Office for National Statistics

Article

Developing labour market metrics for the market sector, UK: 2016

Development of new labour market metrics covering market sector employment, hours worked and labour remuneration, which have been compiled at component-industry level for the first time. The primary motivation for this development work is to populate a new industry-level market sector quality-adjusted labour input (QALI) framework to allow more rigorous estimation of market sector multi-factor productivity (MFP).

Contact:
Mark Franklin
productivity@ons.gov.uk

Next release:
To be announced

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1 . Abstract

Describes the development of new labour market metrics covering market sector employment, hours worked and labour remuneration, which have been compiled at component-industry level for the first time. TThe primary motivation for this development work is to populate a new industry-level market sector quality adjusted labour input (QALI) framework – the results of which are described in Quality adjusted labour input: UK estimates to 2015 – to allow more rigorous estimation of market sector multi-factor productivity (MFP). However, the development work described in this article also has potential implications for our other productivity metrics including labour productivity and public service productivity estimates.

In practice, the production of these estimates of labour input requires the compilation of industry-level estimates for the non-market sector, before extracting market sector estimates by residual. Coverage of the non-market sector is determined by our national accounts framework, which allows identification of those industries with non-zero non-market measurable economic activity and also identifies a single industry (public administration and defence) which is 100% non-market.

As always, user feedback is welcome and can be sent to productivity@ons.gov.uk.

2 . Introduction

Productivity is concerned with the relationship between economic inputs and outputs. The nature of this relationship is often modelled in terms of a general production function which relates inputs of factors of production (labour and capital) to the output of goods and services. The growth accounting literature (Solow, 1957, Jorgenson and Griliches, 1967) further assumes that in competitive equilibrium, labour and capital are employed up to the point where their marginal revenue product is equal to their marginal cost or, equivalently, where the value of output is equal to the cost of the factor inputs. This allows growth in economic output to be arithmetically decomposed into contributions from growth in labour and capital, and a residual multi-factor productivity (MFP) component. In the growth accounting framework, MFP represents changes in economic output which cannot be accounted for by changes in factor inputs, and is commonly interpreted as capturing technological change.

There are 2 reasons why fitting this model to real world data works better for the market sector than for the non-market sector. First, there are no market prices for non-market output, which in the UK National Accounts is either measured by the cost of inputs (in which case productivity growth is zero by definition) or by direct measurement of service delivery, including indicators such as the number of pupils taught or the number of hospital operations carried out. This approach delivers output estimates which are independent of input measures, and hence non-zero productivity estimates. However, the output measures are not able to take account of quality changes in the same way that a market-based output would, for example, by picking up changes in quality-adjusted prices[1].

Second, in the national accounts, capital costs in non-market activities are defined as consumption of fixed capital only, that is, the return on capital is defined as zero. As noted in the OECD Measuring Capital manual (OECD, 2009), this means that it is not possible to identify the price and volumes of capital services for assets used by non-market producers in production.

Accordingly it is common practice among those National Statistics Institutes (NSIs) that produce regular estimates of MFP to focus on the market sector or some variant thereof. For example, the US Bureau of Labor Statistics produces MFP estimates for the private business and private non-farm business sectors of the economy. The Australian Bureau of Statistics and Statistics Canada produce MFP estimates for the market sector.

Notes:

1. Boskin (1996) and Johnson (2015) note that accounting for quality change in price measurement is not straightforward.

3 . Existing measures of market sector output and inputs

Producing estimates of the output and input of the market sector is not straightforward as it is not well defined in statistical terms. In the European System of accounts 2010 (ESA 2010), the "market sector" is used to describe the part of the economy in which output is sold at economically meaningful prices. This gives rise to identification of "non-market output" in the supply-use framework (along with "own account output") and compilation of aggregate market sector chained-volume gross value added (GVA) estimates, published within the Quarterly National Accounts (series L48H).

We have produced estimates of market sector GVA since 2005 (Herbert and Pike, 2005) and market sector labour productivity since 2006 (Marks, 2006). Market sector GVA is published as a quarterly chain-volume index series (L48H). Market sector labour productivity divides this series by estimates of market sector employment and hours worked to compile quarterly estimates of market sector output per worker and output per hour worked.

The market sector employment measures currently used to produce estimates of output per worker are calculated by simply subtracting general government employment (that is, the combined institutional sectors of central and local government) from whole economy employment from the Labour Force Survey (LFS). Further education and sixth-form colleges in England were classified out of general government from June 2012, but are classified to the non-market sector throughout, with simple projections from 2012.

Estimates of market sector hours worked used to produce market sector output per hour are produced using the LFS micro-data to derive average hours worked in the market and non-market sectors. This uses an LFS variable which identifies the type of organisation where the LFS respondents work. Employment and average hours estimates are multiplied together, then seasonally adjusted and jointly benchmarked to the published aggregate measure of seasonally adjusted total hours worked (YBUS).

While this process captures the main differences between the market and non-market sector, there are a number of deficiencies with this approach.

