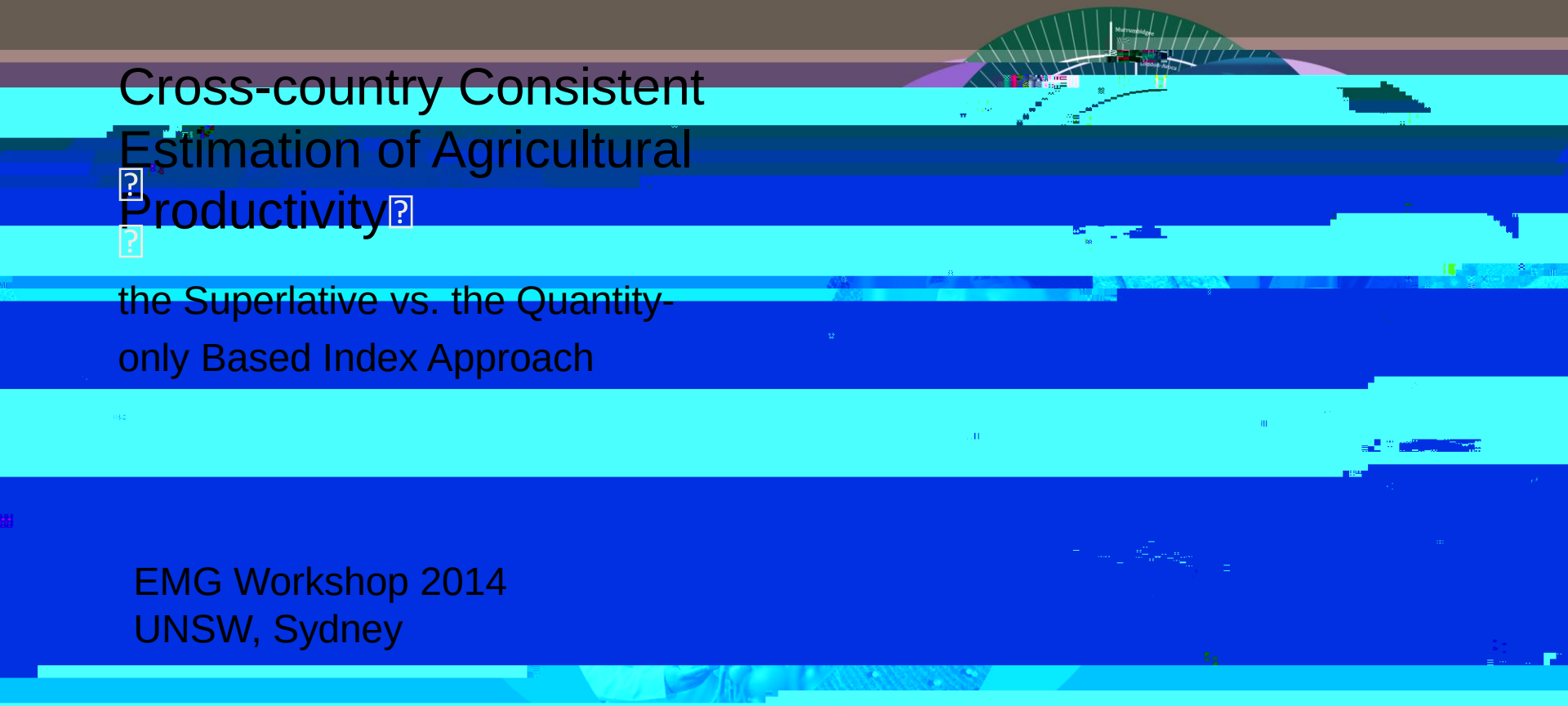
Cross-country Consistent Estimation of Agricultural Productivity

the Superlative vs. the Quantity-only Based Index Approach



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Agricultural productivity growth is at the heart of dealing with global food security

- global agricultural total factor productivity grew at 1.0 pct a year between 1961 and 2010
- it accounted for a significant proportion of agricultural output growth and depressed global food price

However, agricultural productivity grows unevenly across countries

- No evidence of convergence in agricultural productivity between developed countries
- significant gap in productivity levels and growth between developed and developing countries

It is essential to measure and compare agricultural productivity across countries.

