The Effectiveness of Fiscal Policy in Stimulating Economic Activity
An Empirical Investigation

Emanuele Baldacci, Marco Cangiano, Selma Mahfouz, and Axel Schimmelpfennig[1]

November 2001

Preliminary draft. Comments welcome

Abstract

Recent years have seen a revival of the debate about the role of fiscal policy in stimulating economic activity. The empirical literature suggests that fiscal multipliers are typically positive but small, and while there is some evidence of negative fiscal multipliers, there is no clear consensus on the preconditions for such an outcome. However, most of the empirical evidence is for advanced economies and the effectiveness of fiscal policy in emerging market economies, countries in transition, and developing countries remains largely undocumented. This paper tries to fill this gap by using data for a large number of countries, including developing countries and emerging market economies, to examine whether some of the factors identified in the theoretical literature are indeed important in explaining the effectiveness of fiscal policy in responding to a recession. The focus is on episodes of recession and the associated fiscal policy response. Given the large number of countries and episodes, and differences in the size and composition of fiscal responses, initial conditions, and accompanying policies and developments, the paper explores three different and complementary approaches to try to account for the interactions between fiscal policy and growth during recession episodes: descriptive analysis, multidimensional statistical analysis, and standard regression analysis.

I. INTRODUCTION

Recent years have seen a revival of the debate about the role of fiscal policy in stimulating economic activity, particularly given the recessions in Asian crisis countries, the prolonged slump in Japan and, more recently, the slowdown in the United States. Lane and others (1999), while noting fiscal policy in the Asian crisis countries became increasingly oriented toward supporting economic activity as the assessment of the economic situation was changing, point to the questions that remain about the effectiveness of fiscal stimulus during a crisis. Even if it is generally agreed that there are circumstances where fiscal policy cannot be loosened (e.g. when fiscal imbalances or debt sustainability problems are the root causes of the crisis), whether and when expansionary fiscal policy is effective in supporting activity needs to be studied further.

There is a large literature on the effectiveness of fiscal policy in stimulating economic activity in the short term—see Hemming, Kell and Mahfouz (2000) for a review. Economic theory suggests that fiscal multipliers are more likely to be positive and large when economies are relatively closed, there is considerable slack in productive capacity, government debt is low, fiscal expansion focuses on spending, and there is an accompanying monetary expansion. Fiscal multipliers will be smaller, and could turn negative, when debt sustainability problems result in large risk premia on interest rates, consumers are Ricardian, expectations intensify crowding out effects, or a fiscal expansion increases uncertainty. The empirical literature suggests that fiscal multipliers are typically positive, but small, and while there is some evidence of negative fiscal multipliers, there is no clear consensus on the preconditions for such an outcome. However, most of the empirical evidence is for advanced and mainly G3 economies. The effectiveness of fiscal policy in emerging market economies, countries in transition, and developing countries remains largely undocumented.[2]

This paper uses data for a large number of countries, including developing countries and emerging economies, to examine whether there is any evidence that some of the factors identified in the theoretical literature are indeed important in explaining the effectiveness of fiscal policy in responding to a recession.

Following the approach initiated by Giavazzi and Pagano (1996) and Alesina and Perotti (1997), the focus is on specific episodes, but in this case it is episodes of recession rather than episodes of fiscal expansion or contraction, and the response of fiscal policy and its effectiveness in connection with these episodes. There are two main reasons for focusing on recession episodes. First, the question of whether fiscal policy is effective in stimulating economic activity is particularly crucial and often raised when a country is experiencing a recession or downturn. Second, the impact of fiscal policy on economic activity is likely to

---

[2] One notable exception is Giavazzi, Japelli, and Pagano (2000).

be more visible in periods of slow growth, when there is a lot of slack in the economy and the priority is to revive the economy.

Given the large number of countries and episodes, and differences in the size and composition of fiscal responses, diversity of initial conditions, and accompanying policies and developments, together with the complexity of channels through which fiscal policy may affect economic activity, no single approach can extract all the relevant information from the data. The paper therefore explores three different and complementary approaches to try to account for the interactions between fiscal policy and growth during recession episodes: simple descriptive analysis, multidimensional statistical analysis, and regression analysis.

The paper is organized as follows. Section II presents the definitions and the data used in the rest of paper. Section III reports stylized facts about economic activity and fiscal policy during recession episodes. Section IV summarizes the results of a multidimensional statistical approach which partitions the recession episodes into groups with common characteristics. Based on the insights provided by the descriptive and statistical analyses, Section V reports on an econometric investigation aimed at testing more formally the relationship between economic activity and fiscal policy in recessions. Section VI contains the main conclusions.

II. DEFINITIONS AND DATA

A. Definitions

The following definitions are used in the rest of the paper:

- A **recession episode** is defined as a single year or consecutive years in which real GDP growth is more than one standard deviation below trend growth (defined as the average growth for the country over the period 1970-1999).

- The **fiscal response** during a recession episode is measured by the difference between the average fiscal balance in percent of GDP during the episode and before the episode, multiplied by the length of the episode.[3] When this difference is negative, there is an expansionary fiscal response.

- The **severity of a recession** is measured by the cumulative difference over a recession episode between real GDP growth and trend growth.[4] This measure can be broken down into average annual growth (relative to trend growth) during the recession and the length of the recession.

---

[3] Thus, if the fiscal deficit was 1 percent of GDP before the recession, and increased to 4 then 5 percent over a two-year recession, the fiscal response would be -7 percent of GDP.

[4] Thus if a country's real GDP growth was -1 percent during two years of recession, while trend growth over 1970-1999 was 2 percent, the severity of the recession would be -6 percent.

- The **effectiveness of fiscal policy** is measured by the difference in growth outcomes during recession episodes accompanied by an expansionary fiscal policy and episodes accompanied by a contractionary fiscal policy. While not an exact measure of the size of fiscal multipliers, this measure distinguishes whether they are positive or negative.

The correction for trend growth in defining and measuring the severity of a recession reflects the view that differences in trend growth across countries—which are quite large in our sample—reflect structural factors unrelated to the response of fiscal policy.

The use of the change in the actual fiscal balance to measure the stance of fiscal policy is primarily dictated by the absence of data on structural balances for most of the countries in the sample. The advantages of using the actual balance are that automatic stabilizers are therefore part of the fiscal response and that it avoids making a contentious distinction between the discretionary and automatic components of fiscal policy in a recession.[5] On the other hand, since the actual balance is likely to be influenced by real GDP growth, it will be necessary to account for possible endogeneity bias (see Sections III and V).

B. Data

One of the objectives of this study is to have as broad a coverage of countries and episodes as possible. As a result, the choice of the variables used and the empirical strategy is largely driven by data availability. The sample covers 168 countries over the period 1970-1999.[6] Annual data are largely derived from a number of IMF databases, complemented by World Bank public debt data.[7]

Countries are divided into six groups, based on the World Economic Outlook (WEO) country classification: advanced economies (ADV), including newly industrialized Asian economies, four groups of developing countries, Africa (AFR), developing Asia (ASIA), Middle East (ME) and Western Hemisphere (WH), and countries in transition (CIT).

Although the theoretical literature suggests a long list of factors that may influence the effectiveness of fiscal policy (see Box 1 in Hemming, Kell, and Mahfouz (2000)), many of these (e.g. uncertainty, sensitivity of consumption and investment to interest rates) are

---

[5] Determining what constitutes a discretionary policy action remains highly judgmental since any forms of policy inaction can be viewed as a deliberate choice to maintain the status quo. For a discussion of this issue in the context of the Asian crisis, see Box 2.5. "Fiscal balances in the Asian Crisis Countries. Effects of Changes in the Economic Environment Versus Policy Measures," in IMF, 1998.

[6] For countries in transition, episodes prior to 1994 (transition period) are excluded.

[7] A detailed presentation of data sources and variables is given in Appendix 1.

difficult to quantify for a large number of countries. The analysis is therefore limited to the following factors:[8]

Initial conditions:

- slack in the economy, measured by real GDP growth before the recession,

- openness, measured by the ratio of imports to GDP before the recession,

- exchange rate regime, measured by a dummy variable (flexible or fixed),

- debt sustainability, measured by the public debt to GDP ratio before the recession,

- financing constraints facing the government, measured by the fiscal deficit, the current account deficit (both in percent of GDP), and the ratio of foreign exchange reserves to imports, before the recession,

Characteristics of the fiscal response:

- composition of fiscal policy, measured by changes in revenue and expenditure ratios.

Accompanying policies:

- stance of monetary policy, measured by changes in interest rates or in M2 to GDP,

- exchange rate policy, measured by the change in the exchange rate.

In addition to the above factors which are directly derived from the theoretical literature, a few variables (government size, financial depth, terms of trade shocks, inflation, and regional growth) are used to capture other influences.

Finally, an episode is included in the sample only when data for both growth and the fiscal deficit is available before, during and after the episode. After eliminating outliers,[9] the sample is reduced to 276 recession episodes covering 129 countries (see Appendix 1 Table A1 for a list of all the episodes). In a few instances, data limitations reduce the sample size. When this is the case, the number of episodes on which the analysis is based is indicated.

---

[8] However, the variables used only in any section of the paper depend on the methodology used.

[9] Outliers are defined as episodes for which growth or the fiscal deficit are above 15 percent in absolute value. See also Section III and Appendix 1.

III. DESCRIPTIVE ANALYSIS

This section examines some stylized facts on the relationship between growth and fiscal policy during recession episodes.

A. Overview of Recession Episodes

Recession episodes have certain clear general characteristics.

- **They tend to cluster around certain years**, such as 1974-75, 1982-83, 1991-93 and 1997-98 (Figure 1). This clearly points to the influence of some common external or other causes, such as the oil shocks or the Asian crisis.

- **They are generally quite severe**. The severity of the recession is –8.7 percent on average for the overall sample, and annual growth during a recession episode is on average –6.5 percent relative to trend growth (Table 1). This represents a very large fall in real GDP growth. In most cases, growth turns negative during a recession. However, in a few cases, where trend growth is very high, growth may remain positive while falling significantly below trend growth.

- **They tend to be relatively short**. The average length of a recession is 1.3 years, reflecting the fact that 75 percent of the episodes are only one-year long while only a few episodes are more than four-years long.

- **There is a lot of variance among recession episodes**. The standard deviation is thus 6.1 percent for the severity of a recession and 0.7 years for the length.

There are also important differences across country groups. Recessions are more severe on average in the Middle East, Western Hemisphere and in countries in transition, and less severe in advanced economies.

Table 1. Overview of Recessions

Area	Number of episodes	Depth	Length	Growth (relative to long term growth)		
				Before	During	After
AFR	84	-9.5	1.3	0.4	-7.3	1.0
ASIA	52	-8.0	1.3	0.3	-6.0	0.4
MED	13	-10.5	1.1	-0.8	-9.6	-0.4
ADV	61	-5.8	1.4	-0.6	-4.4	0.0
WHD	59	-10.3	1.5	0.3	-7.1	0.8
TRANS	7	-11.9	1.3	-3.8	-9.3	-0.3
ALL	276	-8.7 (6.1)	1.3 (0.7)	0.0 (3.2)	-6.5 (3.1)	0.5 (3.1)

Note: the table presents unweighted averages, standard deviations for the overall sample are in parentheses.

Figure 1. Number of Countries in Recessions, 1971-98
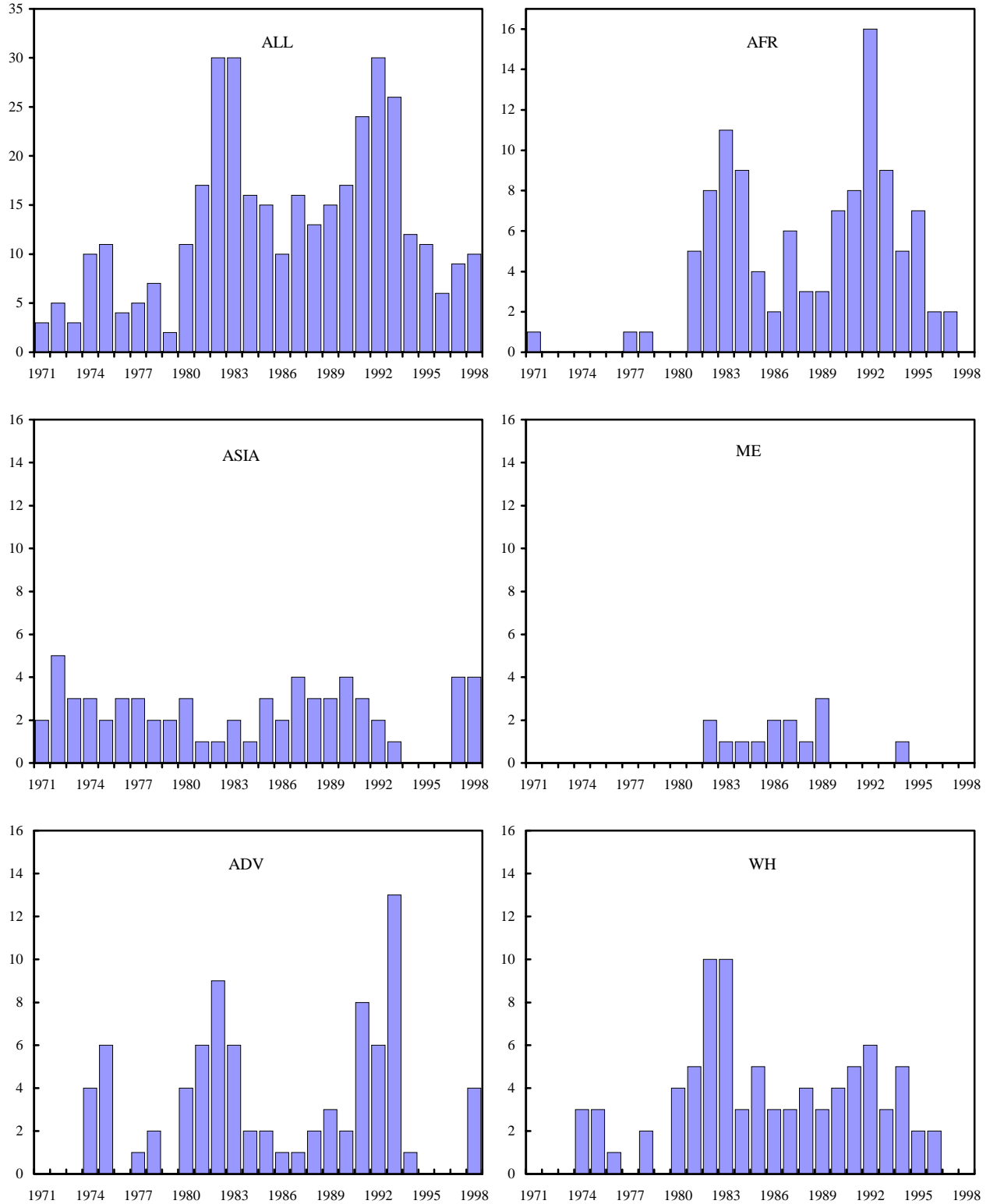
B. Fiscal Response During a Recession

On average, the fiscal response during a recession is expansionary (Table 2). There are, however, differences between country groups: advanced economies exhibit by far the largest expansionary fiscal response (about -3 percent of GDP on average), while Middle East and Western Hemisphere countries have on average a slightly contractionary fiscal response. To examine the effectiveness of fiscal policy, recession episodes are then divided into two groups, those where fiscal policy was expansionary and those where it was contractionary.

