SM/05/42
Correction 2

February 28, 2005

To: Members of the Executive Board

From: The Secretary

Subject: **Canada—Selected Issues**

The attached factual corrections to SM/05/42 (2/2/05) have been provided by the staff. Please note that page numbers 55−122 have changed due to overflow of text.

Page 55, para. 17, line 4: footnote 42 added to read "From the 1994 Budget to the 1998 Budget, prudence was incorporated into the fiscal projections by explicitly adopting economic assumptions that were more pessimistic than the average of the private sector economic forecasts, including higher interest rates and weaker economic growth." Subsequent footnotes renumbered.

Page 65, para. 36: last sentence added to read "Macroeconomic prudence adjustment through the 1998 budget—affecting about half of all sample years for Canada—is estimated to account for 0.1 percentage points of the mean real growth forecast error, and for half as much of the mean GDP inflation error."

Page 68, para. 39: footnote 53 added to read "The forecast error for debt service charges also stems partly from a prudence adjustment to the interest rate forecast in the late 1990s, although this effect could not be quantified."

Page 82, para. 57, line 3: ", which in Canada is provided by the private sector." removed.
            last line: "private sector" removed.

Page 83, line 1: for "late 1990s, but their projections were"
            read "late 1990s. Although prudence adjustments in budgets of the mid- to late 1990s also led to a slight increase in forecast errors, macro projections were"

Questions may be referred to Mr. Bayoumi (ext. 36333) and Mr. Mühleisen (ext. 38686) in WHD.

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Att: (32)

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Box 2. Fiscal Forecasting Arrangements in Canada

In 1994 and 1995, Canada implemented significant changes to the budget formulation process. The government adopted a new public expenditure management system, a two-year rolling planning horizon was introduced, and the forecasting process revamped. This system was refined in 1999 by publishing five-year fiscal forecasts in the fiscal mid-year reports, and by being more explicit about prudent planning assumptions in fiscal forecasts.

For the *macroeconomic forecast,* the Department of Finance surveys approximately 20 private sector forecasters each quarter after the National Accounts are released. Average annual private sector forecasts of real GDP growth, inflation, labor market indicators, and interest and exchange rates form the basis of the government's macroeconomic assumptions. To ensure model consistency, the Department may refine these assumptions in meetings with outside economists. The Department feeds the assumption thus gained into its internal macroeconomic model (the Canadian Economic and Fiscal Model) to construct aggregate revenue and expenditure projections consistent with the private-sector forecast.

The detailed *revenue and expenditure forecast* is produced by the Department of Finance and respective spending agencies. Within the Finance Department, it is principally the Fiscal Policy Division that generates the revenue and expenditure forecasts. Some smaller elements of the revenue forecast, for example, the value added tax low-income rebate, are forecast by the Department's Tax Policy Branch using micro-simulation models. Similarly, the Department's Economic Development and Corporate Finance Branch and certain Crown corporations are also consulted and provide information to help formulate the non-tax revenue component of the revenue forecast. Other departments provide spending forecasts based on three-year business plans, which are reviewed by the Treasury Board Secretariat.

Since 1999, five-year fiscal forecasts have been prepared by private sector forecasters, and are published in the *Economic and Fiscal Update* published in the fall. These forecasts cover broad fiscal aggregates on a general government basis. Based on this forecast, central government projections are again provided by the Department of Finance, with the 2004 Update presenting details on how the central government data have been derived from the private sector's general government forecast.

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17.   *Canada has placed significant emphasis on prudent forecasts, which could have affected forecast accuracy*. While macroeconomic forecasts are obtained from a panel of private sector forecasters, fiscal forecasts contain an explicit cautionary bias—the so-called prudence factor.[42] In addition, the budget includes a contingency reserve to cushion against unforeseen economic developments. In 2004, the prudence factor and the contingency reserve amounted to C\$1 billion and C\$3 billion, respectively, for both the 2004–2005 and 2005–2006 budget projections. If the contingency reserve remains unutilized, it is used to pay down debt. Although on a smaller scale than in Canada, the use of cautious economic assumptions or specific reserves can also be found in other countries (for example, in the

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[42] From the 1994 Budget to the 1998 Budget, prudence was incorporated into the fiscal projections by explicitly adopting economic assumptions that were more pessimistic than the average of the private sector economic forecasts, including higher interest rates and weaker economic growth.

United Kingdom and the Netherlands). In the Netherlands, formal arrangements have also been in place for the utilization of funds from unexpected over-performance of the fiscal balance (Blöndal and Kristensen, 2002).

18.   ***In addition to fiscal rules, expenditure discretion in Canada is constrained by relatively high debt service costs and other nondiscretionary expenditure***. In particular, the share of interest payments is the second-highest among the eleven countries, despite the recent decline in public debt, while the share of social protection is the third-highest (see Table 3).[43] Moreover, as noted before, the share of transfers to other levels of government is far higher in Canada than in most benchmark countries.

C. Fiscal Forecasting Practices in International Comparison

19.   ***The importance of fiscal forecasts for budget planning purposes raises process and transparency issues***. While solid technical capacities are a necessary ingredient to high-quality forecast outcomes, forecasting performance also tends to be boosted by an open budget preparation process, including the involvement of non-governmental agencies, public access to information, and regular reviews of forecasting performance (IMF, 2001). This section contrasts technical aspects of Canada's fiscal forecasting arrangements with other countries, and assesses its transparency aspects.

20.   ***The role of fiscal forecasts in the Canadian budget process is similar to practices in other benchmark countries*** (Table 5).[44] In the majority of surveyed countries, the responsibility for budget preparation is assigned to one government agency (the Ministry of Finance or Treasury), but usually carried out in collaboration with other government agencies. Forecasts are framed within a medium-term horizon in all countries, mostly in the form of a rolling three- to five-year forecasting framework (e.g., euro area countries are required to prepare indicative 5-year fiscal plans). However, the period for which fiscal plans are binding, or for which greater detail is presented, is typically much shorter. In Canada, budget preparation is based on a 2-year framework, although the government since 1999 also prepares five-year fiscal forecasts as part of the mid-year fiscal update.

21.   ***Canada relies more than other countries on macroeconomic forecasts by private forecasters*** (Table 6; see also Box 2). In most benchmark countries, the agency responsible for the budget develops its economic forecast in-house, using econometric and spreadsheet-based models. These estimates are often supplemented with information gained from consultations with non-governmental forecasters or the business sector. In some cases, no outside agencies are formally involved at all, and quality control is left to benchmarking

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[43] The share of interest payments has come down from 20 percent in 1990 to 9 percent in 2003.

[44] Sources for this information include country responses to a short staff questionnaire, an OECD/World Bank survey on budget institutions (OECD/WB, 2003), and available IMF Fiscal ROSC reports. The questionnaire covered the development and organization of the forecasting process, as well as arrangements for quality control and transparency.

against other forecasting agencies (e.g., in Sweden). The main trade-off between the two approaches is that greater involvement of outside agencies may boost forecast credibility, whereas a broader consultation process could imply the use of less systematic forecasting techniques, which may make it more difficult to pinpoint the cause of forecast errors.

Table 5. Key Institutional Characteristics of the Fiscal Forecasting Process

	Budget authority	Forecasting horizon 1/	Macro-economic forecast	Revenue and expenditure
Australia	Treasury, Department of Finance and Administration	Rolling three year	MOF intern based on extensive consultation process	Government internal; revenue: derived from interaction between spreadsheet based forecast and econometric model; expenditure: supplied by spending agencies
Canada	Finance Department and Treasury Board Secretariat	Rolling two year budget forecasts; aggregate fiscal forecasts for 5 years	Average of private forecasters	Revenue and expenditure : two-year budget forecast prepared internally by experts group and respective spending agencies; five year-forecast in mid year based on forecast of private sector
Germany	Ministry of Finance	Five year (SGP)	MOF intern after consultations with forecasting agencies	Revenue: based on consensus among expert group with non-governmental participation; expenditure: government internal supplied by spending agencies
Netherlands	Ministry of Finance	Rolling three year budget forecast; five years at aggregate level (SGP)	Independent public agency for coalition period; MoF otherwise	Revenue: by independent public agency for four year coalition plan; MoF internal revenue forecast for individual budget years, expenditure forecasts by spending agencies;
Sweden	Ministry of Finance	Rolling three year budget forecast; five years at aggregate level (SGP)	MoF intern: model driven benchmarked against other public sector forecasters	MOF internal; revenue model driven benchmarked against other public sector forecasters; expenditure: prepared by spending agencies
Switzerland	Ministry of Finance	Rolling three year budget forecast	Forecast by expert group comprising MoF, central bank and statistical office.	Government internal; revenue: iterative process between different departments in the Ministry of Finance; expenditure: supplied by spending agencies
U.K	Treasury	Five year budget forecast; aggregate long-term projections	Treasury: iterative process between econometric model and micro based fiscal forecasts	Government internal; revenue: iteration between treasury' macro model and micro based expert models in revenue department; expenditure: prepared by spending agencies
France	Ministry of Finance	Five year (SGP)	Ministry of Finance: Forecasting Directorate.	Government-internal; revenue: iteration between various departments in the MoF; expenditure: forecasts made by the MoF's Budget Directorate in coordination with spending ministries.
Italy	Ministry of Finance and Economy	Five year (SGP)	…	…
New Zealand	Treasury	Four year budget forecast	Iterative spreadsheet based forecast including views of expert panel, business, and senior staff from Treasury	Government internal: two revenue forecasts prepared and published separately by Treasury and revenue administration; based on micro and macro-models with consistency check with macroeconomic forecasts and assessment against views of practitioners (tax talks); Treasury forecast used in budget; expenditure forecasts prepared by spending agencies
U.S.	White House (Office of Management and Budget)	Five year budget forecast	…	President's forecast assessed by congressional budget office leading to congressional budget resolution that establishes major fiscal aggregates to constrain the decision-making of the appropriations, taxing, and authorizing committees.

Characteristics of the forecasting process

Source: OECD and World Bank (2003), country authorities, and IMF country desks.

1/ Includes budget year.

Table 6. Fiscal Forecasting: Quality Assurance

	Involvement of non-government agencies 1/		Ex-post assessment of forecasting performance 2/		Availability of information on fiscal performance 3/
	Macro forecast	Revenue forecast	Self	External	Score on detail and regularity
Australia	Medium	Low	Regular	Occasional	Medium
Canada	High	Medium	Regular	Occasional	High
Germany	Medium	High	Occasional	Occasional	Low
Netherlands	Medium	Medium	Regular	No	Low
Sweden	Low	Low	Occasional	No	Low
Switzerland	Low	Low	Occasional	Occasional	...
U.K.	Low	Low	Regular, legal	Regularly	High
France	Medium	Low	Regular	Regular	High
Italy	Low	Low	...	No	Low
New Zealand	Medium	Medium	Regular	Occasional	High
U.S.	...	...	Regular	...	High

Source: OECD/WB (2003); and data provided by country authorities.

1/ Non-governmental agencies play active role (high), are directly consulted (medium), or are not involved (low).
2/ "Self" refers to analysis of forecasting performance in end-of-year reports; "external" refers to reviews by government audit office or other external agency.
3/ Measures the number of annual and regularly provided central government reports on fiscal forecasting from the list of reporting items based on OECD Best Practices. The scores for high, medium and low refer to the country score relative to the group average (=medium).

22.   ***Like the majority of surveyed countries, revenue and expenditure forecasts in Canada are prepared by the Ministry of Finance***. The formalization of the forecasting process varies quite significantly across countries. Some countries prepare stylized forecasts with some cross-checks against sectoral and revenue experts (e.g. Sweden, Switzerland). Others use detailed model driven processes and micro-data based models maintained by technical experts. (e.g., Australia, France, and the United Kingdom). In Canada, there is little direct involvement of outside agencies in preparing revenue and expenditure forecasts for the annual budget. However, projections for the mid-year fiscal update are compiled by a small group of private forecasters, providing an independent view of the medium-term implications of current fiscal policies. Other countries have assigned similar tasks to independent agencies. For example, the U.S. Congressional Budget Office regularly provides 10-year projections of major economic and fiscal variables, based on fiscal policies as legislated by the U.S. Congress. Australia assesses its fiscal forecast through an extensive consultation process with outside experts and the business sector.

