

The FEWS index: Fixed effects with a window splice

Non-revisable quality-adjusted price indexes with no characteristic information

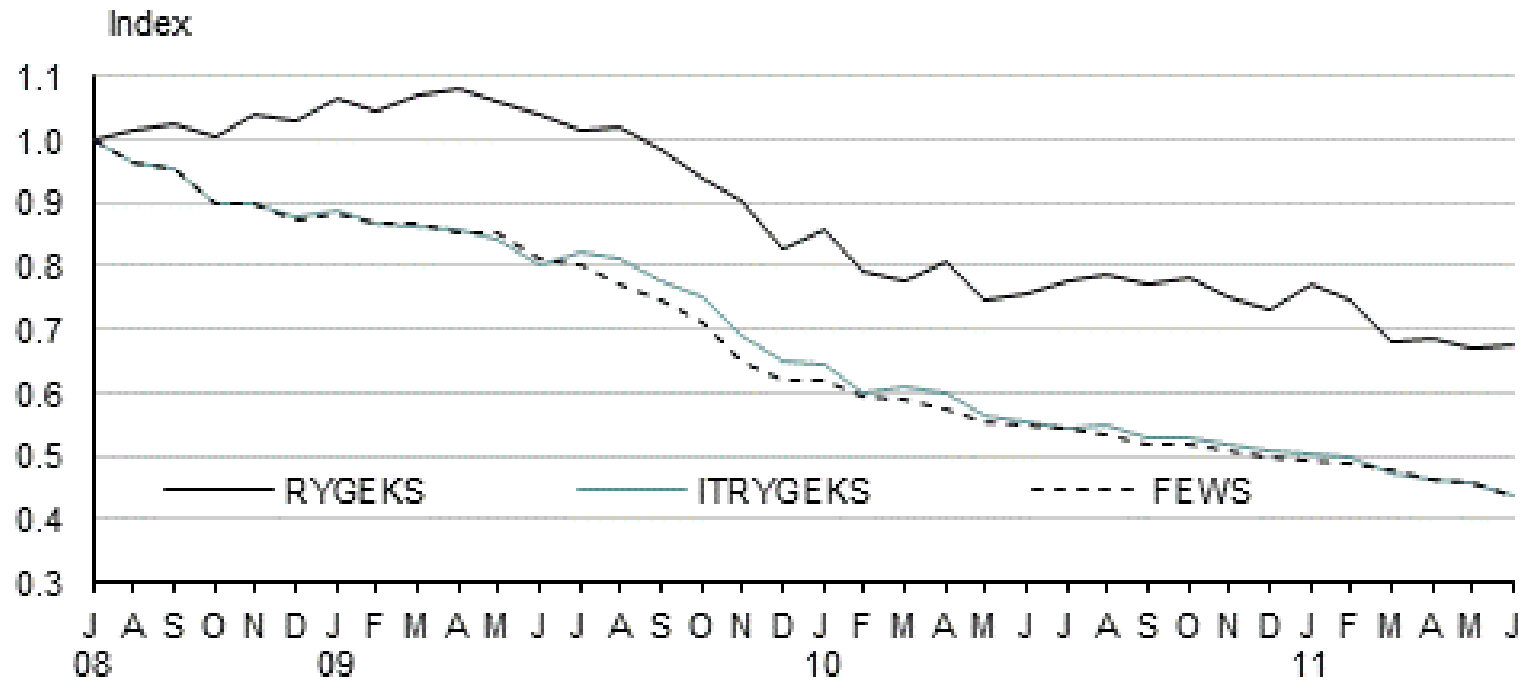
Frances Krsinich, Statistics New Zealand
Geneva, May 2014

UNECE CPI meeting 2014

Outline

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- ⊙ Intuition
- ⊙ Theory
- ⊙ Simulation
- ⊙ The window splice
- ⊙ Empirical results
 - *NZ consumer electronics scanner data (GfK)*
 - *US supermarket scanner data (IRI)*
 - *NZ consumer electronics online data (BPP)*
- ⊙ Comparison of methods

