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Research Technical Paper

An Examination of Data Revisions in the Quarterly National Accounts

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Abstract

The paper presents a real time database of economic time series for Ireland. The database contains a record of what was considered official data at each point in time. The database is used to describe the properties of data revisions to the growth rates of GDP and its expenditure components in the Quarterly National Accounts. The revisions, although significant in an absolute sense, are small relative to average growth over the sample by international standards. Nonetheless, using the methodology of Mankiw et al (1984), it is found that initial estimates of GDP growth are not rational forecasts of final GDP growth. This means that there is a predictable element to the revisions. A number of rational forecasts of GDP growth are constructed using various forecasting regressions. It is found that forecasts of GDP growth estimated using the initial announcement and a measure of stock prices are more accurate reflections of true GDP growth than the initial announcements.

1 Introduction

National statistical agencies are the main providers of the data used in economic analysis. In Ireland, every quarter sees the release of new data on Gross Domestic Product (GDP) and its various expenditure components from the Central Statistics Office (CSO) in the Quarterly National Accounts (QNA). The latest QNA figures obviously relate to a recent quarter and are necessarily provisional. As more data become available over time, the CSO can calculate a more accurate estimate of that specific quarter's GDP. Thus, the numbers first published are subject to revision in subsequent quarters and, in practice, several revisions often taken place.

Data revisions have important implications for such seemingly diverse activities as economic forecasting and historical economic analysis. The implications of data revisions for forecasting are probably more obvious - how can you construct a forecast of GDP for tomorrow if you can't rely on today's figure? Assessing forecasting accuracy is also hindered if data observations held back for pseudo out-of-sample tests are subject to revision. Although slightly less obvious, it is clear that the analysis of historical economic decisions is also affected by data revisions. An economist examining the current version of historical data might argue that interest rates were increased in error ten years ago given the state of the economy at the time. However, the current version of the data might differ considerably to the data that was available when that decision was being made. The monetary policy pursued may have been appropriate given the perception of the economy based on the data available at the time. In this manner, the analysis of economic history can also be affected by data revisions. Orphanides (2001) provides evidence of these effects using a US real time database.

A real-time database is necessary to analyse the properties of data revisions. This is a record of what data were available at each point in time - it provides a snapshot of official data for every period. The data for a specific month or quarter is called a vintage. Vintages are defined according to when the data were released. The data for the January 2005 vintage relates to data that was released by January 2005 although the dataset for this vintage might only contain data up to November 2004 due to reporting lags. This paper outlines the construction of a real-time database for Ireland and uses it to analyse the properties of data revisions in the QNA. It is found that revisions to GDP growth rates have a predictable element.

2 Source of Data Revisions

Data revisions can be traced to two distinct sources. The most common type of data revision is due to additional economic information becoming available over time. The second type of revision results from changes in the methodology used to compile the data. This can include changes of base year, definitional changes for variables and the use of new weighting systems. The first type of data revision is usually termed an “informative” revision in the literature because it incorporates additional economic information. In contrast, the second type of revision is termed an “uninformative” revision. Informative revisions receive more attention than uninformative revisions on the basis that there might some predictable element to informative revisions.

In compiling the QNA, the CSO conduct a number of quarterly and monthly surveys. The Monthly Production Inquiry, which is used to construct the Industrial Production Index, and the Quarterly Accounts Inquiry to Industry are two of the main sources of information used to inform estimates of the main economic variables for industry and manufacturing. The Retail Sales Index and the Quarterly Accounts Inquiry to Service Enterprises provide analogous information on the services side of the economy. Revisions to the national accounts are partially explained by the late return of these survey forms to the CSO. As this information is incorporated in the latest estimates, the figures are revised slightly. Information coming in over the course of the year from other relevant sources and surveys also lead to further revisions.

In addition to these monthly and quarterly surveys, the CSO also undertake larger annual surveys. The industrial sectors of the economy are gauged using the Census of Industrial Production whereas the services sectors are appraised using the Annual Services Inquiry. These surveys are broader in scope than the quarterly and monthly surveys, both in terms of the size of the sample of firms surveyed and in terms of the number of variables collected. There are considerable reporting lags associated with these surveys. However, when the results of these surveys become available the quarterly estimates are revised. The QNA are also revised to ensure consistency with the Balance of Payments and other Trade data, which also rely on a multitude of quarterly and annual surveys. For these reasons, revisions can apply to data for a number of past years.

