Using PPIs and EPIs as proxies for IPIs

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We have been researching alternative methods to deflate import prices when traditional IPIs are unavailable or unsuitable. In this paper, we discuss a proxy approach involving using an aggregate of PPI or EPI series from other countries, which may have uses as both a tool to assess the quality of existing series or as an alternative deflator where necessary. We discuss the positives and negatives and potential use cases, as well as comparing to initial results of using Unit Value Indices to deflate imports.

Contents

1. Introduction and background

Motivation

For a number of years ONS has not achieved the target sample size for the Import Price Indices (IPI). This is one of the aspects referenced in the Office for Statistics Regulation's recent report on the quality of ONS's Producer Price Indices[1]. Work is ongoing to improve our business price statistics, as outlined in the ONS' recent Producer prices development plan[2], but we are also investigating alternatives to the existing IPIs (and PPI proxies) to deflate imports where the current method or sample is potentially unreliable.

Our primary area of alternative trade deflator development is regarding the use of Unit Value Indices for homogeneous products, using admin data from HM Revenue and Customs (HMRC UVIs). However, this method relies on homogeneity at the elementary level and has so far focussed on very homogeneous products such as natural gas and crude oil. We are therefore seeking further alternatives to IPIs while improvements to the sample and coverage take place.

A related challenge is that we do not currently have suitable trade deflators for most services, and no easy means to create them, given that services cannot be tracked by HMRC in the same way as products crossing the border. This is an area of ongoing research but is one where we believe there may be the case to use the SPPIs of other countries – depending on how these services are traded.

In this paper, we explore a method to aggregate PPIs and EPIs from countries which are the source of our imports to create a proxy-import index. We compare these series against our existing IPIs or alternative sources where available, to investigate their potential use as both a tool to add assurance to our existing deflators, and as potential alternative deflators where necessary and suitable. The majority of this paper explores this from the perspective of deflating the prices of products, as we do not currently have IPIs for services. Case Study 3, however, does discuss an initial investigation into the use of these proxy series for deflating imports of services.

Justification

 As noted in the OSR report referenced above, our current approach when a suitable IPI is unavailable involves turning to proxies. In some cases, we substitute the IPI with the PPI for a specific product, or we employ imputation methods that rely on historical trends. We also make use of the US's PPI for pre-packaged software where we would normally use an IPI in deflating GFCF as there is not a suitable IPI available and the US is a large supplier of these services.

Another challenge encountered in our current IPIs is that they generally don't explicitly account for quality change. This is partly because the IPIs ONS produces cover only

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[1] https://osr.statisticsauthority.gov.uk/publication/spotlight-on-quality-producer-price-indices/pages/1/
[2] Producer prices development plan - Office for National Statistics (ons.gov.uk)

imports into manufacturing. Creating a deflator which does account for quality change for some products would be beneficial.

For IPIs with a lower-than-ideal sample size, we can have difficulty establishing whether the trends seen are truly representative of the prices measured, or if they are skewed due to the sample size. Using a method such as the one discussed in this paper offers an alternative way to assure ourselves that the IPIs are suitable for use. In situations where our IPI is not appropriate for use, this proxy index may be an option to use in place of it.

We have recently implemented this method for our IPI for computer hardware products as an interim measure while improvements are made to the sample and quality of the IPI. We have made quality adjustments to other price indices for computer hardware products in our annual Blue Book 2023, and making an improvement to the IPI at the same time was crucial to maintain consistency across transactions[3].

We have investigated the use of PPIs and EPIs for this purpose under the assumption that the products manufactured or exported are likely to line up with those imported by the UK. The PPI has the benefit of being more likely of having quality adjustment applied, when necessary, and is typically easier to access than relevant EPIs.
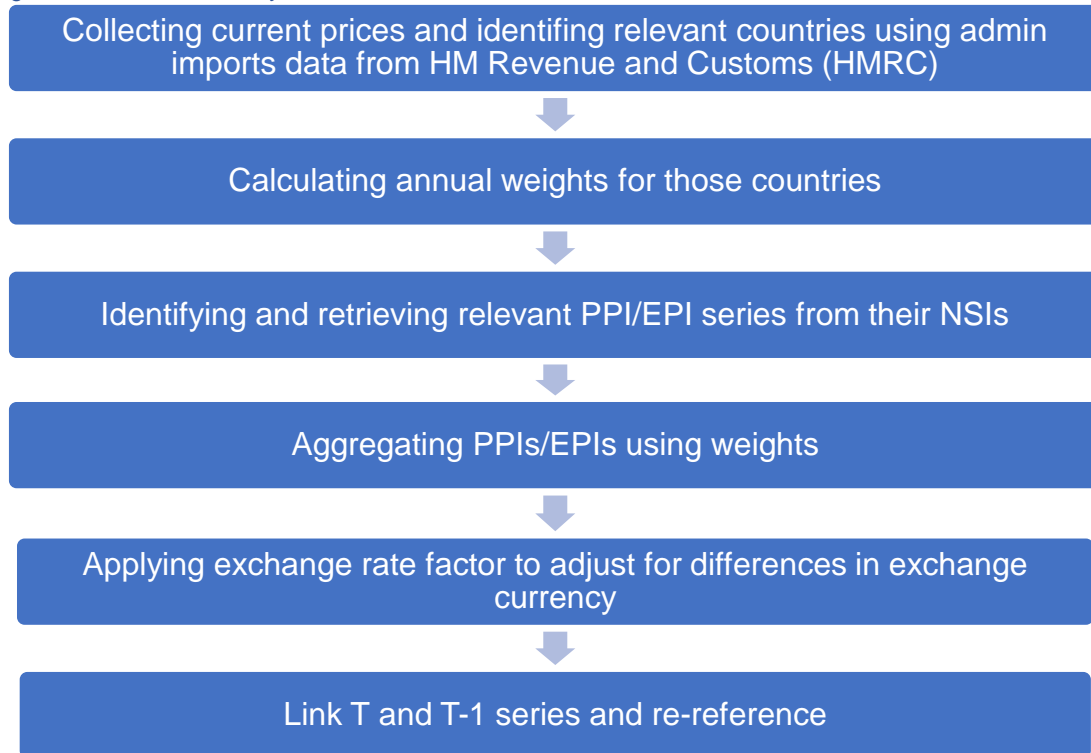
2. Proposed method

The below diagram is a summary of the method followed in this paper to create this proxy index.