Table 2. Fiscal Policy During Recession Episodes

Area	Number of episodes	Fiscal response	Fiscal deficit		
			Before	During	After
AFR	84	-1.1	4.8	5.4	5.3
ASIA	52	-0.9	4.5	5.2	4.7
MED	13	0.2	5.6	4.7	4.5
ADV	61	-3.1	1.3	3.2	3.5
WHD	59	0.5	4.0	4.1	2.9
TRANS	7	-0.5	6.0	6.2	4.0
ALL	276	-1.1 (5.6)	3.9 (4.7)	4.6 (4.1)	4.2 (4.2)

Note: the table presents unweighted averages, standard deviations for the overall sample are in parentheses.

Fiscal policy appears procyclical in 40 percent of the recession episodes (Table 3).[10] The two groups are clearly differentiated, with a fiscal response of about –3¾ percent of GDP for expansionary episodes compared to +3 percent of GDP for contractionary episodes, even though the variance around these numbers is quite large There are also interesting differences between country groups: in particular, fiscal policy is more often expansionary and fiscal contractions tend to be smaller in advanced economies than in the other regions. This result is consistent with, and generalizes, the findings of Gavin and Perotti (1997) that fiscal policy is more countercyclical in advanced economies than in other regions (in their paper, the comparison is with Latin America).

The stance of fiscal policy in a recession appears to be strongly correlated with the country's fiscal situation prior to the recession. The fiscal deficit prior to the recession is significantly larger for episodes accompanied by a fiscal contraction than for episodes accompanied by a fiscal expansion. This result holds for all the groups, with the difference being particularly striking for advanced economies and Middle East countries. Public debt is also higher on

---

[10] Due to the small size of the sample, results for countries in transition are not shown in the rest of the paper, although they remain included in the overall sample.

average before contractionary episodes (Table 4). Government size, as measured by revenue-to-GDP ratio, is larger for episodes with expansionary fiscal policy. Even though this result is partly driven by advanced economies, it holds for most of the groups and may be explained by the fact that automatic stabilizers are larger in countries with a large government.

Table 3. Expansionary versus Contractionary Fiscal Response During Recessions

Expansionary fiscal response

Area	Number of episodes	Percent of total	Fiscal response	Fiscal deficit		
				Before	During	After
AFR	49	58	-4.0	3.6	6.4	6.5
ASIA	26	50	-3.2	2.8	5.3	4.3
MED	7	54	-4.4	2.4	5.6	3.6
ADV	49	80	-4.1	0.3	2.8	3.1
WHD	30	51	-3.8	3.2	6.1	4.4
ALL	166	60	-3.8	2.5	5.1	4.6
			(4.7)	(4.2)	(3.9)	(4.0)

Contractionary fiscal response

Area	Number of episodes	Percent of total	Fiscal response	Fiscal deficit		
				Before	During	After
AFR	35	42	3.0	6.4	4.1	3.6
ASIA	26	50	1.5	6.2	5.0	5.2
MED	6	46	5.5	9.3	3.8	5.5
ADV	12	20	0.8	5.4	4.6	5.1
WHD	29	49	4.9	4.9	2.0	1.3
ALL	110	40	3.0	6.0	3.7	3.6
			(4.4)	(4.6)	(4.3)	(4.3)

Note: the table presents unweighted averages, standard deviations for the overall sample are in parentheses.

Fiscal policy during a recession also appears strongly linked to external factors. In particular, expansionary episodes are accompanied on average by a deterioration in the terms of trade, while episodes with a contractionary fiscal response are characterized on average by an improvement in the terms of trade. This result applies to all the country groups. One possible explanation is that terms of trade shocks directly affect the fiscal deficit in many countries (e.g. through export duties). A deterioration in the terms of trade would thus both increase the fiscal deficit and reduce growth. Another possible explanation is that governments are more prone to let the deficit increase when the recession is caused by a negative terms of trade shock than when it is caused by other factors. The current account deficit is also generally

larger before episodes accompanied by a contractionary fiscal response, which could reflect the impact of external financing constraints.

Finally, recessions accompanied by a contractionary fiscal response are also characterized by higher inflation. This may be explained by the fact that a number of recession episodes in these regions are in countries with very high rates of inflation, and contractionary fiscal policy is only one element of a broader stabilization package.

Table 4. Factors Related to the Stance of the Fiscal Response

Expansionary fiscal response

Area	Public debt		Government size		Terms of trade		Current account balance		Inflation	
	Number of episodes	In percent of GDP	Number of episodes	Revenue to GDP	Number of episodes	In percent of GDP	Number of episodes	In percent of GDP	Number of episodes	In percent
AFR	48	66.5	49	24.8	49	-3.0	43	-4.8	48	13.7
ASIA	20	23.4	26	24.7	24	-1.9	23	-2.4	25	6.7
MED	6	12.1	7	30.1	7	-13.9	6	0.6	7	17.7
ADV	47	24.2	49	39.8	44	-2.1	46	-2.3	49	10.3
WH	27	31.2	30	23.1	30	-0.1	28	-4.2	24	19.5
ALL	153	38.4	166	29.3	159	-2.6	151	-3.4	156	12.7

Contractionary fiscal response

Area	Public debt		Fiscal size		Terms of trade		Current account balance		Inflation	
	Number of episodes	In percent of GDP	Number of episodes	Revenue to GDP	Number of episodes	In percent	Number of episodes	In percent of GDP	Number of episodes	In percent
AFR	34	47.9	35	21.3	35	5.7	34	-5.3	35	16.0
ASIA	20	27.1	26	21.2	26	2.6	26	-2.0	26	11.8
ME	6	47.8	6	29.6	6	9.2	6	-3.9	5	15.5
ADV	11	55.9	12	35.4	11	4.0	12	-1.2	12	7.1
WH	24	35.5	29	21.5	29	3.8	27	-5.6	23	21.0
ALL	97	40.9	110	23.6	109	4.6	107	-4.1	101	15.0

Turning to the composition of fiscal policy, expansionary fiscal responses generally reflect increases in public expenditure rather than tax cuts, while contractionary responses are achieved through a mix of tax increases and expenditure cuts (Table 5). The asymmetry of expansionary fiscal responses is particularly striking for Africa, advanced economies and Western Hemisphere countries, and is observed in all country groups except Middle East. It

is also interesting to note that advanced economies are the only group in which expenditures increase even when the fiscal response is contractionary.

Table 5. Composition of Fiscal Response During a Recession

Expansionary fiscal response

Area	Number of episodes	Change in expenditure	Change in revenue
AFR	49	2.2	-0.6
ASIA	26	1.5	-1.0
ME	7	-0.1	-3.3
ADV	49	2.8	0.3
WH	30	2.9	0.1
ALL	166	2.2	-0.4

Contractionary fiscal response

Area	Number of episodes	Change in expenditure	Change in revenue
AFR	35	-1.2	1.1
ASIA	26	-1.3	0.0
ME	6	-3.3	2.3
ADV	12	1.6	2.4
WH	28	-1.9	1.1
ALL	109	-1.2	1.0

C. Fiscal Response and Economic Activity in a Recession

On average, recession episodes accompanied by an expansionary fiscal response are less severe. The average severity of recessions accompanied by an expansionary fiscal response is –8.4 percent, compared to –9.2 percent for episodes characterized by a contractionary fiscal policy (Table 6). The difference is largest in Asian and Western Hemisphere countries, and holds for all country groups except Africa and advanced economies. On an annual basis (i.e. abstracting from differences in the length of recession), all country groups have higher growth relative to trend during episodes with expansionary fiscal policy compared to those with contractionary fiscal policy. Endogeneity of the fiscal response would lead to the opposite correlation.

On the other hand, growth immediately after the recession is not systematically higher or lower depending on the stance of fiscal policy during the episode. However, as recessions

accompanied by contractionary fiscal policy are generally deeper, the rebound in growth tends to be larger after contractionary fiscal responses.

Table 6. Growth and Fiscal Response During Recession Episodes

Expansionary fiscal response

Area	Number of episodes	Severity	Length	Growth (relative to trend growth)				
				Before	During	After	Decline	Rebound
AFR	49	-9.9	1.4	0.1	-7.1	1.1	-7.3	8.2
ASIA	26	-7.6	1.2	0.4	-6.0	0.2	-6.3	6.2
MED	7	-10.3	1.1	-2.4	-8.6	-1.1	-6.2	7.5
ADV	49	-5.9	1.4	-0.4	-4.3	0.0	-3.9	4.4
WHD	30	-9.5	1.4	0.4	-6.8	0.8	-7.2	7.6
ALL	166	-8.4 (6.1)	1.4 (0.6)	0.0 (2.6)	-6.2 (3.0)	0.5 (3.1)	-6.1	6.6

Contractionary fiscal response

Area	Number of episodes	Severity	Length	Growth (relative to trend growth)				
				Before	During	After	Decline	Rebound
AFR	35	-9.0	1.2	0.7	-7.7	1.0	-8.4	8.6
ASIA	26	-8.3	1.3	0.2	-6.0	0.6	-6.2	6.6
MED	6	-10.7	1.0	1.1	-10.7	0.6	-11.8	11.2
ADV	12	-5.5	1.2	-1.2	-4.5	-0.3	-3.4	4.3
WHD	29	-11.2	1.6	0.2	-7.4	0.8	-7.5	8.2
ALL	110	-9.2 (6.1)	1.3 (0.7)	0.0 (3.9)	-7.1 (3.1)	0.7 (3.1)	-7.1	7.7

Shaded areas indicate observations consistent with effective fiscal policy as defined in Section II

To examine the influence of various factors on the relationship between fiscal policy and growth during a recession, the sample is further split based on the values taken by both the fiscal response and each of the relevant factors. Three broad categories of factors are distinguished: (i) initial conditions, (ii) the composition of fiscal policy, and (iii) accompanying policies.

Initial conditions

Openness and exchange rate regime

In principle, the effectiveness of fiscal policy in stimulating economic activity depends on whether an economy is open or not, and on the exchange rate regime and degree of capital mobility. Fiscal policy is less effective in open economies than in closed economies because

there is some crowding out through imports. With capital mobility, the effectiveness of fiscal policy in an open economy is further reduced with a flexible exchange rate, while it is increased (and possibly more than in a closed economy) with a fixed exchange rate. In the absence of data on the degree of capital mobility, the analysis here distinguishes between only three categories: closed economy, open economy with a flexible exchange rate, and open economy with a fixed exchange rate.

Expansionary fiscal policy is associated with less severe recessions in closed economies or in open economies with a fixed exchange rate (Table 7). Contractionary fiscal policy is then associated with more severe recessions than in open economies with a flexible exchange rate. These results appear remarkably consistent with the predictions of theory (assuming some capital mobility).

Table 7. Openness and Exchange Rate Regime

Growth during recession	Fiscal Policy		
	Expansionary	Contractionary	All
Closed	-5.8	-7.6	-6.6
Open, and flexible exchange rate	-7.1	-6.3	-6.7
Open, and fixed exchange rate	-6.1	-7.0	-6.4

Number of episodes: 118. Openness is defined as imports-to-GDP ratio higher than 30 percent.

Fiscal conditions

When initial fiscal conditions are favorable, expansionary fiscal policy appears to be more effective. In particular, when public debt is relatively low before a recession (below 50 percent of GDP), expansionary fiscal responses are associated with better growth outcomes during the recession than contractionary responses, whereas when public debt is high, the fiscal stance appears to make no difference for the severity of the recession (Table 8). This is consistent with the theoretical prediction that fiscal policy is less effective and crowding out larger when public debt is high. On the other hand, the level of the fiscal deficit before a recession does not seem related to the effectiveness of fiscal policy, whereas it appeared important in determining the choice of the fiscal response, as shown in Table 3. One interpretation is that it may be difficult to finance an increase in an already large deficit, but a large deficit does not in itself necessarily signal sustainability problems, and may therefore not reduce the effectiveness of fiscal policy. Moreover, fiscal policy appears to be more effective in countries with a large government.

Table 8. Initial Fiscal Conditions and Fiscal Response

Growth during recession		Fiscal policy		
		Expansionary	Contractionary	All
High	Yes	-6.9	-7.0	-6.9
public debt	No	-6.0	-7.1	-6.4
before recession	All	-6.2	-7.0	-6.5

Number of episodes: 250. High public debt is defined as higher than 50 percent of GDP

Growth during recession		Fiscal policy		
		Expansionary	Contractionary	All
Large	Yes	-6.7	-7.2	-7.0
fiscal deficit	No	-6.0	-6.8	-6.2
before recession	All	-6.2	-7.1	-6.5

Number of episodes: 276 (full sample). Large fiscal deficit is larger than 5 percent of GDP.

