Price variation in network models of international food-commodity markets.

Craig R. Shenton[1], Spencer A. Thomas[2], David J.B. Lloyd[2], and Angela Druckman[1]

[1]Centre for Environmental Strategy, University of Surrey, [2]Department of Mathematics, University of Surrey

UCL Institute for Sustainable Resources

UNIVERSITY OF SURREY

Contents

- Network models of trade
- Local network motifs
- Results
- Model validation

Network models of trade

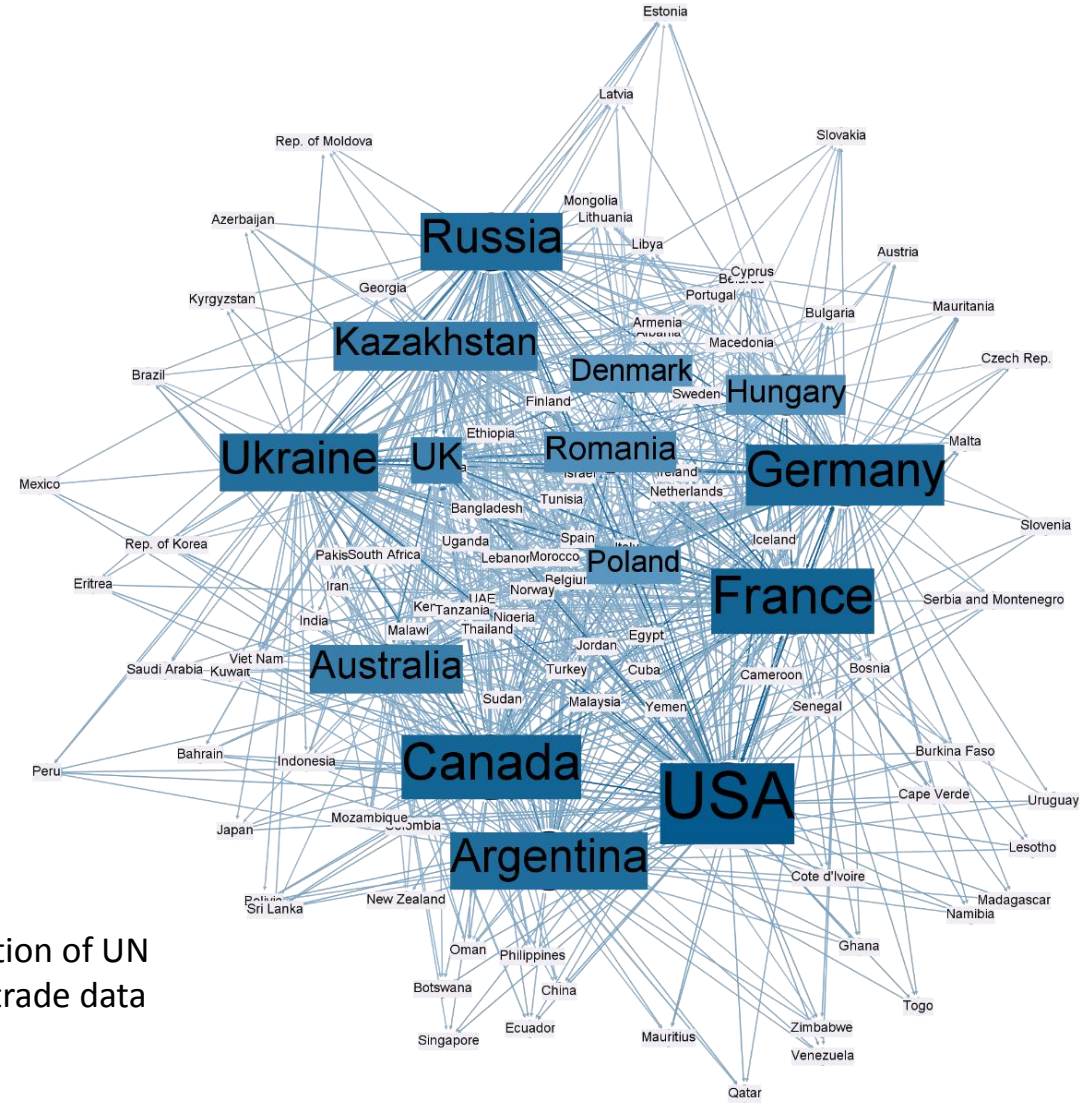


Figure: Network visualisation of UN Comtrade wheat market trade data (year 2006) [2]

