Deflation Methodology for Regional Gross Value Added (Production Approach)

Introduction

A measure of regional Gross Value Added (GVA) using the production approach, giving estimates of GVA on a consistent basis for all regions of the UK, is required under European legislation. Because of current data limitations, the UK does not have a straightforward methodology for meeting this requirement. ONS has therefore been working with the Devolved Administrations, other government departments and other bodies to develop possible methodologies. The resulting methods and data series set out in this article and in the ONS release of Regional Gross Value Added (Production approach), December 2013 are therefore experimental at this stage, while we are further developing and refining them between now and 2017 when the UK is required to deliver the finalised set of estimates to Europe.

Given the experimental nature of the series at this early point in their development, they may contain some surprising data movements or give rise to questions. It is for these reasons that ONS is sharing them widely at this stage: we are very keen to hear the views of users on the methods and on the series themselves. ONS is seeking to develop a methodology which will meet the European requirement for consistent regional GVA while at the same time best meeting the needs of UK users. Views are therefore very welcome.

Where available, existing National Statistics produced by ONS or Devolved Administrations should always be used for monitoring economic performance or comparing regions and countries with the UK as a whole.

Background

The project to develop a measure of regional GVA using the production approach (GVA(P)) was initiated in response to the Review of Economic Statistics for Policymaking[1] by Christopher Allsopp in 2003. One of the recommendations of the review was for the development and publication of regional GVA at constant prices, which involves deflating annual data that are produced at current prices. On conceptual grounds this can only be achieved by developing a method of calculating regional GVA on a production basis. Prior to this development regional GVA has only been calculated on an income basis, which, because of data limitations, cannot be deflated and therefore cannot be used to calculate estimates in constant prices.

[1] http://webarchive.nationalarchives.gov.uk/+/http://www.hm-treasury.gov.uk/consultations_and_legislation/allsopp_review/consult_allsopp_index.cfm

Income and Production approaches

The approach that is currently used to compile regional GVA in the UK is the income approach, or GVA(I). This method uses the sum of all income from employment (compensation of employees), self-employment (mixed income) and other income generated by the production of goods and services (gross operating surplus). A top-down approach is used, whereby the UK National Accounts total for each component of income is allocated to the regions using proportions from regional data sources. These data are at current prices. The effects of price inflation and regional price variation are not removed as conceptually there is no satisfactory method of deflating gross operating surplus.

An alternative method of compiling regional GVA is the production approach, or GVA(P). In this approach GVA is calculated as the total of all goods and services that are produced during the reference period (output), less goods and services used up or transformed in the production process, such as raw materials and other inputs (intermediate consumption). This approach is conceptually equal to the income approach, but it allows deflation of current prices to produce constant price measures since the components relate to goods and services which can be broken down into price and volume indices reflecting the particular industries in a region.

The project began in 2006 and the first stage concerned the development of the methodology to be used and the identification of suitable data sources for the production measure. An inter-departmental Technical Advisory Group (TAG) was established to provide input and quality assurance of the work. This first stage culminated in the publication of a methodology article[2] in 2007 and the methodology being agreed by the TAG.

Following the agreement of the methodology there were two major changes to the user requirement. It was announced in July 2010 that the Regional Development Agencies, whose statistical requirements were a major driver for the original Allsopp recommendation, were to be abolished. Further, the new European System of Accounts 2010 (ESA10) was being drawn up and agreed by EU Member States and Eurostat, and it emerged that this included a new legal requirement for Member States to provide real (i.e. deflated) GVA growth at the NUTS2 level of European geography (Nomenclature of Territorial Units for Statistics). The project therefore continued in order to meet the European legislation.

The new regulation will come into force in 2014. However, because for this new variable a unilateral derogation of three years has been granted to all Member States, data do not have to be delivered until 2017. ONS published the first full set of experimental GVA(P) results in December 2013, with the aim of continuing to explore the scope for further methodological enhancements to the data sources and compilation processes. The publication of experimental statistics is intended to provide a focus for discussion with users and encourage feedback. Any improvements will then be implemented for the subsequent publication in December 2014, in preparation for the delivery to the EU required by 2017.

[2] http://www.ons.gov.uk/ons/guide-method/development-programmes/allsopp-programme/regional-gva--production-approach-/allsopp-regional-gva-p--project--methods-development-of-regional-gva-on-a-production-basis.pdf

National estimates in current prices and chained volume measures

In order to understand the issues underlying the calculation of regional GVA in real terms, it is important to understand how UK Gross Domestic Product (GDP) is calculated.

This description concentrates on how GDP is calculated in a year where supply and use balancing has taken place as the ONS produces estimates of regional GVA only in years that have been balanced. Currently this is for years up to and including 2011.

In the UK, three theoretical approaches are used to estimate GDP: 'production', 'income' and 'expenditure'. The production approach looks at the contribution of each economic unit by estimating the value of output less the value of inputs in the production process. The income approach measures the incomes earned by individuals and corporations in the production of goods and services. The expenditure approach measures total expenditure on finished goods and services in the domestic economy.

Each of the approaches relies on a number of sources of varying quality and these are confronted and 'balanced' annually in current prices (or nominal terms) via the Supply and Use Table (SUT), which produces consistent estimates of supply and demand for 112 products.

