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News or Noise? An Analysis of Brazilian GDP Announcements[*]

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Abstract: Revisions to GDP announcements in many countries are often large, and Faust, Rogers, and Wright (2003) have found that G-7 GDP revisions are predictable to varying degrees.   In this paper, we extend FRW to study revisions to Brazilian GDP announcements. We document that revisions to Brazilian GDP are large relative to those of G-7 countries.   Brazilian GDP revisions are also somewhat predictable, which is consistent with the view that GDP revisions correct errors in preliminary GDP rather than reflect news. However, GDP revisions are far from being entirely predictable. Although GDP revisions are largest only one year following the initial GDP release, those revisions are nearly unpredictable.

Keywords: vintage data, preliminary data, final data, revision, GDP, Brazil

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I. Introduction

In late February 2002, the Brazilian Institute for Geography and Statistics, the IBGE, announced that seasonally adjusted real GDP in the fourth quarter of 2001 declined 1.67 percent—about 6.5 percent at an annual rate. However, when GDP growth in first quarter of 2002 was announced following May, GDP growth in fourth quarter of 2001 was revised up to minus 0.13 percent—about minus 0.5 percent at an annual rate. The large upward revision gave a dramatically different picture of how the economy fared in late 2001 and prompted some commentary (Agencia Estado 2002, JP Morgan 2002). Nevertheless, that large revision was not unprecedented and it was not unusual by international standards. Brazilian GDP announcements have undergone even larger revisions. It is also now well documented that GDP announcements can undergo sizeable revisions in many countries.

As the 2002 episode described above suggests, GDP revisions can present complications for policy makers and analysts who hope for timely, but accurate information on the state of the economy. Therefore, concern about the reliability of the data has been one reason why the GDP revision process has been studied in a number of countries.[1] That history is in a sense "rewritten" each time data undergo revisions has also raised other issues. In particular, a number of authors have questioned whether it is appropriate to use data that have undergone revisions when evaluating past economic policies and assessing forecasting performance. They argue that is more appropriate to use "real-time" data—data available to policy makers and the private sector at the time they made their decisions. This argument has been raised convincingly in various contexts: in the assessment of the forecasting properties of the U.S. Composite Index of Leading Indicators (Diebold and Rudebusch 1991); when comparing model-based forecasts of exchange rates (Faust, Rogers, and Wright 2002); and in studies of the U.S. monetary experience (Evans 1998, Orphanides 2001). In each of these studies, the results using only the data available at the time that decisions were made differed dramatically from the results using revised data.

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[1] Revisions to U.S. GDP have been studied extensively (see Mankiw and Shapiro 1986 and Fixler and Grimm 2002). On the UK experience, see Barklem (2000). Oller and Hansson (2002) look at revisions to annual and quarterly nonseasonally adjusted GDP in Sweden and at revisions to annual GDP of other industrialized countries. The authors survey studies on GDP revisions in Australia and the Netherlands.

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As Faust, Rogers, and Wright (2003, hereafter FRW) emphasize, when researchers use revised data for assessments of forecast performance or for *ex post* analysis of policy, they implicitly make an additional assumption that can be lost on the casual reader—they assume that revisions are perfectly anticipated. That is, decision makers are assumed to know that there are systematic inefficiencies in the methods used by data collection agencies to construct GDP announcements and act on that knowledge. Decision makers therefore would have to make adjustments to preliminary GDP and even make adjustments to GDP revisions, at least up to the moment when the time series on GDP is pulled from the statistical agency's database into the researcher's database. The assumptions implicitly made by users of revised data in empirical work seem quite strong, and should be subjected to empirical verification.

FRW do find that GDP revisions in several G-7 countries have been predictable to varying degrees over the period they study, suggesting some inefficiencies, but have not been perfectly predictable. Because it is common for data collection agencies to change their procedures in an effort to improve the quality of the data, however, it is not clear what these results imply about future predictability of revisions. For these two reasons—because GDP revisions are typically less than perfectly predictable and because evidence of predictability from past GDP revisions may not imply future predictability—on balance, there is a strong argument for using real-time data more often in empirical work than has been the case thus far. Real-time datasets are so far available only for the United States (Croushore and Stark 2001) and the United Kingdom (Castle and Ellis 2002).[2]

Although all of the studies cited above pertain to industrialized countries, the same issues confront many users of data from developing countries and transition economies. Because the lack of timely and accurate data is thought to have been one contributor to the 1995 Mexican crisis and to the crises in developing Asia in the late 1990s, interest in the quality of the data in developing countries has grown markedly over the past decade.[3] At the same time, there has been some, but apparently limited attention

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[2] The Castle and Ellis dataset covers only national income accounts while the Croushore and Stark dataset covers a broader set of economic variables.