Laptop computers

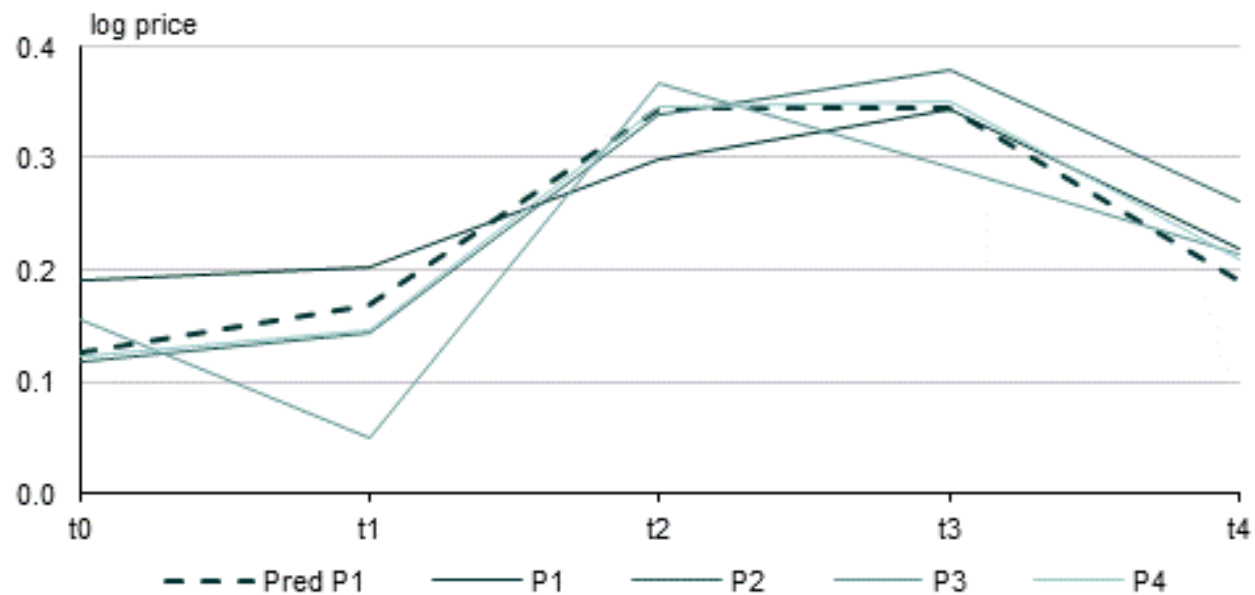


Source: GfK

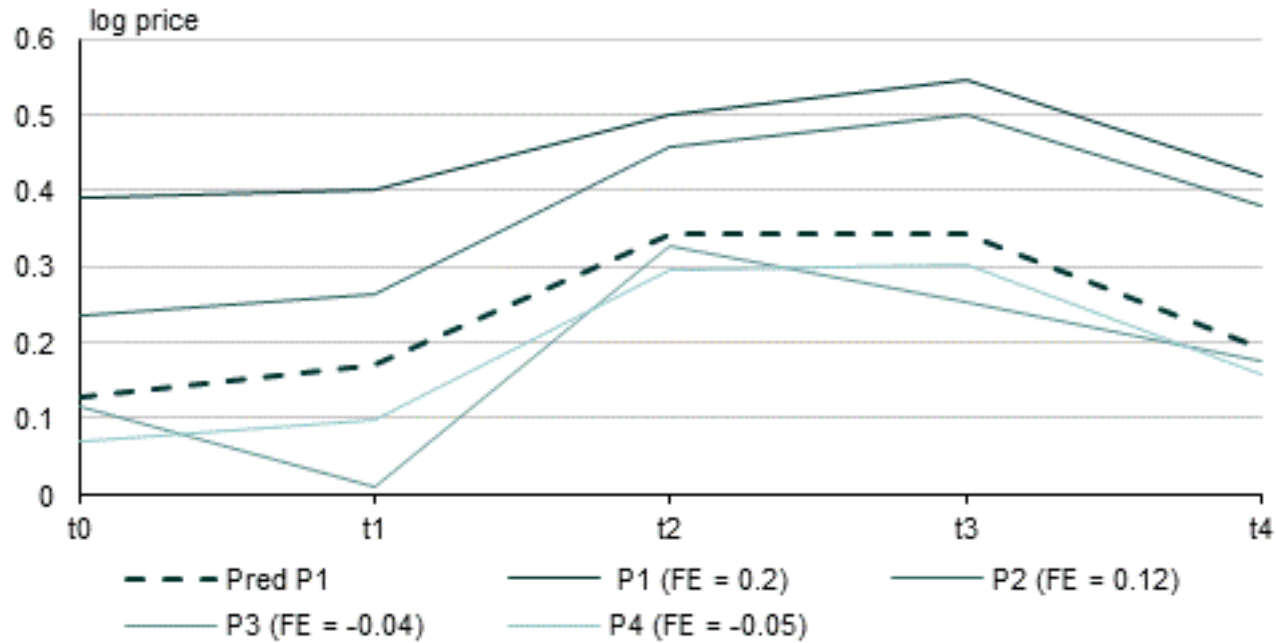
Background

- ⊙ Fixed-effects used to benchmark matched-sample approach to rental index
Krsinich (2011) extended result from Aizcorbe (2003) to show movement for new rental dwellings appropriate
- ⊙ de Haan and Krsinich (2012) ITRYGEKS benchmark – RYTPD (ie fixed effects) performed better than RYGEKS
- ⊙ Krsinich (2013) modified splice of RYTPD – performed even better against ITRYGEKS
- ⊙ De Haan and Hendriks (2013) Dutch online data - concluded fixed-effects don't work
- ⊙ Statistics NZ started using fixed-effects in production for import price indexes – mobile phones and TVs – Dec 2013 qtr
- ⊙ SNZ research on using FEWS for online data (BPP, then PriceStats)