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The growth accounting based index method is widely used a tool to measure agricultural TFP at the industry level.

- initially developed by Jorgenson and Nishimizu (1978) and others
- large amount of literature including Ball et al. (2001, 2010), Fuglie (2010), Coelli and Rao (2005), Ludena et al. (2007) and Nin-Pratt and Yu (2009) etc.

Most of these studies can be categorised into two groups, depending on the index method that they have used

- the superlative index (i.e. Fisher or Törnqvist)
- the quantity-only based index approach (i.e. Malmquist)

Although the two methods should be equal theoretically (Fare 1994), it is not known which one performs better from an empirical perspective.

This paper aims to apply both of these index methods to cross-country

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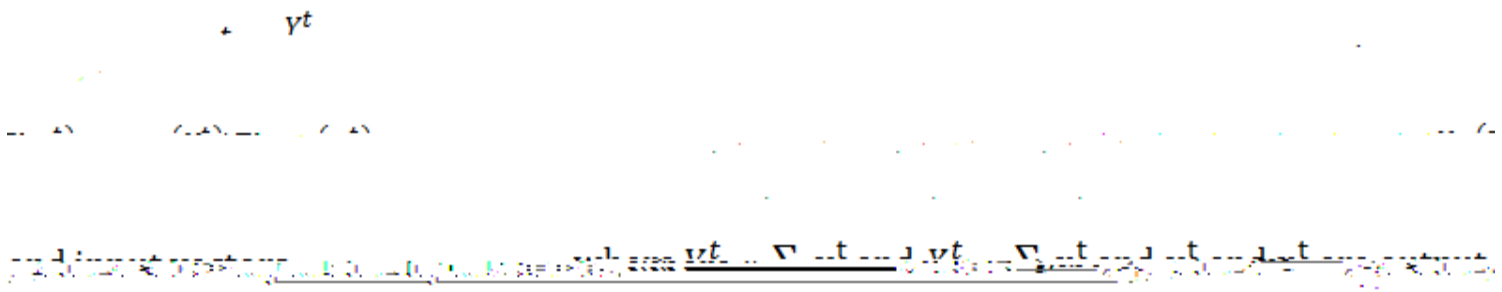
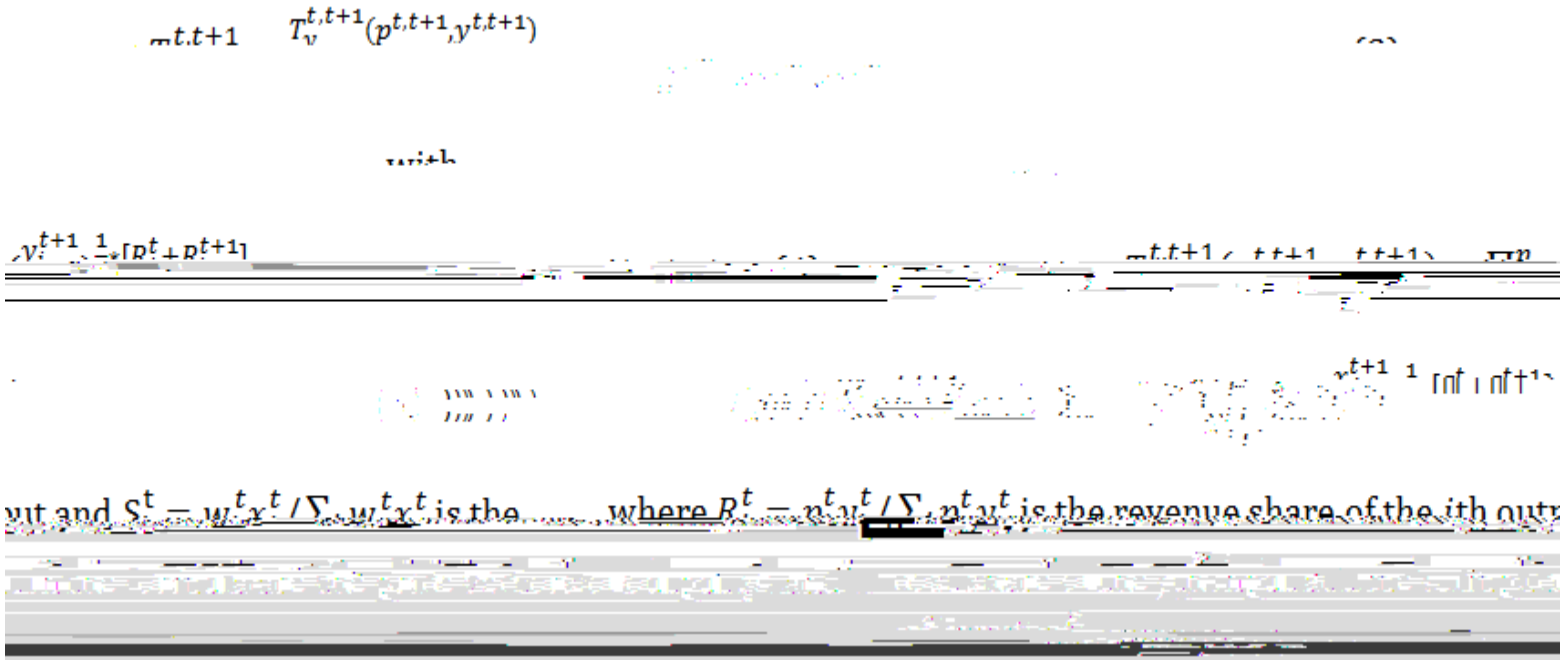
Agricultural TFP is measured as the ratio of gross output to total input such that