Local Network Motifs

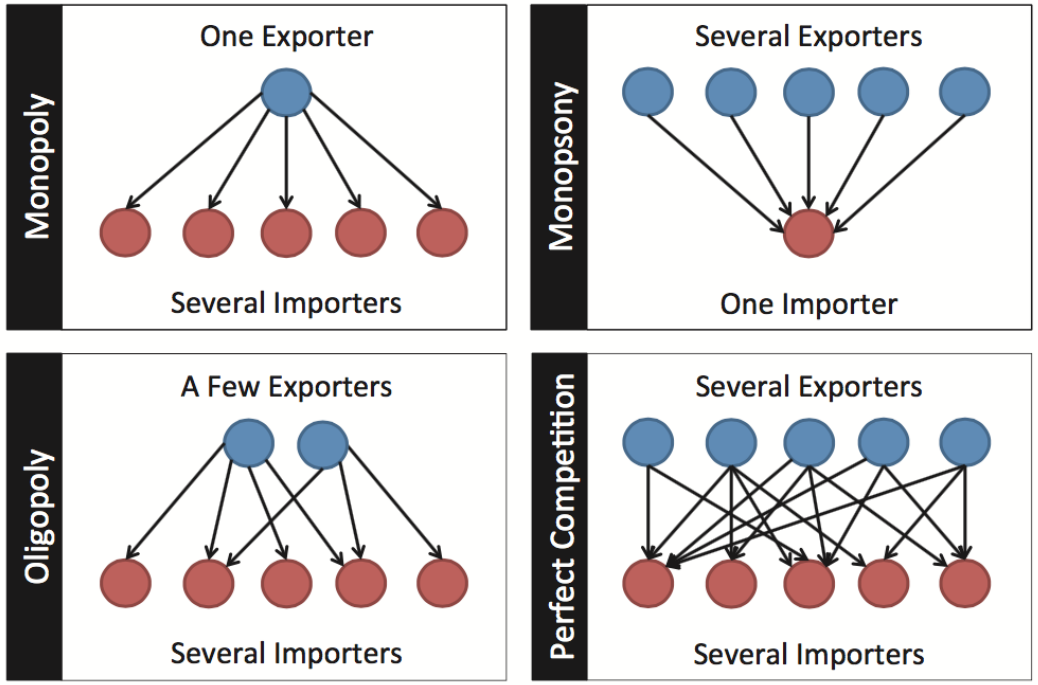


Figure: Repeating patterns of trade in international commodity markets [1].

[1] F. Maximiliano, J. Galeano, and C. Hidalgo. 2011. "A complex network approach to international commodity trade markets." *International Journal of Complex Systems in Science.* 1(2):191– 201.

