Article

Development of the Annual Purchases Survey

Article providing detail on the development and reinstatement of the UK Annual Purchases Survey, detailing goods and services used by businesses in the production process, otherwise referred to as intermediate consumption.

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1 . Introduction

The Annual Purchases Survey (APS) was re-instated by Office for National Statistics (ONS) in 2015 to meet a range of user demands and to fulfil the recommendations for its reinstatement from two independent reviews, one by Dame Kate Barker and Art Ridgeway (PDF, 571KB) and the other by Professor Sir Charles Bean. A previous survey, entitled the Purchases Inquiry, was suspended in 2006 to reduce ONS costs and burden on UK businesses. However, given the important information on the products that UK businesses purchase that the survey provides, it was decided that it should be reintroduced.

The data collected from the APS will feed into the supply and use framework, which is a central component of the national accounts balancing process and sets the annual level of nominal gross domestic product (GDP). The Eurostat Manual of Supply Use and Input-Output Tables recommends that benchmarked supply and use tables are produced at least every five years based on updated source data. These source data should also be updated periodically to reflect the changing composition of business intermediate consumption in various industries.

Estimates have now been processed and validated for the 2015 reference period. This article provides an overview of the work undertaken to design and deliver this survey and the challenges faced. It also details the future work planned to continue the development of the survey.

We are keen to seek views and would welcome your feedback on the contents of this report. If you have any comments, please email us at purchases.survey@ons.gov.uk.

2 . Purpose of the Annual Purchases Survey

The primary aim of the Annual Purchases Survey (APS) is to provide a comprehensive picture of the goods and services used in the production process by UK businesses, otherwise referred to as intermediate consumption. This product-level information is used in supply and use tables (SUTs) and therefore in the compilation of gross domestic product (GDP). The reintroduction of this survey will help Office for National Statistics (ONS) to adhere to international best practice outlined in European System of Accounts: ESA 2010 and Balance of Payments Manual: BPM6. The APS collects information on companies' intermediate consumption, a national accounts concept defined within the ESA 2010 manual as:

"Intermediate consumption consists of goods and services consumed as inputs by a process of production, excluding fixed assets whose consumption is recorded as consumption of fixed capital. The goods and services are either transformed or used up by the production process."

The survey collects information about businesses' expenditure on energy, services, goods and materials that are used up or transformed by the business activity. It includes raw materials, power and fuel, rental on buildings and business services such as advertising, recruitment consultancy and cleaning. It specifically excludes fixed assets or capital investment, staff costs and goods and services bought for resale without further processing.

Intermediate consumption is required as part of the process to set the annual level of GDP, which is an essential statistic for informing fiscal and monetary policy decisions. There is also strong demand for up-to-date data on purchasing patterns between industries as this helps users understand inter-dependencies between, and characteristics of, UK businesses. This is vital for understanding how the economy is likely to respond to economic policy and economic shocks. Additional uses include:

- the production of regional estimates to help produce country-level SUTs consistent with that of the UK

- detailed coverage of water and energy

- the proportion of total purchases as imports

To ensure all requirements were captured, a Purchases Survey External Stakeholder Working Group of government departments was established to guide development. ONS worked with this group, including Department for Business, Energy and Industrial Strategy, Department of Finance and Personnel Northern Ireland, Scottish Government, Welsh Government and Department for Environment, Food and Rural Affairs, to develop the survey.

One of the challenges in introducing a new survey is that it is difficult to validate the data in the first year as there is no previous data for comparison. There is also a greater likelihood of errors in the first year as businesses become accustomed to a new survey. From the second year of the survey onwards we will begin to have sufficient data to identify patterns of stability and volatility.

3 . History

The original Purchases Survey ran from the 1950s to 2006. Data were collected at five-yearly intervals, then annually from 1999 onwards. The sample size and industry coverage was expanded between 1999 and 2001, from 3,000 businesses (covering partial production, distribution and sales industries) to 28,000 (covering full production, construction, distribution and services industries).

In 2006, the Purchases Survey sample size was cut by 50% to reduce costs and burden on businesses. As a consequence, the results collected were considered to be of insufficient quality and the survey was suspended. The last dataset therefore dates from 2005 and covers reference year 2004. In the absence of a Purchases Survey from 2006 onwards, patterns from this most recent survey have been used to apportion total industry data from the Annual Business Survey (ABS).

The industry totals that are currently used in the supply and use tables are provided by the ABS. These estimates are then apportioned to the product level required within the supply and use tables. For many industries, detailed information on purchases from the 2004 Purchases Survey is used to apportion the current industry-level ABS estimate. The re-introduction of the Annual Purchases Survey is designed to collect detailed product level information to replace the proportions, which have not been updated since 2004.

4 . Main survey Information

This section details some of the main facts relating to the Annual Purchases Survey (APS) in terms of the concepts, methods and challenges faced.

Coverage of the survey

The APS covers a large element of the economy with some notable exceptions such as public administration. This information is collected through other sources, primarily administrative data complemented by other Office for National Statistics (ONS) surveys. The exact inclusions and exclusions of industries are detailed in this section.

Inclusions:

- Agriculture, forestry and fishing (section A) (Standard Industrial Classification 01.6 to 01.7)

- Mining and quarrying (section B)

- Manufacturing (section C)

- Electricity, gas, steam and air conditioning supply (section D)

- Water supply; sewerage, waste management and remediation activities (section E)

- Construction (section F)

- Wholesale and retail trade; repair of motor vehicles and motor cycles (section G)

- Transport and storage (section H)

- Accommodation and food service activities (section I)

- Information and communication (section J)

- Financial and insurance activities (section K)

- Real estate activities (section L)

- Professional, scientific and technical activities (section M)

- Administrative and support service activities (section N)

- Education (section P)

- Human health and social work activities (section Q)

- Arts, entertainment and recreation (section R)

- Other service activities (section S)

Exclusions:

- Agriculture, forestry and fishing (section A) (Standard Industrial Classification 01.1 to 01.5)

- Public administration and defence; compulsory social security (section O)

- Activities of households as employers; undifferentiated goods – and services – producing activities of --

- households for own use (section T)

- Activities of extraterritorial organisations and bodies (section U)

Survey questions

The APS asks businesses to provide details on their intermediate consumption. The main information collected and general format of the APS questionnaire is detailed in Table 1.