There is a specific pattern to GDP revisions. Each standard release of the QNA contains revisions to the data for the current year. This means that revisions are generally limited to the three most recent quarters. Once per year, and usually in July, the CSO publish an annual release on the National Income and Expenditure (NIE) Accounts on the same day as one of the QNA releases. This QNA release contains revisions to GDP and its components for several years into the past, as the quarterly figures are amended to reconcile with the new annual estimates in the NIE publication. Thus, on average, only one quarterly release per year contains revisions stretching back more than a few quarters. The revisions to the quarterly data from this annual realignment can stretch back five to six years.

In most countries, the first estimate of GDP for a given quarter is released a fixed amount of days after the end of that quarter. For example, the United States releases initial estimates of GDP 30 days after the end of the quarter. The average is 56 days across the G-7 as a whole. The users of data often request that data are released in as short a time frame as possible but there is an inevitable trade-off between timeliness and accuracy that cannot be avoided. In Ireland, there is not a fixed amount of days after which initial GDP estimates are released. Since the first QNA publication, the preliminary estimate of GDP has been released 147.5 days following the end of the quarter on average. The release has become significantly more timely, however, as the CSO has continued to streamline the collection, calculation and dissemination process. For seven of the last nine quarters, the preliminary GDP figure has related to a quarter that had ended less than a hundred days earlier. As such, it's fair to say that the initial GDP estimate is usually released sometime around the end of the following quarter. Based on a cursory examination of the real-time data from other countries, it would appear that the initial estimate of GDP in Ireland compares favourably with other national statistical agencies in terms of accuracy.

3 Constructing the Database

The first step in constructing a real-time database is deciding whether the database should be monthly or quarterly. Any real-time database will include both monthly and quarterly data. If a quarterly database is constructed, the monthly data is compacted. This results in some information being lost. If a monthly database is constructed, there will be no additional quarterly information in eight months of the year. Once the database has been constructed for a given data frequency, it is a fairly trivial exercise to construct a second version for another data frequency once the publication dates are known. For this reason, both monthly and quarterly real-time datasets have been constructed for most variables in the database for Ireland. The analysis of the QNA is based on the quarterly version of the database.

In order to assign data into the various vintages, a cut-off date is needed. The cut-off for monthly data is the last day of the previous month. Suppose the CSO release data on the 14th February 2005. These data are included in the March 2005 vintage of data. On the other hand, if the CSO release data on the 1st March 2005, these numbers do not make it into the March 2005 vintage because they were not available by the last day of the previous month. The cut-off date for quarterly vintages is the middle day of the quarter - February 15th for quarter 1, May 15th for quarter 2, August 15th for quarter 3 and November 15th for quarter 4. Data must be released by these dates for inclusion in the corresponding quarter.

At present, the real-time database contains real indicators, nominal indicators, financial variables and macro balances. A number of variables that are not subject to any revision are included for the sake of completeness and work is continuing to add more variables to the database. Table 1 provides a full list of the variables included in the database. Most of the variables are available in both monthly and quarterly formats. Each variable has its own excel file representing all the different vintages for that variable. These excel files contain basic information about the series including a brief description and the source of the data. The majority of the series included in the database are originally published in either the QNA or the Central Bank Monthly Statistics. The construction mainly involved collecting old statistical releases and recording the variable of interest. This sort of data entry can be quite prone to error. In order to minimise this sort of error, national accounting identities were used to check that GDP components summed to GDP. The entire database is available on request from the author.

4 How Big are Data Revisions?

The first task following the construction of a real-time database is to assess the magnitude of the revisions to the data. I will limit my attention to GDP and its expenditure components for this exercise on the basis that these are the variables that are subject to the largest and most frequent revisions. I also focus on the quarterly version of the database given that these variables are only released on a quarterly basis. For the most part, I will examine how data revisions affect year-on-year growth rates calculated from the data. However, it is interesting to first look at how the revisions affect the actual data values. Figure 1 indicates how official GDP figures for Quarter 1, 1997 have changed over time. The graph relates to the period prior to the introduction of chain linking and the data are not seasonally adjusted.