First, it is inconsistent with the national accounts approach to measuring output. National accounts treats most of the output of non-profit institutions serving households (NPISH) – including charities and further education colleges – as non-market. However, labour input in organisations classified to NPISH remains classified to the market sector on the current approach. As a consequence, measures of market sector employment are higher than they would be if the approach to the measurement of labour input was harmonised with that for the measurement of value added.

Second, not all output of the general government sector is non-market. As a result, the allocation of all general government labour input to non-market pushes down on estimates of labour input in the market sector.

Third, the LFS micro-data used to compute average market sector and non-market sector hours worked are not filtered by industry and hence allocate some workers to the "wrong" sector.

Fourth, no industry breakdowns of market sector labour inputs or output volumes are currently available. [1]

These challenges notwithstanding, we have previously produced market sector multi-factor productivity (MFP) estimates based on these estimates of market sector labour input – the best available at the time.

It is worth noting that the market and non-market breakdown is distinct from a private and public sector breakdown. In the national accounts, the public sector is well defined in the sector and financial accounts framework as general government plus public corporations. However, this is of limited use for productivity analysis because there are no breakdowns of output or factor inputs in volume terms by institutional sector. Moreover, the scope of public corporations is subject to classification changes which create volatility. For example, during the financial crisis of 2008, several large UK banks were reclassified to the public sector as the government took controlling equity stakes. Some of these institutions have been reclassified back to the private sector as these stakes have been sold down.

Notes:

1. More generally, there is currently no industry by institutional breakdown of the labour market. This is on top of familiar issues with reconciling labour market and national accounts sources, including multiple and conflicting breakdowns of labour by industry and a relative paucity of information on self-employment.

4 . Proposed approach

The proposed new approach differs from the existing treatment in 2 important respects. Firstly, it uses information from the Labour Force Survey (LFS) to identify workers in the non-profit institutions serving households (NPISH) sector and to move them from the market sector to the non-market sector. Secondly, it uses information about the industry distribution of government and NPISH workers to generate more detailed industry information than is currently available. These improvements to the allocation of workers have a corresponding impact on estimates of hours worked. There are various aspects to the new methodology.

It will augment existing series for non-market sector workers (used to define market sector workers by residual) with estimates of workers in the NPISH institutional sector, derived from the LFS. The new methodology will also develop new component estimates of market sector and non-market sector workers by industry using existing information on the industry distribution of general government employment and information derived from the LFS on the distribution of NPISH employment. In both cases, estimates are subject to filtering to remove estimates which would place employment in industries with no non-market output components in the national accounts.

The new methodology will develop new estimates of average hours worked by market and non-market sector and by industry, by augmenting existing coding to extract this information from the LFS.

Estimates of persons employed and average hours worked can be combined to compile estimates of total hours worked.

There will be new estimates of market sector labour income by industry. Top-level estimates of market sector compensation of employees (COE) are available from our sector and financial accounts. To allocate market sector COE between industries we propose using pay weights derived from the LFS.

COE represents the labour income of employees. Turning to the self-employed we propose to treat all self-employment as part of the market sector. This is in line with our current methodology but requires some additional processing of the LFS micro-data to deal with respondents who report that they are self-employed and work in industry O (public administration and defence) with no market sector output component in the national accounts.

5 . Detailed methodology and results

Workers

We compile estimates of market sector workers by residual, that is, by compiling estimates of non-market workers by industry and subtracting these from industry totals. Our starting point is a breakdown of general government employment by industry (consistent with estimates published in the quarterly public sector employment release). Industry-level estimates are currently available only back to Quarter 3 (July to Sept) 2010 and only for Great Britain. As already noted, these estimates allocate a small number of general government workers to industries with no non-market output according to the national accounts. These workers have been reallocated out of the non-market sector.

General government workers in Northern Ireland have been allocated to industries using the Great Britain pattern. The dataset has been extended backwards using the Labour Force Survey (LFS) estimates of workers who report that they work in the types of non-private organisation shown in Table 1. The LFS estimates have been benchmarked to the published aggregate general government series, adjusted to remove the small number of general government workers in wholly market sector industries.

Table 1: LFS categories interpreted as general government

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Central government, civil service
Local government or council (including police etc)
Health authority or NHS trust
Source: Office for National Statistics

To capture workers in NPISH we use the LFS estimates for workers who report that they work in the types of non-private organisations shown in Table 2. Again, we remove such workers who report that they work in industries that are wholly market sector in National Accounts terms.