[3] This interest is demonstrated by the growing number of countries that have elected to participate in the IMF's Special Data Dissemination Standards, which provides a general blueprint for member countries' data collection agencies and contains information on some characteristics of the data. See http://dsbb.imf.org/Applications/web/sddshome/.

in recent years given to the fact that these data also undergo revisions.[4] There have been a growing number of empirical studies of monetary authorities' behavior under inflation targeting regimes (Miskin and Schmidt-Hebbel 2001, Corbo 2002, Caputo 2002, Goldfajn et al 2002, Torres 2002, Clavijo 2003). It is not yet clear how sensitive the results of these studies are to using revised data versus using real-time data.

Thus, in this paper, where we extend FRW to study revisions to Brazilian GDP announcements, we have two main objectives. Our first objective is to determine how large revisions to Brazilian GDP are relative to those of industrialized countries. Our second objective is to shed some light on the question of whether real-time GDP rather than revised GDP should be used in empirical work. The statistical procedures used in this paper, of course, can be applied to study revisions to components of GDP and any other data that undergo revisions.[5]

We investigate whether Brazilian GDP announcements can be characterized as news, noise, or somewhere in between (as in Mankiw and Shapiro op. cit.). Under the news characterization, the data collection agency bases preliminary GDP on all available information; the revisions therefore reflect news. In contrast, under the noise characterization, preliminary GDP is measured with error, and the errors are uncorrelated with the true values. Information available at the time of the GDP announcement, therefore, would be useful in predicting the GDP revision. Forecast rationality tests are employed to distinguish between these two views.

Our data covers 1994Q2 to 2000Q4 (27 quarters). Given our small sample, we allow less time to elapse following the last GDP announcement than do FRW, meaning that the data have had relatively less time to be revised.[6] This, in itself, should weaken the case against forecast rationality, as one might expect that with less time to revise the

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[4] GDP revisions in developing countries did get some attention in the 1970s and 1980s. Glejser and Schavey (1974) characterized annual GDP revisions in 40 countries, about half of which were classified as developing countries; that study was in its preliminary phase. Urdaneta (1974) describes reasons for revisions in Venezuelan national accounts. Meller and Arrau's 1985 paper, which we have not yet seen, study the case of Chile. We have found only two recent papers on data revisions. Van de Eng (1999) explores possible explanations for revisions to Indonesian annual national accounts. Chumacero and Gallego (2001) study the revision process for Chile's Monthly Activity Index (IMACEC).
[5] For example, we have noticed that export and import prices from the Funcex (Fundação Centro de Estudos do Comercio Exterior) undergo sizeable revisions.
[6] In FRW, 2¾-5½ years separated the last GDP announcement in the sample (1997 Q4) from the "final" revision. In this paper, we allow 2 years to elapse after the last GDP announcement.

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data, there would be less variability in the revisions to distinguish between the noise versus news hypotheses. We compare our results with the results that FRW report over their shorter sample period, 1988Q1-1997Q4 (40 quarters). FRW find that revisions to quarterly seasonally adjusted GDP in their ten-year sample have been large for G-7 countries, although not as large as in the larger sample, and are predictable to varying degrees.

We find that revisions to Brazilian GDP are large relative to the G-7 countries and that revisions to quarterly Brazilian GDP are somewhat predictable at time horizons of two or more years. As in FRW, the variable with the most predictive power for revisions is the preliminary release itself, i.e., extreme growth rates tend to be revised toward the mean. The predictability in Brazilian GDP revisions is consistent with the noise view of GDP announcements, but still, GDP revisions are far from being entirely predictable, particularly in the very short run. Although GDP revisions are largest the first year following the initial GDP release, those revisions are nearly unpredictable. Overall, we see these results as reinforcing the case for using real-time data rather than revised data in empirical work.

