The development and production of GDP flash estimates in a newly industrialised country: the case of South Africa

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The Development and Production of GDP Flash Estimates in a Newly Industrialised Country: The Case of South Africa[1]

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Abstract: The experience accumulated from the development and production of a flash estimate of GDP as an official statistic at Statistics South Africa (Stats SA) is presented and discussed. This experience could inform national statistical organisations operating under similar statistical production constraints in other newly industrialised countries or elsewhere. The use of the flash estimate as an early indicator of business cycle slowdowns and upturns is also presented to demonstrate one possible by-product use of the flash estimate.

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1. Introduction

The aim of this paper is to report the experience accumulated from the development and production of a flash estimate of GDP as an official statistic at Statistics South Africa (Stats SA) from its conception in the middle of 2008 to the present. This experience could inform national statistical organisations operating under similar statistical production constraints in other newly industrialised countries, or indeed elsewhere.

The use of the flash estimate as an early indicator of business cycle slowdowns and upturns will also be discussed demonstrating one possible by-product use of the flash estimate.

The paper is organised as follows. Some background is provided on what a flash estimate of GDP entails, followed by a description of data sources and methodology, the results of our experimentation, a discussion on selected aspects of the presentation, and finally some concluding remarks.

2. Background

2.1. A flash estimate of GDP

It is commonly agreed that a flash estimate is the earliest picture of the economy according to national accounts concepts, produced and published as soon as possible after the end of a reference quarter, using a more incomplete set of information than that used for traditional/regular quarterly figures. This definition, however, does not spell out how to actually construct a flash GDP estimate, and it is the purpose of the present section to provide one possible interpretation of this definition as a schema workable in practice.

The approach taken here is based on the premise that identified methods or techniques for flash GDP outlined in the literature should not be treated as cast in stone, since there is no unique solution to producing a flash estimate of GDP. And whilst a particular solution may work well in some instances, this is not to say that it is universally transferable. For instance, the South African approach may work well for Stats SA, but this is not to say that this will be so in other countries, as domestic constraints, whether material, capacity or political, influence the outcomes of the development of any statistical product. Furthermore, continual refinement and adaptation of source data and methods are essential for accurate and reliable measurement of the statistic, thus necessitating changes in data or methods used.

2.1.1. South African specifications

Based on organisational requirements, the flash estimate considered as a statistical product must carry the following attributes:

a) the estimate should be able to fit into the existing statistical production process of the statistical office and be in line with well established national accounts approaches to GDP;

b) it should be brief and easy to communicate in the sense that it depicts a single number;

c) its derivation methodology should possess robustness as its main statistical property, in the sense that under situations where violations occur to the underlying assumptions of its derivation, its reliability is unaffected or at most minimally affected; and

d) it should adhere to international standards, in the sense that the data inputs, methods of production and quality criteria conform to what peer statistical agencies have tried and tested.

2.1.2. South African flash GDP product

Following on from the above, the South African flash GDP product measures the year-on-year quarterly volume development of total value added at basic prices. It is named Flash TVA where the TVA part is named after "total value added". A discussion on nomenclature issues is provided in the appendix.

Flash TVA is independent from the detailed estimates of total value added coming from quarterly national accounts. As an effort to preserve independence, the production systems and processes are located in a separate/autonomous unit at Statistics South Africa -- that is, Socio-Economic Integration.

The calendar release schedule of 35 days for the flash and 60 days for the regular GDP obtained from the full set of national accounts ensures that the GDP estimates adhere to the speedy release of information and compares favourably with peer statistical agencies.

The quality criteria under which Flash TVA operates are sourced in most cases from what has either been used or been suggested by internationally recognised statistical agencies.

2.2. Usage of a flash estimate of GDP

Over and above its advantage as the earliest indicator of economic growth based on statistical principles, the estimate of Flash GDP is useful in other ways.

2.2.1. Economic growth indicator in developing countries

Countries that may not have sophisticated statistical systems, or in turn have systems with weak capacity may derive considerable benefit from producing a flash GDP. There are a number of reasons why this is so:

a) in the absence of a full and sustainable GDP compilation programme, a flash GDP estimate may be accepted by regional or multilateral bodies as an official estimate of GDP for the affected countries, provided the standard principles of official statistics are adhered to in its production. This is because a flash GDP estimate provides policy-makers and decision-makers with the earliest possible *measured* aggregate information of the national economy within an accepted statistical programme for their derivation, as opposed to forecasting models;

b) flash GDP estimates are not necessarily as demanding to produce as the regular GDP estimates;

c) a flash GDP estimate has the potential to provide policy-makers and decision-makers with more frequent estimates of the national economy than the regular GDP, a typical requirement for countries which are in the development or post-development phase.

2.2.2. A quality check on the standard GDP estimates

The converse of the previous subsection is that the flash estimate could be seen as an independent quality check of the regular GDP estimates in a country with well-established national accounts practices and products in the following way. Although discrepancies between the flash GDP and comparable regular GDP numbers are normal and expected, the discrepancies are no cause for concern as long as the occurrences are infrequent; random in that they are equally likely to be positive or negative; and the direction of the growth given by the two estimates is the same. However should the discrepancies persist systematically in a particular direction – that is to say that there is bias - this need not automatically be taken as evidence of weakness in the flash estimate. Granted, a divergence between the two estimates could point to the need to revisit and revise the estimation practices of the flash GDP, but as suggested in Chumakova, Dimova, and Peltola (2009: 7), such an aberration can also be a sign of the need for an adjustment in the compilation process of the regular GDP estimates, especially as it relates to the source data used to produce it. Thus astute use of the results of the flash estimate may serve as an indicator of the accuracy and reliability of the standard GDP estimates, albeit in a limited sense.

2.2.3. Monthly estimates of GDP

Monthly indicators of economic activity are demanded by users in a newly-industrialised country like South Africa where frequent monitoring of a rapidly changing economy is important for policymakers and other users. The majority of source data indicators for both flash and regular estimates of GDP occur on a monthly basis. Despite the fact that in principle monthly estimates of GDP are possible, the monthly production of a full set of national accounts is impractical in most countries, including currently South Africa. On the other hand, flash estimates of GDP are eminently obtainable, and can serve essentially as a proxy for the change in GDP on a monthly basis. This approach, for instance, is practiced in Finland and Malaysia (Kokkinen, 2004: 1; Talib, 2009: 3).