Table 2: LFS categories interpreted as NPISH

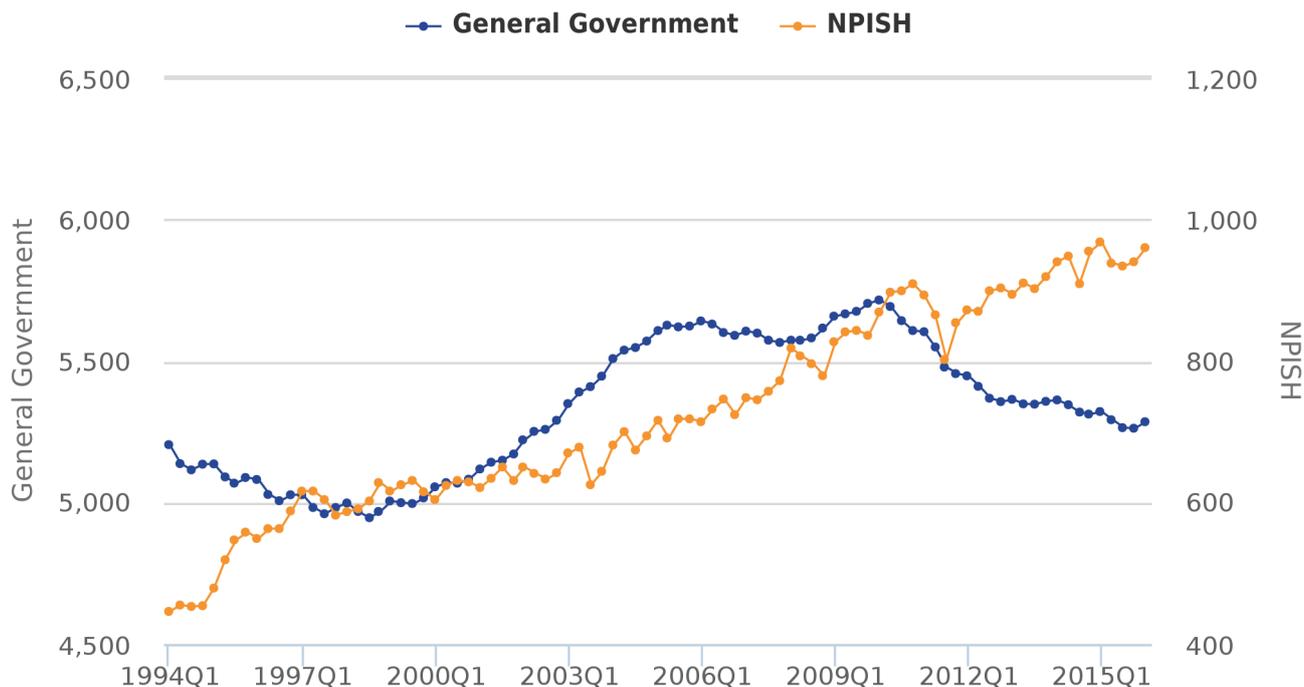| Table 2: LFS categories interpreted as NPISH |
| --- |
| Charity, voluntary organisation etc |
| Other kind of organisation |
| Source: Office for National Statistics |

Notes:

1. NPISH: Non-profit institutions serving households

The resulting aggregate estimates are shown in Figure 1. General government non-market employment has averaged around 5.4 million over the whole period. Employment increased rapidly between 1998 and 2006 then declined a little before another increase to a peak of around 5.7 million in early 2010. Non-market general government employment has fallen by around 0.4 million over the 6 years since 2010. NPISH non-market employment is an order of magnitude lower than general government employment but on a steadily increasing trend.

Figure 1: General government and NPISH non-market workers, time series

UK

Source: Office For National Statistics

Notes:

1. Q1 is Quarter 1 (Jan to Mar), Q2 is Quarter 2 (Apr to June), Q3 is Quarter 3 (July to Sept) and Q4 is Quarter 4 (Oct to Dec).
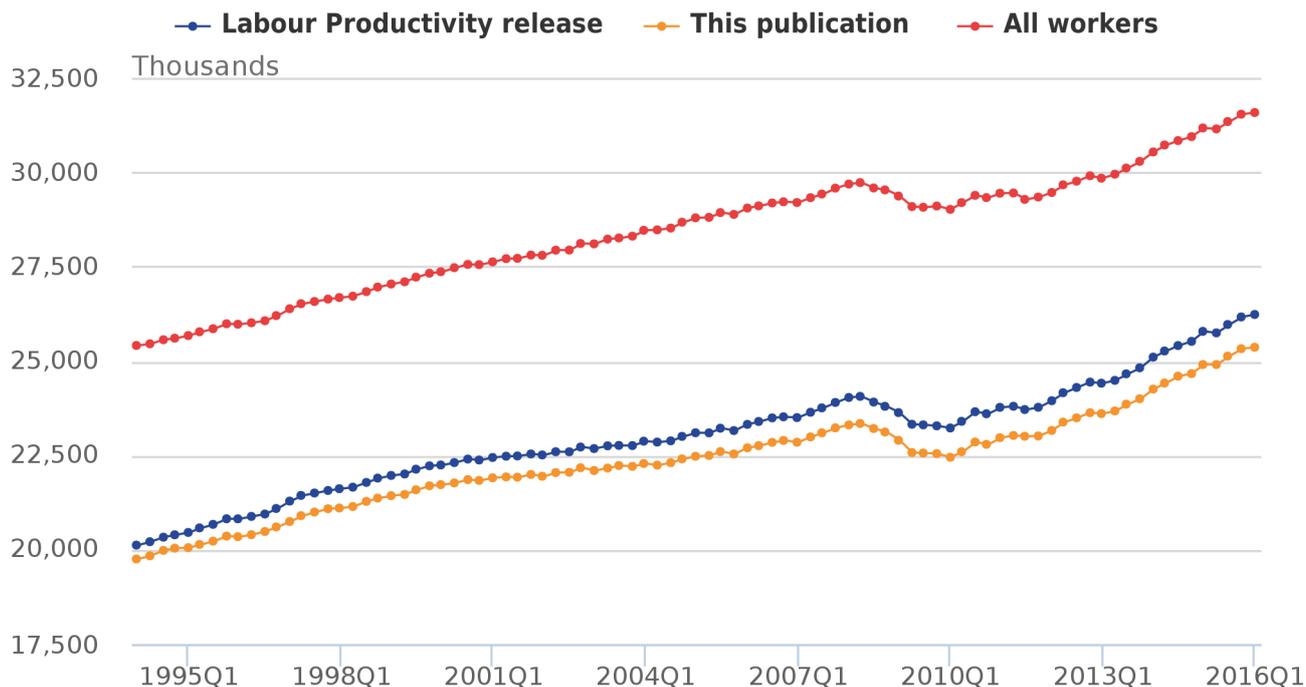
Some 92 to 94% of general government non-market sector workers are in industries O (public administration and defence), P (education) and Q (health and social work). Smaller numbers of general government workers are found in industries R (arts, entertainment and recreation), H (transportation and storage), N (administrative and support service activities), J (information and communication), E (waste management), M (professional, scientific and technical activities) and S (other service activities).