Growth during recession		Fiscal policy		
		Expansionary	Contractionary	All
Large	Yes	-4.8	-6.2	-5.2
government size	No	-7.2	-7.4	-7.3
before recession	All	-6.2	-7.1	-6.5

Number of episodes: 276 (full sample). Large government is when revenue-to-GDP is higher than 30 percent.

External conditions

Similarly, a sound external position before the recession leads to expansionary fiscal response being accompanied by higher growth**.** Conversely, when the current account deficit is large before the recession (i.e. above 5 percent of GDP), contractionary fiscal responses are associated with higher growth (Table 9).

Table 9. Current Account Deficit Before Recession and Fiscal Response

Growth during recession		Fiscal policy		
		Expansionary	Contractionary	All
Large	Yes	-7.6	-7.2	-7.4
current account deficit	No	-5.6	-6.9	-6.1
before recession	All	-6.2	-7.0	-6.6

Number of episodes: 258

Composition of fiscal policy

Expansionary fiscal policy appears to be more effective when it is expenditure-led during a recession. On the other hand, there is virtually no difference for contractionary fiscal responses (Table 10).

Table 10. Composition of Fiscal Policy and Fiscal Response

Growth during recession		Fiscal policy		
		Expansionary	Contractionary	All
Expenditure-led	Yes	-5.8	-7.2	-6.3
Fiscal response	No	-6.9	-7.0	-6.9
	All	-6.2	-7.1	-6.5

Number of episodes: 275

Accompanying policies

Monetary policy

Fiscal policy appears to be more expansionary when monetary policy is also expansionary, with an average increase in interest rates of 0.7 percent versus 1.2 percent. This makes it difficult to disentangle the effects of monetary and fiscal policy in a recession. But, on average, a recession is more severe when both monetary and fiscal policy are contractionary than when they are both expansionary[11] (Table 11). These results are in line with the predictions of the theory. Conversely, when monetary policy is restrictive, fiscal policy does not seem to make much of a difference.

Table 11. Policy Mix and Growth During Recession Episodes

Growth during recession		Fiscal policy		
		Expansionary	Contractionary	All
	Expansionary	-5.0	-5.6	-5.2
Monetary policy	Contractionary	-6.5	-6.7	-6.6
	All	-5.9	-6.3	-6.1

Number of episodes: 171

Exchange rate policy

Recessions preceded by an exchange rate depreciation are more severe on average than recessions preceded by an appreciation, and their severity does not appear to be related to the fiscal response. Similarly, exchange rate policy during a recession does not modify the effectiveness of fiscal policy except that contractionary fiscal policy appears less costly when accompanied by an exchange rate depreciation (Table 12).

---

[11] Similar results are obtained when using the change in M2 to GDP.

Table 12. Exchange Rate Policy Before and During Episodes

Growth during recession		Fiscal Policy		
		Expansionary	Contractionary	All
Exchange rate	Yes	-7.0	-6.9	-7.0
depreciation	No	-4.7	-6.8	-5.4
before recession	All	-6.2	-6.9	-6.5

Number of episodes: 229

Growth during recession		Fiscal Policy		
		Expansionary	Contractionary	All
Exchange rate	Yes	-6.4	-6.9	-6.6
depreciation	No	-5.6	-7.5	-6.3
during recession	All	-6.2	-7.1	-6.5

Number of episodes: 276

D. Sensitivity Analysis

This section examines the sensitivity of the results to changes in the sample and to the definitions used.

Sample

The results presented above are based on a sample in which outliers—defined as episodes with growth or an overall balance to GDP above 15 percent in absolute terms—were excluded. Since this criterion is arbitrary, we need to check how it may influence the results. Alternative criteria for outliers, such as a cut off value of 10 percent rather than 15 percent, or the exclusion of the extreme quintiles or deciles were thus explored. Table 13 shows that even though the sample size varies substantially, the results are not very different.

Table 13. Impact of Filtering Method on Sample Size and Results

Filtering method	Number of episodes	Impact of fiscal response on growth (1)
+/-15 percent interval	276	0.9
+/-10 percent interval	199	0.7
1st and last quintiles excluded	216	0.7
1st and last deciles excluded	124	0.8

(1) Difference between average growth during episodes with expansionary and contractionary fiscal response

Selection bias

Another possible bias comes from the criterion used to define recessions. As growth during a recession is measured by the difference between actual and trend growth, it is by definition bounded by the standard deviation of real GDP growth for the country. This could result in

an undesired correlation between our measure of growth during a recession and the standard deviation (which can be seen as a proxy for the volatility of real GDP growth) if growth during was always very constrained by its upper bound. The average difference between growth during a recession and this bound is 3.2 percent for the overall sample. It therefore appears large enough—as a comparison, the standard deviation of real GDP growth is 4.4 over the sample—to suggest the definition of recession episodes does not bias the results. [12]

E. Preliminary Findings

Overall, many of the observations in this section appear to be broadly in line with theoretical predictions and the following stylized facts emerge:

- On average, fiscal policy is expansionary during recession episodes. However, a very large number of recession episodes (40 percent of total) are accompanied by contractionary fiscal policy. Unfavorable initial conditions (high public debt, and large fiscal and current account deficits) are associated with a contractionary fiscal response in a recession, while negative terms of trade shocks or a large public sector tend to result in a more expansionary fiscal response.

- There is some evidence that expansionary fiscal policy dampens the severity of a recession, especially in open economies with a fixed exchange rate, favorable initial fiscal and external conditions (low public debt, a large public sector, and a small current account deficit), and in combination with expansionary monetary policy. Expenditure-led fiscal expansions are also associated with less severe recessions. All these results are consistent with the predictions of the theory, even though the magnitude of the average effects is small, and the variance is large.

- There are marked differences between advanced economies and other country groups. The fiscal response is more often expansionary in advanced economies. At the same time, the impact of fiscal policy tends to be smaller than in other groups.

- A number of other factors are associated with both the fiscal response and the severity of a recession. Inflation tends to be higher, and monetary policy more contractionary during episodes with a contractionary fiscal response, which makes the interpretation of the results somewhat difficult and points to the need for a multivariate approach.

However, the methodology used here does not allow strong inferences on the relationships between the different variables. In addition, the variance in the sample suggests that the observed differences may not be significant. These issues will be examined in the regression analysis presented in section V.

---

[12] The result holds for each of the country group.

IV. EXPLORATORY MULTIDIMENSIONAL ANALYSIS

A. Rationale

The descriptive analysis of the previous section provides some insights into the nature and impact of the fiscal response in a recession. However, it also suggests that many different factors have to be taken into account simultaneously when assessing the relationship between the main variables of interest. In this section a multidimensional analysis is used to identify typologies of recession episodes and the associated fiscal responses. More specifically, the idea is to identify episodes that constitute relatively homogenous groups for the variables of interest and the key characteristics of these groups. The approach is exploratory since there are no prior assumptions relating the variables. It is also multidimensional as it tries to analyze the simultaneous interactions among these variables. To this end, two different statistical techniques are used in sequence: principal components analysis and cluster analysis.

Multidimensional statistical methods are designed to explain the correlations or covariances among a set of variables in terms of a limited number of unobservable or latent variables (Lebart, Morineau, and Piron, 1995). In reducing the number of original variables into a new set of factors, these methods can extract information present in the original data that cannot be observed directly either because it is difficult to measure (for instance, the set of initial conditions discussed in the previous section) or because economic variables tend to be measured with error. Principal components analysis is particularly useful in identifying a small number of dominant factors among a large number of observed variables that explain most of the variance of the original data (Dunteman, 1980). These factors or principal components are linear combinations of the original variables, and can be interpreted on the basis of their relation with the original variables.[13]

Cluster analysis is then applied to the results of the principal components analysis to partition the sample of recession episodes into homogenous groups. The objective is to sort episodes into groups so that the degree of statistical association is high among members of the same group and low between members of different groups (Everitt, 1974). Since it does not require any assumption on the distribution of the variables in the population, the method is widely used as an exploratory data analysis tool (Diday, 1982). However, since cluster analysis is a descriptive rather than a probabilistic statistical method, it cannot be used to test any hypothesis concerning the causal relationship between variables (Morrison, 1980). The advantage of carrying out cluster analysis on the principal components is that groups can be identified according to multidimensional concepts not directly observable in the original data.

---

[13] For each factors, factor scores are calculated as a linear transformation of the standardized original variables with weights proportional to the correlation coefficients between the original variables and the factor.

B. Principal Components Analysis

Principal components analysis aims at determining the coefficients that relate the observed variables to a reduced number of dominant factors.[14] The key problems are how the determine the optimal number of factors and how to interpret them. Two main criteria are used. First, only factors that explain a larger portion of the total variance than individual variables are extracted.[15] Second, these factors are interpreted, and hence labeled, by looking at their correlation with the original variables. Principal components analysis is thus performed on a matrix of 224 downturn episodes,[16] including the following groups of variables identified in the previous section:

- nature of the recession (average growth during the episode and its length);
- fiscal response and composition of fiscal adjustment;
- initial conditions (fiscal deficit, debt, current account deficit, openness, etc..);
- accompanying monetary and exchange rate policies.

Eight principal components are identified, explaining about 75 percent of the total variance, and the remaining 25 percent can be seen as a residual not related to the common characteristics of the data. The factors are reported in Table 14 for each principal component and can be interpreted as follows.

- **Size of government**. The first principal component is positively correlated with high ratios of expenditure and revenue to GDP.

- **Fiscal response**. The second factor is correlated with fiscal responses and increases in public expenditure, combined with small initial fiscal deficits (or fiscal surpluses).

- **Terms of trade change during episode**. The third principal component is strongly and positively correlated with terms of trade improvements during the recession.

- **Openness and financial depth along with monetary policy response**. The fourth factor is positively correlated to openness, expansionary monetary policy and financial depth, as measured by the ratio of M2 to GDP.

---

[14] These coefficients are called *factor loadings* and can be seen as playing a role similar to coefficients in standard multivariate regression analysis.

[15] In mathematical terms, this means that only factors with eigenvalues higher than one have been retained. To identify principal components, we use Kaiser's varimax criterion to orthogonally transform the original data.

[16] The number of recession episodes is reduced from 276 to 224 when all the variables of interest are included in the sample.

Table 14. Rotated Components Matrix and Total Variance Explained

Variables	Components							
	1	2	3	4	5	6	7	8
Expenditures to GDP, before	**0.93**	-0.08	-0.01	0.17	-0.08	-0.11	-0.04	0.04
Revenues to GDP, before	**0.91**	0.20	-0.03	0.22	0.05	-0.10	-0.06	0.03
Growth during	0.57	0.05	0.04	-0.36	0.27	0.32	0.12	-0.19
Fiscal response	-0.05	**-0.93**	0.13	-0.04	-0.01	-0.07	0.11	-0.01
Fiscal balance before	0.07	**0.77**	-0.04	0.17	0.33	-0.02	-0.06	-0.01
Change in expenditure to GDP	0.01	**0.69**	-0.09	0.03	0.01	0.05	0.68	0.00
Terms of trade shock	-0.02	-0.09	**0.99**	0.00	-0.02	0.00	0.00	-0.01
Openess, before	0.21	0.13	0.08	**0.79**	-0.15	-0.09	-0.09	-0.04
Monetary response	-0.08	0.06	-0.04	**0.65**	0.13	0.41	0.12	-0.04
M2 to GDP before	0.41	0.07	-0.10	**0.61**	0.32	0.01	0.01	-0.08
Current account balance, before	0.18	0.12	-0.05	-0.03	**0.71**	0.11	0.03	-0.08
Public debt before	0.06	-0.03	-0.03	0.05	**-0.70**	0.11	-0.12	-0.11
Reserves to imports before	-0.04	0.10	-0.03	0.20	**0.55**	-0.08	-0.26	0.08
Inflation before	-0.04	-0.08	0.06	-0.11	0.03	**-0.85**	0.05	0.03
Growth before	-0.11	-0.02	0.05	-0.03	-0.06	**0.73**	0.03	0.16
Change in revenues to GDP	-0.04	-0.16	0.03	-0.01	0.00	-0.02	**0.96**	-0.01
Change in exchange rate	-0.11	-0.05	0.07	0.03	-0.05	0.04	0.01	**0.75**
Length of recession	0.11	0.06	-0.09	-0.11	0.14	0.07	-0.02	**0.73**
Sums of squared loadings	2.31	2.09	2.04	1.73	1.66	1.59	1.52	1.20
Total variance explained								
In percent of total variance	12.16	11.00	10.74	9.10	8.72	8.36	8.02	6.30
Cumulative	12.16	23.16	33.90	43.00	51.72	60.08	68.11	74.41

Extraction Method: Principal Component. Rotation Method: Varimax with Kaiser Normalization, converged in 8 iterations.

- **Initial conditions** (public debt, reserves ratio and current account deficit). The fifth factor is negatively correlated to favorable initial conditions;

- **Macroeconomic conditions before the episode** (inflation and growth before the episode). The sixth component is positively correlated with low levels of inflation and relatively high growth before the recession episode;

- **Change in revenues**. The seventh component is positively correlated with an increase in the revenue-to-GDP ratio; and

- **Change in the exchange rate**. The final factor is positively correlated with the change in depreciation during the recession.

C. Cluster Analysis

The eight factors thus identified are then used as input variables in the cluster analysis. Selecting the optimal number of clusters is to some extent a subjective exercise. Using alternative clustering algorithms ensures that robust partitions of the sample are identified. Nonetheless, smaller clusters may present difficulties because they may not be easily assimilated to other clusters as they tend to capture outliers. The strategy adopted here is to select a limited number of large clusters while grouping the remaining clusters and outliers into a single composite group.

