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The Canadian Productivity Review

Revisions to the Quarterly Labour Productivity Estimates

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Statistics Canada

Revisions to the Quarterly Labour Productivity Estimates

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Table of contents

List of tables

List of figures

Abstract

This paper examines the various products associated with the quarterly labour productivity program. It outlines the nature of the volatility in the very short-run estimates and examines properties of the revisions made to the estimates of Canadian labour productivity and its components (gross domestic product and hours worked) since the inception of the program in 2001.

Keywords: revisions analysis, volatility, labour productivity.

Executive summary

Quarterly productivity estimates are produced by Statistics Canada to provide timely information on technological change and potential output trends. At one time, Statistics Canada only produced annual estimates of the growth in labour productivity data and these were produced with a considerable lag—about six months after the end of the year. The introduction in 2001 of the quarterly program has led to more timely data being made available to the analyst community.

Statistics Canada's role is not only to provide timely data but also to provide users with a full understanding of the quality of the data so that they may judge its appropriate uses. To this end, this paper focuses on the nature of the quarterly data and the nature of the revision process. It asks two questions.

1) How stable are quarterly productivity growth rates?

The paper describes various products associated with the quarterly labour productivity program. It outlines the nature of the volatility in the very short-run estimates (quarter-on-quarter growth rates) and emphasizes that the short-run estimates are much more volatile (have a higher variance) than alternates that make use of quarterly information averaged with recent values using a moving average—or other suitable prediction tools. When the quarter-on-quarter growth rate is used to create annualized growth rates, its variance is twice as large as the variance of these alternatives.

Using information from a quarter in conjunction with that from adjacent recent quarters (the annual growth rates from the same quarter in the previous year, for example) provides data series that are less volatile, have quite a different profile and provide a clearer-cut picture of longer-run trends.

2) How large are the revisions that are made to the quarterly growth rate?

Users of the quarterly series need information on the nature and size of the revision process that arises because more comprehensive and more accurate data on both gross domestic product (GDP) and hours worked (the two components of labour productivity growth) are gradually incorporated into the estimates. This is a process that occurs in many of the macroeconomic aggregates that the System of National Accounts produces.

The study therefore examines properties of the revisions made to the estimates of Canadian labour productivity and its components (GDP and hours worked) since the inception of the program in 2001. The analysis examines revisions between the initial estimate and the estimate two years (nine quarters) later. The paper also compares Canadian revisions with U.S. ones.

The analysis of revisions focused on the following questions:

1. *Are revisions of the preliminary estimates of Canadian quarterly labour productivity growth over the two years subsequent to first release significant?*

The study examined several indicators that describe the size of revisions made to the quarterly labour productivity estimates. The study found that the mean revision for Canadian labour productivity growth is quite small and not significantly different from zero at all revision horizons. The Canadian Productivity Accounts produce *unbiased* preliminary estimates of quarterly labour productivity. Thus, the data do not have a significant tendency to be revised in a particular direction (i.e., up or down). The paper also examined the extent to which the estimates from different vintages of quarterly labour productivity track one another. The correlation coefficient between the first release and the release one or two years later is 0.5. Comparison of the size of the mean absolute revision over successive vintages of a release suggests that the size of the revisions is about the same in the first and second years of the revision cycle. Moreover, the absolute difference between the first estimate and the estimate two years later has no discernible trend over the time period studied.

2. *Since the quarterly estimates of the growth rates provide information on the changes in the direction (expansion or contraction) of the longer-run average productivity growth rates in Canada, are the preliminary estimates a good proxy for the final estimates in terms of size and trend prediction?*

Several tests were conducted to see whether information contained in the 'final' estimates is accurately reflected in the first estimates. First, the sign of the final growth rate was compared with the sign of the first estimate. In most cases (in 59% to 73% of revisions), the sign of the 'final' estimate of the growth rate is consistent with the sign of the earlier estimate. Second, incremental information provided by new quarterly productivity estimates was compared with the forecast 'trend' value. To do so, the sign of the difference in the estimate of the average of the quarter-on-quarter growth rates over the last year and the average of past rates over four years was calculated. This compares information on recent trends with longer-run trends—to see whether the productivity series is 'breaking' below or above the long-run trend. The sign of this difference was the same in over 73% of the cases for the final estimate as it was for the first estimate. Third, the time patterns of the differences between the actual and forecast estimates derived from the first and final estimates were examined. They were found to track one another closely. Fourth, time paths of the first estimates were analyzed to see whether they generally fell within the bounds of the subsequent revised estimates, including the final estimate (second quarter, first year and second year). Generally, this was the case.

3. *How do the revisions in the Canadian Productivity Accounts compare with those of the United States?*

Comparison of Canadian and U.S. revisions indicate that the size, significance and signal properties of the revisions in the two countries are very similar. The size of the mean revision for the United States between the first and 'final' estimate two years later is slightly larger than the

size of Canada's mean revision. Both are not significantly different from zero. On the other hand, the U.S. mean absolute revision was smaller than the mean absolute revision for Canada. The latter difference stemmed not from differences in the mean absolute revision to GDP but from the mean absolute revision to hours worked. The mean absolute revision to GDP in Canada is smaller than the mean absolute revision to GDP in the United States but the opposite is the case for hours worked. The Canadian labour data are subject to greater mean absolute revisions than those of the United States because Canada has a greater tendency to revise its hours worked by incorporating Census of Population benchmarks. Maynard (2007) points out that the U.S. labour estimates, when derived from the Current Population Survey, do not make backward revisions when they benchmark to the U.S. population census to the same extent that the Canadian estimates do. This accounts for part of the difference in the size of the absolute revision for hours worked in Canada. The Canadian data are therefore subject to greater revisions, for the sake of accuracy. This finding points to the need to not forget that revisions are made to make estimates more accurate.

1. Introduction

Statistics Canada produces estimates of the growth in labour productivity on a quarterly basis. The growth in labour productivity is calculated as the growth in gross domestic product (GDP) in the business sector per hour worked.

Only the business sector is covered, since much of the output in the non-business sector is measured in the System of National Accounts (SNA) by inputs (labour) and therefore labour productivity growth in this sector is essentially zero by construction. Hours worked are estimated from labour force surveys but are adjusted to cover definitions to accord with the production boundaries used by the SNA to calculate GDP.

The quarterly labour productivity estimates are produced four times a year—two weeks after the estimates of quarterly GDP. They are revised regularly, when more current data from Statistics Canada's collection systems become available.

As part of its program, Statistics Canada provides guidance for its users on the basic characteristics of its products, in order that they may judge to which purposes the statistics may most usefully be put.

This note focuses on the type of information that is provided by the quarterly productivity estimates, looking at two aspects related to the stability of the estimates—their inherent volatility that arises from the nature of the economy and the volatility that evolves from the revision process.

On a quarter-by-quarter basis, the estimates of labour productivity are inherently volatile because the economy itself is constantly changing. Time series of productivity growth rates are driven by long-term trends associated with technological change, cyclical patterns associated with the business cycle and stochastic components that result from a number of factors, such as strikes, disease or inclement weather.

Users who want to follow these changes continuously will need timely statistics—that is, statistics that are produced as soon after a period as possible. The process of generating timely statistics as soon as possible after a period is completed will generate additional uncertainty as to the direction that the economy is taking. The statistical process proceeds in stages. In the very short run, it uses the best data that are available shortly after events occur to produce the first estimates for a given period. As more data are collected, new estimates that contain revisions are produced.

The usefulness of the data for some purposes depends on the size of these revisions. An analysis of revisions provides a key dimension of statistical quality: namely, the provision of information to users on the accuracy of data so that they can use the statistics wisely.

Statistics Canada's policy is one of transparency regarding its data and the revisions that it makes to its data.

The key elements of Statistics Canada's policy with respect to revisions are:

- the timely publication of technical notes on the methodology and frequency of the revision cycles accompanying major releases;
- the regular announcements on the revision dates and cycles in the publication of quarterly and annual data series;
- the publication of revision studies; and
- the conduct of information sessions on the quality of estimates and revisions for users.

This note accompanies earlier publications that outline the purpose of estimates of labour productivity (Kaci 2006), the methodology that is used in the labour productivity accounts (Maynard, Girard and Tanguay 2006) and its revision history (Kaci and Maynard 2006).

2. The quarterly labour productivity program

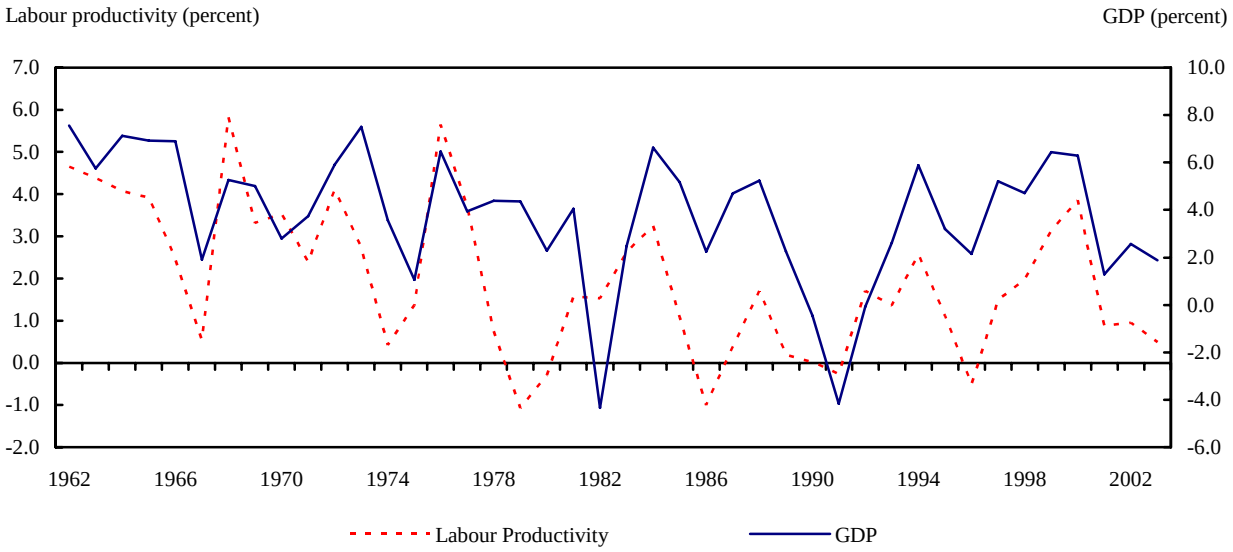
Labour productivity is most commonly used to measure the progress that the economy makes in improving the efficiency of its production processes. It is used as a summary statistic to represent progress being made in improving the efficiency with which the input of labour is transformed into output.

In the short run, movements in labour productivity are likely to occur as a result of short-run changes in capacity utilization. During slowdowns in the economy, employment declines less than output in plants—perhaps because of labour hoarding—when employers keep more employees on staff than are actually needed so that they have the necessary workforce when future expansion occurs. When plants subsequently expand production, they can thus do so without immediately increasing employment. In this situation, labour productivity falls in a recession but grows rapidly as an economy emerges from the recession. And this will cause measures of labour productivity to fluctuate in the short run, even if there has been no change in technological progress.

As a result, labour productivity can be volatile over the business cycle. Annual growth rates in both labour productivity and gross domestic product (GDP) are plotted in Figure 1. Fluctuations in the growth of labour productivity track those of business sector GDP. Moreover, in some periods the amplitude of the fluctuations in the growth rates of labour productivity are greater than in GDP.

Analysts need to look through short-run fluctuations in labour productivity associated with the business cycle to analyse longer-run trends. Improvements in technological progress do not occur quickly. They require new equipment, new organizations and often new plants. These are incorporated into production processes slowly. It is only by looking at longer-run trends that analysts are likely to discern real gains in efficiency. But, as Kahn and Rich (2006, p. 1) have observed, the "difficulty in assessing the trend in productivity growth stems primarily from the extreme volatility of quarterly growth rates."

Figure 1
Annual rates of change in labour productivity and GDP[1]



1. Gross domestic product.
Source: Statistics Canada, Micro-economic Analysis Division.

In order to provide timely data that analysts can use to discern long-run trends, Statistics Canada produces data on a quarterly basis that track the growth in labour productivity.

The quarterly labour productivity accounts produce a range of statistics (Table 1). The percentage change from the previous quarter (quarter-on-previous-quarter growth rates) provides a measure of instantaneous change in the quarter.

Many users are interested in longer-run results. Different measures that can be used to infer longer-run trends are presented in Table 1.

The most frequently used of these measures is what some analysts refer to as the quarterly annualized growth rates. This measure annualizes the quarter-on-quarter growth rate (AQoQ) by approximating what would happen over an entire year if the quarterly rate were maintained—even though this rarely occurs. While the assumption embedded in the use of this measure is problematic, the use of the annualized rate is widespread.

Another useful measure is the annual growth rate measured from the same quarter of the previous year (AQoY). It captures the actual annual growth rate over the immediate past four quarters. It too makes use of the information arising in the latest quarter to provide a longer-run annual estimate—though it combines the information from the last quarter with that from the previous three quarters for this purpose. An alternate longer-run measure is also provided in the table—the average of these annualized rates over four quarters of a particular year (AYoY)—since analysts often want to refer to the performance of a particular year, rather than a particular quarter.

Table 1
Growth rates of labour productivity in business sector, seasonally adjusted, Canada, estimates as of 2006Q3[1]

Quarter	Quarterly estimates		
	Change from preceding quarter (QoQ)	Change from quarter one year ago (AQoY)	Change from previous quarter at annualized rate (AQoQ)
	percent		
2004Q1	0.3	-0.2	1.1
2004Q2	-0.1	-0.2	-0.4
2004Q3	0.4	0.5	1.8
2004Q4	0.5	1.2	2.1
2005Q1	0.5	1.4	2.1
2005Q2	0.5	2.0	2.1
2005Q3	1.0	2.6	3.9
2005Q4	0.3	2.4	1.4
2006Q1	0.4	2.3	1.7
2006Q2	-0.3	1.5	-1.0
2006Q3	-0.1	0.4	-0.3
Year	**Annual Estimates (change from previous year, AYoY)**		
	percent		
2001	1.1		
2002	1.4		
2003	0.0		
2004	0.3		
2005	2.1		

1. Third quarter of 2006.
Notes: Q denotes a quarter; Y denotes a year.
Source: Statistics Canada, Micro-economic Analysis Division.