As discussed above, we view this as a potential tool to add assurance to our existing deflators, as well as, in specific circumstances, offering an alternative deflator which could be investigated and considered on a case-by-case basis before being implemented. As mentioned previously, we are currently also investigating the use of Unit Value Indices as measures of price change for the trade of homogeneous products where we have admin data as an alternative for traditional IPIs created using survey data.

One potential benefit is that PPIs are more often quality adjusted, especially for fast-changing products, and so using PPIs to create a proxy IPI may help to account for some elements of quality change which have not previously been captured in our IPIs. A full discussion of pros and cons is in Section 4.

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[3] [Deflator improvements to the UK National Accounts: Blue Book 2023 - Office for National Statistics (ons.gov.uk)](ons.gov.uk)

Collecting current prices and identifing relevant countries using admin imports data from HM Revenue and Customs (HMRC)

⬇

Calculating annual weights for those countries

⬇

Identifying and retrieving relevant PPI/EPI series from their NSIs

⬇

Aggregating PPIs/EPIs using weights

⬇

Applying exchange rate factor to adjust for differences in exchange currency

⬇

Link T and T-1 series and re-reference

We have completed three case studies which we discuss below. We have chosen these as three distinct scenarios where we investigate using the above methodology.
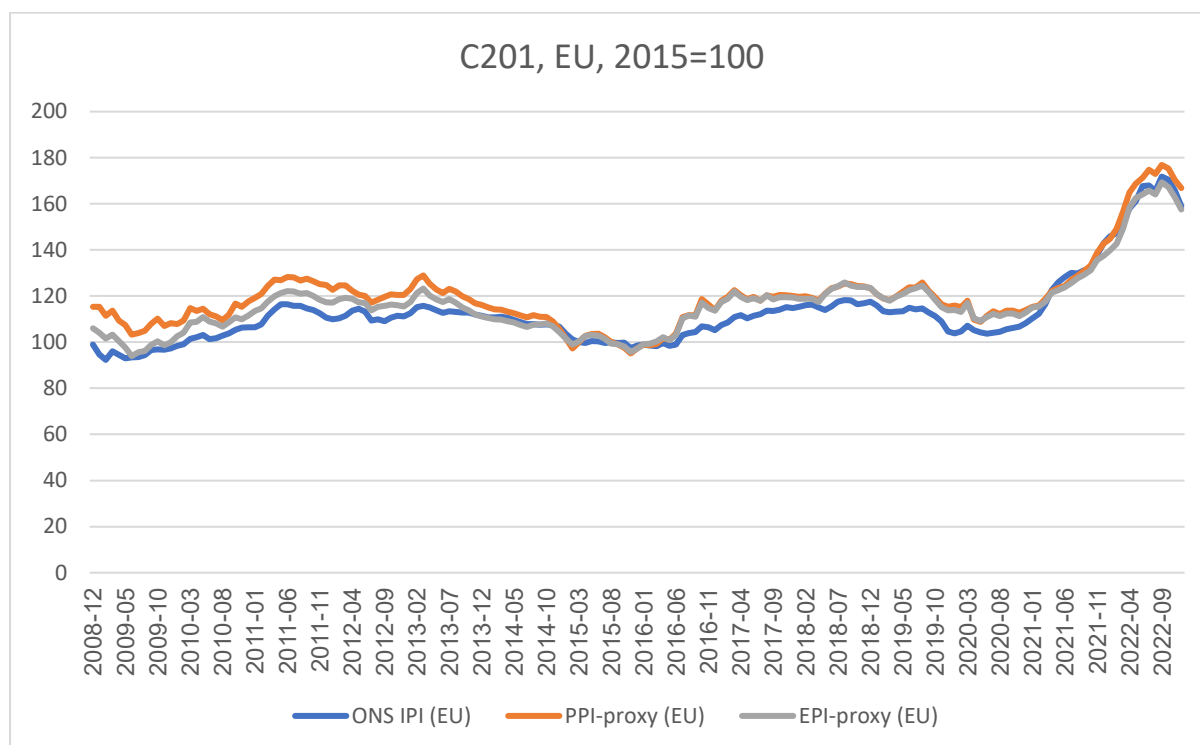
3. Results

Case study one

C201 - Basic Chemicals, Fertilisers and Nitrogen Compounds, Plastics and Synthetic Rubber in Primary Forms

This case study was chosen as a situation where our current IPI is considered "good" for EU Imports, and "poor" for NEU imports, based on current sample size and coverage. In this experiment, we have also created a proxy index using both PPIs and EPIs.

C201, EU, 2015=100

The proxies created above use the PPIs and EPIs of Germany, Belgium, Netherlands, Ireland, France, and reveals several key insights.