Below, we provide further motivation for our study. We then provide a descriptive overview of the Brazilian GDP revision process, followed by an assessment of the revisions.

II. Why Do Analysts Focus on Four-Quarter Changes in Brazilian GDP?

Based on our reading of the commentary that typically follow Brazilian GDP announcements, analysts tend to focus on four-quarter changes in GDP and its components rather than on seasonally adjusted quarter-to-quarter changes. Our impression is that analysts do this because they are skeptical about the quality of the seasonally adjusted data.[7] Nevertheless, in our view, this skepticism is all the more reason to focus on the data revision process for seasonally adjusted GDP.

Focusing on four-quarter changes in GDP is one approach to dealing with seasonality, but this focus comes at a cost. Four-quarter changes in GDP can only

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[7] Seasonal adjustment is issue that has been receiving attention at the IBGE; see Palis, Ramos, and Zani (2003).

identify turning points with a delay. Moreover, although many analysts focus on four-quarter changes in GDP, the commentary following GDP announcements suggests that analysts are at least as interested in quarter-to-quarter seasonally adjusted changes. It is not easy to infer from analysts' statements what judgmental adjustments to preliminary seasonally adjusted GDP they have made (implicitly) from the four-quarter changes.[8]

In our view, the focus on four-quarter changes sweeps under the rug the difficult question of what seasonal adjustment works best. It would be more illuminating if analysts applied their preferred seasonal adjustment filter to the GDP announcement and published their adjusted figures. They could even publish the revisions to their previously published seasonally adjusted GDP announcements.[9] Over time—that is, with enough data points—one could use statistical inference methods to evaluate whose seasonal adjustment procedure has worked better.

III. *Brazilian Quarterly Real GDP and Major Revisions: An Overview*

Our data sources are the GDP press releases of the IBGE, beginning with the press release for 1994Q2. The IBGE began to report quarterly real GDP growth (not the level) in 1980, but it no longer has records of press releases prior to 1994Q2. Over the 1994-2000 period, preliminary GDP was released about 45 days following the end of the quarter.

As of the mid-1990s, as a summary of the state of economic activity, the quarterly national accounts had several major shortcomings. The quarterly national accounts, which were compiled on a production basis only, measured only changes in real output rather than the level of output. This is because quarterly real GDP growth was aggregated from components that measured changes in gross output rather than changes

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[8] Attempts to infer quarter-to-quarter changes from four-quarter changes have, at times, generated fairly convoluted commentary, at least as reported in the popular press. Consider, for example, the comment of one analyst following the release of Brazilian GDP and its production components for the first quarter of 2002: "The decline of 3.91 percent in industry in the first quarter from a year earlier is a recovery because in the fourth quarter it fell 4 percent and something. The decline is decelerating, although it will take some time to turn around and show growth." (*Reuters*, May 28, 2002).
[9] For example, the Brazilian Central Bank did its own seasonal adjustment of the industrial production index compiled by the IBGE because of residual seasonally in the IBGE's seasonally adjusted index. The IBGE's announced 3.4 percent decline in industrial production in March, after the adjustment by the central bank, turned into a slight increase of 0.1 percent (Minutes of the 84th Copom meeting of the Brazilian Central Bank, May 21, 2003).

in value added. The quarterly national accounts, therefore, were analogous to the production side of the annual national income and product accounts only if value-added and gross output changed at the same rate. Furthermore, as was the case with the annual accounts, the weights used to aggregate the production components by sector into GDP were based on the structure of the Brazilian economy as of 1980. These shortcomings were problematical given that various developments over the 1990s would have induced shifts in consumption and production patterns (in part because of relative price changes).[10] These shortcomings became the focus of efforts at the IBGE to improve the methodology for compiling estimates of quarterly GDP over the late 1990s.

In December 1997, the annual national income and product accounts underwent major methodological improvements, prompting changes in the methodology for the quarterly national accounts. A major change in the annual accounts was the move from a fixed base year basis to a chain-weighted basis. Because chain weighting allows for changes in the composition of output over time (including those changes that reflect relative price shifts), this methodological change delivered more accurate estimates of annual GDP growth. Quarterly real GDP growth continued to be based on the aggregation of gross output indices, but the aggregation of the components became based more closely on the weights used to compile annual output. In this sense, quarterly GDP growth was characterized as being compiled on a chain-weighted basis.[11] These methodological innovations resulted in revisions to the quarterly national accounts back to 1990Q1.