23.   ***The Canadian public has relatively broad access to budgetary information***. A comparison of the detail of published fiscal information shows that Canada scores high relative to countries in the benchmark group (see Table 6). The primary budget documents available to the public are the annual *Budget Plan* (usually released in February or March)

and the *Economic and Fiscal Update* prepared mid-year. Both the Budget Plan and the Update provide economic and fiscal forecasts with detailed explanations of anticipated future developments. The level and detail of published information is comparatively high.

24.   ***However, the closed nature of the budget compilation process implies that forecast risks may not be widely understood, limiting public debate on this aspect***. As many other countries, Canada provides relatively little information on the key assumptions and methods underlying the use of macroeconomic assumptions in the compilation of budget forecasts, making it difficult for outsiders to distinguish between fiscal forecasting performance and errors arising from implicit prudence factors.`[45] Some countries in the benchmark group are more inclusive in this regard. In Germany, tax revenue forecasts are the result of a consensus of a technical expert group with participation of non-governmental agencies, providing some assurances that fiscal forecasts are untainted by policy objectives.[46] In Australia and New Zealand, governments are legally required to demonstrate, at the time the budget is issued, that budget policies are consistent with long-term fiscal objectives, including by establishing a clear link between policy objectives, forecasts, and outcomes. This requirement has led to a greater emphasis on forecast outcomes, with performance assessments being used to gauge the realism of new budget plans (Box 3).

25.   ***Unlike most benchmark countries, the Canadian government provides regular and detailed ex-post analyses of its fiscal forecasting performance***. Only a few countries mandate such reports on an annual basis (e.g., Australia, New Zealand, and the United Kingdom). However, despite the lack of an explicit legal requirement, the Canadian government's *Annual Financial Report* analyzes fiscal results for the previous fiscal year, including by listing the sources of deviations from initial forecasts. The Canadian government also initiated a comprehensive review of its forecasting performance in 1994. A special task force conducted reviews of the accuracy of the Department of Finance's economic and fiscal forecasts and their role in the budget planning process, initiating changes that led to the budget process in its current form. A more focused review and consultations with a group of private sector economists in 1999 led to a more explicit treatment of the prudence factor and the introduction of five-year fiscal forecasts beginning with the *Economic and Fiscal Update* in that year (see Box 2).

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[45] Beginning with the *2004 Economic and Fiscal Update*, the government has committed to provide additional information on how national accounts-based fiscal projections provided by private sector forecasters translates into the accounting framework used in the budget.

[46] The 2004 report by Germany's government auditor (the *Bundesrechnungshof*) remarked that tax forecasts were too optimistic, but largely attributed this outcome to overly positive assumptions about macroeconomic developments which are made by the Ministry of Finance.

Box 3. Forecasting Performance and Budget Debate in New Zealand

Faced with a growing debt burden and a history of poor fiscal performance, New Zealand introduced a formal framework to guide its fiscal planning process in the early 1990s. The 1994 *Fiscal Responsibility Act* requires the government to communicate its policy intentions and to quantify the short- and long-term effects of the associated spending and taxation decisions. In addition to extensive data reporting requirements, the law also mandates a continuing review of policy plans and their financial implications, which are assessed against budget plans and actual developments. This review process is enforced through the publication of two regular reports which have enriched the budget debate by making the inherent risks to the fiscal forecast more accessible to the broader public.

- The *Budget Policy Statement* specifies the fiscal intentions of the government for the next three years, including strategic priorities and targets for spending, revenue, the fiscal surplus, and public debt. The policy goals have to be in line with the responsibility principles set out in the 1994 law.

- The *Fiscal Strategy Report*—published at the time of the budget—focuses on the quantitative implications of policies contained in the *Budget Policy Statement*, and assesses whether the budget is consistent with the longer term policy plans. The report is also required to identify deviations between the projected implications under previous policy plans and their original intentions.

By requiring the government to provide separate statements on overall policy goals and their fiscal implications, the public is in a better position to assess the government's track record in meeting its fiscal goals. Mandatory evaluations of the consistency between long-term goals and short-term plans have put greater emphasis on forecast accuracy, and thus on the forecasting process. With deviations of fiscal outturns from projections subject to greater scrutiny, information about sources of forecast errors is being disclosed, and the government has commissioned regular external and internal reviews of forecasting processes and methods.

D. Assessing Forecast Accuracy

26.   *Data problems generally limit the analysis of fiscal forecasting performance across countries*. Although a number of studies have compared macroeconomic forecast accuracy of private sector economists and international organizations (Artis, 1996; Artis and Marcellino, 2001; Ash, *et al*., 1998; Batchelor, 2001; Isiklar, *et al*., 2004, Loungani, 2000; Öller and Barot, 2000), most analyses of budget projections have focused on a single country, given difficulties in obtaining a cross-country data set of budget forecasts. More recently, two studies have analyzed budgetary forecasts for a group of relatively homogenous countries (euro zone members), with one suggesting that the size of forecast errors may depend on structural characteristics of a country's budgetary framework (Strauch, *et al*., 2004), and the other calling for independent budget forecasting agencies on the basis of significant forecast biases (Jonung and Larch, 2004).

27.   *Information obtained for this study provided sufficient detail to compare Canadian central government budget forecasts with benchmark countries in recent years*. At a minimum, most budgets provide 3−4 years of information for key macroeconomic and fiscal variables, including actual or estimated values for the preceding year, an estimate or

projection for the current, and projections for one or two future fiscal years.[47] Most budgets are also compiled near the beginning of a new fiscal year, with the result that the values of economic and fiscal variables reported for the prior year are generally at or close to their final revision. This allows the use of historical data reported in the budget as basis for comparison with projections contained in earlier budgets. A description of available data is contained in Appendix I, and methodological issues are covered in Appendix II.

28.   ***Budget projections are evaluated against subsequent budget "actuals", which provides two advantages over using fully revised values as reported today***. First, data revisions (caused, e.g., by changes in the coverage of government accounts) may be retroactively applied to fiscal outcomes, but not to past budget projections. Therefore, revised historical data cannot be used to measure the accuracy of projections made before a revision has come into force. Under this paper's definition of forecast errors, data losses are limited to at most 2−3 observations around the time a revision was introduced. Moreover, this method is also "fair" in that it focuses on the information that was available to forecasters at the time and mattered for economic agents' expectation formation.

29.   ***On this basis, a comparison of forecasts errors shows notable differences between Canada and other benchmark countries***. For example, projection errors for real GDP growth in Canada appear to have been on the optimistic side in the early 1990s, followed by a more cautious approach during the high-growth phase in the second half of the 1990s (Figure 2).[48] A similar pattern can be observed in the United States, whereas, e.g., German or Swiss budget forecasters appear to have maintained a more optimistic outlook over time. On the other hand, Canadian fiscal forecasts appear to have been consistently one-sided since the mid-1990s, whereas most other countries have reported two-sided errors (Figure 3). Before proceeding to a more formal evaluation, however, a word of caution is on order.

Data Caveats

30.   ***Reflecting the idiosyncratic nature of every country's budget process, the empirical analysis remains complicated by data limitations***. The most important constraints, partly obvious from Figures 2 and 3, are the following:

• ***Time series of consistent forecasts and budget outcomes are relatively short (often with less than 10 observations), limiting the power of statistical tests***. Many countries updated their budget formats and forecasting methods in the early to mid-1990s. This has generally increased the level of information provided but also resulted in structural breaks as new budget concepts and coverage were adopted.

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[47] Given the small number of countries providing medium-term projections, three and more year-forecasts were not considered for this study. Also, central government forecasts were not available for a number of countries, in which case general government forecasts were used.

[48] Errors are defined as projected minus actual values. A negative value therefore implies that the outcome has exceeded expectations, and vice versa.

Figure 2. Forecast Errors: Real GDP Growth

(forecast minus actual growth rate)

National authorities' real GDP growth
error for forecast one year ahead

National authorities' real GDP growth
error for forecast two years ahead
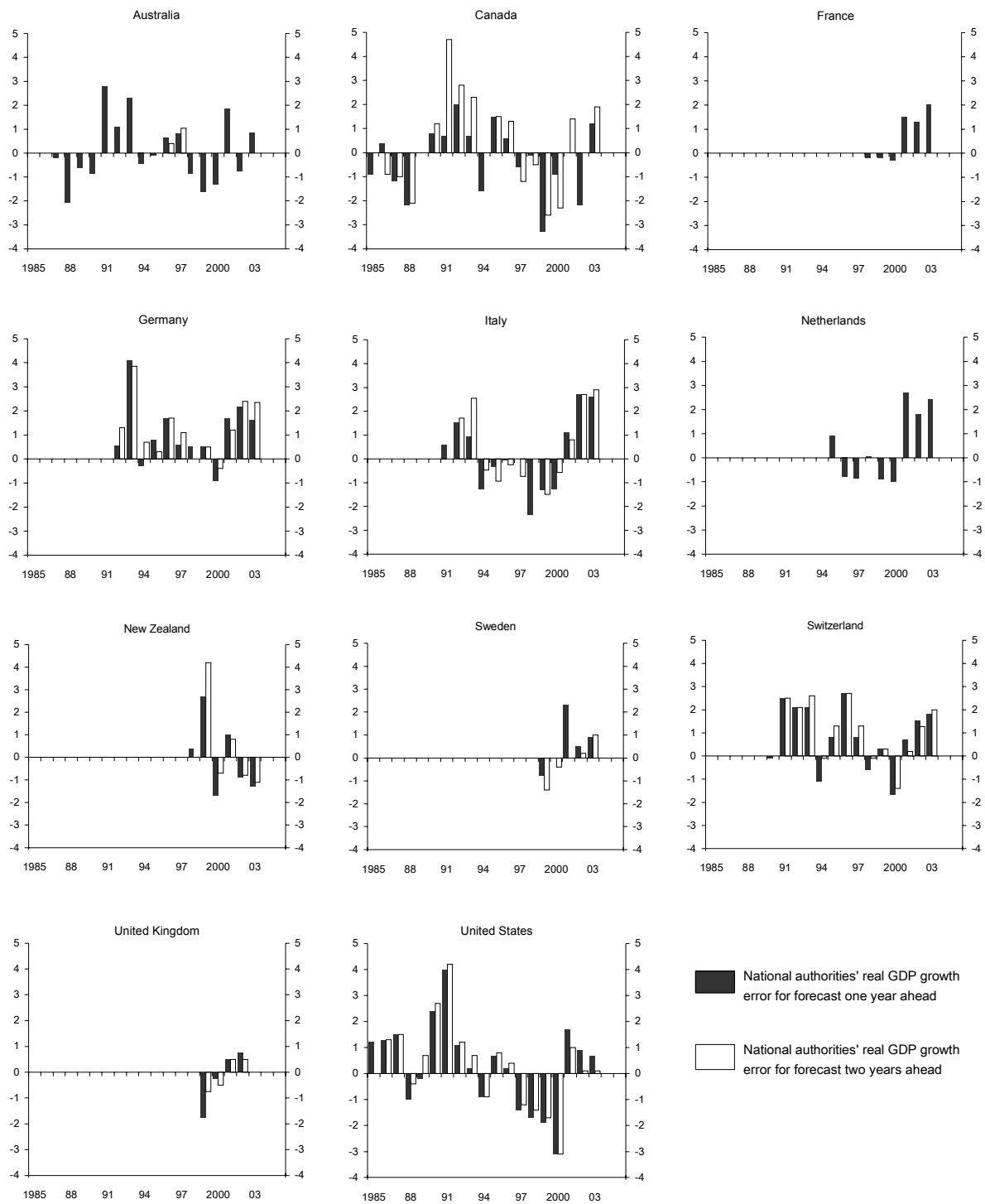
Souce: Staff calculations.