Supply and use balancing therefore gives single estimates of GDP and GVA in nominal terms which can be presented via the production, income or expenditure approaches.

The next step is to convert these balanced estimates into real terms (or chained volume measures). The current methodology was established in the early 1990s and takes the expenditure approach and uses expenditure deflators. In part this is because no obvious deflators exist for the income approach and the current production deflators are 'output' deflators rather than 'GVA' deflators. The development of appropriate GVA deflators has been planned for a number of years as part of the work on producing SUT in previous year prices and this is needed for 2017 to meet an EU requirement.

So overall GDP (and GVA) for the UK is set by deflating the expenditure approach from the balanced supply and use tables. But not all of the expenditure components can be analysed by industry (notably, household expenditure) and so this methodology for calculating overall GDP and GVA does not produce an industrial breakdown. The issue therefore is how to produce an industrial breakdown of GVA, in real terms, consistent with total GDP calculated from the expenditure approach. Again, the current method was established 20 years ago and involves adjusting the estimate of GVA from the 'short term indicators' (Indices of Production, Services and Construction) to be consistent with total GVA in real terms taken from deflating the expenditure components of the SUT. This is achieved by adjusting some of the weaker industry indicators, which are components of the Index of Services. This gives total GVA in real terms by industry at the UK level.

An important consequence of this methodology is that, for the UK, the industrial analysis of GVA in real terms is not based on deflating the nominal estimate of GVA from the SUT. Hence, it is not consistent with the analysis in nominal terms and this difference is important in the context of understanding the issues arising from the publication of real regional GVA estimates, as nominal GVA by industry from the SUT was the starting point for those estimates (see the section below entitled ‘Estimates of regional GVA in current prices’).

Regional Supply and Use Tables

From a conceptual point of view, regional GVA should be calculated by mirroring the methodology used for the calculation of UK GDP. The first step would be to compile for each region (and indeed NUTS2 area) a supply and use table in nominal terms. This would present many challenges, arguably the greatest of which would be to identify goods and services produced in one region/NUTS2 area and consumed in another, the equivalent of imports and exports between regions and NUTS2 areas. Another challenge would be to estimate goods and services sold in an area that are bought by residents of another area. For example, someone who lives in Cardiff might buy a suit in Bristol, which would be an export of goods to Wales from the South West region, but very difficult to identify as such and measure.

All of this makes the production of SUT for each region and/or NUTS2 area impracticable, although there are examples of regions for which SUT are produced (Scotland) or are being developed (Northern Ireland). Where this happens, GVA for the region based on the SUT will produce better estimates than the experimental statistics contained in this article but we would not be able to produce consistent figures across all areas. For compliance with the European regulation, there is a need to develop a methodology that will produce estimates for all regions of the UK on a consistent basis.

Estimates of regional GVA in current prices

Current price GVA(P) in this article has been compiled using a top-down approach. Regional indicator data are used to calculate regional proportions for each of 112 industry components, corresponding to the industry groups used in the National Accounts SUT. These regional proportions are then used to allocate the UK total for that industry obtained from the most recent UK National Accounts Blue Book.

Regional indicator data for output and intermediate consumption are mostly provided by the Annual Business Survey (ABS). For industries not covered by the ABS, alternative regional data are used. In addition, for industries where a significant amount of business is generated by single person enterprises, these parts of the national total are allocated to regions using data on sole traders from HM Revenue and Customs. Similarly, where there is a significant public sector component, public sector employment data are used as the regional indicator.

A consequence of this methodology is that current price regional GVA(P) will always sum to the latest national totals for each industry, as will the regional GVA(I) estimates (see box), even though at regional level GVA(P) and GVA(I) estimates may differ due to the different methods used to compile them.

The next stage of development will seek to develop a process for ‘balancing’ the two approaches to measuring current price regional GVA, in order to produce a single estimate that draws on the strengths of both approaches. Until then ONS will publish both the National Statistic GVA(I) estimates and the experimental GVA(P) estimates, so that users can see clearly where the differences exist.

Estimates of regional GVA in constant prices

The basic approach agreed by the TAG was to apportion the UK SUT estimates of nominal GVA by industry to individual regions and then to deflate to real estimates of regional GVA using the appropriate industry output deflators. For reasons discussed in the section 'National estimates in current prices and chained volume measures', this method produces estimates of regional GVA by industry that are not consistent with total GVA for the UK (as this is calculated using the expenditure approach) but arguably produces estimates that better meet the needs of users of regional industrial statistics, particularly those interested in comparing the performance of different industries within the same region.

However, these estimates have not been constrained to UK totals. Such constraining would provide a consistent coherent pattern at the UK level, but would obscure the picture at the detailed industry and region level. Different users will have different needs. Those interested in comparing changes in the performances of the mining and quarrying industry and the construction industry in the North East region, for example, may prefer to see the unconstrained estimates, i.e. those published on 18 December. Others will want to see a regional breakdown that is consistent with the UK picture in order to take a wider economic view.

Constraining regional GVA estimates to national totals at constant prices

When SUT are available in previous year prices, the issue of appropriate deflation of regional estimates should be resolved. This is due in 2017 by which time not only should there be GVA deflators available that are consistent with the national figures, but these should allow the input and output of an industry to be deflated separately, so called 'double deflation'. Until that time the options available are: (a) to use the existing national output deflators, and accept the difference in growth of the economy at a regional level from the national growth pattern; or (b) to constrain the constant price (i.e. deflated) regional GVA estimates to sum to the corresponding national total, for each industry component used in the GVA(P) compilation.