Using a non-hierarchical algorithm (see Appendix II),[17] seven clusters representing 202 episodes are identified, while the remaining 22 episodes are grouped in a residual cluster.[18] The distribution of episodes by cluster membership and region is presented in Table 15.[19] Advanced economies are concentrated in cluster 3, which groups 61 percent of the episodes for this region. More than half of the Asian countries are in cluster 6. Middle Eastern countries are mostly in cluster 7. Other regions tend to be more evenly spread across clusters, although countries in transition are in a large part in clusters 3 and 8, African countries in 2 and 6, and Western Hemisphere countries in 1 and 6. Most of the 1998 Asian crisis countries are included in cluster 7. Outliers (cluster 8) are fairly evenly distributed across regions, except for an over-representation of countries in transition.

Descriptive statistics and tests are calculated within each cluster and across clusters to identify variables that are significantly different from the sample average (Table 16).[20] *Active* variables that are used in the principal components and cluster analysis are distinguished from *illustrative* variables that are helpful in describing the characteristics of the clusters.

---

[17] Appendix II briefly reviews cluster analysis and clustering algorithms. As changes in the pre-determined number of clusters can produce groups with different characteristics, a robustness check using alternative numbers of partitions was conducted. It showed that the identified clusters are relatively stable implying that they identify "strong partitions" in the original data.

[18] Caution is needed in the interpretation of the results for this cluster as it aggregates smaller clusters and isolated episodes (outliers).

[19] A list of all episodes by clusters is reported in Table A2 in Appendix II.

[20] Non parametric statistics are also used to test the assumption that the means are equal across the groups and confirm they are statistically different across the clusters.

Table 15. Clusters Composition by Region

Area	Clusters	1	2	3	4	5	6	7	8	Total
ADV	No.	1	2	31	1	7	5	1	3	51
	in percent of area	2.0	3.9	60.8	2.0	13.7	9.8	2.0	5.9	100.0
	in percent of cluster	3.4	6.9	79.5	6.7	25.9	9.3	11.1	13.6	22.8
AFR	No.	12	16	2	8	9	18	1	9	75
	in percent of area	16.0	21.3	2.7	10.7	12.0	24.0	1.3	12.0	100.0
	in percent of cluster	41.4	55.2	5.1	53.3	33.3	33.3	11.1	40.9	33.5
ASIA	No.	4	1	2	2	4	19	3	1	36
	in percent of area	11.1	2.8	5.6	5.6	11.1	52.8	8.3	2.8	100.0
	in percent of cluster	13.8	3.4	5.1	13.3	14.8	35.2	33.3	4.5	16.1
MED	No.					1	2	4	1	8
	in percent of area					12.5	25.0	50.0	12.5	100.0
	in percent of cluster					3.7	3.7	44.4	4.5	3.6
TRANS	No.	1	1	2		1			2	7
	in percent of area	14.3	14.3	28.6		14.3			28.6	100.0
	in percent of cluster	3.4	3.4	5.1		3.7			9.1	3.1
WHD	No.	11	9	2	4	5	10		6	47
	in percent of area	23.4	19.1	4.3	8.5	10.6	21.3		12.8	100.0
	in percent of cluster	37.9	31.0	5.1	26.7	18.5	18.5		27.3	21.0
Total	No.	29	29	39	15	27	54	9	22	224
	in percent of area	12.9	12.9	17.4	6.7	12.1	24.1	4.0	9.8	100.0
	in percent of cluster	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Four clusters (47 percent of the sample) group countries that responded to the recession with expansionary fiscal policies.

- **Cluster 1** (29 episodes) groups episodes with the most severe recessions, both in terms of the average growth and the length of the recession. African and Western Hemisphere countries account for 80 percent of the episodes in this cluster. The fiscal policy is driven by higher spending while monetary policy is restrictive. Government size tends to be small and financial sectors not particularly developed. In addition, the episodes are accompanied on average by large negative terms of trade shocks and exchange rate depreciations—especially the three Argentina episodes (1981-82, 1985, and 1989), Costa Rica (1980-82), Mexico (1982-83), and Sierra Leone (1991-92)—preceded by relatively high inflation rates.

- **Cluster 2** (29 episodes) contains relatively short recessions of average depth. Fiscal expansion is sizeable (about 4½ percent of GDP), driven by a mix of expenditure increases and, to a lesser extent, tax cuts, and accompanied by a mild monetary contraction. Initial conditions point to a mix of high public debt—the Gambia (1994), Madagascar (1991), Tanzania (1992), and Jamaica (1988)—and large current account deficits—Chile (1982-85), Honduras (1982-83), Madagascar (1991), and Nigeria (1987). Inflation is relatively low both before and during the recession. Similar to the

Table 16. T-tests and Kruskal-Wallis Tests by Variables and Clusters

Active variables	Cluster no. 1 Mean	t-test	Cluster no. 2 Mean	t-test	Cluster no. 3 Mean	t-test	Cluster no. 4 Mean	t-test	Cluster no. 5 Mean	t-test	Cluster no. 6 Mean	t-test	Cluster no.7 Mean	t-test	Cluster no. 8 Mean	t-test	Total Mean	K-W	Median
Growth																			
Growth during	-8.2	***	-6.7		-3.8	***	-8.9	***	-5.7		-5.8	**	-8.9		-8.1	**	-6.4	***	***
Length of recession	1.6		1.1	***	1.6	**	1.1	***	1.3		1.1	***	1.1	*	1.8		1.3	***	***
Growth before	0.2		0.1		-0.1		0.3		-1.3	**	1.2	**	-1.7	**	-1.9		-0.1	**	
Policy response																			
Fiscal response	-1.1		-4.3	***	-2.2	***	1.0	**	2.9	***	0.3	***	-2.3	*	-0.8		-0.8	***	***
Monetary response	-0.5	***	0.5		0.8		-0.1	**	0.7		1.9		9.3	**	3.6		1.4	***	**
Initial conditions																			
Public debt before	35.1		54.2	**	27.9	***	52.8	**	56.3	***	31.1	***	14.1	***	52.6		40.0	***	***
Fiscal balance before	-5.0	*	-0.7	***	-1.2	***	-7.6		-8.9	***	-4.8		-0.8	**	-3.7		-4.1	***	***
Current account balance, bef.	-5.0		-6.8	**	-1.7	***	-8.4		-5.3		-3.0		-1.8		-6.1		-4.4	***	***
M2 to GDP before	29.0	***	29.7	***	56.5	***	26.8	***	41.9		34.0	***	84.5	***	46.9		40.5	***	***
Inflation before	53.7		12.6	***	9.3	***	35.9		14.9	***	26.3	**	3.2	***	281.2		48.5	**	**
Reserves to imports before	23.3		17.9	**	20.0		14.8	***	13.2	***	22.2		69.6	**	33.2		22.8	**	
Revenues to GDP, before	16.3	***	26.1		42.7	***	22.9		31.6	**	17.8	***	33.6	**	28.9		26.7	***	***
Expenditures to GDP, before	21.3	***	26.9	**	43.9	***	30.5	***	40.4	***	22.6	***	34.4		32.5		30.8	***	***
Composition of fiscal policy																			
Change in expenditures to GDP	1.2		2.6	***	2.0	***	0.1	*	-2.6	***	0.4		1.2		2.6		0.9	***	***
Change in revenues to GDP	0.1		-1.6	***	-0.3		1.1		0.3		0.7	**	-1.1		1.7		0.2	***	***
Other factors																			
Openness	40.3		35.9		33.3		24.0	***	42.4	*	24.0	***	60.1	***	51.3	***	34.9	***	***
Exchange rate depreciation	240.6	***	17.2	***	10.9	***	47.5	**	65.4	***	30.9	***	14.8	***	13830.8		1412.8	**	**
Terms of trade change	-0.2	***	0.0		0.0		0.3	***	0.0		0.0	**	-0.1		0.1		0.0	***	***

Descriptive variables	Cluster no. 1 Mean	t-test	Cluster no. 2 Mean	t-test	Cluster no. 3 Mean	t-test	Cluster no. 4 Mean	t-test	Cluster no. 5 Mean	t-test	Cluster no. 6 Mean	t-test	Cluster no.7 Mean	t-test	Cluster no. 8 Mean	t-test	Total Mean	K-W	Median
Depth of recession	-12.45	***	-7.94		-6.31	***	-9.54		-7.50		-6.37	***	-10.2		-13.5	**	-8.55	***	***
Growth after	0.74	***	0.83	***	-0.43	***	0.15	*	0.63	***	1.12	***	-2.0	**	0.4		0.44	*	
Decline in growth	-8.44	**	-6.81		-3.76	***	-9.14	**	-4.48	***	-6.98		-7.0		-6.2		-6.36	***	***
Rebound in growth	8.98	**	7.53		3.41	***	9.02	*	6.36		6.95		6.8		8.5		6.89	***	***
Change in interest rates	2.59	***	1.18		-2.55	**	-0.80		-0.63		-0.11		0.3		0.7		-0.18	***	***
Fiscal balance	-6.13	***	-5.01	***	-3.42	***	-6.63	***	-5.92	***	-4.48	***	-3.1	***	-4.5	***	-4.84	**	*
Fiscal balance after	-5.14		-5.15		-4.14		-4.89		-4.98		-4.44		-2.5		-3.7		-4.51		
Inflation during	158.49		15.09	***	11.03	***	53.19		36.18	*	36.43	**	-2.2	**	365.4		77.15	***	***
Exchange rate depreciation, bef.	-84.71		-94.98		-101.39	***	-84.46		-91.37		-93.09		-93.7		-81.0		-91.74	***	***

T-test to verify that for each variable cluster means are equal to the sample means. KW test and median test are non parametric tests of the hypothesis that variable means are equal across clusters.
The tests' significance levels are denoted as a ten (*), five (**), and one (***) percent, respectively.

previous cluster, African and Western Hemisphere countries account for more than 80 percent of the episodes, with more than half of the episodes falling in the African region.

- **Cluster 3** (39 episodes) has relatively longer but milder recessions than the sample average. Fiscal expansion is driven by expenditure increases and accompanied by monetary expansion. Countries in this cluster are characterized by large government sector and favorable initial conditions (e.g., low inflation, almost balanced current account, and low public debt and fiscal deficit ratios to GDP). The bulk of the episodes (85 percent) is in advanced economies, including Israel (1989). Exceptions include South Africa (1990-92), Tanzania (1982-84), Barbados (1981-82 and 1990-92), and Samoa (1990), and two countries in transition, Czech Republic (1998) and Romania (1997-98).

- **Cluster 7** (9 episodes) is similar to cluster 3, except for a more accentuated expansionary monetary policy response and a more balanced fiscal response. Asian and Middle Eastern countries account for most of the group. Although rather small, this cluster is of particular interest since it features some of the Asian crises. Recessions are on average shorter and deeper, and they occur against generally favorable fiscal and external initial conditions, although macroeconomic conditions are less so.

Three clusters, covering 43 percent of the sample, are characterized by contractionary fiscal policy.

- **Cluster 4** (15 episodes) groups recessions that are shorter than the sample average but show a deeper decline in output. The fiscal contraction is relatively mild (one percent reduction in the deficit), largely driven by higher revenue. Monetary policy was also tightened. Initial fiscal conditions are rather unfavorable, particularly in the case of Zambia (1994) and Honduras (1994). The same applies to initial external conditions, with fairly large current account deficits in Madagascar (1981), Rwanda (1991), and Samoa (1974). Countries in this cluster tend to be African (53 percent) and Western Hemisphere countries (27 percent).

- **Cluster 5** (27 episodes) contains episodes in which the fiscal contraction is more accentuated than in the previous group and mostly driven by expenditure reduction. The monetary response is moderately expansionary. Initial fiscal conditions are less favorable than the sample average in terms of higher fiscal deficit prior to the crisis—Cameroon (1988), Cote d'Ivoire (1983-82), and Tonga (1988)—and high public debt ratios—Ethiopia (1991-92) and Togo (1983). Countries in this group are also characterized by a large public sector and consist of advanced (26 percent) and African (33 percent) economies. Advanced economies are represented by Belgium

(1983 and 1993) and Italy (1982 and 1993), two of the tales of expansionary fiscal contractions discussed in Alesina and Ardagna (1998).[21]

- **Cluster 6** (54 episodes) is the largest and most robust group. These recession episodes are relatively short and mild. Fiscal contraction is mild (0.3 percent of GDP), pursued by a mix of revenue increase and expenditure reduction, and accompanied by a moderate expansionary monetary policy (1.9 percent). Countries in this group have on average a small public sector size and relatively favorable initial conditions, both fiscal and non-fiscal. Asian and African countries account for 69 percent of the episodes in this cluster. Notable exceptions are Turkey (1989 and 1994), the United States (1980, 1982, 1991), and Japan (1974).

- Finally, **cluster 8** (22 episodes or 10 percent of the sample) groups episodes characterized by hyperinflation and consequent sharp devaluation—Brazil (1990), Peru (1988-90), Belarus (1995) and Kazakhstan (1995)—countries with an unusually high degree of openness—Hong Kong SAR and Singapore— and episodes with very unbalanced initial fiscal and external positions—the Republic of Congo (1994), Equatorial Guinea (1991), the Republic of Mozambique (1992) and Sudan (1983-84). It also includes very long episodes, reaching to 6 years in the case of Trinidad and Tobago (1983-89). Table 17 summarizes the main characteristics of each cluster.

