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WP/98/100

INTERNATIONAL MONETARY FUND

European I Department

**From Inflation to Growth: Eight Years of Transition**

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Authorized for distribution by Carlo Cottarelli

July 1998

**Abstract**

This paper reexamines growth in transition using panel data to 1997. It suggests that output has been strongly affected by export market growth; that inflation has been associated with weaker output only above a threshold inflation rate; that structural reform has been associated with weaker output initially, but that it stimulates higher growth thereafter; and that rapid disinflation has been associated with output losses only in the presence of pegged exchange rates.

JEL classification numbers: E31, F43, O40, P20.

Keywords: Transition, growth, inflation, disinflation.

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<sup>1</sup> We would like to thank our colleagues in the IMF for providing data, Ratna Sahay for providing the war dummy variable, and David Maxwell for research assistance. We are indebted to Craig Beaumont, Carlo Cottarelli, and Stephen Phillips for comments on an earlier draft.

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## SUMMARY

This paper attempts to address some issues in the literature on panel data studies of growth in transition, and to highlight remaining areas of concern. It focuses on the role of export market growth, the relationship between output and inflation, the role of structural reforms, and the impact of disinflation (as opposed to low inflation) on output. These issues are fundamental to understanding transition and therefore to the design of policy in transition economies.

The paper finds export market growth to be strongly associated with output in transition, underscoring in particular the importance of Russia to growth in many transition economies. But even given external shocks, structural reform and disinflation can stimulate growth. Previous studies omitted export market growth and so overstated the output costs of inflation, as well as the short-run costs of structural reform and its long-run benefits.

Controlling for export market growth, the paper finds evidence that inflation above the low teens has been associated with output losses. This estimate is higher than has been found in studies using the same functional form for inflation for longer panel data sets for developed and developing countries. Accordingly, the threshold may fall as transition economies increasingly come to resemble full-fledged market economies.

There is no evidence that disinflation necessarily incurs significant output costs, even at moderate inflation rates. Losses only appear to arise when moderate inflation is stabilized in the presence of exchange rate pegs. Even in this context, however, the losses seem likely to be due to undervalued pegs, rather than pegs per se.

## I. INTRODUCTION

Since the output declines in the early- to mid-1990s, economic growth has generally resumed in the transition area and inflation rates have fallen sharply.

Various efforts have been made to identify the causes and consequences of these developments using regressions on panel data. But key issues have yet to be settled, including the relative role of external and domestic policy factors in determining output, and whether and in what circumstances disinflation prolonged or deepened recessions that were already underway. These issues are not only of historical interest: they are fundamental to understanding transition and to the design of policy in transition economies now.

This paper reexamines what explains growth in transition in a panel data context, suggesting four new conclusions:

- First, export market growth is strongly associated with output in transition economies. None of the earlier panel data studies controlled for this, and the omission explains key features of their results.
- Second, in transition economies, there is evidence that inflation is associated with weaker output only above a threshold inflation rate, just as appears to be the case for market economies. This approach encompasses those which do not allow for a “kinked” relationship between output and inflation.
- Third, given export market growth and the kinked relationship between inflation and output, structural reform is associated with weaker output in the year that it is introduced, but is associated with higher growth thereafter.
- Finally, given these elements, the only significant evidence of output losses due to disinflation arises when inflation is stabilized rapidly in the presence of a pegged exchange rate. This may reflect stabilization in the context of undervalued pegs rather than stabilization in the presence of pegs per se.

Section II summarizes the growth and inflation trends in transition since 1990. Section III outlines and assesses the earlier growth regressions that have attempted to account for those trends. Section IV outlines our approach and presents the key results. Section V discusses the results, and Section VI makes concluding observations.

## II. OUTPUT AND INFLATION TRENDS

The collapse of output and employment, combined with surging inflation were the defining macroeconomic features of the early stages of transition.

Output declined steeply in the Central European Economies (CEE) until 1993, and until 1996 in the Baltics, Russia, and other countries of the former Soviet Union (BRO) countries (Figure 1 top left-hand panel), and its cumulative fall was considerably greater in the latter cases. At the same time, inflation skyrocketed (Figure 1, middle left-hand panel).