Table 1: Annual Purchases Survey questionnaire structure

Section	Variable	Description
A	Reporting period	Reporting period start and end dates
B	Total Purchases	Total expenditure on energy, services, goods and materials, consisting of:
		Total expenditure on energy, services, goods and materials purchased for resale without further processing
		Total expenditure on energy, services, goods and materials used up or transformed by the business
C, D, E	C. Total expenditure on energy, water and waste D. Total expenditure on services E. Total expenditure on goods, materials and related services	Individual industry specific product values Additional product values not relating to industry assumptions Total expenditure used up or transformed by the business Expenditure from suppliers located inside our outside the UK
F	Summary of purchases	This is a total of sections C, D and E Comments
G	Completion time and contact details	Contact name, Time taken to complete; Hours and minutes, Cost of completion, Telephone number, Fax number, Email

Source: Annual Purchases Survey

The APS currently has 109 questionnaire types with an average of 53 questions on each. All questionnaires contain a set of 35 main questions but there is a need for industry-specific questionnaires to collect detailed and specific information. This is based on the level of detail required to feed into the supply and use tables (SUTs) aligned with the requested product-level information. For example, within Section D, (total expenditure on services) businesses may be requested to provide detail on products categorised as:

- architectural, engineering and technical testing services

- telecommunications services

- publishing services

A list of all products required can be found in the Classification of Products by Activity Explanatory notes.

Cognitive testing was undertaken with a selection of businesses to produce a questionnaire. Consultation with external stakeholders also informed the final design. Most users' requirements are met by national accounts needs, but additional requirements to wider users include:

- the production of regional estimates to help produce country-level SUTs consistent with that of the UK

- detailed coverage of water and energy

- the proportion of total purchases as imports

Determination of sample size

A programme of work to determine an appropriate sample design was undertaken and various options explored with a range of different sample sizes tested. The relative quality of the different samples was assessed by comparing the coefficients of variation for the estimate of total turnover. This variable was used as there was no contemporaneous information available on total purchases.

Data are collected by ONS from around 31,000 businesses across the UK. The sample is selected randomly from businesses being grouped by employment size band, Standard Industrial Classification (SIC) and geographical region.

Validation of the estimates

A set of core editing and validation rules were implemented to minimise errors and improve data quality. Atypical results were reviewed and amended as appropriate. These core checks included:

- invalid reporting periods, question numbers and non-responses

- sum of the products matched to totals

- non-rounded figures

As this was the first year of data collection, it was not possible to compare results against data from previous years. Therefore, further validation involved comparing the total intermediate consumption figure from the APS against a derived equivalent figure from the Annual Business Survey (ABS). This provided additional challenges, which are discussed in further sections.

Challenges implementing a new survey

With the introduction of a new survey, there are always challenges whether in terms of appropriate questionnaire design, achieving a suitable response rate or ensuring an appropriate level of quality. The encouraging response rate of just over 80% for the 2015 survey period allowed estimates to be produced for the whole population and methodological work to be undertaken.

The biggest challenge in implementing the survey in the first year was the validation of returned questionnaires. For well-established ONS business surveys, change over time, at both a micro- and macro-level, forms a large element of the quality assurance process. As this was not possible for the first year of the APS, other validation options were explored.

The approach was to compare both the micro-data and the aggregates against the ABS. This presented its own challenges; the ABS does not collect the same level of detail as the APS. Specifically it does not ask for an intermediate consumption figure, however, one can be derived. Hence it is important to have a second year of the APS to help validate both the 2015 and 2016 estimates.

More detail on the coherence and issues faced between the APS and ABS can be found in Section 6 "Coherence between the Annual Purchases Survey and Annual Business Survey".

5 . Initial results from the Annual Purchases Survey

The following tables show Intermediate Consumption estimates (product by industry) collected as part of the 2015 Annual Purchases Survey (APS). The industry and product proportions have been benchmarked to industry totals from the 2015 Annual Business Survey (ABS). This approach is the same as that of the previous Purchases Survey and as set out in the initial requirements; the ABS is an established survey with a much larger sample so provides a better estimate at the aggregated level.

The primary purpose of the APS is to produce product level estimates with the ABS currently being the primary source for total intermediate consumption. A more detailed explanation and example of the benchmarking methodology can be found in Annex A.

Table 2: Intermediate consumption by industry and product group[1]

£million

| Product | Industry Group | | | | | | | | | | |
	A	B - E	F	G - I	J	K[2]	L	M - N	O - Q[3]	R - S	Total
A	437	8,894	50	2,947	2	0	20	680	1	59	13,089
B - E	1,001	249,677	43,642	93,738	15,115	1,544	2,143	32,143	4,532	4,862	448,398
F	25	3,701	58,392	2,284	81	667	2,256	5,945	241	72	73,663
G - I	261	19,327	2,924	42,342	4,551	1,722	475	18,549	1,084	1,496	92,731
J	69	11,565	4,095	12,429	21,722	3,817	917	15,666	943	1,810	73,032
K	87	6,708	2,674	7,514	2,805	3,622	600	6,636	529	638	31,813
L	16	4,999	3,686	19,075	4,689	1,497	2,544	8,866	1,132	1,459	47,962
M - N	274	43,333	20,454	49,219	21,158	8,308	4,935	57,909	4,270	6,302	216,162
O - Q	1	698	201	442	567	238	59	2,232	1,252	72	5,763
R - S	5	756	98	635	1,033	157	58	990	204	1,176	5,112
Total	2,177	349,658	136,215	230,626	71,723	21,572	14,006	149,615	14,188	17,946	1,007,726

Source: Annual Purchases Survey 2015

Notes:

1. Values are constrained to industry total derived from the Annual Business Survey (ABS) 2015

2. Figures for Financial and insurance industries are mainly compiled from Purchases Survey data. These industries in the main are not surveyed by the Annual Business Survey.

3. Excludes Public administration and defence

4. Industry and Product group key: A: Agriculture, B-E: Production, F: Construction, G-I: Distribution, transport, hotels and restaurants, J: Information and communication, K: Finance and insurance, L: Real estate, M-N: Professional and support activities, O-Q: Government, health and education, R-S: Other services

Table 2 shows that businesses in the production industries have the highest estimate of intermediate consumption at £349.7 billion, followed by distribution, transport, hotels and restaurants at £230.6 billion and professional and support activities at £149.6 billion. The agriculture industries have the lowest estimate for intermediate consumption at £2.2 billion.