Theoretical Results

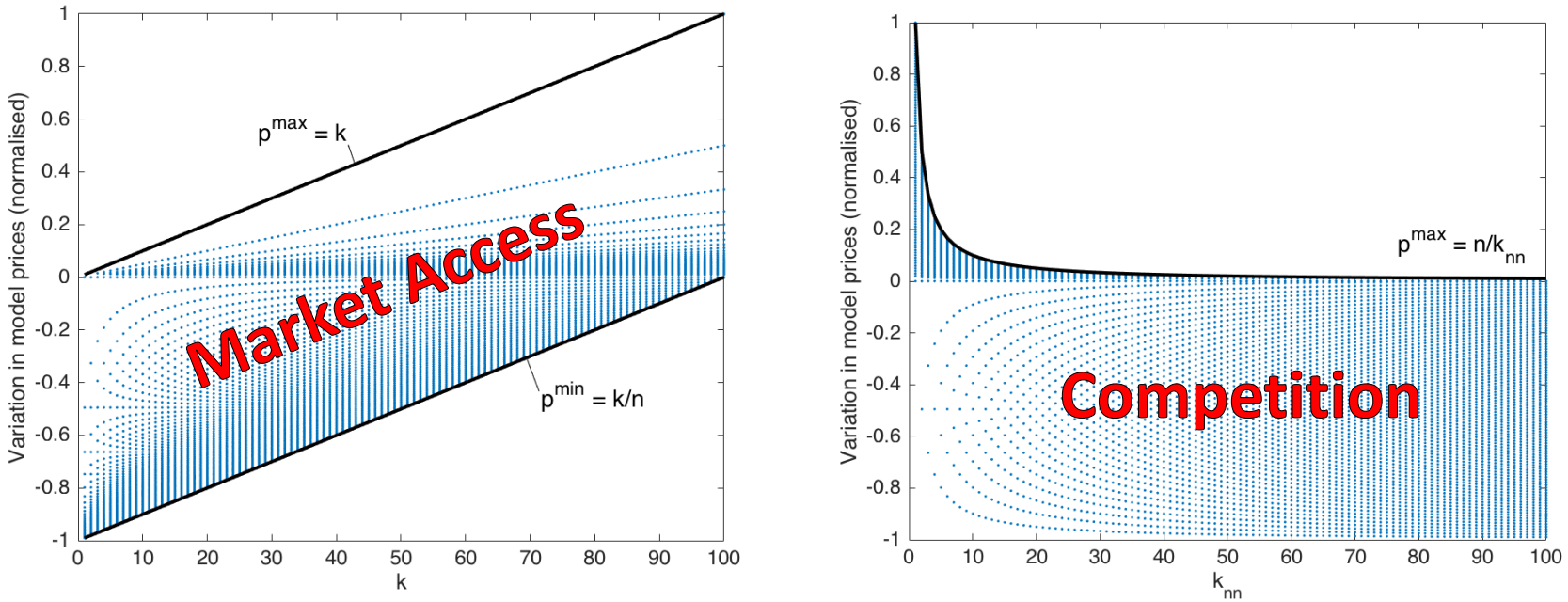


Figure: (**Left**) variation in normalised model prices *p* as a function of degree *k*. (**Right**) price variation as a function of the average nearest neighbour degree k_{nn}.

Model Results

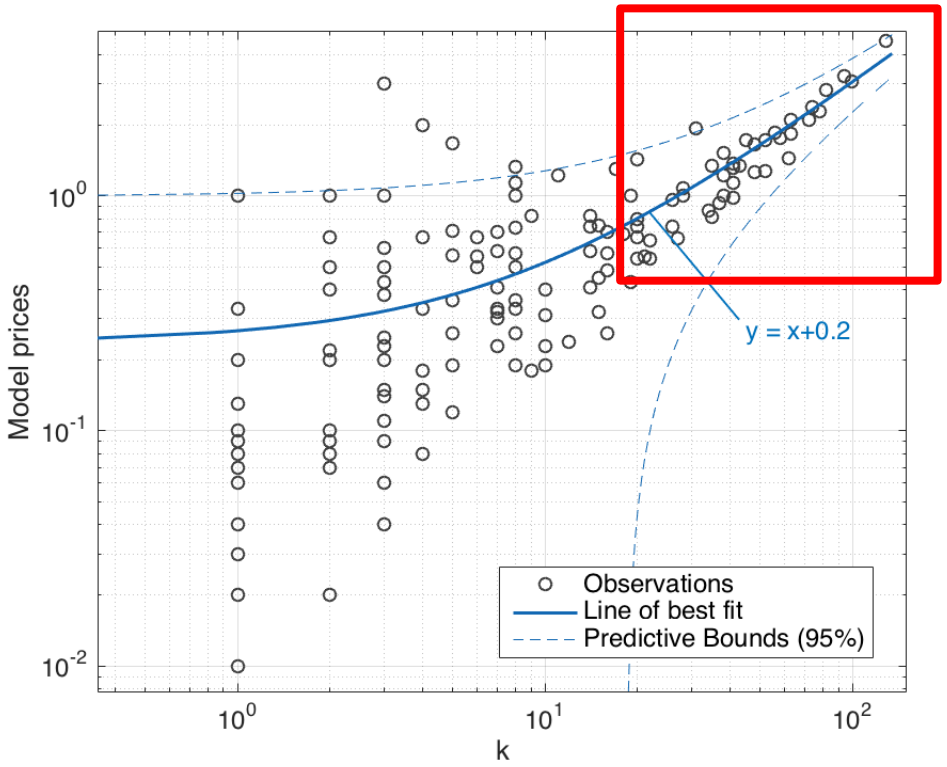
Model Price Variation			
Country	k	k_{nn}	Price
USA	128	28	4.63
France	94	29	3.29
Canada	99	32	3.05
Germany	82	29	2.84
Ukraine	74	31	2.40
Russia	78	34	2.29
Italy	63	30	2.13
Argentina	72	34	2.12
United Arab Emirates	31	16	1.96
Australia	63	34	1.87
United Kingdom	56	30	1.85
Netherlands	58	33	1.77
Spain	45	26	1.75

