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Incorporating the Share economy into the Australian CPI.

Abstract: Traditional economic flows are simple and involve two parties; producers and consumers. However technological advancement and the advent of the internet have provided a new platform for institutional units to operate and engage in economic activities and transactions with each other. The Share economy is a model in which providers use existing assets to generate new economic flows through a third-party facilitator, generally using a web-based platform. The Share economy is structured with three parties; a producer, facilitator and consumer. There are two types of economic activity that occurs: the first is the Provider selling a good or service to the Consumer; the second is the Facilitator providing the platform for the Producer to enable the transaction to take place.

This paper provides information on a new and emerging kind of economic activity termed the 'Sharing economy'. The primary contribution of this paper is to the broad Share economy debate is to provide a decision tree that can be used to determine on a case-by-case basis if and how a Share economy business should be included in one or more Price Index. Empirical results are also presented.

Key words: Share economy, Decision tree, Ride sharing, Share accommodation

The views expressed in this paper are those of the author and do not necessarily reflect the views of the Australian Bureau of Statistics (ABS).

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1. Introduction

Maintaining a contemporary basket of goods and services is an important step in ensuring the ongoing relevance of a Consumer Price Index (CPI). The treatment of new outlets and products can be a difficult exercise for compilers of CPI's and can, at times attract debate as to the most appropriate approach. The ABS's approach to overcoming this is to assess the scope, classify and develop pricing techniques as soon as possible after the introduction of a new product or outlet into a market. Increasing innovation in digital services has facilitated a rise in popularity of Share economy products which has in turn resulted in the need for price statisticians to assess and develop techniques for inclusion into price indexes.

The ABS has developed a decision tree which allows compilers of a CPI to assess Share economy products and determine the appropriateness of their introduction into a Price index. This paper presents this decision tree and outlines some of the practical challenges faced by the ABS when incorporating Share economy products into the Australian CPI. Challenges facing the introduction of Ride sharing and Share accommodation services are particularly discussed in detail as well as the strategies for overcoming them.

2. Concepts, Scope and Classifications

2.1 Concept and Share economy structure

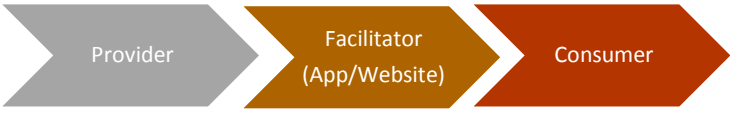
Currently there is no internationally endorsed definition of the Share economy due to its relative ambiguity and the presence of widespread debate among academics and government institutions as to how the definition should be constructed.

The Share economy consists of three parties: the Producer (or provider)[1], the Facilitator and the Consumer (see Figure 1). The Share economy is a market where buyers (consumers) and sellers (providers) are connected through a facilitator who generally operates a mobile app or a website.[2] For the purpose of economic measurement, it can be thought of as an environment where consumers use mobile or online platforms to provide temporary access to products with no transfer of ownership.

[1] Consumers who are providing goods or services in the Share economy are referred to as 'providers' in this paper so as to differentiate them from non-share economy producers

[2] Australian Taxation Office

Figure 1: Share Economy Structure



2.1.1 Share economy decision tree

The ABS has constructed a decision tree (see Appendix 1) which can be used to determine on a case by case basis if and how a Share economy product should be included in an economic measure. If a transaction meets the criteria of each step of the decision tree, it then warrants classification into the Share economy; if it doesn't meet a step then it will be excluded from consideration as a Share economy transaction. Using this decision tree, the ABS has determined that Ride sharing and Share accommodation services, meet this criteria and can be thought of as Share economy transactions.

2.1.2 Assessing the scope and classifications of the Share economy

When assessing Share economy products it is important to first consider whether they are within scope of a CPI. The purpose of the Australian CPI is to measure the change in the prices paid for all goods and services consumed by households. Therefore, all transactions consumed by households warrant inclusion in the CPI, even those where households themselves are involved in production. However, practical difficulty exists in measuring all goods and services that are within scope of a CPI resulting in some goods and services with a relatively low consumer expenditure share being excluded from the CPI sample for practical purposes.