Figure 3. Forecast Errors: Fiscal Balance

(forecast error in percent of size of government)
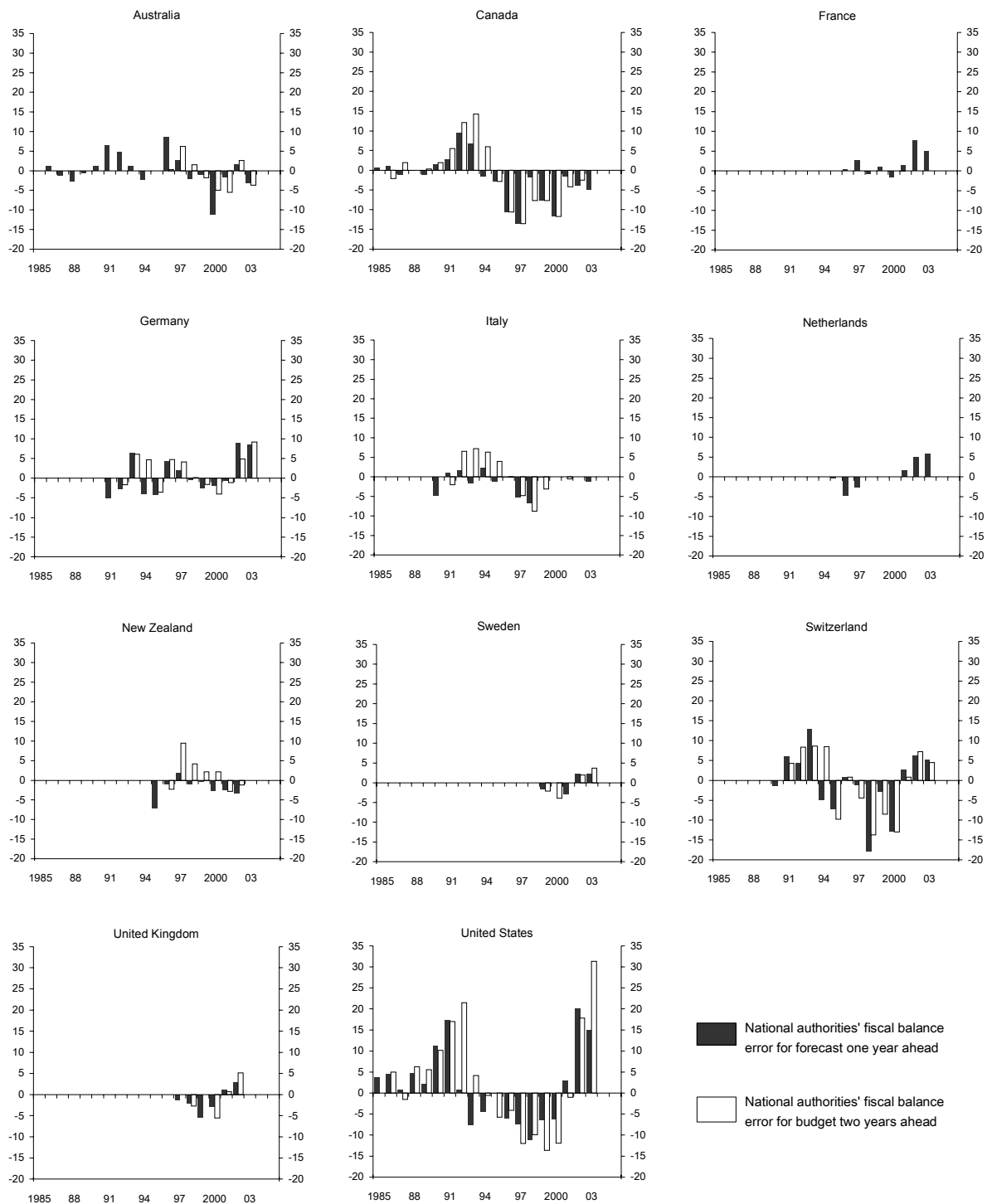
Souce: Staff calculations.

- ***Although the coverage of revenue and expenditure data is broadly similar across most countries, there are limits to how closely they can be compared***. For example, while tax categories are relatively similar, some countries include social insurance contributions as government revenues. Moreover, sources for nontax revenues (which may include receipts from asset sales, royalties from natural resources, or frequency spectrum fees, to name a few) tend to differ significantly across countries.

- ***A comparison of expenditure subcategories appears particularly difficult***. For example, the distinction between discretionary and mandatory spending components—each of which poses a different challenge to budget forecasters—is difficult to obtain for most countries, or can only be approximated. Similarly, data on transfers to other levels of government are not provided on a consistent basis.

- ***Checks for internal consistency and structural breaks may not have captured all data anomalies***. These checks resulted in the rejection of a considerable number of data points. However, given relatively scant institutional knowledge of the information contained in government budgets more than a few years back, only obvious statistical outliers were eliminated.

31.   ***Importantly, revised forecasts published in mid-year budget updates or other publications are also not considered in this study***. In many countries, governments provide updated budget projections in the course of the fiscal year—for example, in Canada's Economic and Fiscal Update, or in convergence programs provided by countries in the euro area. Other public bodies (such as the U.S. Congressional Budget Office) often conduct complementary analyses of fiscal developments. Including such information, however, would have greatly increased the cost of collecting and preparing a consistent data set.

32.   ***This may exacerbate problems caused by policy shifts that are implemented mid-year***. For example, the relatively large U.S. fiscal "error" underlines the difficulties in limiting the focus of this study to annual budget documents. If negotiations over fiscal measures conclude a considerable time after a budget has been published, the likelihood that policy outcomes differ from underlying assumptions in the budget may be higher, possibly resulting in a significant deviation of fiscal projections from outcomes. However, such deviations would be policy-driven and not the responsibility of budget forecasters.[49]

Macroeconomic forecasts

33.   ***The remainder of this section presents a formal comparison of forecast errors since 1995, separated into macroeconomic and fiscal projections***. First, the mean error (ME) and root mean squared error (RMSE) for one-year forecasts of key macroeconomic variables are presented in Table 7. The mean error is the simple average of forecast errors over 1995−2003, providing an indication of the direction of forecast errors. The RMSE, defined as the square root of the mean of the errors squared, is independent of the error sign and

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[49] Indeed, the consequences of U.S. tax and spending measures were well anticipated at the time of passage.

therefore a better measure for the size of forecast errors. Limiting the sample to the years indicated focuses the analysis on the period during which the current Canadian forecasting methodology was in force. Moreover, longer time series were not available for many countries, and 2005 budgets have not yet been released in most cases.

34.   ***The evidence suggests that economic growth in Canada has on average been ½ percentage point higher than budget projections in recent years***. Canadian projections of nominal GDP and real GDP growth show higher RMSEs than in most other countries, and Canadian mean errors are at the negative end among the benchmark countries (Figure 4). Decomposing the RMSE into its two components indicates that this result appears to be mostly a function of the large mean error, given that the standard deviation of Canadian forecast errors has not been as high as in many other benchmark countries.[50] This could suggest that Canadian forecasters have adopted a relatively consistent forecast bias, as opposed to other countries where deviations are spread more equally on the positive and the negative side (see next section for statistical tests of this hypothesis).

35.   ***Canadian forecasters also underestimated GDP inflation by 0.2 percentage points on average, but short-term unemployment trends were anticipated quite well***. Projection errors for increases in the GDP deflator show a distribution similar to the growth forecast, with high RMSEs and a mean at the negative end among the sample countries. By contrast, the one-year forecast of the unemployment rate exhibited a lower RMSE and (positive) mean error than for other countries.

36.   ***These findings indicate that Canadian budget forecasts generally adopted a conservative view of macroeconomic developments over the past 10 years***. Errors made in forecasting major macroeconomic variables are internally consistent. Growth and inflation were on average stronger than expected, and unemployment rates lower than anticipated. The projection of nominal GDP also suffers from the fact that Canadian forecasters have underestimated base year GDP by about one percent on average—the largest negative value in the benchmark group (see Appendix II, equation 4, for a breakdown of the nominal GDP forecast error into the errors for base year GDP, real growth and GDP inflation).[51] Macroeconomic prudence adjustment through the 1998 budget—affecting about half of all sample years for Canada—is estimated to account for 0.1 percentage points of the mean real growth forecast error, and for half as much of the mean GDP inflation error.

Fiscal forecasts

37.   ***A similarly conservative approach appears to have been applied to Canada's fiscal projections***. An analysis of revenue and expenditure projections generally finds Canada

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[50] See Appendix II, equation 6.

[51] For this study, the base year (or "in-year") is the year preceding the budget year (for example, the base year for the FY 2004-05 budget is FY 2003-04). Although a similarly large base year error was only found for the United States, cross-country comparisons involving the GDP deflator suffer from the fact that inflation forecasts were not available for some countries, and had to be calculated as the difference between the nominal and real GDP growth rates, with base year values substituting for actual values.

among the group of countries with relatively weak forecast accuracy (as measured by the RMSE). Moreover, compared to the benchmark group, the average error takes on one of the largest negative values for revenues, and one of the largest positive values for expenditures

Table 7. Descriptive Statistics of One-Year Budget Forecast Errors, 1995-2003[1]

	Australia	Canada	France	Germany	Italy	Nether-lands	New Zealand	Sweden	Switzer-land	U.K.	U.S.
Macroeconomic Variables											
Nominal GDP	-0.0066	-0.0236	0.0035	0.0244	0.0002	-0.0111	-0.0037	-0.0271	0.0116	-0.0170	-0.0168
	0.0290	0.0344	0.0142	0.0292	0.0138	0.0296	0.0209	0.0357	0.0281	0.0199	0.0390
	8	9	8	9	9	9	9	4	9	6	9
Real GDP growth	-0.0500	-0.4750	0.6833	0.9611	0.1395	0.4778	0.0333	0.7250	0.7078	-0.1500	-0.4333
	1.1592	1.7211	1.2364	1.3393	1.8577	1.5830	1.6637	1.4679	1.4698	0.9893	1.6809
	9	8	6	9	8	9	6	4	9	5	9
GDP deflator	0.2859	-0.1750	0.1833	0.5611	…	-0.1611	…	0.2557	0.5762	0.0057	0.1669
	1.2536	1.0522	0.3623	0.7792	…	0.6889	…	1.2417	0.9609	0.9038	0.3510
	9	8	6	9	0	9	0	4	9	5	9
Unemployment rate	0.4000	0.0875	…	…	0.2333	0.3500	0.2000	-0.3500	…	…	0.2778
	0.6638	0.2834	…	…	0.4447	0.6005	0.5797	0.6265	…	…	0.8149
	9	8	0	0	3	9	6	4	0	0	9
Fiscal Variables											
Government revenue	-0.0154	-0.0379	0.0105	0.0155	-0.0180	-0.0278	-0.0175	-0.0329	-0.0209	-0.0085	0.0027
	0.0466	0.0620	0.0313	0.0464	0.0280	0.1232	0.0288	0.0351	0.0840	0.0276	0.0921
	8	9	6	9	6	6	8	4	9	6	9
Tax revenue	-0.0207	-0.0292	0.0086	0.0226	…	0.0024	0.0001	-0.0409	…	-0.0055	0.0049
	0.0510	0.0569	0.0286	0.0507	…	0.0542	0.0244	0.0430	…	0.0262	0.0993
	8	9	6	9	0	9	9	4	0	6	9
Personal income tax	0.0093	-0.0273	…	0.0605	…	0.0199	-0.0063	-0.0257	…	-0.0194	-0.0145
	0.0234	0.0537	…	0.1032	…	0.0713	0.0215	0.0360	…	0.0435	0.1524
	2	9	0	9	0	6	9	4	0	6	9
Corporate income tax	-0.0686	-0.0694	…	0.1352	…	0.0388	0.0371	-0.0387	…	0.0065	0.0987
	0.1068	0.1652	…	0.4788	…	0.1803	0.1035	0.2194	…	0.1093	0.2340
	2	9	0	9	0	6	9	4	0	6	9
Social insurance taxes	-0.0885	…	…	…	…	…	…	…	…	-0.0168	-0.0004
	0.1486	…	…	…	…	…	…	…	…	0.0234	0.0277
	2	0	0	0	0	0	0	0	0	6	9
Indirect taxes	-0.0276	-0.0160	…	0.0349	…	0.0087	0.0015	-0.1304	…	-0.0017	0.0772
	0.0407	0.0603	…	0.0926	…	0.0357	0.0455	0.2043	…	0.0078	0.1039
	2	9	0	9	0	6	9	4	0	6	9
Other revenue	-0.0434	-0.1861	…	-0.0550	…	-0.3883	-0.2091	0.0343	…	-0.0649	0.0642
	0.1244	0.2350	…	0.1589	…	0.5502	0.2592	0.0730	…	0.1695	0.2241
	8	9	0	9	0	5	8	4	0	6	9
Government expenditure	-0.0062	0.0082	-0.0111	-0.0007	0.0076	-0.0172	0.0022	0.0082	0.0110	0.0072	0.0027
	0.0288	0.0258	0.0178	0.0234	0.0261	0.0678	0.0092	0.0146	0.0222	0.0100	0.0209
	8	9	6	9	6	6	8	7	9	6	9
Mandatory expenditure	…	-0.0020	…	-0.0225	…	…	…	…	…	…	0.0159
	…	0.0435	…	0.0394	…	…	…	…	…	…	0.0314
	0	9	0	9	0	0	0	0	0	0	9
Discretionary expenditure	…	-0.0051	…	0.0568	…	…	…	…	…	…	-0.0221
	…	0.0362	…	0.0715	…	…	…	…	…	…	0.0340
	0	9	0	9	0	0	0	0	0	0	9
Interest expenditure	-0.0750	0.0245	…	0.0187	0.0079	-0.0131	-0.0200	0.0364	…	0.0093	0.0295
	0.1040	0.0458	…	0.1381	0.0566	0.1260	0.0501	0.1503	…	…	0.0816
	9	7	0	9	6	9	9	4	0	1	9
Fiscal balance	-0.8025	-6.5427	1.9792	1.5599	-2.4218	0.7900	-1.9792	-0.0811	-3.0378	-1.2985	0.0711
	5.6913	7.9428	3.6246	5.0669	3.7109	4.2089	3.2954	2.5785	8.7606	3.2585	10.8211
	8	9	8	9	6	6	8	4	9	6	9
GDP ratios											
Government revenue	-0.1375	-0.2723	0.1727	-0.0934	-0.3433	-1.5255	-0.5984	-0.3000	-0.3643	0.3264	0.4333
	0.6645	0.7071	0.4355	0.4248	0.6721	3.3993	1.0994	1.4663	0.8941	0.8507	1.4397
	8	9	6	9	5	5	8	4	9	6	9
Government expenditure	-0.0875	0.5204	-0.1671	-0.2888	0.4600	-1.0793	0.0848	0.2883	-0.0076	0.9485	0.3000
	1.0256	0.7185	0.3747	0.5317	1.3600	1.9885	0.6233	0.5278	0.4187	1.0896	1.0654
	8	9	6	9	6	5	8	7	9	6	9
Fiscal balance	-0.1111	-1.1146	0.3625	0.1954	-0.7867	-0.3106	0.1331	-0.0250	-0.3567	-0.5122	-0.0778
	1.3950	1.3637	0.6626	0.5926	1.2274	1.9998	0.4821	1.2013	1.0577	1.2705	2.0367
	9	9	8	9	6	5	8	4	9	6	9

