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Dear Convener

INQUIRY INTO ECONOMIC STATISTICS REPORT: HOW TO MAKE DATA COUNT

I found the report of the Committee very timely and helpful, and very much welcome the suggested direction of travel. I am responding to the recommendations pertinent to my role as Chief Statistician. I wrote previously to the Committee setting out my role with regard to the production of statistics in Scotland.

You recommended that Scottish Government “Undertake a feasibility study to assess the practicalities and costs and consider the pros and cons of greater independence for the production of economic statistics in Scotland”. I strongly believe that Scottish economic statistics are produced with a high level of independence by statisticians in Scottish Government, the Office for National Statistics and other public bodies. I am responsible for the content and timing of all economic statistics, and what statisticians do is independently monitored by the Office for Statistical Regulation.

There is a real synergy in having our economic statisticians co-located with the economists in the Directorate for the Chief Economist. Their joint knowledge of the data is helpful in strengthening the quality, trustworthiness and public value of the statistics – which would suffer under different structural options. In addition, we know from the provision of health statistics that were we to locate the data collection and dissemination outwith SG there would still be a requirement to have in house statisticians to carry out a range of work. Given our starting point for economic statistics this duplication would add to the cost for what I believe is limited gain. As such I am not convinced of the merits of a feasibility study at this time, and therefore I do not accept this recommendation. However I am happy to set out fuller detail to the Committee if that would be helpful.

You also recommended that Scottish Government “End PRA to economic statistics which are market sensitive – including Scottish GDP, the Retail Sales Index for Scotland (RSIS), Quarterly National Accounts Scotland (QNAS) and Government Expenditure and Revenues (GERS) – and set out how it will do so.” I have thought carefully about this matter and asked for a review of all Scottish economic statistics to understand whether they are truly market sensitive. I have attached the findings which show that there is no evidence that markets moved at times where current Scottish economic statistics were published, even when looking at just Scottish firms. I am seeking views on this analysis before deciding how to

respond to your recommendation. As such, it would be particularly useful to have a view from the committee about my findings.

Yours sincerely

A handwritten signature in black ink that reads "Roger Halliday". The signature is written in a cursive style with a small flourish at the end of the last name.

Roger Halliday
Chief Statistician and Data Officer

Market Sensitivity of Economic Official Statistics on the Scottish Economy

1. Background

- Market sensitive statistics are defined in the **Pre-Release Access to Official Statistics (Scotland) Order 2008**¹ as statistics which *"if disclosed would, in the opinion of the person responsible, be reasonably likely to have a significant effect on the value or traded volume of any investment"*. The order limits the maximum period of pre-release access to these statistics to 24 hours before public release.
- The following economic statistics produced by the Scottish Government are currently classified as market sensitive.
 - Scottish GDP Index
 - Scottish Retail Sales Index
 - Quarterly National Accounts Scotland
 - Government Expenditure & Revenue Scotland (GERS)
- It is ultimately the responsibility of the Scotland's Chief Statistician to decide who gets pre-release access to Scottish Government statistics. The Chief Statistician has decided that where there are statistics whose early release could lead to an effect upon markets, while the risk of early release of data is minimal, the impact could be significant therefore pre-release access will not be allowed.
- This paper examines the potential for Scottish Economic Statistics to have a significant impact on financial markets.

2. Timing of Scottish Economic Statistics

- For a statistical publication to have a significant effect on financial investments, it would need to provide timely new information on the current performance of the economy or companies, or new information about the future direction of the economy or economic policy, which is useful for investment activities
- Sub-UK statistics are often produced a few weeks after the UK equivalent figures. This is largely due to the additional time it takes to analyse the data on receipt and to augment it with data from other sources. The Scottish GDP, Retail Sales, Quarterly National Accounts Scotland and GERS, for example, are published with a longer delay from the end of the reporting period than the equivalent UK series. Such a gap means that by the time the Scottish economic data are released, markets are likely to already reflect the macroeconomic, and sector specific, events which occurred during the time period covered by these data. For example, Scottish GDP estimates are released around 60 days on average after the ONS releases the first estimates of UK GDP. Similarly the Scottish Retail Sales publications are generally published around 3-4 weeks after their UK counterparts (Table 1).
- The timing of publications relative to the reporting period and the UK level publications mean that Scottish economic statistics are unlikely to affect overall financial markets. While companies with a specific focus on Scotland may be expected to be more influenced by Scottish Economic statistics, empirical analysis presented here shows no evidence for an impact on the share value of publicly listed companies headquartered in Scotland.

