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Forecasting Commodity Prices using a Global Vector Autoregressive Model

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Aims of the paper and the GVAR Model

Main aims of the papers:

a) Forecasting wheat commodity prices
b) Validate a new Global Vector Autoregressive Model (Gutierrez, Piras, Roggero, 2014)

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A Global Vector Autoregression Model for the Analysis of Wheat Export Prices

Luciano Gutierrez, Francesco Piras, and Pier Paolo Roggero

Food commodity price fluctuations have an important impact on poverty and food insecurity across the world. Conventional models have not provided a complete picture of recent price spikes in agricultural commodity markets, and there is an urgent need for appropriate policy responses. Perhaps new approaches are needed to better understand international spill-overs, the feedback between the real and the financial sectors, as well as the link between food and energy prices. In this article, we present the results from a new worldwide dynamic model that provides the short and long-run impulse responses of the international wheat price to various real and financial shocks.

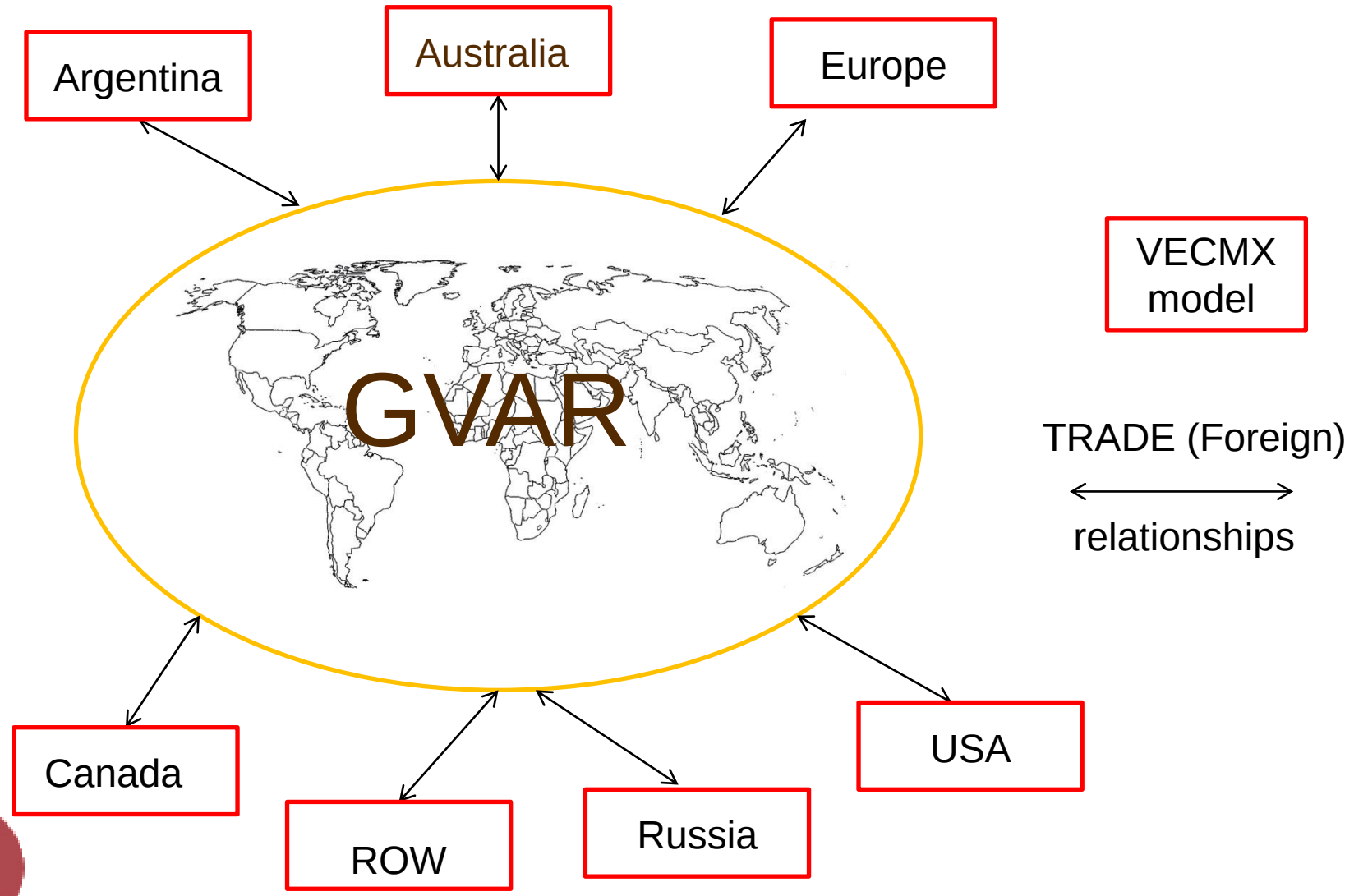
Key words: Global dynamic models, price analysis, wheat market.