In general, recession episodes for the same country tend to fall consistently within the same cluster. This seems to reflect both the relative stability of key structural characteristics, such as government size, and some persistence in policy responses to a crisis. However, a few exceptions are worth noting. At one extreme we find the three Philippines episodes (1984, 1991, and 1998) falling in three different clusters—clusters 1, 6, and 4, respectively. The different policy responses in the case of the Philippines may be dictated, among other things, by a steady increase in the government size, from 12 percent in 1974 to 20 percent in 1998. Other cases are the United States—with the 1980, 1982, and 1991 recession episodes characterized by a contractionary response, whereas the earlier 1974 episode followed what appears to be a standard advanced economy response (fiscal expansion driven by expenditure increases and accompanied by accommodating monetary policy)—and India, with four episodes—1972, 1976, 1979, and 1991—characterized by an overall contractionary response vis-à-vis the expansionary fiscal policy pursued during the 1974 episode.

---

[21] Two other well documented cases of expansionary fiscal contractions, namely Denmark (1983-86) and Ireland (1987-89), discussed in Giavazzi and Pagano (1990) and reviewed in Hemming, Kell, and Mahfouz (2000) are not captured by our definition of recession. This is not surprising since these are episodes of sucessful fiscal contraction, characterized by high growth.

Table 17. Summary Qualitative Description of Clusters

|	*Cluster 1*	*Cluster 2*	*Cluster 3*	*Cluster 4*	*Cluster 5*	*Cluster 6*	*Cluster 7*
Growth							
Growth during	**Low**	Average	**High**	**Low**	Average	**High**	Low
Length of recession	Long	**Short**	**Long**	**Short**	Average	**Short**	Short
Depth of recession	**Severe**	Average	**Mild**	Severe	Average	**Mild**	Severe
Policy response							
Fiscal response	Expan.	**Expan.**	**Expan.**	**Contr.**	**Contr.**	**Contr.**	Expan.
Monetary response	**Contr.**	Expan.	Expan.	**Contr.**	Expan.	Expan.	**Expan.**
Initial conditions							
Public debt	Average	**High**	**Low**	**High**	**High**	**Low**	**Low**
Fiscal deficit	Average	**Small**	**Small**	Large	**Large**	Average	**Small**
Current account deficit	Average	**Large**	**Small**	Large	Average	**Small**	Small
Inflation	Average	**Low**	**Low**	Average	**Low**	**Low**	**Low**
Fiscal size	**Small**	Average	**Large**	Average	**Large**	**Small**	Average
Growth	Average	Average	Average	Average	**Negative**	**Positive**	**Negative**
Composition of fiscal policy	Spending	**Mix**	**Spending**	Revenue	**Spending**	Revenue	Mix
Other factors							
Terms of trade	**Neg.**	Average	Average	Positive	Average	Average	Average
Exchange rate dep.	**Large**	**Small**	**Small**	**Small**	Average	Small	**Small**
Inflation during	High	**Low**	**Low**	Average	Low	**Low**	**Low**
Region(s)	WHD	AFR	ADV	AFR	AFR	ASIA	MED
	AFR	WHD	TRANS	WHD	ADV	AFR	ASIA

Bold characters identify variables that are different from the sample mean at a five percent significance level.

So far, clusters have been described on the basis of the within-cluster averages of each variable. But the above described characteristics as well as differences and similarities among the clusters can also be visually summarized by plotting all the cluster averages (or centers) against selected principal components (Figures 2 and 3).[22] The following observations can be highlighted, bearing in mind that these are purely illustrative.

 Clusters 1, 5, and 7 tend to lie in opposite portions of the charts. Cluster 1 clearly seems to identify episodes characterized by expansionary fiscal responses with relatively unfavorable initial fiscal and external conditions but average initial macroeconomic conditions (Figure 2,

---

[22] These averages are calculated as averages of the factor scores for each principal components.

Figure 2. Distribution of Cluster Centers by Selected Factors
Fiscal response with initial fiscal, external and macroeconomic conditions
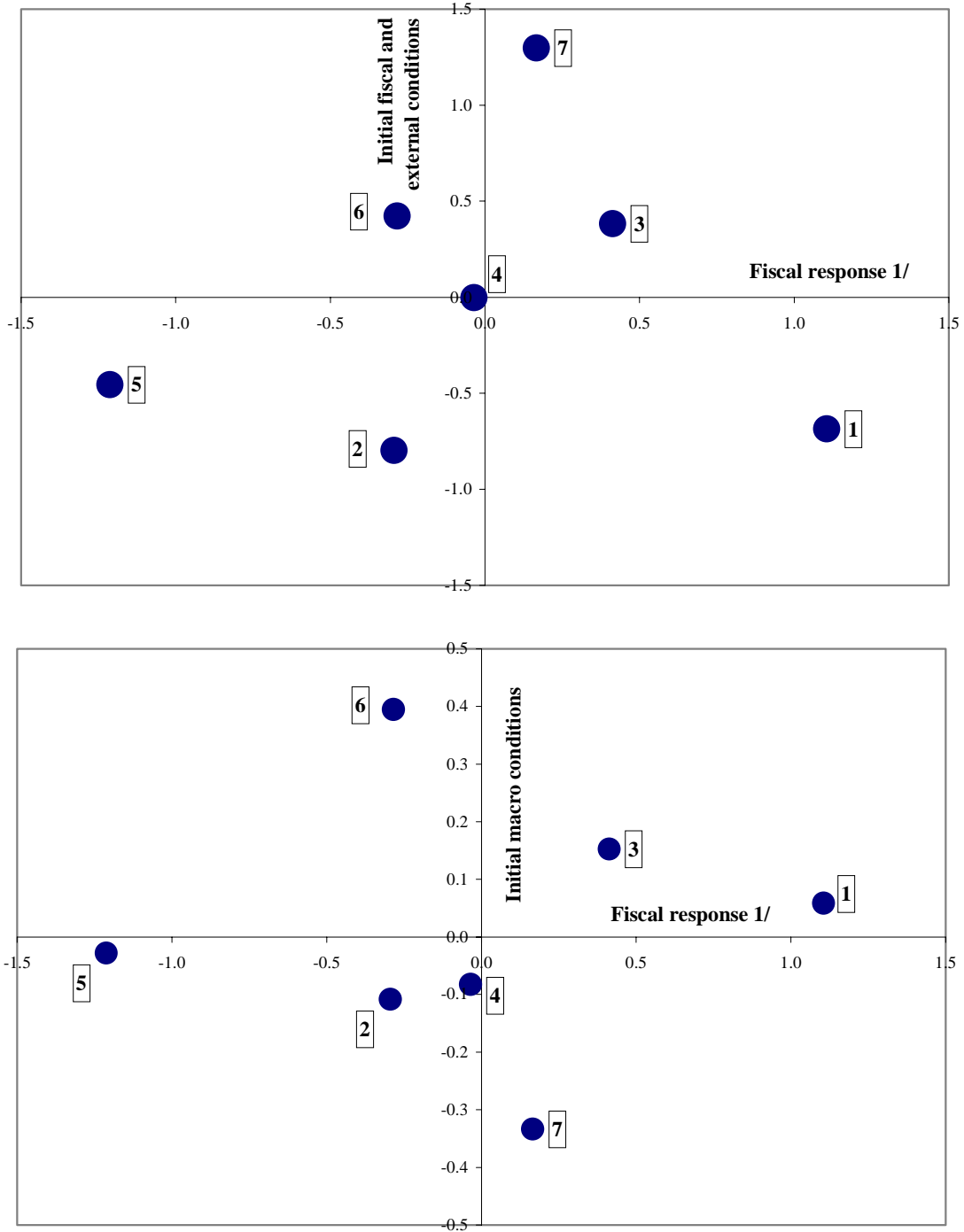
1/ Factor correlated with episodes showing fiscal response led by expenditure increases with favorable initial fiscal balance

Figure 3. Distribution of Cluster Centers by Selected Factors
Fiscal response with government size and monetary policy response
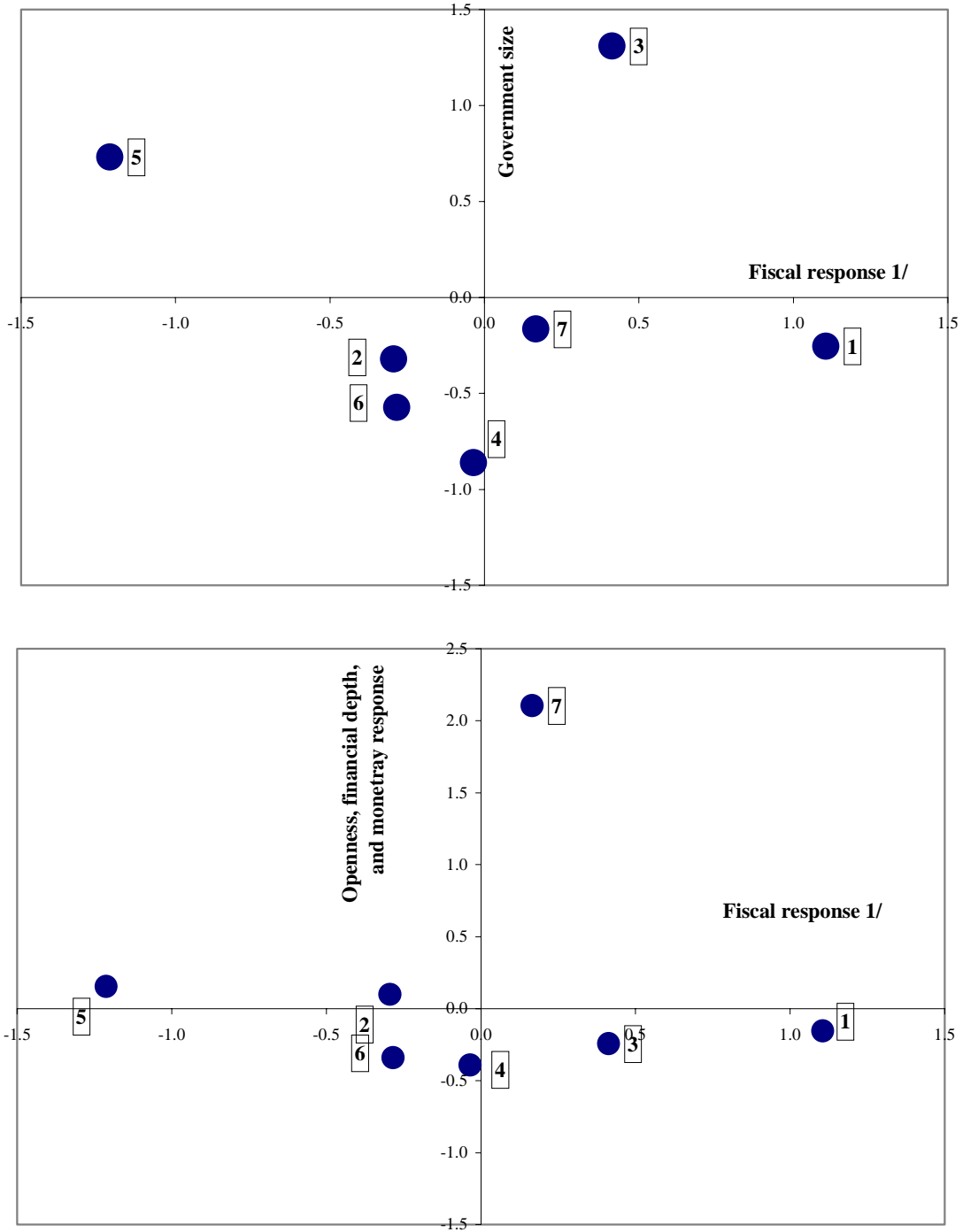
1/ Factor correlated with episodes showing fiscal response led by expenditure increases with favorable initial fiscal balance

top and bottom panels). While sharing similar initial conditions, cluster 5 pursues opposite fiscal responses. These seem to be associated with the fact that cluster 5 has on average a larger government size (Figure 3, top panel). While showing a moderate expansionary fiscal response, cluster 7 appears to have more favorable initial fiscal and external conditions as compared with the other two clusters (Figure 2, top panel) but relatively unfavorable initial macroeconomic conditions (Figure 2, bottom panel). Further, it appears to feature a more expansionary monetary policy. However, regardless of these differences these groups seems to be equally unsuccessful at dampening the fall in output during a recession.

Clusters 3 and 6 pursue different fiscal policies, in spite of the fact that they tend to lie on the same portions of the charts in terms of initial conditions and accompanying monetary policies. However, government size is much smaller in cluster 3 than in cluster 6. The different fiscal policy responses in these groups lead, however, to similar recessions.

Cluster 2 and cluster 4 are quite similar in a number of respects. They share similar initial unfavorable macroeconomic conditions, whereas cluster 4 has slightly more favorable fiscal and external conditions (Figure 2, top and bottom panels). Their government sizes are below the sample average. The most notable difference is that the fiscal response is more contractionary in cluster 2 than in cluster 4, quite the opposite of their monetary responses. Nonetheless, recessions appears less severe in cluster 2.

D. What Have We Learned?

As expected, when initial conditions, fiscal response and accompanying policies are simultaneously analyzed in a multidimensional framework, the link between fiscal policy and growth appears less clear than in the previous section. Considering the various groups that emerged from the analysis, a number of general observations can be made.

- As indicated by the findings of the previous sections, initial conditions—fiscal, external, and macroeconomic—are important factors in determining the effectiveness of fiscal policy. The analysis of this section qualifies those findings by showing that it is a combination of these initial conditions, as emerged via principal components analysis, rather than a single condition that matters.

- Countries with large government tend to rely on fiscal expansions during a recession more than countries with small government size. This is also consistent with the findings of the previous section. Expansionary fiscal policy in countries with large government appears to be associated with relatively less severe recessions. While part of this may reflect the presence of more sophisticated fiscal systems, which are often associated with larger automatic stabilizers, it may also reflect some endogeneity between fiscal response and growth.

- Consistently with the findings in the previous section, fiscal expansions associated with expenditure increases appear to be correlated with less severe recessions. This

seems to support the intuition that expenditure multipliers are larger than revenue multipliers.