The number given for GDP in the original release, which corresponds to the first vintage, was 14,585m. In the fourth vintage, the figure for GDP was revised upwards to 14,716m suggesting that GDP for the first quarter of 1997 was initially underestimated by 131m. In subsequent periods, there were four additional revisions so that the final figure prior to the introduction to chain linking was 14,850m. These revisions are represented by discreet jumps of the level of the graph in Figure 1. The final number suggests real GDP was initially underestimated by 265m or 1.8%. Figure 2 provides a similar graph for nominal GDP. The revisions to nominal GDP are of a similar magnitude to the revisions to nominal GDP. In this quarter, it is primarily revisions to nominal GDP that are driving the real revisions. In certain quarter, revisions to the deflator also play an important role.

There are two ways to measure the size of data revisions. The first way is to look at the difference between the current value of a data point and its value when it was originally released. This is normally called the 'final revision' although the term is slightly misleading in the sense that some data may be subject to further revisions in the future. A potential problem with this approach is that the final revision might be small if positive and negative revisions to the data in different vintages have offset each other. To illustrate this point, consider a graph of the revisions to real GDP for the first quarter of 2000. The final revision shown is 96m, suggesting that there have not been large revisions to the data following its initial publication. From Figure 3, however, it is clear that there have been significant revisions but they have largely offset each other. Figure 4 also demonstrates that this is a quarter for which deflator revisions played an important role. The large revision in the deflator in the fourth vintage meant that a large revision to nominal GDP did not result in a large revision to real GDP.

A second approach is to look at revisions at a number of specific time horizons. This will give a picture of how revisions are changing over time and how frequently revisions take place. However, this will not necessarily solve the problem of offsetting revisions. To counter this problem, it is possible to look at the difference between data points in successive releases or vintages and calculate the absolute cumulative change. This statistic will not be affected by offsetting revisions because it is based on absolute values. In remainder of this paper, I look at how the growth rates of GDP and its components are revised. Both approaches to measuring revisions are examined for GDP growth. Only statistics on the final revision are reported for its expenditure components.

5 Growth Rate Revisions

5.1 GDP Growth Rate Revisions

The revisions to the growth rates of variables are often of more interest than revisions to the levels. This is chiefly because GDP and its components are most often reported in the media in terms of growth rates rather than levels. In addition, policy-makers are generally more interested in growth rates rather than levels. Another consideration in terms of data revisions is that revisions to the levels are likely to grow over time simply because GDP itself is growing over time. This could lead someone to believe that the problem was getting worse unless he considered the revision as a percentage of the original GDP figure.

Table 2 presents a number of statistics that shed light on the properties of growth rate revisions. The revisions to the growth rate are considered at specific time horizons. The first row of the table refers to revisions at the one quarter horizon. This is calculated for every vintage. It gives an indication of how the growth rate of GDP is likely to be revised in the quarter following its initial publication. Similar statistics are provided for other horizons in the next rows of the table. Finally, the same statistics are produced for the final revision in the last row.

The first statistic reported is the frequency of revisions. At 0.95 for a 1 Quarter horizon, this indicates that the growth rate of GDP is revised in the quarter following its initial release 95% of the time. Similarly, the second row of the table indicates that GDP is revised two quarters following its release 73% of the time. This statistic can be thought of as a crude estimate of the probability of a revision at a given time horizon. One would expect revisions to become less frequent over longer time horizons. This is confirmed by the first column in the table. The frequency of revisions declines as the time horizons considered increase. The last row indicates that all GDP growth rates considered were revised at some point in time. It can be seen that if we ignore the final revision, the frequency statistic tends towards 0.25 as the time horizon increases. This is due to the pattern of revisions mentioned earlier, with only one set of revisions per year stretching back more than a few quarters. The frequency statistic can be expected to tend towards zero at very long time horizons.