Source: Staff calculations.

[1] For each variable, rows list mean error, root mean square error, and number of observations. Errors are calculated in percent of actual outcomes, except for forecasts of GDP growth, GDP inflation, the unemployment rate, and GDP ratios where simple difference was taken. Error in forecasting fiscal balance expressed in percent of average of actual revenue and expenditure. Positive error indicates that forecast was above outturn.

Figure 4. Descriptive Statistics for One- and Two-Year Macroeconomic Budget Forecasts, 1995-2003
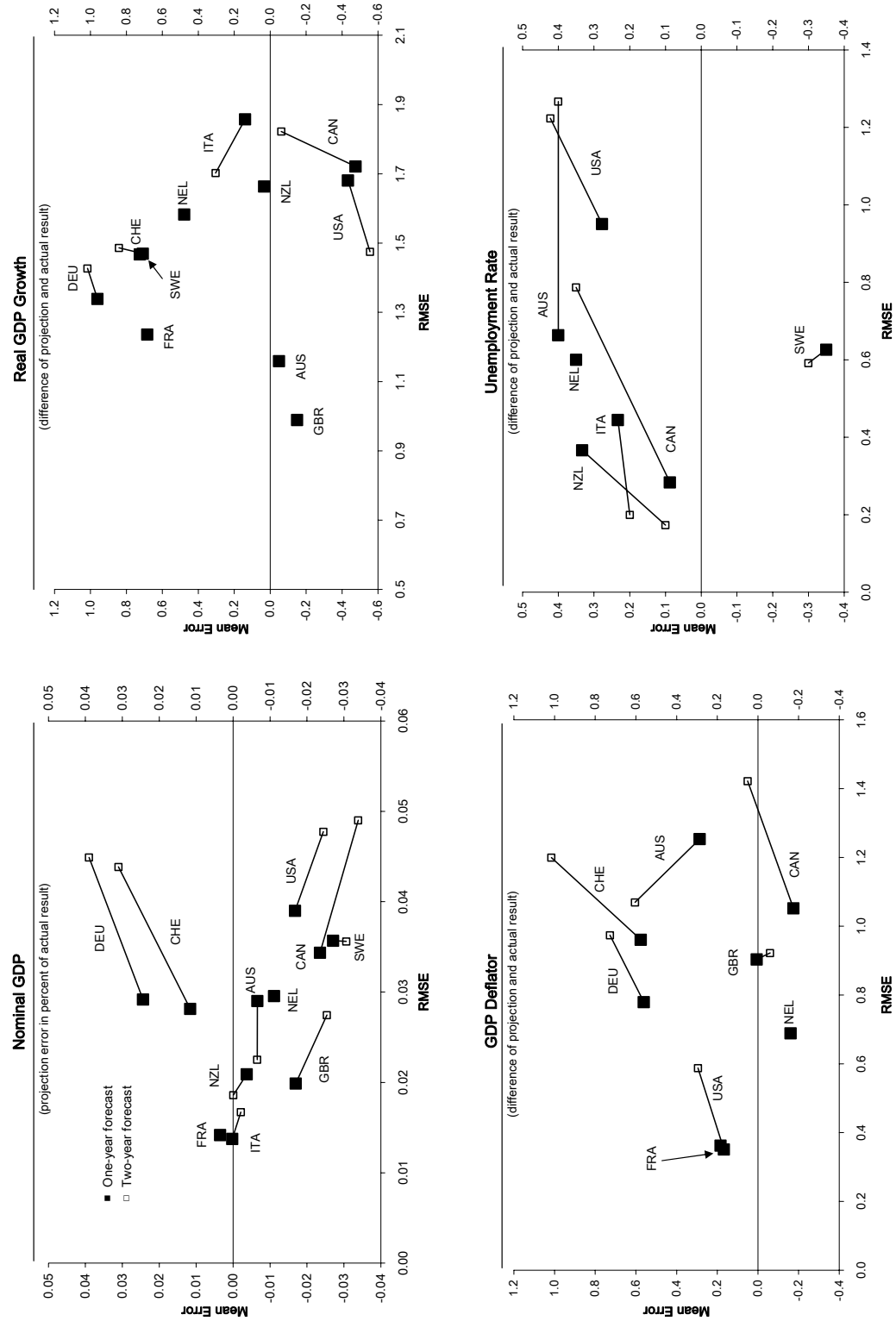
Source: Staff calculations.

(Figure 5). Taken together, this implies that Canada has the largest negative mean error for the overall deficit forecast, even after allowing for economic prudence and contingency factors.[52]

38.   **On the revenue side, projections of personal income tax and GST/MST revenue have contributed most to the overall forecast error** (Figure 6). As far as subcomponents of tax revenue are concerned, Canadian RMSEs are generally not as large relative to other countries as for aggregate revenues. What makes Canada stand out, however, is that the mean error for all subcomponents is negative, compared to at least one positive error for all of the other 5 countries for which similar data have been available. It is the accumulation of small but persistently negative errors, rather than large forecast errors *per se*, that make Canadian forecasters appear relatively pessimistic.

39.   *Deviations on the expenditure side appear partly driven by smaller than expected debt servicing costs*. For all countries, expenditure forecasts have been significantly more accurate than revenue forecasts, as evident from substantially lower MEs and RMSEs. Canada has been no exception as far as mandatory and discretionary expenditure items are concerned. However, interest payments were on average 2 percent lower than projected, leading to an average forecast error of 0.1 percent of GDP.[53]

40.   *Even when scaled by the size of GDP, Canadian fiscal forecasts appear unusually conservative*. When forecast errors are defined as the difference between actual and projected GDP ratios, Canada still has the largest negative mean error compared to the benchmark group (see Figure 6, bottom right panel), although the RMSEs are in a more moderate range. Canada may have been helped by the fact that forecast accuracy improves once revenues are expressed as GDP ratios, given the close to unit elasticity of tax revenues in many countries. On the other hand, projections of expenditure-to-GDP ratios suffer particularly from GDP forecast errors as nominal expenditures tend to be more closely in line with budget targets.

E. Statistical Analysis of Forecast Outcomes

41.   *This section uses statistical tests to further explore the forecast characteristics described in the previous section*. First, tests will be used to check for the presence of a forecast bias, and whether projections are efficient in the sense that they use all information available at the time of the forecast. Second, budget projections for GDP growth and the fiscal balance are compared with private sector consensus forecasts. Third, using structural

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[52] Economic prudence and contingency are categorized neither as revenue nor expenditure, with the result that the discrepancy between projected and actual deficits in Canada is larger than the difference between the revenue and expenditure errors. Redefining the projected deficit as the difference between revenue and expenditure projections corrects for this factor.

[53] The forecast error for debt service charges also stems partly from a prudence adjustment to the interest rate forecast in the late 1990s, although this effect could not be quantified.

information described earlier in this paper, country data are pooled to test whether variables describing the forecasting environment have a significant impact on projection outcomes.

Figure 5. Descriptive Statistics for One- and Two-Year Fiscal Budget Forecasts, 1995-2003
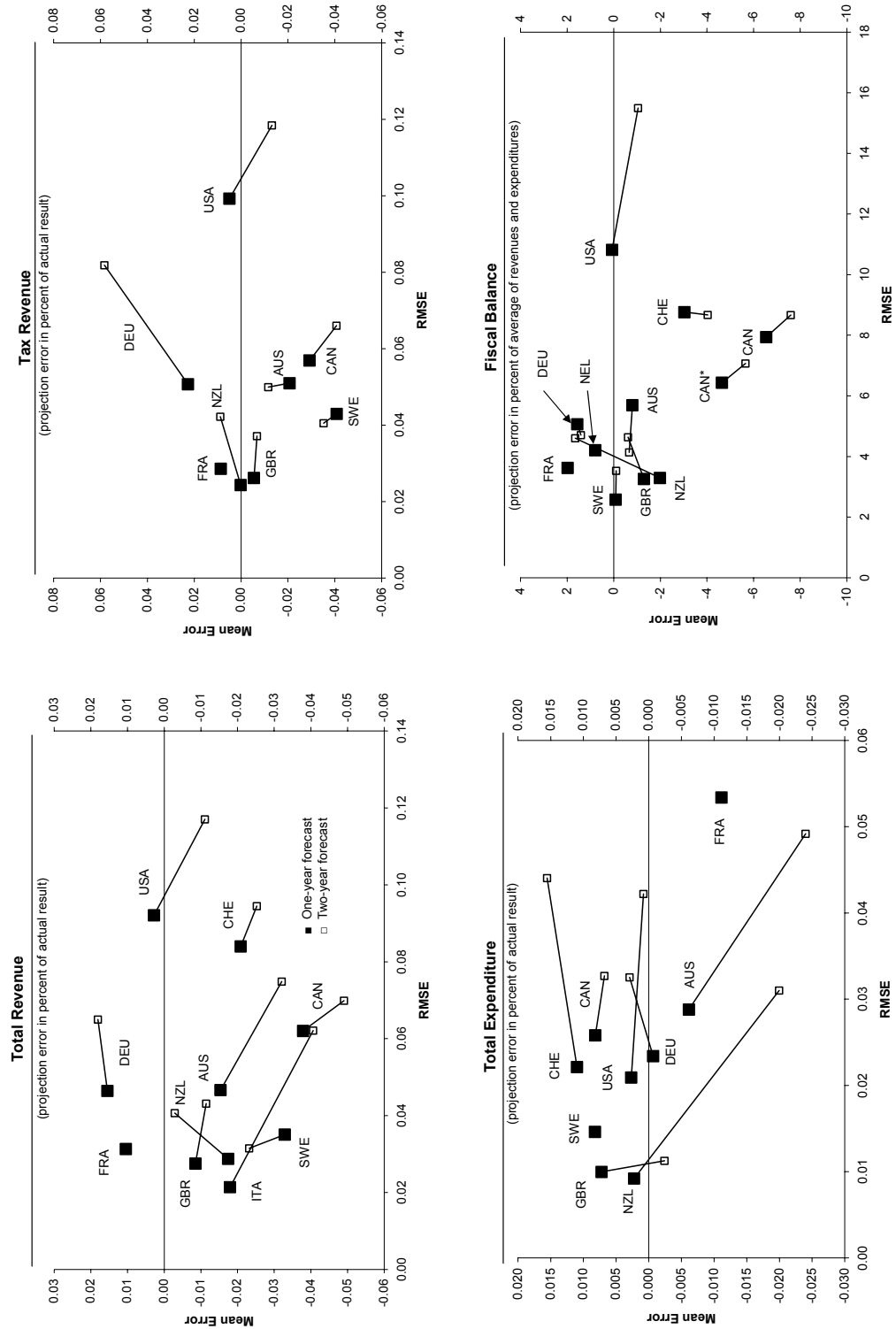
Source: Staff calculations.
1 CAN* indicates forecast error relative to planning target (i.e., excluding prudence and contingency).