Figure 1 shows a comparison of the implied deflators that can be derived from the unconstrained regional GVA(P) series with the UK GVA in basic prices implied deflator that is published as part of the Quarterly National Accounts release (series identifier CGBV). This illustrates the difference in the long-term trend of price increase between the output deflators and the national GVA deflator. **So the impact of the unconstrained methodology is generally to underestimate the growth at the regional level.**

Implied deflators from the constrained regional GVA(P) series are very much closer to the UK implied deflator, although there remain small variations due to differences in the regional composition of industries.

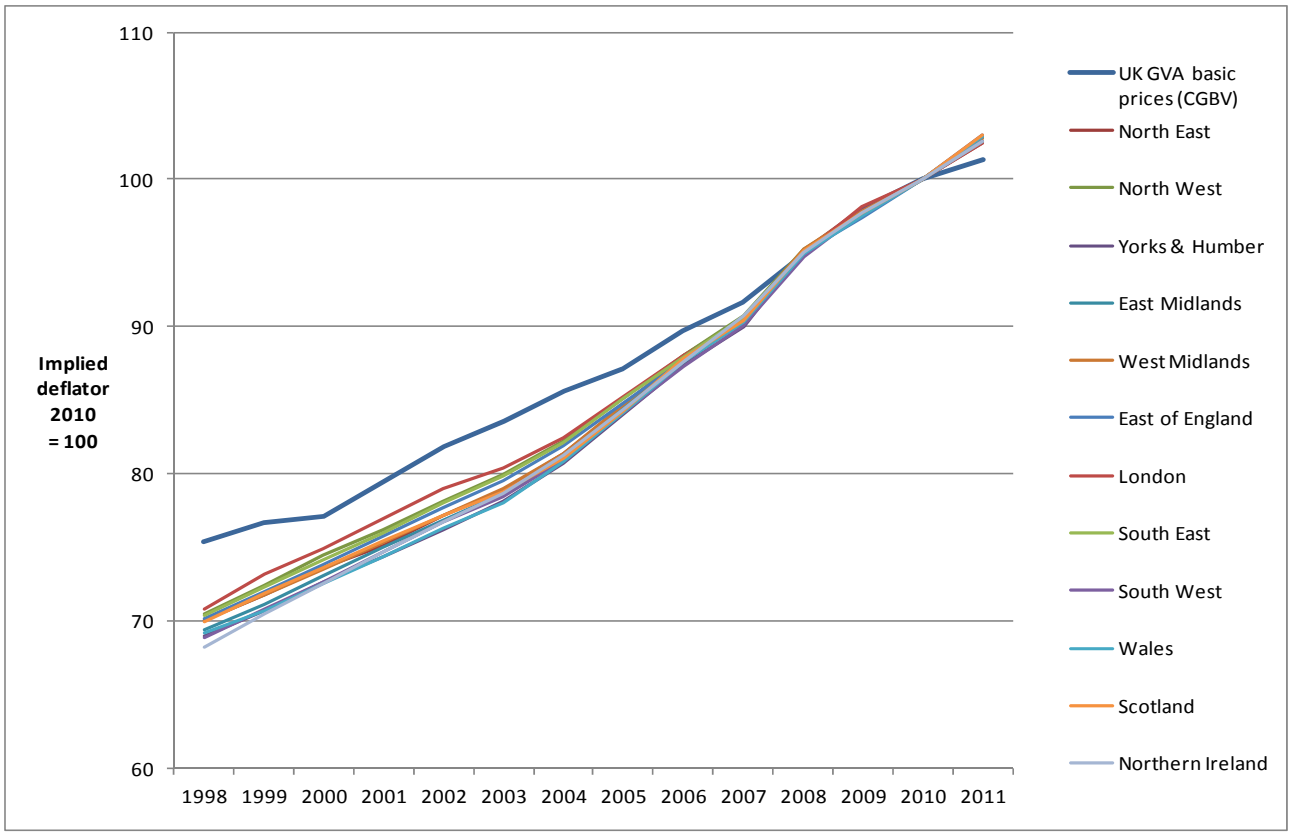

Figure 1: Comparison of UK and unconstrained regional GVA(P) implied deflators (2010=100)

Constraining the detailed NUTS1 and NUTS2 estimates for real GVA to be consistent with the overall UK estimate of GVA for an industry is clearly appropriate for the purpose of macroeconomic analysis of a region's or area's economic performance. However, the downside to the constraining methodology is that it undermines the approach to delivering a proxy for regional prices.

Ideally estimates of real regional GVA should be calculated by deflating nominal values using regional prices that reflect the differences in pricing of goods and services in different parts of the UK. However, in the UK, as in most EU Member States, regional prices are not available for this purpose. As a consequence of this the EU Manual on Regional Accounts recommends the use of national prices applied at a detailed level of industrial classification, in order to model regional differences in the composition of products. By this method the regional variation in products serves in place of actual regional price differences.

