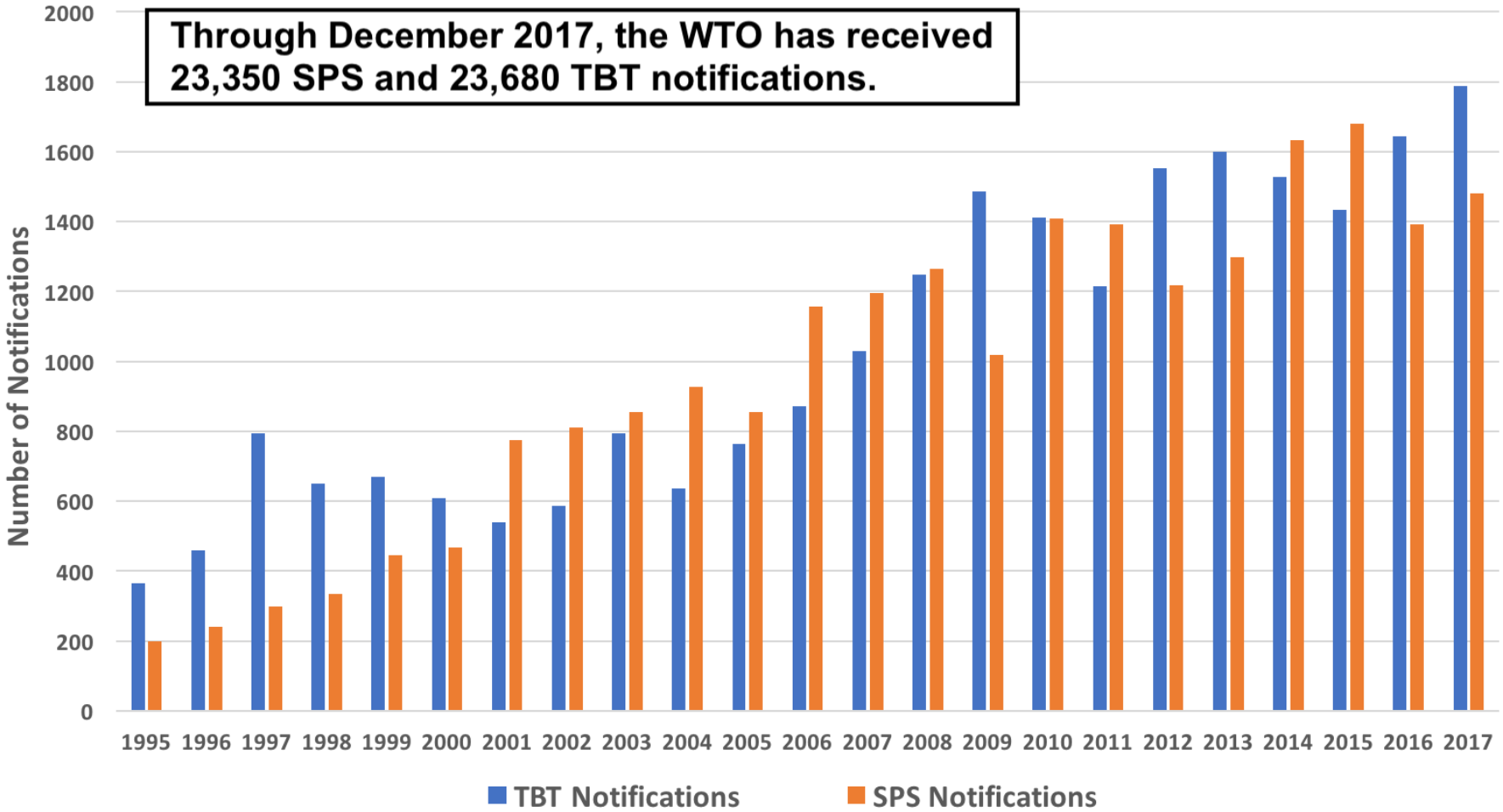
Outline

- Introduction
- Data and Model
- Empirical Results
- Conclusions

Introduction

- With the proliferation of FTAs in the last decades, the focus of trade policies has increasingly shifted from border related costs such as tariffs, quotas, and export subsidies, to non-tariff obstacles and a plethora of standards and "behind-the-border" regulations.
- Among those NTMs impacting agricultural and food trade, *sanitary and phytosanitary (SPS) measures* are of particular relevance.
  - Sensitive nature of food safety, plant/animal health, pest and disease risks;
  - SPS Agreement permits countries to adopt their own standards (risk assessment, non-discriminatory and minimally trade distorting);
  - SPS measures are the most frequently encountered non-tariff issues in ag. trade (World Bank 2008; ITC 2011).