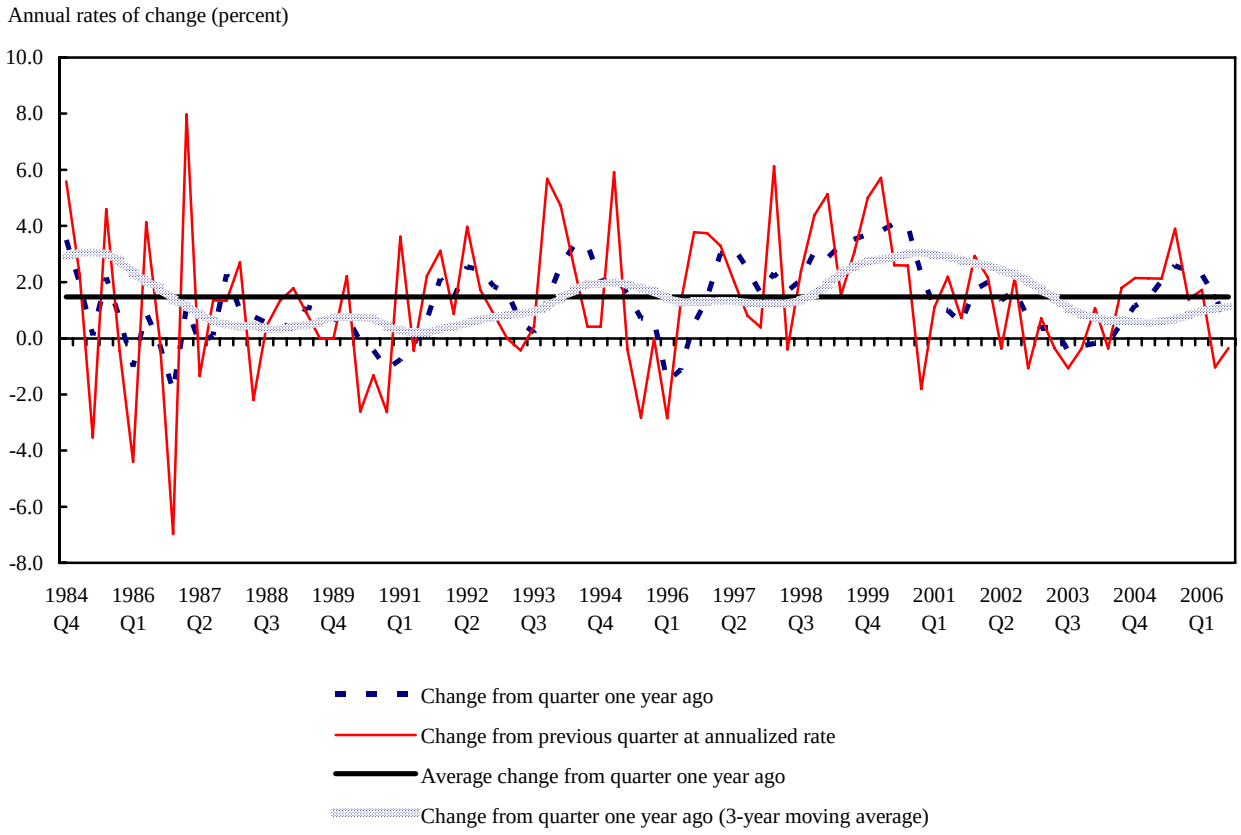
The annualized quarter-on-quarter growth (AQoQ) and the annual growth rate from the same quarter of the previous year (AQoY) are graphed in Figure 2. The quarterly labour productivity estimates fluctuate because changes in output and labour inputs do not take place in a smooth monotonic fashion during the year. Changes in output may occur that are not anticipated, and, therefore, are not accompanied immediately by adaptation of the labour force. As a result, measures such as labour productivity that are calculated as the ratio of two variables (GDP divided by hours worked) also move in a random fashion, sometimes fluctuating from positive growth in one quarter to negative growth in the subsequent period. More importantly, measures of labour productivity inherently magnify the changes in the underlying numbers. Since the change in labour productivity is approximately the difference in the growth in output minus the growth in labour input, sudden movements in output that are in the opposite direction from the changes in labour inputs lead to even more pronounced movements in the measure of labour productivity.

While AQoQ and AQoY have quite different amplitudes, their means are the same—1.5% annual growth rates. But the variance of the former is 8% while it is only 2% for the latter. The annualized quarterly growth rates of labour productivity are more volatile than the annual rates derived from the same quarter of the previous year. The coefficient of variation of the former is

about 2 and for the latter about 1. These annualized quarterly rates are quite variable because they compound the 'white noise' that is in the quarterly series.

The graph also illustrates how difficult it is to discern longer-run movements using the estimates of the annualized rate of change that are produced every quarter.

Figure 2
Labour productivity growth rates, Canada



Note: Q denotes a quarter.
Source: Statistics Canada, Micro-economic Analysis Division.

Analysts make use of different methods to reveal longer-run trends in productivity growth. One way is to take a multi-period moving average. A 3-year (or 12-quarter) average of the annual rates derived from the same quarter of the previous year (AQoY) is also included in Figure 2 for this purpose. The 3-year period for averaging is chosen arbitrarily. Ideally for discerning technology cycles, the length of the moving average would be chosen to allow trends in technological progress to emerge from the effects of short-run extraneous fluctuations in economic activity that hide underlying real trends.

The graph also includes the average for the entire time period, since an average over long time periods is sometimes used to predict future productivity growth rates. Use of an overall average has the advantage of providing a constant against which any period's productivity can be

compared; but in a world where technological progress may speed up or slow down, its use may well hide periods of acceleration or deceleration in technical change.

The three-year moving average in labour productivity started below the full-period average in the late 1980s, moved up to the full- period average in the early 1990s, above it in the late 1990s, and has moved back below it after 2003.

3. Revisions[1]

The interpretation of long-run trends in productivity also faces the challenge that revisions are made to quarterly labour productivity series. Initial estimates of quarterly labour productivity growth are made as soon as the first data sources needed to provide decent estimates become available to a statistical system. Subsequently, as more and improved data become available to the statistical system, revisions are made to the first estimates to improve their accuracy.

Revisions to the Canadian data regularly occur over a statistical production cycle for a number of reasons (McKenzie 2006).

1. Incorporation of source data with more complete or otherwise better reporting (e.g., including late respondents) in subsequent estimates.
2. Replacement of first estimates derived from incomplete samples (e.g., sub-samples) judgmental or statistical techniques when firmer data become available.
3. Incorporation of source data that more closely match the concepts and/or benchmarking to conceptually more accurate but less frequent statistics.
4. Incorporation of updated seasonal adjustment factors.
5. Revisions to the System of National Accounts (SNA) statistics arising from the confrontation of data in supply and use tables.

In addition, revisions are made periodically because of changes in statistical methodology—such as the introduction of chain-linked volume estimates—and historical revisions due to changes in definitions and classifications.

The Canadian estimates of labour productivity for a particular quarter (e.g., first quarter [Q1] of 2001) are produced at the end of the subsequent calendar quarter (e.g., second quarter [Q2] of 2001). They are then revised in subsequent quarters as additional data become available. Revisions in labour productivity occur because of revisions to the estimates of gross domestic product (GDP) and labour that are used to create the estimates of labour productivity.

GDP estimates are revised regularly over a cycle of four years. They are revised each time a subsequent quarter is released during the first year, then when the first quarter estimates are produced in years two, three and four (the estimates being released in the second quarter of each of these subsequent years). These revisions incorporate data that are generally more complete

1. This study refers only to the estimates for the aggregate business sector. Quarterly estimates have also existed for industries on an experimental basis since 2005.

(items 1 through 4 on the list), making use of improved data. In the first two years, these estimates come from a variety of sources that, while extensive, are not yet combined into supply and use tables associated with the input–output system. The revisions that are made after one year add in improved data on capital expenditure; the revisions after two years come from the incorporation of information from tax returns regarding compensation and the Survey of Household Spending on consumer expenditure and revised investment information. The SNA then develops much more detailed data from industry sources and builds detailed industry input–output tables. The GDP estimates are then once again revised in the third and fourth year as they are confronted by the supply and use tables that the input–output accounts generate. Table 2 summarizes this process.

The labour data for the quarterly labour productivity accounts come from the Labour Force Survey (LFS) and are corrected for the fact that the monthly survey sometimes is done in a reference week that includes a major holiday. In this case, the results for the reference week cannot be directly applied to other weeks in the month that may not include a holiday (alternatively, the reference week does not contain a major holiday and the other weeks in the month do). During the four quarters after the estimates of labour productivity are first produced, the labour data are derived from the LFS survey results of that year (as they become available monthly), using historical data on the impact that major holidays had on hours worked in previous years. Revisions are continuously made in the first year because the seasonal factors are being adjusted and the data on the non-business sector that are used to estimate the business sector from the total economy are sometimes revised during this period. In the following year, the entire year's LFS from the year for which the preliminary estimates were produced is then analysed to ascertain whether actual hours lost during holidays taken in the previous year followed the historical patterns that had been used for the estimates reported in the first, second, third and fourth quarters (Q1, Q2, Q3 and Q4); if they did not, the previous year is adjusted. When the quarterly labour program was first implemented, this adjustment was initially made coincident with the release of the estimates of the third quarter in the following year, which are released in the fourth calendar quarter of the following year, but this adjustment is now being made earlier. It is now made with the release of the Q1 estimates of the following year, made in the second calendar quarter.

Additional sources of change in the quarterly productivity series arise over time because of adjustments that must be made to the quarterly pattern when the level of GDP or hours worked is revised for a particular year and the quarterly growth rates are benchmarked to the new estimate of the level of GDP or hours worked. If the levels of output for a particular year are changed subsequently (e.g., if the input–output system finds considerably more GDP in one industry than the preliminary estimates suggested), the quarterly growth patterns for both that year and years adjacent to that year have to be adjusted to provide for a smooth adjustment from one year to another (item 5 in the list of the causes of revisions).

Adjustment algorithms are used that prevent all adjustments from being concentrated just in the fourth quarter of the previous year or just in the first quarter of the year being revised.

Table 2 illustrates the revision cycle that takes place over each of four consecutive years. Consider the example of a revision cycle that started in the first quarter of 2001. The first

estimate of GDP for 2001Q1 is released at the end of second calendar quarter (2001Q2) and revised in each of the three subsequent releases—at the time the quarters 2001Q2, 2001Q3 and 2001Q4 are released (which occur in calendar quarters 2001Q3, 2001Q4 and 2002Q1, respectively).

When information is released for 2002Q1 (which is done in the calendar quarter 2002Q2), there are revisions made for all four quarters of 2001, but no subsequent revisions for the year 2001 are made for another year—until information for 2003Q1 is released (which occurs in 2003Q2). The same pattern occurs in the next year.

Table 2
Canadian labour productivity revisions cycle

Quarter of the release	Quarter of estimate			
	2001Q1	2001Q2	2001Q3	2001Q4
2001Q2	y	…	…	…
2001Q3	y,hw	y,hw	…	…
2001Q4	y,hw	y,hw	y,hw	
2002Q1	y,hw	y,hw	y,hw	y,hw
2002Q2	y	y	y	y
2002Q3	…	…	…	…
2002Q4	hw	hw	hw	hw
2003Q1	…	…	…	…
2003Q2	y	y	y	y
2002Q3	…	…	…	…
2003Q4	hw	hw	hw	hw
2004Q1	…	…	…	…
2004Q2	y	y	y	y
2004Q3	…	…	…	…
2004Q4	hw	hw	hw	hw

… not applicable
Notes: Q denotes a quarter; *y* denotes a point at which gross domestic product is revised; *hw* denotes a point at which hours worked are revised.
Source: Statistics Canada, Micro-economic Analysis Division.

The revision in the estimate of 2001Q1 that arises from the initial revision to hours worked is done at the time of the release of quarter 2002Q3, which is made in calendar quarter 2002Q4. More recently, this revision has been advanced in time and now corresponds with the release of the data for the first quarter of the year after the first estimates are released (which occurs in the second calendar quarter of that year). Major changes due to new estimates from LFS revisions were also incorporated in 2005Q4 and 2006Q3.

In addition to this regular revision that occurs because full-year LFS data are being analysed for the first time and incorporated into the preliminary estimates, the third quarter is used to introduce any benchmark changes that are brought about when the LFS issues revisions—when, for example, it benchmarks to new Census of Population estimates.

In addition to these regular revision points, changes also occur because of major re-benchmarking of the source data. For example, the SNA made a major update in 2001, as it

incorporated changes bringing it closer in line with the world standard outlined in the SNA (1993) and moved to Fisher indices. The LFS periodically revises its series to the Census of Population. The most recent example occurred in 2004.[2] It also incorporated new data that revised the split between public and private sector employees in the following year.[3] In addition, other data sources that are used for the non-commercial sector that originate from the Public Institutions Division have been changed on occasion, due to changes in methodology.

4. Investigating statistical properties of revisions to quarterly labour productivity series

4.1 Purpose of the analysis

Revisions analysis focuses on the difference between the initial estimates that are produced by a statistical agency and the 'final' revisions—in order to assess how far the initial estimates were from the ultimate picture of the economy as provided by the 'final' estimates.[4] Since the revisions cycle can take many years (and is never finished if major methodological changes are included), this makes choice of the 'final' version of history for a study of revisions somewhat arbitrary.

But, just as summary statistics that are produced need to be matched up to the purpose intended (a summary statistic that is useful for one purpose is not necessarily fit for all uses to which a user may put it), the choice of the reference point for revisions analysis needs to ask what the exercise is evaluating.

Quarterly labour statistics are used by analysts who are making forecasts about the immediate future, by individuals who are concerned about the present and the immediate future. They use these estimates to try to understand the present—to ask what new information very recent events add to the information that they have from past events—in order to predict the direction that the world is about to take.

2. These are discussed in Kaci and Maynard (2005).
3. These changes were incorporated into the hours worked estimates of the quarterly labour program in the fourth quarter of 2005 (2005Q4) and the third quarter of 2006 (2006Q3). See Appendix 9.
4. In 2003, in order to capitalize on earlier revisions works at Statistics Canada in the late 1970s, and to standardize and integrate revision processes for the System of National Accounts (SNA) programs, the National Accounts and Analytical Studies Field initiated a project that would produce a toolkit for revisions analyses. This resulted in the development of the *Toolkit for Revision Studies* by Doris de Zilva (2004). The methodology has become a part of the quality assurance procedures at SNA. Later, these Statistics Canada 'best practices' received special attention among statistical agencies of member countries of the Organisation for Economic Co-operation and Development (OECD), and were further developed by the OECD Statistical Directorate under the auspices of the OECD Project on Revisions Analysis, led by Professor Tommaso Di Fonzo (2005). Statistics Canada methodologist Doris De Zilva played a prominent role in this project by providing training for the staff of OECD and member countries. The OECD Revisions Analysis Project resulted in the 2005 release of the Main Economic Indicators Original Release Data and Revisions Database for OECD countries, followed by the series of cross-country studies on the statistical properties of the revisions to many macroeconomic indicators.

For our purposes, therefore, we choose the 'final' estimate as the revision that occurs two years after the first estimate (at the ninth quarter) after the first estimate is released. In doing so, we focus on the estimates that are generated over the first two years of the revision cycle and subsequent changes—at Q2, Q5 and Q9.

An original estimate (that is, Q1) is followed by various vintages at Q2, Q3, Q4…. For our analysis, we will focus on the estimate one quarter later (Q2), one year later (Y1) and two years later (Y2). As noted previously, the revisions that are made two years later at Y2 make use of data on investment, labour compensation from tax files and consumption expenditure from the Survey of Household Spending. A previous study (Kaci and Maynard 2006) already examines the annual revisions over longer time periods that have been made in the labour productivity program. This study allows the interested reader to adopt a longer time perspective.

But even if we had wanted to do so, adopting a longer time horizon to examine the revision history of the labour productivity program is not feasible at this time. Since the labour productivity program was only commenced in 2001, its track history is relatively short, and data are not plentiful for this analysis. In the interest of transparency, we nevertheless present its present history, despite this shortcoming. It should be noted that this period does not contain many major revisions of data because of changes in methodology or benchmarks to GDP, and it therefore provides a picture of the nature of the normal revision process outside these major changes.

4.2 Methodology

The analysis proceeds in four steps. These are:

1. Constructing real-time data sets.
2. Defining analysis variables.
3. Conducting statistical tests of revision size and significance, and reliability of signals.
4. Conducting international comparisons (Canada–United States) of key revision statistics.

The steps that will be followed for our analysis of revisions in the quarterly productivity accounts are illustrated in Figure 3.