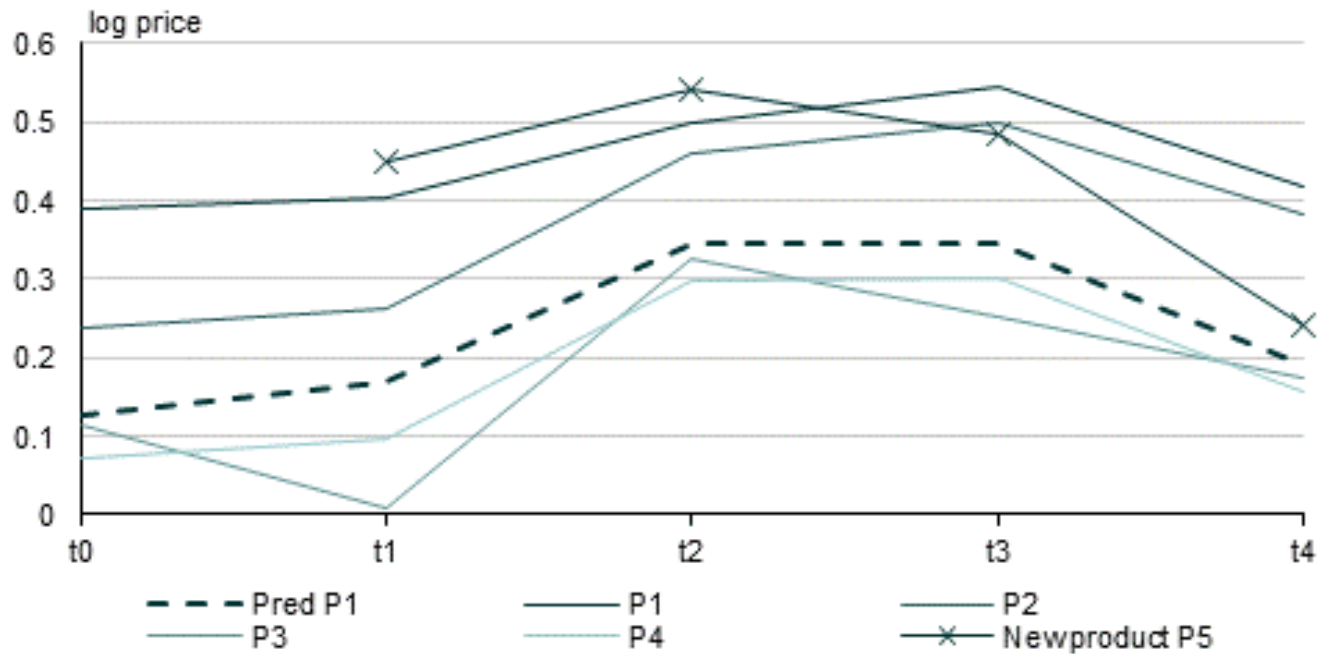
Intuition



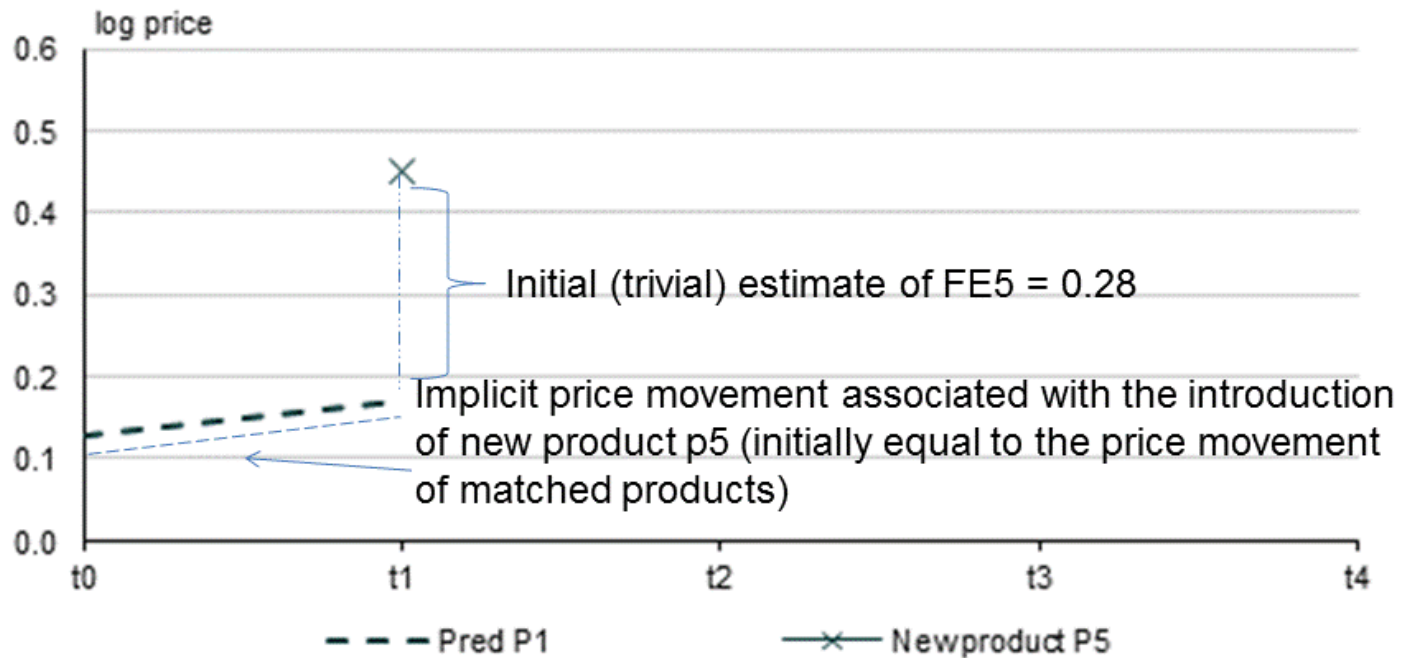
Source: Statistics NZ



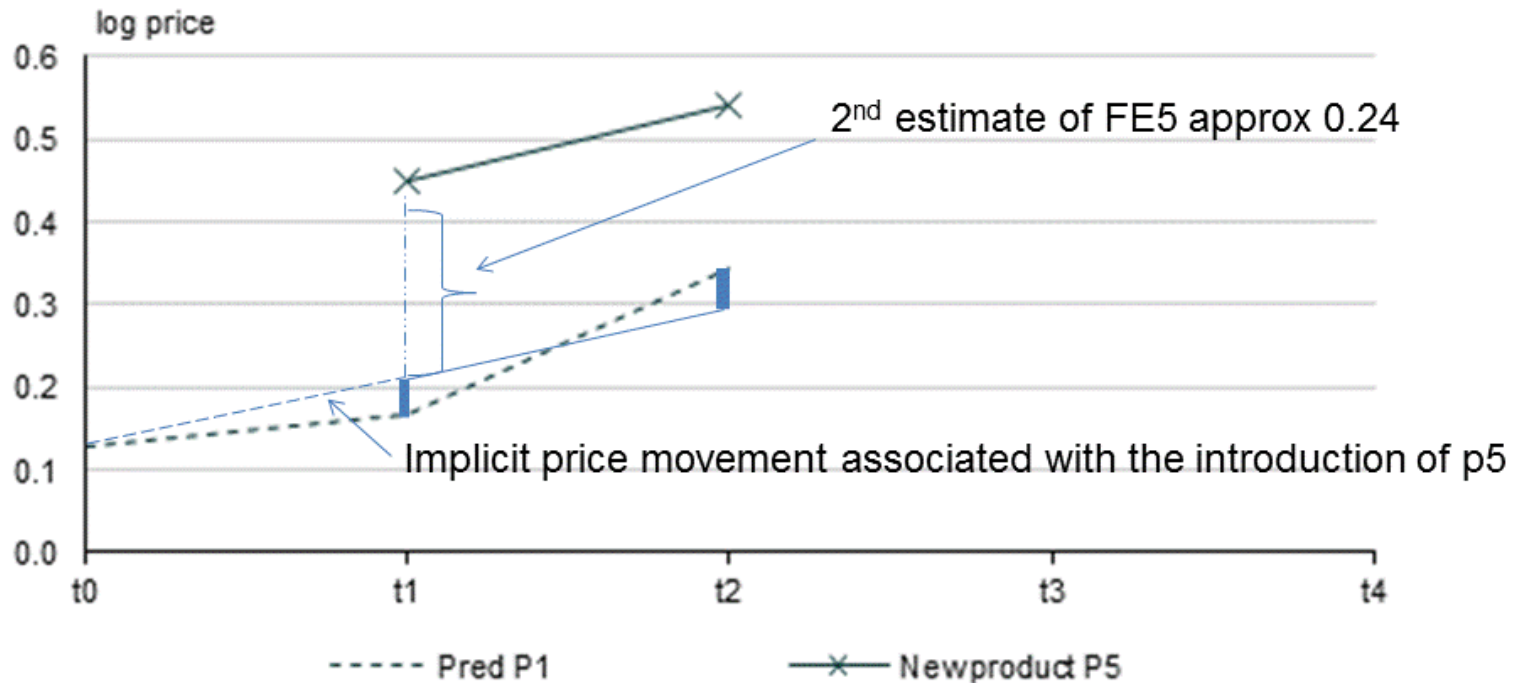
Source: Statistics NZ

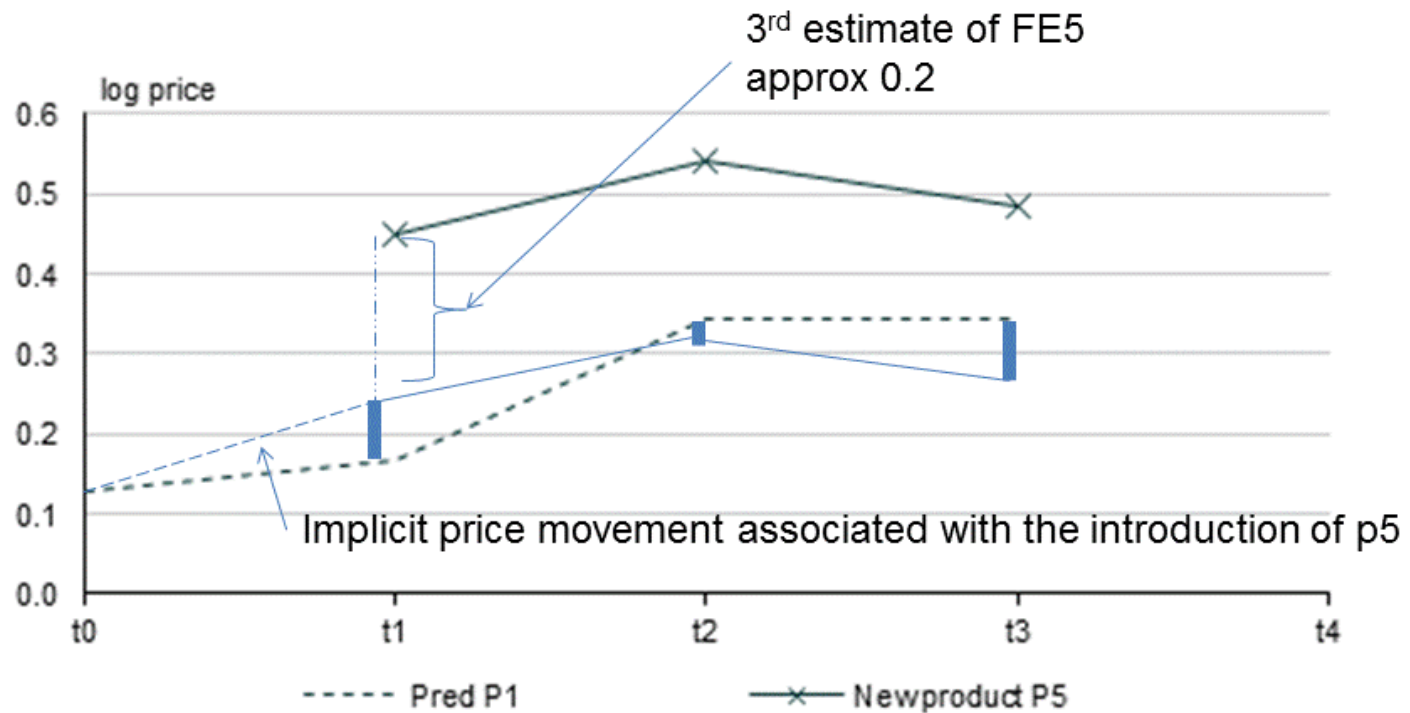


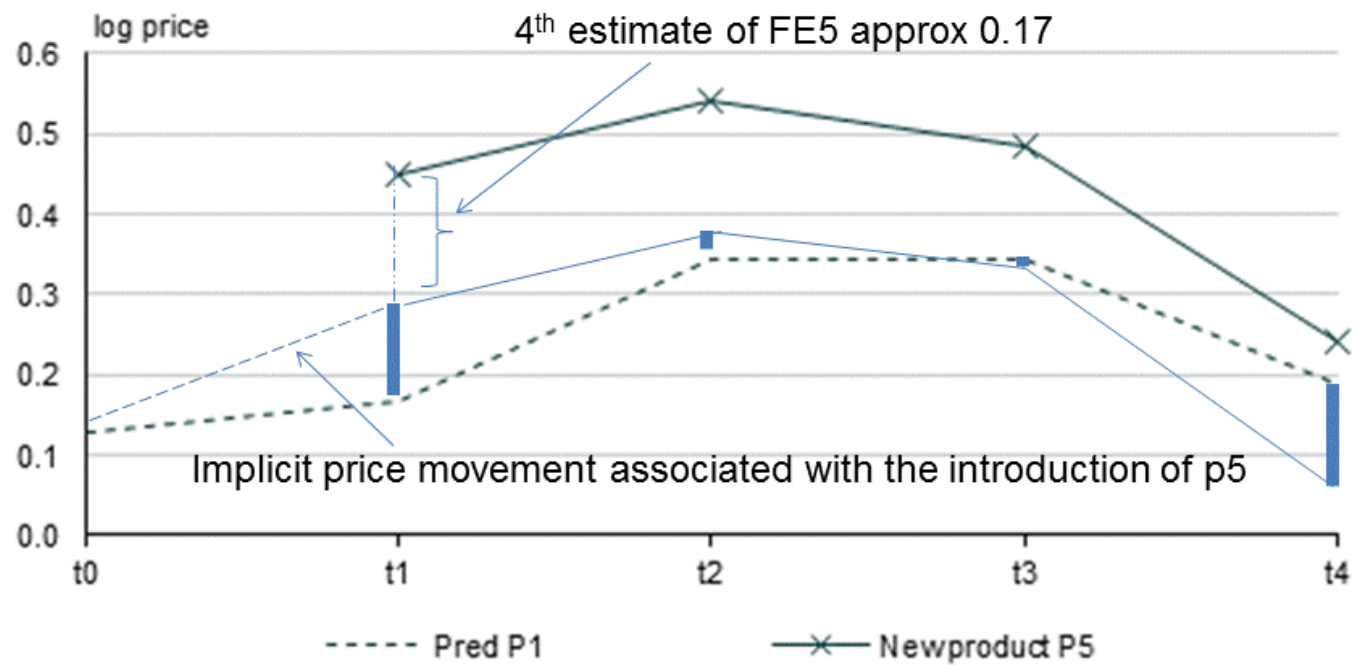
Source: Statistics NZ



Source: Statistics NZ







Theory

Time-dummy hedonic index
(main-effects)

$$P_{TD_{ME}}^{0t} = \exp(\hat{\delta}^t) = \frac{\prod_{i \in S^t} (p_i^t)^{\frac{1}{N^t}}}{\prod_{i \in S^0} (p_i^0)^{\frac{1}{N^0}}} \exp \left[\sum_{k=1}^K \hat{\beta}_k (\bar{z}_k^0 - \bar{z}_k^t) \right]$$

QA factor

Time-dummy hedonic index (two
categorical characteristics and fully-
interacted)