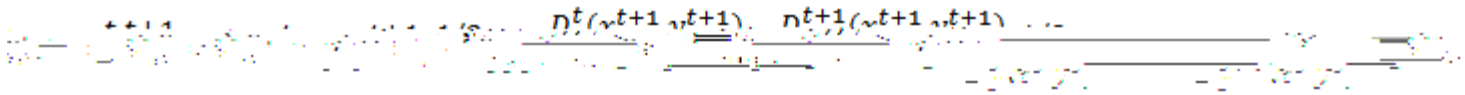
How we aggregate different outputs and inputs into the corresponding quantity/volume index matters for the final results

- Form of transformation function (i.e. parametric vs. non-parametric)
- Weights to be used (i.e. real price vs. implicit price)

The superlative index (i.e. Törnqvist) uses revenue shares as weights for output aggregation and cost shares as weights for input aggregation.



The quantity-only based index (i.e. Malmquist) uses implicit prices as weights for output and input aggregation



A distance function has been employed into the estimation of changes in aggregate input and output quantity

the measure could be further used to split the efficiency change component from a technical change component, implying that there could be off-frontier possibilities.

Following Kousmanen et al. (2004), t

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The results obtained from this paper will be summarised in three areas

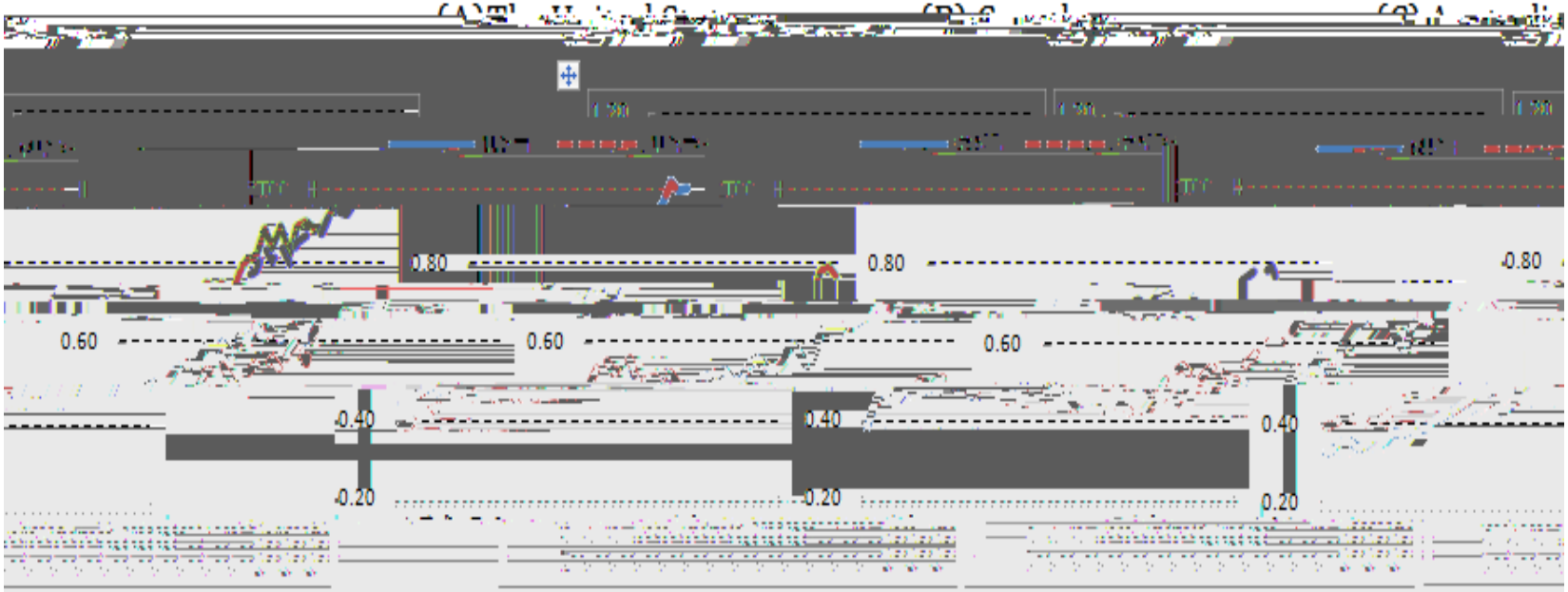
Compare agricultural TFP estimates between the United States, Canada and Australia

Examine difference in the results obtained from using the two methods and explore the potential reasons.

- In particular, we need to compare the value shares used as weights for outputs and inputs in aggregation
- This means we need to compare real prices to implicit prices, since the quantities are same.

Explore the relative performance of the two methods at different aggregation levels

- 2 outputs x 4 inputs
- 6 outputs x 10 inputs
- 16 outputs x 10 inputs



N", and "AUS" denote the

"_M" stand for results from the

Note: The three figures display levels of agricultural TFP for the three countries. "USA", "CA

United States, Canada and Australia respectively. The last letter of each indicator, "_T" and

Agricultural TFP has been increasing in all the three countries over time

The finding is consistent with our previous study

It is consistent with literature using different methods and data.

The two index method will generate different agricultural TFP estimates across countries.

The difference lies in agricultural TFP estimates for all countries

The estimates obtained from the two approaches is opposite in direction for Canada