The graph shows that the proxies generally follow similar movements to the ONS IPI over the periods covered. This result could be viewed in two ways: when used as a tool, it adds support to the ONS' IPI being suitable for use; when viewed as an alternative deflator, if needed, both the PPI- and EPI-based proxies could be suitable. Since 2021, the three series have moved in more similar ways, lending further support to the current quality of our IPI.

We would expect exchange rates to have some influence on the proxy data, as generic (EU-wide) exchange rates used here may not fully account for fluctuations in currency values used for trading. The proxies consistently follow the month-to-month movement of the ONS IPI quite closely. This suggests that they provide a real-time representation of changes in industrial production in the UK, and there is a similar rate of increase since the beginning of 2021.

Figure 3 illustrates that the rate of change of the indices plotted in Figure 2 generally move in step. In each period, they move in the same direction, with slight differences in the magnitudes of the changes. This again adds support to our continued use of the existing IPI.
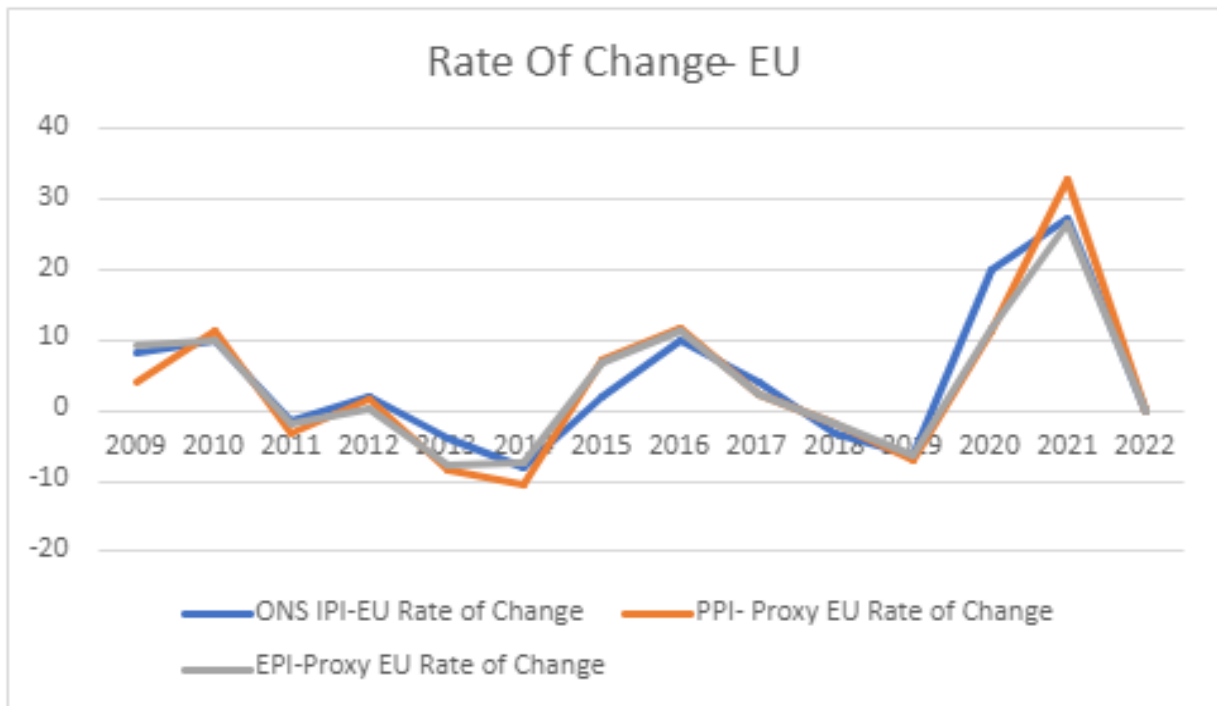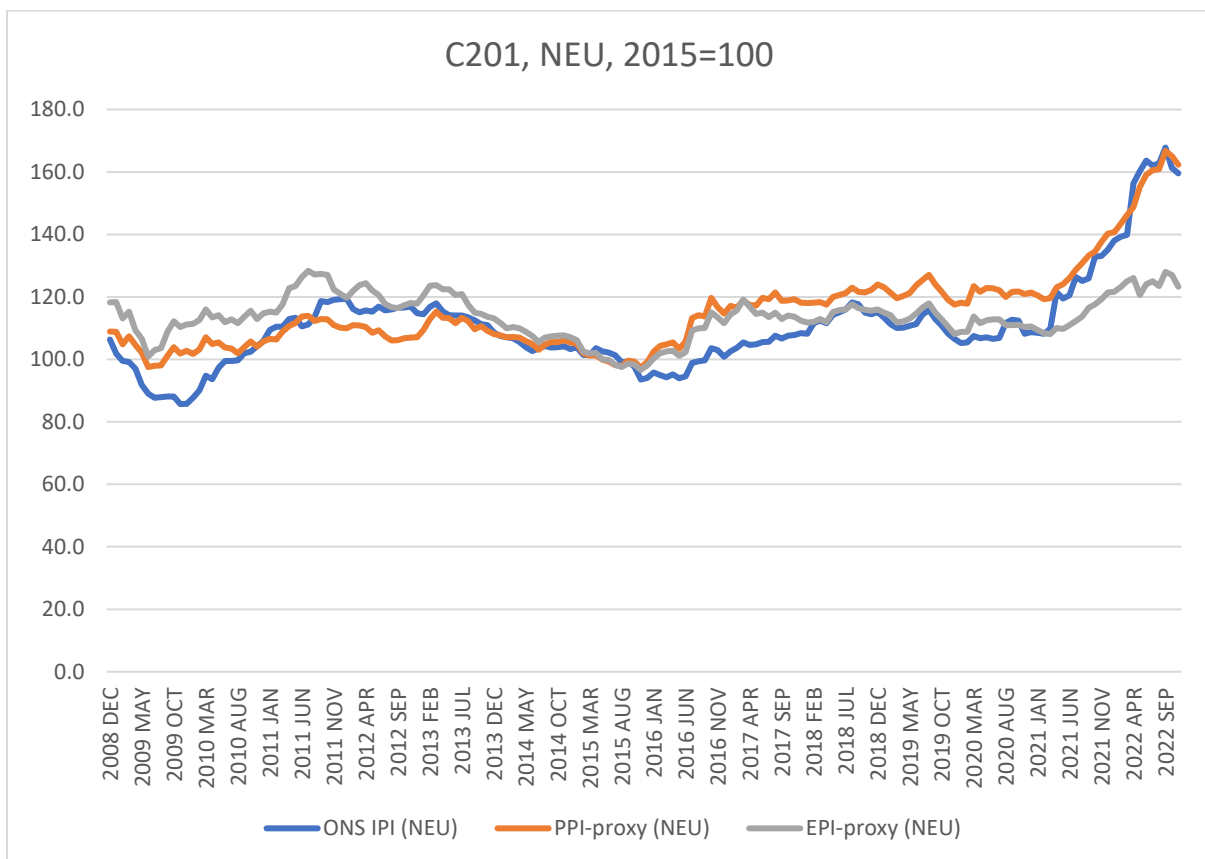
Figure 3: Annual Rate of Change- EU