$$P_{TD_{full}}^{0t} = \exp(\hat{\delta}^t) = \frac{\prod_{i \in S^t} (p_i^t)^{\frac{1}{N^t}}}{\prod_{i \in S^0} (p_i^0)^{\frac{1}{N^0}}} \exp \left[\sum_{l=1}^L \hat{\beta}_l (\bar{D}_l^0 - \bar{D}_l^t) + \sum_{m=1}^M \hat{\beta}_m (\bar{D}_m^0 - \bar{D}_m^t) \right]$$

QA factor

Fixed-effects index

$$P_{FE}^{0t} = \exp(\hat{\delta}^t) = \frac{\prod_{i \in S^t} (p_i^t)^{\frac{1}{N^t}}}{\prod_{i \in S^0} (p_i^0)^{\frac{1}{N^0}}} \exp \left[\hat{\gamma}^0 - \hat{\gamma}^t \right]$$

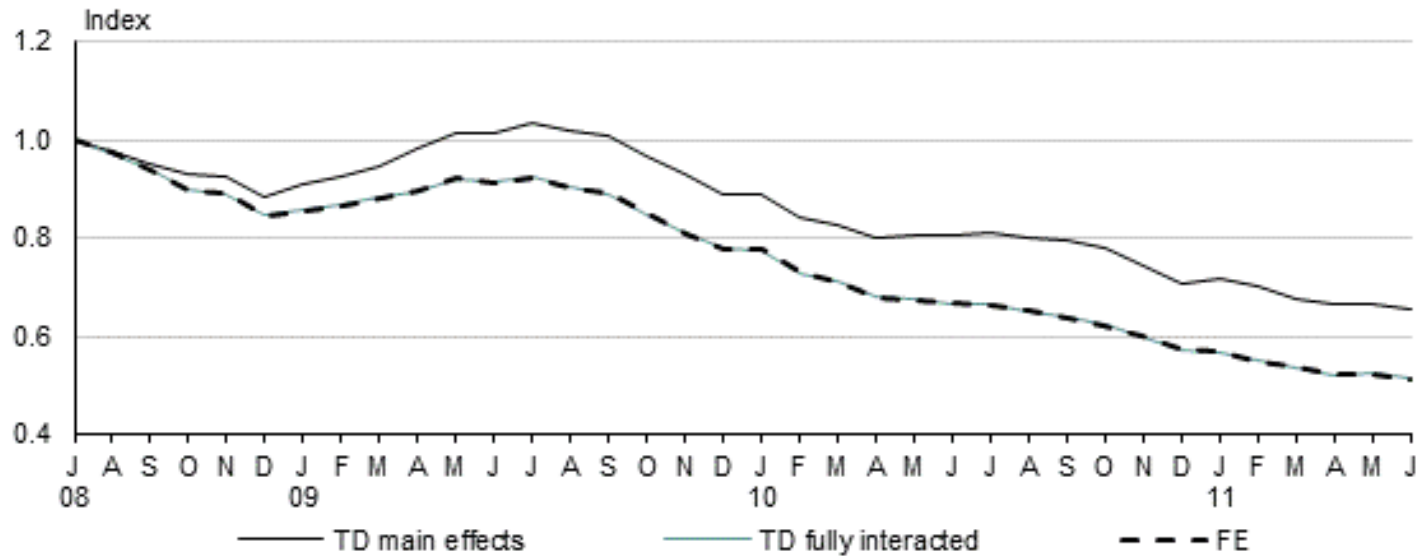
QA factor

- ⊙ Two characteristics A and B, each with 3 categories 1,2,3
- ⊙ Product i has characteristics A3 and B1
- ⊙ Main effects β_{A3} and β_{B1}
- ⊙ 2nd order interaction β_{A3B1}
- ⊙ Characteristics fixed across time so fixed effect
$$\gamma_i = \beta_{A3} + \beta_{B1} + \beta_{A3B1}$$