Inflation was brought under control more rapidly in the CEE, albeit from less extreme rates. Most disinflations there and in the Baltics date from the early 1990s. These stabilizations tended to be accompanied by "big bang" structural reforms, as shown in the lower right hand panel of Figure 1.<sup>2</sup> Disinflations elsewhere in the transition area came in a "second wave" in 1993–95, and were not marked by significant accelerations of structural reform. In both cases, disinflation was generally rapid (Figure 1, middle right hand panel) and output began to grow within roughly two years of stabilization (Figure 1, upper right hand panel).

16 transition countries had brought inflation below 15 percent by end-1997. However, only Croatia, Macedonia, Czech Republic and Slovenia have maintained inflation in single digits for a number of years.

### III. REVIEW OF THE LITERATURE

On the basis that growth resumed relatively quickly following disinflation, some commentators adduced that while disinflation may have compounded the fall in output already underway,<sup>3</sup> it may also have been critical to the early restoration of economic growth.<sup>4</sup> However, Ghosh<sup>5</sup> emphasized that the variety of output-stabilization patterns in transition countries cautioned against casual claims about growth and inflation, echoing the call of others for formal econometric evidence to disentangle the relative contribution of disinflation and structural reform to the resumption of economic growth.<sup>6</sup>

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<sup>2</sup> The "Transition Index" referred to in Figure 1 and elsewhere is drawn from various EBRD Transition Reports and from De Melo et al. (1997). It is a composite of scores from eight institutional characteristics, ranging from privatization to price liberalization to banking reform and interest rate liberalization. The eight scores are weighted together to yield the aggregate "Transition Index" for each country. The highest scores indicate institutional structures similar to those prevailing in fully-fledged market economies.

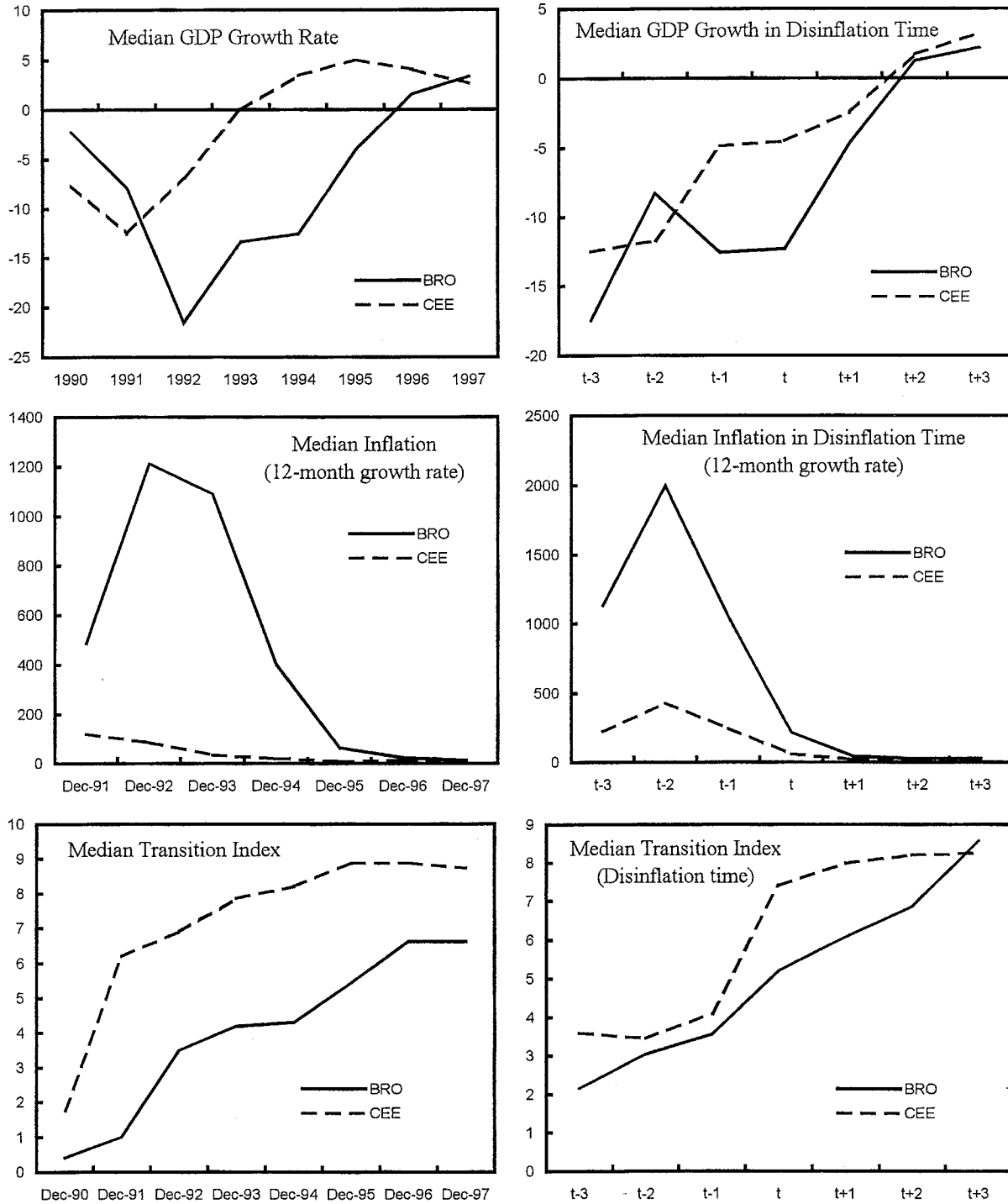
<sup>3</sup> Calvo and Coricelli (1992), Portes (1993), Asmden, Kochanowicz, and Taylor (1994), and Federov (1995).