- Monetary policy response is linked to the depth of the recession. The episodes in which monetary policy is contractionary have more severe recessions on average than the whole sample, while the episodes in which monetary policy is expansionary are associated with milder recessions. This is consistent with the results of the previous section. There is also a moderate positive association between expansionary monetary response and inflation during recession. As in the previous section, however, it is difficult to disentangle whether this is the effect of monetary policy itself or the result of a combination of factors. Irrespective of the policy response and the other initial conditions, inflation during a recession tends to be low as long as it was low before the episode.

- Other factors, including terms of trade shock and exchange rate devaluation, are less of an influence on the effects of fiscal policy. In contrast to the findings in the previous section, we do not observe a strong association between exchange rate devaluation and fiscal policy. We also find only moderate support for the finding that negative terms of trade shocks trigger fiscal expansions. Moreover, neither the terms of trade shock nor the change in the exchange rate seem to have a sizeable impact on the success of fiscal policy in restoring growth.

The above findings will be further tested in the next section by way of a standard econometric analysis.

V. ESTIMATES OF A REDUCED-FORM EQUATION

A. Methodology

Based on the findings of the preceding sections, the relationship between fiscal policy and growth during a recession is now analyzed in a standard regression framework. The specification retained here nests the effects of the various factors examined in previous sections (initial conditions, accompanying policies, composition of fiscal policy, and other developments, and cluster membership) into a single reduced form equation in order to test their joint significance.

Two models are estimated. The first model includes variables that reflect economic policy during the recession, initial conditions, and regional dummy variables. This model can be seen as a generalization of the descriptive approach in Section III. The second model includes the same variables reflecting economic policy and initial conditions as model one, but includes dummy variables for membership in the clusters instead of regional dummy variables. Since the effectiveness of fiscal policy can be influenced by several factors, the fiscal response is interacted with dummies for a flexible exchange rate regime, open economies, high initial public debt, high initial fiscal deficit, expansionary monetary policy, and the dummy variables in each model. Monetary policy is measured by the change in the interest rate during the recession; thus a positive value indicates an expansionary monetary policy. Initial conditions are measured by the revenue to GDP ratio before the episode, the current account balance before the episode, and growth before the episode. Finally, regional growth and dummies for episodes occurring in the 1970s and the 1980s are included to capture the common external or other shocks.[23]

B. Specification Search and Results

Specification strategy

For each model, the initial specification includes all variables. From this initial specification all insignificant variables are dropped with the exception of the fiscal response and the monetary response. Thus, all conditioning variables are identified before testing whether fiscal and/or monetary policies influence growth during recession episodes.

In both models, all variables are jointly significant, while a large share is individually insignificant. Since this finding is typically associated with a high degree of multicolinearity in the regressor matrix, insignificant variables are excluded in three steps to avoid eliminating too many variables. In the first step, all variables which are insignificant at the 50 percent level are excluded. In the second step, all variables which are insignificant at the 20

---

[23] For model 1, 159 observations are available after excluding episodes characterized by hyperinflation. Hyperinflation is defined as having a change in the deposit rate greater than 200 in absolute value. For model 2, 156 observations are available after excluding hyperinflation episodes.

percent level are excluded. And, in the third step, all variables which are insignificant at the 10 percent level are excluded. For each step, we test whether we can reject the joint exclusion of all dropped variables from the initial specification. Only the initial and the final specification are reported.

Model 1: Regional dummy variables

There is no clear relationship between fiscal policy and growth during recessions across all observations (Table 18). An expansionary fiscal response appears to reduce growth during recessions. However, the estimated coefficient is not significant at any standard level. In open economies, expansionary fiscal policy lowers growth even further. This result, which is significant at the 5 percent level, is consistent with the theoretical literature. For economies with a high initial fiscal balance, expansionary fiscal policy increases growth during a recession. This result is significant at the 10 percent level.

Expansionary monetary policy increases growth during recessions. As in the case of the fiscal response, the estimated coefficient is not significant at any standard level. Countries with large governments tend to have higher growth during recessions than other countries. The result is significant at the 5 percent level. One interpretation could be that automatic stabilizers are larger and therefore more effective in dampening the severity of the recessions in those countries. A high current account balance before the episode improves the growth performance during the recession. Domestic policy stimuli would presumably be more effective in countries with a strong external position as the stimuli would not be lost through net-imports.

All interactions of regional dummies with fiscal policy are excluded from the model, implying that the impact of fiscal policy on growth does not differ between regions in general. Rather, a country's economic characteristics such as openness and initial conditions appear to matter. Likewise, regional intercept dummies are excluded from the model except for transition economies. Regional effects on growth appear to be better captured by the regional growth variable included in the model.

Model 2: Cluster dummy variables

Under this model, expansionary fiscal policy is associated with increased growth during recessions across all episodes in the sample (Table 19). The result is significant at the 10 percent level. However, for episodes in clusters 3 and 7, expansionary fiscal policy is associated with decreased growth during recessions. Cluster 3 contains episodes with fiscal contraction driven by expenditure reduction. Initial fiscal conditions are not favorable. Hence, the reversed sign could be consistent with an expansionary fiscal contraction. Cluster 7 contains episodes that occurred during the Asian crisis, where fiscal and monetary policy were expansionary, recessions short and deep, and occurred against favorable fiscal and external initial conditions.

As in the case of model 1, expansionary monetary policy also increases growth during recessions, but the estimated coefficient is not significant at any standard level. Countries with large governments tend to have higher growth during recessions than other countries. The result is significant at the 5 percent level. The dummies for membership in clusters 3, 5 and 6 remain in model 2 as significant at the 5 percent level. Regional growth has a significant positive impact on growth during recessions highlighting the importance of regional links over the cycle.

Table 18: Regression Results – Model 1 with Regional Dummy Variables 1/

	Model 1a			Model 1b		
Observations			159			159
Wald test for overall significance		F(23,135)	10.22		F(8,135)	10.23
R2			0.33			0.30
Adjusted R2			0.22			0.26
Wald test of restrictions vs. Model 1			…		F(15,135)	1.13
	Coeff.	t-stat.	P-val.	Coeff.	t-stat.	P-val.
Fiscal response	-0.78	-0.07	0.95	-0.09	-0.66	0.51
* flexible exchange rate	-0.01	0.00	1.00	…	…	…
* open economy	-0.03	-0.01	0.99	-0.36	-2.12	0.04
* high initial public debt	0.01	0.00	1.00	…	…	…
* high initial fiscal balance	0.29	0.21	0.84	0.30	1.74	0.08
* expansionary monetary policy	0.22	0.04	0.97	…	…	…
* Dummy for Africa	0.56	0.09	0.93	…	…	…
* Dummy for Asia	0.07	0.01	0.99	…	…	…
* Dummy for Western Hemisphere	0.47	0.08	0.94	…	…	…
* Dummy for Middle Eastern	0.72	0.08	0.94	…	…	…
* Dummy for Transition	3.00	0.41	0.69	…	…	…
Change in interest rate	0.03	0.36	0.72	0.04	1.00	0.32
Government size before	0.08	0.68	0.50	0.08	5.75	0.00
Current account balance before	0.04	1.03	0.30	0.06	2.02	0.05
Growth before	-0.04	-0.42	0.67	…	…	…
Dummy for Africa	-1.69	-0.24	0.81	…	…	…
Dummy for Asia	-1.53	-0.18	0.86	…	…	…
Dummy for Western Hemisphere	-1.46	-0.17	0.86	…	…	…
Dummy for Middle Eastern	-2.40	-0.20	0.84	…	…	…
Dummy for Transition	-6.97	-0.51	0.61	-3.81	-1.74	0.08
Regional growth during episode	0.33	0.82	0.41	0.35	2.34	0.02
Dummy for episode in 1970s	0.37	0.13	0.90	…	…	…
Dummy for episode in 1980s	-0.06	-0.02	0.98	…	…	…
Constant	-7.16	-0.96	0.34	-8.69	-13.95	0.00

Source: IMF databases; and Fund staff calculations.
1/ Estimation by instrumental variable with robust standard errors (Huber/White sandwich estimator).
Dependent variable: average growth during episode relative to trend growth.
Fiscal response is instrumented by change in expenditures.

Table 19: Regression Results – Model 2 with Cluster Dummy Variables 1/

	Model 2a			Model 2b		
Observations			156			156
Wald test for overall significance	F(27,128)		7.96	F(9,146)		11.86
R2			0.41			0.38
Adjusted R2			0.29			0.34
Wald test of restrictions vs. Model 1			…	F(18,128)		0.75
	Coeff.	t-stat.	P-val.	Coeff.	t-stat.	P-val.
Fiscal response	0.46	1.21	0.23	0.17	1.71	0.09
* flexible exchange rate	-0.28	-1.62	0.11	…	…	…
* open economy	-0.33	-1.54	0.13	…	…	…
* high initial public debt	0.24	1.00	0.32	…	…	…
* high initial fiscal balance	-0.02	-0.09	0.93	…	…	…
* expansionary monetary policy	-0.19	-0.88	0.38	…	…	…
* Dummy for cluster 1	-0.36	-0.80	0.43	…	…	…
* Dummy for cluster 2	0.19	0.47	0.64	…	…	…
* Dummy for cluster 3	-0.41	-1.47	0.14	-0.42	-1.98	0.05
* Dummy for cluster 4	-0.22	-0.48	0.63	…	…	…
* Dummy for cluster 5	0.03	0.11	0.92	…	…	…
* Dummy for cluster 6	-0.48	-1.31	0.19	…	…	…
* Dummy for cluster 7	-0.69	-1.56	0.12	-0.82	-2.20	0.03
Change in interest rate	0.03	0.60	0.55	0.05	1.07	0.29
Government size before	0.05	2.09	0.04	0.04	2.27	0.03
Current account balance before	0.03	0.78	0.44	…	…	…
Growth before	-0.01	-0.08	0.94	…	…	…
Dummy for cluster 1	2.01	1.15	0.25	…	…	…
Dummy for cluster 2	1.20	0.79	0.43	…	…	…
Dummy for cluster 3	3.74	3.32	0.00	3.43	4.93	0.00
Dummy for cluster 4	0.19	0.16	0.87	…	…	…
Dummy for cluster 5	2.65	2.22	0.03	2.16	2.85	0.01
Dummy for cluster 6	1.87	1.75	0.08	1.83	3.24	0.00
Dummy for cluster 7	-0.05	-0.04	0.97	…	…	…
Regional growth during episode	0.38	2.04	0.04	0.32	1.95	0.05
Dummy for episode in 1970s	-0.06	-0.05	0.96	…	…	…
Dummy for episode in 1980s	0.66	1.66	0.10	…	…	…
Constant	-10.30	-8.16	0.00	-9.47	-14.90	0.00

Source: IMF databases; and Fund staff calculations.
1/ Estimation by instrumental variable with robust standard errors (Huber/White sandwich estimator).
Dependent variable: average growth during episode relative to trend growth.
Fiscal response is instrumented by change in expenditures.

VI. CONCLUDING REMARKS

Based on the findings of the descriptive analysis conducted in Section III, recessions accompanied by an expansionary fiscal response are on average less severe than recessions accompanied by a contractionary fiscal policy. However, the difference is small and the variance in the sample is large. In addition, initial conditions, accompanying policies, and

some other factors appear related to the nature and effectiveness of fiscal policy in a recession as expected. The descriptive analysis also points to important differences between various country groups. In particular, advanced economies stand out in many respects, which suggests that the results of most of the empirical literature based on advanced economies may not necessarily apply for emerging or developing economies.

The exploratory multidimensional statistical approach pursued in Section IV takes into account all the interactions between variables, without imposing any prior structure on the data. The link between the fiscal response and the growth outcome during a recession appears weaker than in the descriptive analysis. Instead, a typology of episodes emerges, emphasizing the role of a combination of initial conditions, fiscal response, accompanying policies, and other factors, rather than each of these factors considered separately.

Finally, the regression results presented in Section V show that although there is some role for fiscal and monetary policies in stimulating growth during a recession, the relation is not very strong. This reflects the very large variance of the main variables in the sample. Overall, the influence of fiscal policy is affected by initial conditions, such as the degree of openness and the fiscal balance before the episode, and by membership to some clusters.

Overall, the main lessons of this empirical investigation are twofold.

- First, based on average outcomes, there are some interesting stylized facts in the response of fiscal policy and its effectiveness in a recession.

- Second, there is also a wide variety among recession episodes, which results in a large variance and insignificant results in the econometric analysis.

This suggests, perhaps not surprisingly, that a simple theoretical framework may not capture all the country-specific factors that are likely to play a role in accounting for the complex relationship between fiscal policy and economic activity. Indeed, factors that are not captured in the previous analysis such as political instability, weather related shocks, for African countries, or contagion and banking sector problems for Asian crisis countries are likely to play an important role in explaining developments in a number of recession episodes.