2.2.4. Early warning system

A final application considered here is to treat the Flash TVA as an early warning signal to detecting turning points in the business cycle. Statistics South Africa has adapted a novel technique proposed by Jiancheng (2009: 22-25) for using Flash TVA in this manner. According to this technique the pace of production - as represented by the year-on-year quarterly rate of change in flash total value added - may, depending on historical ups and downs, be classified at a given point in time as normal/stable, warm, hot, cool, or cold. The attraction of this technique stems from using only actual observations and assigning to them a classification using the distribution of historical data. This enables the presentation and subsequent interpretation on changes in production activity directly to the reported measurements only and some well-managed assumptions classifying economic conditions. This particular use of Flash TVA is further discussed below and experimental results presented.

3. Data matters and methodology

The main points regarding the Stats SA flash estimate of GDP follows.

- The construction of the South African Flash TVA estimate involves combining an annually quarterised estimate of total value added obtained from changes in the population growth rate and income per capita with an estimate obtained from a composite coincident indicator which monitors the monthly changes in total output through economic activities in the primary, secondary, and tertiary sectors of the economy. Whilst the parameters for each model will have to be re-calculated at every instance when the estimate is calculated, it is accepted practice that functionally the models themselves should only be revised on an annual basis, and then only if needed, to maintain the necessary verisimilitude. The resultant Flash TVA estimate is the weighted sum of the two estimates, subject to quality control.

- The estimates production draws on a mixture of real observations and imputation for the cases where information is missing, involving data sources from within and outside Statistics South Africa. The imputation is usually conducted for the last month of a quarter for some data sources, and is done in order to meet the 35 day deadline of the Flash TVA estimate.

- The volumes of source data for the composite indicators are obtained by deflation using the producer price index (PPI) where necessary. This is done with reference to constant prices in terms of a 2005 base year. Rebasement is done once every 5 years.

- The pace of the economy is captured by a Flash TVA snapshot, which depicts the Flash TVA as an early warning business cycle signal system that classifies this pace as normal, warm, hot, cool, or cold. The relative position of these conditions is recalculated once every 5 years in line with the conventional practice on index rebasing.

Flash TVA is produced 35 days after the end of a reference quarter thus meeting and/or exceeding OECD country standards in most cases. The estimate is revised upon receipt of data previously imputed. These revisions are reported quarterly.

The details of the above procedures are given below.

3.1. Quarterly estimate procedure

Firstly, the quarterly estimate is produced by selecting appropriate data, creating a monthly composite indicator from these data sources, transforming the input data and monthly indicator to a weighted quarterly indicator, and then essentially superimposing the changes in total value added determined by the quarterly indicator on the overall profile of the total value added level obtained from the regular GDP estimate.

3.1.1. Data Sources

The required data for the construction of South Africa's Flash TVA estimate are a combination of internal plus external sources. This includes primarily survey area collections from Statistics South Africa, complemented by records from the South African Futures Exchange (SAFEX), South Africa's Richards Bay Coal Terminal and Transnet. The time series stretch from January 1998 onwards, and updates occur monthly. The composite indicator will draw on production data measured in volumes obtained by means of deflation following the suggestion in Reed (2000: 56). Table 1 lists the selections based on suggestions in Kokkinen (2002: 8) and Rosidi (2009: 4).

Table 1. Data for the composite indicator

Industry	Data description	Data source
Agriculture	Sum of volumes of futures contracts traded on SAFEX in white maize, yellow maize and wheat.	SAFEX. Trading volume stats.
Mining	Index of physical volume of total mining production, including gold.	Mining: Production and Sales. Stats SA statistical release, P2041.
Manufacturing	Index of physical volume of total manufacturing production.	Manufacturing: Production and Sales. Stats SA statistical release, P3041.2.
Electricity	Index of physical volume of electricity production.	Electricity Generated and Available for Distribution. Stats SA statistical release, P4141.
Construction	Total value of recorded building plans passed by larger municipalities, in current prices.	Building Statistics. Stats SA statistical release, P5041.1.

Retail	Total retail sales, in current prices.	Retail Trade Sales. Stats SA statistical release, P6242_1.
Motor trade	Total sales of new vehicles, used vehicles, workshop. and other sales, in current prices.	Motor Trade Sales. Stats SA statistical release, P6343_2.
Wholesale	Total wholesale sales, in current prices.	Wholesale Trade Sales. Stats SA statistical release, P6141_2.
Transport	Rail transport of petroleum products in volumes.	Transnet. Internal records.
Services	Rail transport of crops, fruit and vegetables in volumes.	Transnet. Internal records.
Outward-bound commodity intensive foreign trade	Coal exports in volumes.	Richards Bay Coal Terminal. Operating statistics – monthly.

As can be seen, employment is not included. This stems from findings which show that employment data does not add much to tracking quarterly flash GDP because of a lagging effect that takes around six months to reflect in output (INE, 2009: 19; Scheiblecker and Steindl, 2006: 83). And, although Kokkinen (2002: 2) suggests including employment from construction, in the South African case this cannot be implemented, as unbroken data for this variable is not available for the referred time period.

The listed data sources should not be taken as exhaustive.

3.1.2. Monthly composite indicator

The process of deriving the composite indicator from monthly indicators involves the following steps:

1) Begin by analysing the input indicators, looking for outliers in particular. The outlier points are smoothed by Winsorising, if necessary.

2) Deflate the indicators referring to sales data at current prices with the Producer Price Index to produce a volume variable.

3) If not already based to be 100 in 2005 (the base year in this instance), convert the data into index numbers of the form: average of months of 2005=100.

4) The monthly differences of these index numbers are the key variables of analysis. Standardise the monthly differences of these index numbers to have a mean of zero and a standard deviation of 10 throughout the period 1998 – 2008 or whatever the chosen time period is, following the approach suggested in the OECD Composite Indicators Handbook (2008: 28). The most recent year represents the upper end of

the range because information from the most recent period is more important than older data in the construction of the Flash TVA.

5) Finally, investigate the reliability of the standardised set of index numbers in describing the envisaged composite indicator by checking for its internal consistency using Cronbach's alpha. A suitable value of Cronbach's alpha is a value above 0.7. Indicators which contravene this limit are deemed unsuitable for inclusion.

3.1.3. Quarterly composite indicator

1) Impute missing data to complete three months of data for each indicator, usually the last month. Typically the flash is produced using 79% of available hard data from the reference period, and imputing the rest of the data, which involves information for the third/last month in a quarter. This is done using single, double, or triple Holt-Winters exponential smoothing which are a subset of more general ARIMA methods (see, for example, Roberts (1982: 817)). In this sense nowcasting for the quarter takes place. The effect of the imputed data is smaller than one would naively expect. In fact, the last monthly change only contributes $1/9^{th}$ to the estimate of quarterly change in any particular quarter. See the appendix for an elaboration of this fact.