The use of this method relies upon having an accurate profile of the product composition in each region, so that the correct weights are used for each component price index. Under the current process for deriving UK industry data in constant prices, the adjustments applied to some industries (but not to others) cause changes to the regional industry profiles that misrepresent the true balance of products in each region. **This raises a concern that constraining to UK totals might undermine the current experimental method as a proxy for true regional prices.**

Almost certainly, the constrained estimates will be those that are the basis of what will eventually be sent to Eurostat. But that requirement is only for an all industries total within NUTS2 areas. As constraining can obscure the picture at a more detailed level (through the impact on the approach for delivering a proxy for regional prices), in some circumstances it might be preferable to use unconstrained estimates. Releasing these estimates as experimental statistics provides the opportunity to seek users' views and feedback on the most appropriate methodology and presentation for their particular needs.

As an example, constraining to UK totals has resulted in significant changes to the Mining and Quarrying (SIC Section B) industry, with regions having a large oil and gas extraction industry (London, where many large companies have their head offices, Scotland and Extra-Regio[3]) showing a decrease across most years of the time series, while all other regions show a corresponding increase. This is the result of changes to the detailed SUT components that comprise the Mining and Quarrying industry.

Annex A contains charts showing a comparison of unconstrained and constrained GVA chained volume measures (CVM) for each NUTS1 region. The full dataset, including NUTS2 sub-regions and a breakdown into 31 industry sectors, is published alongside this article in reference tables.

Annex B contains a table showing, for each NUTS1 region, the growth of GVA(P) in current prices, unconstrained CVM and constrained CVM.

Scottish GDP estimates

Scottish Government (SG) produces a chained volume index of Scottish GDP in basic prices (equivalent to GVA), which is a National Statistic. The GDP index uses methods and sources consistent with the ONS GDP statistics for the UK, including relevant extracts of ONS short term output data and UK deflators at SUT level. The SG also produces balanced SUT for Scotland, which provide annual benchmarks of nominal GVA and industry weights for the volume index. As part of the production of the SUT the SG estimates, amongst other things, Scottish 'trade' ('imports' and 'exports') with the rest of the UK, which is not a concept for which ONS has any data sources. Figures using this methodology are not available for any other region of the UK.

The SG estimate provides the best estimate of total Scottish GVA/GDP in nominal terms as it is calculated using a methodology that is as consistent as possible with the UK methodology within a balanced Supply and Use system. However, this methodology cannot be replicated for other regions of the UK (e.g. because there are no data available on 'exports' and 'imports' between other regions of the UK) and so the ONS National Statistic GVA(I) should be used for comparisons between regions in nominal terms. In real terms, the SG estimate again provides the best estimate for Scotland but, for the same reasons as for the nominal estimates, this methodology cannot be used for any other region. Hence there is a need, for compliance with EU requirements, to develop a methodology that will deliver estimates on a consistent basis for all UK regions.

Scottish GDP and Scottish National Accounts data should be used for analysis of Scotland's economic growth rate over time and for comparisons with the UK total. The Welsh Government and Northern Ireland Executive also produce National Statistics on their respective economies. As for Scotland these should be taken as the definitive estimates rather than the experimental statistics in this article.

[3] The 'Extra-Regio' region consists of those activities that cannot be allocated to any region.