The second statistic reported is the average revision. At 0.178% for a 1 Quarter Horizon, this indicates that GDP growth was revised upwards by an average of 0.178% in the quarter following its initial release. The average revision is positive for most time horizons. One question often posed in the literature is whether the revisions to GDP growth depend on the position of economy in the business cycle. The Irish economy has experienced a boom over the period concerned and growth revisions have been positive, providing prima facia evidence to support the hypothesis. In addition, the magnitude of the final revision is positive. This positive bias is shown to be statistically significant later. This means that GDP growth has been systematically underestimated in the initial release over the period considered. It is still too early to draw definitive conclusions on this issue for Ireland, however, as we have yet to see how revisions behave when the economy is in recession. The economy did experience a slight slowdown in 2001 but there is not a higher incidence of negative revisions over this period.

The table also reports the Mean Absolute Revision (MAR). The average revision is a useful statistic but, in taking an average, positive and negative revisions tend to offset each other and this can mask the real magnitude of the revisions. To counter this problem, the MAR is calculated - this statistic does not offset positive and negative errors when averaging over vintages and is a better indicator of the general size of the revisions. The MAR after one quarter is 0.558%. Taken in conjunction with the frequency statistic for this horizon, one can say that there is a 95% chance that the growth rate for GDP will be revised in the quarter following its release and the average size of the revision is 0.558%.

Although 0.558% appears to be a large revision to a year-on-year growth rate, it has to be taken in the context of average GDP growth over the sample period. Average year-on-year growth in GDP was 7.5% when measured using the last vintage prior to chain linking.

The figure in brackets in the MAR column expresses the MAR as a percentage of this average growth rate. The MAR for the first quarter was 7.4% of average GDP growth. In this context, the first quarter revision is quite small. Looking down the fourth column, it is clear that the revisions to any specific quarter are small relative to average growth but this does not hold true in relation to the cumulative revision or the final revision.

The Mean Absolute Cumulative Revision is 2.23%, which is equivalent to almost 30% of the average growth rate over the sample. Thus, if the sign of the revisions is ignored, the total magnitude of successive revisions between the preliminary and final estimate amounts to 2.23% on average. The Mean Absolute Final Revision is 1.48%, which is equivalent to almost 20% of GDP growth over the sample. Thus, on average, the final figure for GDP growth is roughly 1.5% higher or lower than initially announced. The difference between these two statistics can be taken as a rough estimate of the extent to which there are offsetting revisions to GDP growth between its preliminary announcement and its final value.

The final column in the table reports the range of revisions. This is another measure of uncertainty but it highlights the extreme revisions rather than the average ones. The smallest range of revisions is for the 2 Quarter Horizon while the largest range is for the final revision. The final revision ranged between -3.63% and +3.17%. These extreme values represent large revisions to GDP growth, even when expressed as a fraction of average growth over the period. Thus, on occasion, revisions to GDP growth are large.

5.2 GDP Expenditure Component Growth Rate Revisions

It is clear that data revisions have a significant impact on GDP growth rates. This section briefly examines their influence on the growth rates of the main GDP expenditure components. Table 2 reports a similar set of statistics to Table 1 but there are a couple of small differences. Table 2 only reports statistics based on the final revision so the statistics for the expenditure components are comparable to the statistics in the final row of Table 1 for GDP. In addition, because there are always revisions at some point in the time, the frequency statistic is not reported. It is replaced with a column that reports the average year-on-year growth rates for the individual components.

The first column shows that the growth rates of the GDP components varied considerably over the sample. Recalling that the average growth rate of GDP was 7.5%, it can be seen that consumption growth, both private and public, lagged behind. Investment growth, at 7.9%, was slightly higher than GDP growth. The high growth rates in the tradable sectors are remarkable given that they are average year-on-year figures over an eight-year period.

Concentrating on the revisions, the average revision was positive. It was mentioned that this resulted in a statistically significant positive bias to revisions for GDP growth. The MAR for individual components is generally larger than it is for GDP as a whole, even when expressed as a percentage of the item's growth rate. The MAR for investment was 3.8%, equivalent to 48% of the average growth rate of that component, indicating that initial estimates of investment growth must be treated with caution. At the other end of the scale, initial estimates of personal consumption growth are quite accurate with a MAR corresponding to only 13% of average growth.