¹ <https://gss.civilservice.gov.uk/wp-content/uploads/2013/03/The-Pre-release-Access-to-Official-Statistics-Scotland-Order-2008.pdf>

Example of a regular UK/Scottish Quarterly Publication Cycle

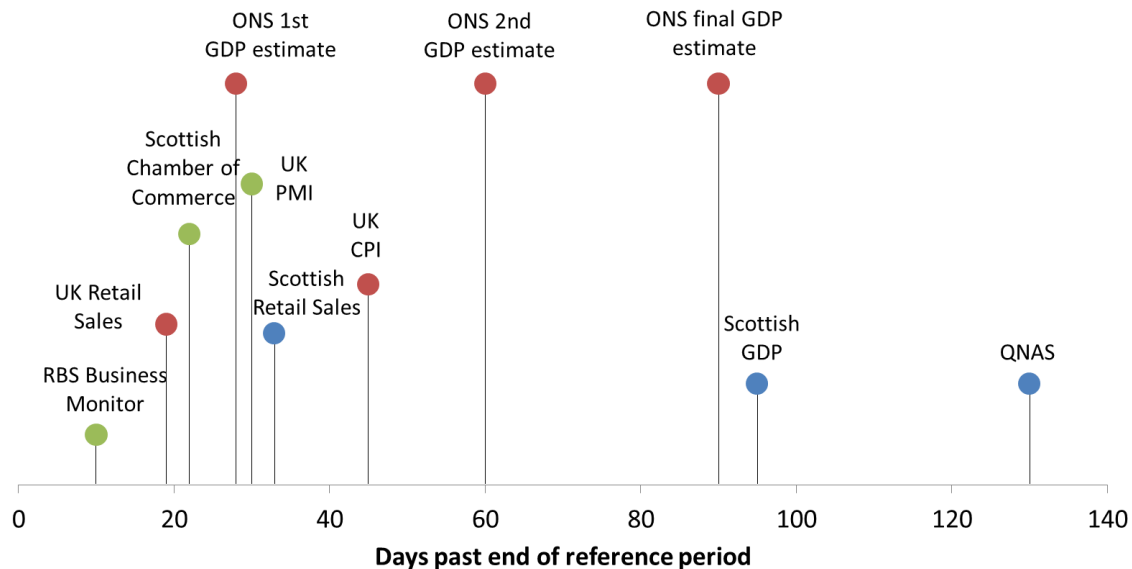


Table 1: Timing of Scottish Economic Statistics relative to reporting period and publication of UK wide statistics

Days between the end of 2016 Q4 and Publication of corresponding Statistics	
Scottish GDP Index	95 days
Scottish Retail Sales Index	33 days
Scottish National Accounts	130 days
Government Expenditure and Revenue Scotland (2016/17)	145 days after end of financial year (and 120 days after first UK PSF figure is available).

3. Empirical Analysis

3.1 No evidence that Scottish economic statistics impact the daily stock return or volatility of Scottish share prices

- The Office of the Chief Economic Adviser has reviewed the status of the statistics it publishes, in line with best practice for official statistics.
- A method was developed to empirically test whether the release of Scottish economic statistics, and the new information they bring to the market, are having a statistically significant effect on the price of publicly listed Scottish headquartered companies.
- To undertake the analysis, a Scottish share price index was constructed (see technical annexes) containing 36 companies that are headquartered in Scotland and publically traded on the London Stock Exchange. The index was weighted using companies’s market capitalisation (total value of a company’s outstanding shares which acts as a proxy for company size).
- The mean and the conditional variance (volatility) of the index was calculated across the time series. This allowed two possible impacts of new Scottish economic data to be tested for;
 - Firstly, to examine whether Scottish economic statistics led to any significant movement in the daily stock return, the effect of the date of publication on the mean return of the Scottish Index was tested.
 - Secondly, to examine whether Scottish economic statistics led to increased volatility in stock prices, the effect of the date of publication on conditional variance (volatility) of the Scottish Index was tested. This captures general market movements in response to new information and doesn’t specify whether share prices go up, or down.