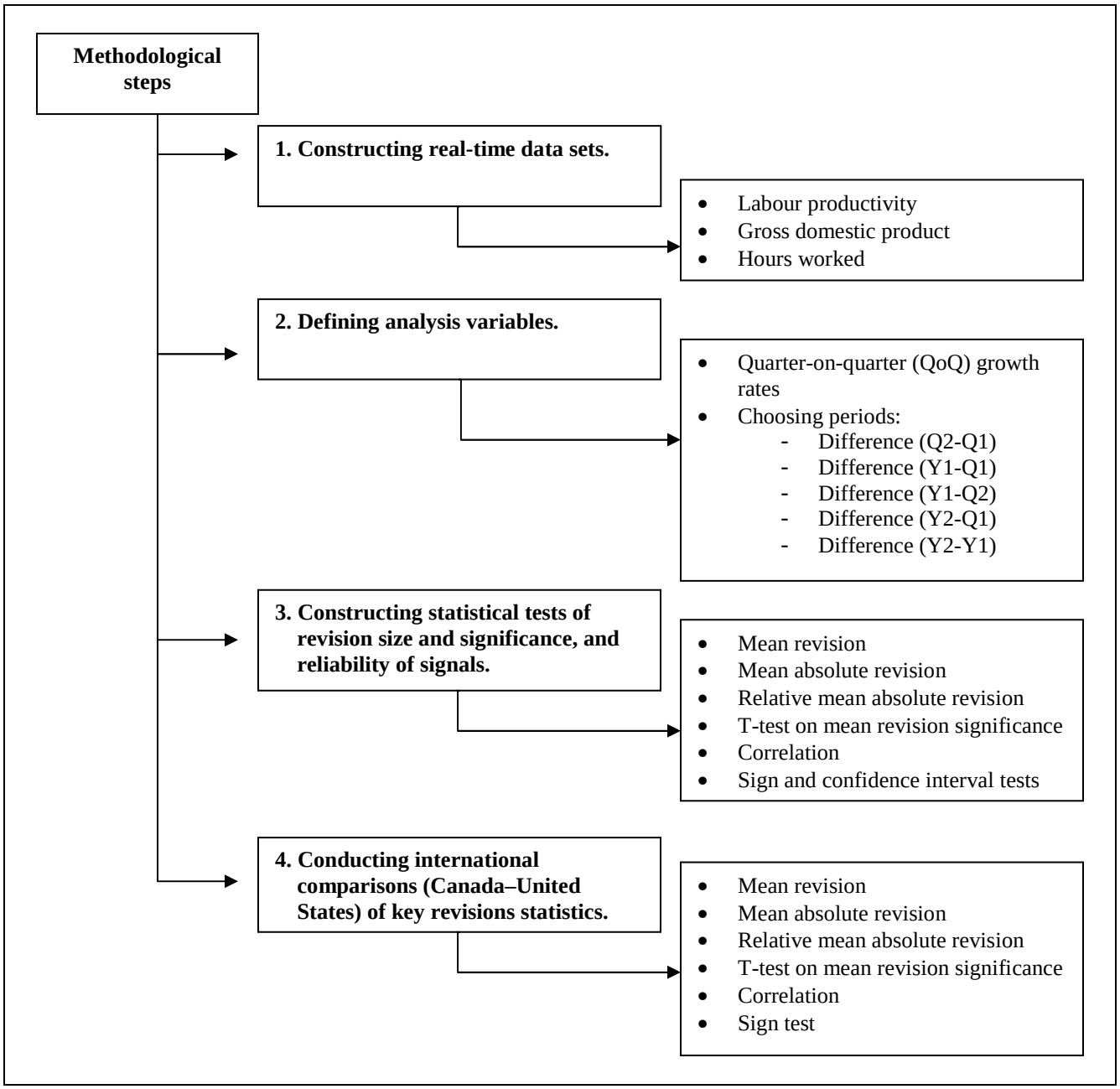
The **first step** requires the construction of the real-time triangular data set for the Canadian quarterly labour productivity series. Triangular real-time or revisions data sets are data sets that compile vintages of the data released at each point of time in order to account for the revisions that were published at that time.

In the **second step**, quarter-on-quarter growth rates of labour productivity are used to track revisions over a particular time horizon that is chosen for the analysis. We first examine the change that is made in Q2 after the estimate is first produced in Q1, then the change that occurs one year later at Y1, and then the change that occurs two years later at Y2. In our analysis, we will examine the size of the changes at each step and their cumulative effect over time.

The **third step** involves the construction of the descriptive statistics for the revisions measures and their analysis (see the Appendixes for detailed descriptions). We are interested in knowing whether the changes tend to move the estimate up or down in one direction. For this, we estimate the mean change due to revisions and test its significance. We are also interested in knowing whether the size of the change, either positive or negative, is large or small. For this, we calculate the mean absolute revision. We also examine relative absolute revisions for the evidence on the size of the average revision relative to the final value. Further, we are interested in knowing how the changes affect the pattern of growth over time. For this, we examine the correlation of series of different vintages with one another. We also investigate the reliability of the signals produced by the quarterly labour productivity estimates.

In the **fourth step**, we compare the descriptive statistics of Canada with those of the United States.

Figure 3
Overview of the methodology for revisions analysis



Notes: Q denotes a quarter; Y denotes a year.
Source: Statistics Canada, Micro-economic Analysis Division.

4.3 The real-time data sets

A real-time data set is formed for all quarters starting at 2001Q1 and ending in 2006Q3 to examine the changes in labour productivity growth due to the System of National Accounts cycle revisions, and methodological revisions. Each column of this data set represents the quarterly data vintages published at the quarterly Statistics Canada release dates from 2001Q1 to 2006Q3. The resulting triangular data set is illustrated in Table 3 below. Real-time data sets of the same triangular type were also constructed for the growth rates in business sector gross domestic product (GDP) and the growth rates in hours worked in the business sector, and corresponding data sets were created for the United States.

Table 3
Triangular format of the comprehensive real-time data set

Quarter	Quarterly data vintages													
	2001Q1	q	q	q	q	q	q	q	q	q	q	q	-	2006Q3
2001Q1	r	r	r	r	r	r	r	r	r	r	r	r	-	r
q	…	r	r	r	r	r	r	r	r	r	r	r	-	r
q	…	…	r	r	r	r	r	r	r	r	r	r	-	r
q	…	…	…	-	-	-	-	-	-	-	-	-	-	r
2006Q3	…	…	…	…	…	…	…	…	…	…	…	…	…	r

… not applicable
- cells of *q* are populated consecutively and cells of *r*, diagonally
Notes: Q denotes a quarter; *q* denotes labels for the quarters in consecutive order; *r* denotes a real-time data point, which may include a revised estimate.
Source: Statistics Canada, Micro-economic Analysis Division.

4.4 Analysis variables

The real-time database contains the estimates that are made at different points after the first release. Revisions are calculated by taking the differences between the various vintages of labour productivity growth. These revisions are provided in Appendix 7 for labour productivity, Appendix 8 for GDP and Appendix 9 for hours worked.

To measure the change in the quarterly growth rates due to revisions in the short-run period (up to two years), the estimate that is first made (Q1) is compared with the estimate made one quarter later (Q2), one year later (Y1) and two years later (Y2). Five basic measures of revisions are calculated by taking differences in the estimates that are made at these different points in time.

The first three measure incremental revisions over the consecutive time points used in this analysis. These are:

- **Q2-Q1**: the difference between the estimate published one quarter later and the first published estimate—an estimate of the first incremental change;
- **Y1-Q2**: the difference between the estimate published one year later and the estimate published one quarter later—an estimate of the incremental change from the first revision to one year later; and

- **Y2-Y1**: the difference between the estimate published two years later and the estimate published one year after the first estimate is released—an estimate of the incremental change from one year after the first published estimate to two years after the first published estimate.

The second set of measures includes the cumulative revisions from the first estimate. These are:

- **Y1-Q1**: the difference between the estimate published one year after and the first published estimate—an estimate of the cumulative change from the first estimate to one year later; and
- **Y2-Q1**: the difference between the estimate published two years later and the first published estimate—an estimate of the cumulative change from the first estimate to the 'final' estimate.

The generalized formula for the revisions is

$$R_t^h = L_t^{h_{end}} - P_t^{h_{start}}$$

Where

R_t^h = Revision for the quarterly growth rates at quarter *t* and horizon *h*.

$L_t^{h_{end}}$ = Later estimate for the quarterly growth rates at quarter *t* and horizon *h*.

$P_t^{h_{start}}$ = Previously published real-time data point for the quarterly growth rates at quarter *t* and horizon *h*.

For example, the value of a one-quarter-horizon revision (Q2-Q1) for the growth rate estimates of the first quarter of 2004 may be represented as follows:

$$R_{2004Q1}^{(Q2-Q1)} = L_{2004Q1}^{2004Q2} - P_{2004Q1}^{2004Q1}$$

Various summary statistics for the estimates and revisions are outlined in Appendix 1. These include, *inter alia*, the mean revision, the mean absolute revision, the relative mean absolute revision and other measures found in the project on Revisions Analysis of the Organisation for Economic Co-operation and Development. Summary statistics of the revisions for both Canada and the United States are found in Appendixes 4, 5 and 6. Appendix 4 contains the statistics for labour productivity growth. Appendix 5 contains the statistics for business sector GDP growth. Appendix 6 contains the statistics for growth in hours worked.

5. Analysis of the revision cycle for the reference period from 2001Q1 to 2006Q3

5.1 Revision patterns

Before turning to the size of the revisions, we examine the time pattern of the quarterly estimates that is presented by the various vintages of the estimates. To do so, we make use of the estimates of the values of the quarterly productivity growth rates for different vintages of each estimate—for estimates that correspond to Q1, Q2, Y1 and Y2 (first quarter, one quarter later, one year later, two years later). Similar profiles indicate that information on the pattern of growth and decline over the period is not changed over the revision cycle.

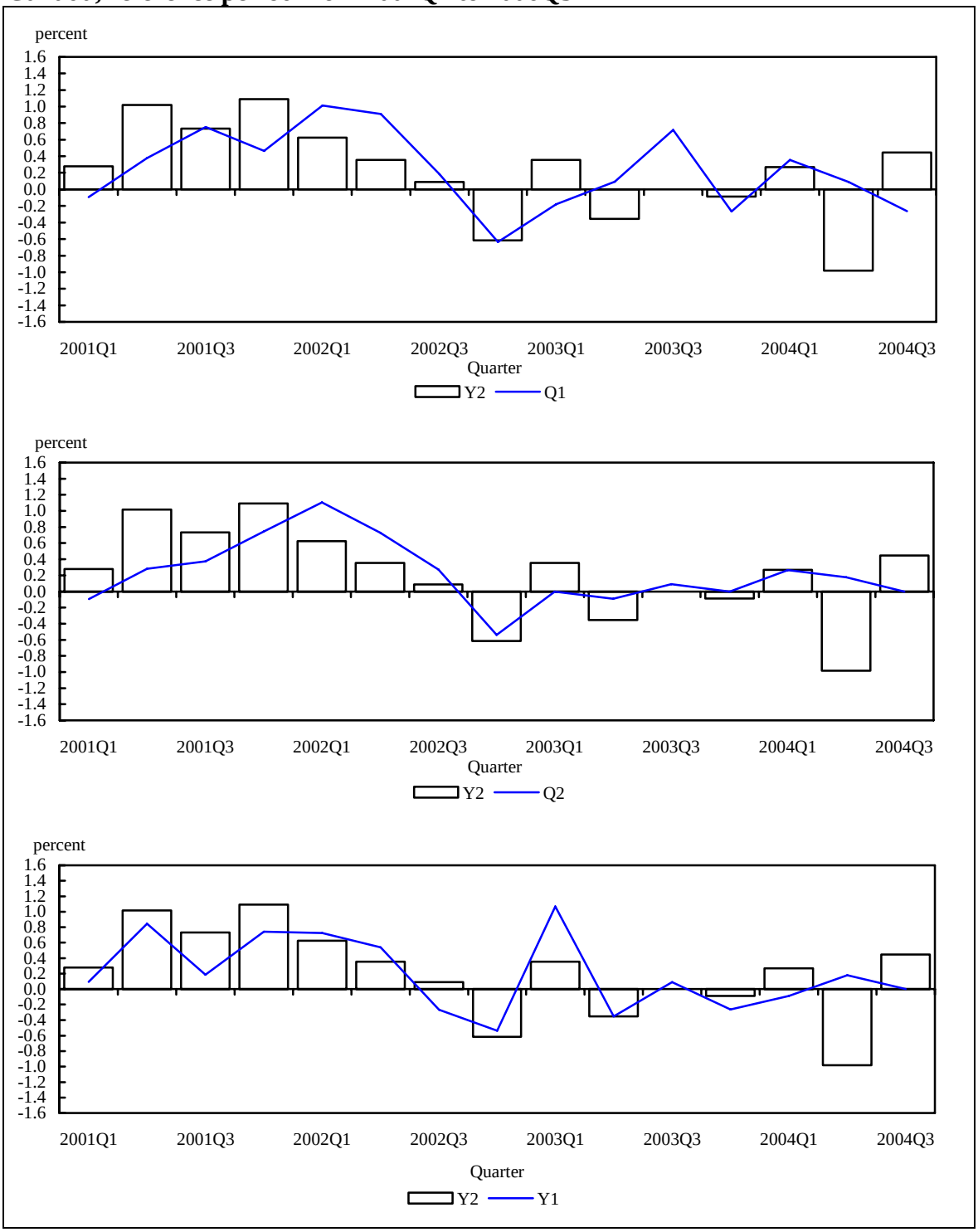
These profiles are presented in Figure 4.[5] The bar in each panel represents the final estimate of the quarter-on-previous-quarter growth rates (QoQ) for each quarter two years after originally first issued. Each of the panels represents a step in the process. The first panel contains the first estimate (Q1), the second panel contains the estimate when the first revision is made one quarter later (Q2) and the third panel contains the estimate when the revision is made one year later (Y1). The difference between the estimates of the quarter-on-previous-quarter growth rates at each of the revisions points (Q2, Y1) and the bar (Y2) represent the extent of the revision that was made.

Comparisons of the profiles of each of the vintages with the final estimate show strong similarities over the first half of the period. All vintages show that productivity growth was increasing early in the period and then declined to a trough in the fourth quarter of 2004.

In the latter part of the period, the first estimate differs from the final pattern more substantially with a false peak in the third quarter (Q3) of 2003 that disappears in the final estimate. But this signal is corrected one quarter later. By contrast, the revision after one year introduces a false peak into Q1 of 2003—one that disappears by the 'final' estimate. However, in interpreting the reliability of the estimates during the last half of the period, it must be remembered that this period saw little productivity growth. Quarterly estimates during the year fluctuate from positive to negative, quarter to quarter. All the vintages of the estimates indicate that there is no strong trend in productivity during this period. Each of the vintages averages out to zero productivity growth.

5. In this and most other figures and tables, comparisons across vintages (Q1, Q2, Y1, Y2) and summary statistics for each vintage (i.e., mean revisions) are calculated over the period 2001Q1 to 2004Q3 because the length of cycle chosen for the analysis (a full nine quarters) does not permit a longer period to be chosen at the time this paper was written.

Figure 4
Estimates of QoQ[1] growth rates of labour productivity at different horizons, Canada, reference period from 2001Q1 to 2006Q3[2]



1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2003.

Notes: Q denotes a quarter; Y denotes a year.