The range of revisions for the individual components varies significantly. In addition to having the lowest MAR, personal consumption growth also has the smallest range of revisions. Conversely, gross fixed capital formation had the largest MAR and range of revisions. The larger revisions for gross fixed capital formation can partially be explained by the fact that investment is a more volatile series than consumption. However, it also the case the short-term indicators of consumption are more reliable. Current estimates of consumption are guided by sources such as the retail sales index, quarterly surveys, car sales and trade data. Current estimates of investment are guided by quarterly surveys and data on the imports of machinery and equipment but investment estimates are more reliant on the annual surveys than is the case with consumption.

6 Predicting Revisions

6.1 News versus Noise

Mankiw, Runkle and Shapiro (1986) ask whether revisions are due to either news or noise. The distinction between news and noise hinges on whether the initial GDP announcement is a rational forecast of its true value. The rational forecast has three key properties:

1. The forecast error has mean zero.

2. The forecast error is uncorrelated with all information currently available.

3. The forecast has lower variance than the true value.

Under the noise hypothesis, initial GDP data contain noise in the sense that they are measured with error. Subsequent releases of GDP data aim to minimise this measurement error. The measurement error or revision will depend on the magnitude of GDP growth - higher growth will result in a commensurately larger measurement error. This means that the revision is correlated with the initial announcement. Consequently, the initial GDP announcement is not a rational forecast of its true value because the revision is correlated with information currently available.

Under the news hypothesis, initial GDP data announcements are made using all currently available information in an efficient manner. Subsequent releases of GDP are solely due to the availability of new information. The initial GDP figure is a rational forecast of its true value. In the analysis that follows, the true value of GDP will be the GDP series from 2005Q2 vintage, which contains data until the end of 2004. This has the advantage of being the last vintage prior to the introduction of chain linking so the large unrepresentative revisions that took place due to chain linking do not bias the results. The last few observations in the vintage might have been subject to non-trivial revisions even in the absence of the move to chain linking, which will slightly bias the results, but most of the data can be assumed to be close to their final value.

Regardless of whether the news or the noise hypothesis is true, the preliminary announcement, X_t^p, can be described as equal to the final value, X_t^f, and an error term, ϵ_t.

$$X_t^p = X_t^f + \epsilon_t \tag{1}$$

Under the noise view, ϵ_t is correlated with X_t^p but uncorrelated with X_t^f. In contrast, under the news view, ϵ_t is uncorrelated with X_t^p but correlated with X_t^f. From the equation above, it follows that the revision, R_t is simply the negative of the measurement error.

$$R_t = X_t^f - X_t^p \tag{2}$$

Table 4 presents some basic summary statistics on the preliminary announcement, final value and revisions to year-on-year GDP growth. The variance of the preliminary announcement, which corresponds to the forecast, has a higher variance than the final value. This violates the third property of a rational forecast as set out above. In addition, the revision has a much stronger correlation with the preliminary announcement than with the final value. This violates the second property of a rational forecast. The statistics from Table 2 also shows that the mean revision is non-zero which is in violation of the first property. The non-zero mean indicates a potential bias in the initial announcement which could be exploited to predict revisions. However, a slightly more formal test of bias is required rather than relying solely on an estimate of the sample mean.

6.2 The Mincer-Zarnowitz test

The Mincer-Zarnowitz (1969) test is a simple test of forecast rationality based on the following regression

$$R_t = \alpha + \beta X_t^p + u_t \tag{3}$$

The basic idea is to see if the revision can be forecast using the preliminary announcement. Under the null hypothesis of forecast rationality, the preliminary announcement should be uncorrelated with the revision. Thus, forecast rationality can be tested by testing the joint hypothesis that $\alpha = \beta = 0$. All standard errors are robust to hetroscedasticity and autocorrelation using Newey-West standard errors. Running the regression above yields:

$$\begin{array}{rlcl} R_t = & 0.0217 & + & 0.7326\ X_t^p \\ & (0.0046) & & (0.0727) \end{array} \tag{4}$$

Standard errors are in parentheses. The F-test of the joint hypothesis that the constant and the coefficient are both zero has a marginal significance level of 0.87×10^{-5}. The null of forecast rationality is overwhelmingly rejected meaning that this equation could be used to forecast future revisions and, consequently the final value of GDP growth.

