

Impact of information exchange on supplier forecasting performance



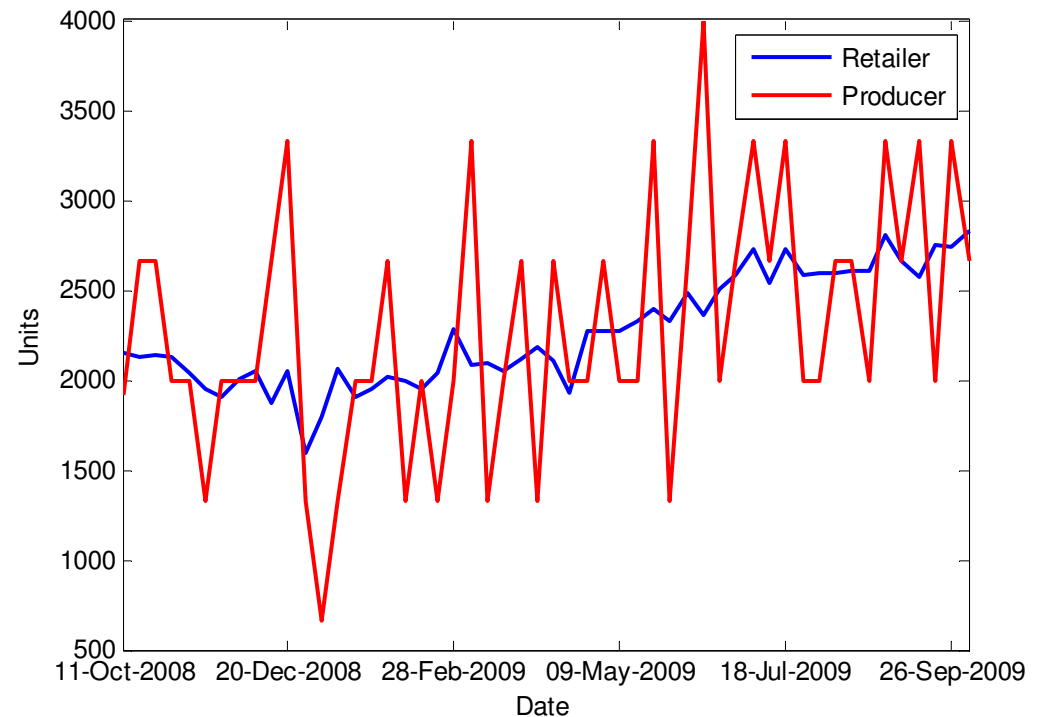
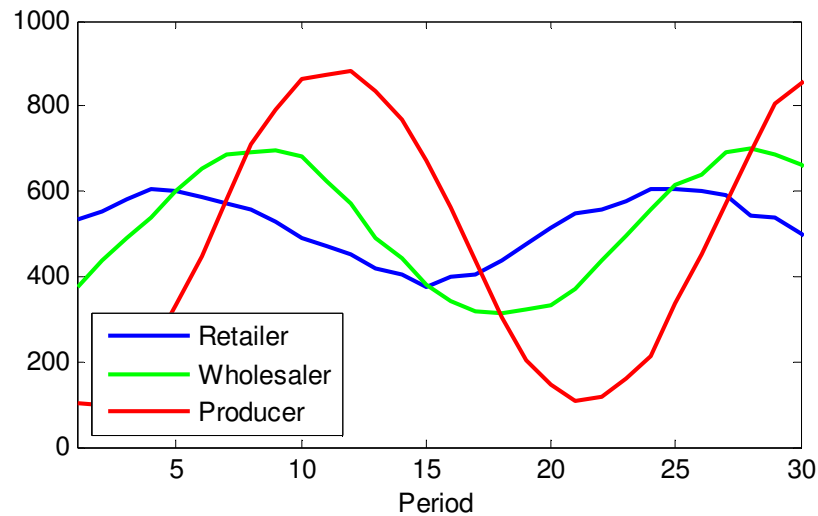
Juan R. Trapero, Nikolaos Kourentzes, Robert Fildes
Omega, 40 (2012), p 738-747.