2) Sum the three months of data to convert the monthly indicator data to quarterly indicator data.

3) Calculate the composite indicator as a weighted sum. The weights are chosen in one of two ways. In the first way the weights are all set to unity. This gives a baseline comparison with the second potential scheme. Here, analogous to Reininga and Kazemier (1996: 8-10), the weights are the parameter values that best fit a multiple linear regression of the composite indicator with total value added at basic prices. This is implemented through two stages: an exploratory regression analysis (first stage) followed by a regression to determine the required weights (second stage).

   a) The first stage serves merely to check for cross-correlations and residual autocorrelation in the input indices by performing a basic regression. Collinearity among the indicators is determined by analysing the condition indices of the eigenvalues of the system. If the condition index of a particular eigenvalue is greater than 100, then the collinearity is significant according to standard practice. The Durbin-Watson test statistic determines positive and/or negative autocorrelation of the residual series, at a level of significance of 5%.

   b) In the second stage the weights for the coincident indicator are obtained through a regression where the year-on-year changes in the quarterly change indices act as explanatory variables to the year-on-year change in the quarterly change of real total value added as expressed at constant 2005 prices. The resultant weights for the composite indicator are the normalised set of parameter values obtained from this regression.

   c) Comparability demands that real total value added is converted into index form analogously to the way the composite indicator is converted.

d) The resultant indicator is scaled to have a mean and a standard deviation equal to the mean and standard deviation of the quarter-to-quarter change of real total value added throughout the period 1998 to the current period being estimated.

3.1.4. Quarterly estimate indicator

The calculation of the quarterly estimate is taken from a quarterly model, similar to that suggested by Scheiblecker and Steindl (2006: 82) and Haluska (2009: 7), under the assumption that total value added changes at a linearly trending rate, with changes around the trend introduced by the composite indicator. The technique used is a Regression-ARIMA one incorporating outlier adjustment.

3.2. Quarterised annual estimate procedure

The second step in the measurement towards Flash TVA is taken from an annual population based Chenery-Syrquin model as described in UNIDO's 2004 *Industrial Development Report* (2004: 62-63). This relates value added to the population rate and the income per capita on an annual basis. The resultant annual estimates are quarterised using the Lisman-Sandee quarterisation method as outlined in the IMF Quarterly National Accounts Manual (2001: 120-123). The annual GDP and population source data are from official Stats SA sources only.

3.3. Flash TVA estimate procedure

In the third step, the final quarterly flash estimate is calculated as the average of the estimates in the first and second steps. This is a weighted average where the weights are the inverses of the mean absolute percent error (MAPE) for each estimate, normalised. As a quality check, an ARIMA forecast is produced as a filter for each of the two estimates. The reasoning is that any estimate produced must be at least as good as a sound ARIMA forecast to be a valid estimate. If either of the two estimates fails this quality check, it is not used in the final estimate. In the unlikely event that they both fail this quality test then the estimation methodology is reviewed.

3.4. Snapshot of economic pace

The prime flash estimate, that is the year-on-year change in total value added, is represented on a graph with observations classified into cold, cool, normal, warm, and hot respectively according to percentiles fixed for a specified time period. Their corresponding percentiles are the 10th, 25th, 50th, 75th, and 90th percentiles respectively. The percentile values come from a historical series of the Flash TVA, which in the South African case covers the 1998 – 2008 period. To account for growth, the percentile reference lines are rebased every 5 years.

4. Results

The results reported are from simulated production of Flash TVA as if it were an official statistic under realistic operational and data constraints as set out above. The first estimate was produced at the beginning of January 2010 for the last quarter of 2009.

4.1. Experimental findings

4.1.1. Quarterly composite indicator

The two approaches for developing a composite indicator were compared by analysing the correlations of each indicator with the change in real GDP at basic prices. The second approach, which had nontrivial weights, consistently produced a correlation better than the first approach where the weights were all unity, and for the period 1998 – 2009 produces a correlation of 0.87 which is significantly larger than the correlation of 0.84 produced by the first approach. The two panels in figure 1 illustrate the correspondences by plotting the chosen Stats SA indicator and the indicator with unit weights, each against the quarter-to-quarter change in real total value added at constant 2005 prices.