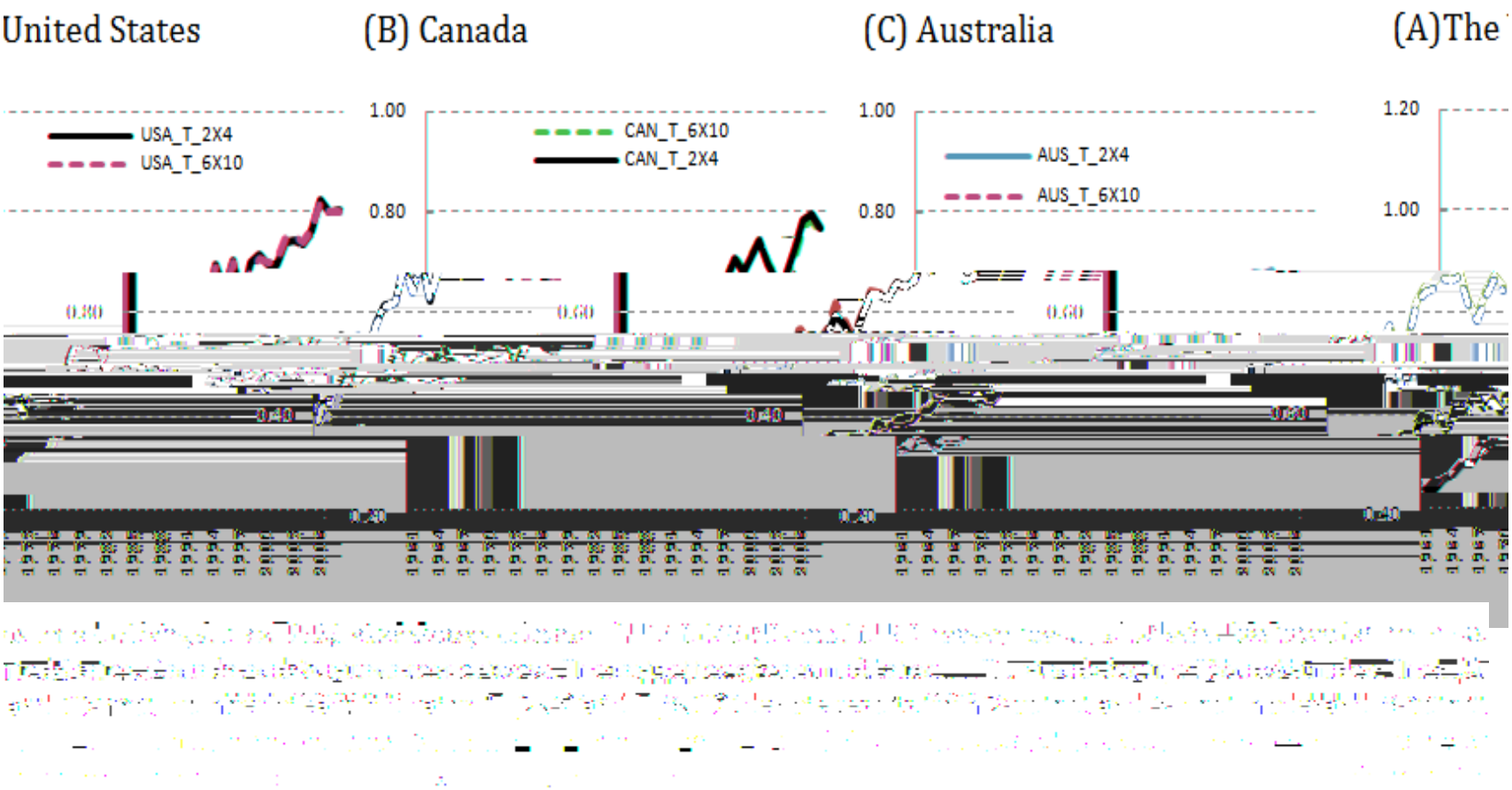
Reasons need to be provided to explain the difference in findings obtained from the two index methods

The data are same so it will not cause the problem.