Figure 4: Current NEU (Non-EU) IPI and proxies created using PPIs and EPIs from other NSIs

The current ONS NEU IPI for CPA C201 is rated poor quality due to limited sample and coverage sizes, resulting in us potentially being less confident in the trends exhibited.

The PPI-based proxy in this case is based on indices from the US, Norway, and Japan, while the EPI-proxy also includes data from Switzerland. In this case, the spread of the proxies is greater than for the EU countries, with the EPI in particular behaving differently to the IPI and PPI-based proxy.

A specific challenge for creating this proxy for NEU imports is the variety of classification systems used and the difficulty in identifying the most appropriate index. By comparison, the EU data was all accessed directly via Eurostat, and was all using the same classification system. This may be the cause for some of the dispersion in the proxy indices. In this situation, there are larger differences between the existing IPI and the proxies. Given that for a significant proportion of the timeseries, the IPI and proxies move in similar ways (better illustrated in Figure 5 below), using these for comparison can add some reassurance to our use of our own IPI. Furthermore, the increase in our IPI from the start of 2021 is also seen in the PPI-proxy, suggesting that this trend is genuine and one we should expect exhibited in our IPI. The periods of most significant divergence from the proxies are those where there were rapid changes in the exchanges rates between GB Pounds, Euros and Dollars, in 2008/2009 and 2016. Given that we are assuming instant pass through in the exchange rates, this may partially explain the divergence.

Figure 5 shows the annual rate of change of the indices provided in Figure 4. Though movements are in general in the same direction for the IPI and the proxies, there is a larger difference between these indices for these NEU series than for the EU case study above. As mentioned, collecting NEU prices is complicated by data availability and differing classification systems. It may also be that there are fewer similarities in price changes between countries than for EU countries which may be more likely to experience similar challenges.
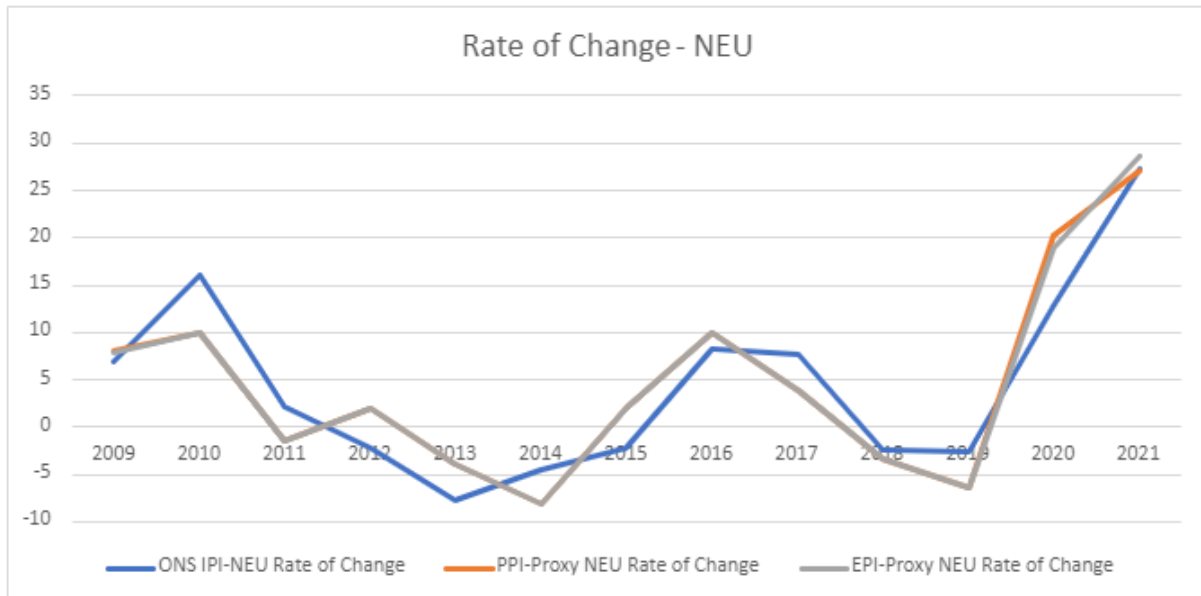
Case study two

B061 – Crude oil

This case study was chosen as a situation where the proxies can be compared with an experimental Unit Value Index (UVI), as well as the existing deflator. UVIs represent a straightforward price index method that quantifies the average price per unit (unit price) of a product or service without any additional adjustments for quality differences. UVIs rely on the assumption that the products within the index are essentially identical in terms of quality, characteristics, and specifications and are therefore only suitable for homogeneous products or services for which no quality adjustments are required.