Simulation

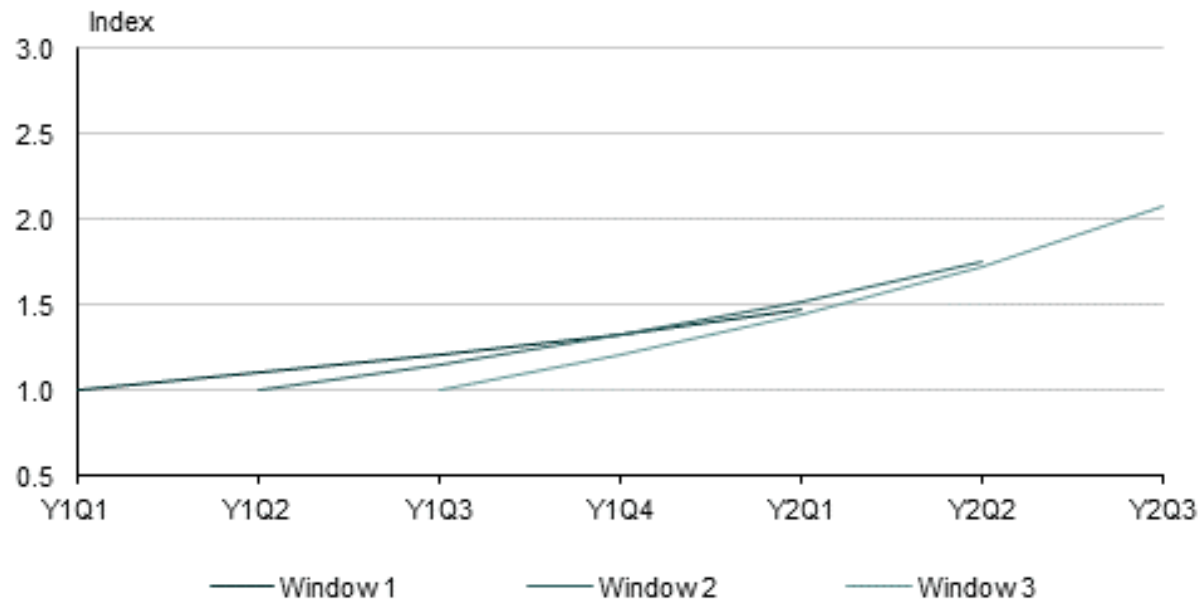
- ⊙ Digital cameras (scanner data from GfK)
- ⊙ Use 3 (of approx 40) characteristics
- ⊙ Brand (22), depth in mm (295) photos per second (78)
- ⊙ Product identifiers for fixed effects based on combo of characteristics eg 'A_12_100', 'B_25_200'

