Workshop 5
Higher-level indices: a practical guide

CPI expert group meeting

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Objectives

- Outline the ‘traditional’ approach to compiling the higher-levels of a CPI
- Outline some weaknesses and proposals to address these weaknesses
- Outline a quality framework so countries can make their own decisions about improvements to their CPI
- Aim for this workshop to be a discussion

Workshop outline

- The fundamentals
  - terminology
  - purpose of a CPI

- Part 1: The ‘traditional’ approach to compiling the higher-levels of the CPI

Workshop outline con't

- Part 2: Some weaknesses of the 'traditional' approach
  - substitution bias
  - proposals to address these weaknesses
    - Methods and data sources

- Part 3: A data quality assessment framework
  - Dimensions of data quality

Fundamentals

- Terminology
  - Higher-level index is an index for some expenditure aggregate above the level of an elementary aggregate. A higher-level index includes the overall CPI. E.g. beer, tobacco
  - Elementary aggregates are the smallest groups of similar (ideally homogenous) products for which weighting data are available. E.g. types of beer

Fundamentals – con't

- Often the term 'base period' is used
- Weight reference period: period covered by the expenditure weights (usually a year).
- Price reference period: period for which prices are used in the denominator in index calculation.
- Index reference period: period for which the index is set to 100.0

Fundamentals – con’t

- Laspeyres: price reference period and weight reference period coincide
- Young: weight reference period is from some period prior to the price reference period.
- Lowe: weight reference period is from some period prior to the price reference period, with weights price updated to the price reference period.
- Laspeyres-type index label is imprecise
- Paasche and Fisher
- Superlative index which requires current period weights

Fundamentals – con't

- Purpose of a CPI
  - Influences methodological and conceptual decisions
  - ABS CPI is a measure of household inflation (acquisitions approach)
  - ABS also has Living cost indexes (outlays approach)
  - ABS does not produce Cost of living index (COLI)

Fundamentals – con't

- Fixed basket: quality and quantity (weights) of products remain fixed.
- COLI: quality fixed, quantities (weights) are allowed to vary.
- Many NSOs do not construct their CPI as a COLI. This is because the quantities in one period is unlikely to be observable in practice.

- This workshop focuses on the fixed basket.

Fundamentals – con't

- Discussion
  - How do countries describe the purpose of their CPI?

Traditional approach

- The calculation of the CPI at the higher-levels requires two inputs:
  - Elementary aggregates (EAs); and
  - Weights
- Leads to two questions:
  - How to combine the EAs? and
  - What is the source of the weights?

Traditional approach – con't

- The higher-levels of the CPI are traditionally calculated as weighted arithmetic averages of the EAs using weights from some earlier point in time.

- Lowe or Young? Depends on purpose.

- What are the views of participants?

Traditional approach – con't

- Source of weights
  - Household Expenditure Survey
  - Very expensive
  - Infrequent in Australia
  - Under-reporting (alcohol, tobacco, gambling).

- Chain-linking when new weights available.

Part 2: Weaknesses

- Substitution bias
  - Comparison of the CPI versus the ideal index.
  - ABS 0.2ppts per year.
  - Statistics South Africa

Impact of methodology change on order of Laspeyres, Paasche and Fisher Indices

Statistics South Africa

May 2014

Introduction

- The official CPI is based on a Laspeyres-type (Young index) index, in which the weights are based in an historical period.

- Because consumers are believed to change their buying patterns away from higher inflation items over time, the Laspeyres index theoretically contains an inbuilt upward bias, the inverse is applicable to the Paasche-type index (both are fixed basket indices).

- The Fischer index is an approximation of a cost-of-living index (COLI).

Introduction

- A backward Paasche, forward Laspeyres and Fisher (based on the Paasche and Laspeyres) was calculated when the new weights were introduced in January 2013.

- For this exercise the base remained at 2008 = 100

- There were many methodological changes made in the CPI, most notable the use of the net weight for insurance and used vehicles and price-updating of the weights.

- The methodological changes introduced major shifts if the weights.