EU

This case study does not include EU imports as the vast majority of crude oil imports to the UK are NEU.

NEU

Context

Non-EU countries dominate imports of CPA B061 to the UK. In 2021, imports from non-EU countries represented 99.9% of the total value of CPA B061 imports to the UK. Since 2008, there has never been a year in which non-EU countries' share of imports was below 95%.

Since 2008, 85.5% of non-EU imports of B061 by value came from five countries:

- o Norway (54.3%)
- o United States (9.9%)
- o Nigeria (7.6%)
- o Algeria (7.0%)
- o Russia (6.8%)

Of these countries, analogous PPI data are available for only three: Norway, the United States and Russia. We could not identify a PPI for Algeria or Nigeria. Regarding

the latter, the International Monetary Fund (IMF) recently said there was 'an ongoing effort for an updated producer price index'[4] for that country.

The limited availability of PPI data presents a challenge for constructing a fully representative proxy deflator, particularly in years where countries for which data are available contributed a smaller share of imports. In 2013, Norway, United States and Russia accounted for around half (50.0%) the value of non-EU imports, meaning the proxy will overstate the effect of price movements in these countries. Similarly, Nigeria and Algeria accounted for around a quarter (25.3%) of the value of non-EU imports in 2013, but the proxy is not able to capture the effects of price movements specific to these countries. Moreover, a UK ban on Russian oil imports has been in effect since December 2022[5] as part of a broader sanctions package. This effectively removes the rationale for including Russian price data in the proxy deflator as long as these sanctions remain in effect and reduces the coverage scope to Norway and United States. Amid these sanctions, Libya became the fifth-ranking source of non-EU B061 imports in 2023. As with Algeria and Nigeria, we could not identify a PPI for Libya.

Analysis

Figure 6 shows the movement of the constructed proxy (based on PPIs) compared to analogous series from other sources namely:
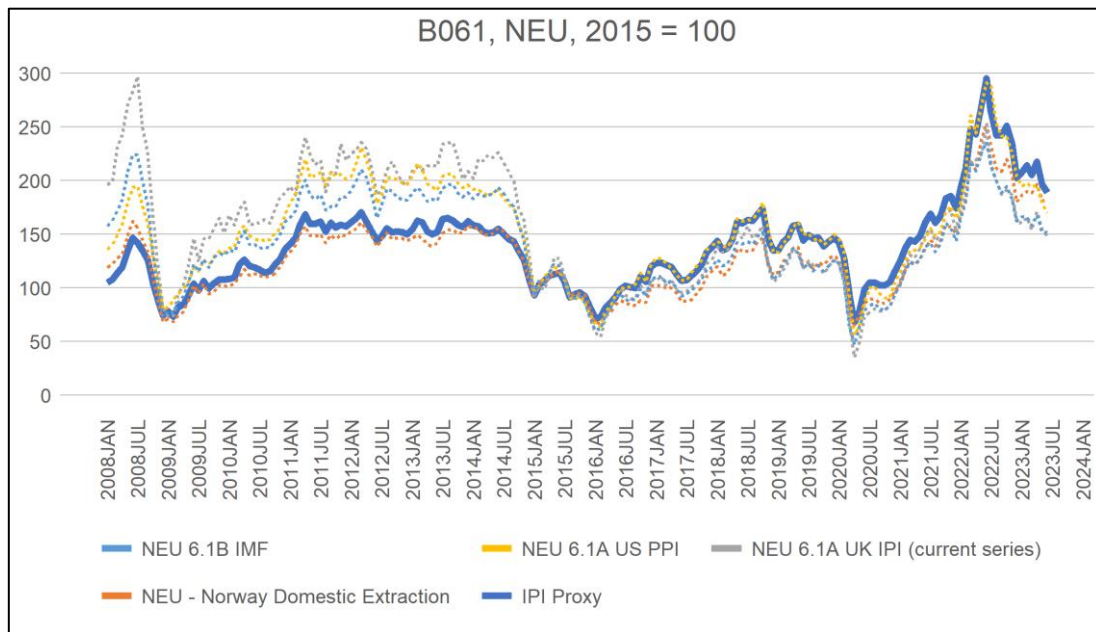
- UK IPI – current series
- United States Bureau of Labor Statistics (US BLS)
- International Monetary Fund (IMF)
- Statistics Norway

All series are referenced to 2015=100.

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[4] https://www.vanguardngr.com/2023/02/nigerias-inflation-index-outdated-imf/

[5] https://www.gov.uk/government/publications/uk-ban-on-russian-oil-and-oil-products/uk-ban-on-russian-oil-and-oil-products#:~:text=The%20ban%20came%20into%20effect,Russian%20oil%20to%20third%20countries

Figure 6: Comparison of current NEU IPI, proxy created using PPIs from other NSIs and other crude oil price indices

Prior to 2015, the proxy level runs substantially below those from the current UK IPI, US BLS and IMF, and it most closely tracks the Statistics Norway series until the beginning of 2016. This is a consequence of Norway's dominance as a source of imports, particularly among the countries for which PPI data were available for inclusion in the proxy. From 2008 to 2015, imports from Norway accounted for 59.9% of all B061 imports by value. Russia and the United States, the other two countries included in the proxy, accounted for 8.3% and 0.1%, respectively. As a result, Norway's PPI received a much greater weight, and thus had a much higher influence on the proxy.