Evidence of either of these would support the hypothesis that publications are potentially market sensitive and having a material impact on markets.

- These analyses were carried out for the following Scottish economic official statistics publications:
 1. Scotland's Gross Domestic Product (GDP)
 2. Retail Sales Index for Scotland (RSIS)
 3. Quarterly National Accounts Scotland (QNAS)
 4. Government Expenditure & Revenue Scotland (GERS)
- No significant effect of publication date on the mean return of the Scottish Index was found for any of the four publications tested (Table 2).
- There was no statistically significant effect of publication date on the on conditional variance (volatility) of the Scottish Index for GDP, QNAS and GERS publications (Table 2). For RSI publication dates the index was significantly less volatile than usual, which is not what we would expect to find were the publications having an impact on the value of the index.

Table 2: Impact of Scottish Economic Statistics publication dates on mean return and volatility of the constructed Scottish Index

Publication	Estimated impact of publication date on mean return	Statistical significance (p-value)	Estimated impact of publication date on conditional variance (volatility)	Statistical significance (p-value)
GDP	+ 0.24	0.25	- 0.13	0.20
QNAS	+ 0.07	0.75	- 0.06	0.57
RSI	- 0.31	0.23	- 0.23	0.02*
GERS	+ 0.23	0.65	- 0.35	0.14

* statistically significant at the 5% level

3.2. No evidence of an impact of Scottish economic statistics on daily stock return and volatility of the Scottish share price index while controlling for general UK market movement

- It is possible that the day-to-day market movement may be masking some of the impact Scottish economic statistics on the Scottish Index, e.g. a relatively small effect could be drowned out by the noise of the general day-to-day movement of the market.
- In order to test the robustness of our findings the above analysis was repeated using an index series with the estimated general UK market movement was stripped out (giving the estimated abnormal returns).
- There was no significant effect of publication date on the estimated abnormal returns for any of the four publications tested (Table 3).
- There was no statistically significant effect of publication date on the on conditional variance (volatility) of the estimated abnormal returns for GDP and QNAS publications (Table 3). For RSI and GERS publication dates the index was significantly less volatile than usual.

Table 3: Impact of Scottish Economic Statistics publication dates on mean return and volatility of the estimated abnormal returns of the constructed Scottish Index

Publication	Estimated impact of publication date on mean abnormal return	Statistical significance (p-value)	Estimated impact of publication date on conditional variance (volatility)	Statistical significance (p-value)
GDP	- 0.05	0.72	+ 0.05	0.48
QNAS	+ 0.07	0.58	- 0.07	0.38
RSI	- 0.07	0.61	- 0.33	<0.01**
GERS	+ 0.18	0.64	- 0.40	<0.01**

** statistically significant at the 1% level

4. Conclusion

- The above analysis also finds no evidence that the Scottish economic statistics are market sensitive.
- Scottish economic data lags the corresponding UK figures and few traded financial instruments are exclusively or predominantly 'Scottish'. As such the likelihood of Scottish economic statistics having a significant effect on financial markets is low. This has been supported by the empirical analysis presented in this paper.

Technical Annexes

Annex A: Details of the Methodology

The aim of the empirical section was twofold. First to estimate any impact publication dates had on the mean return of the financial series in question. Second, whether there was any evidence of an increase in the conditional volatility of the financial series on the dates of publication. As can be seen from the charts within this report, volatility within financial data is seldom constant, and often exhibits evidence of volatility clustering. Hence a methodology is required that can provide a systematic framework for modelling such volatility. In order to do so and to make any findings robust to the time varying volatility of stock returns, a generalized autoregressive conditional heteroscedasticity (GARCH) parameterization can be used.