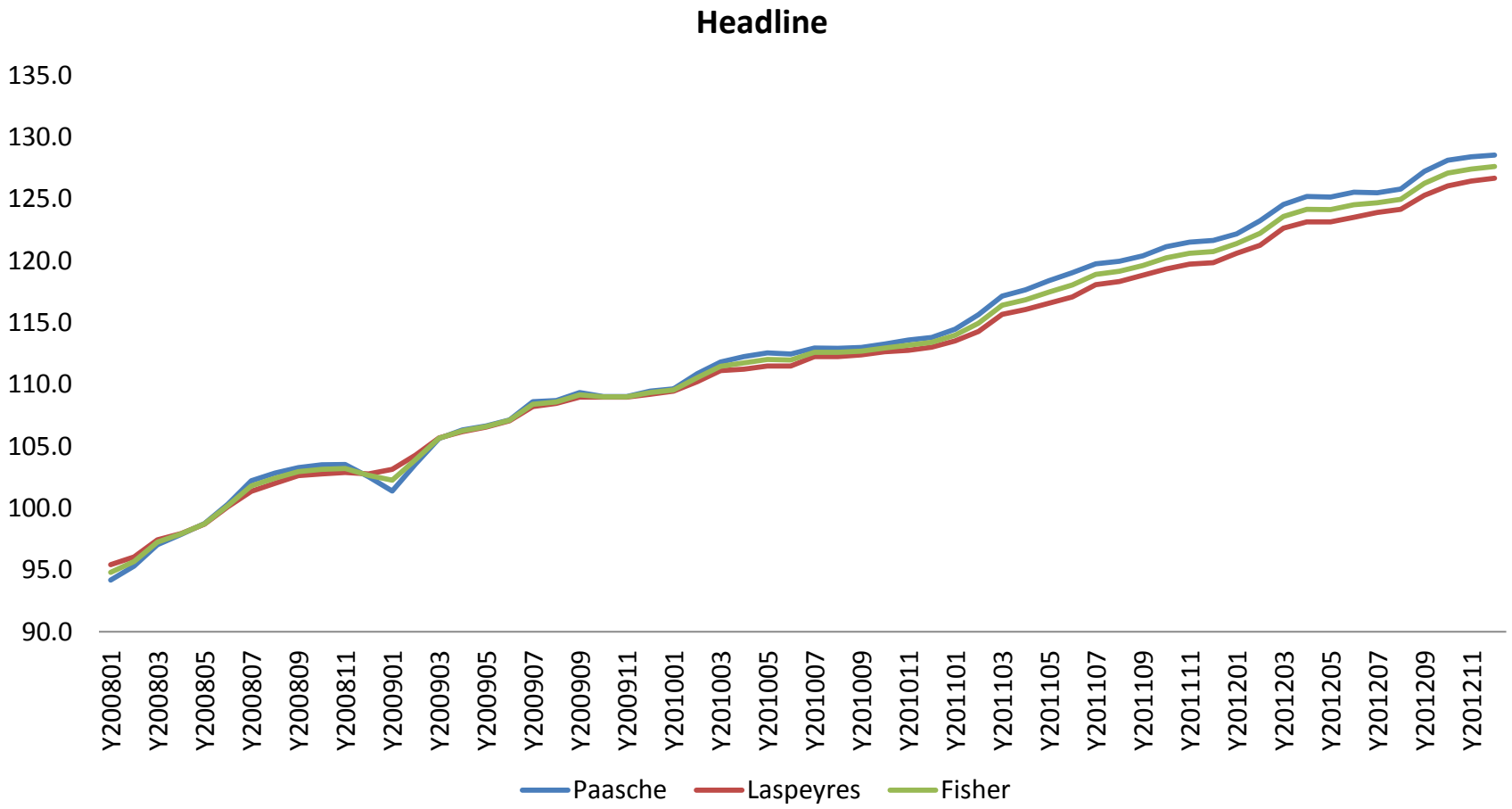
Weights

COICOP Division	Laspeyres	Adjusted Laspeyres	Paasche
Food and non-alcohol beverages	18,28%	20.59%	18.19%
Alcoholic beverages and tobacco	5,56%	5.43%	5.37%
Clothing and footwear	4,42%	3.74%	4.37%
Housing and utilities	21,04%	23.40%	23.14%
Household contents and services	6,14%	5.56%	4.93%
Health	1,48%	1.38%	1.39%
Transport	17,79%	14.80%	16.07%
Communication	3,13%	2.60%	2.54%
Recreation and culture	3,93%	4.65%	4.07%
Education	2,15%	2.02%	2.66%
Restaurants and hotels	2,78%	3.17%	3.33%
Miscellaneous goods and services	13,30%	12.67%	13.94%