Around half of NPISH workers are estimated to be in industry Q. The next largest industries in terms of NPISH industries are P, S, R and L (real estate activities). This allocation is consistent with the distribution of NPISH organisations, which include charities, churches, political parties and trade unions.

Figure 2 shows the resulting series for market sector workers, alongside the existing series used in the quarterly labour productivity statistical release and the whole economy total. Unsurprisingly, the MS* series is lower, reflecting the allocation of NPISH workers to the non-market sector and hence out of the market sector. Both series follow very similar profiles. Even though the NPISH series follows a different profile to the general government series, average growth between 2008 and 2015 is unchanged at 1.1% each year (compared with growth of 0.8% each year for the whole economy series). Non-market sector workers fell by 0.8% each year over this period.

Figure 2: Market sector workers, seasonally adjusted

UK

Legend: Labour Productivity release — This publication — All workers

Source: Office For National Statistics

Notes:

1. Q1 is Quarter 1 (Jan to Mar), Q2 is Quarter 2 (Apr to June), Q3 is Quarter 3 (July to Sept) and Q4 is Quarter 4 (Oct to Dec).
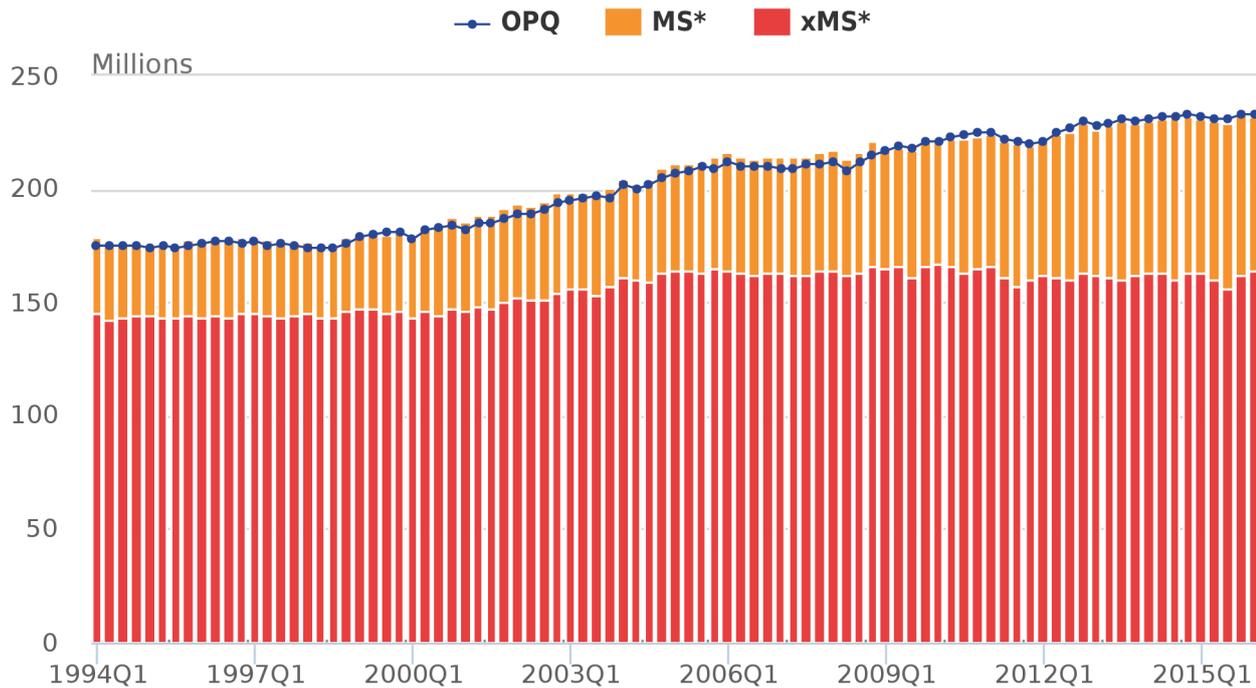
6 . Hours worked