Figure 6. Decomposition of Mean Forecast Errors[1]

(Forecast errors in percent of GDP)

Tax Revenue

Fiscal Balance[2]

Expenditure

Fiscal Balance (Ratio Forecast)[3]
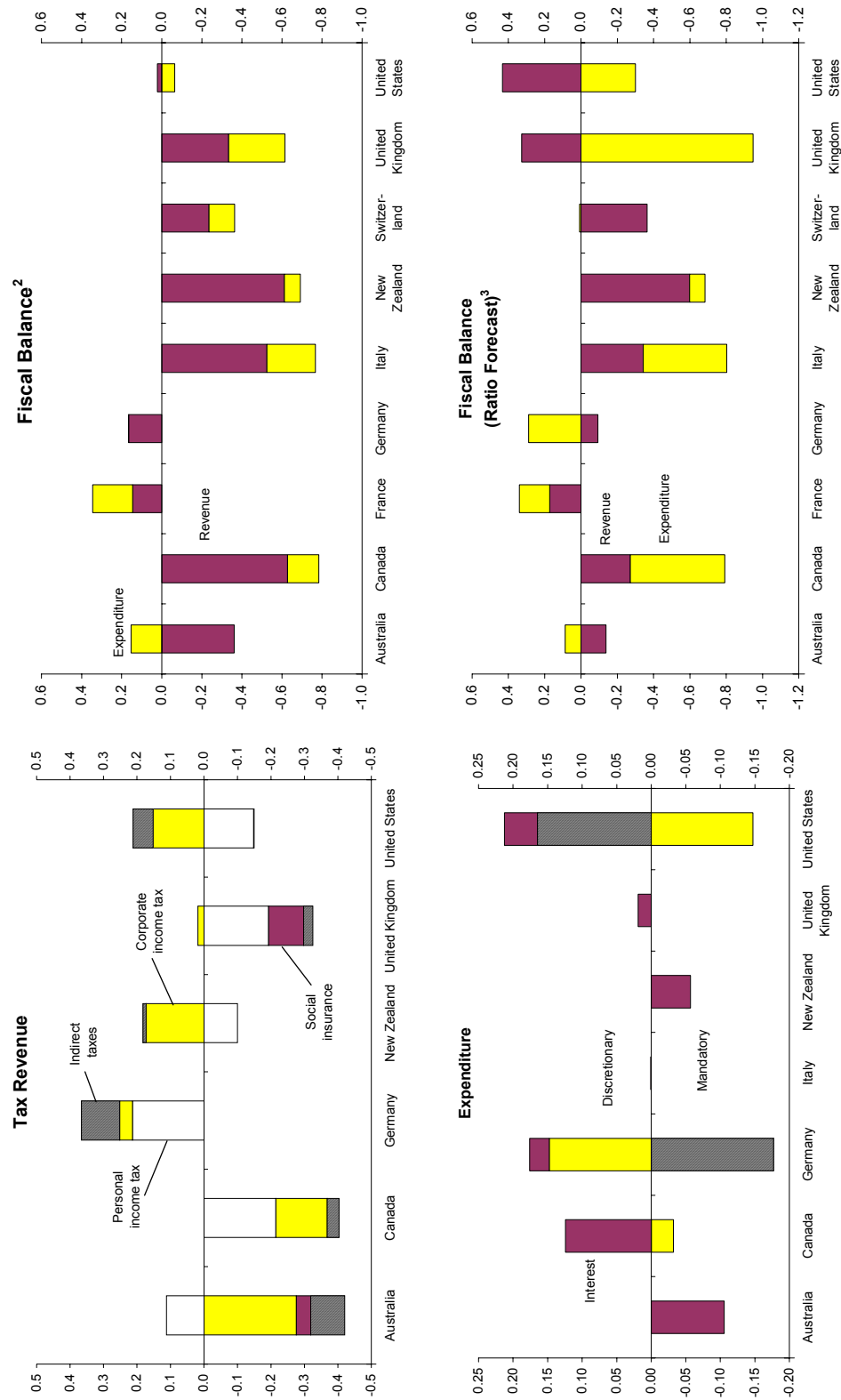
Source: Staff calculations.
[1] Components may not add up to overall amounts as only most common components are listed or information is incomplete.
[2] Forecast erro in nominal terms in percent of actual GDP.
[3] Difference in projected and actual revenue and expenditure-to-GDP ratios.

Bias and efficiency tests

42.   *A series of statistical tests confirm a forecasting bias in some components of Canada's macroeconomic and fiscal forecasts* (Table 8). The tests—which are described in Appendix II—suggest that, between 1995 and 2003, the mean and median of the forecasts for nominal GDP, as well as total and nontax government revenue were significantly different from zero. This places Canada in a group with Germany, New Zealand, Sweden, and the United Kingdom, which all exhibit a consistent bias in either the macro forecast or aggregate fiscal revenues or expenditures. By comparison, Australia, France, Italy, the Netherlands, and the United States are largely free of such findings.

43.   *The tests also underline that it is the aggregation of small unidirectional forecast errors that leads to an overall bias in growth and revenue estimates in Canada*. For example, both real GDP growth and GDP inflation forecasts have a negative mean error that is not statistically different from zero. However, the hypothesis of a zero nominal GDP error (to which both the growth and inflation error contribute) is clearly rejected. Similarly, the mean errors of individual tax revenue components were not significant at the 10 percent level, unlike the statistically significant aggregate revenue forecast error. Nontax revenues, which account for about 10 percent of total revenues, also appear strongly downward biased.

44.   *Errors in the output projection tend to explain a substantial share of revenue errors across most countries, including in Canada*. In a second battery of mean tests, forecast errors for macroeconomic variables were added to the right hand side of the test regression. Whereas inflation and unemployment rate forecast errors failed to affect test outcomes, either nominal GDP or real growth errors eliminated much of the apparent bias in revenue forecasts across most countries. In the case of Canada, the null hypothesis of unbiased forecasts was no longer rejected once nominal GDP errors were included, suggesting a close approximation of the country's tax base.[54] Given the typically small share of unemployment assistance and other cyclically sensitive components in total government expenditure, it is not surprising that macroeconomic variables appear to have a lesser influence on the outcome of expenditure projections, with exceptions including Sweden and Switzerland and some spending components in the United States and Germany.

45.   *Finally, tests of forecast efficiency suggest that Canadian budget forecasts may not have employed all of the information available at the time they were made*. Under an "efficient" forecasting process, forecasters would update their forecasting models to take into account any source of systematic forecast errors, such as a permanent improvement of a country'sgrowth prospects. As a result, forecast errors would at least be independently if not normally distributed. Using tests described in Appendix II, this hypothesis is rejected for Canadian growth and revenue estimates, as well as a number of variables for Germany, the Netherlands, the United Kingdom, and the United States (Table 9). Consistent with the

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[54] Among countries with a significant nominal GDP coefficient, the measured elasticity of revenue errors was between 1¼ and 2, with Canada in the middle (1½) and the United States at the high end.

Table 8. Results of Forecast Error Median and Mean Tests [1]

	Australia	Canada	France	Germany	Italy	Nether-lands	New Zea-land 2/	Sweden 2/	Switzer-land	U.K.	U.S.
Nominal GDP	- (8)	SWVCc (9)	- (8)	SWVCc (9)	- (9)	- (9)	- (9)	C (4)	- (9)	SWVC (6)	- (9)
Real GDP growth	- (9)	- (8)	- (6)	SWVCc (9)	- (8)	- (9)	- (6)	- (4)	- (9)	- (5)	- (9)
GDP inflation 3/	- (9)	- (8)	- (6)	Cc (9)	...	- (9)	...	- (4)	Cc (9)	- (5)	c (9)
Unemployment rate 3/	C (9)	- (8)	...	...	- (3)	C (9)	- (6)	- (4)	...	...	- (9)
Government revenue	- (8)	WVCc (9)	- (6)	- (9)	Cc (6)	- (6)	WVC (8)	VC (4)	- (9)	- (6)	- (9)
Tax revenue	- (8)	- (9)	- (6)	- (9)	...	- (9)	- (9)	VC (4)	...	- (6)	- (9)
of which:											
Personal income tax 3/	- (2)	- (9)	...	C (9)	...	- (6)	- (9)	C (4)	...	- (6)	- (9)
Corporate income tax 3/	- (2)	- (9)	...	- (9)	...	- (6)	- (9)	- (4)	...	- (6)	- (9)
Social insurance taxes 3/	- (2)	...	...	...	...	...	...	...	...	C (6)	- (9)
Indirect taxes 3/	- (2)	- (9)	...	- (9)	...	- (6)	- (9)	- (4)	...	- (6)	C (9)
Other revenue	- (8)	SWVCc (9)	...	- (9)	...	SWVCc (5)	SWVCc (8)	- (4)	...	- (6)	- (9)
Government expenditure	- (8)	- (9)	Cc (6)	- (9)	- (6)	- (6)	- (8)	SWVc (7)	SW (9)	WVC (6)	- (9)
Mandatory expenditure	...	- (9)	...	C (9)	...	...	...	...	...	...	WV (9)
Discretionary expenditure	...	- (9)	...	SWVCc (9)	...	...	...	...	...	...	SWVC (9)
Interest expenditure	SWVCc (9)	- (7)	...	S (9)	- (6)	- (9)	c (9)	- (4)	...	- (0)	- (9)
Fiscal balance 3/	- (8)	C (9)	- (8)	- (9)	C (6)	- (6)	C (8)	- (4)	- (9)	- (6)	- (9)
Mean tests including growth terms 4/											
Government revenue	- (8)	Gg (9)	ng (6)	g (9)	Nng (6)	nGg (6)	NG (8)	NG (4)	Gg (9)	n (6)	- (9)
Tax revenue	- (8)	g (9)	ng (6)	- (9)	...	g (9)	- (9)	NG (4)	...	- (6)	- (9)
Other revenue	n (7)	Gg (9)	...	- (9)	...	NnGg (5)	NnGg (8)	- (4)	...	- (6)	- (9)
Government expenditure	- (8)	g (9)	Nng (6)	- (9)	- (6)	- (6)	- (8)	N (4)	- (9)	g (6)	- (9)
Mandatory expenditure	...	- (9)	...	- (9)	...	...	...	...	...	...	- (9)
Discretionary expenditure	...	- (9)	...	g (9)	...	...	...	...	...	...	NG (9)
Interest expenditure	NnGg (8)	Nn (7)	...	- (9)	g (6)	- (9)	n (9)	- (4)	...	...	- (9)

Source: Staff calculations. See Appendix II for a description of the underlying methods.