Appendix I. Variables, Definitions, and Data Sources

Variable	Definition	Source
Length	Length of recession in years	Authors' calculations
Growth	Real GDP growth (measured relative to trend growth)	WEO (ngdp_r)
Trend growth	Average real GDP growth over 1970-1999	Authors' calculations
Depth	Sum of growth (relative to trend) over episode	Authors' calculations
Fiscal balance	General government balance in percent of GDP	WEO (ggb/ngdp)
Revenue	General government, total revenue and grants	WEO (ggrg)
Expenditure	General government, total expenditure and net lending	WEO (ggenl)
Fiscal size	Revenue to GDP ratio	Authors' calculations
Interest rate	Deposit rate	IFS
Openness	Imports of goods and services in percent of GDP	WEO (tm/ngdpd)
Public debt	General government net debt, in percent of GDP (for ADV) and public and publicly guaranteed debt, in percent of GDP	WEO (ggnd/ngdpd) WB
Exchange rate regime	1 = flexible (groups 9 (other managed float) and 10 (float) 2= fixed (groups 1 to 8 (pegs and others) and 12 (EMU))	Based on 1989 IMF classification
Current account balance	Current account balance in percent of GDP	WEO (bca/ngdp_d)
Terms of trade	Terms of trade, index	WEO (tt)
Exchange rate	Exchange rate, national currency per US dollar	WEO (enda)
Inflation	CPI inflation rate	WEO (pcpi)
M2 to GDP	Money and quasi money in percent of GDP	IFS and WEO
Regional growth	Average real GDP growth over countries in each region	Authors' calculations
Reserves to imports	Foreign exchange reserves in percent of imports	IFS and WEO

Notes: WEO= IMF World Economic outlook

WB = World bank Global Development Finance

IFS= IMF International Finances Statistics

The following dummies based on the above variables are also used in the descriptive and econometric sections:

Dummy	Definition
Open economy	Openness before above 30 percent
High public debt before	Public debt to GDP ratio above 50 percent
Large fiscal deficit before	Fiscal balance to GDP below –5 percent
Large fiscal size before	Revenue to GDP ratio above 30 percent
Large current account deficit before	Current account deficit to GDP ratio above 5 percent
Expenditure-led fiscal response	Change in expenditure to GDP is larger than change in revenue to GDP (in absolute values)
Expansionary monetary policy	Negative interest rates response (decline in rates)
Exchange rate depreciation before	Positive exchange rate change in year before recession
Exchange rate depreciation during	Positive exchange rate response during recession
Positive terms of trade shock	Improvement in terms of trade during recession

In addition, the following definitions apply throughout the paper:
Before indicates the variable is measured the year immediately before the recession episode.
After indicates the variable is measured the year immediately after the recession episode.
During refers to the average of the variable over the recession episode.
Response or *Change in* is defined as the difference between *during* and *before.*

Monetary response is generally defined in the paper as the interest rate response in a recession. However, in order to keep a larger sample, an alternative definition is used in section IV (Cluster analysis) as the response in M2 to GDP.

Outliers

Observations are considered outliers and excluded in the descriptive analysis when:

- Growth (before, during, or after) is above 15 percent in absolute value,
- Fiscal balance (before, during, or after) is above 15 percent of GDP in absolute value,
- Public debt to GDP is above 300 percent,
- Inflation is above 100 percent,
- Interest rate is above 100 percent in absolute value,
- Change in revenue to GDP or expenditure to GDP is above 20 percent in absolute value,
- Current account balance to GDP is above 20 percent in absolute value,
- Openness is above 100 percent,
- Exchange rate percentage change is above 100 percent in absolute value,

The first two criteria lead to a sample of 276 episodes that consitute the main database used throughout the paper (see Table A1 below).[24][25] The other criteria are only used in the descriptive section. In the principal component and cluster analyses, outliers are determined by the procedure itself (see section IV). In the econometric analysis, in order to keep as large a sample as possible, outliers are defined as observations for which the change in the interest rate is more than 200 percent (see section V).

---

[24] Observations for which data on growth and fiscal balance before, during or after the episode is not available are not included in the sample. This excludes episodes starting in 1970 or ending in 1999.

[25] However, as noted in section II, all the variables used in the analysis are not available for the 276 episodes. The sample size is indicated for each Table in section III, is 224 in section IV, and further reduced to 167 in section V.

Table A1: Recession Episodes

Country	First year	Last year	Country	First year	Last year	Country	First year	Last year	Country	First year	Last year
AFRICA			**ASIA**			**ADVANCED ECONOMIES**			**WESTERN HEMISPHERE**		
Algeria	1971	1971	Bhutan	1972	1973	United States	1974	1975	Antigua and Barbuda	1982	1982
Algeria	1988	1988	Bhutan	1975	1975	United States	1980	1980	Antigua and Barbuda	1992	1992
Algeria	1993	1993	Brunei Darussalam	1989	1989	United States	1982	1982	Antigua and Barbuda	1995	1995
Benin	1983	1983	Brunei Darussalam	1992	1992	United States	1991	1991	Argentina	1976	1976
Benin	1987	1987	Cambodia	1990	1990	Japan	1974	1974	Argentina	1978	1978
Benin	1989	1989	Cambodia	1997	1998	Japan	1993	1994	Argentina	1981	1982
Botswana	1992	1995	China	1972	1972	Germany	1981	1982	Argentina	1985	1985
Burkina Faso	1983	1983	China	1974	1974	Germany	1993	1993	Argentina	1989	1989
Burkina Faso	1987	1987	China	1976	1976	France	1975	1975	Bahamas, The	1975	1975
Burkina Faso	1990	1990	China	1981	1981	France	1991	1991	Bahamas, The	1981	1981
Burundi	1993	1993	China	1989	1990	France	1993	1993	Bahamas, The	1991	1992
Burundi	1995	1996	Fiji	1977	1977	Italy	1982	1982	Barbados	1981	1982
Cameroon	1988	1988	Fiji	1980	1980	Italy	1993	1993	Barbados	1990	1992
Cameroon	1990	1993	Fiji	1983	1983	United Kingdom	1974	1975	Brazil	1981	1981
Cape Verde	1990	1990	Fiji	1985	1985	United Kingdom	1980	1981	Brazil	1983	1983
Cape Verde	1992	1992	Fiji	1987	1987	United Kingdom	1991	1992	Brazil	1990	1990
Central African Republic	1982	1983	India	1972	1972	Canada	1982	1982	Brazil	1992	1992
Central African Republic	1987	1987	India	1974	1974	Canada	1990	1992	Chile	1982	1983
Central African Republic	1990	1990	India	1976	1976	Spain	1981	1981	Costa Rica	1980	1982
Central African Republic	1992	1992	India	1979	1979	Spain	1992	1993	Costa Rica	1985	1985
Central African Republic	1996	1996	India	1991	1991	Netherlands	1993	1993	Costa Rica	1991	1991
Chad	1993	1993	Indonesia	1982	1982	Belgium	1983	1983	Costa Rica	1996	1996
Comoros	1989	1989	Lao P.D. Republic	1977	1979	Belgium	1993	1993	Dominican Republic	1984	1985
Comoros	1991	1991	Lao P.D. Republic	1987	1988	Sweden	1991	1993	Dominican Republic	1990	1991
Comoros	1994	1995	Malaysia	1998	1998	Austria	1978	1978	Ecuador	1983	1983
Congo, Rep. of	1994	1994	Maldives	1975	1977	Austria	1981	1981	Ecuador	1987	1987
Congo, Dem. Rep. of	1997	1997	Myanmar	1986	1988	Austria	1984	1984	Grenada	1992	1993
CÂte d'Ivoire	1983	1984	Myanmar	1991	1991	Austria	1993	1993	Haiti	1982	1982
CÂte d'Ivoire	1987	1987	Nepal	1971	1971	Denmark	1974	1975	Haiti	1992	1992
Djibouti	1977	1977	Nepal	1973	1973	Denmark	1980	1981	Haiti	1994	1994
Equatorial Guinea	1991	1991	Nepal	1980	1980	Denmark	1989	1989	Honduras	1974	1975
Ethiopia	1984	1985	Nepal	1983	1983	Denmark	1993	1993	Honduras	1982	1983
Ethiopia	1991	1992	Nepal	1985	1985	Finland	1991	1993	Honduras	1994	1994
Gabon	1981	1981	Pakistan	1971	1972	Greece	1982	1982	Jamaica	1974	1974
Gabon	1992	1992	Pakistan	1993	1993	Greece	1987	1987	Jamaica	1988	1988
Gambia, The	1984	1984	Pakistan	1997	1997	Greece	1993	1993	Mexico	1982	1983
Gambia, The	1995	1995	Philippines	1984	1985	Portugal	1983	1984	Mexico	1995	1995
Ghana	1982	1982	Philippines	1991	1991	Portugal	1993	1993	Netherlands Antilles	1982	1982
Guinea-Bissau	1983	1983	Philippines	1998	1998	Ireland	1983	1983	Netherlands Antilles	1984	1986
Guinea-Bissau	1986	1986	Samoa	1974	1974	Luxembourg	1975	1975	Panama	1983	1983
Kenya	1992	1993	Samoa	1990	1990	Luxembourg	1977	1977	Panama	1987	1988
Madagascar	1981	1981	Sri Lanka	1987	1987	Luxembourg	1981	1983	Paraguay	1982	1983
Madagascar	1991	1991	Sri Lanka	1989	1989	Norway	1978	1978	Paraguay	1986	1986
Malawi	1981	1981	Thailand	1997	1998	Norway	1982	1982	Peru	1983	1983
Malawi	1992	1992	Tonga	1988	1988	Norway	1988	1988	Peru	1990	1990
Mali	1983	1983	Tonga	1990	1990	Israel	1989	1989	St. Kitts and Nevis	1975	1975
Mauritania	1982	1982	Tonga	1997	1997	Iceland	1983	1983	St. Kitts and Nevis	1978	1978
Mauritania	1990	1990	Vanuatu	1986	1986	Iceland	1988	1989	St. Kitts and Nevis	1980	1980
Mauritius	1981	1981	Vanuatu	1992	1992	Iceland	1992	1992	St. Kitts and Nevis	1983	1983
Mauritius	1984	1984	Vietnam	1972	1973	Korea	1980	1980	St. Lucia	1980	1980
Morocco	1981	1981	Vietnam	1978	1978	Korea	1998	1998	St. Vincent and the Gren	1991	1991
Morocco	1987	1987	Vietnam	1980	1980	Australia	1982	1983	St. Vincent and the Gren	1993	1994
Morocco	1992	1993				Australia	1990	1991	St. Vincent and the Gren	1996	1996
Morocco	1995	1995	Number of episodes	52		Taiwan Province of Chir	1982	1982	Suriname	1974	1974
Morocco	1997	1997				Taiwan Province of Chir	1998	1998	Suriname	1980	1980
Mozambique, Rep. of	1982	1984				Hong Kong SAR	1985	1985	Suriname	1993	1994
Mozambique, Rep. of	1992	1992	**MIDDLE EAST**			Hong Kong SAR	1998	1998	Trinidad and Tobago	1983	1988
Namibia	1990	1990				Singapore	1975	1975	Venezuela	1989	1989
Niger	1992	1992	Bahrain	1985	1985	Singapore	1985	1986	Venezuela	1994	1994
Nigeria	1987	1987	Bahrain	1987	1987	Singapore	1998	1998			
Rwanda	1982	1982	Iran, Islamic Republic of	1986	1986	New Zealand	1991	1991	Number of episodes	59	
Rwanda	1989	1989	Iran, Islamic Republic of	1988	1988						
Rwanda	1991	1991	Jordan	1989	1989	Number of episodes	61		**TRANSITION COUNTRIES**		
Senegal	1984	1984	Malta	1982	1982						
Senegal	1993	1993	Malta	1984	1984				Albania	1997	1997
Seychelles	1994	1995	Oman	1987	1987				Belarus	1995	1995
Sierra Leone	1985	1985	Syrian Arab Republic	1986	1986				Bulgaria	1996	1997

Appendix II. Multidimensional Analysis: A Methodological Note

Principal components analysis

The purpose of principal components analysis is to project the information contained in an N x p matrix X, where N is the number of observations and p is the number variables, in an r-dimensional space where r is much smaller than p. The lower-dimensional space accounts for most of the variability in the initial data as measured by a multivariate variance index (inertia). The new p N-dimensional vectors that are obtained as a result of the procedure (principal components or factors) are linear combinations of the original variables with weights proportional to the linear correlation between the variables in X and the principal component. The first p principal components have two desirable mathematical properties: (i) each component is orthogonal to the other, meaning that the linear correlation coefficient between two subsequent principal components is zero; and (ii) the first principal component explains the largest share of total variance in the original data matrix X. Each subsequent principal components accounts for the largest share in the remaining variance. Since principal components analysis is a descriptive rather than a probabilistic statistical method it can neither be used to test any hypothesis concerning the causal relationship between variables nor is any measure indicative of the quality of the fit. What is relevant to the analysis is the association between variables in the lower-dimensional space determined by the observations included in the dataset.

Results can be then evaluated looking at the correlation between the original variables in X and the principal components. The higher the correlation the more important is the specific variable in the explanation of the variance accounted for by the principal component[26]. The share of total variance explained by the first r principal components is an indicator of the quality of the representation, while the ratio of the variance explained by each component to total variance is a measure of the relative importance of each factor. Given the original variables in X and the first r characteristic vectors, it is possible to calculate r factor scores associated to each observation. These scores can be interpreted as new variables that have zero average and that are mutually orthogonal. The scores can also be interpreted geometrically as individuals' coordinates in a r-dimensional space. Therefore, distances between observation could be used to assess whether units in the sample can be grouped together according to some distance function. In general, observations lying together is the same part of the r-dimensional space will share common characteristics represented by the factors.

---

[26] Since factor scores are invariant to any post-multiplication by any conformable orthogonal matrix it is possible to calculate principal components according to an algorithm that maximize the contribution of the original variables to the factor while at the same time minimizing the number of factors to which a variable contribute. One of these algorithms, called varimax rotation, produces principal components that are much easier to interpret in terms of the original variables.

Cluster analysis

Cluster analysis is a class of statistical methods used for partitioning[27] an observed population sample into homogenous groups, according to some multidimensional distance function. The purpose of cluster analysis is to classify the observations in the sample, according to an index of proximity, which is based on some dissimilarity measure calculated for the vector of individual characteristics. As it does not require any assumption on the distribution of the variables in the population, the method is widely used as an exploratory data analysis tool. During the clustering process, the overall variability of the dataset is decomposed into a within-group and a between-group dimensions. The objective of cluster analysis is to find the best partition of the sample units, which yields the highest value for the ratio of between to within variability.

Cluster analysis is a descriptive rather than a probabilistic statistical method. As such, it cannot be used to test any hypothesis concerning the causal relationship between variables. In every step of the analysis the researcher's judgment is very important. Different partitions can be obtained as a result of the choice of the variables considered or the number of clusters retained. Once the best partition of the sample data has been obtained, a description of the cluster is needed. The latter can be obtained by analyzing the specific characteristic of each group, both in terms of the variables used to build the partitions and extra-analysis variables.