6.3 Augmented Regressions

The Mincer-Zarnowitz test shows that forecast rationality has already been violated to the extent that the preliminary data can be used to forecast revisions but there is no reason to focus only on the preliminary estimate. There might be other variables that have some forecasting power for future revisions. This can be tested by putting additional variables in the regression. In testing this, I limit my attention to variables that are generally not subject to revision in order to keep things simple. Following the lead of Faust et al (2000), I test whether equity prices, oil prices, total employment or interest rates have some predictive power for revisions. These variables are all chosen on the basis that their influence on the business cycle might help predict GDP growth rate revisions.

The results of the augmented regressions are presented in Table 5. Each of the four variables is added to the forecasting regression in turn. The significance level of the null hypothesis that the coefficient is equal to zero is given in parentheses. The first line in the table indicates that oil prices have predictive power at the 10% level in a regression with the preliminary announcement. The current level of employment has similar predictive power. A monthly series of stock prices was constructed as the average value of the ISEQ in each month. As the data are quarterly, the stock price measure in the regression is the average of this series over the previous three months. It has predictive power at the 1% level. Interest rates have no predictive power in the sample. The final regression includes all variables which had predictive power individually at the 10% level. In this regression, only the stock price variable maintains its predictive power. The results of this analysis suggest that recent stock market performance can be used to forecast how GDP growth will be revised.

Faust, Rogers and Wright (2000) point out that past predictability is no guarantee of future predictability because new methods for compiling data are constantly introduced. This warning is particularly apt in the current case because the final value of GDP was taken from the last vintage before the introduction of chain linking. Even if there is still a predictable element to revisions, the new methodology could lead to a structural change in the coefficients in the forecasting regression. The likelihood of this problem is lessened, however, by the use of growth rates rather than levels as methodological changes of this nature tend to influence levels proportionately to their magnitude, thereby minimising the effects on growth rates. An additional concern is that the sample of data relates to a period when the economy was booming. This raises questions as to whether the predictive relationship might break down when a turning point in the business cycle is reached, as revisions might reverse sign in this situation.

7 Summary and Conclusions

Data from the Quarterly National Accounts provide an important measure of the health of the economy. However, due to standard statistical practices, these data are subject to revision. This introduces a certain degree of uncertainty in terms of assessing the current state of the economy and predicting its future performance. The aim of this paper was to provide an idea of the size of data revisions and to see if there was any way that these revisions could be predicted.

The analysis required the construction of a real time database of economic time series for Ireland. The database is used to analyse the properties of revisions to the growth rates of GDP and its expenditure components. The final revision to the growth rate of GDP is found to be 1.48%, which is equivalent to almost 20% of average GDP growth over the sample. The average revision is also positive, indicating that initial announcements of GDP growth are generally too pessimistic. Using a forecast rationality test, it is found that revisions to GDP growth contain a predictable element. The preliminary growth announcement and a stock price variable can be used to forecast final GDP growth. These results are tentative however due to sample constraints so these issues will be worth re-visiting in the future when more information is available.

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Table 1: Variables Included in Real Time Database

Real Indicators	**Nominal Indicators**	**Monetary and Financial Series**
GDP	Nominal GDP	Narrow Money Supply - M1
Personal Consumption	Nominal Personal Consumption	Broad Money Supply - M3
Public Consumption	Nominal Public Consumption	3 Month Interest Rate
Exports	Nominal Exports	10 Year Government Bond Rate
Imports	Nominal Imports	Stock Prices
Capital Formation	Nominal Capital Formation	Current Account Balance
Total Employment	Inflation	Total Loans
Unemployment Rate	Core Inflation	Total Credit
Industrial Production		