In late 2000, the quarterly national accounts began to be generated on an expenditure basis. Output was now available in both current *reais* and on a chain-

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[10] Changes in production patterns, for example, would have expected to have occurred as a result of structural changes associated with trade liberalization and privatization process in the 1990s. There were also sizeable relative price changes that accompanied changes in the macroeconomic environment. Brazil suffered periods of hyperinflation over the early 1990s that would have induced changes in consumption and production patterns. An anti-inflation program that was launched in mid-1994 (the Real Plan) was followed by a sizeable increase in the relative price of non-traded goods (e.g., services) over the second half of the 1990s, also affecting production and consumption patterns.

[11] The weight for gross output in industry, for example, was the same as the weight in the value-added for the industrial sector in the annual accounts.   In the GDP announcement for the first quarter of year t, the base period weights come from the annual accounts for year t-2. By the time subsequent GDP announcements are released throughout the year, annual figures for GDP in year t-1 are available, so the weights are updated to reflect the relative price structure in year t-1.

weighted basis. On the production side, GDP became generated on a value-added basis. The 2000 changes also resulted in revisions to quarterly real GDP growth back to 1990Q1.

Since 1998, major methodological revisions have been made once a year and have been included in the release of third quarter GDP (Cardoso, Ramos, and Zani 2002). At the same time, the IBGE has taken steps aimed at minimizing revisions to quarterly GDP. In late 2000, the IBGE adopted the Denton Method (Denton 1971), which minimizes revisions when quarterly GDP are reconciled with annual totals. In late 2001, the release of preliminary GDP was moved from 45 to 60 days following the end of the quarter. The additional lag between the end of the quarter and the GDP announcement was aimed in part at eliminating revisions associated with the reconciliation of the preliminary production-based and preliminary expenditure-based measures of output.[12] Revisions still occur with each GDP release for two major reasons. First, because of the arrival of source data that had not been available at the time of the GDP announcement or because of revisions in those earlier estimates.[13] Second, the seasonal adjustment filter is re-estimated each quarter (a practice known as concurrent seasonal adjustment).

We follow FRW by studying revisions to seasonally adjusted GDP growth rates. The IBGE computes quarterly seasonally adjusted GDP via the direct method of seasonal adjustment. That is, non-seasonally adjusted GDP is computed by aggregating its components, and is then passed through a filter (X-12 ARIMA) to arrive at seasonally adjusted quarterly GDP. Seasonally adjusted GDP is not constrained to be a chain-weighted aggregate of its seasonally adjusted components, as would be the case using the indirect method. As Astolfi, Ladiray, and Massi (2001) note, the indirect method is the preferred method by users of national accounts, given the consistency it imposes between the total and its components. As a recent example of the problems for users that can arise under the direct method, in the announcement for 2003Q1 seasonally adjusted GDP, it

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[12] The release of GDP and its components on an expenditure basis initially came 90 after the end of the quarter, and therefore, 45 days after the release of preliminary GDP on a production basis.
[13] The lag in the availability of source data for the telecommunications sector, for example, has been as much as one year.

was impossible to reconcile a slight decline in GDP (0.2 percent annual rate) with large declines in the components.[14] This issue will be the subject of future research.

This overview highlights a drawback to our evaluation of the GDP revision process; especially with our small sample, we have no way of assessing the extent to which methodological changes have improved the GDP revision process over time. Thus, it is not clear that our results for the entire sample period apply to future GDP revisions. This caveat also applies to most other studies of the revision process for GDP.

IV. Summary Statistics

All reported growth rates are seasonally adjusted real GDP growth at quarterly rates. From hard copies of the IBGE's press releases, we collected data on GDP announcements (i.e., growth rates) and on GDP growth that the IBGE reported for the same quarter one year later and two years later. As our "final" version of GDP growth, we downloaded the growth rates from the IBGE's website on March 3, 2003, the Monday following the release of the preliminary GDP for 2002Q4 (on February 28, 2003). "Final" is shorthand for the latest estimate of real GDP growth, as in practice, in Brazil, as in other countries, revisions to national income accounts typically continue for many years.