The proxy begins to diverge from the Norway series in 2016, and thenceforth tracked very closely with the current IPI series. Notably, 2016 marked the first year the United States accounted for more than 1% of B061 imports to the UK, a share that has since continually grown. This had the effect of diluting the Norway series' influence on the proxy.

Figure 7 plots the rate of change (month-over-month percent change) for all the proxy and previously specified analogues.

The figure indicates that the proxy's movements generally follow the same trends as the analogues, including the UK IPI series. Figure 8 is a boxplot illustrating the distribution of differences in the rate of change between the proxy and each series for the corresponding month. The figure indicates that across each series, the percentage-point difference in the rate of change is usually within the single digits.

B061, NEU, 2015 = 100

Legend: NEU 6.1B IMF; NEU 6.1A US PPI; NEU 6.1A UK IPI (current series); NEU - Norway Domestic Extraction; IPI Proxy
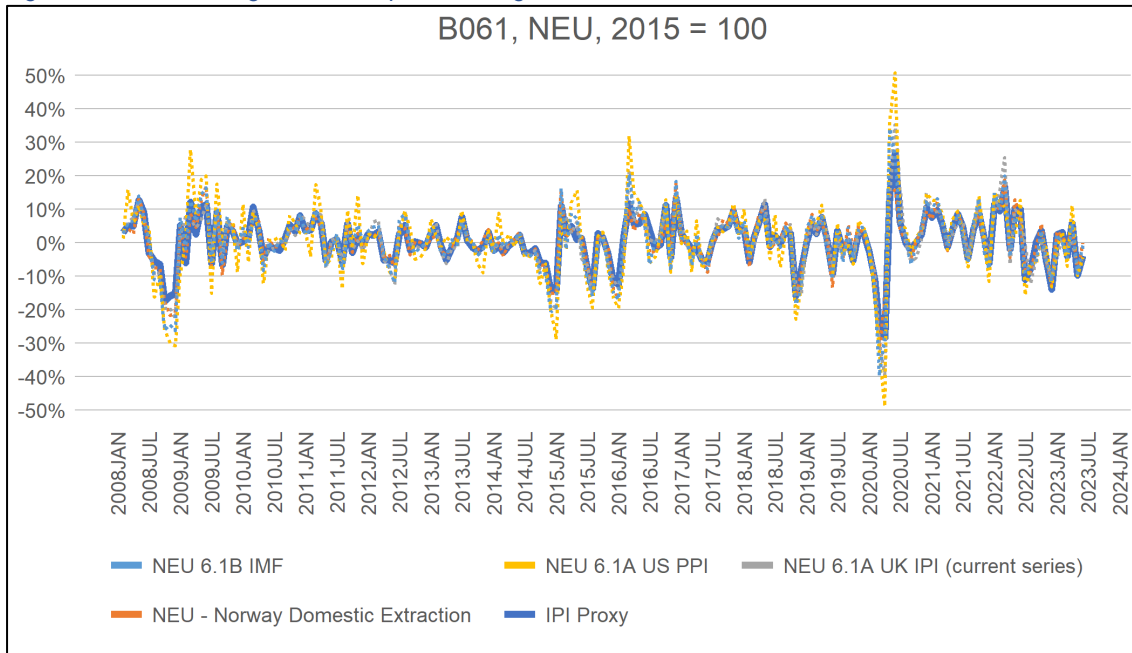
Figure 8: Boxplot showing distribution of comparison series against proxy index.

Distribution of differences from proxy series

NEU - Norway Domestic Extraction   NEU 6.1B IMF   NEU 6.1A US PPI   NEU 6.1A UK IPI (current series)
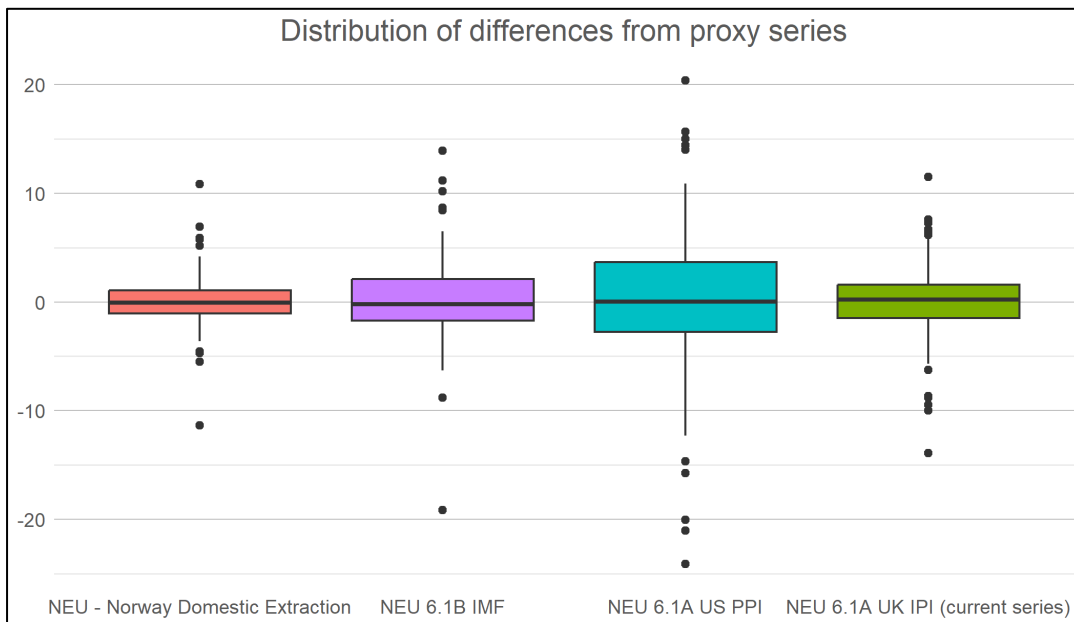
Crude oil is a very uniform commodity, especially within its grades. Unlike consumer goods, where quality can vary significantly, crude oil of the same type usually has consistent properties. Crude oil is traded in large quantities, which helps collect reliable price data. UVIs are therefore well suited to analysing price changes in these uniform groups.