Information Exchange in Supply Chain

Key problem in supply chain management → **Bullwhip effect (BWE)** (Geary et al., 2006)

BWE → Demand variability amplification when moving upwards in the supply chain



BWE leads to:

1. Poor forecasts
2. Excessive stock
3. Poor customer service
4. Increased costs



Information Exchange in Supply Chain

What causes the Bullwhip Effect? (Lee et al., 1997)

1. Order batching → companies often group orders together
2. Rationing and shortage gaming → ordering behaviour in periods of supply shortage
3. Price fluctuations → promotions modify real buying behaviour
4. Demand forecast updating → demand forecasts are based on past demand → includes problems above

BWE increases the stochasticity of demand upstream in the supply chain



Information Exchange in Supply Chain

Collaboration in the supply chain has often been proposed to counter the BWE

Collaboration:

- Information sharing
- Find a global optimal solution for all members instead of sub-optimal solutions for each company

Collaboration can take the following forms (Holweg et al., 2005):

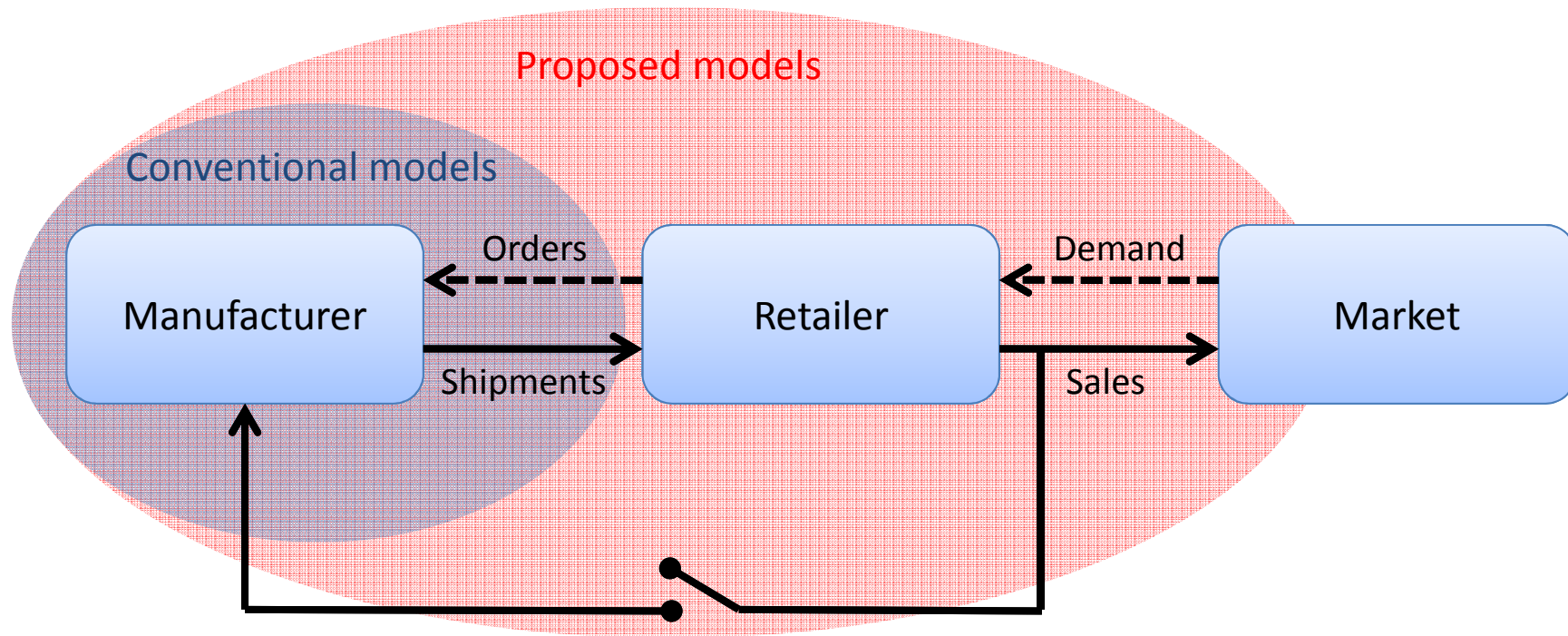
1. No collaboration → Traditional supply chain
2. Information exchange → Demand planning collaboration
3. Inventory collaboration → Vendor managed replenishment
4. Planning and inventory collaboration → Synchronised supply

Information transparency mitigates BWE (Geary et al. 2006)



Information Exchange in Supply Chain

Conceptual Framework



Proposed models use inputs from multiple levels of the supply chain
Aim → Less Bullwhip → More accurate forecasts



Information Exchange in Supply Chain

For a consumer goods chemicals company we have past historical sales and Point Of Sale (POS) data. We can forecast demand per SKU using:

1. Conventional Time Series Models (univariate)

1. Random Walk (Naive)
2. Moving Averages (MA)
3. Single Exponential Smoothing (ETS)
4. AR and ARIMA

Standard demand
planning statistical
models

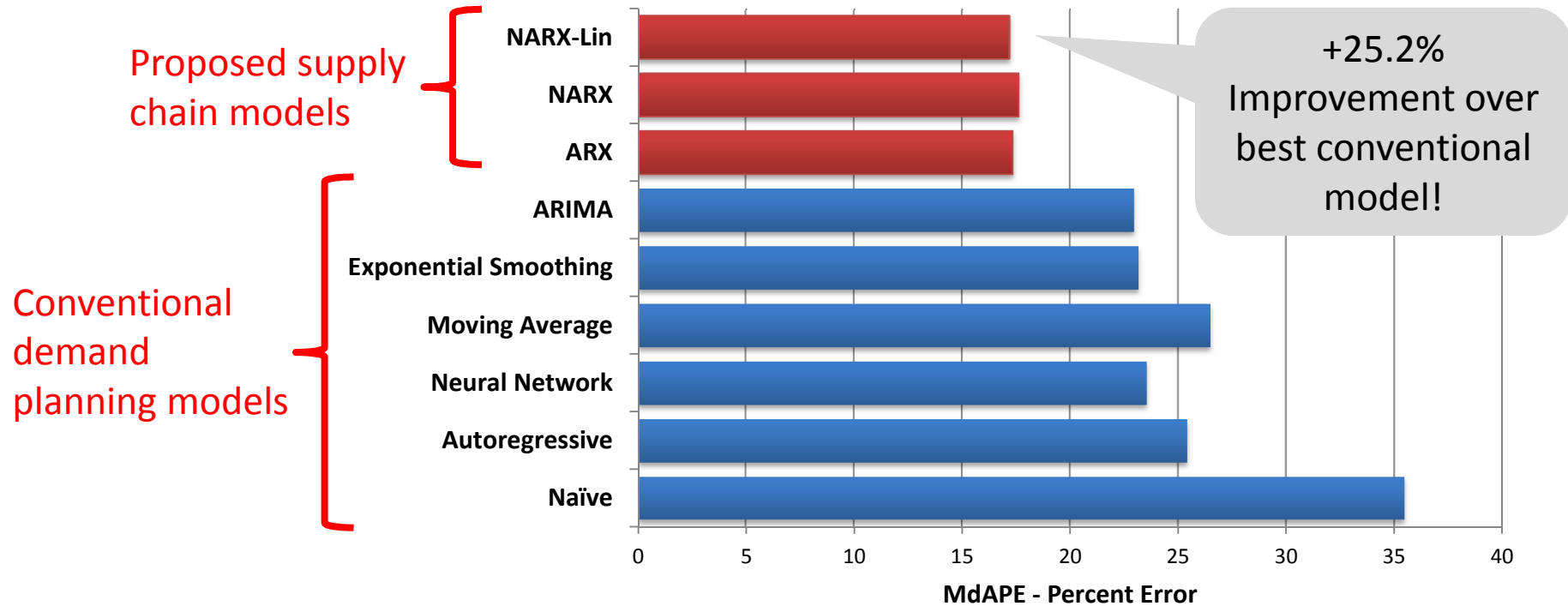
2. Models that use past supplier's demand and retailers' demand (multivariate)

1. Neural Networks (NAR - NARX)
2. ARX (and ARIMAX)

Proposed supply chain
models

Direct empirical comparison → Are multivariate more accurate?

Case Study



Method	Univariate						Multivariate		
	Naïve	AR	NAR	MA	SES	ARIMA	ARX	NARX	NARX-Lin
MAPE %	47.05	38.20	34.82	36.28	34.43	34.50	<u>26.63</u>	27.61	26.97
MdAPE %	35.46	25.41	23.53	26.50	23.16	22.96	17.35	17.62	<u>17.18</u>

Percentage errors;
lowest is better

Multivariate models better → Collaboration impacts positively on accuracy!



Information Exchange in Supply Chain

- Empirical evidence that information sharing positively affects forecasting accuracy
- **Information sharing → reduced forecasting errors**
 - Mitigates Bullwhip Effect
 - Reduce inventories → costs
 - Reduce supply chain waste → costs
 - Results considered in company that provided data

Detailed analysis, findings and references in the paper:

<http://kourentzes.com/forecasting/2012/04/19/impact-of-information-exchange-on-supplier-forecasting-performance/>