SPS and TBT Notifications, 1995-2017



Source: Authors' calculation based on WTO notification data.

Literature Review

- Extensive studies have been conducted in the literature investigating the impact of NTMs on international trade.
  - Deardorff and Stern (1998), Josling et al (2004), Fontagne et al (2005b), Kee et al. (2006, 2009), Disdier et al (2008, 2016), Peterson et al (2013), Arita et al (2015), Grant et al (2015) etc.
  - Different methods/data used for identifying the SPS and TBT measures and estimating their impact on the volume of trade.
- However, few studies have explored whether and how the various NTMs affect the *duration* and *hazard rates* of trade relationships, particularly in agri-food exports.

Duration Analysis

- A growing literature of duration analysis has found that trade relationships tend to be short-lived with multiple entries and exits in a destination market leading to multiple spells of service.
  - Besedes and Prusa (2006a, 2006b, 2017), Hess and Persson (2011, 2012), Nitsch (2009), Cadot et al (2011), Esteve-Perez et al (2012), Peterson et al (2017), etc.
  - Despite of the different trade data and countries, the overall spell length of continuous export is around 3 years at the mean, and merely one year at the medium.
- In this article, we contribute to the literature by examining whether and how various types of SPS measures affect the duration and the hazard rate of disaggregated agri-food exports.

Research objectives

1. **Extend** the database of SPS Specific Trade Concerns (STCs) described in Grant and Arita (2017) through 1995-2016.
2. **Match** the SPS concerns to a database of global bilateral trade relationships (1995-2016) depicting export duration and survival.
3. **Quantify** the heterogeneous impacts of SPS concerns and other market structure determinants on agri-food export survival and hazard rates using a discrete-time duration model (Peterson, Grant and Rudi-Polloshka 2017).