Once deemed within scope of the CPI, Share economy products can then be classified accordingly. In the case of the ABS this is by CPI Commodity Classification (CPICC). In this way we can consider that Share economy products are within scope of a CPI and can be classified in the standard way according to purpose.

A common problem facing compilers of a CPI is identifying when and how to: replace obsolete products; and introduce new products. This includes ensuring that representative products and outlets are incorporated into the CPI at an appropriate point in time. Substitution bias can occur if the outlets and products are introduced too early or too late and without appropriate weights. If a new outlet or product is introduced into the CPI basket before it starts to claim a representative share of the relevant market; or too long after it has claimed a representative share, the index could be subject to bias as important price change effecting consumers is missing from CPI estimates. For this reason it is important to identify and classify the Share economy, assess its importance in terms of consumer expenditure share and incorporate it into the CPI if it is deemed appropriate to do so. The ABS' approach to this is to attempt to incorporate new outlets and products as soon as it is

feasible, and updating fixed weights somewhat frequently, thereby limiting the effects of substitution bias as much as possible.

2.1.3 The ABS's treatment of Share economy products

One of the key steps in assuring the basket of products is representative of consumer purchasing patterns is to assess whether the new outlet or product has quality determining characteristics that may indicate whether the unit is an evolutionary and/or revolutionary product. According to the ILO manual, "an evolutionary new good or service is one that meets existing needs in much more efficient or new ways, whereas a revolutionary new good or service provides completely new kinds of services or benefits".

Consumer-to-consumer transactions are not a new phenomenon, however have practical barriers to accurate measurement which make their inclusion in CPI estimates difficult. Improvements in digital technology has allowed for greater access to the consumer-to-consumer market resulting in the creation of Share economy facilitators. It can therefore be argued that, from a consumer's perspective, Share economy products can be regarded as evolutionary in nature as the creation and subsequent rise in Share economy facilitators such as Airbnb and Uber, provides a new and efficient way of accessing already existing products. The ABS has therefore regarded the introduction of Share economy products as evolutionary rather than revolutionary and the introduction of Share economy facilitators as new outlets who provide greater access to Share economy products.

As stated above, there are two transactions that take place with regard to a Share economy transaction. One is the service provided by the Share economy facilitator and the other is the product being offered by the provider. Conceptually these are two different services each with differing characteristics in terms of quality and purpose. It can be argued that these two services should be measured individually, resulting in classifying the services separately according to CPICC. However, separating out the two services may not be practically possible, therefore in such cases the transaction could be classified according to the primary purpose of the service being provided to the household i.e. accommodation in the case of Share accommodation services.

3. Practical Considerations and Methods

Evolutionary products and new outlets can be introduced into already existing Expenditure Classes (EC), Sub-Classes or Elementary Aggregates (EA) depending on whether the new items can be considered as perfect or imperfect substitutes. Perfectly substitutable products suggest that there already exists an appropriate EA for which the new product can be classified into, whereas imperfect substitutes suggest that there is a need for new Sub-Class or EA's to be created.

There is potential for there to be debate around whether Share economy goods and services can be considered perfect or imperfect substitutes with determinations being highly dependent on specific products. The ABS has thus far considered the two case studies of Share economy goods and services (Ride sharing services and Share accommodation services) in this paper as imperfect substitutes, the specific details of which are discussed below in 3.1 Ride sharing and 3.2 Share accommodation. As Share economy products have been determined as imperfect substitutes, they have been classified into EC's as Sub-Class and new EA fixed weight indexes have been created in order to more accurately measure price change. As new EA's have been created for the Share economy products, estimation of a reservation price was not deemed as necessary and an entirely new sample of Share economy products were introduced using the overlap method. The matched model approach is then used to estimate price change for the sample of products in the Share economy indexes.