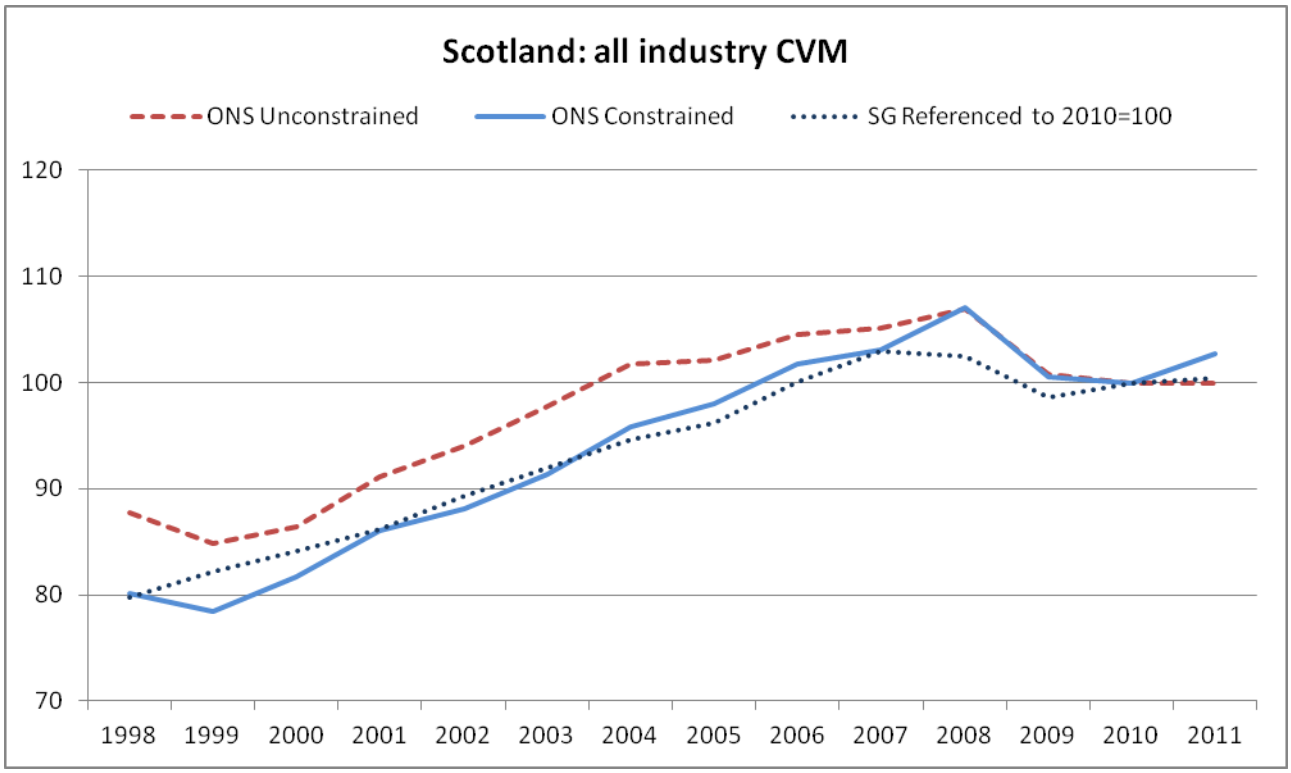

Figure 2: Comparison of Scottish GVA estimates in chained volume measures (2010=100)

Figure 2 shows the difference constraining to the UK total makes to the GVA estimates for Scotland. The latest SG figures are shown alongside for comparison. SG figures are currently based on 2009=100, so we have referenced these to 2010=100 in order to show them on a consistent basis.

Next steps

The next steps in the development of estimates of regional GVA(P) are:

- Jan 2014: Publish article and reference tables containing unconstrained and constrained regional GVA(P) estimates in chained volume measures. Seek feedback from users on the two options.
- Summer 2014: Publish a further article summarising the response to this article and setting out plans to take account of users' views.
- Dec 2014: Publish experimental Regional GVA(P) bulletin, with format and content revised to reflect user preferences.
- Dec 2015: Provisional target date for first publication of 'balanced' regional GVA estimates (balanced income and production data at current prices).
- Dec 2017: Provisional target date for implementation of double deflation in regional GVA estimates (subject to availability of SUT in previous year prices).

ONS invites users to compare the unconstrained and constrained estimates published in the reference tables alongside this article, and to consider the issues discussed within this article. We would like to hear your views on the question of whether we should continue to publish the unconstrained industry by region estimates, or just concentrate on the estimates constrained to sum to national totals.

You may send any comments and views to:

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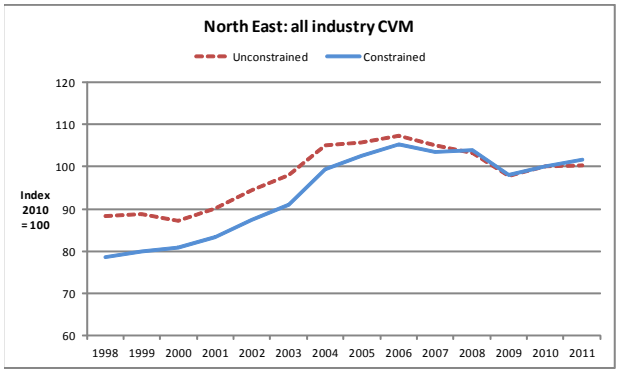
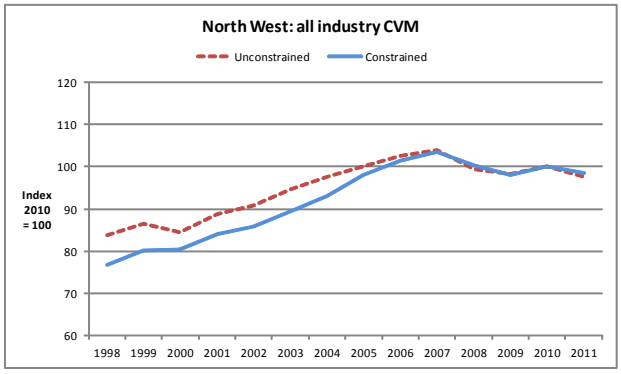
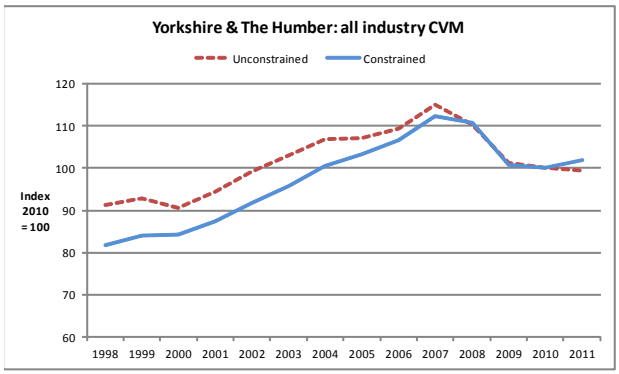
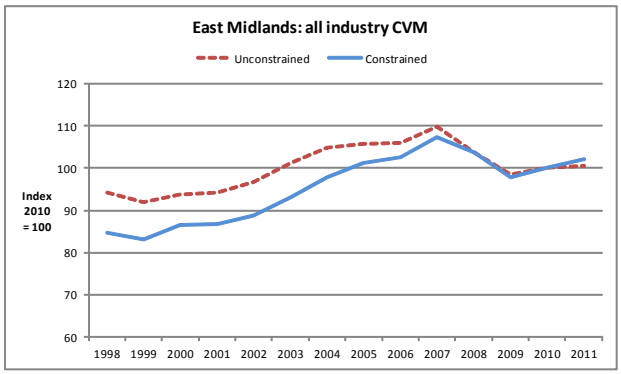
Newport, South Wales, NP10 8XG
e-mail: RegionalAccounts@ons.gsi.gov.uk