Using a GARCH framework enables the estimation of the variance of a series at a particular point in time. While conventional econometric models assume the variance of the disturbance term is constant, using a GARCH process, as first shown by [Engle, 1982], it is possible to model the mean and the variance of a series simultaneously. This can then capture periods of time when an event leads to a change in the volatility of a company's stock returns. An example of such an approach is [Gulen and Mayhew, 1999] where a GARCH specification is used to examine stock market volatility before and after the introduction of equity index futures trading.

Furthermore, several extensions can be applied to account for asymmetric responses to positive and negative shocks, such as the asymmetric GARCH (GJR-GARCH) model of [Glosten et al., 1993] and the exponential GARCH (EGARCH) of [Nelson, 1991]. These test the hypothesis that the sign of the shock to the disturbance terms is not equal. In financial data, this is often attributed to the hypothesis that "bad" news, e.g. a negative shock, may increase the conditional volatility of a stock to a greater degree than "good" news or a positive shock.

GARCH Specification

For each series a univariate GARCH specification is estimated. To select an appropriate specification, the mean equation for each series is modelled using the Box-Jenkins approach and the stock return series is tested for any evidence of ARCH effects. Using a technique similar to that employed by [Cappiello et al., 2006] a model selection process for the most appropriate GARCH specification is applied using three alternative specifications: the standard symmetric GARCH model, the asymmetric GARCH (GJR-GARCH) and the exponential GARCH (EGARCH):

$$\begin{aligned} h_t &= \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1} \text{ [GARCH]} \\ \log(h_t) &= \omega + \alpha \frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}}} + \gamma \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \beta \log(h_{t-1}) \text{ [EGARCH]} \\ h_t &= \omega + \alpha \varepsilon_{t-1}^2 + \gamma I[\varepsilon_{t-1} > 0] \varepsilon_{t-1}^2 + \beta h_{t-1} \text{ [GJR - GARCH]} \end{aligned}$$

Where h_t is the conditional volatility at time t , ε_{t-1} is the innovation at time $t-1$ and I is a dummy variable which assumes a value of one in response to good news ($\varepsilon_{t-1} \geq 0$) and zero otherwise. If the coefficient γ is negative and statistically significant then this provides evidence that a positive shock is having a lesser impact on the conditional volatility than a negative shock,

Once each of the three models is tested, three information criterion – the log-likelihood function ($\log(L)$), the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC), are used to build evidence suggesting the best-performing model.

Dummy variables for each publication are then created equal to unity on the dates of release, and equal to zero at all other periods of time. Each dummy variable can then be individually incorporated into the best conditional variance equation or mean equation, for example in the case of GJR-GARCH conditional volatility equation:

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \gamma I[\varepsilon_{t-1} > 0] \varepsilon_{t-1}^2 + \beta h_{t-1} + \delta_t D_t$$

Where D_t is an event dummy which takes on a value equal to one on the day of release of the publication under examination. Estimates of δ_t can then be examined for evidence of a significant change in the behaviour of the conditional volatility on the dates of release.

Annex B: Building the Scottish Index

The Scottish Index consists of a constructed series of daily closing prices for 37 **publicly listed** UK companies with headquarters legally registered in Scotland. The information for constructing the index was obtained from several sources, including [Symon, 2016] and the headquarter location was then confirmed using [Bradstreet, 2014] which includes a comprehensive directory of all companies located within the UK each year including headquarters and their location.

The historical prices for all companies are sourced from Yahoo Finance, and the end of year market capitalisation for each company across time is sourced from the London Stock Exchange. The sample of Scottish companies are then used to construct a portfolio. The portfolio has a rolling weight across time by each company's market capitalisation. Three of the companies whose combined value comprises 0.72% of the total portfolio value, do not have price data available extending back fully across the sample period. To account for this the portfolio is rebalanced if a company drops out of the sample period. The portfolio is expressed in Sterling terms and the daily returns R_t are calculated as the logarithmic price relatives $R_t = 100 \times \ln\left(\frac{P_t}{P_{t-1}}\right)$ where P_t is the daily closing price.