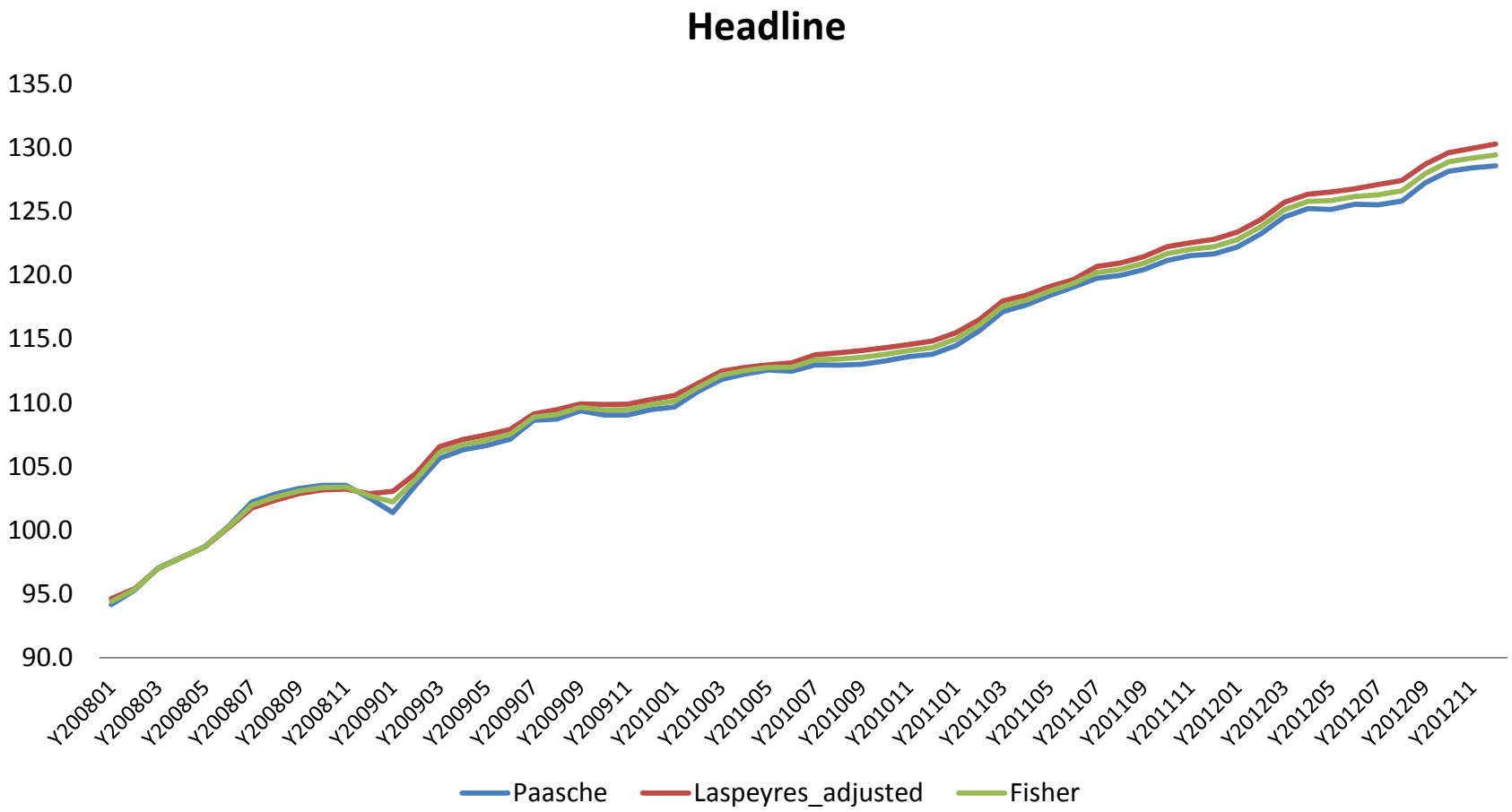
Weights

- The Laspeyres weights set refers to the weight set that was used up till December 2012.
- The Paasche weights set refers to the set used from January 2013.
- The adjusted Laspeyres set is the weight set based on the set used up to December 2012, that is adjusted with all the methodological changes made to the 2013 set.