1/ Letters indicate tests that reject a zero median or mean at the 10 percent significance level. (1) Median tests. S: sign test, W: Wilcoxon test, V: van der Maerden test; (2) Mean tests. C: regression on constant, c: C with AR(1) term. The number of observations is listed in brackets for each cell.
2/ Test with AR(1) terms and robust residuals were only calculated for variables with more than 4 observations.
3/ Mean test only.
4/ Letters indicate tests that reject zero mean at the 10 percent significance level. N: regression on constant and nominal GDP forecast error, n: N with AR(1) term, G: regression on constant and real GDP growth forecast error, g: G with AR(1) term.

results of this test, Canada is also one of the few countries to exhibit strong autocorrelation in both tax and nontax revenue errors.

Budget vs. private sector forecasts

46.   ***One measure of comparing budget forecasts against each other is to study how they hold up against private sector forecasts in their countries***. For that purpose, one-year budget forecasts were compared with Consensus projections for growth and the fiscal balance, taken from the month when the corresponding budget was released (March for Canada, February for the United States, etc.). Descriptive statistics for consensus projection errors reveal that their magnitude is generally close to those of budget forecast errors, and that neither growth nor fiscal forecast errors are consistently larger for public or private forecasters across countries (Figure 7).

47.   ***Differences in government and private sector forecast errors in Canada are relatively small***. Private sector forecasts exhibit a slightly smaller RMSE for growth and fiscal forecasts than those of the government, similar to the cases of Italy and New Zealand (Table 10). Although the difference in the growth forecast appears rather minor—reflecting the fact that budget forecasts are largely based on macroeconomic projections provided by private forecasters—the test of RMSE equality is rejected at relatively high confidence levels. As for the fiscal forecast, anecdotal evidence suggests that the private sector is usually focusing on the underlying budgetary balance (i.e., the simple difference between federal revenues and expenditures, excluding the economic prudence and contingency reserve; Figure 8). The difference in RMSEs indeed becomes statistically insignificant once that concept is used.

48.   ***Tests for statistical dominance have also proved inconclusive***. While a visual inspection already suggests that the difference between the two sets of projections is small relative to the magnitude of the overall error, a formal test can also be used to analyze whether one of the forecasts statistically encompasses the other (see Appendix II). As shown in Table 10, these tests often yield inconclusive results—such as when coefficients are estimated with similar magnitude but opposite sign—as in the case of the Canadian growth forecast. The fiscal forecast contained in Canada's budgets appears somewhat weak relative to consensus, but the only clear-cut cases of statistical dominance relate to fiscal forecasts in Italy and New Zealand, where the private sector appears to have a clear edge over the government, and vice versa in France.

Factors affecting forecast errors

49.   ***Finally, this paper attempts to relate forecast performance to major characteristics of the fiscal environment, as well as measures of underlying economic volatility***. This approach follows Strauch, *et al.* (2004) who analyzed whether budget forecasts by EMU countries were influenced by elections or institutional factors. Accordingly, some of the information collected in sections B and C of this paper has also been used for empirical testing (a list of variables is contained in Table 11).

Table 9. Results of Efficiency Tests

	Australia	Canada	France	Germany	Italy	Netherlands	New Zealand	Sweden	Switzerland	U.K.	U.S.
Joint significance tests[1]											
Nominal GDP	- (8)	FC (9)	- (8)	FC (9)	C (9)	C (9)	- (9)	- (4)	- (9)	FC (6)	- (9)
Real GDP growth	- (9)	C (8)	- (6)	FC (9)	FC (8)	- (9)	- (6)	- (4)	- (9)	C (5)	FC (9)
GDP inflation 3/	- (9)	- (8)	FC (6)	FC (9)	...	- (9)	...	- (4)	FC (9)	- (5)	- (9)
Unemployment rate 3/	FC (9)	- (8)	...	...	C (3)	FC (9)	- (6)	- (4)	...	...	- (9)
Government revenue	- (8)	C (9)	- (6)	- (9)	C (6)	FC (6)	- (8)	FC (4)	- (9)	C (6)	C (9)
Tax revenue	- (8)	- (9)	C (6)	- (9)	...	- (9)	- (9)	FC (4)	...	- (6)	C (9)
of which:											
Personal income tax 3/	...	- (9)	...	FC (9)	...	- (6)	- (9)	FC (4)	...	C (6)	- (9)
Corporate income tax 3/	...	C (9)	...	- (9)	...	FC (6)	- (9)	- (4)	...	C (6)	FC (9)
Social insurance taxes 3/	...	...	...	...	...	...	...	...	...	FC (6)	- (9)
Indirect taxes 3/	...	- (9)	...	- (9)	...	FC (6)	- (9)	- (4)	...	- (6)	FC (9)
Other revenue	- (8)	FC (9)	...	FC (9)	...	FC (5)	FC (8)	- (4)	...	FC (6)	FC (9)
Government expenditure	- (8)	- (9)	- (6)	- (9)	- (6)	- (6)	- (8)	- (7)	- (9)	FC (6)	C (9)
Mandatory expenditure	...	- (9)	...	- (9)	...	...	...	...	...	...	FC (9)
Discretionary expenditure	...	- (9)	...	FC (9)	...	...	...	...	...	...	FC (9)
Interest expenditure	FC (9)	- (7)	...	- (9)	- (6)	FC (9)	- (9)	C (4)	...	...	- (9)
Error autocorrelation[2]											
Nominal GDP	-	-	-	-	-	3	-	-	-	-	-
Real GDP growth	-	-	-	-	1	-	...	-	-	-	-
Government revenue	1	3	-	-	-	-	-	-	-	-	2
Tax revenue	-	2	3	-	...	-	-	-	...	-	3
Other revenue	-	3	...	1	...	-	-	...	...	-	-
Government expenditure	-	-	-	-	2	-	-	-	-	-	-

Source: Staff calculations. See Appendix II for a description of the underlying methods.

1/ Letters indicate which tests reject the joint hypothesis of zero constant and unity coefficient in a regression of actual values on a constant and one-year forecasts at the 10 percent significance level. F: F-Test assuming i.i.d. normal residuals. C: Chi-Square test. The number of observations is listed in brackets for each cell.
2/ Test reports longest lag for which autocorrelation in error terms was found (with a maximum of 3). This test was run with data going back to 1990.

Figure 7. Budget and Consensus One-Year Growth Forecast Errors
(forecast minus actual growth rate)

National authorities' real GDP growth
error for forecast one year ahead

Consensus forecast of real GDP
growth error for forecast one year ahead
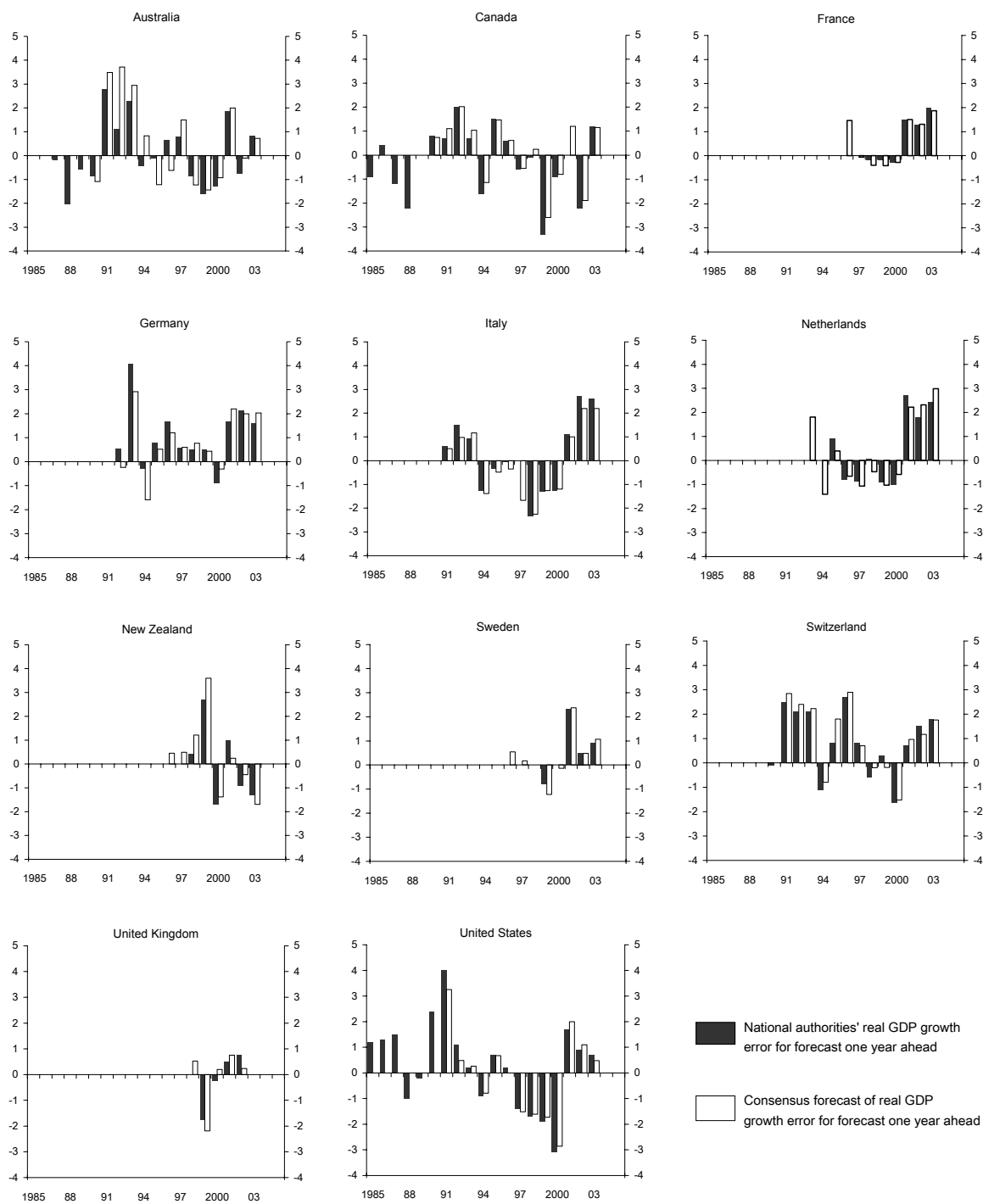
Souce: Staff calculations.

Table 10. Comparing Budget and Consensus Forecasts

	Australia	Canada[1]	France	Germany	Italy	Nether-lands	New Zea-land	Sweden	Switzer-land	U.K.	U.S.
Consensus Forecast											
Real GDP Growth											
Mean Error	-0.1468	-0.2971	0.5970	1.0501	-0.0181	0.4587	-0.6335	0.6767	0.8203	-0.0938	-0.3843
RSME	1.2776	1.4690	1.2223	1.3611	1.6526	1.6704	1.1669	1.6395	1.5510	1.1948	1.6510
Number of observations	9	8	6	9	8	9	3	4	9	5	9
Fiscal Balance											
Mean Error	4.2995	-4.1836	2.9321	-7.2919	-0.4437	...	-0.1229	...	...	-1.5113	0.1102
RSME	7.0366	5.9744	6.1863	9.3923	2.1655	...	1.5276	...	...	3.7213	11.6112
Number of observations	8	9	8	9	6	...	8	...	...	6	9
Test for RMSE Equality[2]											
Growth Forecast											
F-test (prob)	0.7635	0.0112	0.2876	0.6720	0.0007	0.7977	0.2895	0.2365	0.7682	0.2844	0.6735
Chi square-test (prob)	0.7554	0.0000	0.1774	0.6564	0.0000	0.7918	0.1796	0.0396	0.7604	0.1397	0.6581
Fiscal Balance Forecast											
F-test (prob)	0.0701	0.0198 0.6761	...	0.0036	0.1168	...	0.2626	...	...	0.5966	0.0709
Chi square-test (prob)	0.0139	0.0007 0.6609	...	0.0000	0.0212	...	0.1855	...	...	0.5547	0.0191
Encompassing Test[3]											
Growth Forecast											
Budget (β_0)	-0.3349	-4.1244	4.7033	0.2791	-5.9446	1.2641	-0.6091	3.9354	0.5234	-0.1455	-0.0028
(t-statistic)	-0.77	-4.49	1.05	0.25	-4.45	0.92	-0.66	4.20	0.32	-0.14	0.00
Consensus (β_1)	-1.6358	4.7403	-3.0184	1.0733	5.9657	-0.2955	-4.7099	-4.3690	0.2757	0.0445	-1.0778
(t-statistic)	-2.86	4.05	-0.66	0.86	2.42	-0.11	-2.92	-6.16	0.39	0.06	-0.40
Fiscal Balance Forecast											
Budget (β_0)	0.3018	-0.6603 -0.7459	1.6933	-0.6804	-0.2732	...	0.2558	...	...	3.0585	5.3721
(t-statistic)	0.51	-0.78 -0.87	5.37	-3.43	-0.86	...	1.23	...	...	1.57	2.86
Consensus (β_1)	0.5097	1.4235 1.5208	-0.5001	0.3713	1.1442	...	0.6480	...	...	-1.1826	-4.9973
(t-statistic)	1.21	1.88 1.89	-1.75	3.30	3.52	...	4.63	...	...	-1.00	-2.49

Source: Staff calculations. See Appendix II for a description of the underlying methods.