Source: Statistics Canada, Micro-economic Analysis Division.

A more formal measure of the relationship between the later and earlier estimates of the quarter-on-previous-quarter growth rates is the coefficient of correlation of the two estimates. This shows the extent to which variations in one series are closely related to another series. The level of the correlation between the earlier and later estimates of the quarter-on-previous-quarter growth rates is presented in Table 4.

Table 4
Correlation between QoQ[1] growth rates of labour productivity at different horizons, Canada, reference period from 2001Q1 to 2006Q3[2]

	Q1	Q2	Y1	Y2
Q1	1.0	0.85	0.47	0.48
Q2	…	1.0	0.62	0.58
Y1	…	…	1.0	0.64
Y2	…	…	…	1.0

… not applicable
1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2006.
Notes: Q denotes a quarter; Y denotes a year.
Source: Statistics Canada, Micro-economic Analysis Division.

Table 5
Correlation between QoQ[1] growth rates of labour productivity at different horizons, United States, reference period from 2001Q1 to 2006Q3[2]

	Q1	Q2	Y1	Y2
Q1	1.0	0.98	0.90	0.88
Q2	…	1.0	0.92	0.90
Y1	…	…	1.0	0.94
Y2	…	…	…	1.0

… not applicable
1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2006.
Notes: Q denotes a quarter; Y denotes a year.
Source: Statistics Canada, Micro-economic Analysis Division; and U.S. Bureau of Labor statistics.

The highest correlation of 0.85 is observed at the first revision point (Q2), while the 1-year and 2-year consecutive estimates have a correlation of 0.62 and 0.64, respectively. The correlation between the original estimates and the estimates at the 1- and 2-year points falls to 0.47 and 0.48, respectively.

The same correlations are presented for the U.S. quarterly labour estimates calculated over about the same period (2001 to 2004) in Table 5. The first estimates (Q1 and Q2) have a correlation of 0.98. The correlation between the first and the final estimate is 0.88.

5.2 Characteristics of revision levels

5.2.1 Mean revisions of quarter-on-quarter growth rates

Revisions should be of random nature, equally likely to be positive or negative, and centered on zero:

> …an important output of a revisions analysis study are [sic] the tests to determine whether mean revisions (calculated at a range of different time lengths from the first estimate) are statistically significantly different from zero. Statistically significant mean revisions imply that the data have a significant tendency to be revised in a particular direction (*i.e*. up or down) and that the compilation methodology for early estimates should be reviewed (McKenzie 2006, p. 4).

The value of the mean of the revisions for Canada is presented in Table 6. The average is slightly negative between the first two quarters (-0.01), negative until the next year (-0.02), and slightly positive over the second year (0.02). The total over the entire period is only -0.02. This is small relative to the mean value of quarterly growth of 0.19 over the period.

Table 6
Summary statistics for revisions for QoQ[1] growth rates of labour productivity at different horizons, Canada, reference period from 2001Q1 to 2006Q3[2]

Statistics	Horizons			
	Q2[3]-Q1[4]	Y1[5]-Q2	Y2[6]-Y1	Y2-Q1
Mean revision	-0.01	-0.02	0.02	-0.02
Is the mean significantly different from zero?	No	No	No	No
Mean absolute revision	0.19	0.27	0.33	0.43
Relative mean absolute revision	0.61	0.67	0.67	0.88

1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2006.
3. Estimate published one quarter later.
4. First published estimate.
5. Estimate published one year later.
6. Estimate published two years later.

Source: Statistics Canada, Micro-economic Analysis Division.

Using an adjusted t-test for mean revision significance,[6] which accounts for the autocorrelation and heteroscedasticity of the variance of mean revisions, we find that the mean revision for all horizons of the quarterly labour productivity revisions was not significant (using a 5% confidence interval) during the reference period. Results of our t-test, consistently rejecting the significance of revisions, confirm that the statistical methodology for the production of the quarterly labour productivity estimates performs well using this criterion.

6. For detailed description of the adjusted t-test for the revisions significance, see Appendix B "How to judge significance of the mean revision: A note" (Di Fonzo 2005).

Table 7
Summary statistics for revisions for QoQ[1] growth rates of labour productivity at different horizons, United States, reference period from 2001Q1 to 2006Q3[2]

Statistics	Horizons			
	Q2[3]-Q1[4]	Y1[5]-Q2	Y2[6]-Y1	Y2-Q1
Mean revision	0.02	0.04	-0.02	0.04
Is the mean significantly different from zero?	No	No	No	No
Mean absolute revision	0.10	0.20	0.20	0.27
Relative mean absolute revision	0.11	0.22	0.21	0.28

1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2006.
3. Estimate published one quarter later.
4. First published estimate.
5. Estimate published one year later.
6. Estimate published two years later.

Source: Statistics Canada, Micro-economic Analysis Division; and U.S. Bureau of Labor Statistics.

The mean changes across the same reference points are larger for the United States but the differences are small. The overall change for the United States is 0.04 compared with -0.02 in Canada during this period (see Table 7). Using the same statistical test, we find the U.S. estimates too are not significantly different from zero, despite their larger size.

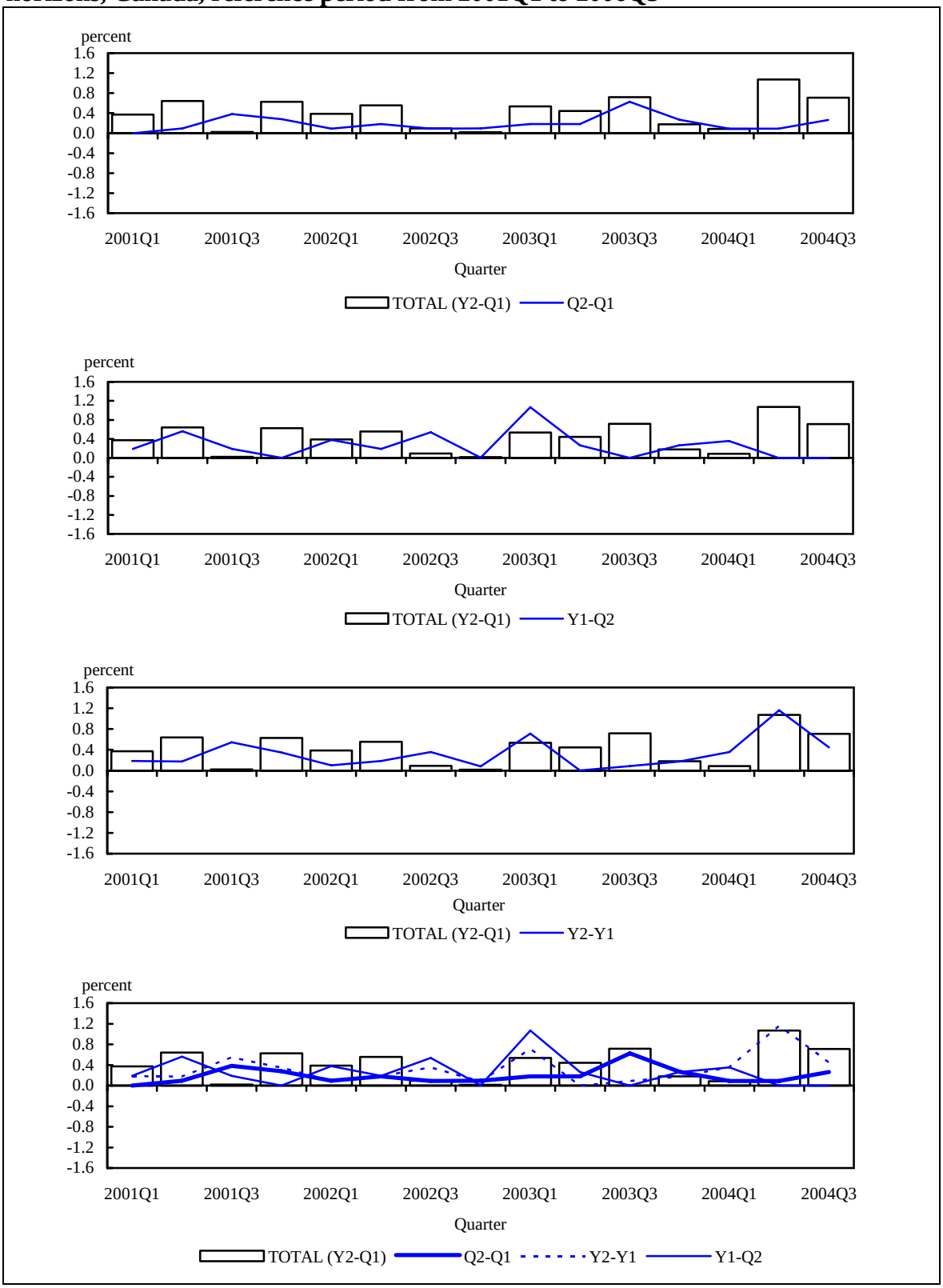
A comparison of the mean revisions for the numerator of the labour productivity measure (business sector gross domestic product [GDP] growth) and the denominator (hours worked growth) also shows close similarities for Canada and the United States—see Appendixes 5 and 6. The mean revision in GDP growth between Q1 and Y2 for Canada was 0.05 and for the United States was -0.05. For the growth in hours worked, it was 0.06 for Canada and -0.12 for the United States.

5.2.2 Mean absolute revisions for quarter-on-quarter growth rates

An alternate summary statistic to the mean revision that is commonly used to evaluate the size of revisions is the mean of the absolute size of the revisions. Examination of the mean allows us to ask whether positive and negative revisions essentially offset one another. The mean absolute revision considers all revisions to have the same sign (positive) and averages them, thereby providing a measure of the size of each revision that can be compared over time.

In Figure 5 we present the graphs of the absolute revisions for the quarter-on-previous-quarter growth rates in Canadian labour productivity by consecutive time periods. The length of the bars for each quarter in each panel represents the absolute size of the revisions between the first and the final estimate. There is little evidence that the absolute size of the revisions has either increased or decreased over the period studied.

Figure 5
Absolute revisions of QoQ[1] growth rates of labour productivity at different horizons, Canada, reference period from 2001Q1 to 2006Q3[2]



1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2006.
Notes: Q denotes a quarter; Y denotes a year.
Source: Statistics Canada, Micro-economic Analysis Division.

A comparison of the individual panels reveals that changes between the first two estimates are relatively small when compared with the changes that occur between the second period and a year later. All three estimates are grouped together in the fourth panel so that the size of the revisions occurring by the second year (Q2 to Y1) and by the third year (Y1 to Y2) can be compared. The revisions made by the second year are greater than those by the third year.

The average absolute revisions in Canada over the three time periods used (Q1 to Q2, Q2 to Y1 and Y1 to Y2) in Table 6 were 0.19, 0.27 and 0.33. The revisions subsequent to the second release (Q2) are therefore approximately equal in importance and larger than the very first revision between Q1 and Q2.

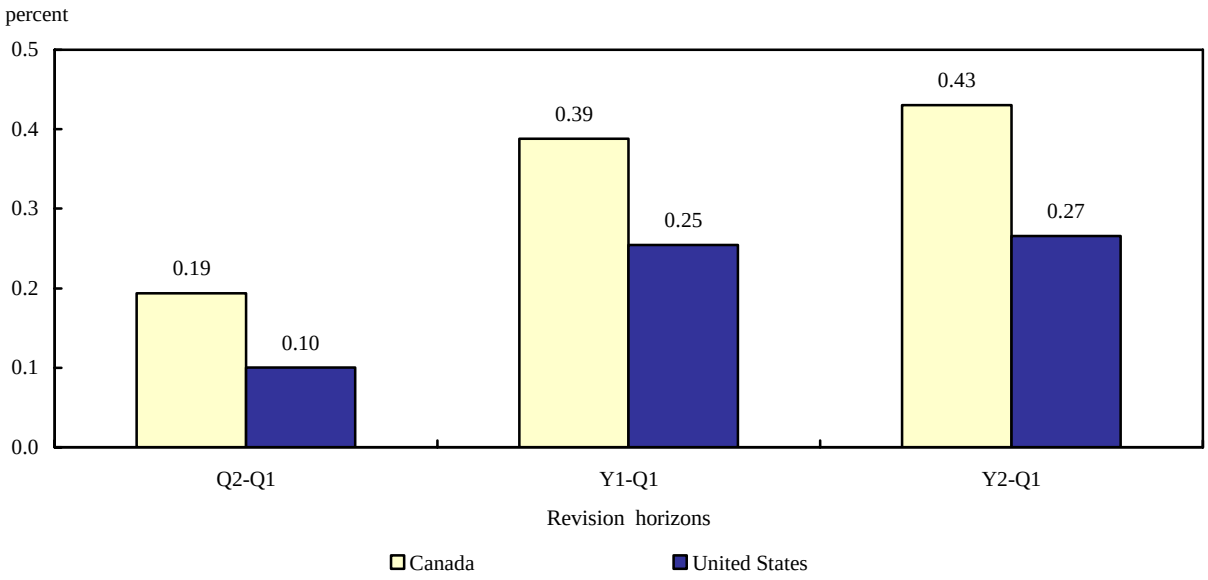
These two revisions (between Q2 and Y1 and between Y1 and Y2) make use of different types of new data. The revision over the first year adds in improved data sources associated with income and expenditures accounts that produce GDP from final demand estimates on capital expenditure; the revision over the second year comes from the incorporation of information from tax returns regarding compensation and the Survey of Household Spending on consumer expenditure and revised investment information. The relative size of the absolute revisions suggests that the new information that is being incorporated into the statistical system in each of these years has an approximately equal impact on changes.

The average absolute revisions in the United Sates for the same three time periods were 0.10, 0.20 and 0.20 (Table 7). The revisions subsequent to the second release (Q2) are also approximately equal in importance and larger than the very first revision between Q1 and Q2.

The average absolute revisions for the quarter-on-previous-quarter growth rates of U.S. labour productivity are generally smaller over the entire revisions cycle (from Q1 to Y2) than those in Canada. The differences between Canada and the United States arise not so much from differences in the mean absolute revisions for GDP, which is about the same in the two countries (0.22 and 0.25, respectively)—see Appendix 5, as from a larger mean absolute revision in hours worked in Canada (0.34) than in the United States (0.26)—see Appendix 6.

Maynard (2007) points out that the U.S. labour estimates, when derived from the Current Population Survey, do not make backward revisions when they benchmark to the U.S. population census to the same extent that the Canadian estimates do. This accounts for part of the difference in the size of the absolute revision for hours worked in Canada. The Canadian data are therefore subject to greater revisions—but do so for the sake of accuracy. This points to the need to not forget that revisions are made to make estimates more accurate.

Figure 6
Mean absolute revisions for labour productivity, QoQ[1] growth rates at different revision horizons, Canada and United States, reference period from 2001Q1 to 2006Q3[2]



1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2006.
Notes: Q denotes a quarter; Y denotes a year.
Source: Statistics Canada, Micro-economic Analysis Division; and U.S. Bureau of Labor Statistics.

5.2.3 Relative mean absolute revisions for quarter-on-quarter growth rates

Tables 6 and 7 also contain the ratio of the mean absolute revision to the final value of the quarter-on-previous-quarter growth rates—the relative mean absolute revision. This summary statistic provides evidence on the size of the average revision relative to the final value. When this ratio is relatively small, variations in the signal as to the nature of productivity that come from revisions are small relative to the final value. But it should be recognized that this measure unfortunately depends both on the size of the mean absolute revision and on the level of productivity growth in the economy. It can take on a large value not because the absolute revision size is large but because productivity growth is low.