We have, as a result, three measures of GDP revisions: the "very short-term" revision that compares preliminary GDP growth with the revision one year later, the "short-term" revision that compares preliminary GDP growth with the revision two years later, and the "long-term" revision. FRW study the short-term and long-term revisions. In our study, we included the very short-term revisions for two reasons. First, because in our study we did not have the luxury of allowing more time to elapse after the last GDP announcement. (Recall that our sample has 27 observations—small enough as it is.) Therefore, the closer we are to the end of the sample period, the more short-term and long-term revisions are being driven by the same types of revisions. For 2000 Q4, the short-term and long-term revisions are identical of course; differences between the two revision measures only become noticeable in 2000 Q1 (see graph below).

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[14] In the August 2003 GDP announcement for the second quarter, seasonally adjusted real GDP growth for the first quarter of the year was revised down from -0.2 to -2.3 percent.

Second, in Brazil, as noted above, each quarter, the seasonal factors are re-estimated, resulting in revisions in previous quarters (back to 1991). Thus, the very short-term revisions were also studied because revisions owing to changes in seasonal factors may dominate the revisions up to one year after the release of the GDP announcement. However, other types of revisions are also incorporated into very short-term revisions, and updating of seasonal factors may well continue to have an important influence on revisions beyond the first year following the GDP announcement. We could not isolate the effect of changes in seasonal factors by comparing revisions to seasonally adjusted GDP to revisions to non-seasonally adjusted GDP, as we had fewer data points on revisions to non-seasonally adjusted quarterly GDP.[15] We do, however, address below the question of whether there may have been inefficiencies in seasonal adjustment procedures.

Figure 1 plots the three measures of revisions to seasonally adjusted GDP. As can be seen, real GDP growth in the second quarter of 1997 (just prior to the onset of the crisis in Asia) was revised sharply downward, and this downward revision remained in subsequent vintages of GDP. It may be tempting to think that revisions, particularly the long-term revisions, have diminished over time, as the revisions appear smaller after 1997. However, as noted at the beginning of this paper, the upward revision to growth in the fourth quarter of 2001 was large; that upward revision has remained in subsequent GDP releases. Furthermore, because the IBGE revises its methodology from time to time, it is possible that future GDP revisions may be larger. The size of the revisions also tells us little about the quality of the revision process.

Table 1 reports summary data on the GDP revisions, and reports, for comparison, the same statistics from FRW for the United Kingdom and the United States. The root mean squared error (RMSE) and the mean absolute error (MAE) of the short-term and long-term revisions in Brazilian GDP are well above those of the United Kingdom and the United States. This is even though the U.K. and U.S. GDP announcements are released with a shorter lag.[16] The RMSE and MAE of the Brazilian GDP revisions are

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[15] Prior to 1996Q3, IBGE's press releases only showed revisions to the previous three quarters of GDP growth.

[16] The U.K. and U.S. GDP announcements were announced, on average 26 days and 30 days after the end of the quarter over the second half of the 1990s (see fn 8, p. 6 of FRW's 2000 version of their paper,

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closer to those that FRW report for Germany (not shown here), which exhibited the largest revisions by these measures among the G-7. It is interesting that the RMSE and MAE for the very short-term revisions (one year after the release of preliminary GDP) are higher than in the short-term revisions (revisions two years after the release of preliminary GDP). Possibly, the re-application of the seasonal adjustment filter each quarter induces negative autocorrelation in the seasonal factors.

The mean revisions are positive for all revisions, so as in the case for most of the G-7 countries studied by FRW, there was a tendency for pessimism in the Brazilian GDP announcements. One can reject the hypothesis that the very short-term revisions have mean zero. However, the mean short-term and long-term revisions are lower, and at least in this small sample, one cannot reject the hypothesis that these revisions have mean zero. (The standard errors used in the t-tests were adjusted for heteroskedasticity and autocorrelation with a lag truncation parameter of 4).

V. *Forecast Efficiency Tests*

Figure 2 displays scatter plots of preliminary GDP against the very short-term, short-term, and long-term revisions. If GDP revisions only incorporate news, then there should be no systematic relationship between preliminary GDP and revisions. The plots give a hint of some reversion to the mean, particularly for very-short term revisions. Relatively high preliminary GDP growth tends to be revised downward, while relatively low initial data releases tend to be revised upward. An inverse relationship between GDP announcements and revisions was found by FRW in several G-7 countries; for several countries, the pattern was far more striking than it is here.