Collection of transactions or administrative datasets would be the ideal form of data collection due to the relatively low ongoing cost, greatly expanded sample coverage and ability to use more sophisticated price measurement methodologies. Acquiring these datasets, however, and the development of appropriate methodologies and practices to measure price change with these datasets can be a time consuming and potentially costly exercise and relies on co-operation of parent companies. In order to limit the effects of substitution bias in the CPI, the ABS deemed it appropriate to collect the data online and use the matched model approach until such data could be acquired.

3.1 Ride sharing services

3.1.1 Quality determining characteristics

Ride sharing and other forms of private transportation, such as taxi or car services, can be thought of as broadly similar in terms of utility, however, enough differing quality determining characteristics exist to make separate measurement the preferred method. Some examples of these characteristics include:

- Flexibility in payment methods.
- Hail or call.
- Accessible ratings for drivers.
- Real time GPS tracking.
- Type of vehicle provided

3.1.2 Deriving fixed weights for Sub-Class and Elementary Aggregate components

As described above, due to differences in quality, new Sub-Class and EAs with fixed weights have been introduced into the Australian CPI. Due to the rapid pace of Share economy products, acquiring appropriate market share and expenditure information was particularly difficult. Data was available regarding the US Share economy; however the Australian Share economy began at a later point in time meaning that US data did not give a good reflection of Australian consumer behaviour and was best used for comparative purposes only.

Household Expenditure Surveys (HES) are widely used in order to determine expenditure shares. Depending on the level of detail and classification used in this survey, estimates for fixed weights of private transportation services may be available and was so for the ABS. HES data indicated that expenditure shares for Ride sharing services and non-Ride sharing services was 19% and 81% respectively.

3.1.3 Price collection and the matched model approach

In order to derive a pricing methodology for Ride sharing services, potential data sources need to be considered. In the case of Ride sharing services in Australia, transactions or administrative data was not readily available. However, online collection of individual price components could be achieved, allowing for the creation of a matched model.

In constructing the Ride sharing pricing model there were a few considerations that had to be discussed. These included surge pricing, cancellation fees and the facilitator fee. Ideally, the matched model should attempt to measure the 'final' price to the consumer by including any additional fees and charges. This can be achieved through the creation of a final price algorithm. For example:

Final Price = Trip fee x surge price/multiplier (if applicable) + facilitator fee + taxes and other charges.

Surge Pricing

Surge pricing is an increase in price to the consumer when there is a high demand for Ride sharing services in comparison to the supply of Ride sharing services at specific points in time. For example: at times of peak demand such as New Year's Eve when there may be less providers available, a surge multiplier is added to the standard fare in order find a suitable equilibrium price between supply and demand for those services. Ride sharing services generally offer low rate prices, however the addition of surge pricing can result in Ride sharing services becoming

comparable to taxis in terms of price level at those peak periods. In these circumstances Ride sharing services could become more expensive than taxis potentially leading to substitution between the services. It is therefore ideal to capture surge pricing in the final price algorithm as it constitutes a real inflationary impact for a consumer.

Capturing surge pricing presents a number of challenges, the first being that the surge multipliers applied to Ride sharing pricing algorithms are dynamic. Meaning that the multipliers change depending on the consumer demand for rides and the number of drivers available at a specific point in time; therefore, deriving an accurate 'average' surge multiplier is difficult without data sourced directly from a Ride sharing service facilitator or provider. The second challenge is deriving the frequency of surge trips in comparison to non-surge trips, which is currently not possible via Ride sharing facilitator's websites or mobile phone applications.

Lastly as mentioned above, when surge pricing is active there is a disincentive to use Ridesharing services, leading to consumers substituting to other modes of transport which may be more competitive.These challenges are difficult to overcome given the limitations in the data available; therefore the ABS has selected to omit surge pricing from ongoing estimates of price change until a more comprehensive data set or collection method can be developed.