Digital cameras June 2008 to June 2011

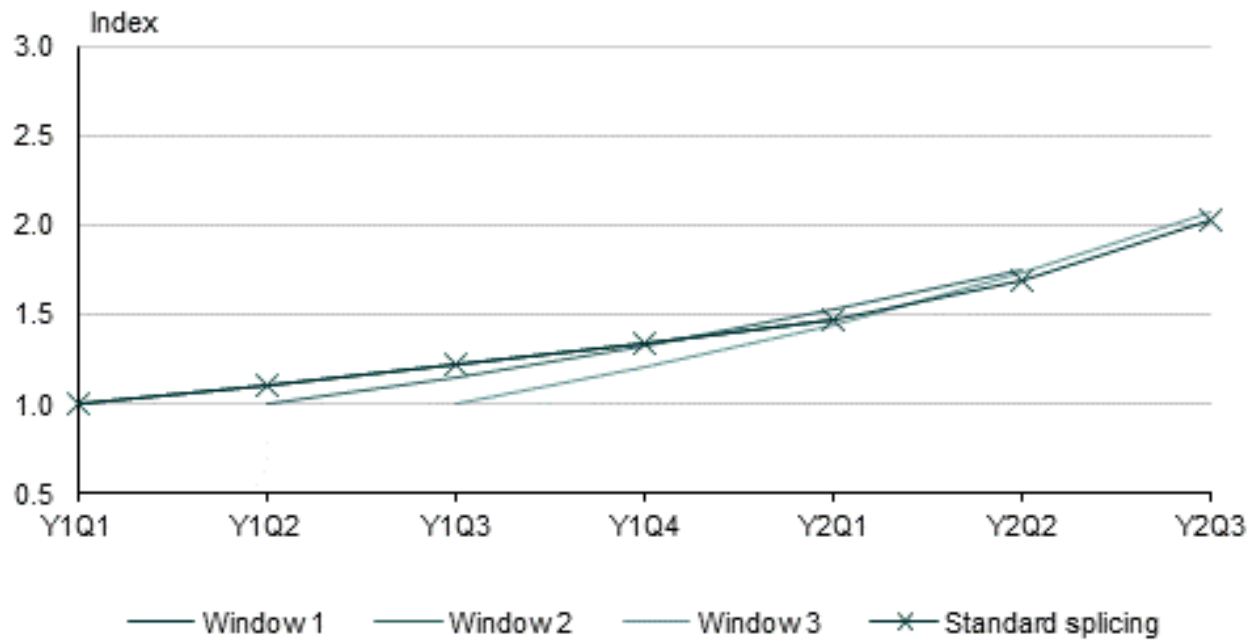


Source: GfK

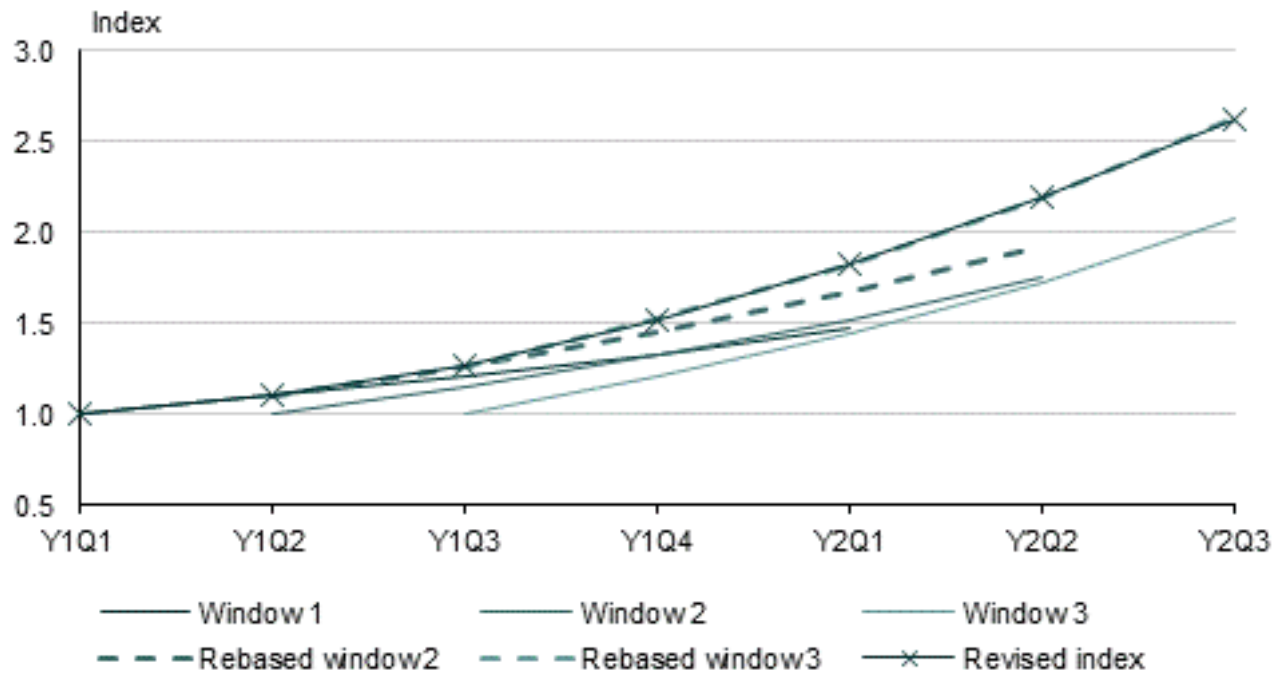
The window-splice



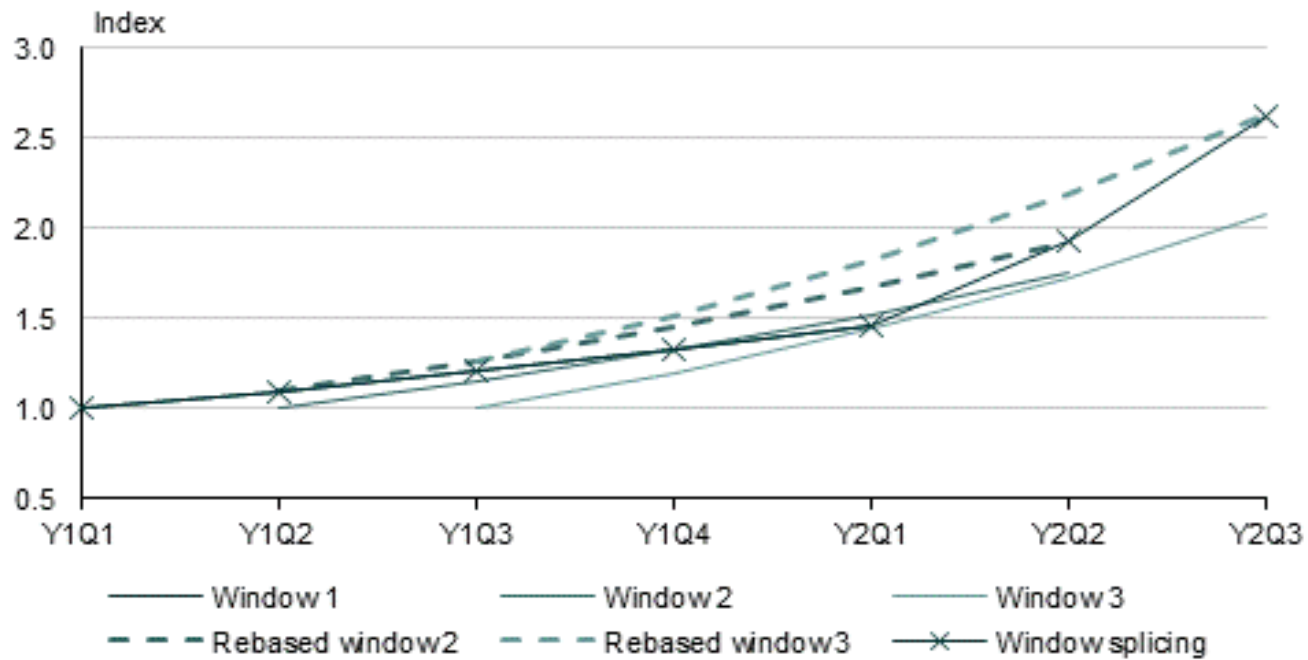
Source: Statistics NZ



Source: Statistics NZ



Source: Statistics NZ



Source: Statistics NZ

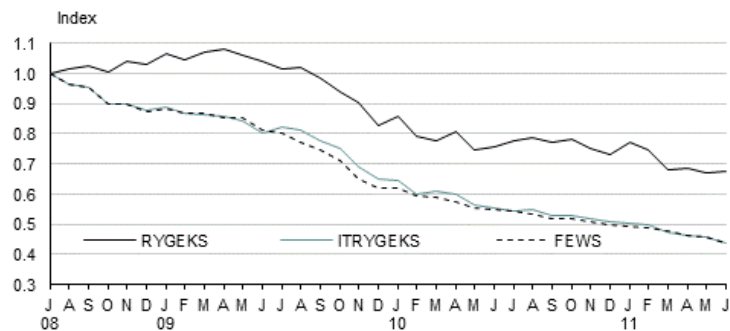
Empirical results

- ⊙ NZ consumer electronics scanner data (GfK)
3 years monthly data – characteristics and quantities
- ⊙ US supermarket scanner data (IRI)
6 years weekly data – no characteristics, quantities
- ⊙ NZ consumer electronics online data (BPP)
15 months daily data – no characteristics, no quantities

NZ consumer electronics (GfK)

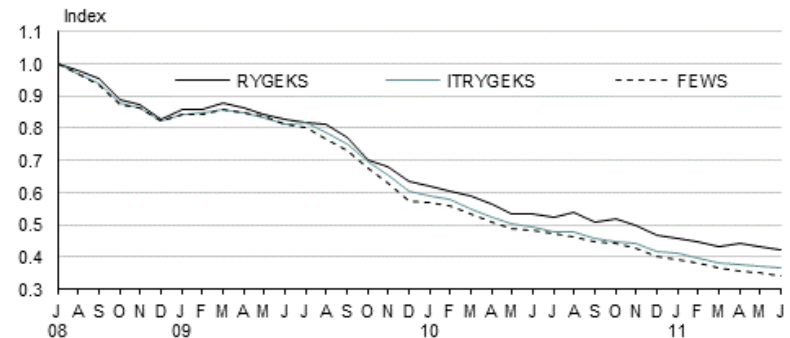
scanner data – characteristics and quantities

Laptop computers



Source: GfK

Televisions

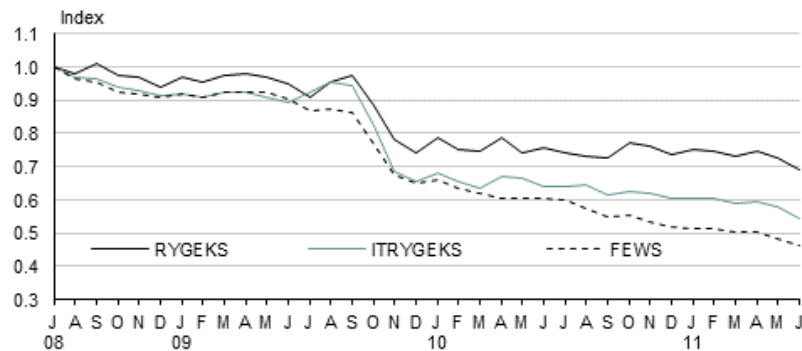


Source: Statistics New Zealand

NZ consumer electronics (GfK)

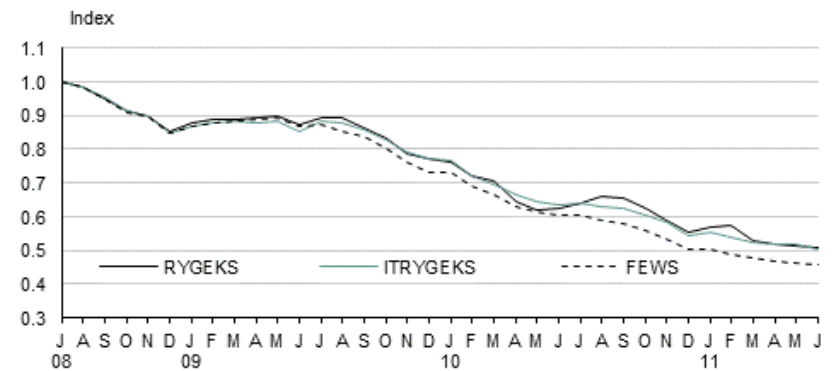
scanner data – characteristics and quantities