For this measure, the Canadian statistical process fares less well relative to the American one. The ratio is 88% over the period from the first estimate Q1 to the last Y2 in Canada but only 28% in the United States. But it must be recognized that the difference comes not from smaller absolute revisions in the United States, but from the fact that the United States economy has been producing higher productivity growth numbers.

5.3 Reliability of the signals produced by the quarterly labour productivity accounts

This section investigates the reliability of the signals that are given by the first estimates of quarterly labour productivity.

In many macroeconomic models, quarterly labour productivity estimates influence forecasts of potential output. A quarterly estimate of productivity growth might be used to predict its direction of change by asking whether quarterly growth is positive or negative.

In this case, the **first test** of the suitability of the early estimates is to ask whether the sign of the estimate of productivity growth at the 'final' reference point is the same as that provided by the first estimate. To evaluate this, we calculated the percentage of observations where the estimate of the quarter-on-previous-quarter growth rates (QoQ) had the same sign as the original estimate at different revision horizons. At Q2, 73% of the signs were the same as at Q1; at Y1, 60% were the same as at Q1; at Y2, some 60% were the same as at Q1 (see Appendix 4).

We also performed a **second test** that asked whether revisions affect the signal that the quarterly information is making with regards to longer term trends that are derived from historical data in previous periods. This test made use of the difference between the information produced by the quarterly estimate at each point in time during the 2001 to 2006 reference period—using the triangular real-time data set described previously—and the moving-average 'trend' forecast of that estimate. The 2006Q3 is chosen as the **'final' estimate** for each quarter, and the data vintages for each quarter before the 2006Q3 real-time 'slice' are chosen as the **preliminary estimates** for each quarter.

The quarterly estimate provides new, incremental information each quarter on the direction that the economy is taking. It is often compared with the existing information that is generated from data generated in previous quarters—'trend' forecasts that are generated from existing data in different ways—using regressions, moving averages or other techniques.

Incremental information provided by new quarterly productivity estimates that is different from the forecast 'trend' value may be used to infer that the economy is taking a new direction. When the new quarterly value is less or greater than the forecast one, the economy can be interpreted as moving in a direction that diverges from predictions based on the past. If this difference is negative, the incremental information is suggestive that downward revisions should be considered for predictions of long-term productivity trends. If it is positive, upward revisions of expectations may be warranted.

In order to test how the Canadian labour productivity series fares if used in this fashion, we estimated two difference measures:

1. the difference between the value of quarter-on-previous-quarter (QoQ) growth rates of labour productivity and its 'trend' forecast value derived from a 16-quarter moving average of QoQ;

2. the difference between the 4-quarter moving average value of QoQ growth rates of labour productivity as an estimate of the new information emerging in a particular quarter, and the 'trend' forecast value derived from the 16-quarter moving average of this measure.

Two different moving averages were used. The first was a simple unweighted average. The second used Henderson weights and offers a more sophisticated projector that takes into account cyclicality in the quarterly data.[7]

Table 8 reveals the percentage of times when the short-run signals (the sign of the difference described above) corresponded to the correct longer term signals that emerge from the data base as of 2006Q3—what we refer to as the 'final' data series.

Table 8
Coincidence of signs from preliminary and final difference measures

Test statement	% Sign (Preliminary) = Sign (Final)	
	Using unweighted moving averages	Using weighted moving averages
	percent	
Was the sign of the difference between QoQ[1] values and the four-year moving average forecast of QoQ the same using both the preliminary and 'final' series?	59	77
Was the sign of the difference between four-quarter moving averages of QoQ values and the four-year moving average forecast of QoQ the same using the preliminary and 'final' series?	73	73

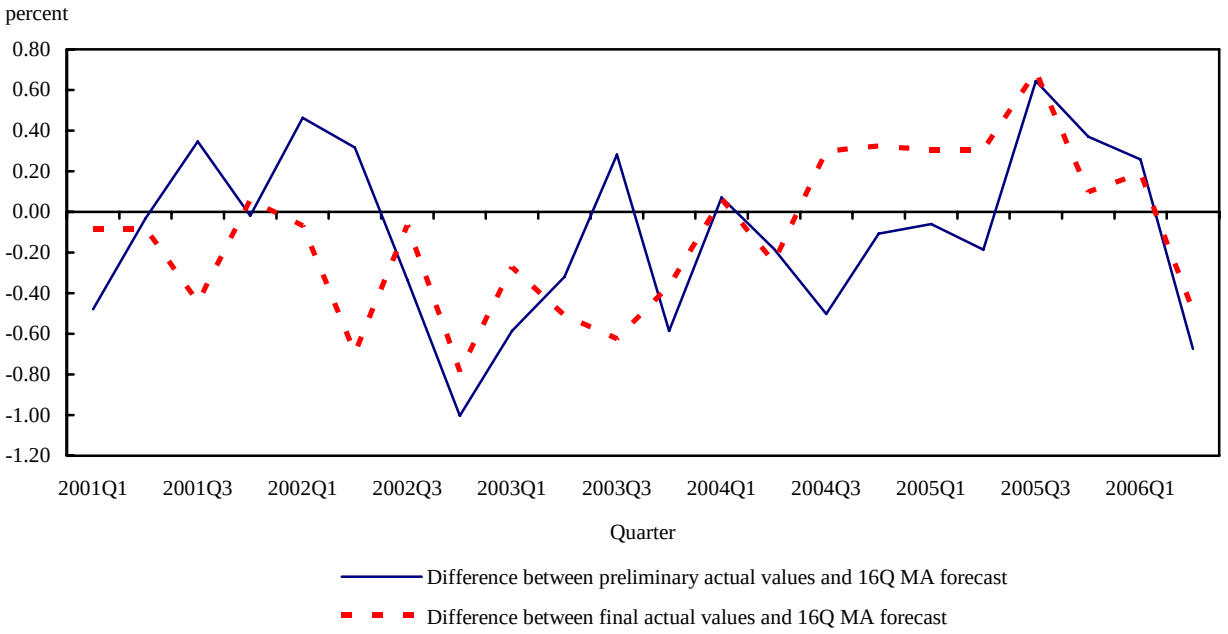
1. Quarter-on-quarter.
Source: Statistics Canada, Micro-economic Analysis Division.

On the basis of this test, the first signal that is produced by the process is correct 59% of the time, when the signal is taken from the more volatile quarter-on-quarter growth rate, and 73% of the time when it is taken from the less volatile average quarterly growth rate measured over the previous four quarters, and the trend projector is taken from the unweighted moving average. The signs are the same for 77% and 73% of the time for the weighted projectors. Accuracy then depends on the sophistication of the method that is used to project trend.

A **third test** examines the time pattern in the differences used in the second test. If these differences are trending in a particular direction, then this type of cumulative, sequential information may be used to generate predictions about the direction that the economy is taking relative to the trend that it has been previously following. The time pattern of these differences, using the projector that is based on the unweighted moving average, is presented in Figures 7 and 8. The differences between the actual and the forecast estimates derived from preliminary values and those derived from the final estimates track one another quite closely. For example, the correlation between the two in Figure 7 is 0.71.

7. For the Henderson moving average, 5- and 13-quarter periods were chosen.

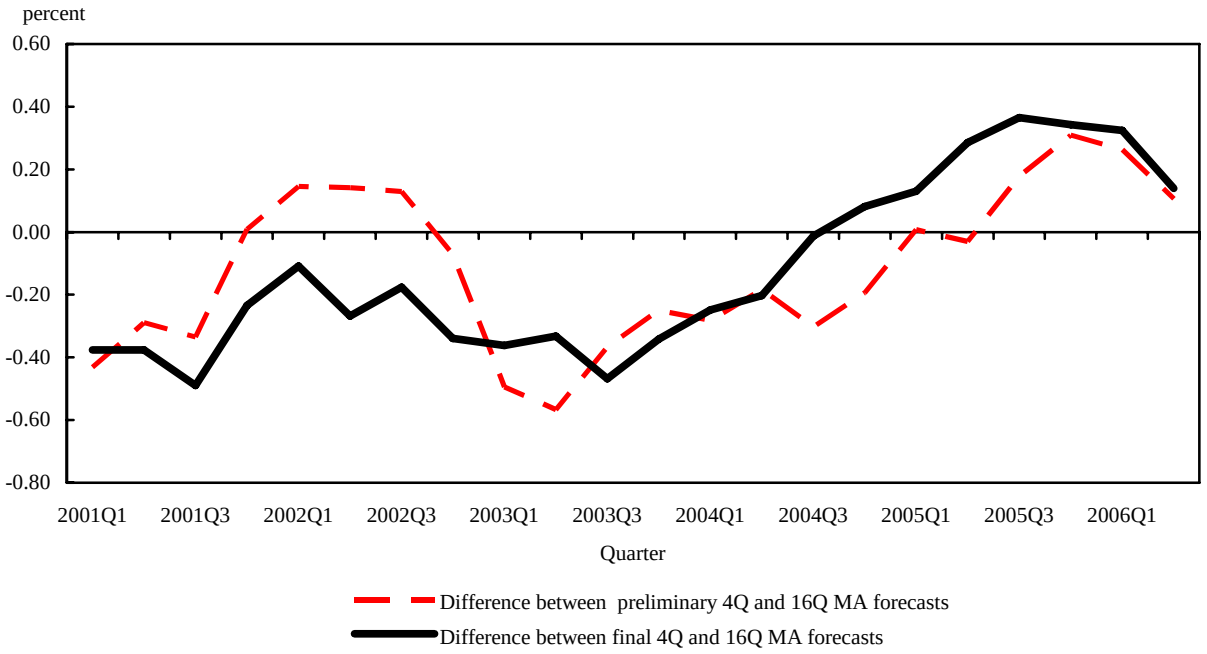
Figure 7
Difference between preliminary and 'trend' forecast values of growth rates for labour productivity, Canada, reference period from 2001Q1 to 2006Q3[1]



1. From the first quarter of 2001 to the third quarter of 2006.
Notes: Q denotes a quarter; MA denotes a moving average.
Source: Statistics Canada, Micro-economic Analysis Division.

A **fourth test** involves asking whether the information that is generated by the first quarterly estimate falls within the confidence interval of the 'final' estimate. The assumption that underlies this test is that the 'final' estimate is a random variable that has a central tendency but that varies around that central tendency. It varies around that central tendency because the economy is inherently volatile quarter by quarter—with some quarters having large positive rates of labour productivity growth and others having large negative values of productivity growth. Even a 'final' estimate of productivity growth in any quarter is therefore not known with certainty. Confidence intervals are used to provide bounds within which any estimate might truly fall. If the preliminary estimate falls within this estimate, it does not in a statistical sense fall outside of the 'natural' range of uncertainty—that is, the range that accompanies the 'final' estimate.

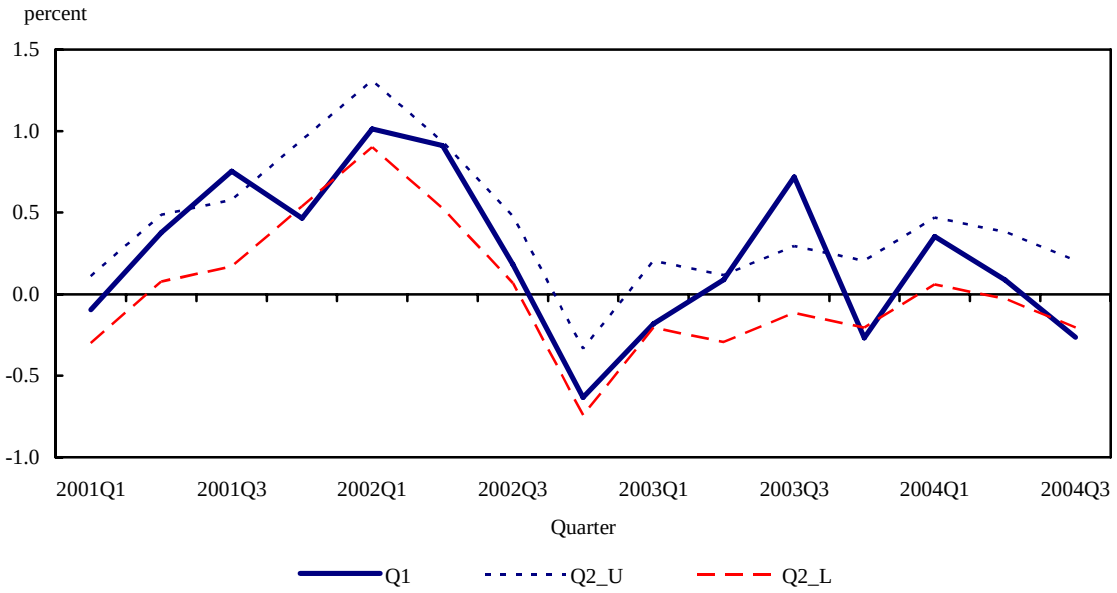
Figure 8
Difference between preliminary and 'trend' forecast values of growth rates for labour productivity, Canada, reference period from 2001Q1 to 2006Q3[1]



1. From the first quarter of 2001 to the third quarter of 2006.
Notes: Q denotes a quarter; MA denotes a moving average.
Source: Statistics Canada, Micro-economic Analysis Division.

To test whether this is the case, we plot the estimate and the confidence interval for Q2, Y1 and Y2 in Figures 9, 10 and 11, respectively. We chose Q2, Y1 and Y2 in turn as the 'final' estimates—because analysts will be doing so over time as each of these vintages are produced. In each case, we plot the first estimate Q1 as well so that we can judge whether it falls in the 'natural' bounds that we might expect. It is evident that the first estimate generally falls within the confidence interval of each of the subsequent vintages—at Q2, Y1 and Y2. In this sense, the first estimate produced by the quarterly program does not fall outside the bounds that arise because of the intrinsic volatility in the economy.

Figure 9
Actual Q1[1] estimates compared with the confidence interval for the estimates at Q2[2]

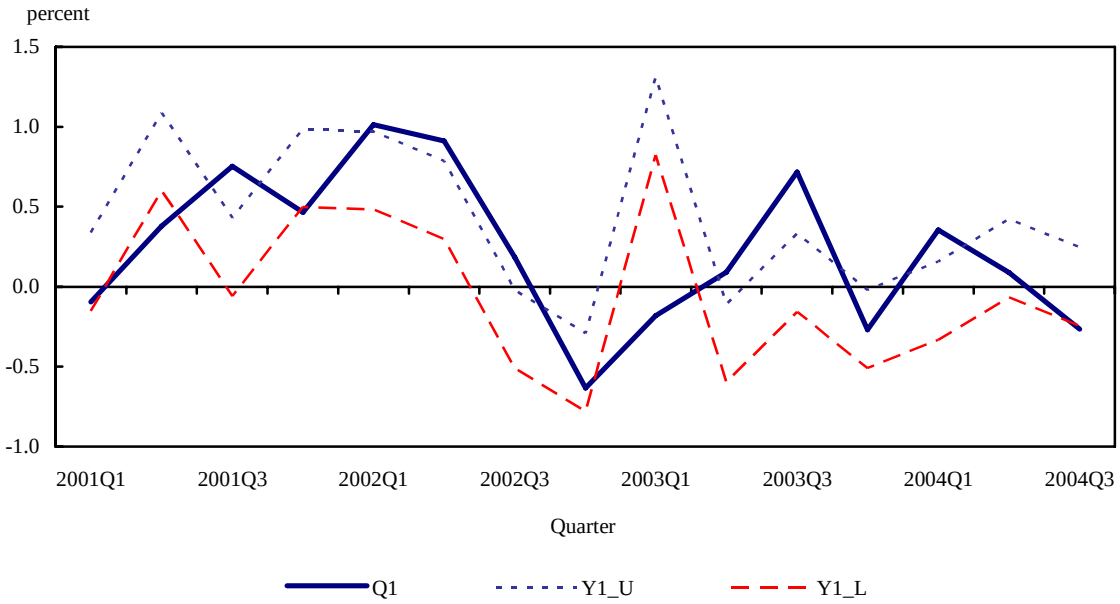


1. First quarter.
2. Second quarter.

Notes: Q denotes a quarter; U denotes the upper boundary of the confidence interval; L denotes the lower boundary of the confidence interval.