Other fees and Charges

Cancelation fees also constitute an important charge that can be considered as in scope of a final price algorithm for Ride sharing services. In order to accurately include cancelation fees in the pricing algorithm, a representative weight must be determined. The most appropriate method of determining this weight is to multiply the frequency or number of cancelation fees charged by the unit fee. Without surveying the Share economy facilitators directly or acquiring transactions data, the frequency of cancellation fees is difficult to estimate, therefore, despite the assumption of stable prices , they were not included as part of the pricing algorithm as relevant weighting information is not yet available.

As with most Share economy products, the Ride sharing service transaction is made up of two components, the facilitator fee and the provider fee. Ride sharing facilitator's do not generally advertise their commissions or fees, meaning that the split of facilitator fee and provider fee cannot be reliably monitored unless it is directly and regularly reported by the facilitator or the provider.

In addition to this the facilitator fees are not uniform across providers. This makes consistent measurement of facilitator fees through advertised modes or provider report unfeasible. As has

been mentioned above, as the facilitator transaction cannot be separated from the provider charge, the entire service will be classified according to the primary purpose being provided to the household; in this case the newly created Ride sharing services index.

Matched model approach

Pricing to constant quality and ensuring homogeneity in matched model pricing is also a challenge for Ride sharing services. An essential component of Ride sharing services is that the provider sources a vehicle for use in providing private transportation for a consumer. This means that the vehicle quality will differ for each individual transfer depending on the supply of Ride share services available at a specific point in time. To overcome this, vehicles status and quality is classified into classes differentiating vehicle capacity or preference. For example; a trip undertaken in a standard five person sedan versus a larger van. Another differentiation could be between cheaper basic vehicles and more luxury models. In this way it is impossible to price completely homogenous Ride sharing services. As the vehicles are grouped into classes however, applying the matched model approach to the classes rather than the individual service can be considered a suitable proxy and is the method in which the ABS has chosen to measure Ride sharing services.

Due to the difficulty in including the above fees and charges in the pricing algorithm, the ABS has determined that price change for Ride sharing services will be made up of the trip fare (which will include the facilitators fee), booking fee and any relevant taxes and charges until a suitable methodology or data set sufficient for the inclusion of surge pricing in particular can be developed.

Ride sharing facilitators tend to advertise the base fare, booking fee, rate per minute and rate per kilometre. These pricing characteristics can be used to create a consumer 'final price' trip fare in the form of an algorithm in which price change can be estimated on an ongoing basis. This algorithm is similar to that used for taxis in the ABS and includes a function of average length of trip, rate per minute, average distance of trip, rate per kilometre, base fare and booking fees as expressed below:

$$Trip\ Fare\ = (t \times p^1) + (d \times p^2) + b + f$$

Where:
t = Average length of time per trip
p^1 = Rate per minute of trip
d = Average distance of trip
p^2 = Rate per kilometre of trip
b = Base trip fare
f = booking fee

This trip fare can then be incorporated into the final price algorithm mentioned above to become:

Ride share price =
$((t \times p^1) + (d \times p^2) + b + f) \times Surge\ price\ multiplier + Facilitator\ fee + Taxes\ and\ Tarrifs$

As mentioned above, it is not yet possible for the ABS to estimate surge price multipliers, therefore the final algorithm used by the ABS is as follows:

Ride share price = $((t \times p^1) + (d \times p^2) + b + f) + Facilitator\ fee + Taxes\ and\ Tarrifs$

The average length of the trip and the average distance of the trip are kept constant in order to measure pure price change. This means that the periodic prices collected will be the only contributors to price change each quarter. In this model, it is assumed that the average length and distance of a trip will not change in the short run making this a fairly stable way to measure pure price change to a constant level of quality.