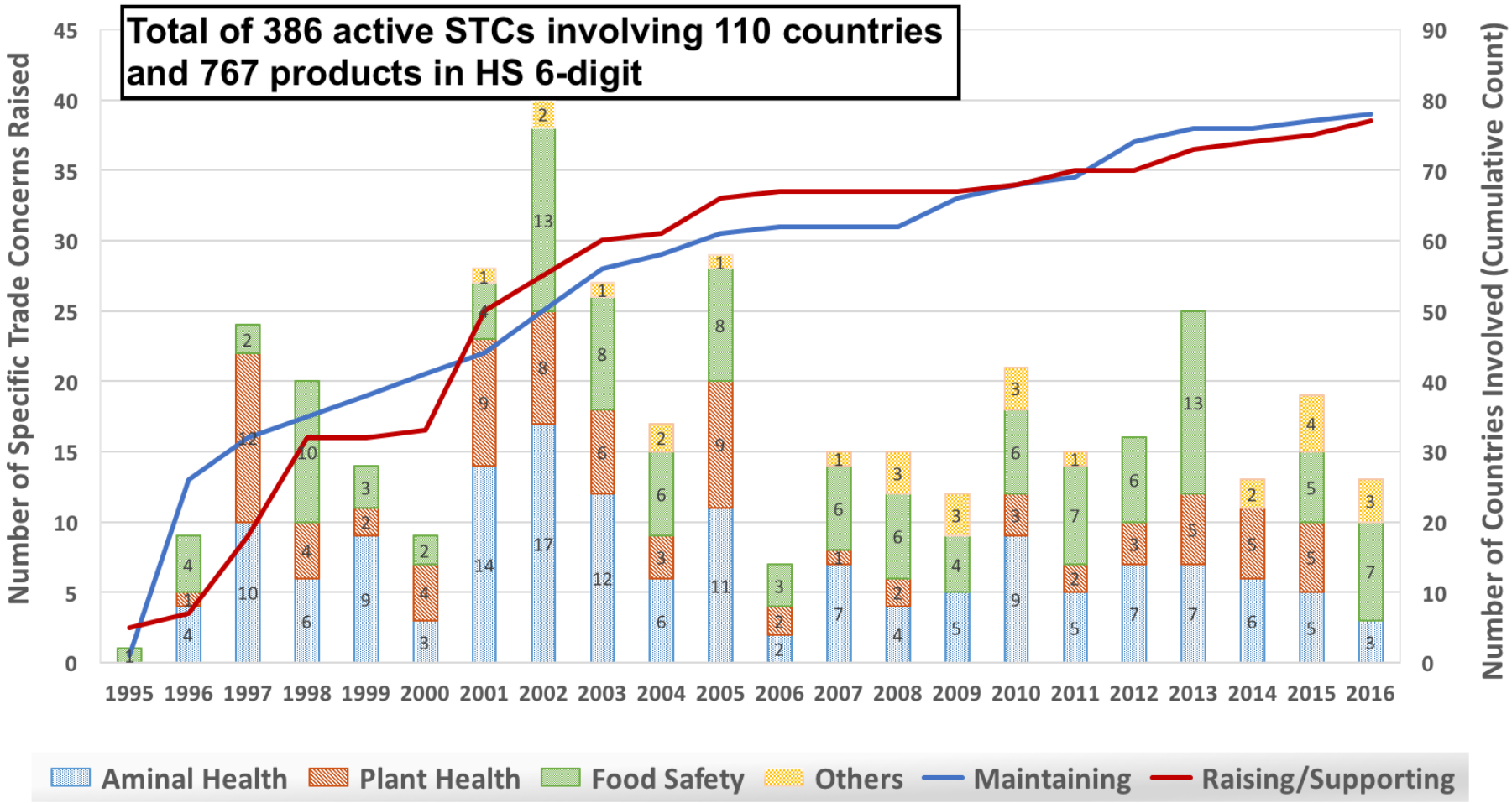
Data

- Bilateral trade data in HS 6-digit collected from UN Comtrade 1989-2016
- SPS concern measures from Grant and Arita (2017) and extended through 2016 (`http://spsims.wto.org/en/SpecificTradeConcerns/Search`)
- ERS Macro Economic dataset for exchange rates
- World Bank GDPs
- CEPII (gravity variables such as distance, contiguity, common language, common RTA, etc.)
- Other market structural/experience variables

Identification of SPS Measures

- Make use the SPS specific trade concerns raised orally in the WTO SPS Committee meetings as a way to reveal SPS measures that possibly restrict trade or are inconsistent with the SPS Agreement.
  - Not a formal dispute in any legal sense (only 43 total disputes have escalated out of STCs)
  - No obligation for members to raise a concern
- Contain a rich set of information for empirical trade assessment:
  - Years when a concern was raised and resolved
  - Products affected in HS code
  - Members maintaining and raising/supporting the concern
  - Number of times a concern was subsequently raised
  - WTO subject of the concern (animal disease, plant health, food safety, or others)

Updated SPS Specific Trade Concerns, 1995-2016



Source: Authors' calculation. more

Empirical Model

- Conditional discrete-time random-effect probit model at HS 6-digit product line from 1995 to 2016

$$h_{ijkt} = P(T_{ijk} < t+1 \mid T_{ijk} > t, x_{ijkt}) = \Phi(x_{ijkt}\beta + \gamma_{ij} + \gamma_t + \nu_{ijkt})$$

$$\ln l = \sum_{i,j,k=1}^{N} \sum_{t=1}^{T} [y_{ijkt} \ln(h_{ijkt}) + (1 - y_{ijkt}) \ln(1 - h_{ijkt})]$$

- h_{ijkt} is a conditional probability that a bilateral trade relationship *ijk* ends in year t, also termed as the discrete-time hazard rate.
- y_{ijkt} is a binary variable equal to one if a trade relationship (spell of service) *ijk* ends in year t and zero otherwise.

Covariates

$$y_{ijkt} = f(dur_{ijkt}, spell_{ijkt}, left_{ijk}, \mathbf{STC}_{ijkt}, grav_{ijt}, exp_{i,jkt}, \alpha_{ij}, \alpha_t) + \varepsilon_{ijkt}$$

- dur_{ijkt} = number of years the current spell of service has lasted
- $spell_{ijkt}$ = binary variable controlling for 1,2,3 and more spells of service
- $left_{ijk}$ = binary variable indicating trade relationship is left censored (has ongoing spell of service before the year 1995)
- STC_{ijkt} = binary variable indicating active SPS trade concern for ijk
- $expr_{i,jkt}$ = number of suppliers of product k competing in destination i's market; number of markets of product k exporting from origin j
- Other gravity variables, period and region indicator variables

Trade Relationship Description

- Data include 3,500,970 country-pair-by-product (called triplet) trade observations and 725,559 active SPS concerns from 1995 to 2016.
- After mapping and keeping those triplets that at least experienced one STC within the sample period, we have 1,041,227 observations with 213,579 active SPS concerns for estimation.
- Short-lived ag. trade relationship
  - Over a third of trade relationships have a single spell of service, and about 90 % of them have multiple spells of service less than 4.
  - About a quarter of all spells last for just a single year and approximately a half last for 4 years or less.

