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A COLLABORATION WITH

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Alternative Approaches to the Treatment of Access Charges and Bundled Products in Price Index Construction

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Fixed Access Charges

These charges are payments for accessing goods and services, but are not dependent on the amounts ultimately purchased. This relatively neglected topic is increasingly important given the growth in telecommunications, data and entertainment services that use an access charge model.

Basing our models in alterative consumer behaviour frameworks and using UK telecommunications data, we show that the choice of treatment can be very consequential empirically for price indexes. As result, it is also consequential for the measurement of national output, consumption and productivity.

Four Models:

Model 1: Consumers regard an access charge as a charge on income. They then decide expenditure on products using the remaining net income.
- The price index is then constructed only over products purchased, excluding fixed charges.

Model 2: Consumers regard the access charge as a separate product that gives utility even if they do not consume any products.
- The price index is then constructed by the addition of the fixed charge, where the quantity is equal to one and the charge is the price.

Model 3: Consumers allocate the access charge in a proportional-to-expenditure manner across the "usage" prices.
- The price index is then constructed using these adjusted prices.

Model 4: This approach is used when constructing producer price indexes for the telecom sector.
- The price index is then calculated using the number of line connections as the output measure for the access charge.

Data

1. UK geographic calls in millions of minutes;
2. International calls in millions of minutes;
3. Calls to mobile phones in millions of minutes;
4. Other calls in millions of minutes;
5. Fixed line access charges; units are the number of lines in thousands.

Fixed line UK retail telecommunications from Ofcom's Telecommunications Market Data Tables and the Communications Market Reports; see Abdirahman, Coyle, Heys and Stewart (2022).

Results from applying these four models using different index number formulae, both direct and chained ("CH") are given in tables 1 to 5. Figure 1 plots Fisher indexes for all models.
Results are very different across models.

Bundled Products

Four different approaches to the bundling problem will be pursued in this project:

1. Simple proportional allocation;
2. Treat the bundled product as a separate product;
3. Hedonic regression methods and
4. Estimation of semi-flexible preferences.

Our project builds on Abdirahman, M., D. Coyle, R. Heys and W. Stewart (2022), "Telecoms Deflators: A Story of Volume and Revenue Weights", *Economie et Statistique / Economics and Statistics*, 43–59. https://doi.org/10.24187/ecostat.2022.530.2063

Table 1: Model 1 Laspeyres, Paasche and Fisher Indexes

Year t	P_{L1}^t	P_{P1}^t	P_{LCH1}^t	P_{PCH1}^t	P_{F1}^t	P_{FCH1}^t
2010	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2011	0.9839	0.9825	0.9839	0.9825	0.9832	0.9832
2012	0.9658	0.9644	0.9661	0.9648	0.9651	0.9655
2013	0.9802	0.9811	0.9805	0.9797	0.9807	0.9801
2014	1.0243	1.0259	1.0274	1.0249	1.0251	1.0262
2015	0.9979	1.0066	1.0034	1.0009	1.0022	1.0022
2016	0.9746	0.9832	0.9931	0.9790	0.9789	0.9860
2017	1.0466	1.0355	1.0690	1.0481	1.0411	1.0585

Table 2: Model 2 Laspeyres, Paasche, Fisher Indexes

Year t	P_{L2}^t	P_{P2}^t	P_{LCH2}^t	P_{PCH2}^t	P_{F2}^t	P_{FCH2}^t
2010	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2011	1.0112	1.0126	1.0112	1.0126	1.0119	1.0119
2012	1.0565	1.0671	1.0611	1.0658	1.0618	1.0634
2013	1.1051	1.1276	1.1137	1.1203	1.1163	1.1170
2014	1.1558	1.1877	1.1659	1.1722	1.1716	1.1691
2015	1.1943	1.2506	1.2198	1.2282	1.2221	1.2240
2016	1.2343	1.3185	1.2797	1.2870	1.2757	1.2834
2017	1.2996	1.3946	1.3419	1.3465	1.3463	1.3442