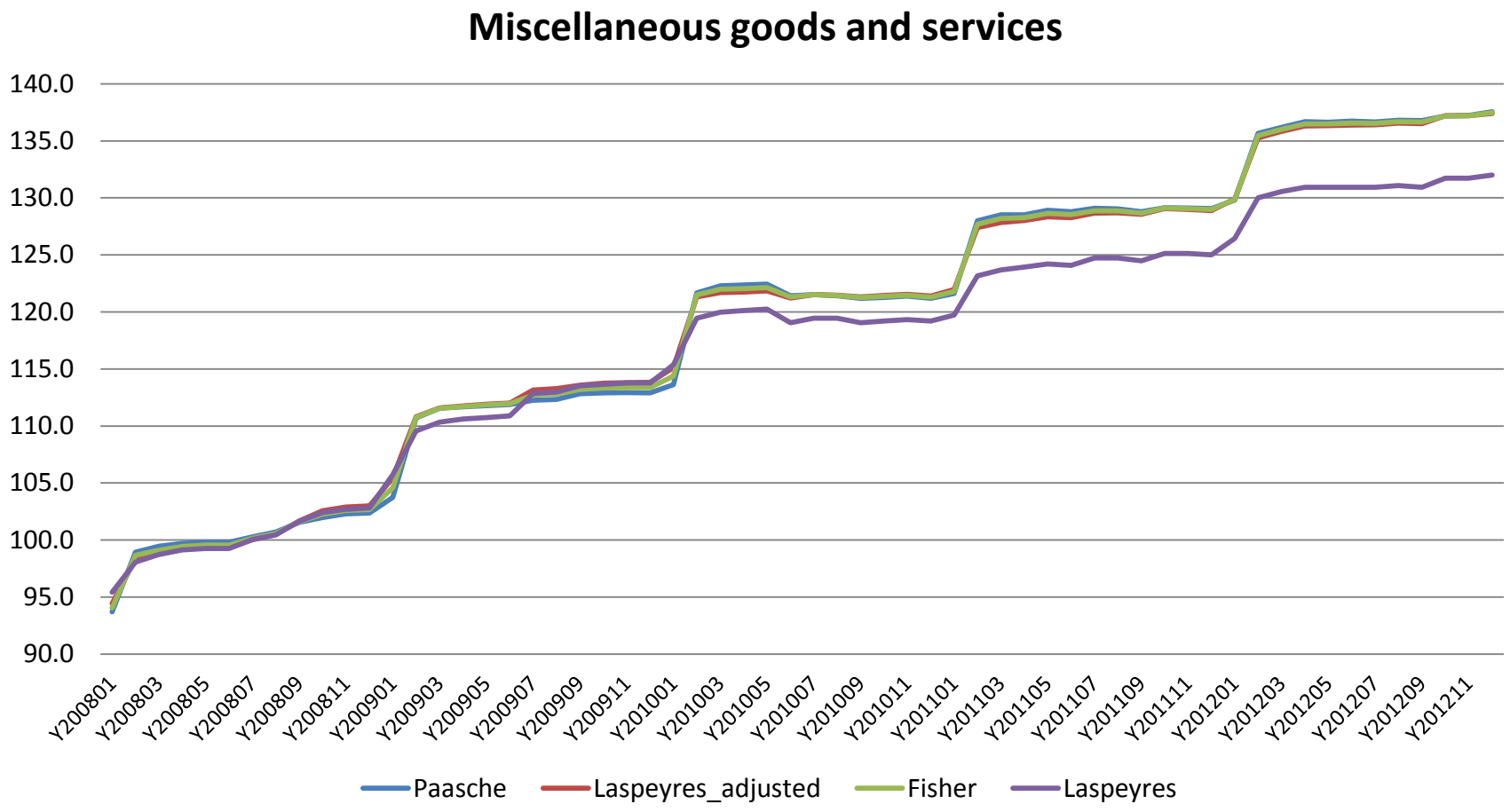
Results based on unadjusted Laspeyres



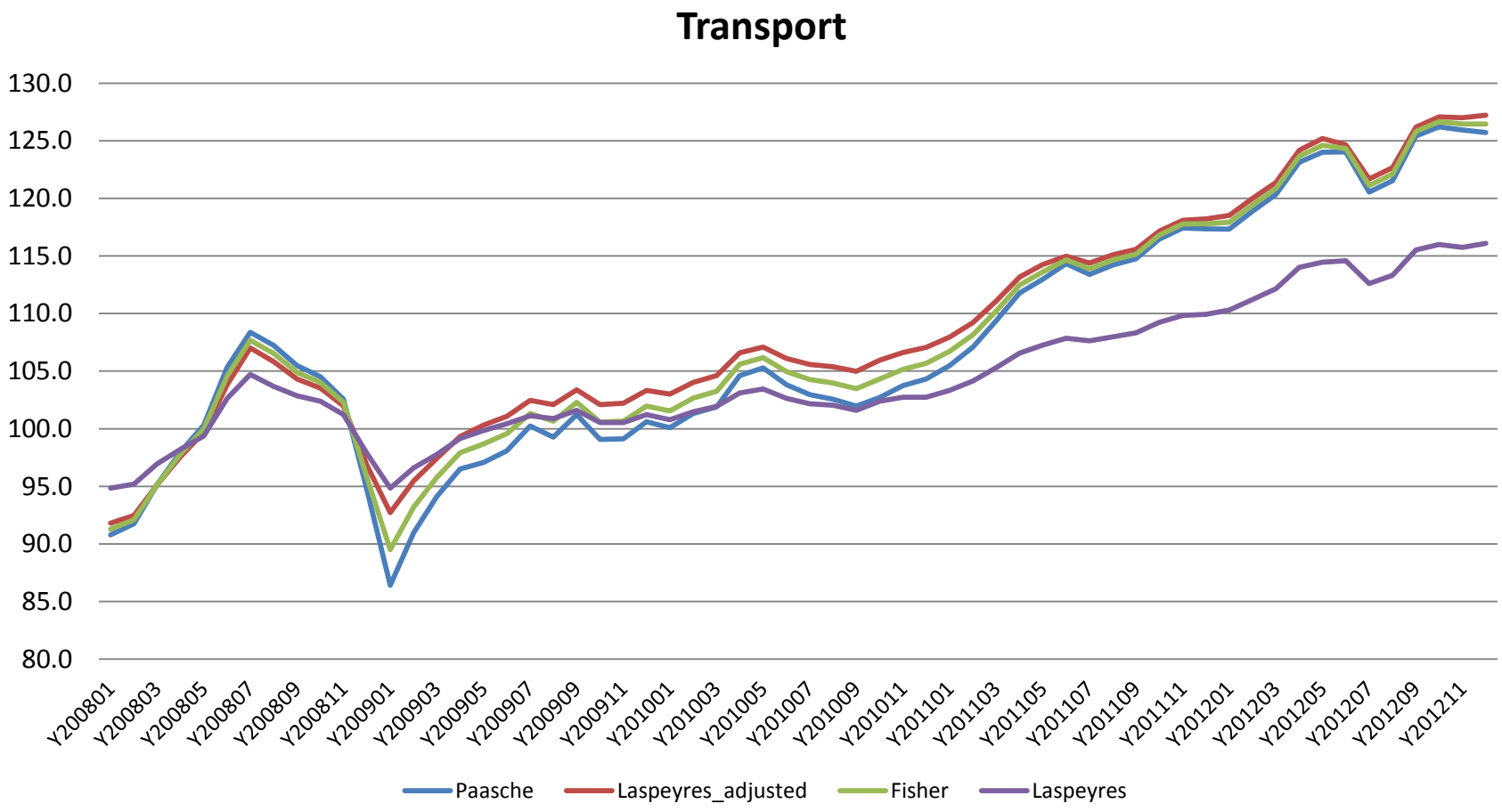
Results based on adjusted Laspeyres



Differences: Miscellaneous goods and services



Differences: Transport



Addressing weaknesses

- Source of weights
  - HES versus HFCE
  - Country experiences