Analysis of UN-Comtrade dataset [2]. Wheat market selected over the years 2000-2008.

[2] United Nations Statistics Division. 2014. "United Nations Commodity Trade Statistics Database (UNcomtrade)." (Online) Available at: http://comtrade.un.org/ .

Table: Local network characteristics of major wheat exporters. Values denote: degree *k*, average nearest neighbour degree k_{nn}, and the local equilibrium price *p* determined by the graphical economy model.

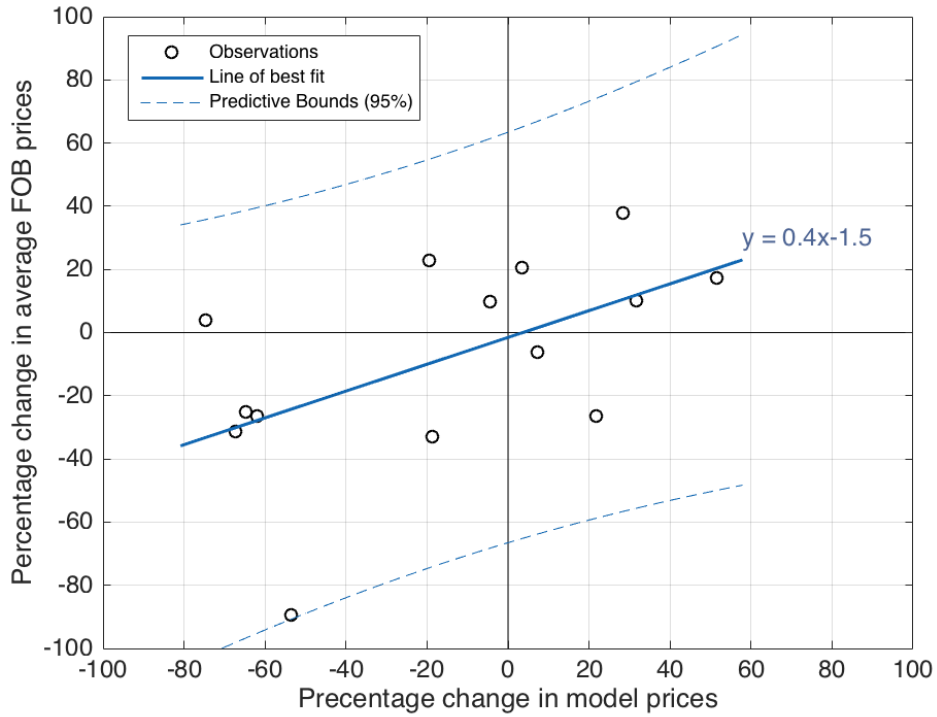
Model Results



[3] Kakade, S.M., M. Kearns, L.E .Ortiz, R. Pemantle and S. Suri. 2004. *Economic properties of social networks*. Advances in Neural Information Processing Systems. pp. 633–640.

Figure: Linear model of prices as a function of exporter degree. Unlike Kakade et al. [3], we find that *k* is an accurate predictor of price for high values of *k.*

Model Validation



[4] Agriculture and Horticulture Development Board (AHDB). 2015. Market Data Centre: Physical Prices.“ URL: *http://www.ahdb.org.uk*

Figure: Change in model prices (measured as a percentage change from the mean) over the change in average F.O.B (Free On Board) prices over 2003-2006 [4]. Correlation coefficient r = 0.61, statistical significance (two-tailed T-test) p = 0.043* (p = 0.053 with outlier excluded).

Thank You

email: c.shenton@surrey.ac.uk