The composition of the full Scottish portfolio has a few concerns regarding the weighting. Just over 95% of the portfolio value comes from 11 of the 37 Scottish based firms, with the Royal Bank of Scotland (RBS) and Scottish Southern Energy (SSE) alone comprising 54% of the total market value. This obviously raises concerns about the weighting of the portfolio being heavily skewed, where single events relating to RBS and SSE could adversely bias the modelling of the overall portfolio. In particular under examination RBS appears to have a considerably higher stock return variance relative to the others. There are also concerns about RBS unduly biasing the results due to the recent history of the company, such as the near bankruptcy and the nationalisation by the UK government in 2008. Due to these concerns RBS is dropped from the portfolio. The final Scottish portfolio containing 36 companies, excluding RBS, can be seen below along with the average weighting and the sector each company operates in.

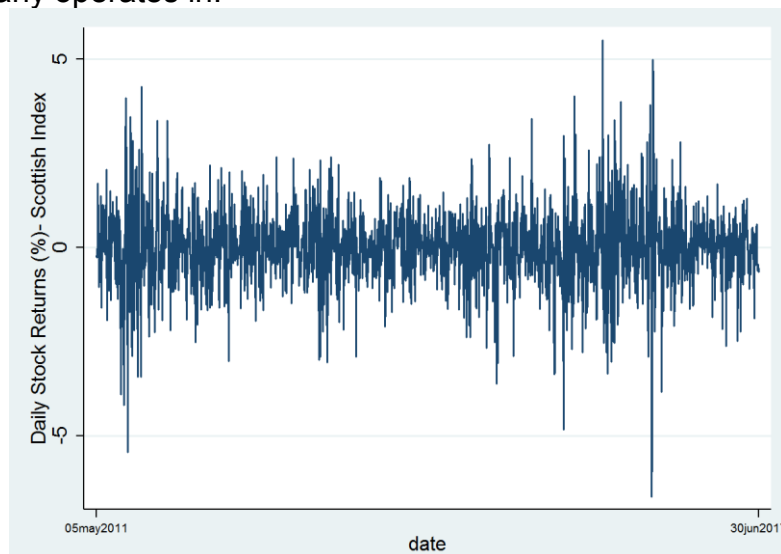
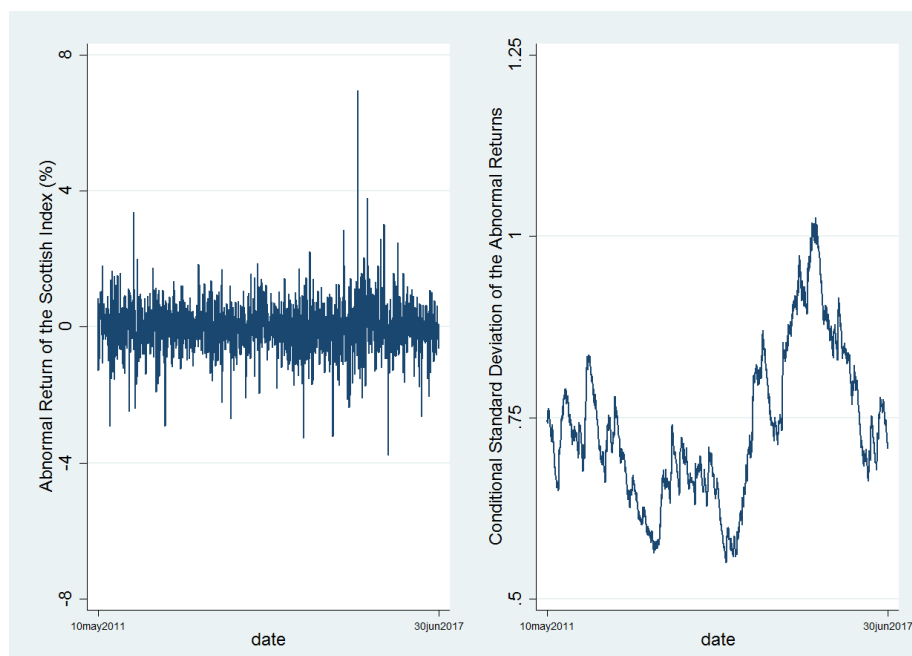


Figure 1: Time-series of the daily stock return of the Scottish Index from May 2011 to June 2017. Index constructed by the Scottish Government using financial data sourced from Yahoo Finance and the London Stock Exchange.