- Methods – ‘Post Laspeyres’

HES v HFCE

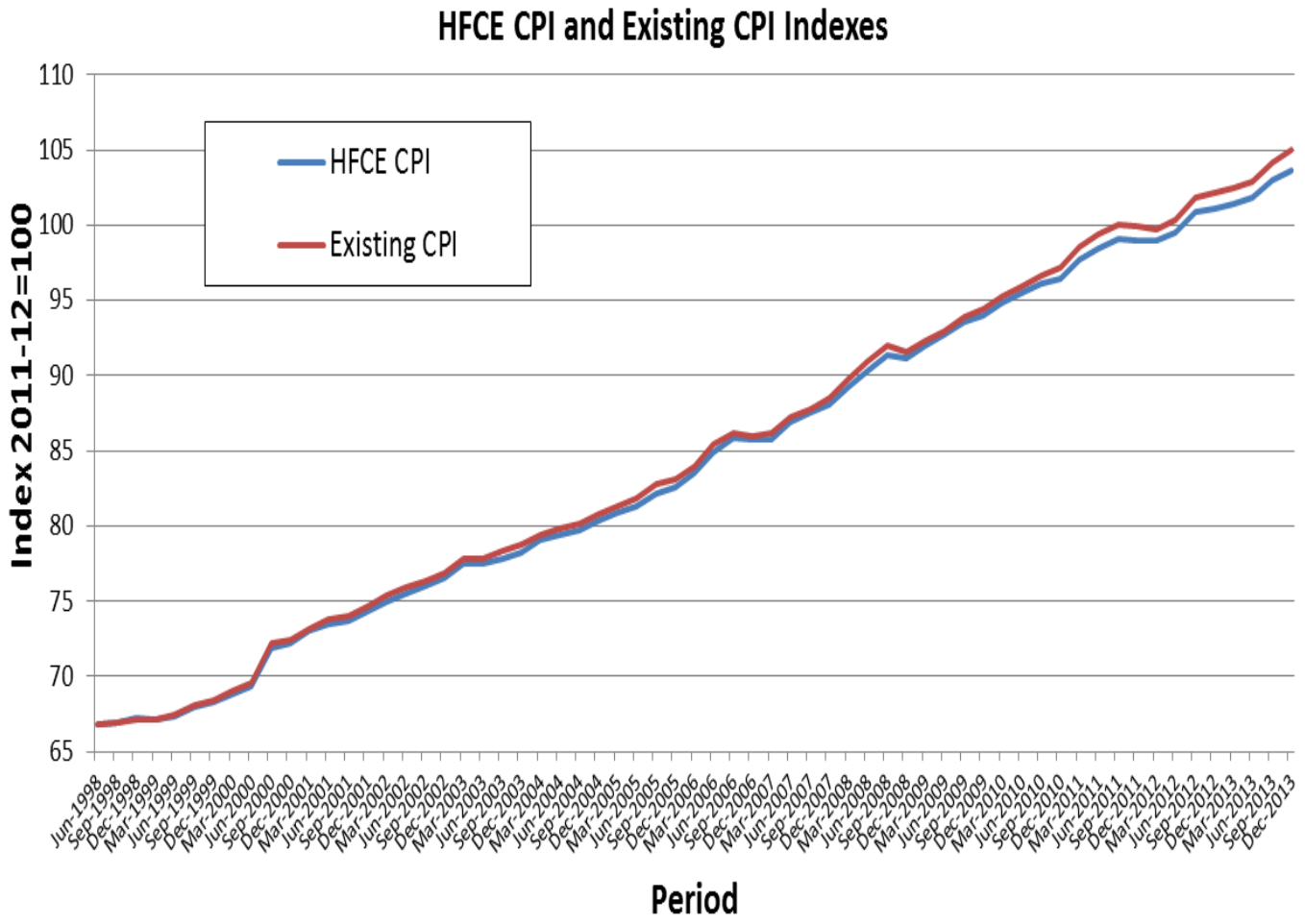
- ABS study
- Examines the use of an alternative source of data for deriving the weights applied at higher levels of the CPI. Weights applied at the lower levels are subject to more frequent change and are derived from HES data and a range of supplementary sources.

