Working Party on National Accounts

MEASURING THE EFFICIENCY OF A STATISTICAL PROGRAM

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MEASURING THE EFFICIENCY OF A STATISTICAL PROGRAM

Macroeconomic statistics are used in establishing monetary and fiscal policy, making investment decisions and assessing the overall performance of an economy. They are used to evaluate the well-being of individuals and the environment, the state of our health, level of our education and incidence of crime. Clearly, the degree and scope of their use demands that they are both highly reliable, accurate and produced efficiently.

Macroeconomic account compilers have spent a large amount of time developing quality and accuracy indicators. These indicators range from such things as survey response rates, sampling rates, and coefficients of variation to revisions analysis. While quality and accuracy indicators are generally readily available there has been less attention paid to measures which speak to the efficiency of a national account program.

Over the past number of years the Government of Canada has been asking programs to develop performance indicators which can be used to guide the management of government programs. One such indicator that has been requested is an efficiency indicator. Efficiency is important for two reasons. First it is a means to assess the stewardship of public funds. Most statistical programs are a public good and are delivered using public funds. The public deserve to be as well-informed regarding the efficiency of a statistical program as they do about the quality. Secondly, managers of statistical programs need to be aware of a program’s efficiency in order to effectively manage the program. Understanding efficiencies will aid managers in redirecting funds to program enhancements or strategic investments. Understanding inefficiencies will trigger a need to find better ways to do things or a realization that the benefits no longer outweigh the costs.

One way to measure efficiency is to measure whether or not a program’s growth in output exceeds its growth in inputs. For most businesses the output is represented by the total value of the sale of a good(s) or service(s) in the marketplace. Firms then gauge their efficiency by looking at whether or not their sales revenue is growing at a faster rate than their expenses – an increase in profitability reflecting an increase in efficiency. Businesses can also look at the physical inputs (labour, capital, materials) used to produce a good in relation to the quantity of the good produced to determine overall efficiency.

For governments there is a significant challenge in using the ‘business approach’ to measure their efficiency and its evolution through time. Given most government program outputs are public goods and are not ‘sold’ on the market it is not possible to derive a revenue figure for the program and hence it is not possible to derive the ‘profitability’ of the program. The majority of government output is a service in nature and it often very difficult to consistently ‘count’ the physical units of output. In light of these limitations alternative measures of output and input need to be produced. This paper proposes a way to measure the output of a macroeconomic statistics program and combine this measure with an appropriate input measure to arrive at an indicator of efficiency.

Output

There are various ways to measure the output of a macroeconomic statistical product. One could envision using the number of data points produced as a measure of output. Another measure could be the
number of data users or number of different uses of the information. One problem with this approach is the sensitivity of the measure to changes in the way the data are produced, disseminated or used that have nothing to do with the actual output of the program. For example, a program could disseminate a table of data – industry by region. It could then decide, for ease of use, to disseminate the same data by region by industry. A simple count of the series disseminated would double the product’s output – but in reality it is the same data – the output may have changed but certainly did not double.

Most statistical products in the macroeconomic accounts can be described by their dimensions. For example, the production account could be described by the level of industry, sector, product and valuation dimensions (to name a few). These dimensions define the output of the account. It can be surmised that a change in any of these dimensions represents an increase (or decrease) in the output of the product.

It is proposed that the output of a macroeconomic accounts product at Statistics Canada be tracked from one year to the next by examining the change in the dimensions of the product. This proposed method seeks to simply determine if the output increased or decreased relative to the previous year. It does not propose to determine how much the output increased. At a program level the idea is to develop a quantifiable (albeit binary) and justifiable methodology that will allow the program manager to say to their data users (and funders) that the output of a given product increased, remained the same or decreased relative to the previous year (or accounting period).

The proposed methodology has three steps all of which are completed by the manager responsible for delivering the product.

First, the manager must identify the dimensions associated with the product from the following list of possible dimensions:

- Visibility of the product
- Availability of metadata
- Geography
- Industry
- Sector
- Demographic
- Social
- Environmental
- Content
- Relevance
- Quality

The manager of the statistical product would need to select the dimensions which most appropriately describes their product. For example, in many cases in the macroeconomic accounts a demographic dimension (e.g. age, sex) is not applicable. As such the program manager would not select this dimension to describe their program.

Second, the program manager must determine the importance of each of the dimensions in the output of the product since one dimension may have a greater importance than another in the overall development of the product. In order to incorporate this idea into the methodology the manager must assign a weight to each of the dimension of the program. The weights are determined (arbitrarily) by the program manager and are based upon their knowledge of the effort associated with expanding a given dimension.
Finally, once the manager has selected the dimensions and assigned a weight to each of the dimensions they can begin ‘scoring’ each dimensions for the current year relative to the previous year by responding to the following questions for each dimension:

- Where there major improvements associated with this dimensions in this product over the previous year (10 points)
- Where there minor improvements associated with this dimensions in this product over the previous year (5 points)
- Was there no change associated with this dimensions in this product over the previous year (0 points)
- Was there a minor deterioration associated with this dimensions in this product over the previous year (-5 points)
- Was there a major deterioration associated with this dimension in this product over the previous year (-10 points).