Desktop computers



Source: GfK

Digital cameras

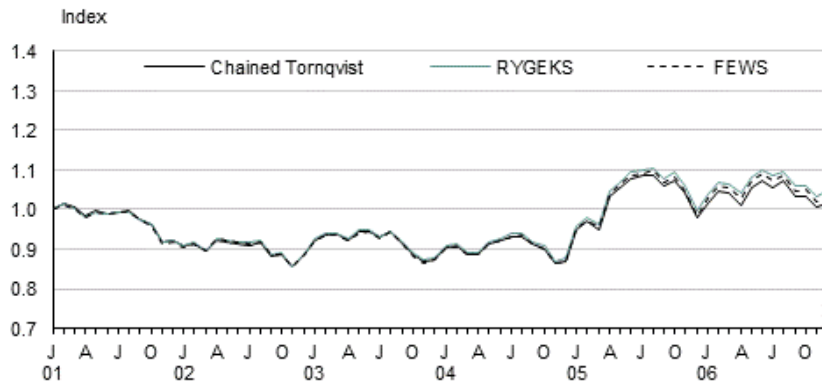


Source: GfK

US supermarket products (IRI)

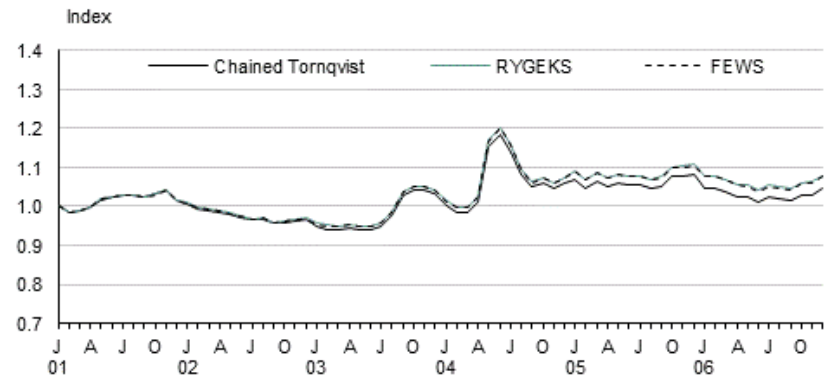
scanner data – no characteristics, quantities

Coffee



Source: IRI marketing

Milk

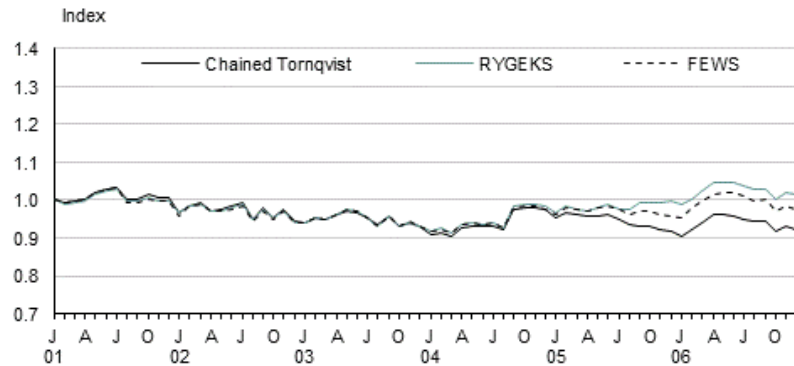


Source: IRI marketing

US supermarket products (IRI)

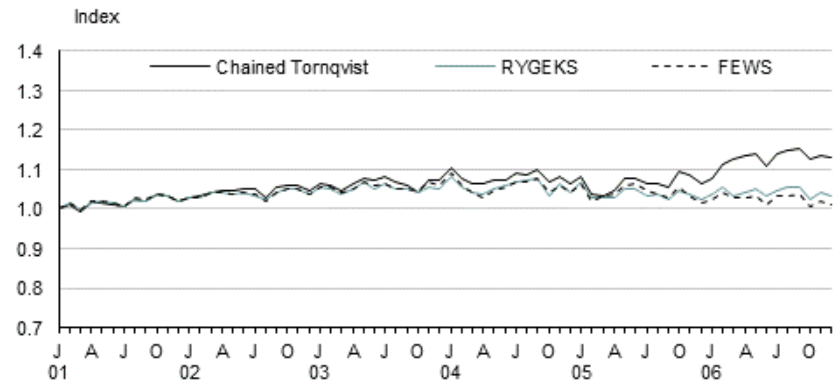
scanner data – no characteristics, quantities

Facial tissues



Source: IRI marketing

Razors

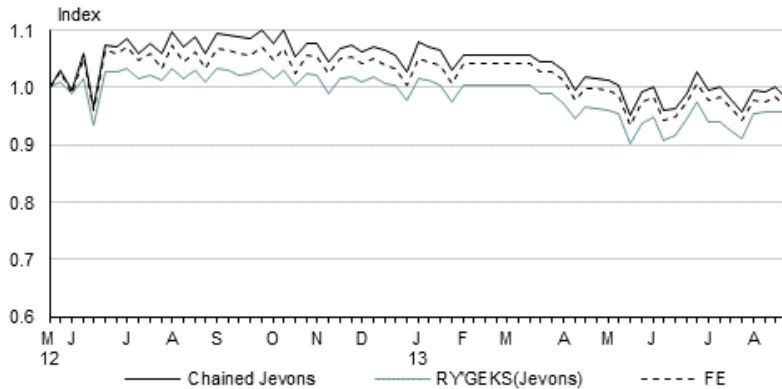


Source: IRI marketing

NZ consumer electronics (BPP)

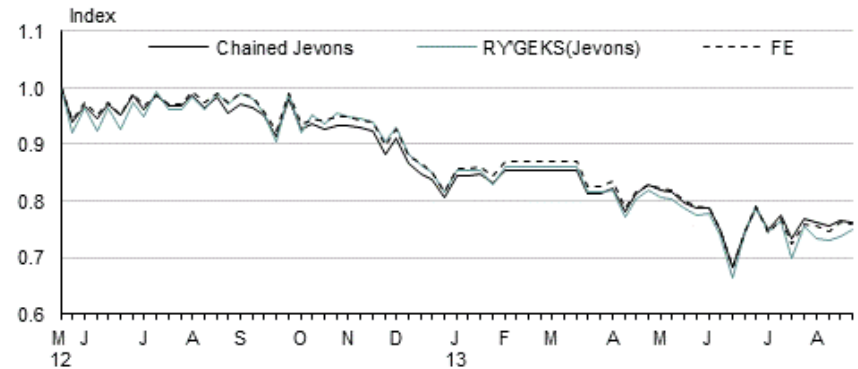
online data – no characteristics or quantities

Mobile computers



Source: Billion Prices Project @ MIT

Mobile phones

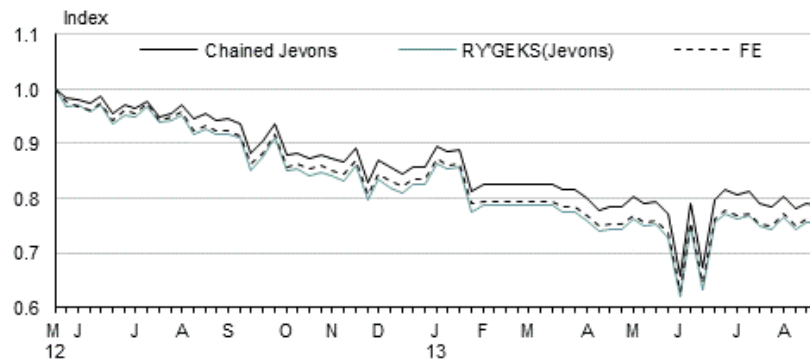


Source: Billion Prices Project @ MIT

NZ consumer electronics (BPP)