Estimates of hours worked are derived by multiplying employment by LFS-derived estimates of average hours of market and non-market sector workers. This echoes the methodology in the aggregate market sector hours worked series except that it is carried out at the industry level and treats the market sector as the residual, that is, defined as (aggregated) total hours worked less non-market sector hours worked. A consequence of this method is that combined market and non-market hours worked can differ from the equivalent series in the labour productivity system. For example, industry O (public administration and defence) is 100% non-market according to the national accounts, but the direct estimates of non-market hours worked in this industry in the new system is lower than the overall estimates in the labour productivity system. And since overall hours worked are constrained to the same aggregate series, market sector hours in other industries are adjusted upwards slightly.

This is illustrated in Figure 3, which compares market sector (MS*) and non-market sector (xMS*) hours worked in the combined industries of O, P and Q with hours worked in this industry group in the labour productivity system (OPQ). It can be seen that there are small differences between the sum of the new component sector series and the combined series in the labour productivity system.

Figure 3: Industry group OPQ, hours worked, seasonally adjusted

UK

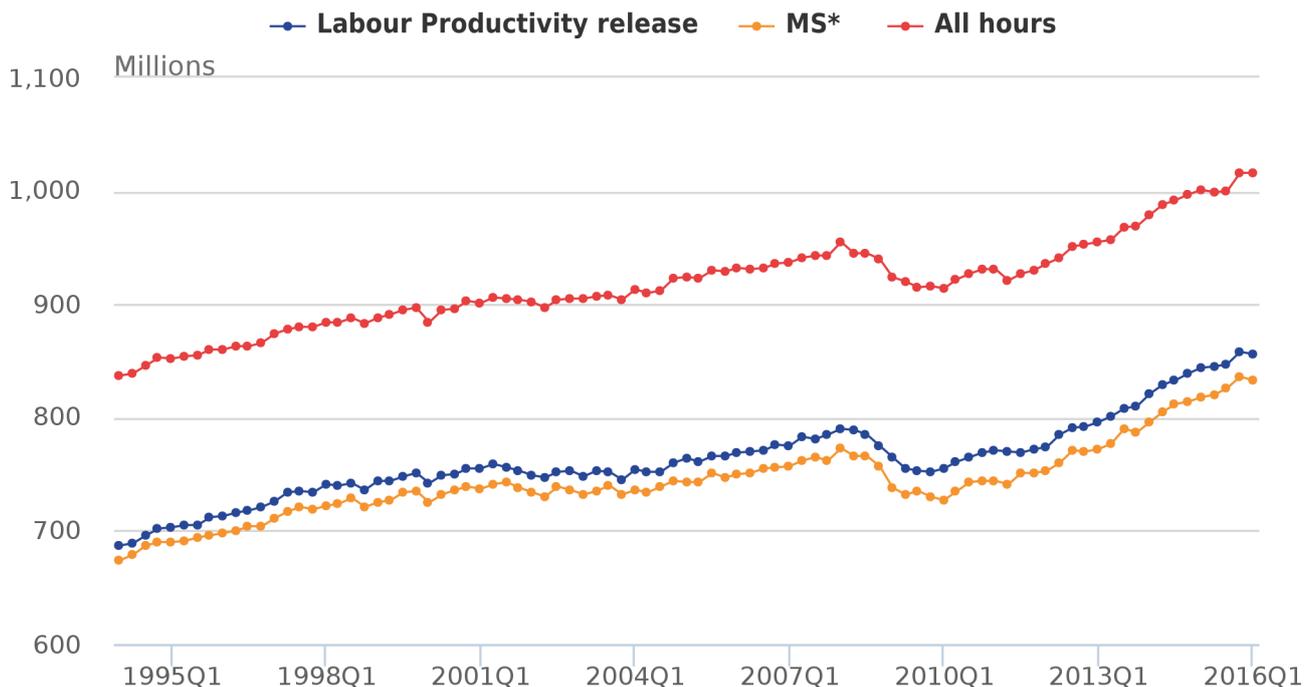Source: Office For National Statistics

Notes:

1. Q1 is Quarter 1 (Jan to Mar), Q2 is Quarter 2 (Apr to June), Q3 is Quarter 3 (July to Sept) and Q4 is Quarter 4 (Oct to Dec).

2. OPQ = Labour Productivity system, MS*= Market sector, xMS* = Non-market sector

Figure 4 shows aggregated estimates of industry-level market sector hours worked (MS*) alongside the existing aggregate series (MS) and total hours worked (YBUS). As in Figure 2, the new series is lower than the existing series due to the removal of hours worked in the NPISH sector. The time trends of both series are very similar, however. Market sector hours worked have grown a little faster than overall hours. Between 2008 and 2015, market sector hours worked grew by 1.1% per year on average, compared with growth of 0.9% across the whole economy. Non-market sector hours worked fell by 0.4% per year on average over this period.