Table 2: Revisions to Real GDP Growth Rates

Revisions from 1997Q1 - 2004Q4	**Frequency**	**Average**	**Mean Absolute (relative to growth)**	**Range**
1 Quarter Horizon	0.95	0.178%	0.558% (7.4%)	-0.91% - 2.39%
2 Quarter Horizon	0.73	0.131%	0.221% (2.9%)	-0.44% - 1.02%
3 Quarter Horizon	0.45	0.142%	0.373% (5%)	-1.64% - 2.88%
4 Quarter Horizon	0.27	0.121%	0.39% (5.2%)	-2.29% - 2.95%
8 Quarter Horizon	0.26	-0.067%	0.149% (2%)	-0.90% - 0.77%
Cumulative Revision	n\a	n\a	2.23% (29.7%)	0.34% - 5.03%
Final Revision	1.00	0.268%	1.48% (19.7%)	-3.63% - 3.17%

Table 3: Revisions to GDP Expenditure Component Growth Rates

Revisions from 1997Q1 - 2004Q4	**Average Growth**	**Average Revision**	**Mean Absolute (relative to growth)**	**Range**
Personal Consumption	5.6	0.3	0.7% (13%)	-1.4 %- 1.9%
Public Consumption	6.6	1.4	2.3% (36%)	-6.7 %- 6.7%
Investment	7.9	1.4	3.8% (48%)	-6.4 %- 8.6%
Exports	10.9	1.3	1.9% (18%)	-1.7 %- 6.4%
Imports	10.1	2.1	3.2% (31%)	-5.9 %- 7.8%

Table 4: GDP Growth: Final, Initial and Revision Sample Statistics

	X_t^f	X_t^p	R_t
Mean	7.41	7.15	0.27
Variance	0.0011	0.0016	0.0003
Correlation with			
X_t^f	1.00		
X_t^p	0.89	1.00	
R_t	-0.19	-0.60	1.00

Table 5: **Augmented Regressions, Dependent Variable R_t**

Independent Variable					
Constant	X_t^p	Oil Prices	Equity Prices	Employment	Interest Rates
-0.352	0.287	0.00049			
(0.00039)	(0.00014)	(0.085)			
-0.081	0.209		1.26×10^{-5}		
(1.26×10^{-5})	(0.002)		(0.0014)		
-0.090	0.326			3.77×10^{-5}	
(0.026)	9.48×10^{-5}			(0.084)	
-0.023	0.252				0.0009
(0.0003)	(0.007)				(0.7148)
-0.1202	0.2503	4.16×10^{-5}	1.17×10^{-5}	2.32×10^{-5}	
(0.087)	(0.001)	(0.949)	(0.002)	(0.633)	

Regression tests whether final revision to GDP growth can be forecast using independent variable. Significance levels of zero null are given in parentheses. Significant coefficients indicate variable's ability to forecast final revision.