Figure 1. Comparison of the Stats SA composite indicator and the unit weight composite indicator
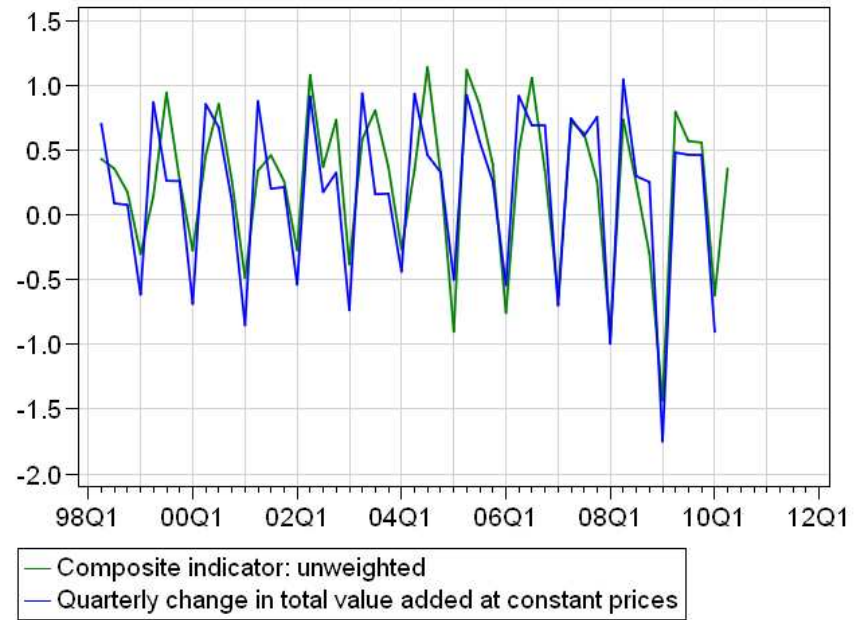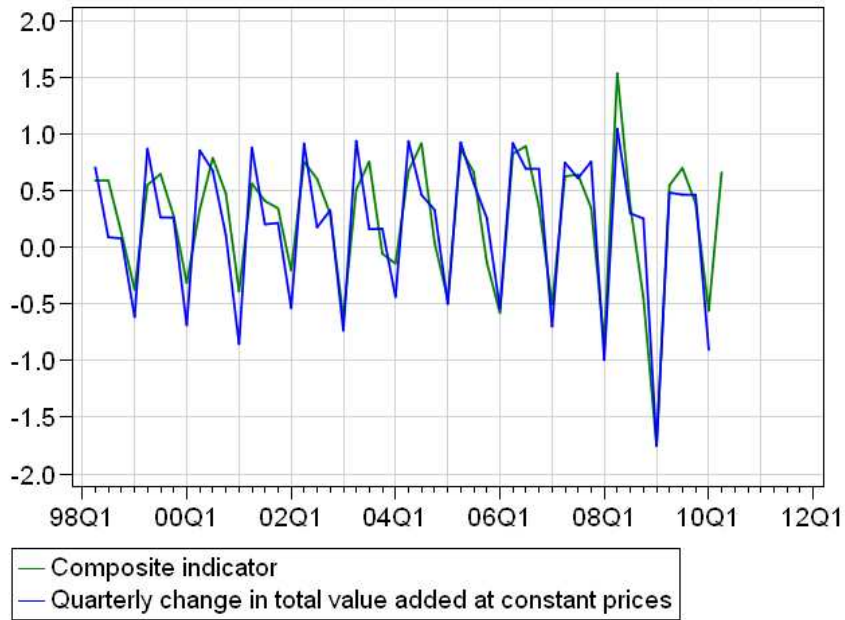
Both methods compare favourably with the comparable Economic Sentiment Indicator (ESI) of the Euro area for which the correlation with GDP growth came to 0.84 over the period 1992 – 2004 (EC, 2004: 6-7). Recently the services sector has been included to produce a new ESI, resulting in an improved correlation of 0.92 for the ESI. This suggests that the addition of similar indicators is likely to improve the Stats SA composite indicator. Jiancheng (2009: 20-21) suggests that additional potential candidates can include total imports and exports, total government revenue, real profit rate, mortgage loans by financial institutions, M1 and M2 money supply, the consumer price index, and firm liquidations and insolvencies as proxies for services activity.

4.1.2. Flash TVA

The key Flash TVA estimate -- the year-on-year change in total value added -- is presented as a snapshot of the economic state of the country. The chart in figure 2 illustrates the use of this indicator as an early indicator of business cycle changes applied to South African data between 1998 and 2008. These estimates emerged 35 days after the end of their respective quarters, or 25 days ahead of the release of the regular GDP estimates.

The reference lines are created in the following fashion. The observations are arranged in ascending order. The normal situation reflects that economic activity remains stable, implying a 50% probability that the early warning indicator falls between the yellow and light blue lines. The cool situation (between the light blue and blue lines) and warm situation (between the yellow and red lines) reflect that economic activity departs from stability. This departure is taken to be represented adequately by the early warning indicator having a 15% chance to fall in either of these situations. The remaining 20% of historic values will either point to a cold situation (below the blue line) or hot situation (above the red line) equally. These stand for drastic conditions that indicate either a "cold economy" or an "overheated economy".

Figure 2. Snapshot of percentage change in total value added at basic prices

Year-on-year change in quarterly Flash TVA and total value added
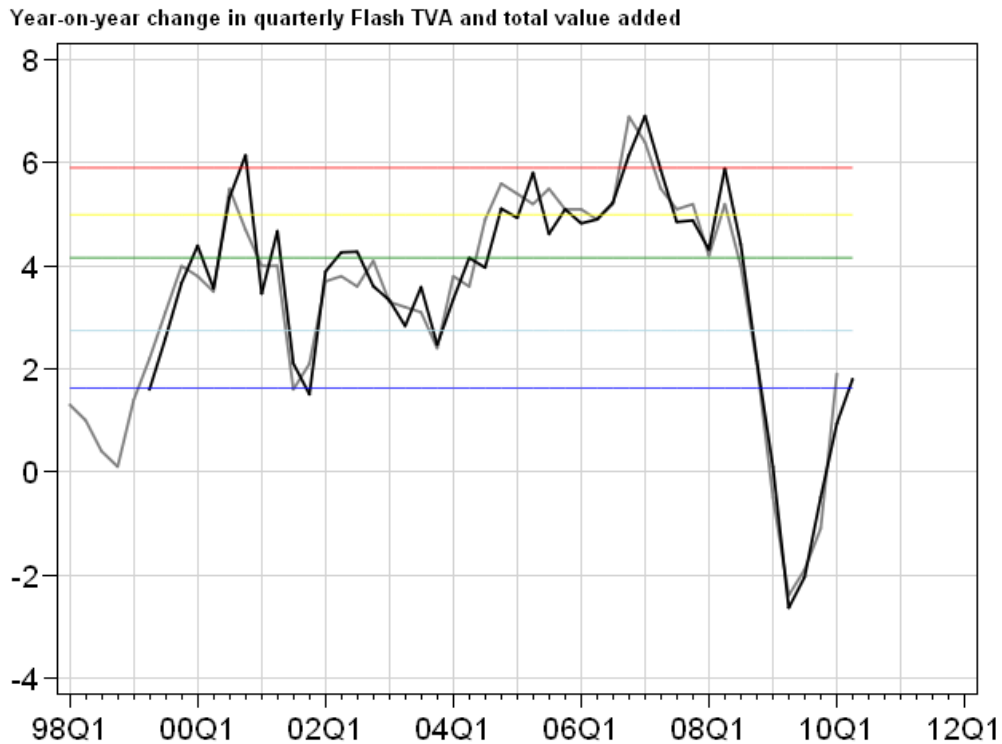
This chart shows the slide from warm crossing over to normal in quarter 2 2008, followed by a rapid decline to cold, finally levelling off in quarter 2 2009. The subsequent upturn in quarter 3 2009 is also evident. Noteworthy is the fact that the downward slide from the peak in early 2008 to quarter 2 2009 is traced well, and would be determined at 35 days after the reference period, long before the preliminary GDP estimates arrive.

4.2. Quality controls

The quality control system under which the Stats SA Flash TVA product operates officially consists of controlling both the modelling error and the revision error.

4.2.1. Performance compared to regular GDP

The accepted method for comparison is to choose a metric, or preferably a set of metrics, to measure the performance of a statistic such as Flash TVA. Based on experience obtained at Statistics Netherlands, Bruinooge (2009: 1) has reported that accuracy may be controlled as the difference between the final flash and final regular estimate of less than 0.75 percentage points. These control limits have been adopted for the South African Flash TVA in a more or less official sense. The results at time of writing are presented in table 2. The one relevant set of observations is clearly under control.