For each of the responses the manager is required to provide evidence in the form of a written narrative to support their assessment. The fact that the manager must justify their rating in writing is an important part of the overall methodology and should help guard against false positives, especially if the ratings are reviewed by a third party.

Output – An Example

As a means to illustrate the above methodology assume that a manager is asked to evaluate the output of their annual production account. The manager first determines that the following dimensions and weights best represent the annual production account.

- Industry (weight=.4)
- Region (weight=.4)
- Metadata (weight=.1)
- Visibility (weight=.1)

Upon reflecting on the performance of the program over the past year the manager notes that the program was able to add a regional dimension to its production account. This undertaking was substantial in that this work required the elaboration of new data sources, updates to the processing system, communication with stakeholders, and the development of a number of new methods national to regional allocation methods. Based on this justification the program manager would indicate there were major improvements (+10 points) associated with the regional dimension of the product.

Assume further that the manager was unable to update the user documentation associated with the product. This lack of metadata represents a deterioration in the metadata dimension of the product. The manager determines that the deterioration is minor (-5 points) since the existing metadata covers part of the metadata requirements of the new dimension.

Finally, the manager noted that the industry dimension did not change and there was a minor increase in the visibility of the product due to a number of analytical reports that were published highlighting the new data. The results of the manager’s assessment can be found in table 1.
For the first time, the annual production account was published for each region in Canada (10 provinces and 3 territories). This undertaking was substantial in that this work required the elaboration of new data sources, updates to the processing system, communication with stakeholders, and the development of a number of new estimation methods. This represents a major improvement in the regional dimension of the program.

While the regional data were released—the program was unable to update the related metadata (sources and methods guide) associated with the production account. As such, the current sources and method guide no longer corresponds to the product released to the public.

As part of the release the program was able to release a number of articles providing insight into the output and value-added for each province and territory in Canada.

Based on the manager’s assessment the output of the program increased by ‘4’. The major drawback with this methodology is the arbitrary nature of the rating system. What does 10 points or 5 points really represent? Can we be certain that a major improvement is worth twice as much as a minor improvement? Is a ‘10’ point improvement in the regional dimension worth the same as a ‘10’ point improvement in the industrial dimension? These are valid concerns and need to be taken into consideration in the overall methodology and interpretation of the results. As such, the results of the above example should only be interpreted as follows: “the output of the program increased over the previous year”. While this may seem obvious the exercise has permitted the manager to justify their determination that output has increased.

**Inputs**

In order to produce an efficiency measure, a measure of the program’s inputs must also be derived. One way would be to use the overall cost of the program. The problem with this method is the dollar cost associated with the inputs will not have any relationship to the output indicator developed above. Instead the input indicator needs to be constructed in a similar manner as the output indicator in order for the efficiency indicator to have any managerial usefulness. Therefore the same approach has been taken with respect to the development of the input indicator.

Managers are first asked to describe the input dimensions of the program by selecting from the following dimensions:

- Salary costs
- Non-salary costs
- Use of corporate services

Similar to the output indicators, the manager is then asked to determine a weight for each of the input dimensions. This weighting could be determined by using the actual historical costs associated with the production of the statistical product. Once the input dimensions have been weighted the manager can then access the current year’s inputs relative to the previous year’s inputs by responding to the following questions for each input:
Was there a large increase in funding over the previous year (10 points)
Was there a minor increase in funding over the previous year (5 points)
No change over the previous year (0 points)
Was there a minor decrease over the previous year (-5 points)
Was there a major decrease over the previous year (-10 points).

Input – An Example

As a means to illustrate the above input methodology assume that a manager is asked to evaluate the inputs of their annual production account. As noted above the annual production account added a regional dimension in the current year. The manager first determines that the following dimensions best represent the inputs used in the creation of the annual production account.

- Salary (weight=.6)
- Non-salary (weight=.1)
- Use of corporate services (weight=.3)

The manager then identifies if any of the inputs into the program changed in the current year. Upon reflection they note that in order to produce the new set of regional accounts they required an additional analyst. The addition of the analyst represents a minor increase in the product’s associated salary costs. The manager also notes that they required some additional data from other program areas and indicates that this represented a major increase in the use of corporate services. Finally, the manager notes that the non-salary expenditures were unchanged.

The results of the manager’s assessment can be found in table 2:

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Weight</th>
<th>Score</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary</td>
<td>.4</td>
<td>5</td>
<td>An analyst was added to the annual production account section. The annual production account section was comprised of 10 people. The addition of one analyst represents a minor increase in salary costs.</td>
</tr>
<tr>
<td>Non-Salary</td>
<td>.1</td>
<td>0</td>
<td>There was no change in non-salary expenditure.</td>
</tr>
<tr>
<td>Use of corporate services</td>
<td>.3</td>
<td>10</td>
<td>A number of previously un-exploited regional data was processed by a number of data suppliers. This represented a major increase in the use of corporate services.</td>
</tr>
<tr>
<td>Total (weighted)</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

From the manager’s assessment it can be determined that the inputs used by the annual production account program increased by ‘5’ over the previous year.