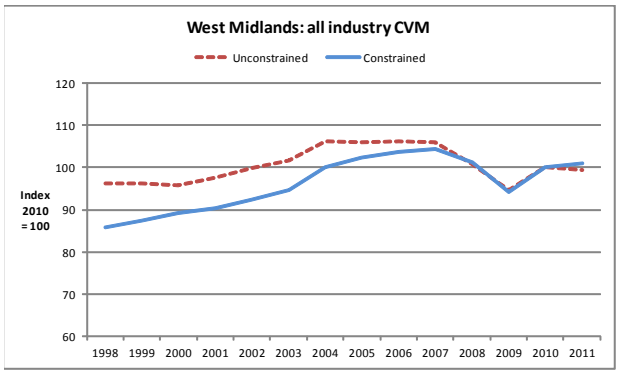
Annex A: Comparison of unconstrained and constrained GVA(P) chained volume measures for each NUTS1 region of the UK

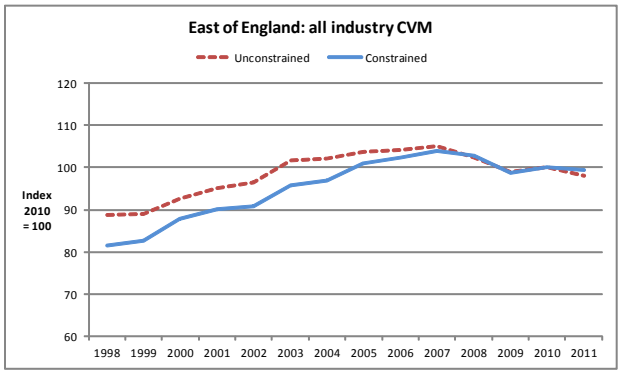


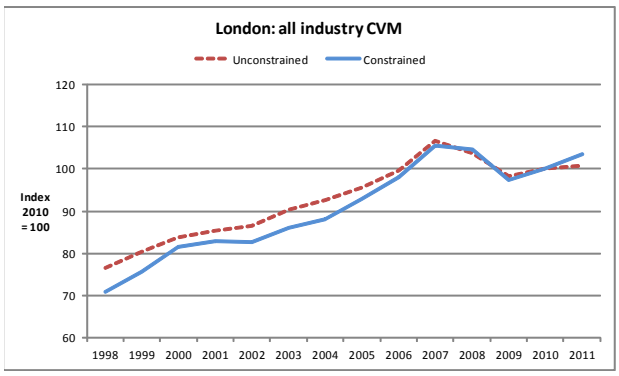


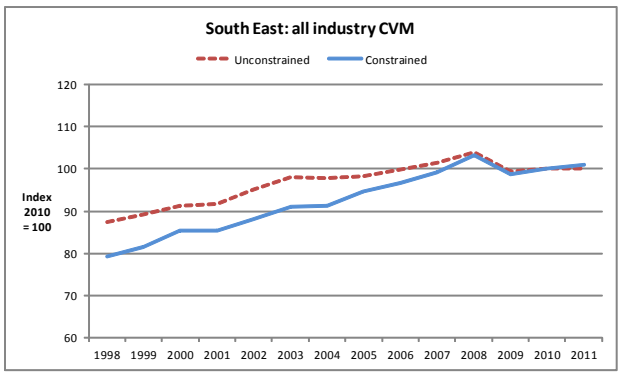


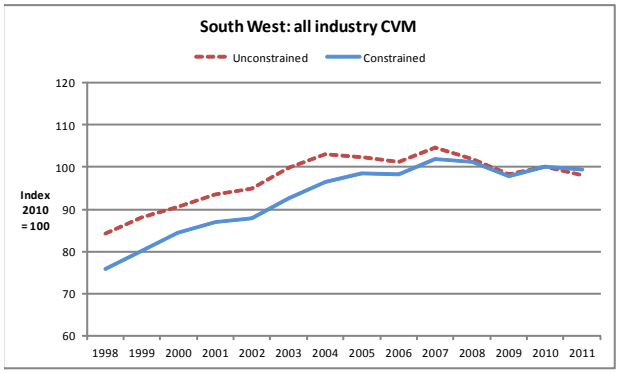











South West: all industry CVM
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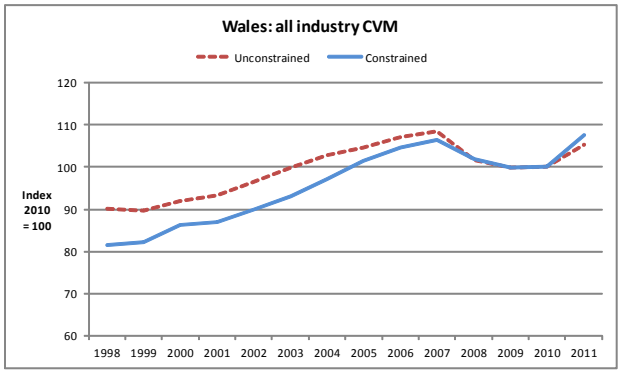
1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011