Table 2. Flash TVA performance as measured against GDP estimates

| Reference quarter	Final Flash TVA	Final gross value added	Discrepancy
09/Q4	-0.8%	-1,1%	0.3 p.p.
10/Q1	0.9%	1.9%	-1.0 p.p.
11/Q2	2.1%	3.1%	-1.0 p.p.

A more visual representation of accuracy and reliability is provided by studying the correlation between the two series over suitable regimes. The interesting and critical behaviour typically occurs around the turning points. It is thus appropriate to look at correlations for two regimes, one in the nonlinear regime and one away from it. The two regimes were determined by visual inspection of the turning points by using the trend obtained from the direct seasonal adjustment of the Flash TVA as shown in figure 3, and snipping it into two sections: one around the 2008 turning point and one away from this turning point. This leads to identifying two regions: Q1 2008 to Q4 2009, and Q1 2006 to Q4 2007. The regions have been chosen to have an equal number of points to compare with; that is 8 data points in each set.

Figure 3. Turning point regime of flash estimate series (Rand million)

Seasonally adjusted and annualised Flash TVA
Trend
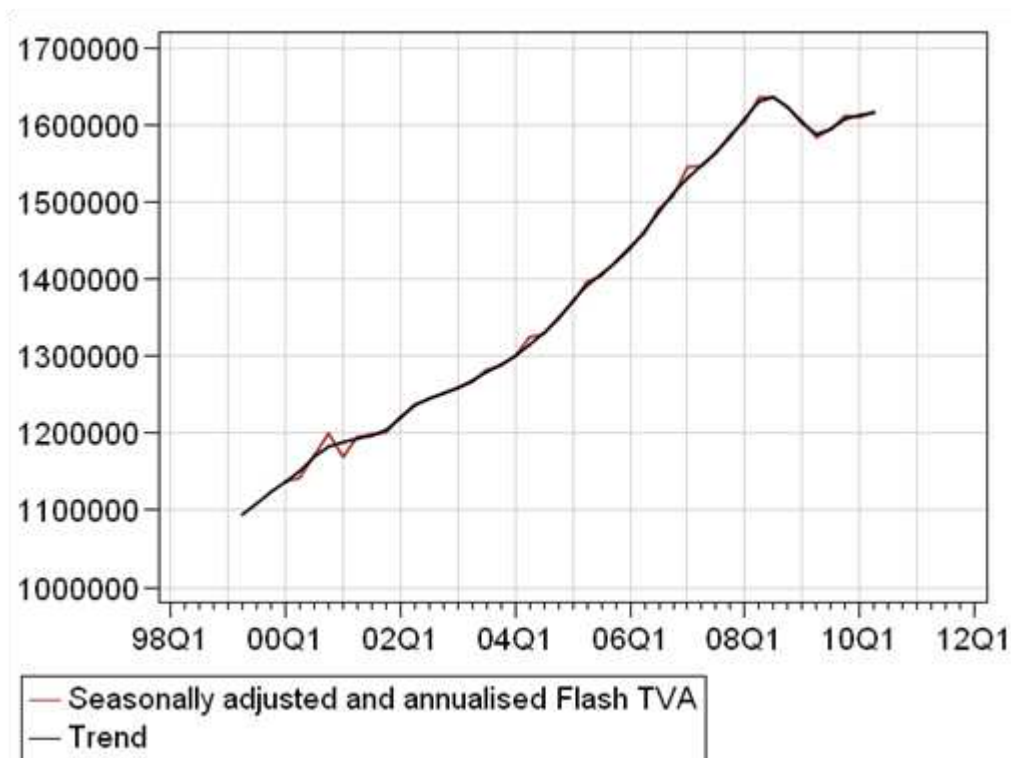
For the chosen regimes the year-on-year quarterly change in total value added has a correlation of 0.994 around the turning point, and 0.853 away from the turning point. These results can be seen graphically in figure 4 by noting how close to each other the flash and regular year-on-year quarterly changes in TVA are in the regime around the turning point and how they diverge the further one goes back in time. In short the Flash TVA estimate is more accurate and reliable around the turning point than away from it. The reason this is so is that Flash TVA has been designed such that it performs best at recent times. This stems from the manner that the composite indicator has been constructed. The data sources for the indicator are chosen, and the composite indicator is constructed, in such a way as to effectively give weight to more recent and significant data to the final estimate.

Figure 4. Year-on-year quarterly percentage changes in flash and regular total value added
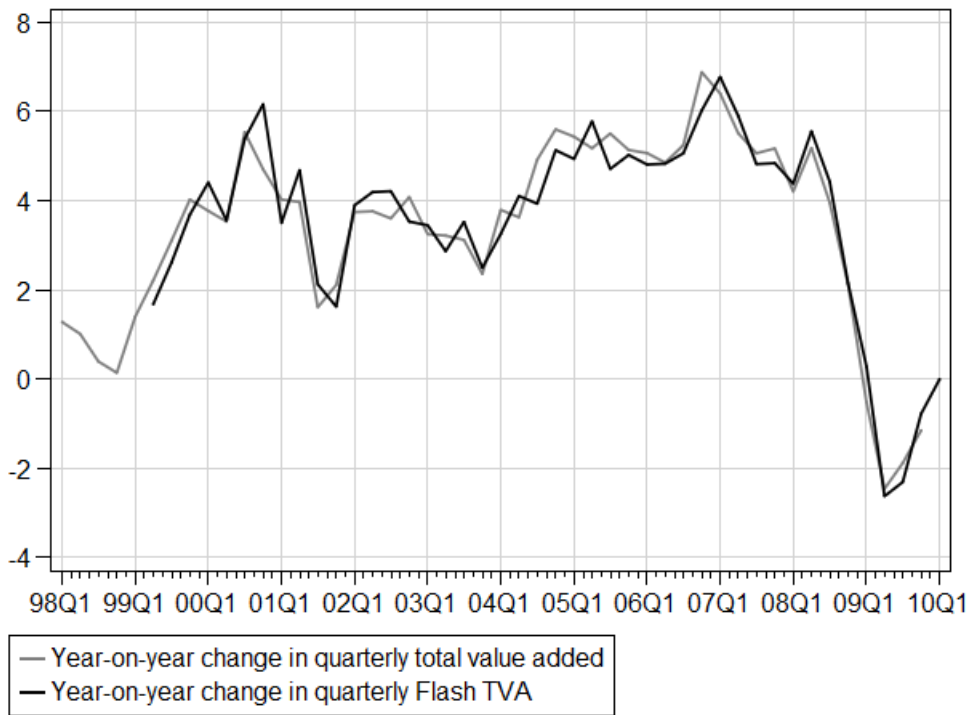
As can be seen from the snapshot, the Flash TVA depicts the same pace of production as that posited by the regular TVA with the advantage that it does so quicker. Whenever there has been a change in direction of the regular total value added estimate from GDP estimates, the Flash TVA has performed fairly consistently. In particular, as shown in the snapshot, the Flash TVA estimate suggested an upturn to total value added for the last quarter of 2009 and the first quarter of 2010.