In terms of products, production-related products have the highest estimate of intermediate consumption at £448.4 billion, followed by professional and support activities at £216.2 billion and distribution, transport, hotels and restaurants at £92.7 billion. Products categorised as other services have the lowest estimate of intermediate consumption at £5.1 billion.

With regards to intermediate consumption, by industry and product category, the production industries' estimated expenditure on production-related products is the highest at £249.7 billion. This is followed by the distribution, transport, hotels and restaurants industries' expenditure on production-related products at £93.7 billion and the construction industries' expenditure on construction works at £58.4 billion.

A more detailed breakdown of the products and industries that make up the product and industry groups contained in Table 2 and Table 3 can be found in Annex B.

Table 3 provides the proportions of intermediate consumption for products within each industry group.

Table 3: Proportion of product group Intermediate Consumption within industry group[1]

Percent (%)

Product	A	B - E	F	G - I	J	K[2]	L	M - N	O - Q[3]	R - S
A	20.1	2.5	0.0	1.3	0.0	0.0	0.1	0.5	0.0	0.3
B - E	46.0	71.4	32.0	40.6	21.1	7.2	15.3	21.5	31.9	27.1
F	1.2	1.1	42.9	1.0	0.1	3.1	16.1	4.0	1.7	0.4
G - I	12.0	5.5	2.1	18.4	6.3	8.0	3.4	12.4	7.6	8.3
J	3.2	3.3	3.0	5.4	30.3	17.7	6.5	10.5	6.6	10.1
K	4.0	1.9	2.0	3.3	3.9	16.8	4.3	4.4	3.7	3.6
L	0.7	1.4	2.7	8.3	6.5	6.9	18.2	5.9	8.0	8.1
M - N	12.6	12.4	15.0	21.3	29.5	38.5	35.2	38.7	30.1	35.1
O - Q	0.1	0.2	0.1	0.2	0.8	1.1	0.4	1.5	8.8	0.4
R - S	0.2	0.2	0.1	0.3	1.4	0.7	0.4	0.7	1.4	6.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Annual Purchases Survey 2015

Notes:

1. Values are constrained to industry total derived from the Annual Business Survey (ABS) 2015

2. Figures for Financial and insurance industries are mainly compiled from Purchases Survey data. These industries in the main are not surveyed by the Annual Business Survey.

3. Excludes Public administration and defence

4 . Industry and Product group key: A: Agriculture, B-E: Production, F: Construction, G-I: Distribution, transport, hotels and restaurants, J: Information and communication, K: Finance and insurance, L: Real estate, M-N: Professional and support activities, O-Q: Government, health and education, R-S: Other services

The production industry had the highest intermediate consumption, with the majority of its expenditure on production-related products (71.4%) and professional and support activities (12.4%). The industry with the second highest intermediate consumption, distribution, transport, hotels and restaurants, also had the highest proportion of expenditure in production-related products (40.6%), followed by expenditure on professional and support activities (21.3%).

Professional and support activities also account for the largest proportion of expenditure in the following industries: professional and support activities (38.7%), finance and insurance (38.5%), real estate (35.1%) and other services (35.2%).

An intermediate consumption (product by industry) table is also produced as part of the Blue Book Summary Supply and Use Tables for the UK. This is not comparable with Table 2 as the table contained in Blue Book is subject to various adjustments. This contains not only ABS data, but is also supplemented by a number of other data sources such as Civil Aviation Authority, National Health Service, public corporations and non-profit institutions serving households (NPISH).

6 . Coherence between the Annual Purchases Survey and the Annual Business Survey

The estimates of industries' total Intermediate Consumption used in the supply and use tables (SUTs) are derived in part from the Annual Business Survey (ABS). The ABS is a well-established survey providing information on turnover, amongst other variables, to help inform and feed into the SUTs and national accounts.

Although the ABS does not specifically collect Intermediate Consumption, it does ask businesses for their total purchases and contains a number of questions that can be used to derive an estimated total figure. Figures from the Annual Purchase Survey (APS) are benchmarked to the ABS estimates to ensure consistency and comparability, as it has a larger sample frame and gives a better aggregate estimate of intermediate consumption.

The purpose of the APS is to produce up-to-date purchasing patterns within industries to improve estimates of Intermediate Consumption by product. In 2015, the estimate of Intermediate Consumption from the APS was approximately £898 billion and the derived estimate for Intermediate Consumption from the ABS was £986 billion. However, as the ABS has a larger, more robust, sample frame, we will continue to use it at an aggregate level and will only use the APS to estimate product level details.

It is important to understand the reasons for any differences between the APS results for intermediate consumption and the derived equivalent on the ABS. This comparison also forms part of the validation process. It is not expected that these figures will be the same, as there are notable differences between the surveys, such as:

- coverage

- definitions

- methodology

This section explores the differences between the surveys, including the estimates and returned figures and some of the underlying reasons behind them.

Differences between sources

Table 4 shows that the total estimate of intermediate consumption from the APS was approximately £898 billion. This estimate includes constructed data from the ABS for non-responding large businesses and the ABS estimates for businesses with low employment and high turnover.

The table also details how the ABS figure for intermediate consumption is derived from the component parts. The estimate for total purchases from the ABS was £2.2 trillion and the derived estimate for intermediate consumption was £986 billion. These estimates have been calculated for comparable businesses on the ABS and therefore exclude public sector businesses.