Wales: all industry CVM
Unconstrained
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Index 2010 = 100
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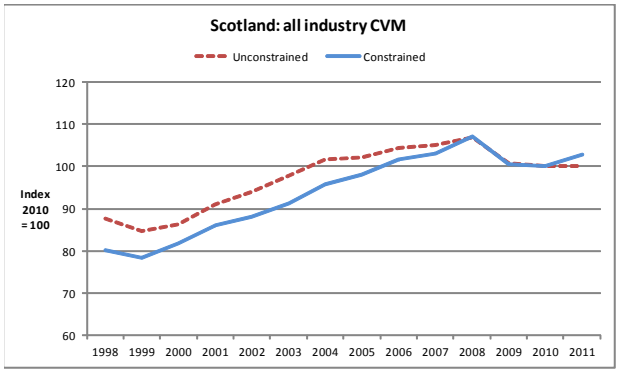
Scotland: all industry CVM
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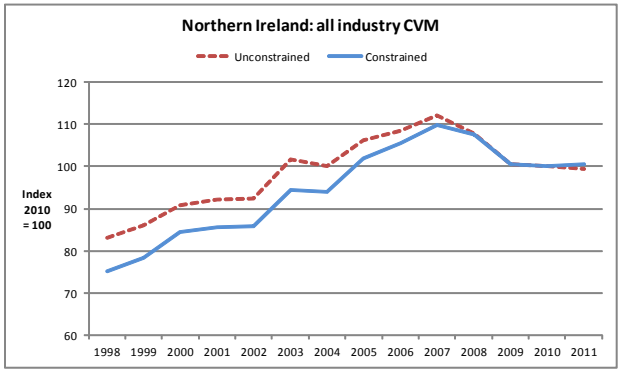
Northern Ireland: all industry CVM
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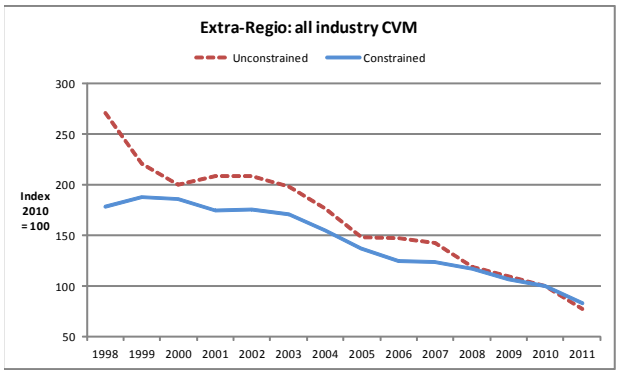
Extra-Regio: all industry CVM
Unconstrained
Constrained
Index 2010 = 100
300
250
200
150
100
50
1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

Annex B: Comparison of GVA(P) growth in current prices, unconstrained and constrained chained volume measures for each NUTS1 region of the UK