Figure 1: Revisions to Real GDP for 1997Q1

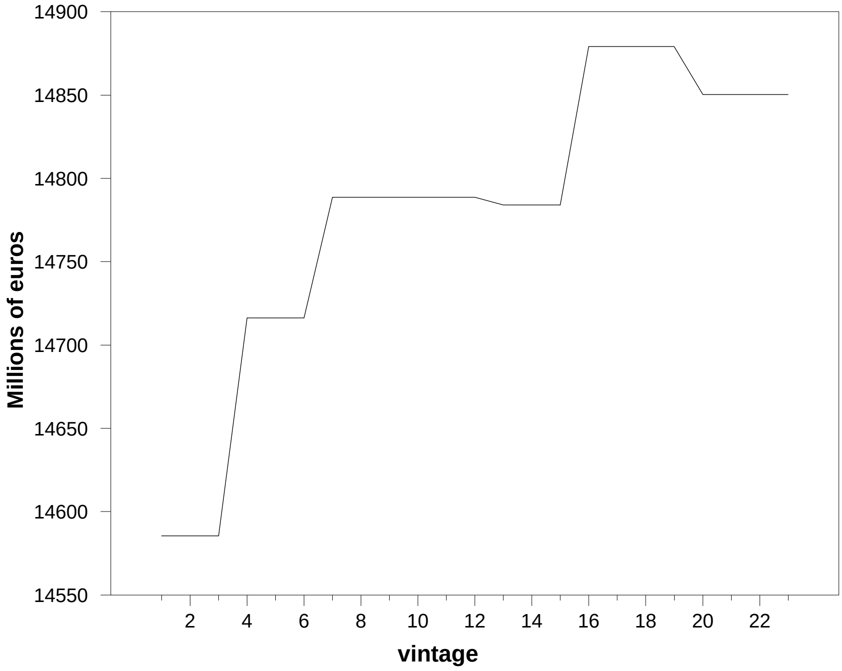

Figure 2: Revisions to Nominal GDP for 1997Q1

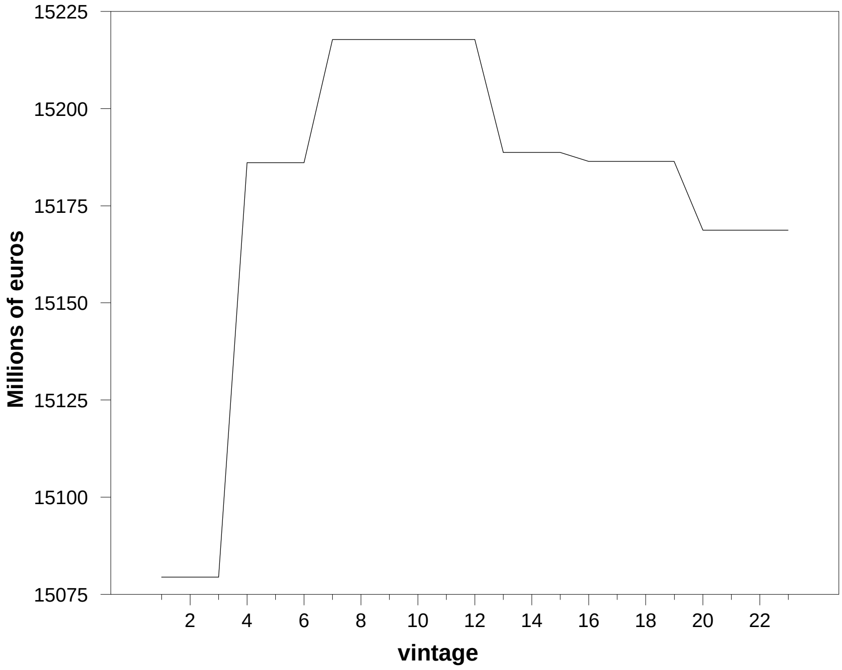

Figure 3: Revisions to Real GDP for 2000Q1

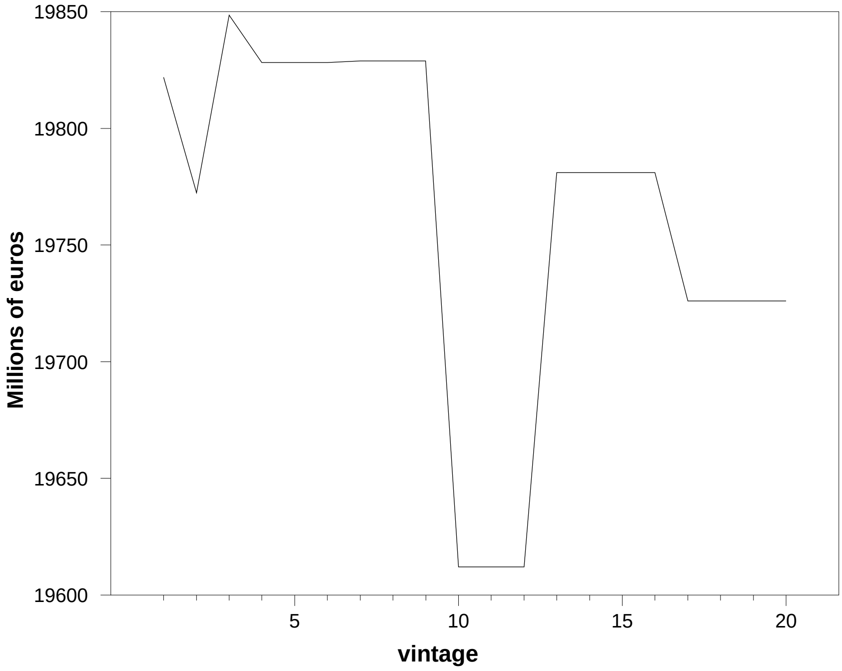

Figure 4: Revisions to Nominal GDP for 2000Q1