JEL codes: C12, C15, G14, Q14.

Models

- Single equation (Moore, 1917, Sarle,1925, Ezekiel 1927, Hopkins 1927)
- Multi-equation models (Wright and Williams 1982, Deaton and Laroque 1992)
- Spatial equilibrium and interregional competition models (MacAulay,1978, Martin and Zwart, 1975)
- Box-Jenkins and exponential smoothing methods (Schmitz and Watts, 1970, Bourke 1979)
- Multivariate time series analysis (Shonkwiler and Spreen 1982, Bessler, 1984, Brandt and Bessler 1984, Bessler and Hopkins 1986, Bessler and Kling 1986)
- ARCH and GARCH models (Bernard et al., 2006, Ramirez and Fadiga, 2003).

Wheat main competitors and Global VAR



Domestic, Foreign and Global Variables

• Domestic (endogenous) variables:
- wheat export prices in country i
- wheat stock to utilization ratio in country I
- fertilizer price
- bilateral exchange rate local country i / US$
- consumer prices in country i

• Foreign (weakly exogenous) variables:
- trade weighted average export prices
- trade weighted average wheat stock to utilization ratios
- trade weighted average exchange rates
- trade weighted average consumer prices

• Global (exogenous) variables :
- Oil price
- Weather variables

GVAR MODEL ESTIMATION

1. Step : Single country VARX (VECMX) parameter estimation

2. Step : All individual country models are stacked and linked by using trade weight matrices

3. Step : Solving the model and obtaining the Global VAR model as

$$y_t = b_0 + \sum_{i=1}^{p} F_i y_{t-i} + \sum_{i=0}^{q} B_i x_{t-i} + v_t$$

Main advantages in using a GVAR model

• First, the model is specifically designed to analyze market fluctuations and interactions between countries/regions.

• Secondly, the GVAR lets us model the dynamism in wheat export prices caused by the effects of country-specific and foreign-specific variables.

•Thirdly, the GVAR model has proven to be especially useful for describing the dynamic behaviour of economic and financial time series.

• Finally, the model is mainly based on Vector Autoregression methodology which has usually been known as a natural tool for forecasting.

Forecast results 2012.2-2014.6 (1)

Tab.1 MAPE statistics for one-month-ahead, *h*=1, forecasts

COUNTRY	GVAR	AR	ARt	VAR	VECMX
Argentina	4.713	9.566	9.194	5.549	5.963
Australia	6.662	13.642	13.529	12.244	6.905
Canada	5.864	8.429	9.326	5.056	4.653
Russia	6.600	11.272	10.682	6.218	8.409
EU	6.190	9.981	9.249	9.985	8.611
USA	5.674	9.943	10.308	20.453	7.600
AVG	5.950	10.472	10.381	9.917	7.023
WAVG	6.151	10.537	10.411	10.264	7.418

Forecast Results (2)

Tab.4 MAPE statistics for twelve-months-ahead, *h*=12, forecasts

COUNTRY	GVAR	AR	ARt	VAR	VECMX
Argentina	19.946	19.564	7.695	24.995	26.964
Australia	33.820	23.540	15.813	44.975	38.037
Canada	19.878	9.298	42.417	25.516	25.722
Russia	19.842	10.318	18.481	18.262	20.844
EU	16.925	12.555	19.411	53.470	49.377
USA	18.071	12.131	16.866	69.289	23.534
AVG	21.414	14.568	20.114	39.418	30.746
WAVG	20.606	12.867	21.232	39.353	29.446

Turning Point Results (3)

Tab.8 Turning point statistics for one-month-ahead, *h*=1, forecasts

COUNTRY	GVAR	AR	ARt	VAR	VECMX
Argentina	40.74	33.33	33.33	33.33	62.96
Australia	66.67	37.04	37.04	37.04	44.44
Canada	51.85	40.74	44.44	51.85	51.85
Russia	70.37	40.74	44.44	70.37	51.85
EU	55.56	48.15	48.15	44.44	48.15
USA	66.67	44.44	48.15	33.33	51.85
AVG	58.64	40.74	42.59	45.06	51.85
WAVG	62.42	42.04	44.50	49.92	50.82