Table 3: Model 3 Laspeyres, Paasche and Fisher Indexes

Year t	P_{L3}^t	P_{P3}^t	P_{LCH3}^t	P_{PCH3}^t	P_{F3}^t	P_{FCH3}^t
2010	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2011	1.1040	1.1024	1.1040	1.1024	1.1032	1.1032
2012	1.2403	1.2385	1.2407	1.2391	1.2394	1.2399
2013	1.4068	1.4081	1.4072	1.4061	1.4074	1.4066
2014	1.6199	1.6225	1.6249	1.6209	1.6212	1.6229
2015	1.7854	1.8010	1.7953	1.7909	1.7932	1.7931
2016	2.0191	2.0369	2.0575	2.0282	2.0280	2.0428
2017	2.4972	2.4706	2.5506	2.5008	2.4839	2.5256

Table 4: Model 4 Laspeyres, Paasche and Fisher Indexes

Year t	P_{L4}^t	P_{P4}^t	P_{LCH4}^t	P_{PCH4}^t	P_{F4}^t	P_{FCH4}^t
2010	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2011	1.0085	1.0097	1.0085	1.0097	1.0091	1.0091
2012	1.0390	1.0484	1.0427	1.0470	1.0437	1.0449
2013	1.0737	1.0927	1.0800	1.0857	1.0832	1.0829
2014	1.1084	1.1316	1.1135	1.1178	1.1199	1.1156
2015	1.1298	1.1733	1.1479	1.1541	1.1513	1.1510
2016	1.1544	1.2209	1.1904	1.1953	1.1872	1.1929
2017	1.2115	1.2796	1.2419	1.2438	1.2451	1.2428

Table 5: Fixed Base and Chained Fisher Indexes for All Four Approaches

Year t	P_{F1}^t	P_{FCH1}^t	P_{F2}^t	P_{FCH2}^t	P_{F3}^t	P_{FCH3}^t	P_{F4}^t	P_{FCH4}^t
2010	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2011	0.9832	0.9832	1.0119	1.0119	1.1032	1.1032	1.0091	1.0091
2012	0.9651	0.9655	1.0618	1.0634	1.2394	1.2399	1.0437	1.0449
2013	0.9807	0.9801	1.1163	1.1170	1.4074	1.4066	1.0832	1.0829
2014	1.0251	1.0262	1.1716	1.1691	1.6212	1.6229	1.1199	1.1156
2015	1.0022	1.0022	1.2221	1.2240	1.7932	1.7931	1.1513	1.1510
2016	0.9789	0.9860	1.2757	1.2834	2.0280	2.0428	1.1872	1.1929
2017	1.0411	1.0585	1.3463	1.3442	2.4839	2.5256	1.2451	1.2428
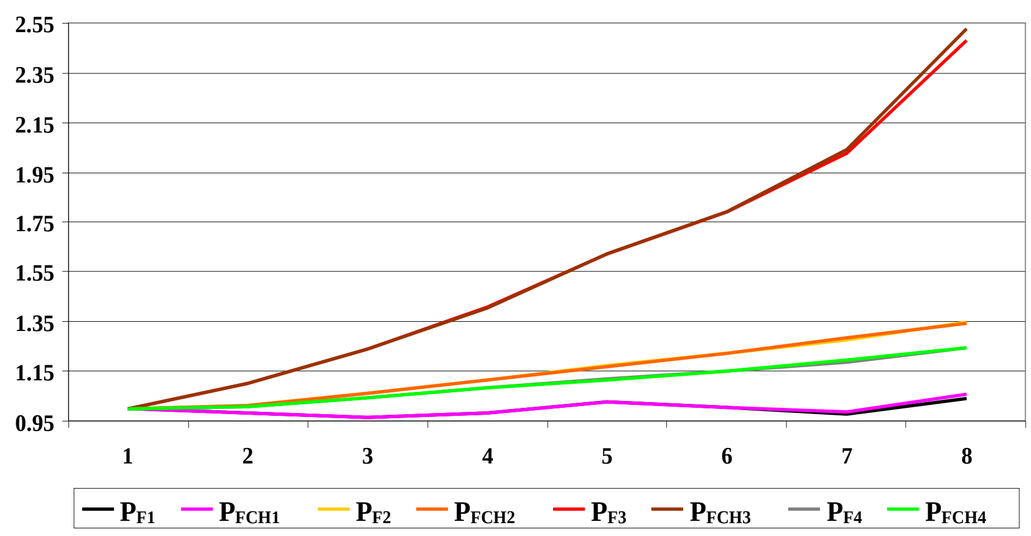
Figure 1: Alternative Approach Fisher Indexes