Table 4: The 2015 Annual Purchases Survey and Annual Business Survey estimates for intermediate consumption

			Estimate (£million)
APS Intermediate Consumption			898,042
ABS Total Purchases			2,217,137
ABS Intermediate Consumption			986,390
Components of Intermediate Consumption	Q402	Goods and all raw materials used in the running of the business	358,765
	Q404	Value of industrial services purchased[1]	16,798
	Q405, 407-410	Amounts payable for: hiring, leasing or renting plant, machinery and vehicles/ road transport services/telecommunications services/computer and related services/ advertising and marketing services	121,928
	Q411	Amounts payable for other services purchased	248,849
	Q421	Amounts payable to sub contractors	165,333
	Q427-428	Energy/water used in the running of your business	52,702
	Q430	Amounts payable to employment agencies for agency staff	20,827
	Q435	Sewerage charges and other costs of waste disposal	4,161
	Q479	Parts used solely in repair and servicing activities[2]	6,732
	Q6100	Purchases of water transport services[1]	41
	Q270-Q272	Change in stock	-9,747

Source: Annual Purchases Survey 2015 and Annual Business Survey 2015

Notes:

1. Production only

2. Motor Trades only

The businesses' allocation of their total purchases to the components, which are used to derive intermediate consumption on the ABS, may help to explain some of the difference at the aggregate level. Further work is being conducted to help understand these differences.

Coverage

Differences between the populations for both the APS and the ABS will have an impact on estimates, at an overall level and for specific industries, as it will affect weights and estimation. The main differences are:

- the ABS population includes public sector organisations that are outside the public administration, education and health industries (Standard Industrial Classification 84 to 86) whereas all public sector organisations are excluded from the APS population

- the APS has a greater coverage of the financial industries and dental practices

To compare the populations for both surveys by employment size-band and to ensure consistency between the populations, the public sector businesses were removed from the ABS population and financial industries and dental care businesses were removed from the APS population.

Table 5: Difference in the number and percentage of businesses in the Annual Purchases Survey and Annual Business Survey populations by employment size-band

	Registered business difference (APS minus ABS)	
Employment size band	**Count**	**%**
0-249	94,192	4.2
250+	41	0.6
Total	94,233	4.2

Source: Annual Purchases Survey and Annual Business Survey

The difference in the number of businesses in the population was relatively small in the largest size-band. However, in the APS there were over 94,000 more businesses with employment of 249 or less. This was a result of unproven or unmatched Pay-As-You-Earn (PAYE) businesses on the Inter-Departmental Business Register (IDBR) that were included in the APS population but not in the ABS population. These businesses are included within the scope of ABS from the 2016 survey period onwards. ABS 2015 results have been analysed both including and excluding these businesses.

It was also important to determine where there were differences in businesses' Standard Industrial Classification (SIC) and size-band between the populations. These differences could impact the estimates at a divisional level and potentially at an overall level.

There were a number of businesses where the SIC and size-band were different in the APS and the ABS populations. This could have an effect on weighting in the calculation of estimates. The reason for this difference was due primarily to the timing of when each survey sample was taken.

The difference in population is unlikely to significantly affect the total estimates, although the changes in size-band and SIC will have specific impacts for certain industries and size-bands.

Methodology and sampling

There is an important difference in the methodology used to calculate the weighted estimates. The ABS uses turnover as the auxiliary variable, taken from the IDBR, for calculating the calibration weights, whereas the APS uses employment.

In terms of sampling, the selections from the populations are at different time points for each survey and the ABS collects data and estimates results for Great Britain and Northern Ireland separately. The ABS has a sample size of around 73,000 compared with the APS sample of around 31,000 businesses.

Differences in business returns

The ABS survey has long and short versions of questionnaires, to reduce respondent burden where appropriate. The short version only asks for totals, including the total purchases figure, whereas the corresponding long version asks for a more detailed breakdown of these totals. The figures from the long version are then used to derive intermediate consumption. Many of the smaller businesses (fewer than 250 employment) are only sent a short version, which asks for total purchases. The breakdown of this overall value is then estimated using component proportions of businesses returning the long version.

The returned figures for the larger businesses should, however, be more comparable as they all receive the long version. For 2015, there were over 11,000 businesses where there was an estimate for both surveys. Out of these, approximately 10,000 businesses had actual returns to both surveys.

When comparing these businesses the following metrics were observed:

- over 4,000 businesses had a higher returned figure for intermediate consumption on the APS compared with the derived equivalent on the ABS; of these, approximately 1,300 businesses were within 5% of the derived figure on the ABS

- more than 6,000 businesses had a higher derived figure for intermediate consumption on the ABS than reported for the APS; of these, around 1,000 businesses were within 5% of the APS-returned figure

- approximately 250 businesses had an absolute difference greater than £100 million; these businesses contributed to a combined difference of £26.4 billion (the ABS estimate was higher than the APS)

A breakdown of the differences for businesses that responded to both surveys, by size of the business (in terms of employment), is detailed in Table 6.

Table 6: The number of businesses with returns for intermediate consumption on both surveys and the difference in total intermediate consumption by employment size-band

Employment size band	Number of business with returns for both surveys	APS £million	ABS £million	Difference in returned Intermediate Consumption £million
0-249	4,881	18,211	20,286	2,075
250+	6,450	448,244	500,791	52,547
Total	11,331	466,454	521,077	54,623

Source: Annual Purchases Survey and Annual Business Survey

The comparison suggests that returned data are a main contributing factor to the difference in estimates for intermediate consumption. However, each survey asks different questions and the ABS does not directly ask for intermediate consumption; rather the figure is derived from a number of questions.

Average returns per business

For the smaller businesses (fewer than 250 employment), there is limited overlap in businesses that returned to both surveys because smaller businesses are sampled randomly.

There are very few businesses that are sampled for both surveys in the size-band where businesses have fewer than 10 employment. In order to determine if there are any similarities or differences for these smaller businesses, an average return per business was calculated by industry and size of businesses (based on standard size-bands).

The differences in the average returns per business suggest the ABS-returned data are higher than the APS, not just for businesses returning to both surveys, but across all businesses. This could be due to the number of issues and definitional differences identified previously.

Summary

There are a number of reasons for the differences in estimates of intermediate consumption between the two surveys. These arise from fundamental differences between the surveys, which include their coverage, methodology, population universes, sampling and the questionnaire design.

Work is ongoing to ensure consistency in the methodology, with some planned changes for the 2017 survey period. Further details on this are provided in the section "Next steps". However, both surveys measure slightly different concepts, therefore while there will be similarities, fundamental differences will remain.

7 . Next steps

Following the results of the 2015 Annual Purchases Survey (APS), a number of actions have been implemented with the aim of continually developing and improving the survey both from an Office for National Statistics (ONS) and respondent perspective.