To investigate the relationship between the revised data and the preliminary data more systematically, adopting FRW's notation, let X_t^p and X_t^f denote preliminary and final GDP growth. The revision between final and preliminary GDP growth is defined as $R(t) \equiv X_t^f - X_t^p$. Testing for forecast efficiency (rationality) in the baseline case involves estimating the following equation[17]

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[17] Also called the Mincer-Zarnowitz test (1969) for forecast efficiency.

$$R_t = \alpha + \beta X_t^p + u_t$$

and testing whether $\alpha = \beta = 0$. Acceptance of the null hypothesis that $\alpha = \beta = 0$ is an acceptance of the hypothesis of forecast rationality, i.e., data revisions incorporate news. If GDP revisions are predictable, that would be consistent with the notion that GDP announcements have substantial measurement errors (noise) that are corrected in subsequent revisions. These forecast efficiency equations are employed to study the very short-term, short-term, and long-term revisions.

Table 2 reports the results from the baseline regressions. For all revisions, the p-value for the F statistic of the joint hypothesis that $\alpha = \beta = 0$ is less than 0.05 (prior to rounding), a rejection of the hypothesis of forecast rationality. However, the degree of predictability is very low for the very short-term revisions. The adjusted R^2 in the regression for very short-term revisions is 0.13, versus 0.28 in the regression for two other measures of revisions. Therefore, in the baseline case at least, GDP revisions are far from perfectly predictable, particularly in the very short term.

In FRW, as a robustness check, larger outliers were dropped because of possible errors (typos) in the secondary source they relied on for their data. Here, since we rely on the primary source, the case for dropping outliers is weaker. We nevertheless show the results of re-estimating the baseline equations omitting 1997 Q2, where there was a relatively large downward revision. The coefficient estimates change little and we again reject the hypothesis of forecast rationality. The degree of predictability in very short-term data revisions remains very low; the adjusted R^2 is only 6 percent.

Next, we added more variables to the forecast efficiency equations. We first added quarterly seasonal dummies as a way of testing for inefficiencies in the seasonal adjustment filter. We subsequently added the GDP announcement lagged one quarter; the coefficient on the lagged GDP announcement was never significantly different from zero and the results are not shown here. We also added, in various combinations, the international price of oil (in dollars), the stock market index (the Bovespa index), and a measure of the sovereign credit risk spread (the Brazilian EMBI+ spread over U.S.

Treasuries). We would have preferred to use a domestic energy price index rather the international price of oil because domestic prices of energy (both petroleum and electricity) were controlled in Brazil over the period. However, we were unable to obtain a consistent index covering the sample period.[18] Changes in the international price of oil should still affect economic activity in Brazil, even though it has been a small net oil importer, but via more complex channels of transmission that include the effect on the fiscal budget balance.

Similar business cycle indicators to the ones used above (except for the credit risk spread) were used by FRW and other authors on US and other G-7 GDP revisions. Business cycle indicators are added to determine whether there may be inefficiencies in the data revision process that are correlated with the state of the business cycle. We hypothesized that the EMBI+ spread would be more closely associated with business conditions than a short-term interest rate, as nominal interest rates would have reflected relatively high inflation rates that prevailed over the early part of the sample period. Also, because the change in the Bovespa index in the second quarter of 1994 mainly reflected the rise in nominal stock prices during the hyperinflation Brazil experienced until a stabilization plan was enacted in July 1994, we dropped 1994Q2 from regressions that included the Bovespa index.
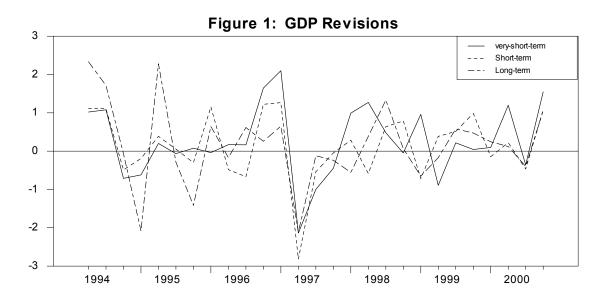
The results are reported in Table 3. The first three columns report the results for augmented forecast efficiency regressions that add only the seasonal dummies. The hypothesis of forecast rationality cannot be rejected in very short-term revisions, but can be rejected in short-term (two years after the GDP announcement) and long turn revisions. The seasonal dummies are jointly significantly different from zero in the regressions for the short-term revisions. Possibly, there are inefficiencies in the seasonal adjustment procedure that take two years to be corrected. In the long-term revisions, however, the seasonal dummies are jointly not significantly different from zero. Only for short-term revisions does the inclusion of the seasonal dummies increase noticeably the explanatory power of the regression, and very short-term revisions remain largely unpredictable.