Source: Statistics Canada, Micro-economic Analysis Division.

Figure 10
Actual Q1[1] estimates compared with the confidence interval for the estimates at Y1[2]

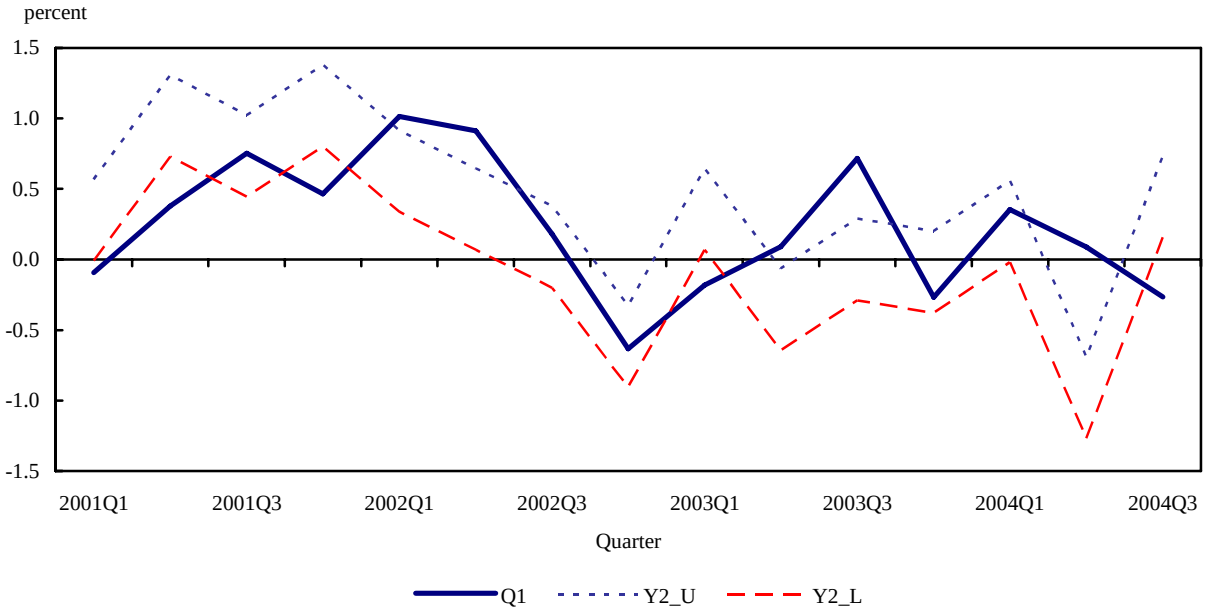


1. First quarter.
2. First year.

Notes: Q denotes a quarter; U denotes the upper boundary of the confidence interval; L denotes the lower boundary of the confidence interval.

Source: Statistics Canada, Micro-economic Analysis Division.

Figure 11
Actual Q1[1] estimates compared with the confidence interval for the estimates at Y2[2]



1. First quarter.
2. Second year.

Notes: Q denotes a quarter; U denotes the upper boundary of the confidence interval; L denotes the lower boundary of the confidence interval.

Source: Statistics Canada, Micro-economic Analysis Division.

6. Conclusions

Quarterly productivity estimates are produced by Statistics Canada to provide timely information on the direction that the economy is taking with regards to technological change. At one time, Statistics Canada only produced annual labour productivity estimates with a considerable lag—about six months after the end of the year. The introduction, in 2001, of the quarterly program has led to more timely data being made available to the analyst community.

Statistics Canada's role is not only to provide more timely data but also to provide users with a full understanding of the quality of the data so that they may judge the data's appropriate uses. To this end, this paper focuses on the nature of the quarterly data and the nature of the revision process.

The paper first describes the quarterly time series of labour productivity estimates. It points out the very short-run estimates are much more volatile—have a higher variance—than alternates that make use of quarterly information averaged with recent values using a moving average, or other suitable prediction tool. Use of the quarterly growth rate alone provides measures of annualized growth rates whose variance is twice as large as the one-year quarter-on-previous-quarter growth rate.

Quarterly information can be used in alternate ways that have different advantages and disadvantages. The more instantaneous the estimate (quarter-on-quarter growth rates—QoQ), the higher will be its volatility. Using information from one quarter in conjunction with that from adjacent recent quarters (for example, annual growth rates from the same quarter in the previous year—AQoY) provides data series that are less volatile, have quite a different profile and provide a clearer-cut picture of longer-run trends.

None of this means that one series is better than another for all purposes. Rather, it indicates that the quarterly productivity estimates can be used in different ways to understand trends in the economy. Some of these produce more volatility than others, and users should be aware of the alternatives available to them.

Users of the quarterly series also need to understand the nature and size of the revision process that arises because more comprehensive and more accurate data on both gross domestic product (GDP) and hours worked—the two components of labour productivity growth—are gradually incorporated into the estimates. This is a process that occurs in many of the macroeconomic aggregates that the System of National Accounts produces.

Our study has examined several indicators that describe the revisions made to the quarterly labour productivity estimates. It has shown that the mean revision for Canadian labour productivity growth was quite small and not significantly different from zero. Statistical tests consistently indicated that the mean revisions at all revision horizons were not significantly different from zero. Thus, the data did not have a significant tendency to be revised in a particular direction (i.e., up or down).

The paper also examines the extent to which the estimates from different vintages of quarterly labour productivity track one another. The correlation coefficient between the first release and the release one or two years later is 0.5.

Comparison of the mean absolute revision over time suggests that the size of the revisions has not changed dramatically over time.

Several tests suggest that some of the information contained in the ‘final’ estimates is accurately reflected in the first estimates that are made before any revisions. Four tests were chosen. First, the sign of the final growth rate was compared to the sign of the first estimate. In most cases (in 59% to 73% of revisions), the sign of the ‘final’ estimate of the growth rate was consistent with the sign of the earlier estimate. Second, incremental information provided by new quarterly productivity estimates was compared with the forecast ‘trend’ value. To do so, the sign of the difference in the estimate of the average of the quarter-on-quarter growth rate over the last year and the average of past rates over four years was calculated. Its sign was the same in over 73% of the cases for the final estimate as it was for the first estimate. Third, the first estimates were examined to see whether they generally fell within the bounds that exist for the final estimates, due to the fact that these estimates themselves are random variables that are accompanied by statistical uncertainty. Generally, this was the case.

The paper also compares the revisions of the Canadian quarterly labour productivity estimates with those for the same statistic produced by the United States. The mean revision for the United States between the first and final estimate was also not significantly different from zero but at 0.04 was slightly larger than that for Canada's mean revision of -0.02. On the other hand, the U.S. mean absolute revision over the same period (0.27) was smaller than for Canada (0.43). The latter difference stemmed not from revisions to GDP but from revisions to hours worked.

Appendix 1 Description of OECD statistical indicators for revisions analysis

Revisions indicator	**Description**
Later estimate	L_t
Preliminary (earlier) estimate	P_t
Mean revision	$\bar{R} = \frac{1}{n}\sum_{t=1}^{n}\left(L_t - P_t^h\right) = \frac{1}{n}\sum_{t=1}^{n} R_t$
Mean absolute revision	$MAR = \frac{1}{n}\sum_{t=1}^{n}\left\|L_t - P_t\right\| = \frac{1}{n}\sum_{t=1}^{n}\left\|R_t\right\|$
Relative mean absolute revision	$RMAR = \frac{\sum_{t=1}^{n}\left\|L_t - P_t\right\|}{\sum_{t=1}^{n}\left\|L_t\right\|} = \frac{\sum_{t=1}^{n}\left\|R_t\right\|}{\sum_{t=1}^{n}\left\|L_t\right\|}$
Mean squared revision	$MSR = \frac{1}{n}\sum_{t=1}^{n}\left(L_t - P_t\right)^2 = \frac{1}{n}\sum_{t=1}^{n}\left(R_t\right)^2$
Adjusted t-statistic	$t = \frac{\bar{R}}{\sqrt{\mathrm{var}(\bar{R})}} = \frac{\bar{R}}{st.dev.(\bar{R}) - HAC\_formula} = \frac{\bar{R}}{\sqrt{\frac{1}{n(n-1)}\left\{\sum_{t=1}^{n}\left(R_t - \bar{R}\right)^2 + \frac{3}{4}\sum_{t=2}^{n}\left(R_t - \bar{R}\right)\left(R_{t-1} - \bar{R}\right) + \frac{2}{3}\sum_{t=3}^{n}\left(R_t - \bar{R}\right)\left(R_{t-2} - \bar{R}\right)\right\}}}$ Mean revision divided by standard deviation of mean revision adjusted for heteroskedasticity and autocorrelation.
Range	Max Revision – Min Revision (value of the highest revision – value of the lowest revision).
% Later > Earlier	The percentage of observations where the later estimate is larger than the earlier estimate, i.e., revision is greater than zero.
% Sign (later) = Sign (earlier)	The percentage of observations where the sign of later estimate and the sign of earlier estimate are the same.

Sources: Statistics Canada, Micro-economic Analysis Division; Organisation for Economic Co-operation and Development.

Appendix 2 Decomposition of mean squared revision

The following is an excerpt from Di Fonzo (2005, p. 18–19).

"For unbiased preliminary estimates (that is, $E(R_t)=0$, t=1,….*n*, where the symbol $E(\cdot)$ denotes the expected value), *MSR* is the variance of the revision. Taking the square root gives the Root Mean Squared Revision (RMSR), which is a suitable measure of accuracy when using a quadratic loss function. The disadvantages of *RMSR* are that (i) while it has a minimum value of zero, it is unbounded and that (ii) it is unrelated to the variation in the latest estimate. Theil (1966) proposed an inequality coefficient (*U*) defined as the positive square root of

$$U^2 = \frac{MSR}{\sum_{t=1}^{n} L_t^2 \Big/ n} ,$$

which takes account of the variation in the most recent series. It has the value one when all the latest figures are zero, which is an interesting property if the index is used on growth rates. For, a value of *U* between zero and one indicates that the early estimates of growth rate are an improvement over a no-change estimate, while larger values imply poor preliminary estimates. Theil (1961) proposed two alternative decomposition of *MSR* and, following Granger and Newbold (1973), we consider the following:

$$MSR = \bar{R}^2 + \left(S_P - \rho S_L\right)^2 + \left(1-\rho^2\right) S_L^2 ,$$

where $\bar{R}$ is the mean revision, S_L and S_P are the standard deviations of the latest and preliminary estimates, respectively, and ρ is their correlation. Dividing throughout by *MSR* gives

$$1 = UM + UR + UD$$

where

$$UM = \frac{\bar{R}^2}{MSR}; \quad UR = \frac{\left(S_P - \rho S_L\right)^2}{MSR}; \quad UD = \frac{\left(1-\rho^2\right) S_L^2}{MSR}$$

"The interpretation of these is helped by consideration of the regression model in which the latest estimate is linked to the preliminary estimate as

$$L_t = \alpha + \beta P_t + u_t , \qquad (1)$$

for which the least squares estimators are $\hat{\beta} = \frac{S_{LP}}{S_P^2}$ and $\hat{\alpha} = \bar{L} - \bar{\beta}\hat{P}$, where S_{LP} is the covariance between L_t and P_t. If the preliminary estimates are unbiased, $\alpha = 0$ and $\beta = 1$, so that $\bar{R}$, and hence *UM*, is zero. That is, *UM* gives the proportion of *MSR* due to systematic differences between the preliminary and the latest estimates. For *UR* we note that $S_P - \rho S_L = S_L(1-\hat{\beta})$, so that *UR* is the proportion of *MSR* due to the slope coefficient in (1) differing from one. Finally, if (1) gave a perfect fit, then *UD* would be zero, so *UD* can be interpreted as the disturbance proportion of *MSR* or that part of the observed revision which is not explained by the mean or slope error. 'Good' preliminary estimates will have low values of *UM* and *UR* and a high value of *UD*...."

Appendix 3 Formulas for the various measures of growth rates of quarterly labour productivity index for Canada

1. % change from previous quarter (QoQ):

$$\left(\frac{QLPI_t - QLPI_{t-1}}{QLPI_{t-1}}\right)*100$$

Where:

$QLPI_t$ = Quarterly Labour Productivity Index at quarter *t*.

$QLPI_{t-1}$ = Quarterly Labour Productivity Index one quarter earlier at *t*-1.

2. % change from same quarter one year ago (AQoY):

$$\left(\frac{QLPI_t - QLPI_{t-4}}{QLPI_{t-4}}\right)*100$$

Where:

$QLPI_t$ = Quarterly Labour Productivity Index at quarter *t*.

$QLPI_{t-4}$ = Quarterly Labour Productivity Index 4 quarters (1 year) earlier at *t*-4.

3. % change from previous quarter at annualized rate (AQoQ):

$$\left[\left(\frac{QLPI_t}{QLPI_{t-1}}\right)^4 - 1\right]*100$$

Where:

$QLPI_t$ = Quarterly Labour Productivity Index at quarter *t*.

$QLPI_{t-1}$ = Quarterly Labour Productivity Index one quarter earlier.

4. % change from previous year (AYoY):

$$\left(\frac{ALPI_t - ALPI_{t-1}}{ALPI_{t-1}}\right)*100$$

Where:

$ALPI_t$ = Annual Labour Productivity Index at year *t*, defined as the average of the quarterly growth rates for year *t*.

$ALPI_{t-1}$ = Annual Labour Productivity Index one year earlier at *t*-1, defined as the average of the quarterly growth rates for year *t*-1.

Appendix 4 Summary statistics of revisions analysis for quarter-on-previous-quarter labour productivity estimates for Canada and the United States

Table 9
Labour productivity (QoQ[1] growth rate measures), revisions analysis, Canada, 2001Q1 to 2004Q3[2]

Summary statistics	1-quarter horizon (Q2[3]-Q1[4])	5-quarter horizon (Y1[5]-Q1)	1-year horizon (Y1-Q2)	2-year horizon (Y2[6]-Q1)	Consecutive 1-year horizon (Y2-Y1)
Number of observations	15	15	15	15	15
Mean absolute revision	0.19	0.39	0.27	0.43	0.33
Mean revision (Rbar)	-0.01	-0.04	-0.02	-0.02	0.02
St. dev (Rbar) - HAC formula	0.05	0.10	0.10	0.12	0.09
Mean squared revision	0.06	0.23	0.15	0.27	0.19
Relative mean absolute revision	0.61	0.97	0.67	0.88	0.67
t-stat	-0.26	-0.36	-0.24	-0.16	0.18
t-critical value	2.14	2.14	2.14	2.14	2.14
Is mean revision significant?	NO	NO	NO	NO	NO
Correlation between L and P	0.85	0.47	0.62	0.48	0.64
Min revision	-0.63	-0.63	-0.54	-1.07	-1.16
Max revision	0.28	1.25	1.07	0.71	0.55
Range	0.91	1.88	1.61	1.78	1.71
% Later > Earlier	53.33	53.33	33.33	46.67	53.33
% Sign (later) = Sign (earlier)	73.33	60.00	80.00	60.00	66.67
Variance of later estimate	0.15	0.22	0.22	0.30	0.30
Variance of earlier estimate	0.22	0.22	0.15	0.22	0.22
UM %	0.28	0.58	0.37	0.14	0.16
UR %	29.32	26.05	6.40	14.52	6.83
UD %	70.39	73.37	88.71	85.34	93.01

1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2004.
3. Estimate published one quarter later.
4. First published estimate.
5. Estimate published one year later.
6. Estimate published two years later.