Initial changes

Although little change was made to the 2016 survey, to ensure consistency with the 2015 survey, a number of changes will be made for the 2017 survey based on feedback received. Further changes may also be made to the 2018 survey following the results of work around the questionnaire design, which will take place over the coming months.

The main changes to the 2017 survey are the sample selection and despatch of questionnaires to respondents. The 2017 APS will select its sample from the Inter-Departmental Business Register (IDBR) on the same day as the Annual Business Survey (ABS), to ensure that the two surveys will have a consistent survey population. This will allow for easier comparison of data across the two surveys.

The 2017 APS will also use a single questionnaire despatch rather than the two-phase approach used in 2015 and 2016. The 2017 survey will despatch all questionnaires around the end of February 2018, in line with the annual timeframe for the phase one despatch in 2015 and 2016. This will result in more timely survey response and consequently earlier quality assurance of survey results.

Future work

We plan to review the questionnaire for the APS. Small wording changes and additional questionnaire completion guidance for respondents has been implemented. This did not require significant formatting changes and will be in place for the 2017 survey.

A project is also being undertaken to better understand the discrepancies between respondent returns. An overlap exists between respondents answering both surveys; the project will seek their views on the different surveys. This will be achieved through interviewing a sample of businesses, with directed questions around main elements of the survey. The project will also seek views from businesses whose reported data were the same for both surveys, as well as businesses that responded only to the APS. Businesses will also be asked specific questions relating to completion procedures for the surveys.

Part of this work will involve ongoing questionnaire redesign and redevelopment, with potential formatting and wording changes. These changes will feed into the survey design for the 2018 survey period.

ONS has set up a new International Business Unit (IBU) to review the structure of large multinational businesses to help understand how they operate both within and outside of the UK. Businesses consulted as part of this work will help to inform and understand the data provided to both surveys and will add additional value to the congruence work.

Dissemination

The 2016 APS data is currently being quality assured, with the aim to publish in the summer of 2018. In the future, the intention is for the release of APS estimates to follow a similar release schedule to the ABS. Initial estimates would be released in November and revised estimates the following April. This timeline is still provisional and subject to review and change. Current plans are for APS data to be used in full in the compilation of Blue Book 2019 and where possible estimates from the survey will be used to inform Blue Book 2018.

Figure 1: Timeline of Annual Purchases Survey main milestones
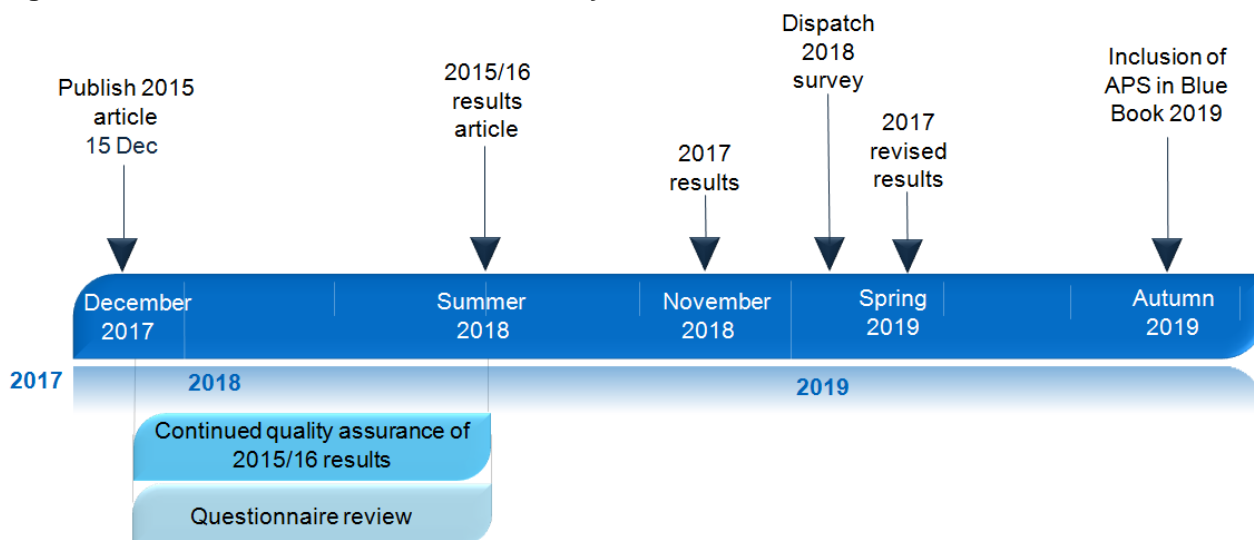
We are keen to get your views on the methods and work to date to help inform and make improvements to the APS. If you have any comments, please email us at purchases.survey@ons.gov.uk.

8 . Annex A – Methodology used within the Annual Purchases Survey

This section describes concepts and statistical methods underlying the Annual Purchases Survey (APS). It includes information about sample design, data collection, results processing, publications and quality issues. These generally follow a similar approach to the previous Purchases Survey that was conducted up to 2006.

Sample procedure

Sampling frame

The Inter-Departmental Business Register (IDBR) is used as the sampling frame for the APS. This includes businesses that are:

- registered for Value Added Tax (VAT) with HM Revenue and Customs (HMRC)

- registered for a Pay As You Earn (PAYE) scheme with HMRC

- an incorporated business registered at Companies House

The IDBR covers businesses in all parts of the economy, except some very small businesses. The self-employed and those without employees are not registered for PAYE and those with low turnover are not registered for VAT; this includes some non-profit making organisations.

There are approximately 2.1 million businesses on the IDBR covering nearly 99% of UK economic activity. It is used by government departments, including Office for National Statistics (ONS), as the sampling frame for most business surveys. Administrative data, from the sources defined previously, are supplemented by data from surveys such as the Business Register and Employment Survey (BRES) to keep information on the IDBR up-to-date.

Further information about the IDBR can be found on the ONS IDBR web pages.

Standard Industrial Classification

Each business is classified according to the Standard Industrial Classification of Economic Activities (SIC) system. The UK is required by European legislation to have a system of classification consistent with the European Union's industrial classification system. The system underwent a major review in 2007. UK SIC (2007) is divided into 21 sections, which are then broken down into divisions and classes (four digits). The full structure of SIC 2007 consists of 21 sections, 88 divisions and 615 classes.