Figure 4: Market sector hours worked, seasonally adjusted

UK

Legend: Labour Productivity release — MS* — All hours

Notes:

1. MS = Market sector

According to the LFS, market sector workers work on average some 4 hours a week longer than non-market sector workers. This partly reflects industry composition: industries characterised by longer working hours such as agriculture, mining and quarrying, and construction are entirely market sector. Additionally, self-employed workers report longer average hours than employees, and all self-employed are allocated to the market sector cohort. There is no clear pattern in industries with a mix of market and non-market workers. In industries P and Q, non-market sector workers' average hours are higher than their market sector counterparts. In other industries, such as E, H and J, the reverse is the case. This is likely to reflect differences in proportions of full-time and part-time working between the 2 sectors.

7 . Compensation of employees (COE) and total labour income

Estimates of market sector COE by industry are compiled as follows:

1. Use detailed Labour Force Survey (LFS) data to compile estimates of average gross weekly pay in first jobs of employees in general government and NPISH using the organisation categories in Tables 1 and 2 (filtered to remove industries with no non-market sector gross value added (GVA).

2. Use estimates of general government workers, compiled as described above, to compile estimates of total general government pay in first jobs by industry. We add NPISH estimates using LFS-based estimates of NPISH workers by industry.

3. Add estimates of earnings from second jobs by assuming that the ratio of earnings in second to first jobs is common between the non-market and market sectors.

4. Use estimates of total pay and non-market sector pay to derive weights of market sector to total pay by industry.

5. The weights from step 4 are applied to industry estimates of COE, which are derived from a modified version of our sectional unit-labour cost system (Franklin and Mistry, 2012). This uses quarterly industry-level COE estimates compiled within our household income branch. In some cases, the level of industry detail is expanded using estimates from detailed supply-use tables and LFS-derived estimates of relative pay rates as a proxy for COE. The sectional unit labour cost system also revises quarterly profiles of manufacturing and non-manufacturing production industries to improve alignment with reported earnings and employment in these industries.

6. The resulting industry-level market sector COE estimates are benchmarked to an overall market sector total derived from the distribution and use of income accounts as the sum of COE of private non-financial corporations, financial corporations, public corporations and households.

Total labour income is COE plus the share of self-employment income that represents a return to labour rather than to capital employed. We treat the entire self-employment cohort as an input to the market sector. The LFS reports a small number of self-employed in industry O (public administration and defence) which is wholly non-market in the national accounts. Having examined a sample of occupations of these LFS respondents we have reallocated their hours and remuneration to industry M (professional, scientific and technical activities).
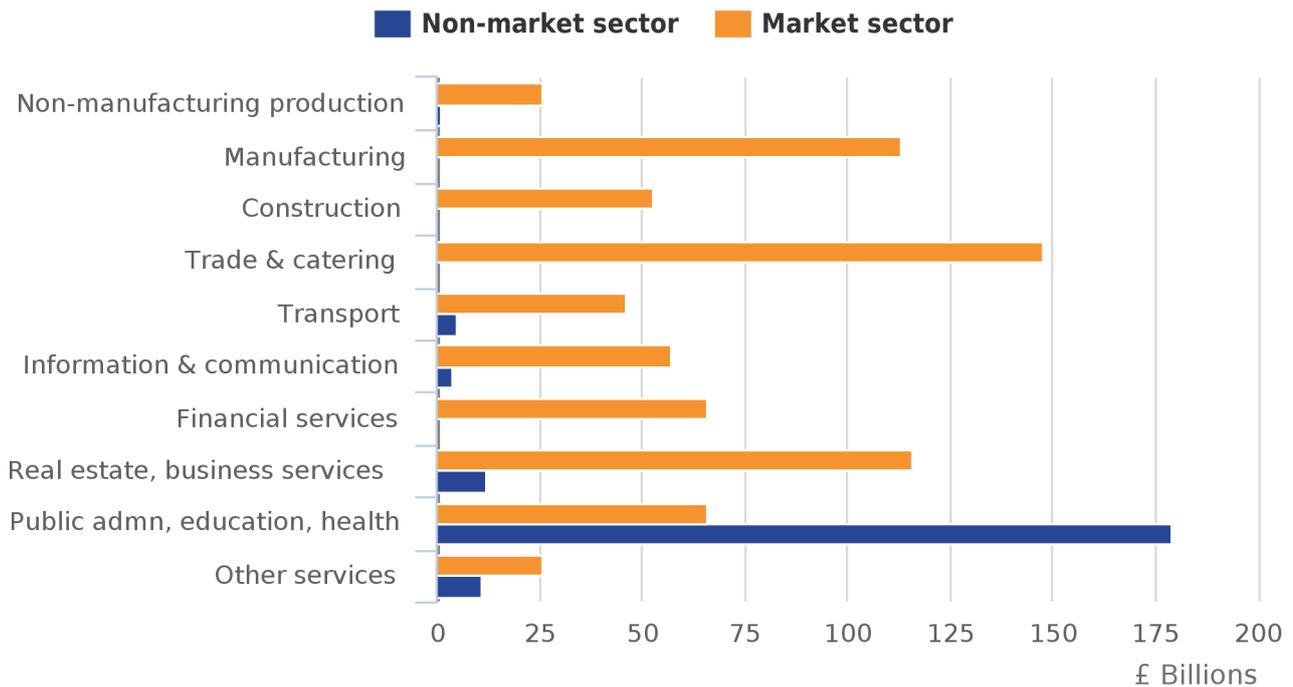
Our internal supply-use tables provide annual estimates of COE (and mixed income) at a detailed industry level. The supply-use framework provides a market and non-market sector breakdown of gross output and of capital incomes, but does not provide a breakdown of value-added.