In figure 5 the levels of the Flash TVA estimate are compared to the analogous GDP series. The correlation between the flash level estimate series and its reference total value added series from standard GDP production is 0.999.

Note that the level estimate obtained from the Flash TVA procedure correlates as follows with the comparable series obtained from GDP. Around the turning point the correlation is 0.986, and away from the turning point it is better: 0.996. This is due to the fact that abnormally high correlations may occur in series which are trending over long periods of time.

Figure 5. Flash estimate and regular total value added (Rand million)
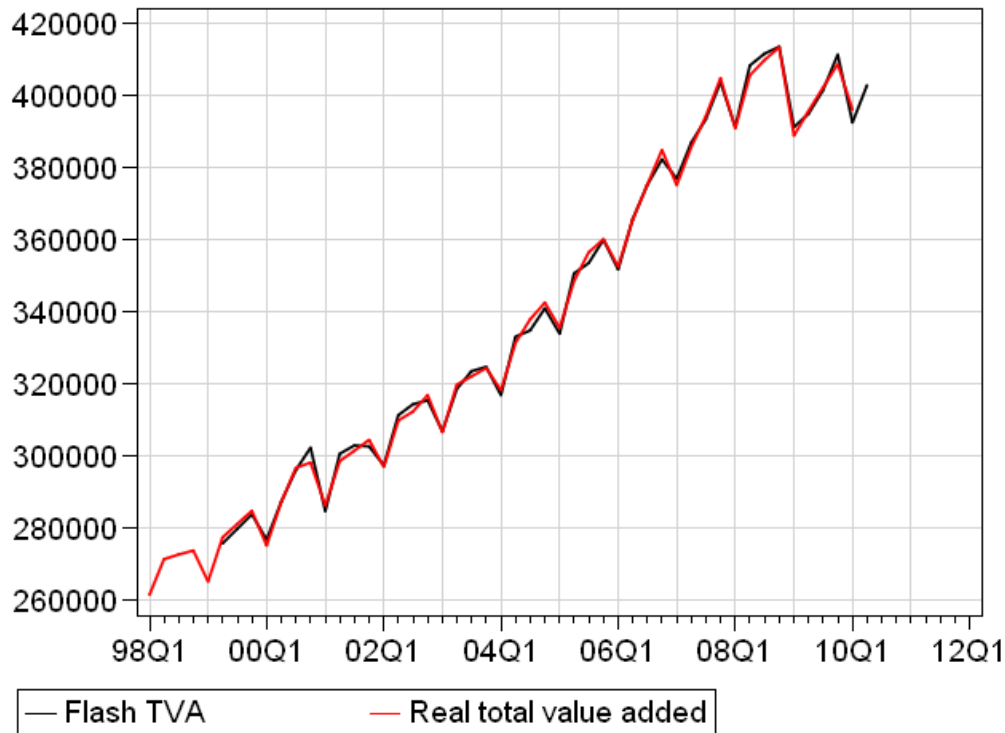
4.2.2. Performance compared to forecasts

The ratio of the Mean Absolute Percent Error (MAPE) of the Flash TVA estimate for the level to that of the level obtained from the appropriate ARIMA forecast model (ARIMA (0,1,1) (0,1,1) on the log-transformed total value added) is a useful metric measuring the amount by which the Flash TVA model exceeds the ARIMA forecast model in accuracy and reliability. This number must always be less than unity. Table 2 displays the value of this ratio for the Flash TVA from quarter one 2009 to quarter four 2009.

Table 3. Flash TVA performance compared to ARIMA forecast, and probability of Flash TVA not being within 0.5 p.p of true gross value added

Year	Quarter	MAPE$_{Flash\ TVA}$	MAPE$_{Flash\ TVA}$ / MAPE$_{ARIMA}$	Probability	Sample

1999	Q$_2$	0.60%	0.76	1.00	
	Q$_3$	0.54%	0.74	0.50	
	Q$_4$	0.48%	0.65	0.33	
2000	Q$_1$	0.51%	0.78	0.50	
	Q$_2$	0.41%	0.75	0.40	
	Q$_3$	0.38%	0.48	0.33	
	Q$_4$	0.52%	0.61	0.43	
2001	Q$_1$	0.52%	0.66	0.50	
	Q$_2$	0.54%	0.77	0.56	
	Q$_3$	0.54%	0.62	0.50	
	Q$_4$	0.54%	0.61	0.55	
2002	Q$_1$	0.51%	0.55	0.50	
	Q$_2$	0.51%	0.58	0.46	
	Q$_3$	0.52%	0.63	0.50	
	Q$_4$	0.51%	0.65	0.47	
2003	Q$_1$	0.48%	0.60	0.44	
	Q$_2$	0.48%	0.63	0.41	
	Q$_3$	0.48%	0.65	0.39	
	Q$_4$	0.46%	0.63	0.37	
2004	Q$_1$	0.46%	0.59	0.35	Ex ante
	Q$_2$	0.46%	0.60	0.38	
	Q$_3$	0.48%	0.61	0.41	
	Q$_4$	0.48%	0.62	0.39	
2005	Q1	0.48%	0.64	0.38	
	Q2	0.48%	0.67	0.40	
	Q3	0.50%	0.70	0.42	
	Q4	0.48%	0.69	0.41	
2006	Q1	0.47%	0.70	0.39	
	Q2	0.46%	0.69	0.38	
	Q3	0.44%	0.68	0.37	
	Q4	0.45%	0.67	0.39	
2007	Q1	0.45%	0.66	0.38	
	Q2	0.45%	0.66	0.36	
	Q3	0.44%	0.66	0.35	
	Q4	0.43%	0.67	0.34	
2008	Q1	0.43%	0.64	0.33	
	Q2	0.43%	0.64	0.35	
	Q3	0.43%	0.62	0.34	
	Q4	0.42%	0.59	0.33	
2009	Q1	0.43%	0.57	0.35	
	Q2	0.42%	0.55	0.34	
	Q3	0.42%	0.54	0.33	
	Q4	0.42%	0.55	0.35	
2010	Q1	0.43%	0.53	0.36	Ex post
	Q2	0.42%	0.53	0.36	

The results in table 3 indicate that Flash TVA is different in nature to a forecast, in the sense that accuracy is considerably and systematically greater.