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[18] In 1999, there was a major revision in the survey used to compile the consumer price index. As a result, classifications in the energy categories, even at a fairly aggregated level, differed markedly beginning in August 1999.

The second three columns report the results of adding the change in the Bovespa index and the change in the dollar price of oil. (Dropping 1994Q2 from the baseline regressions did not significantly alter the results, which are not shown here.) Forecast rationality is rejected for all three revisions. In the regressions with very short-term revisions, however, only preliminary GDP was statistically significant from zero, and short-term revisions remain largely unpredictable. In the regressions with short-term revisions, the stock price index and in the price of oil were significantly different from zero at the five percent level. In the regressions with long-term revisions, the stock price index was significantly different from zero. For both short-term and long-term revisions, adding stock prices and oil prices increased markedly the explanatory power of the regressions, although the coefficients in these regressions are very small.

VI. Conclusion

Policy changes and the increased attention given to data quality were two responses to the economic crises seen in Latin America and developing Asia in the 1990s. However, while revisions to GDP and other economic data have attracted increasing attention in industrialized countries, the implications of data revisions in developing countries and transition economies for policy analysis and forecasting are virtually unexplored territory. These considerations motivate this paper, where we study revisions to Brazilian GDP. We find that revisions to Brazilian GDP are large relative to those of industrialized countries, and find that revisions are partly predictable. Because the sample size is small, the results should be treated with caution. Nevertheless, taken together, we view the results of this study as strengthening the case for using real-time data rather than revised data in empirical work.

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Figure 1: GDP Revisions
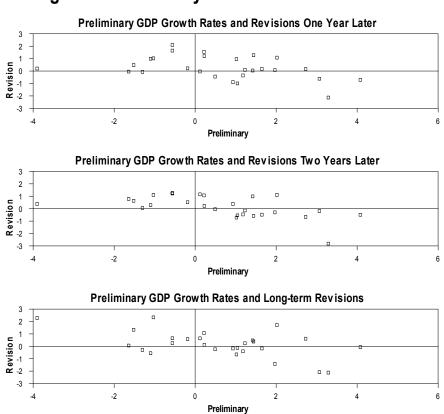
Figure 2: Preliminary GDP Growth and Revisions

Preliminary GDP Growth Rates and Revisions One Year Later

Preliminary GDP Growth Rates and Revisions Two Years Later

Preliminary GDP Growth Rates and Long-term Revisions

Table 1: Summary Statistics on Data Revisions

	UK	US	Brazil
	1988Q1-1997Q4		**1994Q2-2000Q4**
Very Short-Term Revision			
Mean	na	na	0.26
t-stat	na	na	2.12
root mean square	na	na	0.96
mean absolute	na	na	0.73
prelim mean growth	0.30	0.60	0.60
Short-Term Revision			
Mean	0.15	-0.01	0.13
t-stat	1.70	-0.13	1.08
root mean square	0.64	0.30	0.88
mean absolute	0.31	0.23	0.69
Long-Term Revision			
Mean	0.25	0.11	0.17
t-stat	2.35	2.58	1.05
root mean square	0.75	0.37	1.06
mean absolute	0.44	0.31	0.78

Notes: U.K. and U.S. data from Table 1 in Faust, Rogers, and Wright (2003b). The preliminary data and revisions are quarter-over-quarter growth rates, in percent. Preliminary refers to the first release of the quarterly growth rate. The very short-term revision is reported GDP growth one year after the preliminary GDP release minus preliminary GDP growth. The short-term revision is reported GDP growth two years after the preliminary GDP release minus preliminary GDP growth. Final refers to the GDP growth release for 2002Q4 (in February 2003), which incorporates any revisions to history. Long-term revision is final GDP growth minus preliminary GDP growth rate. The t-statistics are based on heteroskedasticity and autocorrelation consistent standard errors and are for the hypothesis that the mean is zero.