1/ Tests using budget projections of the overall balance (left column) and underlying balance (i.e., projected revenues less expenditures, excluding economic prudence and contingency reserve; right column).
2/ Ashley test. Null hypothesis is that the RMSE of the budget and Consensus forecasts are identical.
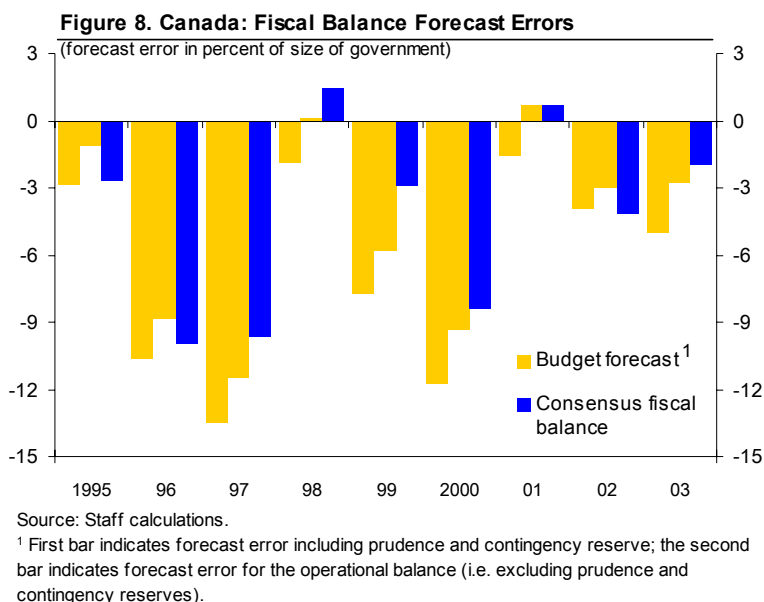3/ The test probes whether both the budget and Consensus forecasts contain unique information.

Table 11. Potential Factors Affecting Forecast Outcomes

Federal structure (dummy variable)	Presence of a federal political structure.	Budget lead time (dummy)	Average number of months between submission of the budget and the budget vote (see Table 1).
Fiscal rule (dummy)	Presence of a fiscal rule (see Table 4).	Prudential framework (dummy)	Combination of "Prudential framework 1" and "Prudential framework 2."
Expenditure ceiling (dummy)	Presence of a formal expenditure ceiling.	Prudential framework 1 (dummy)	Positive response to the question whether there is an explicit "prudence" factor built into the economic assumptions which reduces the final economic estimates by a set amount?
Deficit ceiling (dummy)	Presence of a formal deficit ceiling.		
Appropriation	Share of budget expenditure subject to appropriation (midpoint of range; see Table 1).	Prudential framework 2 (dummy)	Positive response to the question whether growth assumption underpinning the medium term fiscal framework contains a margin of "prudence" vis-à-vis the forecast.
Regulatory framework (dummy)	Number of aspects regulated by the constitution or by law (see Table 1).	Stable tax revenue	Average share of personal income, social security, and indirect tax revenue in total revenue (1991-2002)
Budget reporting	Number of OECD Best Practices met (see Table 1).		
Accountability framework (dummy)	Positive response to the question whether a formal comparison is made between the medium-term fiscal policy objectives and the government's annual budget with explanations given for any deviations.	Mandatory expenditure	Average share of mandatory expenditure in total central government expenditure.
		Transfers	Share of transfer payments to sub-national governments in total central government expenditure (see Table 3)
Performance assessment (dummy)	Regular, occasional, or no external ex-post assessment of forecasting performance (see Table 6).		

Sources: OECD/WB (2003); staff calculations.

50.   ***The paper also tests the hypothesis that strong fluctuations in a country's economy could affect the accuracy of budget forecasts***. For example, commodity-exporting countries like Australia, Canada, and New Zealand could be expected to suffer from larger and more frequent exogenous shocks than other countries. Given the difficulties of economic models in predicting turning points, this could make economic projections more difficult.

Figure 8. Canada: Fiscal Balance Forecast Errors
(forecast error in percent of size of government)

Source: Staff calculations.
[1] First bar indicates forecast error including prudence and contingency reserve; the second bar indicates forecast error for the operational balance (i.e. excluding prudence and contingency reserves).

51.   ***Indeed, Canada has experienced greater macroeconomic volatility than many other countries***:

- ***Overall, Canada registered the third highest output volatility among benchmark countries between 1990 and 2003*** (Table 12). Short-term interest rates also fluctuated relatively strongly during that period, but other macroeconomic variables, including consumer price inflation, business sector wages, and the nominal effective exchange rate remained comparatively stable.

- ***However, fiscal aggregates have not been significantly more volatile than in other countries***. Volatility in Canada's expenditure-to-GDP ratios was higher than in many benchmark countries. This could partly reflect policy-induced changes in the expenditure ratio, such as cutbacks in spending on economic affairs (subsidies) and social protection related to consolidation in the 1990s, as well as sharp reductions in public debt payments. By contrast, Canada's revenue volatility (measured relative to the size of GDP) has been lower than in any of the other ten countries—with the exception of corporate income tax revenue, which may have been particularly affected by export volatility.[55]

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[55] For comparing volatility across countries, fiscal aggregates have been divided by GDP. Sources of volatility include policy changes, such as enhanced public expenditure programs in the United Kingdom since 2000, expenditure cuts in Canada or Sweden during the 1990s, or tax cuts in the United States. The results are not corrected for this fact, both because it can be argued that volatility stemming from policy changes also contributes to a more difficult forecasting environment, and because estimates of non-policy induced volatility are not available for most countries.

Table 12. Volatility of Macroeconomic and Fiscal Variables, 1990- 2003

	Australia[1]	Canada	France	Germany[2]	Italy[3]	Netherlands	New Zealand	Sweden	Switzerland	U.K.[4]	U.S.	Rank Canada
Macroeconomic Variables	(standard deviation of annual percent changes, unless specified otherwise)											
GDP, real	1.5	2.1	1.3	1.2	1.1	1.6	2.2	2.2	1.5	1.5	1.4	3
Private consumption[5]	0.8	0.5	0.3	0.3	0.3	0.4	2.1	0.3	0.2	0.5	0.6	4
Public consumption[5]	0.2	0.4	0.3	0.3	0.3	0.3	0.5	0.5	0.2	0.3	0.2	3
Gross capital formation[5]	2.0	1.5	1.3	1.0	1.1	1.1	2.2	1.8	1.6	0.9	1.0	5
Change in inventories[5]	0.8	0.8	0.6	0.5	0.5	0.6	0.8	0.8	1.0	0.4	0.4	4
Exports of goods & services[5]	0.9	1.9	1.1	1.4	1.3	2.1	0.8	1.9	1.7	0.8	0.5	3
Consumer price index	1.9	1.4	0.8	1.1	1.6	0.7	1.3	3.2	1.9	2.1	1.0	6
Short-term interest rate in percent	4.6	4.1	3.8	2.6	5.4	2.6	5.4	3.8	2.5	3.7	3.8	4
Nominal effective exchange rate	6.5	3.4	3.2	3.6	6.3	3.0	7.7	6.6	4.0	5.8	4.9	9
Tax Revenue	(standard deviation of percentage shares in GDP)											
Total tax revenue	1.5	0.9	1.0	1.3	1.5	2.2	1.4	2.2	1.6	1.2	1.3	11
Taxes on income, profits and capital gain	1.1	0.9	1.9	0.7	0.8	1.8	1.0	1.3	0.5	1.0	1.3	8
Of individuals	0.7	0.9	1.4	0.6	0.4	2.2	1.1	1.2	0.3	0.6	1.1	6
Of corporations	0.7	0.8	0.5	0.3	0.5	0.5	0.7	0.7	0.4	0.7	0.4	1
Social security contributions	...	0.2	1.3	0.7	0.8	1.3	...	0.9	0.5	0.1	0.1	7
Taxes on payroll and workforce	0.1	...	0.1	...	0.6	...	0.2	0.9	...	...	...	...
Taxes on property	0.1	0.2	0.3	0.1	0.6	0.2	0.2	0.2	0.2	0.5	0.1	6
Taxes on Goods and Services	0.5	0.3	0.4	0.5	0.3	0.4	0.3	0.4	0.7	0.3	0.1	10
Central Government Expenditure												
Total expenditure	1.1	3.3	2.1	1.7	...	4.0	...	3.7	1.5	2.5	0.7	3
General public services	0.5	0.8	...	0.9	...	0.8	...	1.6	0.3	0.8	0.7	3
of which: Public debt transactions	0.2	1.1	...	0.3	...	0.9	...	...	0.1	...	0.6	1
Defense	0.2	0.3	...	0.3	...	0.3	...	0.3	0.2	0.6	0.8	5
Economic affairs	0.3	0.5	...	0.3	...	0.4	...	1.4	0.2	0.6	0.4	3
Education	0.3	0.2	...	0.0	...	0.4	...	0.8	0.0	0.3	0.1	5
Health	0.2	0.5	...	0.4	...	1.3	...	0.4	0.2	0.3	0.5	2
Housing and community amenities	0.1	0.1	...	0.1	...	0.8	...	0.9	0.0	0.2	0.1	7
Public order and safety	0.0	0.0	...	0.0	...	0.2	...	0.1	0.0	0.1	0.1	5
Social protection	0.8	1.3	...	1.5	...	0.9	...	2.6	1.2	1.1	0.4	3

Sources: *IMF World Economic Outlook*; *IMF Government Finance Statistics*; *OECD Revenue Statistics*; Fund staff calculations.

[1] Revenue data available thorugh 2002.
[2] Excluding 1991 and 1992 for GDP and its components.
[3] Expenditure data available thorugh 2000.
[4] General government. Data available through 2002.
[5] Standard deviation of contributions to real GDP growth.

52.   ***The results suggest that structural characteristics of the fiscal environment have limited explanatory power for cross-country differences in forecast errors***. For the most important variables contained in budget forecasts, a series of simple OLS regressions of mean errors (MEs) and RMSEs on a constant and one of the structural variables yields few significant results (Table 13).[56] The conservative stance of Canada's forecasts is consistent with some of the findings, but there are also counter-intuitive relationships:

- For example, there is some evidence that stronger accountability reduces the RMSE for the growth and tax revenue forecast, but a federal structure has the opposite effect.

- In countries where the budget is presented to parliament early, revenues appear to be harder to forecast. However, this result may be influenced by a coincidence with recent policy shifts in the United States, which has the largest budget lead time.

- There is weak evidence that deficit and expenditure ceilings coincide with conservative revenue estimates.

- Fiscal rules are associated with overly optimistic forecasts, albeit the same applies to countries with a high share of voted appropriations. A higher share of mandatory expenditure is positively correlated with the forecast error for government spending.[57]

53.   ***On the other hand, the evidence that forecasts tend to be more conservative in the presence of macroeconomic and fiscal volatility is relatively strong***. Especially a more volatile GDP growth environment pushes growth and, by implication, revenue forecast errors downward while leaving expenditure forecasts unaffected.

54.   ***In some equations, volatility indicators and institutional features were found to be jointly significant***. A combination of growth volatility and prudence indicators was found to provide the best explanation for fluctuations in mean errors and RMSEs across benchmark countries, with volatility being consistently and more strongly significant across the range of regressions carried out. Paradoxically, a more formalized accountability framework and stricter requirements for assessing fiscal policy were found to be associated with overly optimistic expenditure forecasts. This may be due to "adverse selection"—formal accountability may have been strengthened particularly in countries with expenditure discipline problems.