Efficiency Indicator

At this point the manager has been able to justify the fact that both the program’s output and input increased – but what of efficiency. One way to determine the efficiency is to derive a simple ratio of the output measure divided by the input measure (4/5). In the case of our example this would mean that the overall efficiency of the annual production program declined since the increase in inputs was greater than the increase in outputs.
In order for this statement to be accurate it relies on the manager being able to access both inputs and outputs on the same scale. One could argue that this may not always be the case or that managers have a self-interest in showing an increase in efficiency such that they will always have a tendency to overstate changes in output and understate changes in inputs. One way to address this issue is to ensure that the exercise remains a simple management tool and does not get tied to managerial performance or program budgets.

Secondly, the requirement to justify the ratings permits for an independent evaluator or peer evaluation of the process. If the ratings are used to assess the overall performance of a product an independent evaluator could review the justifications to ensure that the ratings were applied correctly – keeping in mind the end goal is to only determine if the program is more efficient or less efficient relative to the previous year.

Finally, the output and input indicators could simply be a binary indicator. If both output and inputs are showing increase then there is no change in efficiency (regardless of the actual score). If outputs are increasing in input remain the same then efficiency is increasing (and all possible combinations thereof).

In addition to being a tool that can be used to access the post-anti performance of a product it could also be used a priori. For example, assume a manager is considering the expansion of a given product. They could assess the impact on output, the impact on inputs and determine if the benefits (increase in output) is larger than the costs (increase in costs). They could then use this information to help determine whether or not to move forward with a project.

**An aggregate measure**

While the efficiency indicator is calculated at the product level – its real usefulness may be when it is rolled up to program (multiple products) or agency level. A report as simple as a count of number of programs that showed an increase in efficiency, no change in efficiency and a decline in efficiency relative to the previous year could be very informative to management. Another way to develop a corporate indicator is a weighted aggregate of the efficiency measures where the cost of the program is used to determine the weight. This approach ensures that the efficiency (or lack thereof) of the largest products are appropriately reflected in the aggregate program indicator. Another measure could simply be a dashboard type of report that displays green for those products increasing in efficiency, yellow for those unchanged and red for those showing a decrease.

In the end this tools should enable an organization or part of an organization to state (fully justified) whether their output has increased and whether or not they are more efficient in producing that output relative to the previous reporting period.

As way of a test, the above methodology was applied to the following products within the Canadian Macroeconomic Accounts program for the period 2006 to 2014:

1. Quarterly Gross Domestic Product (QGDP)
2. Supply and Use Tables (IO)
3. Quarterly Labour productivity (QLP)
4. Provincial and Territorial GDP by Industry (PGDP)

The results indicate that the efficiency of the programs increased over this period. The path for each product differed with the majority of the products showing no change or increases and one program showing both an increase and a decrease.

![Efficiency Indicator - Selected Programs (MEA Branch)](chart1.png)

The products were aggregated together to the program level (using the program cost as weights) and showed a general increase each year with the exception of 2014.

![Program Weighted Efficiency Indicator](chart2.png)
An alternative approach that was used to aggregate the product detail was to develop a dashboard which provided a visual representation of the progress of the program over the period 2007 to 2014. Using this approach it is possible to conclude that there was an overall improvement in the efficiency of the program between 2007 and 2014 and the majority of this improvement occurred in the latter half of the period.

<table>
<thead>
<tr>
<th>Year</th>
<th>Programs that increased efficiency</th>
<th>Programs where there was no change</th>
<th>Programs that decreased efficiency</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
<td><img src="image.png" alt="Red" /></td>
<td><img src="image.png" alt="Green" /></td>
</tr>
<tr>
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<td><img src="image.png" alt="Red" /></td>
<td><img src="image.png" alt="Green" /></td>
</tr>
<tr>
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<td><img src="image.png" alt="Yellow" /></td>
<td><img src="image.png" alt="Red" /></td>
<td><img src="image.png" alt="Green" /></td>
</tr>
<tr>
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<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
<td><img src="image.png" alt="Red" /></td>
<td><img src="image.png" alt="Green" /></td>
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<tr>
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<td><img src="image.png" alt="Yellow" /></td>
<td><img src="image.png" alt="Red" /></td>
<td><img src="image.png" alt="Green" /></td>
</tr>
<tr>
<td>2012</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
<td><img src="image.png" alt="Red" /></td>
<td><img src="image.png" alt="Green" /></td>
</tr>
<tr>
<td>2013</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
<td><img src="image.png" alt="Red" /></td>
<td><img src="image.png" alt="Green" /></td>
</tr>
<tr>
<td>2014</td>
<td><img src="image.png" alt="Green" /></td>
<td><img src="image.png" alt="Yellow" /></td>
<td><img src="image.png" alt="Red" /></td>
<td><img src="image.png" alt="Green" /></td>
</tr>
</tbody>
</table>