The industries included and excluded by the APS are detailed in this section.

Inclusions:

- Agriculture, forestry and fishing (section A) (SIC 01.6 to 01.7)

- Mining and quarrying (section B)

- Manufacturing (section C)

- Electricity, gas, steam and air conditioning supply (section D)

- Water supply; sewerage, waste management and remediation activities (section E)

- Construction (section F)

- Wholesale and retail trade; repair of motor vehicles and motor cycles (section G)

- Transport and storage (section H)

- Accommodation and food service activities (section I)

- Information and communication (section J)

- Financial and insurance activities (section K)

- Real estate activities (section L)

- Professional, scientific and technical activities (section M)

- Administrative and support service activities (section N)

- Education (section P)

- Human health and social work activities (section Q)

- Arts, entertainment and recreation (section R)

- Other service activities (section S)

Exclusions:

- Agriculture, forestry and fishing (section A) (SIC 01.1 to 01.5)

- Public administration and defence; compulsory social security (section O)

- Activities of households as employers; undifferentiated goods – and services – producing activities of -

- households for own use (section T)

- Activities of extraterritorial organisations and bodies (section U)

Sample design

Data are collected by ONS from around 31,000 businesses across the UK. The sample is selected randomly from groups of businesses (strata) defined by three stratification variables:

- employment size band (0 to 9, 10 to 19, 20 to 49, 50 to 99, 100 to 249, 250 and over)

- SIC (five-digit level)

- geographical region (England and Wales, Scotland, Northern Ireland)

The sample is selected independently within each stratum. The size of the sample in each stratum is determined by an algorithm, which allocates the sample amongst the stratum to achieve the lowest estimated variance (uncertainty). This design is significantly more efficient (it gives a much more accurate estimate for the same size sample) than a simple, un-stratified random sample.

For the largest size-bands, containing businesses with employment of 250 or more, all businesses are selected. This is because these strata tend to have few businesses in them and yet, as they are large businesses, they are dominant contributors to the UK economy. Including all the largest enterprises significantly reduces uncertainty on the estimated total values.

For most businesses with employment of 0 to 9, Osmotherly rules apply. These rules state that when a business with 0 to 9 employment has been selected in a survey, it will only be selected for a single year and then will not be reselected for a minimum of three years. There are a few exceptions to these rules, but in general, they are implemented to reduce the burden on small businesses.

Data collection

The APS currently has 109 questionnaire types with an average of 53 questions on each. The survey questions were created using the Statistical Classification of Products by Activity (CPA) version 2.1.

The CPA is the classification of products (goods as well as services), which is specified by the European Union (EU). Product classifications are designed to categorise products that have common characteristics. They provide the basis for collecting and calculating statistics on the production, distributive trade, consumption, international trade and transport of such products.

All questionnaires contain a set of 35 main questions but there is a need for industry-specific questionnaires to collect detailed and specific information. The remaining CPA product questions are included as appropriate to particular industries. This avoids placing unnecessary burden upon respondents in sifting through questions that may be irrelevant. In due course, ONS is moving towards online data collection, which will aid questionnaire filtering.

The main variables that are collected on the survey are described in Table 7.

Table 7: Annual Purchases Survey questionnaire structure

Section	Variable	Description
A	Reporting period	Reporting period start and end dates
B	Total Purchases	Total expenditure on energy, services, goods and materials, consisting of:
		Total expenditure on energy, services, goods and materials purchased for resale without further processing
		Total expenditure on energy, services, goods and materials used up or transformed by the business
C, D, E	C. Total expenditure on energy, water and waste D. Total expenditure on services E. Total expenditure on goods, materials and related services	Individual industry specific product values Additional product values not relating to industry assumptions Total expenditure used up or transformed by the business Expenditure from suppliers located inside our outside the UK
F	Summary of purchases	This is a total of sections C, D and E Comments
G	Completion time and contact details	Contact name, Time taken to complete; Hours and minutes, Cost of completion, Telephone number, Fax number, Email

Source: Annual Purchases Survey

Converting respondent data into published estimates

Editing and validation

Questionnaires are sent to businesses by post, along with detailed instructions on completion and return. When responses are received, questionnaires are scanned and the data are transferred to the processing system. Initial validation checks are carried out on the returned data. For example, data will fail validation if:

- the data are for periods other than the required year

- there is an invalid question number on the questionnaire

- no questions have been completed

After the initial validation, further editing is carried out. These include checking the sum of the breakdown of components against the total values and that figures are provided to nearest thousand pounds.

There are a certain number of businesses that have returned data for both the APS and ABS. These are generally businesses with an employment greater than 250. A total intermediate consumption figure is derived from the ABS and compared against the APS return. A threshold is defined based on the actual and percentage difference and those above this are reviewed, in many cases by re-contacting the business to correct or understand the difference.

When all data have passed the required tests and validation failures have been edited, the dataset is considered "clean" and industry estimates for publication can be calculated. The industry estimates are then subject to further quality checks, as described in the Post-results processing validation section.

Construction

Constructions are used to estimate missing data due to non-response. This gives better results than deletion, in which all businesses with any missing values are omitted from the analysis. Constructing data is done mainly for large businesses, such as those with 250 or more employment. For non-responding smaller businesses (fewer than 250 employment) construction is not carried out; instead, figures are estimated using weighting (see the Estimation section).

The first stage is to check if the business was selected and responded to the ABS within the same reporting period. If this is the case, a total intermediate consumption figure is derived from the ABS data and is used in place of a non-response. Returned values for a business are likely to be closer to the true value being measured than values produced through weighting and estimation. The ABS does not collect information at the level of detail required by the APS, so this can only be done for totals.

The components therefore need to be estimated for businesses constructed from the ABS. This is done by calculating component proportions for those businesses that have returned to the APS and using these proportions to estimate the size of the components for the other businesses. Proportions are calculated from businesses in the same employment size-band and same four-digit SIC industry (stratum) as the businesses that are being estimated where sufficient response allows.

Estimation

It is not feasible to collect data on every UK business every year because the burden on businesses would be too great and the cost of running a business census would be prohibitive. A well-designed sampled survey can produce better estimates than a census with a poor response rate.