Note: The summary statistics are explained in Appendixes 1 and 2.
Source: Statistics Canada, Micro-economic Analysis Division.

Table 10
Labour productivity (QoQ[1] growth rate measures), revisions analysis, United States, 2001Q1 to 2004Q3[2]

Summary statistics	1-quarter horizon (Q2[3]-Q1[4])	5-quarter horizon (Y1[5]-Q1)	1-year horizon (Y1-Q2)	2-year horizon (Y2[6]-Q1)	Consecutive 1-year horizon (Y2-Y1)
Number of observations	15	15	15	15	15
Mean absolute revision	0.10	0.25	0.20	0.27	0.20
Mean revision (Rbar)	0.02	0.06	0.04	0.04	-0.02
St. dev (Rbar) - HAC formula	0.03	0.06	0.06	0.08	0.06
Mean squared revision	0.02	0.10	0.08	0.13	0.07
Relative mean absolute revision	0.11	0.27	0.22	0.28	0.21
t-stat	0.90	1.11	0.61	0.53	-0.31
t-critical value	2.14	2.14	2.14	2.14	2.14
Is mean revision significant?	NO	NO	NO	NO	NO
Correlation between L and P	0.98	0.90	0.92	0.88	0.94
Min revision	-0.23	-0.68	-0.68	-0.53	-0.53
Max revision	0.33	0.61	0.53	0.69	0.43
Range	0.56	1.29	1.20	1.22	0.96
% Later > Earlier	53.33	66.67	60.00	46.67	40.00
% Sign (Later) = Sign (Earlier)	93.33	93.33	86.67	93.33	86.67
Variance of later estimate	0.45	0.53	0.53	0.55	0.55
Variance of earlier estimate	0.48	0.48	0.45	0.48	0.53
UM %	2.94	3.81	1.80	1.47	0.59
UR %	7.23	1.34	0.00	1.47	1.71
UD %	89.83	94.85	98.19	97.06	97.70

1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2004.
3. Estimate published one quarter later.
4. First published estimate.
5. Estimate published one year later.
6. Estimate published two years later.

Note: The summary statistics are explained in Appendixes 1 and 2.
Sources: Statistics Canada, Micro-economic Analysis Division; and U.S. Bureau of Labor Statistics.

Appendix 5 Summary statistics of revisions analysis for quarter-on-previous-quarter gross domestic product estimates for Canada and the United States

Table 11
Gross domestic product in business sector (QoQ[1] growth rate measures), revisions analysis, Canada, 2001Q1 to 2004Q3[2]

Summary statistics	1-quarter horizon (Q2[3]-Q1[4])	5-quarter horizon (Y1[5]-Q1)	1-year horizon (Y1-Q2)	2-year horizon (Y2[6]-Q1)	Consecutive 1-year horizon (Y2-Y1)
Number of observations	15	15	15	15	15
Mean absolute revision	0.12	0.16	0.15	0.22	0.18
Mean revision (Rbar)	0.02	-0.02	-0.04	0.05	0.07
St. dev (Rbar) - HAC formula	0.03	0.05	0.06	0.04	0.03
Mean squared revision	0.03	0.04	0.04	0.06	0.04
Relative mean absolute revision	0.15	0.23	0.22	0.27	0.22
t-stat	0.66	-0.40	-0.70	1.08	2.00
t-critical value	2.14	2.14	2.14	2.14	2.14
Is mean revision significant?	NO	NO	NO	NO	NO
Correlation between L and P	0.97	0.95	0.96	0.92	0.95
Min revision	-0.32	-0.34	-0.41	-0.30	-0.31
Max revision	0.34	0.34	0.32	0.58	0.40
Range	0.66	0.68	0.74	0.88	0.71
% Later > Earlier	46.67	53.33	40.00	53.33	60.00
% Sign (later) = Sign (earlier)	100.00	100.00	100.00	100.00	100.00
Variance of later estimate	0.44	0.35	0.35	0.42	0.42
Variance of earlier estimate	0.38	0.38	0.44	0.38	0.35
UM %	1.92	1.13	4.79	3.60	11.05
UR %	2.04	7.26	20.61	0.66	1.02
UD %	96.04	91.60	74.60	95.74	87.92

1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2004.
3. Estimate published one quarter later.
4. First published estimate.
5. Estimate published one year later.
6. Estimate published two years later.

Note: The summary statistics are explained in Appendixes 1 and 2.
Source: Statistics Canada, Micro-economic Analysis Division.

Table 12
Gross domestic product in business sector (QoQ[1] growth rate measures), revisions analysis, United States, 2001Q1 to 2004Q3[2]

Summary statistics	1-quarter horizon (Q2[3]-Q1[4])	5-quarter horizon (Y1[5]-Q1)	1-year horizon (Y1-Q2)	2-year horizon (Y2[6]-Q1)	Consecutive 1-year horizon (Y2-Y1)
Number of observations	15	15	15	15	15
Mean absolute revision	0.06	0.16	0.16	0.25	0.19
Mean revision (Rbar)	0.01	0.05	0.03	-0.05	-0.09
St. dev (Rbar) - HAC formula	0.02	0.04	0.05	0.06	0.03
Mean squared revision	0.01	0.06	0.06	0.08	0.06
Relative mean absolute revision	0.07	0.17	0.17	0.29	0.22
t-stat	0.74	1.09	0.73	-0.74	-2.80
t-critical value	2.14	2.14	2.14	2.14	2.14
Is mean revision significant?	NO	NO	NO	NO	YES
Correlation between L and P	0.99	0.95	0.95	0.93	0.95
Min revision	-0.14	-0.50	-0.57	-0.50	-0.50
Max revision	0.19	0.51	0.44	0.41	0.35
Range	0.34	1.01	1.01	0.91	0.85
% Later > Earlier	53.33	73.33	60.00	40.00	26.67
% Sign (later) = Sign (earlier)	100.00	100.00	100.00	93.33	93.33
Variance of later estimate	0.54	0.52	0.52	0.53	0.53
Variance of earlier estimate	0.51	0.51	0.54	0.51	0.52
UM %	2.20	3.92	2.00	2.77	14.82
UR %	5.52	1.35	4.77	1.77	1.31
UD %	92.28	94.73	93.23	95.46	83.86

1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2004.
3. Estimate published one quarter later.
4. First published estimate.
5. Estimate published one year later.
6. Estimate published two years later.

Note: The summary statistics are explained in Appendixes 1 and 2.
Sources: Statistics Canada, Micro-economic Analysis Division; and U.S Bureau of Labor Statistics.

Appendix 6 Summary statistics of revisions analysis for quarter-on-previous-quarter hours worked estimates for Canada and the United States

Table 13
Hours worked in business sector (QoQ[1] growth rate measures), revisions analysis, Canada, 2001Q1 to 2004Q3[2]

Summary statistics	1-quarter horizon (Q2[3]-Q1[4])	5-quarter horizon (Y1[5]-Q1)	1-year horizon (Y1-Q2)	2-year horizon (Y2[6]-Q1)	Consecutive 1-year horizon (Y2-Y1)
Number of observations	15	15	15	15	15
Mean absolute revision	0.14	0.32	0.29	0.34	0.20
Mean revision (Rbar)	0.06	0.03	-0.02	0.06	0.03
St. dev (Rbar) - HAC formula	0.06	0.10	0.10	0.13	0.08
Mean squared revision	0.08	0.20	0.15	0.19	0.09
Relative mean absolute revision	0.22	0.51	0.45	0.46	0.26
t-stat	1.06	0.34	-0.26	0.50	0.37
t-critical value	2.14	2.14	2.14	2.14	2.14
Is mean revision significant?	NO	NO	NO	NO	NO
Correlation between L and P	0.92	0.79	0.80	0.84	0.93
Min revision	-0.18	-0.89	-0.89	-0.63	-0.73
Max revision	0.89	0.72	0.62	0.98	0.70
Range	1.08	1.60	1.51	1.61	1.42
% Later > Earlier	20.00	66.67	66.67	60.00	53.33
% Sign (later) = Sign (earlier)	86.67	73.33	86.67	80.00	86.67
Variance of later estimate	0.33	0.42	0.42	0.64	0.64
Variance of earlier estimate	0.48	0.48	0.33	0.48	0.42
UM %	4.49	0.61	0.40	2.14	0.93
UR %	35.25	17.67	1.73	0.26	10.48
UD %	60.26	81.71	97.87	97.61	88.59

1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2004.
3. Estimate published one quarter later.
4. First published estimate.
5. Estimate published one year later.
6. Estimate published two years later.

Note: The summary statistics are explained in Appendixes 1 and 2.
Source: Statistics Canada, Micro-economic Analysis Division.

Table 14
Hours worked in business sector (QoQ[1] growth rate measures), revisions analysis, United States, 2001Q1 to 2004Q3[2]

Summary statistics	1-quarter horizon (Q2[3]-Q1[4])	5-quarter horizon (Y1[5]-Q1)	1-year horizon (Y1-Q2)	2-year horizon (Y2[6]-Q1)	Consecutive 1-year horizon (Y2-Y1)
Number of observations	15	15	15	15	15
Mean absolute revision	0.10	0.18	0.09	0.26	0.15
Mean revision (Rbar)	-0.02	-0.04	-0.02	-0.12	-0.08
St. dev (Rbar) - HAC formula	0.03	0.04	0.03	0.07	0.07
Mean squared revision	0.02	0.04	0.03	0.08	0.04
Relative mean absolute revision	0.21	0.42	0.22	0.52	0.30
t-stat	-0.63	-0.96	-0.69	-1.66	-1.16
t-critical value	2.14	2.14	2.14	2.14	2.14
Is mean revision significant?	NO	NO	NO	NO	NO
Correlation between L and P	0.97	0.92	0.95	0.90	0.97
Min revision	-0.25	-0.49	-0.52	-0.50	-0.42
Max revision	0.17	0.26	0.17	0.34	0.17
Range	0.43	0.74	0.69	0.85	0.59
% Later > Earlier	46.67	46.67	53.33	33.33	40.00
% Sign (later) = Sign (earlier)	100.00	93.33	93.33	86.67	86.67
Variance of later estimate	0.26	0.23	0.22	0.35	0.35
Variance of earlier estimate	0.26	0.26	0.26	0.26	0.23
UM %	1.77	3.49	1.72	16.94	16.23
UR %	1.14	12.67	14.01	0.73	26.21
UD %	97.09	83.84	84.30	82.32	57.57

1. Quarter-on-quarter.
2. From the first quarter of 2001 to the third quarter of 2004.
3. Estimate published one quarter later.
4. First published estimate.
5. Estimate published one year later.
6. Estimate published two years later.

Note: The summary statistics are explained in Appendixes 1 and 2.
Sources: Statistics Canada, Micro-economic Analysis Division; and U.S. Bureau of Labor Statistics.

Appendix 7 Vintage revisions for quarter-on-previous-quarter labour productivity estimates for Canada and the United States

Table 15
Labour productivity in business sector (QoQ[1] growth rate measures), vintage revisions,[2] Canada, 2001Q1 to 2006Q3[3]

Q	2001 Q1	2001 Q2	2001 Q3	2001 Q4	2002 Q1	2002 Q2	2002 Q3	2002 Q4	2003 Q1	2003 Q2	2003 Q3	2003 Q4	2004 Q1	2004 Q2	2004 Q3	2004 Q4	2005 Q1	2005 Q2	2005 Q3	2005 Q4	2006 Q1	2006 Q2	2006 Q3
2001 Q1	...	0.0	-0.1	0.8	-0.5	0.0	0.0	0.0	0.2	0.0	-0.1	0.0	0.1	0.0	0.3	0.0	-0.3	0.0	-0.1	0.1	0.0	0.0	0.0
2001 Q2	...	...	-0.1	0.3	0.3	0.0	0.0	0.0	0.2	0.0	-0.7	0.0	0.2	0.0	0.0	0.0	0.2	0.0	-0.1	-0.7	0.0	0.0	0.7
2001 Q3	...	...	...	-0.4	-0.2	0.0	0.0	0.0	-0.2	0.0	0.7	0.0	0.2	0.0	0.0	0.0	-0.5	0.0	-0.1	0.8	0.0	0.0	-1.0
2001 Q4	...	...	...	...	0.3	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.1	0.0	0.0	0.0	-0.2	0.0	-0.2	0.1	0.0	0.0	-0.2
2002 Q1	...	...	...	...	...	0.1	-0.2	0.0	-0.2	0.0	0.0	0.0	-0.1	0.0	0.3	0.0	-0.3	0.0	-0.1	-0.5	0.0	0.0	0.5
2002 Q2	...	...	...	...	...	...	-0.2	-0.1	-0.1	0.0	-0.3	0.0	0.1	0.0	0.1	0.0	-0.4	0.0	-0.1	0.1	-0.3	0.0	0.1
2002 Q3	...	...	...	...	...	...	...	0.1	-0.5	0.0	-0.1	0.0	0.4	0.0	0.0	0.0	0.5	0.0	-0.1	0.1	0.0	0.0	-0.1
2002 Q4	...	...	...	...	...	...	...	...	0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.3	0.0	-0.1	0.1	0.3	0.0	-0.2
2003 Q1	...	...	...	...	...	...	...	...	...	0.2	0.2	0.6	0.3	0.0	-0.5	0.0	-0.2	0.0	0.0	0.1	-0.4	0.0	0.2
2003 Q2	...	...	...	...	...	...	...	...	...	...	-0.2	-0.3	0.0	0.0	0.3	0.0	-0.3	0.0	0.1	0.1	0.0	0.0	0.1
2003 Q3	...	...	...	...	...	...	...	...	...	...	...	-0.6	-0.1	0.0	0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	-0.3
2003 Q4	...	...	...	...	...	...	...	...	...	...	...	...	0.3	0.0	-0.3	0.0	0.0	0.0	-0.2	0.4	-0.1	0.0	0.1
2004 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	-0.2	-0.1	-0.1	0.0	-0.1	0.0	0.4	0.0	0.0
2004 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.1	0.0	0.0	0.0	0.1	-0.9	-0.4	0.0	0.9
2004 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.3	0.1	0.0	-0.1	1.2	0.2	0.0	-0.9
2004 Q4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.4	0.0	-0.2	0.4	0.1	0.0	-0.3
2005 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.2	0.2	0.1	0.4	0.0	-0.1
2005 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.4	-0.2	0.0	0.3
2005 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.1	-0.1	0.0	0.2
2005 Q4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	0.0	-0.2
2006 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	-0.1
2006 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.2
2006 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

… not applicable

1. Quarter-on-quarter.

2. Vintage revisions are defined as $RV_t = LV_t - PV_{t-1}$, or the differences between the consecutive data vintages in real-time data set.