Annex C: Stripping out the Estimated UK Market Movement

To further increase the robustness of the approach it is possible to estimate the “abnormal returns” of a series, as outlined in [Mackinlay, 1997]. Following the market model methodology a series can be estimated where the “market return” has been effectively stripped out of a series. The reason for doing so is that the day-to-day market movement may be masking some of the impact the publications could be having on the Scottish Index. E.g. the publications are having an impact, but one that is relatively small and hence drowned out by the noise of the general day-to-day movement of the market. Once the average UK market return is stripped out of the Scottish Index, the abnormal returns can then be examined for any evidence therefor improves the robustness of our approach to this criticism.

To do so, the FTSE250, which covers the 101st to 350th largest companies on the London Stock Exchange is used as a proxy for the general UK market return. The justification for investigating the FTSE250 over the more well-known FTSE100 is that the FTSE100 is heavily composed of internationally focused multinational companies while the FTSE250 comprises a lot more medium sized manufacturers and service companies whom are more exposed to the UK economy. This can be seen by the fact that the FTSE250 constituent companies earn 50% of their revenues from the UK market, compared with only 20% for the FTSE100². Testing the sensitivity of Scottish specific publications that are domestically focused within the UK it is likely that the FTSE250 will be more sensitive to such publications than the FTSE100. Furthermore, there is evidence that external factors can unduly influence the FTSE100, such as a strong correlation between itself and the American S&P500³. Focusing on the FTSE250 reduces the chance of spuriously picking up such affects.



² Hunter, M. (2016). “UK’s FTSE250 has more to worry about than Brexit” *The Financial Times*, 10th June 2016: <https://www.ft.com/content/e2eae5be-226a-11e6-aa98-db1e01fab0c>

³ For example see: [Silk, 2012]

Figure 2: Estimated Abnormal Returns (%) of the Scottish Index and the Conditional Standard Deviation. Source: Scottish Government Estimates

Annex D: Constructed Scottish Portfolio (Excl. RBS)

<i>Company</i>	<i>Average Portfolio Weight</i>	<i>Sector</i>
SSE	31.26%	Electricity
Standard Life	18.38%	Life Insurance
Aberdeen Asset Management	10.69%	General Financial
Weir Group PLC	7.56%	Industrial Engineering
Aggreko	7.40%	Support Services
Alliance Trust	5.10%	Equity Investment Instruments
John Wood Group	4.25%	Oil Equipment, Services & Distribution
Stagecoach Group	4.09%	Travel & Leisure
FirstGroup	2.47%	Travel & Leisure
Cairn Energy PLC	1.98%	Oil & Gas producers
AG Barr	1.32%	Beverages
Devro	0.97%	Food Production
Smart Metering Systems	0.65%	Support Services
John Menzies	0.41%	Support Services
Johnston Press	0.34%	Media
British Polythene Industries	0.33%	General Industrials
Iomart Group	0.33%	Software & Computer Services
Faroe Petroleum	0.31%	Oil & Gas Producers
STV Group	0.28%	Media
Craneware	0.25%	Software & Computer Services
Goals Soccer Centres	0.24%	Travel & Leisure
Energy Assets Group	0.24%	Support Services
Parkmead Group PLC	0.21%	Oil & Gas Producers
Eland Oil and Gas	0.20%	Oil & Gas Producers
Bowleven PLC	0.19%	Oil & Gas Producers
Celtic	0.13%	Travel & Leisure
Macfarlane Group	0.09%	General Industrials
J Smart & Co (Contractors) PLC	0.08%	Construction & Materials
Murgitroyd Group	0.08%	Support Services
Indigovision Group PLC	0.05%	Software & Computer Services
Caledonian Trust PLC	0.03%	Real Estate Investment & Services
Seaenergy PLC	0.03%	Electricity
Spaceandpeople PLC	0.02%	Media
Havelock Europa	0.01%	Household Goods
Braveheart Investment Group PLC	0.01%	General Financial
Scotgold Resources LTD	0.01%	Mining
Total	100.00%	

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