A sample of the UK business population is therefore used to collect information for the APS. In order to calculate estimates for the entire business population from sampled data, standard statistical weighting methods are used. Essentially, the results received from the sample are multiplied by two weights:

- the design weight, which accounts for the sample design by inverting a business's probability of selection (that is, the population divided by the sample)

- the calibration weight, corrects for any potential bias in the selected sample (that is, the average employment in the population divided by the average employment in the sample)

The weighted value is then:

weighted value = returned value of the variable × design weight × calibration weight

Estimated population totals are then calculated by aggregating the weighted values over the whole sample.

Identifying and processing outliers

For business returns, where a particular variable is proportionally much higher or lower than other businesses within the same stratum, the return is deemed to be atypical and therefore an outlier. For the APS, an outlier is defined as a returned value that has a very large influence on the overall estimate.

When the outliers have been identified, an additional weight is applied to produce the weighted value, wherein the combined weights of the outliers are reduced to the value one. The method assumes that the sampled outliers are the only outliers in the population.

Post-results processing validation

Post-results processing validation refers to the stage where checks are done on the final industry and product results. The general process is outlined in Figure 2.

Figure 2: Post results validation process
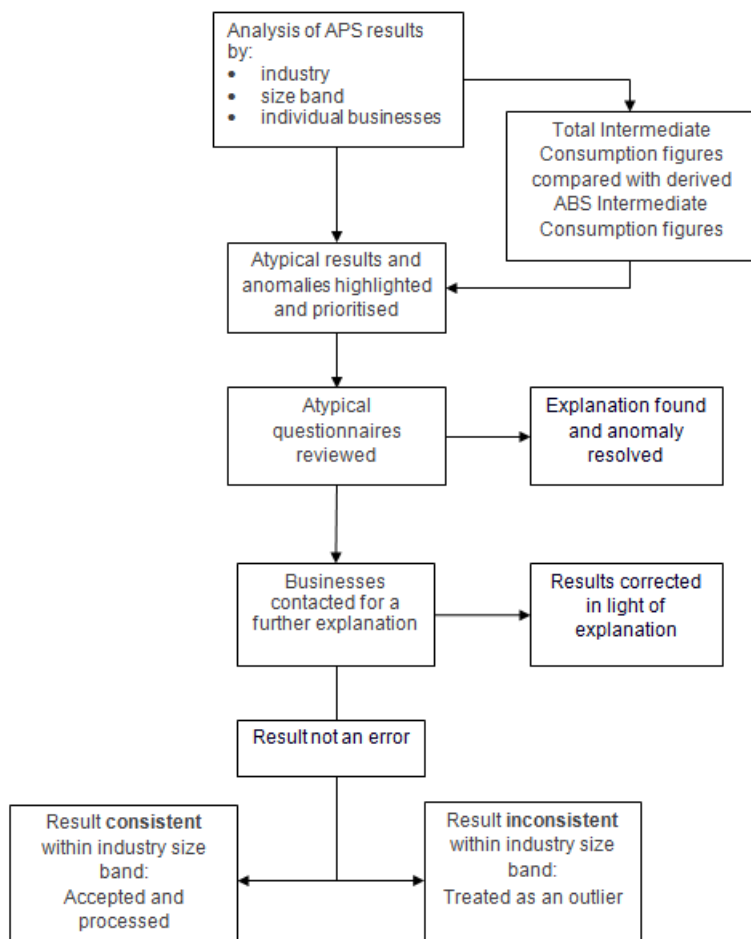
Dealing with low employment, high turnover businesses

There are businesses on the IDBR that have low (fewer than 250) employment and high turnover. These businesses can have an impact on the weighted results depending on whether or not they are sampled. All of these businesses are synthetically added to the sample but the majority do not receive a questionnaire. All of these businesses receive an ABS questionnaire, so these responses are used in the results process.

As the ABS will only approximate a total intermediate consumption figure, the distribution of the component products is estimated based on business returns to the APS (in the same way as large non-responding businesses, as detailed in the Construction section). This is performed at the industry level.

As a small number of these businesses received an APS questionnaire, analysis was undertaken to see if an alternative approach might be more appropriate, specifically using the product distribution just for the low employment and high turnover businesses. The analysis highlighted that this approach would have little impact where the number of businesses was large and would not be robust where there was a small number of businesses.

Benchmarking to the Annual Business Survey

Once estimates for the APS have been produced and validated, the final stage is to benchmark the derived ABS intermediate consumption figure. This is the same approach as was previously done under the Purchases Survey and was a requirement of users as part of the initial design. This is employed because the ABS is an established survey, which has a much larger sample than the APS (73,000 businesses compared with 31,000 businesses). This therefore provides a more robust estimate at the aggregate level and ensures comparability and consistency.

This approach was implemented for industries covered by the APS at the A114 industry level (a breakdown of the economy into 114 industry groupings). A benchmark is calculated for each industry based on the total intermediate consumption figures for both ABS and APS at this level. This benchmark is then applied to each of the product estimates within each industry. Table 8 provides an illustrative example of this.

Table 8: Example of benchmarking

Pre Constraining

	Industry			Total APS	Total ABS
	1	2 …	110		
Product 1	100	200	200	500	N/A
2	300	500	200	1,000	N/A
…				0	
110	400	200	150	750	N/A
Total APS	800	900	550	2,250	
Total ABS	1,000	1,500	400		2,900
Scaling Factor	1.25	1.67	0.73		

Post Constraining

	Industry			New APS	Total ABS
	1	2 …	110		
Product 1	125	333	145	604	N/A
2	375	833	145	1,354	N/A
…					
110	500	333	109	942	N/A
New APS	1,000	1,500	400	2,900	
Total ABS	1,000	1,500	400		2,900

This method maintains the proportions of products purchased within each industry, while maintaining consistent total industry estimates with the ABS. There are some slight variations to this approach for specific industries due to the coverage within both surveys; for example, there is less coverage of the financial industries in the ABS, in comparison with the APS.