55.   ***It remains unclear whether these findings can fully explain the difference between forecast errors in Canada and other countries***. On the one hand, the existence of a mean error/bias for growth and revenue forecasts in Canada appears to be fully explained by a combination of prudence indicators and macro volatility. For example, the predicted value for the mean error of Canada's nominal GDP forecasts is close to the actual value (Figure 9),

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[56] Each of these regressions is run with a maximum sample of only 11 observations, depending on the number of countries for which information was available.

[57] The results are robust in the sense that they hold even if different countries are removed from the sample.

Table 13. Bivariate Regressions of Error Characteristics on Structural and Volatility Indicators[1]

	Nominal GDP		Real GDP Growth		Revenues		Tax revenues		Expenditure		Revenue-to-GDP ratio		Expenditure-to-GDP ratio	
	ME	RMSE	ME	RMSE	ME	RMSE	ME	RMSE	ME	RMSE	ME	RMSE	ME	RMSE
Structural indicators														
Federal structure	0.0070	0.0096 **	-0.1760	0.0077	0.0045	0.0206	0.0015	0.0292 **	0.0035	0.0000	0.2912	-0.4945	-0.0019	-0.2420
Fiscal rule	0.0041	-0.0040	0.5337 *	-0.0432	-0.0050	-0.0011	-0.0018	-0.0149	0.0021	0.0063	-0.1991	0.0384	-0.0148	-0.0285
Expenditure ceiling	-0.0088	0.0031	0.3155	0.1453	-0.0188 *	0.0146	-0.0096	-0.0116	-0.0033	0.0087	-0.8202 **	1.2463 **	-0.4762	0.1658
Deficit ceiling	0.0032	-0.0002	0.3353	-0.1746	0.0035	-0.0294	0.0009	-0.0219	0.0069	-0.0169 *	0.1124	-0.2594	0.2671	-0.3957
Appropriation	0.0002	-0.0001	0.0128 **	-0.0001	0.0000	-0.0001	0.0002	-0.0004 *	0.0000	0.0000	-0.0091	0.0102	-0.0063	-0.0003
Regulatory framework	0.0011	0.0014	-0.1038	-0.0058	0.0028	0.0061	0.0037	0.0058 *	-0.0005	0.0010	0.0743	-0.0607	-0.0085	0.0037
Budget reporting	-0.0026	0.0011	-0.0996	0.0244	0.0000	-0.0016	-0.0017	0.0015	0.0013	-0.0044 *	0.1069	-0.1003	0.0963	-0.1390
Accountability framework	-0.0064	-0.0042	0.2385	-0.2998 *	-0.0059	-0.0084	-0.0088	-0.0311 **	-0.0072	0.0006	-0.2748	0.5084	-0.2500	0.0193
Performance assessment	-0.0078	0.0062 *	-0.3094	-0.0051	-0.0031	0.0217	-0.0006	0.0172	-0.0062 *	0.0061	-0.1379	0.4524	-0.2675	0.0731
Budget lead time	0.0025	0.0025	0.0819	0.0470	0.0051	0.0146 **	0.0070 *	0.0102 **	-0.0020	0.0049	-0.0276	0.2636	-0.1789	0.0989
Prudential framework	-0.0085	-0.0036	-0.3218	0.1132	-0.0169	0.0135	-0.0066	-0.0037	0.0023	0.0133	-0.3665	0.4856	0.1908	0.5978
Prudential framework 1	-0.0135	0.0020	-0.3432	-0.0553	-0.0169	0.0269	-0.0066	-0.0037	-0.0010	0.0144	-0.3666	0.7663	0.0457	0.4786
Prudential framework 2	-0.0022	-0.0078	-0.0506	0.0097	-0.0074	0.0107	0.0062	-0.0103	-0.0013	0.0145	-0.4005	0.7496	0.0169	0.7841
Stable tax revenue	0.0234	-0.0145	2.5825	1.3153	0.0578	-0.0278	0.1054	-0.0204	0.0069	-0.0252	-0.8951	3.0604	-0.5694	-0.1453
Mandatory expenditure	0.0001	0.0001	0.0104	-0.0002	0.0001	0.0009	0.0001	0.0004	-0.0003 *	0.0006 **	-0.0052	0.0138	-0.0164 *	0.0069
Transfers	-0.0004	0.0005	-0.0315	0.0058	-0.0013 *	0.0028 **	-0.0005	0.0009	0.0000	0.0011	-0.0307	0.0391	-0.0118	0.0234
Volatility measures														
Real GDP growth	-0.0231 **	0.0076	-0.2808	0.1122	-0.0273 **	-0.0063	-0.0352 **	-0.0143	0.0051	-0.0079	-0.3234	0.4056	0.1983	-0.2825
Export growth	-0.0020	0.0035	0.4221	0.1278	-0.0196 **	0.0215	-0.0131	-0.0036	-0.0005	0.0162 *	-0.6616 **	0.6377	-0.3788	0.1040
CPI inflation	-0.0087	0.0021	0.0549	-0.0742	-0.0113 *	-0.0179	-0.0197 **	-0.0071	0.0077 **	-0.0094	0.1103	-0.1832	0.3666 *	-0.1804
Tax revenue	-0.0048	0.0051	0.5321	0.0816	-0.0178	0.0284	-0.0112	0.0017	-0.0037	0.0192 *	-0.8355 **	1.4263 **	-0.6057 *	0.4900
Personal income tax revenue	-0.0097	0.0028	0.0945	0.0547	-0.0033	0.0289 *	0.0045	0.0046	-0.0129 **	0.0176 **	-0.5089 *	1.2209 **	-0.6321 **	0.3755
Corporate income tax revenue	-0.0657 **	0.0039	-1.4740	-0.2099	-0.0740 **	-0.0564	-0.0992 **	-0.0544	0.0069	-0.0103	-0.4620	0.0240	1.0707	0.0968
Social insurance tax revenue	0.0102	-0.0070	0.8079 **	0.0033	0.0002	0.0061	0.0068	-0.0179	-0.0148 **	0.0189 *	-0.7551 **	0.7311	-0.9367 **	0.1815
Indirect tax revenue	0.0731 **	-0.0115	2.3091 **	-0.7592	0.0132	-0.0047	0.0251	-0.0867	-0.0073	0.0091	-0.6748	-1.3401	-1.4510	-1.1062
Expenditure	-0.0068	0.0001	0.0748	0.0465	-0.0104 **	0.0026	-0.0074	-0.0074	-0.0010	0.0056	-0.3106 **	0.4271 *	-0.0782	0.1328

Source: Staff calculations. See Table 12 for a definition of structural indicators. Volatility measures are taken from Table 11.

[1] Table reports results of regression of error measures in top row on variable listed in the left column over all countries in the sample (estimated constants are not reported). Asterisks denote significance at the 10 and 5 percent significance level, respectively.

suggesting that forecasters in other countries would on average arrive at the same outcome if they were operating in Canada's forecasting environment. On the other hand, the RMSE—which is a better measure for overall forecast quality—appears little affected by macro volatility, and Canada remains the country with the second highest residual in the bottom chart of Figure 9. Further research—based on more comprehensive data and more refined economic models—would be needed to shed greater light on the relationship between the fiscal forecasting environment and forecast accuracy.[58]

Figure 9. Impact of GDP Volatility on Forecast Quality
(forecast errors of growth rates in annual percent change)
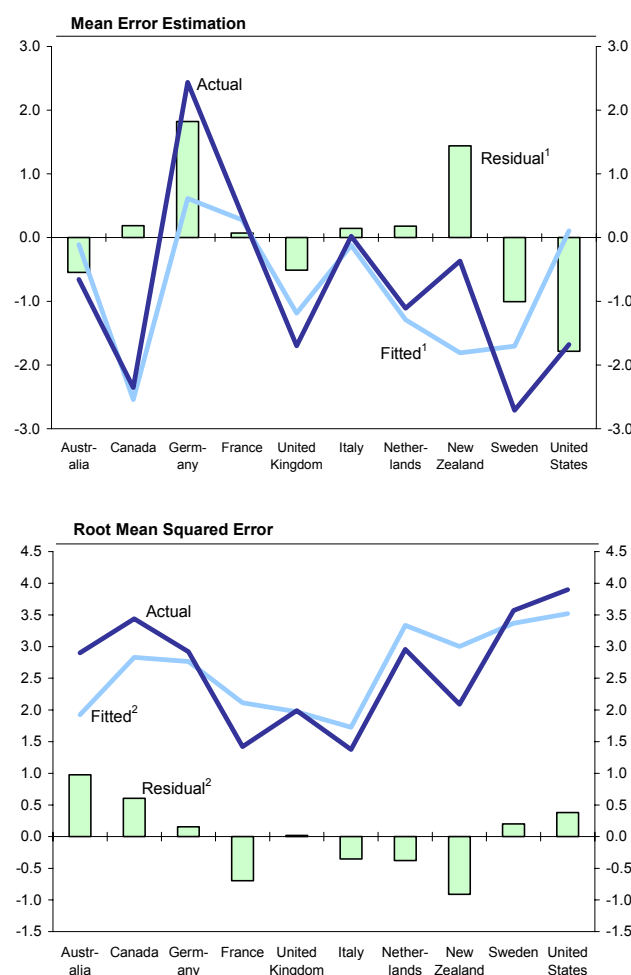
Source: Staff calculations.
[1]Estimation of the mean error between real GDP growth forecasts and the actual results regressed against the volitility of real GDP growth and the budget lead time.
[2]Estimation of the root mean squared error between real GDP growth forecasts and the actual results regressed against the volitility of real GDP growth and prudence indicators.

F. Conclusion

56.   ***The results of this study suggest that Canadian budgets have followed a cautious forecasting approach in recent years***. A descriptive analysis shows Canada with larger and more conservative fiscal forecast errors than most other countries. The study also finds that Canada's aggregate forecast error is composed of small but consistently one-sided errors in fiscal subcomponents, which appears characteristic of a conservative forecasting approach.

57.   ***A considerable part of this outcome appears related to a forecast bias in the macroeconomic component***, ~~which in Canada is provided by the private sector~~. This finding may be partly a consequence of Canada's economic environment, given the link between macroeconomic volatility and pessimistic growth projections established in the last section. Moreover, Canadian ~~private sector~~ forecasters were not unique in underestimating

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[58] Panel estimations are particularly affected by data shortcomings and have added little additional information. However, time dummies for the late 1990s have generally been significant in regressions covering fiscal variables, suggesting that surprises from a strong global growth environment have not been confined to Canada.

the global boom of the late 1990s. Although prudence adjustments in budgets of the mid- to late 1990s also led to a slight increase in forecast errors, macro , but their projections were likely affected by the fact that Canada unexpectedly outperformed other industrial countries throughout much of the period.

58.   ***However, other factors are also likely to have played a role***. Budget forecasters have had to cope with considerable ex-post uncertainty relating to the size of provincial transfers and tax-sharing arrangements, which were exacerbated by the relatively large size of provincial budgets relative to the federal government. Moreover, the economic literature suggests that a conservative budgeting approach constitutes a rational response to a regime where the costs of missing a fiscal target are both high and asymmetric, as has been the case in Canada over the past ten years.

59.   ***Canada could benefit from further improving the transparency of its budgetary forecasts***. Given the importance of restoring public confidence in government finances in the mid-1990s, the consequences of running into deficit were considerably higher than those of achieving a surplus. As Canada's fiscal situation has improved, it is unclear to what extent the relative costs of missing budget targets have changed. However, Canada could benefit from opening up the forecasting process, e.g., by involving private forecasters in producing revenue estimates. Equally important, providing more information about critical parts of the forecasting process—in particular the assumptions and methods used for transforming macroeconomic forecasts into fiscal projections—would invite greater outside scrutiny, helping to improve forecast quality and bolster public confidence in budget projections.[59]

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[59] Examples include Australia and New Zealand, which have adopted transparency legislation to boost public understanding of fiscal forecasts, whereas in other countries—such as Germany and the Netherlands—academic bodies or independent agencies participate in the forecast. IMF (2002) also provides suggestions for expanding the information content of the *Economic and Fiscal Update*.