As a triangulation exercise, we have imputed market sector value-added by industry by assuming a common relationship between gross output and value-added across the market and non-market sectors in each industry and year. Alternative estimates of market sector COE can then be backed out by subtracting non-market sector COE (estimated as non-market value-added minus non-market capital consumption) from the industry total. These estimates are generally lower than the estimates derived from the LFS pay and employment weights as set out above. When aggregated across industries, these estimates are also lower than estimates of total market sector COE derived from the sector and financial accounts, whereas the LFS-derived estimates are closer to the benchmark. Thus we prefer the LFS methodology.

Aggregate market sector COE is derived from the sector and financial accounts and is methodologically unchanged from previous estimates of market sector unit-labour costs and market sector quality-adjusted labour input (QALI)[1]. Broadly speaking, the allocation of market sector COE across industries reflects the allocation of hours worked. There are some differences between pay rates in the market and non-market sectors, but these tend to be fairly stable over time. Figure 5 shows COE for the market and non-market sectors by industry in 2015. Non-market sector COE is zero for industries with entirely market sector output, and is small relative to market sector output for all hybrid industries except public administration, education and health.

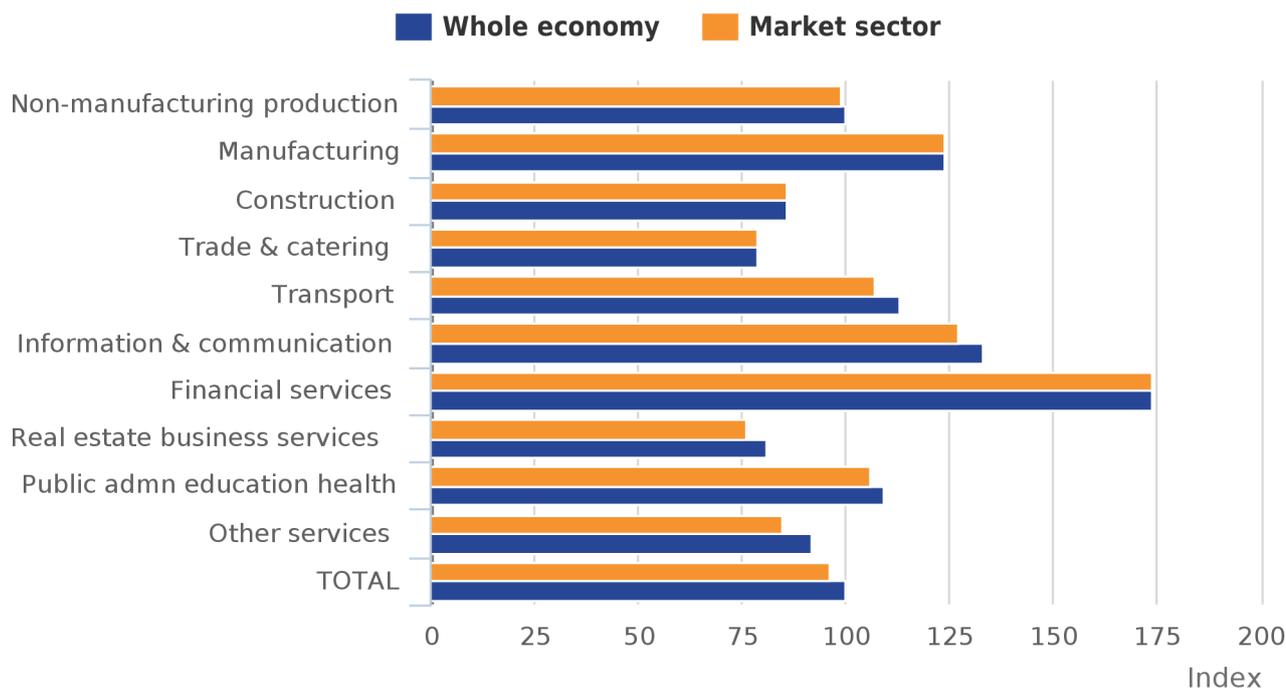**Figure 5: Compensation of employees by industry, 2015**

UK

Source: Office For National Statistics

Figure 6 brings COE and self-employment labour income together in the form of pay relatives, that is, combined labour income per hour expressed as an average of the whole economy in 2015. Hourly labour income is estimated at £18.60 for the market sector and £19.30 for the whole economy. This is consistent with other evidence showing that public sector workers earn more per hour than their private sector counterparts (see for example ONS, 2015).