4.2.3. Revisions

GDP Flash must give good estimations considered as a product within itself, not only compared to the standard GDP estimates. That means that the revisions due to the incorporation of previously unavailable data must be small. We monitor the size of revisions from preliminary to final flash estimate. Fixler (2004: 5) suggests 0.59 percentage points as the control limit for the difference between preliminary and final estimates based on experience at the United States Bureau of Economic Analysis. This control limit is also adopted at Stats SA.

At the time of writing there are only two Flash TVA estimates and only one revision. The revision complies with the control limit set. This is presented in table 4.

Table 4. Flash TVA revision performance

Reference quarter	Preliminary Flash TVA	Final Flash TVA	Revision
09/Q4	-0.7%	-0.8%	-0.1 p.p.
10/Q1	0.0%	0.9%	0.9 p.p.
10/Q2	1.8%	2.1%	0.3 p.p.

5. Discussion

5.1. Population model employed

The decision to use a Chenery-Syrquin model is not in any way based on economic policy considerations. Instead it is premised on national accounts considerations of linking population development on the one side with the evolution of real per capita income on the other side as a way of gauging trends in living standards per person. As Dobrinsky, Hesse, and Traeger (2006: 23-24) outline from a national accounts perspective, this provides an independent check on labour productivity patterns as determined for instance from labour force surveys since gains in labour productivity should ordinarily closely translate or reflect into increases in real per capita incomes. In such context the Chenery-Syrquin model is attractive to implement.

5.2. Revisions

With the inclusion of previously unavailable data, revisions come into play. The revisions compared to the initial and final estimates may contribute "news", that is new information, or not. This may be assessed using a correlation method as outlined in McKenzie, Tosetto and Fixler (2008: 3).

If the revision correlates highly with a revised estimate then it signifies effective incorporation of new information, whereas if the revision correlates highly with the initial estimate, then it does not. Following this, if significant news is contained in a revision then the estimation programme is efficient, and if not, then the underlying processes on which the estimation programme depends need to be examined. These underlying processes may be the methods employed for Flash TVA estimation, or the methods and processes underlying the source data, or both. Once a series of reasonable length has been built up, Flash TVA will also be submitted to such an analysis.

5.3. Forecasting

The flash estimate is a statistic derived by a measurement model. This is not the same as a forecasting model. As clarified in Armstrong's Forecasting Dictionary (2001) a measurement model is a model used to obtain current estimates of the target metric of interest from available information. A forecasting model by contrast is a model developed to produce forecasts – namely estimates of the target metric of interest for a future time or for another situation. As explained in Armstrong's Forecasting Dictionary (2001), nowcasting is current forecasting to obtain an estimate of the current situation in the absence of actual data for it. This could erroneously lead to the conclusion that the Flash TVA is a forecast, whereas only a small portion of the missing data is imputed by forecasting methods. Further discussion is presented in the appendix.

5.4. Business cycles

There are several techniques to decide on turning points in the business cycle. Two popular ones are the Bry-Boschan and Zarnowitz-Moore techniques. The first of these succinctly stated involves identifying turning points from real GDP de-trended by a Spencer moving average. In an environment where policymakers and decision-makers are interpreting the provision of official statistics as actually encountered record, it may be unpalatable for either of these groups to accept that the behaviour of the business cycle is not ascertained from real observations but from model-dependent transformations. This in turn can render this philosophically unworkable in the realm of a statistical office. The same reservations hold for the Zarnowitz-Moore technique. This technique rests critically on stipulating a growth rate benchmark with the fluctuations around it used to infer the turning points in the business cycle. In an environment with multiple ministerial portfolios on economic policy such benchmark can easily be seen as a defined growth rate target, whilst legislatively and otherwise a statistical office is usually not in the business of setting economic growth rates. As a result this technique too can be problematic in the context of the functions of a statistical office. The aforementioned complexities can be circumvented to some degree by the technique described by Jiancheng (2009: 22-25), which has been adapted by Statistics South Africa for Flash TVA as illustrated by the snapshot above.

6. Conclusion

Timely information on production activity is increasingly demanded by policy-makers and decision-makers. A statistical office has to respond accordingly. It has been shown that

subject to an independent and reliable production, which in some ways is anchored to conventional statistical practices and in others makes use of these in novel ways, Flash TVA can be an official statistic with the advantage of reaching policy-makers and decision-makers quicker than the regular main aggregate. None of this is to argue that the latter is without value. On the contrary, as we have attempted to highlight, the flash and regular estimates are complementary to each other, and a full fledged Flash TVA production programme can be an indispensable companion to its regular counterpart by giving a parallel view of the state of production in the economy as a quality tool.

The approach described here of a Flash TVA released 35 days after the end of a reference quarter strikes a healthy balance between being fast and giving an accurate or reliable reading of the main total value added aggregate that can also shed light on the emerging conditions of the business cycle in terms of production.

Taking into account that the approach emerges from a newly industrialised country such as South Africa with its own distinct state of evolution of statistical systems, the approach offers a straightforward step-by-step methodology that can be applied in everyday practice by an average qualified research or national accounts practitioner. As a result the South African method may also prove valuable to other countries on the path of developing their own flash estimates.