HES v HFCE

- Experimental indexes from June 1998 to December 2013 inclusive were calculated using weights derived from the Australian System of National Account (ASNA), Household Final Consumption Expenditure (HFCE) estimates.

- The availability of detailed HFCE data on an annual basis allowed for the calculation of annually reweighted, chain-linked indexes. Results from this analysis show that the index calculated using HFCE weights, hereafter referred to as the “HFCE CPI”, follows the trend of the existing ABS CPI.

HES v HFCE


HFCE CPI and Existing CPI Indexes
HFCE CPI
Existing CPI
Index 2011-12=100
110
105
100
95
90
85
80
75
70
65
Period

HES v HFCE

- There are some challenges to overcome.
- For example, HFCE excludes expenditure on home insurance and maintenance of dwellings, and imputes rental payments for owner-occupied dwellings. The CPI represents home ownership costs by actual net house purchase (excluding land) plus alterations and additions and installed appliances. This is one area in particular where further investigation is required.

HES v HFCE

- Concordance between HFCE and HES.

- Fairly significant differences exist between the weights derived from HFCE and HES for some ECs; such as the rents, automotive fuel, restaurant meals and take away and fast food ECs. These differences are due to the conceptual treatment and the data on which the expenditure estimates are based.

HES v HFCE

- What are the experiences of countries in this area?

Post Laspeyres proposal

- **Post-Laspeyres: The Case for a New Formula for Compiling Consumer Price Indexes**

Paul Armknecht and Mick Silver

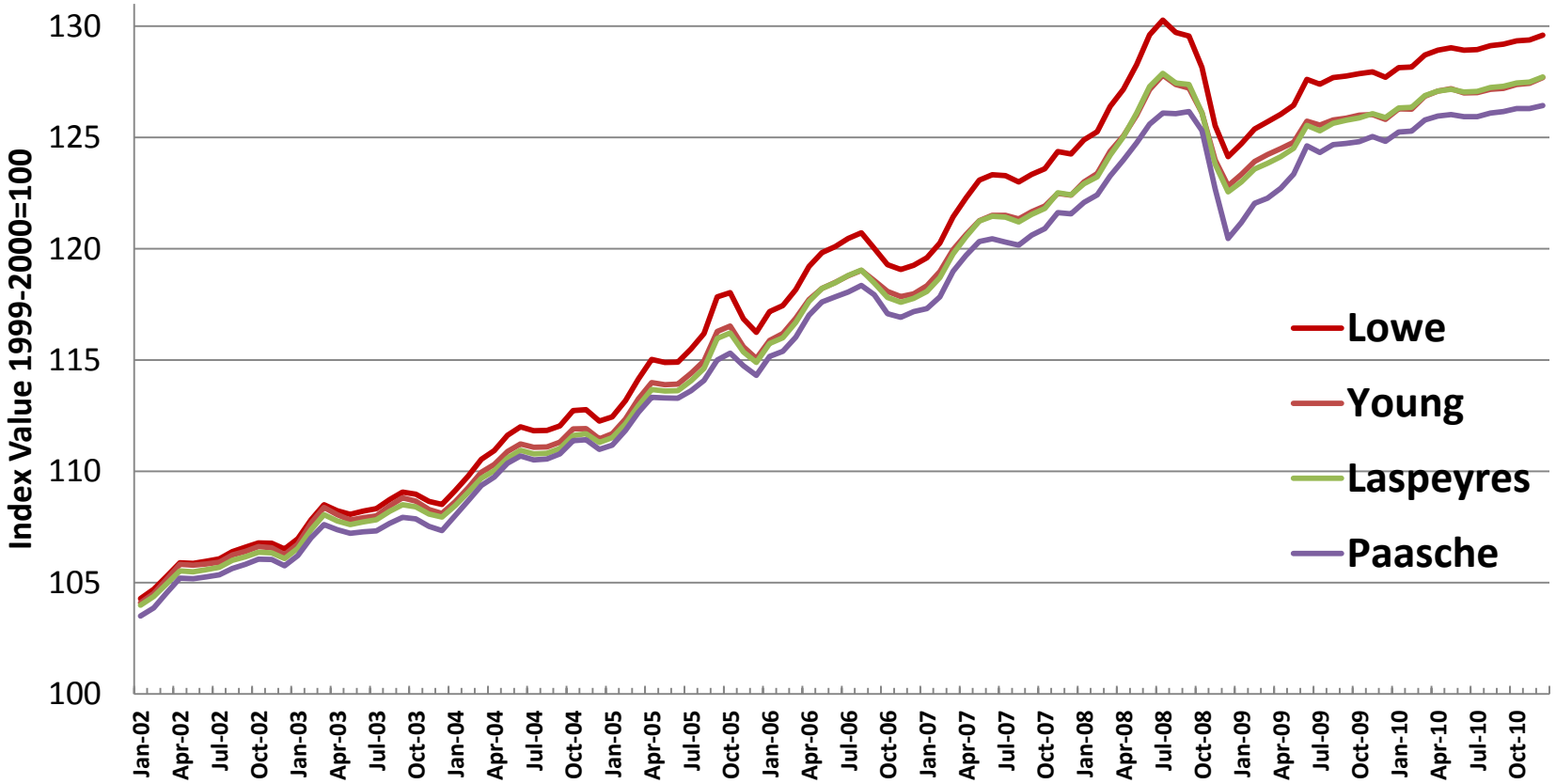
International Monetary Fund[1]