		% annual growth													% growth
		1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**1998-2011**
UKC	**North East**														
	Current price GVA(P)	2.9	0.9	5.4	7.6	6.1	10.7	4.7	5.6	0.6	3.3	-2.4	4.2	2.9	66.4
	CVM Unconstrained	0.5	-1.6	3.2	4.8	3.8	7.3	0.6	1.5	-2.2	-1.6	-5.2	2.1	0.4	13.7
	CVM Constrained	1.9	1.1	3.0	4.9	4.2	9.1	3.2	2.6	-1.7	0.4	-5.7	2.0	1.6	29.4
UKD	**North West**														
	Current price GVA(P)	6.1	0.1	7.8	4.9	6.4	6.1	6.4	6.0	4.3	0.4	1.5	4.0	0.3	69.6
	CVM Unconstrained	3.2	-2.5	5.3	2.2	4.1	3.2	2.7	2.5	1.2	-4.3	-1.0	1.6	-2.4	16.3
	CVM Constrained	4.4	0.4	4.3	2.0	4.3	4.1	5.4	3.5	1.9	-3.0	-2.2	1.9	-1.4	28.4
UKE	**Yorkshire and The Humber**														
	Current price GVA(P)	4.1	0.2	7.0	7.6	6.5	7.2	4.3	6.2	8.3	1.3	-5.4	0.8	2.4	62.5
	CVM Unconstrained	1.6	-2.5	4.4	5.0	3.8	3.9	0.1	2.1	5.2	-4.2	-8.2	-1.3	-0.6	8.9
	CVM Constrained	2.8	0.2	3.6	5.2	4.2	5.1	2.8	3.1	5.4	-1.5	-8.9	-0.9	1.9	24.6
UKF	**East Midlands**														
	Current price GVA(P)	-0.1	4.8	3.2	5.1	7.3	6.8	4.9	3.9	6.9	-0.5	-2.4	3.7	3.5	58.1
	CVM Unconstrained	-2.5	2.0	0.6	2.5	4.8	3.6	0.9	0.2	3.7	-5.6	-5.0	1.4	0.5	6.6
	CVM Constrained	-1.9	4.1	0.2	2.3	5.0	4.8	3.6	1.5	4.6	-3.4	-5.7	2.2	2.1	20.4
UKG	**West Midlands**														
	Current price GVA(P)	2.6	1.9	4.2	4.7	4.3	7.8	3.8	4.0	2.8	-0.1	-3.5	8.0	2.2	51.6
	CVM Unconstrained	0.1	-0.4	1.8	2.3	1.8	4.6	-0.3	0.2	-0.1	-5.1	-6.1	5.7	-0.6	3.3
	CVM Constrained	1.7	2.3	1.2	2.2	2.4	5.6	2.4	1.3	0.7	-3.0	-7.0	6.2	1.0	17.6
UKH	**East of England**														
	Current price GVA(P)	2.8	6.7	5.5	3.8	7.9	3.4	5.2	3.9	4.1	2.2	-0.7	3.6	0.8	61.7
	CVM Unconstrained	0.1	4.0	2.8	1.3	5.4	0.5	1.6	0.4	1.0	-2.7	-3.2	1.0	-2.0	10.2
	CVM Constrained	1.2	6.4	2.5	0.8	5.6	1.1	4.1	1.4	1.6	-1.2	-4.0	1.3	-0.6	21.8
UKI	**London**														
	Current price GVA(P)	8.6	6.8	4.5	4.1	6.2	5.3	6.6	7.6	9.9	2.1	-1.9	3.5	3.3	90.6
	CVM Unconstrained	5.1	4.4	1.8	1.4	4.3	2.7	3.1	4.2	7.1	-2.8	-5.1	1.6	0.8	31.8
	CVM Constrained	6.6	7.9	1.5	-0.1	4.1	2.3	5.6	5.4	7.8	-0.9	-6.9	2.6	3.4	45.8
UKJ	**South East**														
	Current price GVA(P)	4.8	4.8	3.1	6.6	5.4	2.6	4.1	5.0	4.6	7.4	-1.6	2.9	2.7	66.8
	CVM Unconstrained	1.9	2.2	0.5	3.8	3.0	-0.3	0.5	1.6	1.5	2.6	-4.3	0.5	0.1	14.4
	CVM Constrained	2.9	4.8	0.1	3.2	3.3	0.3	3.5	2.2	2.5	4.1	-4.4	1.3	1.1	27.7
UKK	**South West**														
	Current price GVA(P)	0.9	0.9	0.9	1.0	0.9	0.9	1.0	1.0	0.9	1.0	1.0	1.0	1.0	73.5
	CVM Unconstrained	4.6	3.0	3.2	1.5	5.2	3.2	-0.8	-1.1	3.4	-2.6	-3.4	1.6	-1.9	16.5
	CVM Constrained	5.7	5.2	3.0	1.1	5.2	4.1	2.1	-0.1	3.8	-0.8	-3.2	2.0	-0.7	30.7
UKL	**Wales**														
	Current price GVA(P)	1.8	4.9	4.2	5.9	5.9	6.7	5.9	6.5	4.5	-1.5	0.8	2.8	8.3	73.6
	CVM Unconstrained	-0.4	2.3	1.6	3.2	3.5	3.1	1.7	2.4	1.3	-6.3	-1.9	0.2	5.3	16.7
	CVM Constrained	0.9	5.0	0.9	3.2	3.7	4.3	4.3	3.3	1.6	-4.1	-2.1	0.1	7.6	32.0
UKM	**Scotland**														
	Current price GVA(P)	-0.7	4.3	8.1	5.5	6.2	7.2	4.2	6.6	3.6	7.0	-3.1	1.5	3.0	67.8
	CVM Unconstrained	-3.3	1.9	5.4	3.2	4.0	4.1	0.3	2.4	0.6	1.7	-5.7	-0.8	0.0	14.0
	CVM Constrained	-2.2	4.2	5.4	2.3	3.6	4.9	2.4	3.8	1.2	4.0	-6.1	-0.6	2.7	28.1
UKN	**Northern Ireland**														
	Current price GVA(P)	6.9	8.6	4.4	3.2	12.7	1.8	10.2	6.1	6.9	0.7	-4.1	1.8	2.1	80.0
	CVM Unconstrained	3.6	5.5	1.4	0.3	10.0	-1.4	6.1	2.2	3.3	-3.9	-6.8	-0.5	-0.5	19.7
	CVM Constrained	4.4	7.9	1.3	0.1	10.0	-0.3	8.4	3.3	4.2	-2.1	-6.3	-0.7	0.6	34.0
	Extra-Regio														
	Current price GVA(P)	13.5	50.5	-5.5	-2.5	1.8	3.5	17.6	15.4	-0.6	15.9	-29.1	19.2	2.8	125.0
	CVM Unconstrained	-18.2	-9.4	4.1	0.0	-4.7	-11.2	-15.8	-1.0	-3.3	-16.4	-8.2	-8.4	-22.9	-71.5
	CVM Constrained	5.6	-1.0	-6.2	0.2	-2.6	-9.3	-11.2	-9.2	-0.6	-5.7	-8.6	-6.3	-17.3	-53.6