Figure 9 illustrates the trends for the IPI Proxy and experimental UVI series as well as the unadjusted UK IPI for crude oil. Given that our experimental UVI figure lies between the existing IPI and the proxy series, this lends further support to the potential of using UVIs to deflate imports of crude oil. From 2015, the trends of all three series are closely aligned, suggesting both that our existing IPI may be a better measure of

import prices of crude oil in more recent periods, as well as again supporting future use of UVIs. As stated previously, the lower values in the Proxy series pre-2015 are likely the consequence of Norway's substantial influence on the proxy during those years.

Figure 9: comparison of IPI proxy series with current IPI and experimental UVI for crude oil
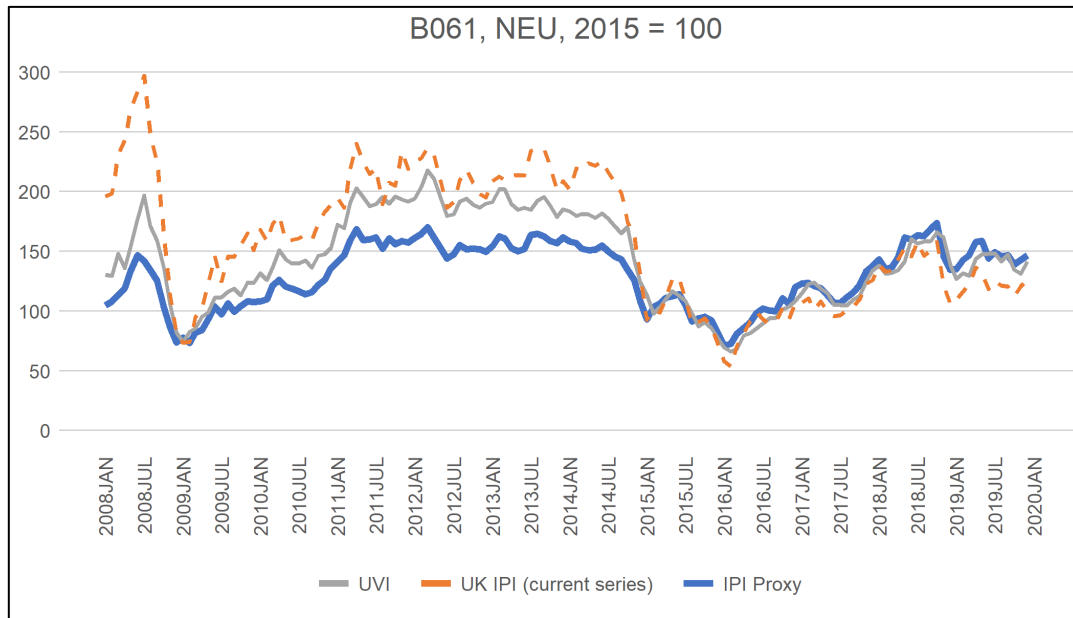
Case study three

H53 – Postal and Courier Services

This case study was chosen as we do not currently have suitable trade deflators for most services, and no easy means to create them.

Figure 10: UK SPPI for Postal and Courier Services and proxy created using SPPIs from other NSIs
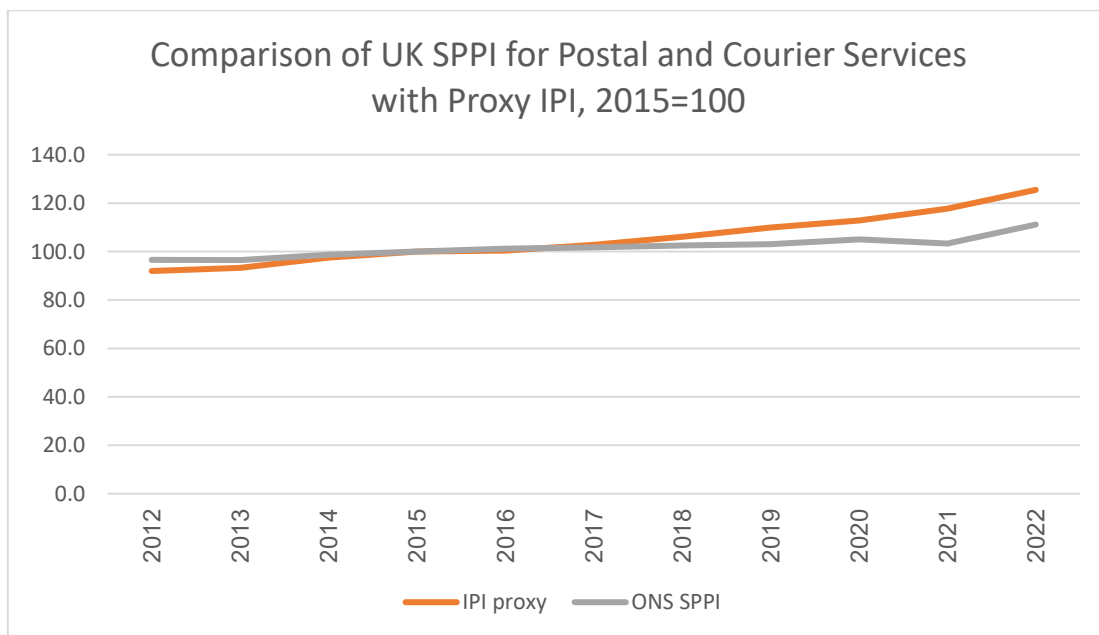
In 2023, the Trade team in ONS requested an investigation into creating an index for the Trade of Postal and Courier Services – or else justification for using our SPPI for this purpose.