<sup>4</sup> Fischer et al, (1996), de Melo et al, (1996).

<sup>5</sup> Ghosh (1997).

<sup>6</sup> De Melo et al., (1997).

Figure 1. BRO and CEE, GDP Growth, Inflation and Transition index, 1990-97  
 (In chronological and disinflation time 1/)



Sources: National authorities; IFS, various EBRD Transition reports; and staff estimates.

1/ Stabilization dates are taken from Fischer et al. (1996), and are reported in table 2.

Only three studies conduct formal tests on panel data of the relationship between inflation and growth for transition economies: Lougani and Sheets,<sup>7</sup> Berg et al.,<sup>8</sup> and Fischer et al.<sup>9</sup> In contrast, de Melo et al.<sup>10</sup> and Aslund et al.<sup>11</sup> use cross section data to model compounded growth rates across several years. The comments made in these studies on data quality, the different methodological approaches adopted, and their somewhat divergent conclusions are noted in turn.

### **Data quality**

All studies note that output is mis-measured. Some point to the overstatement of official output data under the old regime, many emphasize that the data they are using are sparse and or preliminary, and all point to the under recording of output by new firms. A number add that real output measured using post-transition relative prices is stronger than when pre-transition prices are used. Lougani and Sheets speculate that high inflation itself may have driven output "underground," though they do not explain why, and de Melo et al. note that stock building is frequently mismeasured. Most note that inflation is also mismeasured due to sharp improvements in the quality of available goods, and that this compounds the downward bias of measured real output. Only Lougani and Sheets, however, reflect these issues in their methodology. They examine how their results are affected by modeling electricity consumption as a proxy for output, rather than officially recorded GDP.

### **Methodology**

All but Berg et al. deal with the limited available degrees of freedom by ignoring potential complex lag structures and using theoretical priors to select variables to be investigated as potential dependent variables. And only Berg et al. attempt to address potential endogeneity problems by instrumenting.

The regressions are outlined in Table 1. Ticks indicate regressors found to be statistically significant at the 5 percent level, while crosses indicate regressors that were not found to be significant at this level. The "transition index" refers to the indices developed by de Melo et al., updated on the basis of the EBRD transition reports, to proxy for structural reform. Note that Lougani and Sheets alone model inflation in levels, not logs.

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<sup>7</sup> (1997).

<sup>8</sup> (1998).

<sup>9</sup> (1996).

<sup>10</sup> (1996).

<sup>11</sup> (1996).