Figure 6: Hourly pay relatives, 2015

UK

Source: Office For National Statistics

Notes:

1. Whole economy total = 100

Figure 6 shows that the pattern of hourly pay (or more correctly, of labour income including non-wage labour costs of employees and the labour element of self-employment income) across industries is broadly similar across the 2 samples. Pay in financial services is relatively high and pay in trade and catering, construction, real estate and business services and other services is relatively low. Differences between market sector and whole economy hourly pay for those industries with non-market elements partly reflect differences in pay of employees in the 2 sectors, and partly reflect the impact of self-employment. It is perhaps surprising that hourly pay in the market sector component of public administration, education and health is very similar to the entire industry (and hence, implicitly, similar between market sector and non-market sector workers). This is surprising given the large difference in COE between the 2 sectors shown in Figure 5. Further investigation suggests that this masks offsetting differences in average hourly earnings in education (market sector above average) and health (market sector below average).

Differences in hourly pay between the market and non-market sectors are more pronounced in other industries – including real estate and business services (LMN) and other services (RSTU) – leading to the larger differences seen in Figure 6 despite the smaller weights of the non-market elements. Additionally, self-employment has a relatively large weight in RSTU. Since hourly income of the self-employed is generally lower than earnings of employees in the same industry, this exerts a larger drag on the market sector estimate compared with other industries where self-employment is less important.

Notes:

1. We have recently published proposals for improved sectorisation, including full separation of the household and NPISH sectors.

8 . Next steps

Industry-level market sector estimates for hours worked and labour income described in this article have been incorporated in the accompanying quality-adjusted labour input (QALI) release, which also compares QALI estimates of the market sector with the whole economy. Subject to user feedback, it is our intention to use the market sector QALI estimates in future multi-factor productivity (MFP) publications. MFP estimates up to and including 2015 are currently scheduled for publication in April 2017.

No changes to the methodology for compiling market sector workers and hours worked have been implemented in the accompanying labour productivity release for Quarter 2 (Apr to June) 2016 . Again subject to user feedback, we anticipate aligning those estimates with the aggregate market sector estimates described in this article for future labour productivity releases[1]. We welcome views from users on the value of developing quarterly estimates of labour productivity for the market sector by industry.

Lastly, the fuller articulation of the market sector described in this article raises the prospect of parallel estimates for the non-market sector. For closed systems such as hours worked and labour income it is a trivial task to compile non-market estimates; indeed, market estimates of hours worked are themselves compiled by residual. It is also relatively straightforward to construct non-market sector estimates for QALI which may be of some interest in identifying differential movements in labour composition between market and non-market components of the same industry.

Other estimates are less straightforward. Our national accounts systems are not designed to produce non-market gross value added (GVA) in chained-volume terms either by industry or as an aggregate measure. We believe it is possible to extract such estimates but it is likely to require some additional development work and the reliability of the estimates is uncertain at this stage.

As noted earlier, there are conceptual difficulties with capital services for the non-market sector and we currently have no plans to develop non-market VICS and non-market MFP. On the other hand, there is some interest in the role of infrastructure capital, part of which is owned by the non-market sector. We are also considering the role of VICS in the context of public service productivity estimates.

Notes:

1. The analysis presented in this article reallocates self-employment from industry O to industry M. Replicating this change in the labour productivity system would cause revisions to all industry-level jobs and hours series, although the total levels will be unchanged. As these changes are largely level effects, it is unlikely that industry growth rates, and hence productivity trends, would be much affected.

9. References

Boskin, M (1996) 'Toward a more accurate measure of the cost of living: Final report to the Senate Finance Committee from the Advisory Commission to Study the Consumer Price Index. Advisory Commission to Study the Consumer Price Index'

Franklin M and Mistry P (2012) 'Productivity Measures: Sectional Unit Labour Costs', Office for National Statistics

Herbert R and Pike R (2005) 'A new experimental National Accounts aggregate – Market Sector Gross Value Added', Economic trends 623 October 2005

Johnson P (2015) 'UK Consumer Price Statistics: A Review', UK Statistics Authority, January 2015

Jorgenson D and Griliches Z (1967) 'The explanation of productivity change', The Review of Economic Studies, 34(3), 249 to 283

Marks C (2007) 'Market sector GVA productivity measures', Economic & Labour Market Review, Volume 1, Number 3, March 2007, Office for National Statistics

OECD (2009) Measuring Capital, Second Edition, OECD

ONS (2015) 'Annual Survey of Hours and Earnings: 2015 Provisional Results', Office for National Statistics

Solow R (1957) 'Technical change and the aggregate production function', The review of Economics and Statistics, 312 to 320