Table 2: Baseline Forecast Efficiency Regressions and Sensitivity Analysis

	Baseline				Omitting 1997 Q2		
	Very short-term revision	Short-term revision	Long-term revision		Very short-term revision	Short-term revision	Long-term revision
Constant	0.39	0.31	0.37		0.42	0.35	0.40
	2.44*	2.46*	2.16*		2.70*	3.18*	2.39*
Prelim	-0.22	-0.28	-0.34		-0.15	-0.20	-0.28
	-1.80*	-2.06*	-5.06*		-2.10*	-2.63*	-3.39*
R^2_U	0.23	0.33	0.32		0.24	0.34	0.29
$\overline{R}^2$	0.13	0.28	0.28		0.06	0.21	0.21
F	6.0	8.5	30.2		7.3	12.0	14.8
p-val	0.05	0.01	0.00		0.03	0.00	0.00

Notes: See notes to Table 1. The t-statistic below each coefficient is for the hypothesis that the coefficient is zero. "*" indicates that coefficient is significant at the 10 percent level. The F-statistic is for the hypothesis that the coefficients for the intercept and slope terms are zero, with the p-value for this statistic shown in the following row. The rows labeled R^2_U and $\overline{R}^2$ report the uncentered R squared and the adjusted R squared.

Table 3: Augmented Forecast Efficiency Regressions

	One Year Out-Prelim.	Two Years Out-Prelim.	Final-Prelim.	One Year Out-Prelim.(omit 94Q2)	Two Years Out-Prelim.(omit 94Q2)	Final-Prelim. (omit 94Q2)	Final-Prelim. (omit 94Q2)
Constant	0.49	0.72	0.30	0.53	0.70	0.32	0.28
	1.51	3.54*	1.08	1.64*	4.46*	1.09	1.03
prelim	-0.23	-0.30	-0.33	-0.23	-0.32	-0.35	-0.30
	-2.15*	-3.14*	-4.64*	-2.09*	-3.79*	-6.09*	-3.88*
dummy Q1	-0.29	-0.46	0.37	-0.44	-0.73	0.01	0.38
	-0.80	-1.63*	0.99	-1.19	-3.73*	0.02	1.02
dummy Q2	-0.29	-0.86	0.20	-0.47	-1.17	-0.26	-0.04
	-0.62	-2.59*	0.51	-0.85	-4.31*	-0.68	-0.10
dummy Q3	0.23	-0.25	-0.39	0.10	-0.28	-0.53	-0.38
	0.59	-0.82	-0.98	0.26	-0.74	-1.30	-0.96
stock price				0.01	0.01	0.01	
				1.43	2.16*	3.47*	
oil				-0.01	0.02	0.01	
				-0.59	2.97*	1.08	
R^2_U	0.27	0.45	0.39	0.30	0.63	0.52	0.36
$\overline{R}^2$	0.08	0.34	0.26	0.03	0.51	0.36	0.24
F	8.4	16.7	40.0	26.2	91.5	139.5	41.2
p-val	0.13	0.01	0.00	0.0	0.0	0.0	0.00
F (seasonal)	1.8	8.3	2.9	2.5	25.9	3.1	3.0
p-val	0.62	0.04	0.40	0.47	0.00	0.21	0.40
F (price)				3.2	13.1	12.7	
p-val				0.2	0.0	0.0	

Notes: See notes to Table 1. The t-statistic below each coefficient is for the hypothesis that the coefficient is zero. "*" denotes significant at the 10 percent level. The F-statistic is for the hypothesis that the coefficients for the intercept and slope terms are zero, with the p-value for this statistic shown in the following row. F (seasonal) and F(macro) is for the hypothesis that the seasonal dummy variables (macro variables) are zero, with the p-value for this statistic shown in the following row. The rows labeled R^2_U and $\overline{R}^2$ report the uncentered R squared and the adjusted R squared.

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