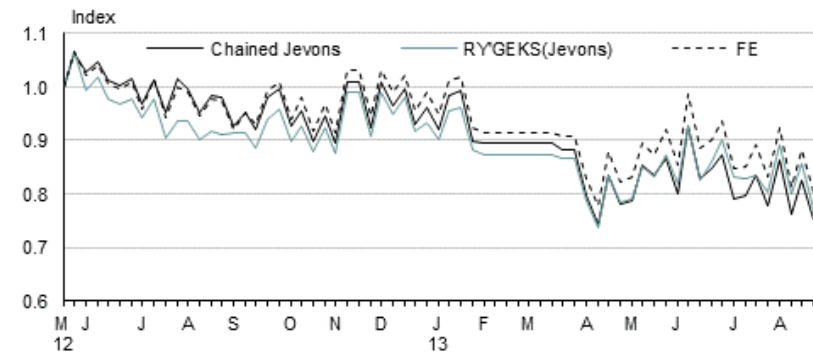
online data – no characteristics or quantities

Digital cameras



Source: Billion Prices Project @ MIT

Televisions

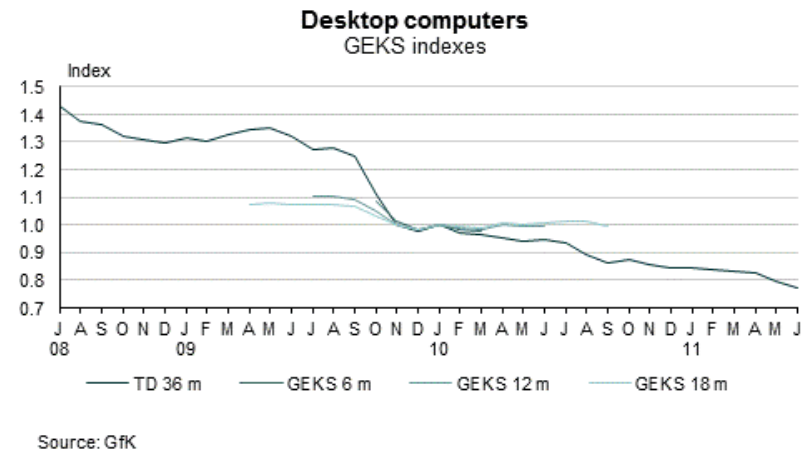
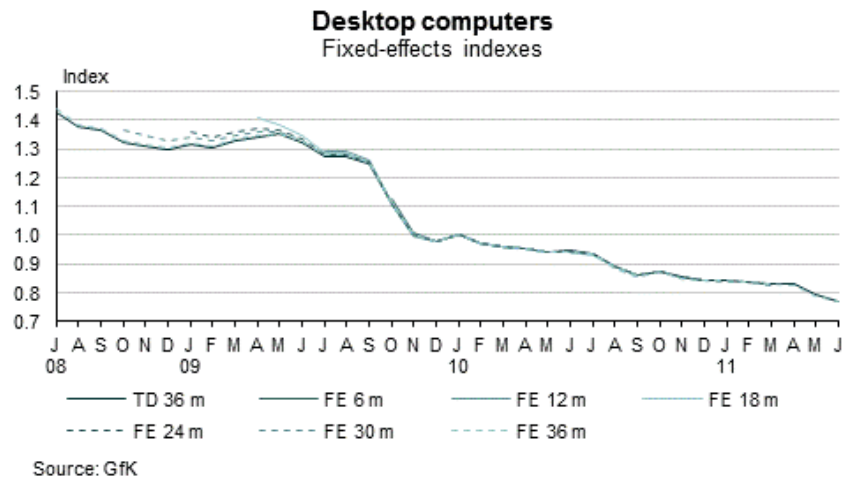


Source: Billion Prices Project @ MIT

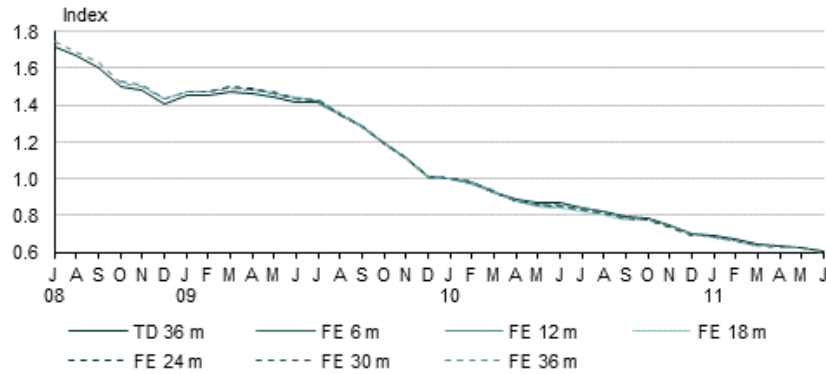
Comparison of methods

Negative	Chained Tornqvist	RYGEKS	RYTD	ITRYGEKS	FEWS
Subject to chain drift	Yes (-)	No (+)	No (+)	No (+)	No (+)
Requires explicit information on characteristics	No (+)	No (+)	Yes (-)	Yes (-)	No (+)
Sensitive to window length	No (+)	Yes (-)	No (+)	Maybe	No (+)
Requires extensive purpose-built code	No (+)	Yes (-)	No (+)	Yes (-)	No (+)
Requires statistical software	No (+)	No (+)	Yes (-)	Yes (-)	Yes (-)
Positive					
Reflects implicit price movements of new/disappearing products	No (-)	No (-)	Yes (+)	Yes (+)	Yes (+)
Can be explicitly formulated in terms of index theory	Yes (+)	Yes (+)	Maybe	Yes (+)	Maybe
Easy to explain	Yes (+)	No (-)	Maybe	No (-)	No (-)

RGEKS's sensitivity to window-length

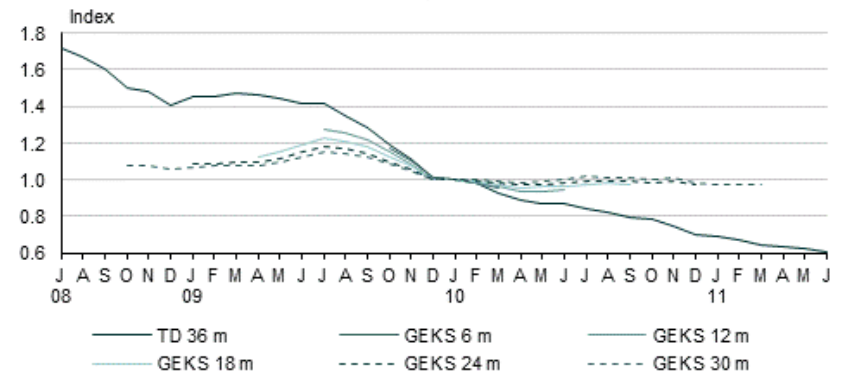


Televisions
Fixed-effects indexes



Source: GfK

Televisions
GEKS indexes



Source: GfK

Data structure required

month	product_spec_id	log_av_price	exp_share
Jan-01	AA1	0.20748	1.76E-05
Jan-01	AA2	1.09527	3.93E-05
Jan-01	AB1	1.79009	8.45E-06
Jan-01	AB4	0.04930	8.57E-06
Feb-01	AA2	1.92729	2.03E-06
Feb-01	AB1	1.09527	1.48E-03
Feb-01	AB4	1.90635	6.39E-06
Feb-01	AB8	1.86231	1.63E-06
	...		
Jan-02	AB4	0.38072	5.83E-06
Jan-02	AB8	1.90020	4.39E-05
Jan-02	BA1	0.13337	2.20E-06
Jan-02	BA2	1.97339	9.12E-04

SAS code for fixed effects model

```
ods output parameterestimates=FE_parameters fitstatistics=  
FE_fit;  
proc glm data=product_data;  
absorb product_spec_id;  
class month;  
model log_av_price = month / solution;  
weight exp_share;  
run;
```