3. From the first quarter of 2001 to the third quarter of 2006.

Notes: Q denotes a quarter. Column captions refer to revisions timing. Row captions represent quarters for which revisions were made.
Source: Statistics Canada, Micro-economic Analysis Division.

Table 16
Labour productivity in business sector (QoQ[1] growth rate measures), vintage revisions,[2] United States, 2001Q1 to 2006Q3[3]

Q	2001 Q1	2001 Q2	2001 Q3	2001 Q4	2002 Q1	2002 Q2	2002 Q3	2002 Q4	2003 Q1	2003 Q2	2003 Q3	2003 Q4	2004 Q1	2004 Q2	2004 Q3	2004 Q4	2005 Q1	2005 Q2	2005 Q3	2005 Q4	2006 Q1	2006 Q2	2006 Q3
2001 Q1	...	0.3	-0.1	0.0	0.0	-0.3	0.0	0.0	0.0	0.3	0.0	0.1	0.0	-0.1	0.0	-0.1	0.1	0.0	0.0	-0.1	0.0	0.0	0.0
2001 Q2	...	...	0.0	0.0	0.0	-0.7	0.0	0.0	0.0	0.4	0.0	0.3	0.0	0.5	0.0	0.2	0.0	0.0	0.0	-0.1	0.0	0.1	0.0
2001 Q3	...	...	...	-0.1	0.0	0.3	0.0	0.0	0.0	0.4	0.0	-0.4	0.0	-0.1	0.0	-0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0
2001 Q4	...	...	...	...	0.1	0.5	0.0	0.0	0.0	0.2	0.0	-0.2	0.0	-0.1	0.0	0.0	-0.2	0.0	0.0	-0.1	0.0	0.0	0.0
2002 Q1	...	...	...	...	...	0.0	0.0	0.0	0.0	0.1	0.0	-0.2	0.0	-0.5	0.0	-0.1	0.1	-0.2	0.0	0.1	0.0	0.0	0.0
2002 Q2	...	...	...	...	...	...	0.1	0.0	0.0	-0.3	0.0	0.2	0.0	0.1	0.0	0.1	0.0	-0.1	0.0	0.1	0.0	0.0	0.0
2002 Q3	...	...	...	...	...	...	...	0.1	0.0	0.1	0.0	-0.2	0.0	0.0	0.0	-0.1	0.1	-0.1	0.0	-0.1	0.0	0.1	0.0
2002 Q4	...	...	...	...	...	...	...	...	0.0	0.3	0.0	0.2	0.0	-0.3	0.0	0.1	-0.1	-0.2	0.0	0.0	0.0	-0.1	0.0
2003 Q1	...	...	...	...	...	...	...	...	...	0.0	0.0	0.2	0.0	0.2	0.0	0.1	-0.2	-0.1	0.0	0.2	0.0	-0.1	0.0
2003 Q2	...	...	...	...	...	...	...	...	...	...	0.0	-0.1	0.0	0.2	0.0	-0.1	0.2	-0.2	0.0	0.0	0.0	-0.1	0.0
2003 Q3	...	...	...	...	...	...	...	...	...	...	...	0.0	0.0	-0.1	0.0	-0.1	-0.1	0.2	0.0	0.0	0.0	0.2	0.0
2003 Q4	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	0.2	0.0	-0.1	-0.1	-0.4	0.0	-0.1	0.0	-0.4	0.0
2004 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.2	0.0	0.0	0.0	-0.1	0.0	0.1	0.0	-0.1	0.0
2004 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.3	0.1	0.1	0.0	0.0	0.1	0.0	0.2	0.0
2004 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	-0.1	0.0	0.0	0.0	0.0	-0.2	0.0
2004 Q4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	-0.2	0.0	-0.1	0.0	-0.3	0.0
2005 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.2	0.0	0.1	0.0	-0.1	0.0
2005 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.1	0.0	0.0	0.0
2005 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	0.0	0.0	0.0
2005 Q4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.1	0.0
2006 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.1	0.0
2006 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1
2006 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

… not applicable

1. Quarter-on-quarter.

2. Vintage revisions are defined as $RV_t = LV_t - PV_{t-1}$, or the differences between the consecutive data vintages in real-time data set.

3. From the first quarter of 2001 to the third quarter of 2006.

Notes: Q denotes a quarter. Column captions refer to revisions timing. Row captions represent quarters for which revisions were made.
Sources: Statistics Canada, Micro-economic Analysis Division; and U.S. Bureau of Labor Statistics.

Appendix 8 Vintage revisions for quarter-on-previous-quarter gross domestic product business sector estimates for Canada and the United States

Table 17
Gross domestic product in business sector (QoQ[1] growth rate measures), vintage revisions,[2] Canada, 2001Q1 to 2006Q3[3]

Q	2001 Q1	2001 Q2	2001 Q3	2001 Q4	2002 Q1	2002 Q2	2002 Q3	2002 Q4	2003 Q1	2003 Q2	2003 Q3	2003 Q4	2004 Q1	2004 Q2	2004 Q3	2004 Q4	2005 Q1	2005 Q2	2005 Q3	2005 Q4	2006 Q1	2006 Q2	2006 Q3
2001 Q1	...	0.0	-0.1	0.0	-0.3	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001 Q2	...	...	-0.1	0.1	-0.3	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
2001 Q3	...	...	...	0.0	0.1	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
2001 Q4	...	...	...	...	0.3	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0
2002 Q1	...	...	...	...	...	0.1	-0.2	0.2	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	-0.1	0.0	0.0
2002 Q2	...	...	...	...	...	...	-0.1	-0.1	-0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	-0.2	0.0	0.0
2002 Q3	...	...	...	...	...	...	...	0.2	-0.4	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0
2002 Q4	...	...	...	...	...	...	...	...	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0
2003 Q1	...	...	...	...	...	...	...	...	...	0.1	-0.2	0.4	-0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	-0.4	0.0	0.0
2003 Q2	...	...	...	...	...	...	...	...	...	...	-0.3	0.2	0.1	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0
2003 Q3	...	...	...	...	...	...	...	...	...	...	...	0.2	-0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
2003 Q4	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	-0.1	0.0	0.0
2004 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.2	-0.2	0.2	0.0	0.0	0.0	0.0	0.4	0.0	0.0
2004 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	0.2	-0.1	0.0	0.0	0.0	-0.3	0.0	0.0
2004 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0
2004 Q4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.2	0.0	0.0	0.0	0.0	0.0	0.0
2005 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	0.1	0.0	0.2	0.0	0.0
2005 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.0	0.0	0.0	0.0
2005 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	-0.1	0.0	0.0
2005 Q4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	0.0	0.0
2006 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	0.1
2006 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.1
2006 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

… not applicable

1. Quarter-on-quarter.

2. Vintage revisions are defined as $RV_t = LV_t - PV_{t-1}$, or the differences between the consecutive data vintages in real-time data set.

3. From the first quarter of 2001 to the third quarter of 2006.

Notes: Q denotes a quarter. Column captions refer to revisions timing. Row captions represent quarters for which revisions were made.
Source: Statistics Canada, Micro-economic Analysis Division.

Table 18
Gross domestic product in business sector (QoQ[1] growth rate measures), vintage revisions,[2] United States, 2001Q1 to 2006Q3[3]

Q	2001 Q1	2001 Q2	2001 Q3	2001 Q4	2002 Q1	2002 Q2	2002 Q3	2002 Q4	2003 Q1	2003 Q2	2003 Q3	2003 Q4	2004 Q1	2004 Q2	2004 Q3	2004 Q4	2005 Q1	2005 Q2	2005 Q3	2005 Q4	2006 Q1	2006 Q2	2006 Q3
2001 Q1	...	0.0	0.0	0.0	0.0	-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001 Q2	...	...	0.1	0.0	0.0	-0.6	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001 Q3	...	...	...	-0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001 Q4	...	...	...	...	0.1	0.4	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002 Q1	...	...	...	...	...	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0
2002 Q2	...	...	...	...	...	...	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002 Q3	...	...	...	...	...	...	...	0.0	0.1	0.0	0.0	-0.3	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
2002 Q4	...	...	...	...	...	...	...	...	0.0	0.0	0.0	-0.1	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
2003 Q1	...	...	...	...	...	...	...	...	...	-0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0
2003 Q2	...	...	...	...	...	...	...	...	...	...	0.1	-0.1	0.0	0.3	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0
2003 Q3	...	...	...	...	...	...	...	...	...	...	...	0.1	0.0	-0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.0
2003 Q4	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.1	0.0	0.0	0.0	-0.3	0.0	0.0	0.0	-0.4	0.0
2004 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0
2004 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
2004 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	0.0
2004 Q4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.1	-0.2	0.0	0.0	0.0	-0.3	0.0
2005 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.1	0.0	0.0	0.0	-0.1	0.0
2005 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.0	0.0	0.1	0.0
2005 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	0.0	0.0	0.0
2005 Q4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.1	0.0	0.0
2006 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.1	0.0
2006 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1
2006 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

… not applicable

1. Quarter-on-quarter.

2. Vintage revisions are defined as $RV_t = LV_t - PV_{t-1}$, or the differences between the consecutive data vintages in real-time data set.

3. From the first quarter of 2001 to the third quarter of 2006.

Notes: Q denotes a quarter. Column captions refer to revisions timing. Row captions represent quarters for which revisions were made.
Sources: Statistics Canada, Micro-economic Analysis Division; and U.S. Bureau of Labor Statistics.

Appendix 9 Vintage revisions for quarter-on-previous-quarter hours worked estimates for Canada and the United States

Table 19
Hours worked in business sector (QoQ[1] growth rate measures), vintage revisions,[2] Canada, 2001Q1 to 2006Q3[3]

Q	2001 Q1	2001 Q2	2001 Q3	2001 Q4	2002 Q1	2002 Q2	2002 Q3	2002 Q4	2003 Q1	2003 Q2	2003 Q3	2003 Q4	2004 Q1	2004 Q2	2004 Q3	2004 Q4	2005 Q1	2005 Q2	2005 Q3	2005 Q4	2006 Q1	2006 Q2	2006 Q3
2001 Q1	...	0.0	0.0	-0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	-0.3	0.0	0.3	0.0	0.2	-0.2	0.0	0.0	0.1
2001 Q2	...	...	0.0	-0.2	-0.4	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.7	0.0	0.0	-0.7
2001 Q3	...	...	...	0.5	0.2	0.0	0.0	0.0	0.0	0.0	-0.7	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.1	-0.7	0.0	0.0	0.9
2001 Q4	...	...	...	...	0.1	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.2	0.0	0.0	0.3
2002 Q1	...	...	...	...	...	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	-0.3	0.0	-0.1	0.0	0.1	0.6	0.0	0.0	-0.6
2002 Q2	...	...	...	...	...	...	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	-0.2	0.0	0.0	0.0
2002 Q3	...	...	...	...	...	...	...	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	-0.5	0.0	0.1	-0.1	0.0	0.0	0.1
2002 Q4	...	...	...	...	...	...	...	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.1	-0.2	0.0	0.0	0.2
2003 Q1	...	...	...	...	...	...	...	...	...	0.0	-0.4	-0.3	-0.3	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
2003 Q2	...	...	...	...	...	...	...	...	...	...	-0.2	0.5	0.1	0.0	-0.2	0.0	0.1	0.0	-0.1	-0.1	0.0	0.0	-0.1
2003 Q3	...	...	...	...	...	...	...	...	...	...	...	0.9	0.0	0.0	-0.2	0.0	0.2	0.0	0.1	0.1	0.0	0.0	0.2
2003 Q4	...	...	...	...	...	...	...	...	...	...	...	...	-0.2	0.0	0.2	0.0	0.3	0.0	0.2	-0.4	0.0	0.0	-0.1
2004 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	0.1	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0
2004 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	0.1	0.0	0.0	-0.1	0.8	0.0	0.0	-0.8
2004 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	-0.1	0.0	0.2	-1.1	0.0	0.0	0.9
2004 Q4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.2	0.0	0.1	-0.3	0.0	0.0	0.2
2005 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.2	-0.1	-0.2	0.0	0.0	0.0
2005 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	-0.3	0.0	0.0	-0.2
2005 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.2	0.0	0.0	-0.1
2005 Q4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.0	0.1
2006 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.1
2006 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1
2006 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

… not applicable

1. Quarter-on-quarter.

2. Vintage revisions are defined as $RV_t = LV_t - PV_{t-1}$, or the differences between the consecutive data vintages in real-time data set.

3. From the first quarter of 2001 to the third quarter of 2006.

Notes: Q denotes a quarter. Column captions refer to revisions timing. Row captions represent quarters for which revisions were made.
Source: Statistics Canada, Micro-economic Analysis Division.

Table 20
Hours worked in business sector (QoQ[1] growth rate measures), vintage revisions,[2] United States, 2001Q1 to 2006Q3[3]

Q	2001 Q1	2001 Q2	2001 Q3	2001 Q4	2002 Q1	2002 Q2	2002 Q3	2002 Q4	2003 Q1	2003 Q2	2003 Q3	2003 Q4	2004 Q1	2004 Q2	2004 Q3	2004 Q4	2005 Q1	2005 Q2	2005 Q3	2005 Q4	2006 Q1	2006 Q2	2006 Q3
2001 Q1	...	-0.3	0.0	0.0	0.0	-0.3	0.0	0.0	0.0	-0.2	0.0	-0.1	0.0	0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001 Q2	...	...	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001 Q3	...	...	...	0.0	0.0	0.1	0.0	0.0	0.0	-0.3	0.0	0.0	0.0	-0.1	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
2001 Q4	...	...	...	...	0.0	0.0	0.0	0.0	0.0	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	-0.1	0.0
2002 Q1	...	...	...	...	...	-0.2	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0
2002 Q2	...	...	...	...	...	...	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.1	0.0	0.0	-0.1	0.0	0.0	0.1	0.0	-0.1	0.0
2002 Q3	...	...	...	...	...	...	...	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
2002 Q4	...	...	...	...	...	...	...	...	0.0	-0.3	0.0	-0.2	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0
2003 Q1	...	...	...	...	...	...	...	...	...	-0.2	0.0	0.0	0.0	0.0	0.0	-0.2	0.3	0.0	0.0	-0.2	0.0	-0.1	0.0
2003 Q2	...	...	...	...	...	...	...	...	...	...	0.1	-0.2	0.0	0.3	0.0	0.1	-0.2	0.0	0.0	-0.1	0.0	0.1	0.0
2003 Q3	...	...	...	...	...	...	...	...	...	...	...	0.1	0.0	-0.3	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
2003 Q4	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2004 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	0.2	0.0	-0.1	0.1	0.0	0.0	0.0	0.0	-0.1	0.0
2004 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.2	0.0	-0.2	0.1	0.0	-0.1	0.0	0.0	0.0
2004 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2004 Q4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.1	0.0	0.0	0.1	0.0	0.0	0.0
2005 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.0	-0.2	0.0	0.1	0.0
2005 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	-0.1	0.0	0.1	0.0
2005 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.1	0.0	-0.1	0.0
2005 Q4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0	0.0	0.0
2006 Q1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	-0.1	0.0
2006 Q2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.0
2006 Q3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

… not applicable

1. Quarter-on-quarter.

2. Vintage revisions are defined as $RV_t = LV_t - PV_{t-1}$, or the differences between the consecutive data vintages in real-time data set.

3. From the first quarter of 2001 to the third quarter of 2006.

Notes: Q denotes a quarter. Column captions refer to revisions timing. Row captions represent quarters for which revisions were made.
Sources: Statistics Canada, Micro-economic Analysis Division; and U.S Bureau of Labor Statistics.

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