- **NOTE: This is a summary of the presentation made by the authors to the Ottawa Group meeting in 2013. All changes to the original presentation have been made by Marcel van Kints and therefore any errors etc are his.**

- [1]*The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management*.

Methods – con't

Figure 1: Arithmetic indexes



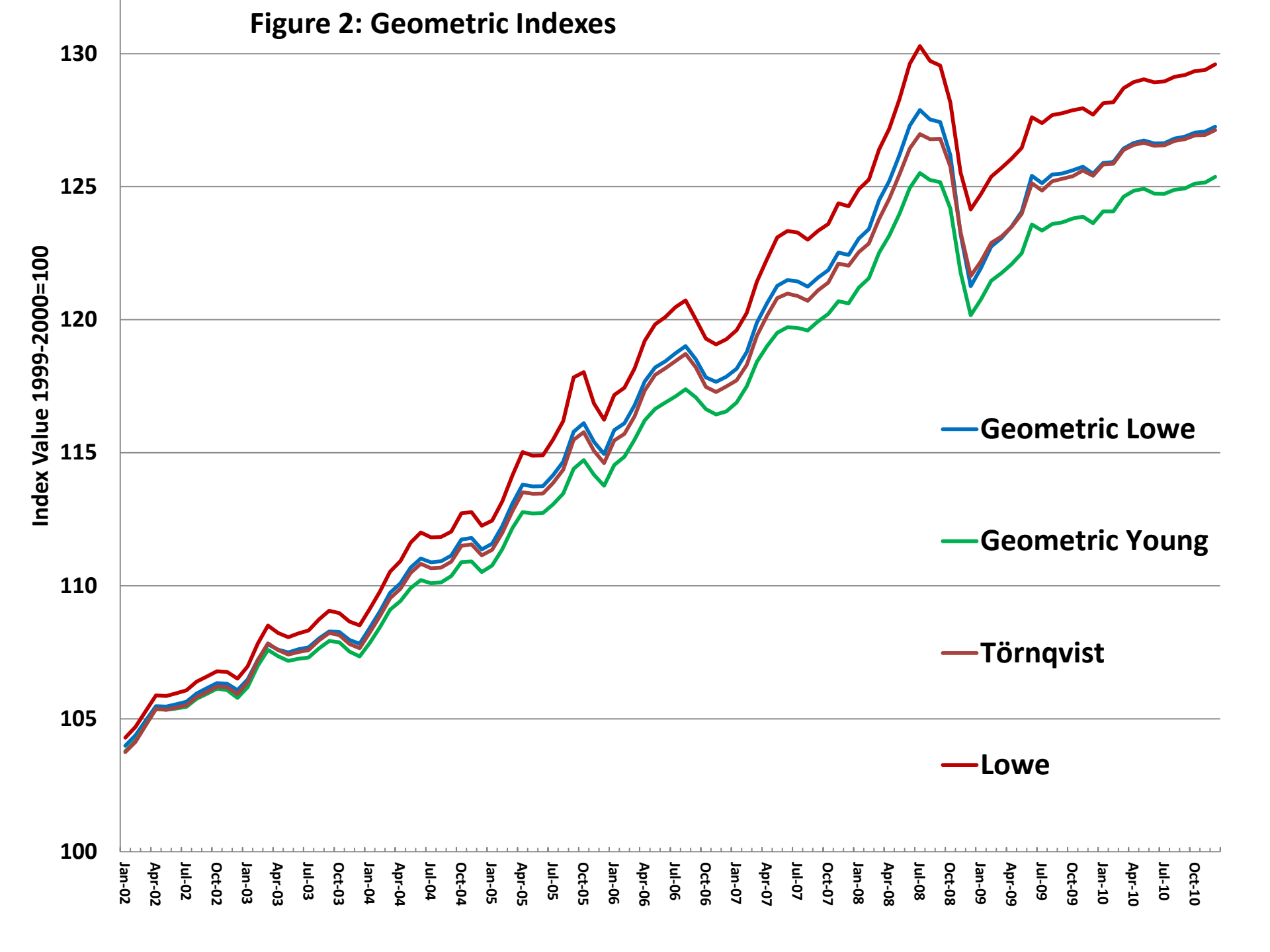


Figure 2: Geometric Indexes
Index Value 1999-2000=100
130
125
120
115
110
105
100
Jan-02
Apr-02
Jul-02
Oct-02
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04
Jul-04
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Jul-09
Oct-09
Jan-10
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Jul-10
Oct-10
Geometric Lowe
Geometric Young
Törnqvist
Lowe

Concluding remarks

- Lowe is upwards bias against Laspeyres,
- Laspeyres upwardly biased against a superlative index.
- Young is problematic axiomatically and is volatile.

Alternatives:

- Are there alternative measures that National Statistical Offices (NSOs) can compile in real time that approximate the target indexes?

CONCLUDING REMARKS (CONTINUED)

- **Alternative measure are available that can be compiled in real time using existing data:**
  - Geometric Lowe,
  - Geometric Young

Data Used for Test Indexes

- **Data**: elementary aggregate indexes for the U.S. CPI and their weights, January 1998 to December 2011 (U.S. Bureau of Labor Statistics).
- 211 product groups for the large part derived using geometric means. Price updated from mean of mid-point to December prior to reweighting (every two years).

Mean-annual expenditures weights for:	Basis of
1993-1995	Jan98-Dec01
1999-2000	Jan02-Dec03
2001-2002	Jan04-Dec05
2003-2004	Jan06-Dec07
2005-2006	Jan08-Dec09
2007-2008	Jan10-Dec11
2008-2009	Jan11-Dec12

Table 2: Percentage Differences in Annual Growth Rates between Alternative vs Target Indexes:[a]		
	Fisher	Tornqvist
Arithmetic formulas		
Lowe	0.161	0.159
Young	0.016	0.013
Geometric formulas		
Geometric Lowe (GLowe)	-0.012	-0.014