Main conclusions

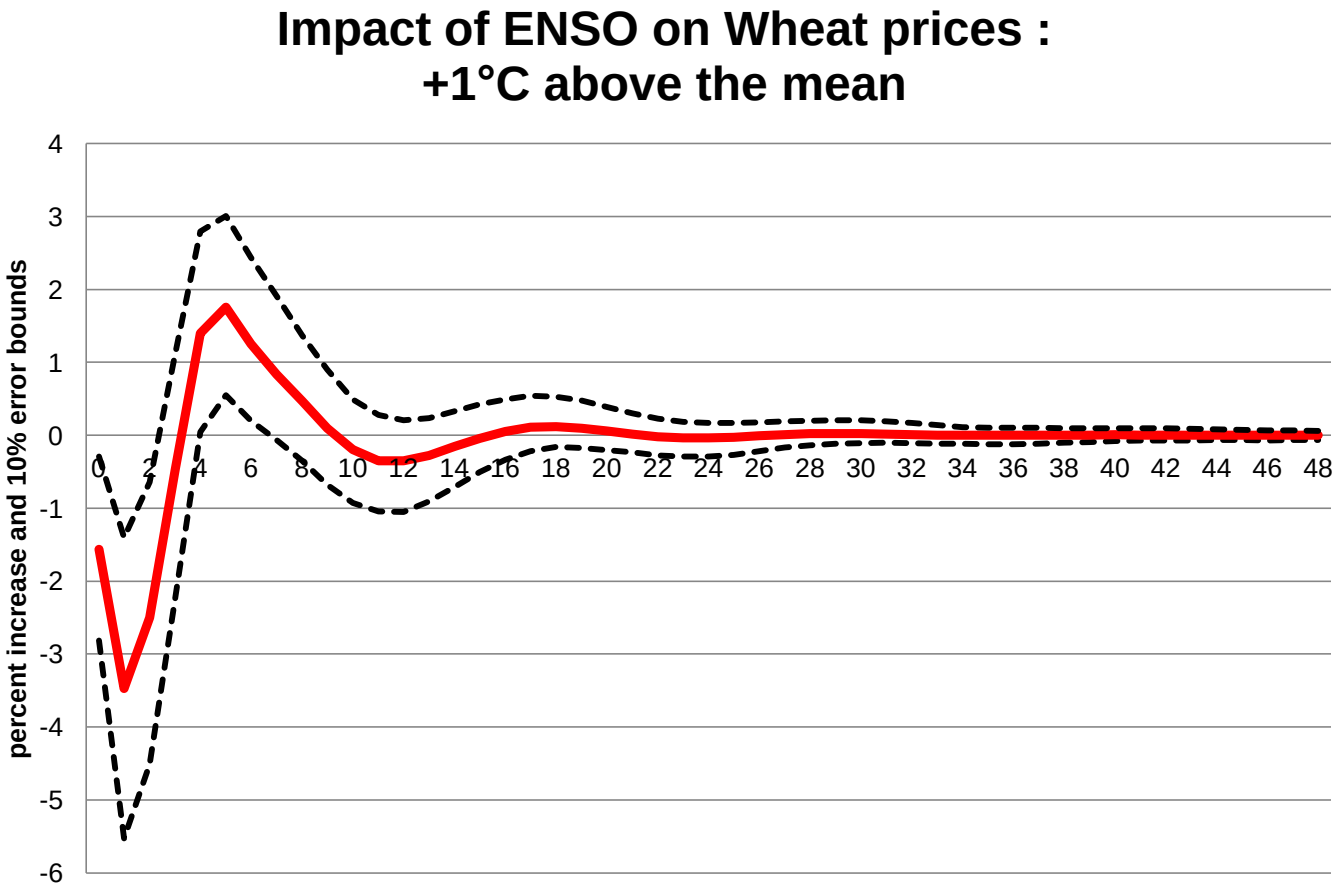
• Two main advantages in using a GVAR model to predict wheat export prices:

A) GVAR model generally produces more precise forecasts than benchmarks models as VAR or VECMX models only based on domestic variables.

B) Thus it seems that there is an advantage in modelling the interdependencies among the main export countries in forecasting and predicting turning points of wheat prices.

Future work..New structural analysis

- El Niño Southern Oscillation (ENSO) impact



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