3.2 Share accommodation

3.2.1 Quality determining characteristics

Similar to ride sharing services, quality differences between Share accommodation services and that of hotels and motels are able to be distinguished. Some examples of these characteristics include:

- Hotel services and amenities, including room servive, concierge etc
- Geographical location and access to transportation
- Property type and number of bedrooms

3.2.2 Deriving fixed weights for Sub-Class and Elementary Aggregate components

Similar to Ride sharing services, HES was originally investigated as a data source for determining the share of household expenditure on share accommodation. However, this data was not appropriate to use in establishing an explicit weight, as Share accommodation expenditure was not classified independently from that of other domestic accommodation services in the HES. Alternanative data sources in which expenditure shares could be estimated, including occupancy rates and aggregate expenditure were then explored in order to derive expenditure shares for Share accommodation services.

Occupancy rates are used to give an estimation of what portion of available accommodation types were occupied over a given time period. By comparing occupancy rates of the entire accommodation services industry to those listed on the share accommodation website the ABS was able to infer the popularity of share accommodation. Aggregate expenditure compares the total amount spent on all other types of accommodation to that spent on share accommodation, allowing the ABS to infer the portion of accommodation expenditure households spend on share accommodation. These methods gave an estimation of share accommodation accounting for 10-20% of the accommodation industry in Australia. This method of determining lower level weights is not explicit, however in the absence of reliable HES estimates, utilising the existing data provided advantages to the ABS in saving resources and time.

3.2.3 Price collection and the matched model approach

Due to the nature of the Share economy, consumers can only purchase transactions through an online platform, therefore making online collection the most logical form of price collection. In this way the ABS was able to assume a matched model approach by collecting prices for the same properties each quarter. This form of price collection also has the advantage of being cost effective and efficient compared to physical or phone collections.

Bookings made via the Share accommodation facilitator's platform incur additional fees including a cleaning fee charged by the provider and a services fee which goes to the share accommodation facilitator providing the platform for the transaction. Similar to Ride sharing services, facilitator fees are conceptually in scope of the CPI, however, should be classified separately from that of the accommodation services being provided. Due to the difficulty in separating facilitator fees and cleaning charges from that of the accommodation services being provided, all fees and charges associated with the transfer will be classified according to the primary purpose of transaction, namely accommodation services.

Properties were selected based on destinations already known to be popular based on household expenditure data. Possible properties were then reviewed and selected based on the number of positive reviews the host had received via the facilitator's platform. The approach of reviewing consumer reviews most closely aligned with that of purposive sampling under the assumption that consumers held consumer ratings in high regard when selecting a property.

4. Summary and conclusions

Maintaining a contemporary basket of goods and services is an important step in ensuring the ongoing relevance of a Consumer Price Index (CPI). For the purose of a CPI, Share economy

products have 3 main participants, the provider, the facilitator and the consumer. The ABS has developed a decision tree to aid in the assessment of Share economy products for price indexes. This decision tree has allowed CPI to classify Ride sharing and Share accommodation services as part of the Share economy and within scope of and warranting inclusion in the Australian CPI.

Following the assessment of quality determining characteristics, both Ride sharing and Share accommodation services have been identified as evolutionary products with the facilitators determined as new outlets. For the purposes of the ABS CPI, this has meant that new Elementary Aggregate fixed weight indexes have been created. This allows the ABS to account for substitution bias between outlets as well as decompose ongoing price change behaviour between Share economy items and non-Share economy items.

Due to the online nature of Share economy products, the ABS is deriving price change via a matched model approach and collecting prices online. Where possible, other fees and charges have been included such as facilitator and booking fees. Conceptually, facilitator fees should be separately measured and classified, however, in terms of simplicity and practicality, are being measured alongside that of the final consumer services primary purpose and classified accordingly.

By introducing Share economy products into the Australian CPI at points where expenditure shares and weighting information have determined it appropriate to do so; the ABS is continuing to ensure that the Australian CPI remains relevant and contemporary.

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6. Appendix

6.1 Appendix 1: Share economy decision tree