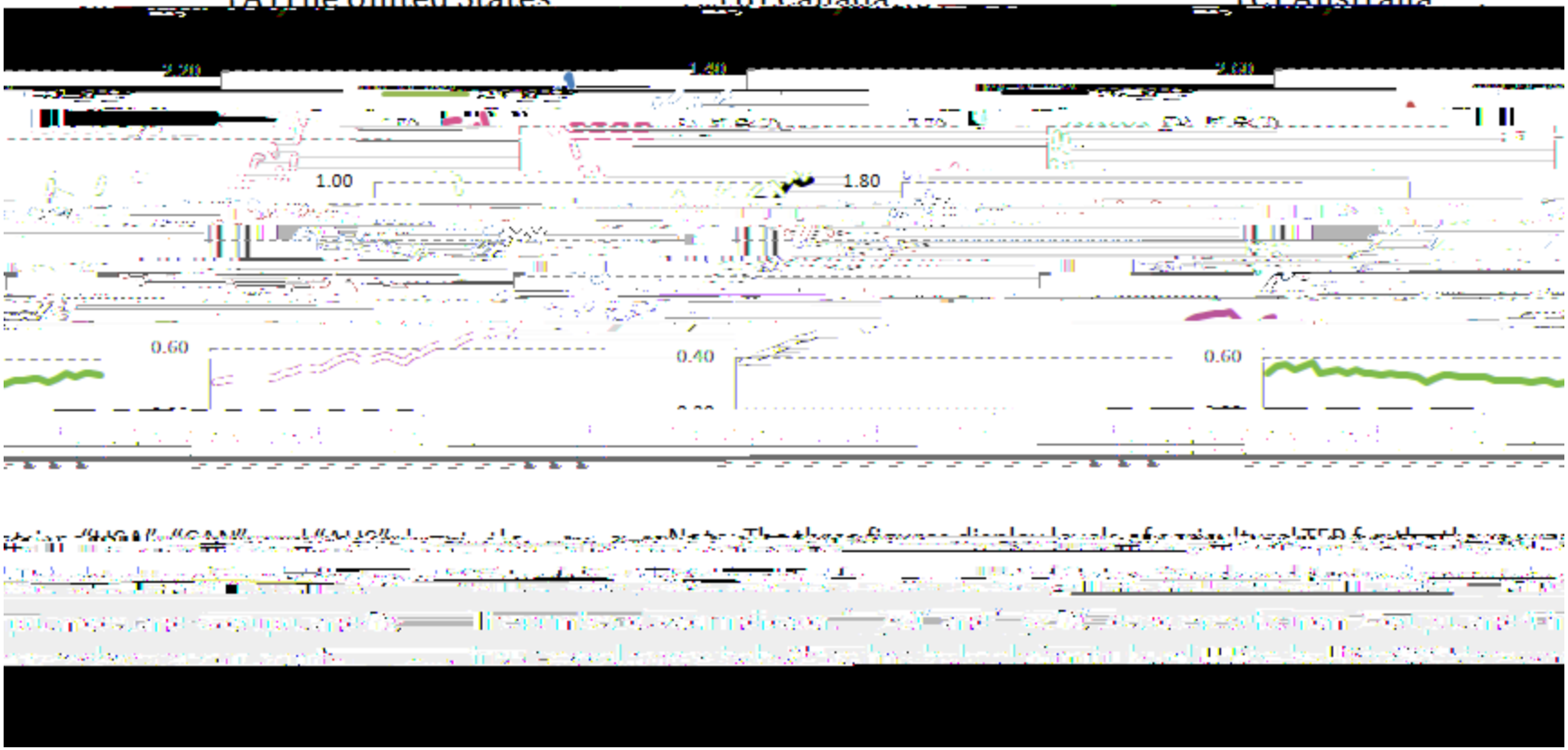
Table 1 Output/input share and real prices in the Törnqvist index: average between1960-2006

Table 2 Output/input share and implicit prices in the Malmquist index: average between1960-2006

Figure 2 Comparison of estimated Törnqvist TFP growth: 2x4 model vs. 6x10 model



(A)The United States (B) Canada (C) Australia



There are challenging issues both in the construction of cross-country consistent data as well as the choice of measurement methods.

We find that agricultural productivity in these three countries have generally been increasing during the period under study, though uneven across countries.

In terms of method comparison, agricultural TFP estimates obtained from using the superlative index outperforms those obtained from using the quantity-only based index.

Our finding points to the importance of price data collection work for cross-country consistent agricultural productivity comparison.

Questions and

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