We investigated this using the method outlined above, with the proxy index above created as an aggregate of the SPPIs from Germany, the Netherlands, the US, Ireland, and France. Overall, we found that the SPPIs for these countries with whom we trade increased more than the UK's SPPI but were generally following the same trend. In this situation, having established that there would be a minimal difference between a proxy or our own index, we regard this as supporting evidence for the suitability of using our own SPPI to deflate imports. ONS is now considering using our SPPI with exchange rate adjustments for measuring the prices of imports of these services, with the exchange rate adjustment designed to account for the move from measuring output to imports.

As for the other case studies mentioned, we would conduct a full investigation into the impacts of using this method before implementation. At this stage, we regard it as a useful tool when researching options for alternative deflators.

4. Discussion

Benefits
This methodology has several benefits in different circumstances. It may be especially useful as a tool to compare to other alternative deflators, as well as being a useful temporary measure of import prices where our current IPIs need improvement.

ONS implemented this methodology for the imports of Computer Hardware products in its annual Blue Book 2023 publication[6]. This is because the current IPIs are not suitable for the deflation of these products without improvement – which is ongoing. In the meantime, the use of this proxy method results in IPIs which are better aligned to our expectations of the price movements of these products.

ONS is also currently making use of the US PPI for pre-packaged software in part of the IPI used in the calculation of GFCF. This is based on similar assumptions as the case studies above – that most of the UK's imports of software are from the US. This is because the ONS doesn't currently produce a suitable IPI, and it would be difficult to do so.

Limitations and further considerations
There are several limitations to this method – including recognising and communicating the construction if the proxy is used for deflation. At this stage, we believe should only be considered as a back-up option when it's not possible to create

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[6] Deflator improvements to the UK National Accounts: Blue Book 2023 - Office for National Statistics (ons.gov.uk)

a deflator from directly measured prices. As outlined above, it has more strengths as a tool to assure our current IPI against.

Creating (and maintaining) a suitable proxy using this method is complicated by practical considerations such as different classification systems and a reliance on the indices used to create the proxy being accessible, regularly published and not subject to significant methodological changes – or being aware when that does occur.

There are also some additional considerations, which need to be addressed to create a suitable proxy. These include:

- IPI definition: in the UK, our IPIs specifically cover imports of inputs into manufacturing only. The product mix captured using this proxy method is unknown but would include (e.g.) final products produced, and so would not match exactly the basis on which we currently produce our IPI.
- Product mix: the mix of products captured by a domestic PPI may differ from the mix exported and again from the mix imported from each country. This may be most relevant for countries which are re-exporting goods produced elsewhere, as their domestic PPI will not be capturing the mix of products exported.
- Lags: we would anticipate there being lags between price changes for each of PPIs, IPIs and EPIs by virtue of when prices are collected.
- Exchange rates: it's necessary to consider the currencies in which these products are traded, which may differ from the national currency as trading is more often done in US Dollars or Euros than smaller currencies. This currency mix may vary with the type of product being traded. We also assume instant pass-through of the exchange rates, which may affect the trends.

5. Conclusions

As an NSI, there are often situations in which an ideal index may be unavailable for a variety of reasons. Having a proxy index is often preferable to being unable to deflate a given transaction, and as such the method outlined in this paper may be suitable in some circumstances.

In the first case study, we compared the proxy series with a high-quality EU IPI for imports of Basic Chemicals, Fertilisers and Nitrogen Compounds, Plastics and Synthetic Rubber in Primary Forms. Both the PPI- and EPI-proxies closely tracked the IPI, supporting the trends in our existing IPI. The NEU IPI for this product had limitations in terms of sample size and coverage, which made comparisons more challenging. Both the PPI- and EPI-proxies did exhibit similar trends to our IPI, adding reassurance to the use of our current series.

In the second case study the proxy was evaluated alongside an experimental Unit Value Index for crude oil and the currently used deflator. Before 2015, the UVI series and the UK IPI series exhibited a closer alignment in their movements compared to

the proxy and UK IPI series. This is likely to be attributed to the significant impact of Norway on the proxy during that period and having limited coverage of countries included in the proxy in that period. After 2015, when coverage improved, movements in the proxy index were much more closely aligned to those of the UVI and UK IPI series. This supports our potential use of the UVI in the future.

In the third case study we created a proxy for a service – Postal and Courier services. The motive for this is our lack of production of trade indices for services. Our analysis revealed that the SPPIs for the countries with which we engage in trade, experienced similar trends in price movements, and therefore a proxy IPI for services could potentially be generated using the methodology discussed in this paper.

At the ONS, our primary focus for innovative methods to measure Trade prices is to make use of Unit Value Indices where possible for homogeneous goods. This method is both practical to implement, and from our initial results returns promising indices, which may be better measures of these prices than our traditional IPIs and EPIs.