Appendices

Nomenclature

An aspect that was not particularly easy to settle on is the naming of the flash as to Flash TVA or Flash GDP at basic prices. As highlighted in *SNA 1993* (p. 154) "there is no named aggregate in the System which corresponds to the sum of the gross values added of all enterprises measured at basic prices". Simply stated what this means is that in *SNA 1993* there are no designated synonyms or alternative labels for gross value added at basic prices. This has not stopped the UK Office of National Statistics (1998: 208) and Statistics Canada (2002: 17, 61) proposing that gross value added at basic prices can be identified as GDP at basic prices. Superficially, this proposed synonym may seem to detract from the thrust of *SNA 1993* and *SNA 2008* to identify GDP at market prices as embodying the concept of gross domestic product. However, this may not be so. The proposal to give gross (total) value added the synonym of GDP at basic prices should be seen as rooted in the System of National Accounts and seems motivated by paragraphs 6.233 in *SNA 1993* and 6.82 in *SNA 2008*. In the former (p 155) it is expressly asserted that "the underlying rationale behind the concept of gross domestic product (GDP) for the economy as a whole is that it should measure the total gross values added produced by all institutional units resident in the economy". In the latter (p 104), this is more or less repeated, if not made clearer: "the underlying rationale behind the concept of gross domestic product (GDP) for the economy as a whole is that it should measure the total gross value added from all institutional units resident in the economy". Indeed, if the flash estimate is a separate and independent product from its regular counterpart, then opting for a term like Flash TVA can emphasise this distinction in the public's perception. This would thereby also encourage the public to treat the statistic as distinct from national accounts statistics. Furthermore if a naming choice for Flash TVA is made, it should be disclaimed whether this is gross or net given that a clear distinction between these two is drawn in the 1993 and 2008 System of National Accounts. If this is not done the term total value added could be interpreted as capturing the total of net value added unless otherwise disclaimed. The disclaimer can potentially avoid such potential confusion.

In short, flash total value added and flash GDP *at basic prices* can be thought of as interchangeable terms.

As Kokkinen (2004: 2-3) observes total value added forms most of the development of GDP at market prices, suggesting that one can also use the flash of total value added as an early indicator of GDP at market prices, since principally the underlying rationale behind the concept of GDP for the economy as a whole is that it should measure the total gross values added produced by all institutional units resident in the economy.

Quarterly differences in terms of monthly differences

It is a basic fact of difference equations that the quarterly change in a quantity depends, in particular, only on $1/9^{th}$ of the change of that quantity in the last month. Young (1993: 40) explicitly demonstrated this fact, and we repeat that calculation here.

Let the source data for an indicator in quarter one (Q_1) be denoted m_1, m_2, m_3 for successive months and in quarter two let the source data (Q_2) be denoted m_4, m_5, m_6. Thus $Q_1 = m_1 + m_2 + m_3$ and $Q_2 = m_4 + m_5 + m_6$. The key statistic we are interested in is the quarterly change $\Delta Q_2 \equiv Q_2 - Q_1$; and we are posing the question: what are the proportionate contributions of the monthly changes $\Delta m_6 \equiv m_6 - m_5$, $\Delta m_5 \equiv m_5 - m_4$, $\Delta m_4 \equiv m_4 - m_3$, $\Delta m_3 \equiv m_3 - m_2$ and $\Delta m_2 \equiv m_2 - m_1$ to the quarterly change?

$\Delta Q_2 \equiv Q_2 - Q_1 = (m_4 + m_5 + m_6) - (m_1 + m_2 + m_3) = (m_4 - m_3) + m_5 + m_6 - m_1 - m_2$ by definition. Replacing the m_i by their respective Δm_i stepwise using the definitions of the monthly differences in the previous paragraph is outlined below.

$$\Delta Q_2 \equiv Q_2 - Q_1 = \Delta m_4 + m_5 + m_6 - m_1 - m_2 = \Delta m_4 + [\Delta m_5 + m_4] + [\Delta m_6 + m_5] - m_1 - m_2$$
$$= \Delta m_4 + [\Delta m_5 + (\Delta m_4 + m_3)] + [\Delta m_6 + (\Delta m_5 + m_4)] - m_1 - m_2$$
$$= \Delta m_4 + [\Delta m_5 + (\Delta m_4 + \Delta m_3 + m_2)] + [\Delta m_6 + (\Delta m_5 + \Delta m_4 + m_3)] - m_1 - m_2$$
$$= \Delta m_4 + [\Delta m_5 + (\Delta m_4 + \Delta m_3)] + [\Delta m_6 + (\Delta m_5 + \Delta m_4)] + (m_2 - m_1) + (m_3 - m_2)$$
$$= \Delta m_4 + [\Delta m_5 + (\Delta m_4 + \Delta m_3)] + [\Delta m_6 + (\Delta m_5 + \Delta m_4)] + (\Delta m_2) + (\Delta m_3)$$
$$= \Delta m_2 + 2\Delta m_3 + 3\Delta m_4 + 2\Delta m_5 + \Delta m_6.$$

The last expression in the list shows that the first and final monthly differences (Δm_2 and Δm_6 respectively) contribute the least to quarterly change, relative to the other monthly differences. If we normalise the coefficients in this expression, we can quantify the relative contributions of the monthly differences to the quarterly difference. The weights are clearly 1/9, 2/9, 3/9, 2/9 and 1/9 in that order, from first monthly difference to last monthly difference. This allows us to draw a few conclusions.

In particular, the last monthly difference, that is the difference between the third month and the second month of the third quarter, contributes only 1/9th of the total contribution to the quarterly difference.

If this weight were unity, instead of 1/9, then the error contained in the last two months data for any particular indicator would be 1/3 of the error of all six months, all other things remaining the same. But in fact, as the calculation above shows, the error contained in the last two months of the second quarter is only $=1/9 \approx 11,1\%$. This contribution to the error is independent of the source of error; it is the same whether the error is caused by the data in the 2nd and/or 3rd months being preliminary, or whether it is due to it being projected.

The calculation also demonstrates that even if there are huge disparities in the final two months of an estimate, this has a much smaller effect on the quarterly difference than one would naively expect. Here is a simple "worst case scenario" example to illustrate. Let us say that the first five monthly differences are all the same value. And let us say that we project the last monthly difference to have the same value, but that it later turns out to be exactly the opposite (i.e. opposite in sign), then it turns out that the original

estimate based on projected values is still 78% of the final estimate for the quarterly difference. Thus the effect of nowcasting is confined to a minute portion of the changes between quarters.

Seasonal adjustment

Regarding the decision to seasonally adjust directly as part of identifying the turning point regime, it should be noted that for balancing - residual - items like the TVA here seasonal adjustment should be implemented on the balancing item directly. In connection with this the IMF Quarterly National Accounts Manual (2001: 142) further observes that:

> "It is convenient, and for some uses crucial, that accounting and aggregation relationships are preserved. Studies and practice, however, have shown that the quality of the seasonally adjusted series, and especially estimates of the trend cycle component, may be improved, sometimes significantly, by seasonally adjusting aggregates directly or at least at a more aggregated level. Practice has shown that seasonally adjusting the data at a detailed level can leave residual seasonality in the aggregates, may result in less smooth seasonally adjusted series, and may result in series more subject to revisions."

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