Frequency of Active Spells across Sectors

Spell across Relationships				
No. of Spells	Frequency (%)			
	F_V	CER	MEAT	SFD
1	37.85	39.23	40.3	35.93
2	27.30	28.14	28.27	27.46
3	17.48	16.96	16.86	17.99
4	9.77	9.08	8.69	10.40
5	4.75	4.25	3.97	5.16
6	1.93	1.63	1.37	2.14
7	0.69	0.57	0.39	0.72
8	0.19	0.13	0.12	0.16
9	0.04	0.02	0.02	0.03
10	0	0	0	0
11	0	0	0	0

Observed Spell Length				
Spell Length	Frequency (%)			
	F_V	CER	MEAT	SFD
1	23.13	20.98	28.57	25.97
2	10.72	10.05	12.75	11.45
3	6.99	6.73	8.09	7.26
4	5.51	5.42	6.18	5.39
5	4.77	4.77	5.15	4.58
6	4.32	4.45	4.54	4.35
7	3.95	4.16	3.96	3.89
8	3.88	4.06	3.63	3.66
9	3.50	3.71	3.14	3.26
10	3.20	3.40	2.77	2.95
11	2.96	3.12	2.47	2.70
12	2.74	2.89	2.22	2.53
13	2.54	2.69	2.00	2.33
14	2.35	2.49	1.80	2.13
15	2.20	2.33	1.62	1.99
16	2.06	2.19	1.48	1.85
17	1.94	2.05	1.36	1.72
18	1.82	1.92	1.26	1.61
19	1.70	1.80	1.16	1.52
20	1.59	1.71	1.04	1.42
21	1.48	1.60	0.97	1.33
22	1.38	1.51	0.84	1.25
23-25	3.30	3.77	1.89	3.13
26-29	1.97	2.23	1.13	1.73

Results - Base Model

	MEAT	F_V	CER	DAIRY	SFD	OILS
Duration	-0.063***	-0.057***	-0.060***	-0.050***	-0.060***	-0.046***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)
Left censored	0.485***	0.207***	0.371***	0.202*	0.203*	0.109
	(0.068)	(0.045)	(0.081)	(0.084)	(0.087)	(0.126)
Duration*Left censored	-0.100***	-0.087***	-0.120***	-0.069***	-0.075***	-0.070***
	(0.010)	(0.007)	(0.014)	(0.012)	(0.013)	(0.018)
Spell 1	0.377***	0.190***	0.286***	0.150**	0.143**	0.007
	(0.042)	(0.024)	(0.040)	(0.049)	(0.046)	(0.065)
Spell 2	0.205***	0.148***	0.203***	0.098*	0.100*	-0.032
	(0.040)	(0.023)	(0.039)	(0.047)	(0.044)	(0.061)
Spell 3	0.161***	0.115***	0.107**	0.073	0.087*	-0.000
	(0.039)	(0.023)	(0.037)	(0.046)	(0.043)	(0.059)
Spell 4	0.084*	0.047*	0.095*	0.096*	0.049	-0.006
	(0.039)	(0.023)	(0.038)	(0.046)	(0.044)	(0.060)
HHI	0.463***	0.303***	0.235***	0.406***	0.449***	0.224***
	(0.037)	(0.021)	(0.037)	(0.046)	(0.045)	(0.066)
Distance (log)	0.080***	0.108***	0.008	0.296***	0.073*	-0.095
	(0.019)	(0.012)	(0.020)	(0.034)	(0.030)	(0.049)
Contiguity	-0.037	-0.159***	-0.168*	-0.078	-0.404**	-0.317*
	(0.040)	(0.043)	(0.079)	(0.053)	(0.142)	(0.153)
Language	-0.040	-0.084***	-0.093**	0.047	-0.086*	-0.116*
	(0.029)	(0.018)	(0.028)	(0.034)	(0.038)	(0.055)
SPS_STC	**0.248*** **	**0.154*** **	**0.172*** **	**0.130*** **	**0.222*** **	**0.192*** **
	(0.017)	**(0.010)**	**(0.015)**	**(0.021)**	**(0.025)**	**(0.034)**
N	*46701*	*148051*	*52763*	*34401*	*32621*	*17291*

Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Results - Model by SPS Types

		MEAT	F_V	CER	DAIRY	SFD	OILS
by WTO Subjects	AH	**0.245*** (0.025)**	-	**0.284*** (0.043)**	0.043 (0.025)	-0.020 (0.050)	**0.488*** (0.080)**
	PH	-	**0.040* (0.018)**	-0.404 (0.214)	-	-	0.253 (0.757)
	FS	0.054 (0.032)	**0.089*** (0.013)**	**0.113*** (0.017)**	**0.112** (0.037)**	**0.191*** (0.034)**	0.068 (0.042)
	OTH	**0.334*** (0.039)**	**0.226*** (0.017)**	0.087 (0.046)	0.025 (0.065)	**0.241*** (0.036)**	-0.343 (0.299)
by Grant and Arita Classification	ADR	**0.281*** (0.027)**	0.174 (0.162)	**0.438*** (0.037)**	**0.098*** (0.026)**	-0.544 (0.385)	0.098 (0.220)
	CPCL	**0.257*** (0.042)**	0.029 (0.019)	**0.078*** (0.020)**	0.116 (0.064)	**0.131*** (0.027)**	-0.015 (0.040)
	CRA	**0.268*** (0.025)**	**0.255*** (0.014)**	**0.149** (0.047)**	-0.050 (0.049)	**0.154*** (0.024)**	0.028 (0.092)
	FAD	**0.528*** (0.043)**	**0.849*** (0.019)**	**0.699*** (0.021)**	**0.620*** (0.044)**	**0.956*** (0.035)**	**0.824*** (0.032)**
	MICROB	-0.096 (0.167)	-0.013 (0.106)	**0.964* (0.381)**	-	-	-
	PHT	-	**0.174** (0.061)**	-	-	-	-
	PLCT	-	**0.176*** (0.016)**	**0.198*** (0.035)**	0.082 (0.062)	-	-0.149 (0.163)
	PPR	**0.108* (0.054)**	-	**0.286* (0.126)**	**0.227* (0.097)**	0.336 (0.255)	**0.212** (0.070)**
	TOL	**-0.346*** (0.044)**	**-0.208*** (0.014)**	**-0.325*** (0.026)**	**-0.209** (0.074)**	**-0.137*** (0.031)**	**-0.543*** (0.041)**

Concluding Remarks

- Preliminary summary statistics on export duration confirm that trade relationships tend to be short lived.
  - $>$ 35% have a single spell of service, and over 90% have multiple spells of service less than 4;
  - $>$ 25% last for a single year, and over a half last for 4 years or less.
- Up to May 2018, members have raised 434 SPS concerns since 1995.
  - Animal disease related (30%) and Tolerances & Limits (16%) are most prominent concerns;
  - Most involved sectors: Meat (29%), F_V (22%), Cereals (12%), and Seafood (8%);
  - EU, US, Japan and China make up a large proportion of SPS concern participation.

Concluding Remarks (cont')

- Estimation results on export hazard rates show that
  - Trade relationships with longer duration are less like to exit an existing market, but more spells of service tend to increase the hazard rates;
  - Ag. trade in a more concentrated destination market tend to have higher hazard rates;
  - Long distance, no shared border/language/RTAs tend to increase the hazard rate;
  - On average, trade with active SPS concerns tend to increase the hazard rates;
  - For different ag. sectors, SPS concerns tend to have heterogeneous impact of the hazard rates based on its type.

Implications

- Quantifying hazard rate of SPS concerns has important economic and policy relevance.
  - Developing/fostering trade relationships likely involve considerable sunk/fixed costs;
  - Once established, exporting firms have an incentive to continue a spell of service to avoid the cost of potentially identifying new buyers after re-entry.
- Future work
  - Examine potentially important interaction effects of specific SPS concerns on export hazard rates;
  - Hazard rate may vary with different resolved status, duration, and time subsequently raised of a concern.

Thank You!

Xin Ning, Jason Grant, and Everett Peterson

Center for Agricultural Trade
Department of Agricultural and Applied Economics
Virginia Tech

Acknowledgements: Financial support from the Office of the Chief Economist of the USDA is gratefully acknowledged. The opinions expressed in this presentation are the authors' and do not reflect the view of Office of the Chief Economist, or the USDA.