Clustering algorithms

Several algorithms exist to group multivariate data into clusters of sampling units. These can be grouped into hierarchical and non-hierarchical methods. The former combine observations hierarchically via a bottom-up procedure. At each step a distance measure of the observations from each other is calculated. The two units with the smallest distance are paired together. In the following step, the two original observations are replaced by a summary measure for the cluster. The process continues until all units have been combined into a single group. The hierarchy can be presented graphically by a dendrogram (Morrison, 1980) that describes the aggregation process on a distance scale. The number of clusters can be decided by stopping the aggregation process at some level of distance. The higher the value of the distance indicator chosen, the bigger is the probability to have a large number of groups.

Before starting a hierarchical clustering algorithm a choice must be done on:

- The unit of measure. In general it is preferable to use a standardize matrix as an input for cluster analysis. However, when variables are measured by a commensurable unit

---

[27] Usually in cluster analysis each observation can not be attributed to more than one cluster. However, recently several alternative cluster analysis methods have been developed to deal with overlapping clustering (clumping) and fuzzy clustering.

or the differences in unit and variability of the observation vectors are relevant to the partitioning, the original data matrix can be processed directly.

- The distance measure. A widely used general distance function is the quadratic form distance: $d^2(e_i - e_{i'}) = (\mathbf{x}_i - \mathbf{x}_{i'})'\mathbf{Q}(\mathbf{x}_i - \mathbf{x}_{i'})$, where e is a generic observation, $\mathbf{x}$ is a vector of individual characteristics and $\mathbf{Q}$ is a symmetric, positive definite matrix of weights. For Euclidean distances, $\mathbf{Q}$ can be chosen to be a diagonal matrix with generic element $1/n$, where n is the sample size. When $\mathbf{Q} = \mathbf{V}^{-1}$, where $\mathbf{V}$ is the data covariance matrix, we obtain the Mahalanobis distance, which takes into account the correlation among the variables;[28]

- The method of aggregation. Once the distance function between the observations is calculated, a sample unit is attributed to a cluster based on some formal rule. If at the first stage of the clustering process two units p and q have been paired in a group h, an additional observation r will be added to the cluster if the distance calculated according to the following rule is minimized: $d(r,h) = \min\{d(r,p), d(r,q)\}$. The former method is called *single linkage* or *nearest neighbor*. An alternative method would choose the observation to be aggregated to the existing partition according to the *furthest neighbor* criterion: $d(r,h) = \max\{d(r,p), d(r,q)\}$.[29]

Non hierarchical clustering algorithms implement a top-down approach. In this case the number of groups is to be decided *a priori*. The method allows to group the sample units in a pre-defined number of clusters that have the lowest internal variance and the largest inter-group variability. One algorithm, often known as *k-means*, consists of comparing the distance of each observation from the average of the pre-defined clusters. The initial value for the latter are usually chosen randomly among the sample data. At each step, the algorithm assigns an observation to the nearest cluster and distances are recomputed immediately. The process continues until the results converge to a solution. The iteration stop-rule is based on the size of the reduction in the intra-group variance. When this is sufficiently small, the iteration stops and the final partition is retained. In the case of non-hierarchical methods, both the unit of analysis and a distance matrix need to be specified. However, there is no need to specify an aggregation method, which in this algorithm is based on the minimization of internal variance.

---

[28] Additional widely used distance measure include the block, Ward, Chebychev, Minkoswky, and χ^2 distances (Morrison, 1980).

[29] Alternative methods include *centroid* and *median* clustering. In this cases the average or the median of the variables vector are used for assessing the distance from the cluster. Ward's method allows to weight the difference in the average vectors with the covariances among the variables (Diday, 1982)

Table A2. Cluster Composition by Episode, Country, and Region

Cluster No. 1: 29 episodes			Cluster No. 2: 29 episodes			Cluster No. 3: 39 episodes			Cluster No. 4: 15 episodes			Cluster No. 5: 27 episodes			Cluster No. 6: 54 episodes			Cluster No. 7: 9 episodes			Cluster No. 8: 22 episodes		
Area	Country	Year	Area	Country	Year	Area	Country	Year	Area	Country	Year	Area	Country	Year	Area	Country	Year	Area	Country	Year	Area	Country	Year
ADV	Korea	1988	ADV	Ireland	1983	ADV	Australia	1982	ADV	Ireland	1983	ADV	Belgium	1982	ADV	Japan	1974	ADV	Korea	1990	ADV	Finland	1991
AFR	Algeria	1982	ADV	Norway	1978	ADV	Australia	1990	AFR	Burundi	1993	ADV	Belgium	1990	ADV	Spain	1981	AFR	Cape Verde	1990	ADV	Hong Kong SAR	1998
AFR	Burundi	1993	AFR	Algeria	1993	AFR	Ethiopia	1978	AFR	Ethiopia	1984	ADV	Greece	1982	ADV	United States	1980	ASIA	Malaysia	1998	ADV	Singapore	1998
AFR	Cameroon	1998	AFR	Benin	1983	ADV	Austria	1981	AFR	Madagascar	1981	ADV	Greece	1987	ADV	United States	1982	ASIA	Thailand	1997	AFR	Botswana	1982
AFR	Central African Republic	1987	AFR	Benin	1987	ADV	Austria	1984	ADV	Malawi	1981	ADV	Greece	1993	ADV	United States	1991	ASIA	Vanuatu	1996	AFR	Cape Verde	1992
AFR	Malawi	1992	AFR	Burkina Faso	1990	ADV	Austria	1992	AFR	Rwanda	1991	ADV	Italy	1982	AFR	Benin	1989	MED	Bahrain	1985	AFR	Central African Republic	1996
AFR	Mauritius	1981	AFR	Côte d'Ivoire	1981	ADV	Canada	1982	AFR	Senegal	1984	ADV	Italy	1990	AFR	Burkina Faso	1983	MED	Bahrain	1987	AFR	Congo, Rep. of	1994
AFR	Niger	1990	AFR	Central African Republic	1980	ADV	Canada	1990	AFR	Zambia	1994	AFR	Cameroon	1988	AFR	Burkina Faso	1987	MED	Malta	1992	AFR	Equatorial Guinea	1991
AFR	Rwanda	1982	AFR	Comoros	1991	ADV	Denmark	1974	AFR	Zimbabwe	1992	AFR	Côte d'Ivoire	1983	AFR	Central African Republic	1982	MED	Malta	1984	AFR	Kenya	1992
AFR	Rwanda	1989	AFR	Comoros	1994	ADV	Denmark	1980	ASIA	Philippines	1998	AFR	Comoros	1989	AFR	Central African Republic	1992				AFR	Mozambique, Rep. of	1992
AFR	Sierra Leone	1991	AFR	Gabon	1982	ADV	Denmark	1989	ASIA	Samoa	1974	AFR	Ethiopia	1991	AFR	Chad	1990				AFR	Sudan	1982
AFR	South Africa	1982	AFR	Gambia, The	1985	ADV	Denmark	1995	WHD	Argentina	1976	AFR	Mauritius	1984	AFR	Gabon	1981				AFR	Uganda	1984
AFR	Togo	1992	AFR	Madagascar	1981	ADV	France	1991	WHD	Honduras	1994	AFR	Seychelles	1994	AFR	Gambia, The	1984				ASIA	Tonga	1997
ASIA	Fiji	1987	AFR	Nigeria	1987	ADV	France	1995	WHD	Suriname	1974	AFR	South Africa	1985	AFR	Ghana	1982				MED	Jordan	1989
ASIA	India	1974	AFR	Senegal	1983	ADV	Germany	1981	WHD	Venezuela	1989	AFR	Togo	1983	AFR	Mali	1983				MED	Malta	1984
ASIA	Myanmar	1986	AFR	Sierra Leone	1985	ADV	Germany	1993				AFR	Tunisia	1986	AFR	Morocco	1981				TRANS	Belarus	1995
ASIA	Philippines	1984	AFR	Tanzania	1982	ADV	Iceland	1988				ASIA	Fiji	1983	AFR	Morocco	1987				TRANS	Belarus	1995
TRANS	Albania	1997	AFR	Tunisia	1982	ADV	Iceland	1992				ASIA	Sri Lanka	1987	AFR	Morocco	1992				TRANS	Kazakhstan	1995
WHD	Argentina	1981	ASIA	Tonga	1980	ADV	Israel	1989				ASIA	Sri Lanka	1989	AFR	Morocco	1995				TRANS	Kazakhstan	1995
WHD	Argentina	1985	TRANS	Moldova	1996	ADV	Japan	1980				ASIA	Tonga	1988	AFR	Morocco	1997				WHD	Brazil	1990
WHD	Argentina	1989	WHD	Chile	1982	ADV	Netherlands	1990				MED	Oman	1987	AFR	Sierra Leone	1985				WHD	Brazil	1990
WHD	Brazil	1983	WHD	Ecuador	1987	ADV	New Zealand	1991				TRANS	Bulgaria	1996	AFR	Sudan	1978				WHD	Netherlands Antilles	1984
WHD	Costa Rica	1988	WHD	Honduras	1982	ADV	Norway	1982				WHD	Brazil	1983	AFR	Tunisia	1983				WHD	Netherlands Antilles	1984
WHD	Dominican Republic	1984	WHD	Jamaica	1988	ADV	Norway	1988				WHD	Dominican Republic	1990	ASIA	Cambodia	1997				WHD	Peru	1988
WHD	Ecuador	1983	WHD	Panama	1987	ADV	Portugal	1990				WHD	Grenada	1992	ASIA	China	1981				WHD	Peru	1992
WHD	Haiti	1992	WHD	Peru	1983	ADV	Spain	1992				WHD	Panama	1983	ASIA	China	1989				WHD	St. Kitts and Nevis	1983
WHD	Honduras	1974	WHD	St. Lucia	1980	ADV	Sweden	1991				WHD	St. Vincent and the G.	1985	ASIA	Fiji	1977				WHD	St. Kitts and Nevis	1985
WHD	Mexico	1982	WHD	St. Vincent and the Gren.	1981	ADV	United Kingdom	1974							ASIA	Fiji	1980				WHD	Trinidad and Tobago	1983
WHD	Paraguay	1986	WHD	St. Vincent and the Gren.	1986	ADV	United Kingdom	1980							ASIA	Fiji	1985				WHD	Trinidad and Tobago	1992
						ADV	United Kingdom	1991							ASIA	India	1972				WHD	Venezuela	1984
						ADV	United States	1974							ASIA	India	1976				WHD	Venezuela	1984
						AFR	South Africa	1990							ASIA	India	1979						
						AFR	Tanzania	1982							ASIA	India	1991						
						ASIA	Samoa	1990							ASIA	Indonesia	1982						
						ASIA	Vanuatu	1992							ASIA	Myanmar	1994						
						TRANS	Czech Republic	1998							ASIA	Nepal	1973						
						TRANS	Romania	1997							ASIA	Nepal	1980						
						WHD	Barbados	1981							ASIA	Nepal	1983						
						WHD	Barbados	1990							ASIA	Nepal	1985						
															ASIA	Pakistan	1993						
															ASIA	Pakistan	1997						
															ASIA	Philippines	1991						
															MED	Turkey	1989						
															MED	Turkey	1994						
															WHD	Argentina	1978						
															WHD	Brazil	1992						
															WHD	Costa Rica	1985						
															WHD	Costa Rica	1994						
															WHD	Costa Rica	1996						
															WHD	Haiti	1982						
															WHD	Jamaica	1974						
															WHD	Mexico	1995						
															WHD	Netherlands Antilles	1992						
															WHD	Paraguay	1992						

References

Alesina, Alberto, and Silvia Ardagna, 1998, "Tales of Fiscal Adjustment," *Economic Policy: A European Forum*, Vol. 27 (October), pp. 487-546.

Alesina, Alberto and Roberto Perotti, 1997, "Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects," *Staff Papers*, International Monetary Fund, Vol. 44, No. 2 (June), pp. 210-248.

Diday, E., and others, 1982, *Elements d'analyse des donnees* (Paris: Dunod).

Dunteman, G.H. 1980, *Principal Components Analysis*, in Series: Quantitative Applications in the Social Sciences, 69 (London: Sage University Paper).

Everitt, B., 1974, *Cluster Analysis* (London: Heinemann).

Gavin, Michael, and Roberto Perotti, 1997, "Fiscal Policy in Latin America," paper presented at the Twelfth NBER Annual Macroeconomics Conference, April 5-4, Cambridge MA.

Giavazzi, Francesco, Japelli, Tullio, and Marco Pagano, 2000, "Searching for Non-linear Effectes of Fiscal Policy: Evidence from Industrila and Developing Countries," *European Economic Review*, Vol. 44, pp. 1259-89.

Giavazzi, Francesco and Marco Pagano, 1990, "Can Severe Fiscal Contractions be Expansionary? Tales of Two Small European Countries," NBER Macroeconomics Annulas 5, pp. 111-6.

Giavazzi, Francesco and Marco Pagano, 1996, "Non-Keynesian Effects of Fiscal Policy Changes: International Evidence and the Swedish Experience," *Swedish Economic Policy Review*, Vol. 3 (Spring), pp. 67-103.

Hemming, Richard, Michael Kell, and Selma Mahfouz, 2000, "The Effectiveness of Fiscal Policy in Stimulating Economic Activity—A Review of the Literature," SM/00/66, IMF, March 2000.

IMF, 1998, World Economic Outlook, October 1998, pp.50-1.

Lane, Timothy, Atish Ghosh, Javier Hamann, Steven Phillips, Marianne Schultze-Ghattas, and Tsidi Tsikata, 1999, "IMF-Supported Programs in Indonesia, Korea and Thailand", IMF Occasional Paper No. 178.

Lebart, L., A. Morineau, and M. Piron, 1995, *Statistique Exploratoire Multidimensionelle*, (Paris: Dunod).

Morrison, D.F., 1980, *Multivariate Statistical Methods (*Singapore: Mac Graw Hill International Editions).