Geometric Young (GY)	-0.156	-0.159
Geometric means of formulas		
GY-Young	-0.070	-0.073
GY-Lowe	0.002	0.000
GLowe-Young	0.002	0.000
GLowe-Lowe	0.075	0.072
Lent-Dorfman (η using 2-year lag) [b]		
GY-Young	-0.046	-0.047
GY-Lowe	-0.046	-0.048
GLowe-Young	-0.003	-0.005
GLowe-Lowe	0.010	0.007
Lloyd-Moulton (η using 2-year lag) [b]		
L-M (Greenlees est of η)	-0.044	-0.047
L-M (L-D est of η)	-0.028	-0.030

[a]Covers January 2002 to December 2010

[b]January 2002 to December 2003 uses a one-year lag

CONCLUDING REMARKS (CONTINUED)

- **In the U.S. data, the Geo-Lowe performs well but there is no theoretical justification for its use.**

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Concluding Remarks (continued)

- Using simple geometric averages of an upward biased index with one that is downward biased can provide good real-time approximations of the target indexes.

CONCLUDING REMARKS (CONTINUED)

- US example more frequent updates than some countries and some smoothing of weights. Differences less pronounced.
- This is an interesting area for additional research so that NSOs can rightly move beyond a Laspeyres-centric world of price index calculations.
- Real purpose is to start a rethink of the Laspeyres-type position.

Part 3: Data Quality Framework

- Difficulty for many NSOs is to determine whether to implement proposed methodological changes or utilise alternate data sources to compile their CPI.

- Key question: What is the impact on the quality of the CPI?

Data quality framework – con't

- Quality means much more than accuracy.

- Various frameworks available.
- ABS framework
  - Institutional environment
  - Relevance
  - Timeliness
  - Accuracy

Data quality framework – con’t

- Coherence
- Interpretability
- Accessibility

- Focus here on timeliness, accuracy, interpretability.

Data quality framework – con't

- Accuracy
  - Results versus an ideal (superlative) index.
- Timeliness
  - Release soon after the reference period
- Interpretability
  - Can the change be explained to users.