9 . Annex B - Classification of Products by Activity (CPA) and Standard Industrial Classification: SIC 2007 mapping

Table 9: Classification of Products by Activity (CPA) and Standard Industrial Classification (SIC) 2007

CPA/ SIC Code	Product/ Industry Group	Description
01	Agriculture	Crop and animal production, hunting and related service activities
02	Agriculture	Forestry and logging
03	Agriculture	Fishing and aquaculture
05	Production	Mining of coal and lignite
06	Production	Extraction of crude petroleum and natural gas
07	Production	Mining of metal ores
08	Production	Other mining and quarrying
09	Production	Mining support service activities
10.1	Production	Processing and preserving of meat and production of meat products
10.2-3	Production	Processing and preserving of fish, crustaceans, molluscs, fruit and vegetables
10.4	Production	Vegetable and animal oils and fats
10.5	Production	Dairy products
10.6	Production	Grain mill products, starches and starch products
10.7	Production	Bakery and farinaceous products
10.8	Production	Other food products
10.9	Production	Prepared animal feeds
11.01-6	Production	Alcoholic beverages
11.07	Production	Soft drinks; production of mineral waters and other bottled waters
12	Production	Tobacco products
13	Production	Textiles
14	Production	Wearing apparel
15	Production	Leather and related products
16	Production	Wood and products of wood and cork, except furniture; articles of straw and plaiting materials
17	Production	Paper and paper products
18	Production	Printing and reproduction of recorded media
19	Production	Coke and refined petroleum products
20.3	Production	Paints, varnishes and similar coatings, printing ink and mastics
20.4	Production	Soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
20.5	Production	Other chemical products
20A	Production	Industrial gases, inorganics and fertilisers (all inorganic chemicals) - 20.11/13/15
20B	Production	Petrochemicals - 20.14/16/17/60

20C	Production	Dyestuffs, agro-chemicals - 20.12/20
21	Production	Basic pharmaceutical products and pharmaceutical preparations
22	Production	Rubber and plastic products
23.5-6	Production	Cement, lime, plaster and articles of concrete, cement and plaster
23 OTHER	Production	Glass, refractory, clay, porcelain, ceramic, stone products - 23.1-4 /7-9
24.1-3	Production	Basic iron and steel
24.4-5	Production	Other basic metals and casting
25.4	Production	Weapons and ammunition
25 OTHER	Production	Fabricated metal products, excluding weapons and ammunition - 25.1-3/5-9
26	Production	Computer, electronic and optical products
27	Production	Electrical equipment
28	Production	Machinery and equipment n.e.c.
29	Production	Motor vehicles, trailers and semi-trailers
30.1	Production	Building of ships and boats
30.3	Production	Air and spacecraft and related machinery
30 OTHER	Production	Other transport equipment - 30.2/4/9
31	Production	Furniture
32	Production	Other manufacturing
33.15	Production	Repair and maintenance of ships and boats
33.16	Production	Repair and maintenance of aircraft and spacecraft
33 OTHER	Production	Rest of repair; installation - 33.11-14/17/19/20
35.1	Production	Electric power generation, transmission and distribution
35.2-3	Production	Gas; distribution of gaseous fuels through mains; steam and air conditioning supply
36	Production	Water collection, treatment and supply
37	Production	Sewerage
38	Production	Waste collection, treatment and disposal activities; materials recovery
39	Production	Remediation activities and other waste management services
41	Construction	Construction of buildings
42	Construction	Civil engineering
43	Construction	Specialised construction activities
45	Distribution, transport, hotels and restaurants	Wholesale and retail trade and repair of motor vehicles and motorcycles

46	Distribution, transport, hotels and restaurants	Wholesale trade, except of motor vehicles and motorcycles
47	Distribution, transport, hotels and restaurants	Retail trade, except of motor vehicles and motorcycles
49.1-2	Distribution, transport, hotels and restaurants	Rail transport
49.3-5	Distribution, transport, hotels and restaurants	Land transport services and transport services via pipelines, excluding rail transport
50	Distribution, transport, hotels and restaurants	Water transport
51	Distribution, transport, hotels and restaurants	Air transport
52	Distribution, transport, hotels and restaurants	Warehousing and support activities for transportation
53	Distribution, transport, hotels and restaurants	Postal and courier activities
55	Distribution, transport, hotels and restaurants	Accommodation
56	Distribution, transport, hotels and restaurants	Food and beverage service activities
58	Information and communication	Publishing activities
59	Information and communication	Motion picture, video and TV programme production, sound recording and music publishing activities
60	Information and communication	Programming and broadcasting activities
61	Information and communication	Tlecommunications
62	Information and communication	Computer programming, consultancy and related activities
63	Information and communication	Information service activities
64	Finance and insurance	Financial service activities, except insurance and pension funding
65.1-2	Finance and insurance	Isurance and reinsurance, except compulsory social security
65.3	Finance and insurance	Pension funding
66	Finance and insurance	Activities auxiliary to financial services and insurance activities
68.1-2	Real estate	Buying and selling, renting and operating of own or leased real estate, excluding imputed rental
68.3	Real estate	Real estate services on a fee or contract basis
69.1	Professional and support activities	Legal activities
69.2	Professional and support activities	Accounting, bookkeeping and auditing activities; tax consultancy
70	Professional and support activities	Activities of head offices; management consultancy activities

71	Professional and support activities	Architectural and engineering activities; technical testing and analysis
72	Professional and support activities	Scientific research and development
73	Professional and support activities	Advertising and market research
74	Professional and support activities	Other professional, scientific and technical activities
75	Professional and support activities	Veterinary activities
77	Professional and support activities	Rental and leasing activities
78	Professional and support activities	Employment activities
79	Professional and support activities	Travel agency, tour operator and other reservation service and related activities
80	Professional and support activities	Security and investigation activities
81	Professional and support activities	Services to buildings and landscape activities
82	Professional and support activities	Office administrative, office support and other business support activities
84	Government, health and education	Public administration and defence; compulsory social security
85	Government, health and education	Education
86	Government, health and education	Human health activities
87	Government, health and education	Residential care activities
88	Government, health and education	Social work activities without accommodation
90	Other services	Creative, arts and entertainment activities
91	Other services	Libraries, archives, museums and other cultural activities
92	Other services	Gambling and betting activities
93	Other services	Sports activities and amusement and recreation activities
94	Other services	Activities of membership organisations
95	Other services	Repair of computers and personal and household goods
96	Other services	Other personal service activities

Source: Classification of Products by Activity (CPA) and Standard Industrial Classification SIC 2007