Table 1. Growth Regressions for Transition Economies

	De Melo	Aslund	Lougani	Fischer
Data Period	1989-1994	1989-1995	1991-1994	1992-1995
Data set	Cross section	Cross Section	Panel	Panel
No. of Countries	26	22	25	25
<b>Dependent variables</b>				
	Compound growth of per capita GDP	Compound growth of GDP	GDP growth & electricity consumption	GDP growth
<b>Independent variables</b>				
Country fixed effects				✓ 1/
Lagged output			✓	
inflation		×		
lagged inflation			✓	
Exchange rate regime				✓
fiscal balance				✓
lagged fiscal balance			✓	
transition index	✓	×		✓ 2/
lagged change transition index			✓	
Per capita GDP 1989	✓			
War dummy	✓	✓		
Ruble zone dummy		✓		
1992 dummy			✓	✓
Other year dummies			✓	

1/ ✓ indicates significant at 5%, with the expected sign. × indicates insignificant at 5%.

2/ Various sub-components of the De Melo et al index were also used.



The approach adopted by Berg et al. is more complex than those reported in the table in several ways. They model both the log level of GDP and the growth rate for 25 CEE and BRO countries, for the period 1991–96 for most CEE countries and 1992–96 for most BRO countries. They consider a much larger set of potential regressors and lag structures than earlier studies, they allow for differential behavior of “old” and “new” productive sectors, they apply ad hoc “test down” procedures—under which insignificant “non-policy” variables are eliminated before insignificant policy variables—to identify significant variables and address robustness,<sup>12</sup> they instrument for inflation and the fiscal balance to address potential endogeneity, and they examine both fixed effects models and models with uniform constants with a rich set of potential “initial conditions” variables.

## Results

The early finding of Aslund et al., that compound growth can be successfully modeled simply with inflation, war, and ruble zone membership, has given way to panel data results indicating that structural reform is also strongly associated with growth. Overall, the results on inflation are particularly dramatic: Lougani and Sheets find that inflation of 500 percent lowers GDP growth by some 2 percentage points, while Fischer et al. find that their peg dummy (a proxy for low inflation) has a very large positive coefficient.

A key discrepancy, however, concerns the different findings for the association of the fiscal balance and growth. Lougani and Sheets find that fiscal deficits are associated with high growth, Fischer et al. finds the converse, while Berg et al. find that the sign and significance depend on the equation specification.

The Berg et al. study contains several interesting nuances. They find a significant growth impairing effect of inflation for the private sector in the fixed effects specifications though they are puzzled by a negative sign on the second lag of inflation. However, they find no impact of inflation on the private sector in the uniform–constant specifications allowing for different initial positions. In contrast, a positive association between inflation and state sector output appears in both cases, which they suggest may reflect that high subsidies to the state sector supports its output but also stokes inflation by weakening the fiscal balance.

They find no robust impact from the fiscal balance on growth. And under some specifications, structural reform has asymmetric effects on the old and new sectors, but not under others: only trade reform exhibits this asymmetry in both specifications. Of the many potential initial conditions considered, only time under communism, urbanization, dependency on the CMEA, and overindustrialization survive the test down procedure, and have the expected signs.

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<sup>12</sup> Hendry (1995).

## Assessment

A number of issues arise from this work which are reflected in the approach adopted here.

None of the studies explicitly control for the impact on growth of export market growth. The use of dummies for 1992 by Lougani and Sheets is an implicit gesture in this direction, but it becomes increasingly inadequate as data sets lengthen and as output has recovered in the transition area. If this factor is a significant determinant of growth in this period—as a priori seems highly likely—then its omission likely upwardly biases the estimates of the output costs of inflation, with which it is negatively correlated (See Figures 1 and 2). This may explain the high estimates of the costs of inflation found in these studies.

None of the studies distinguish the output costs of inflation from the output costs of disinflation, the sacrifice ratio. Hence, they shed no light on how much disinflation itself contributed to the length and depth of the recessions experienced, whatever benefits may have flowed from the lower inflation that the disinflations achieved. Nor are questions of the appropriate exchange regime during disinflation addressed, though these issues have been intensively debated. For example, Sachs (1996) argued that increased real demand for money after stabilizations of high inflation would depress output unless nominal monetary growth remained relatively high, and this risk would be minimized under a pegged exchange rate regime. This was a key element in his criticism of official agencies' endorsement of floating exchange regimes after supporting the Polish peg in 1990.

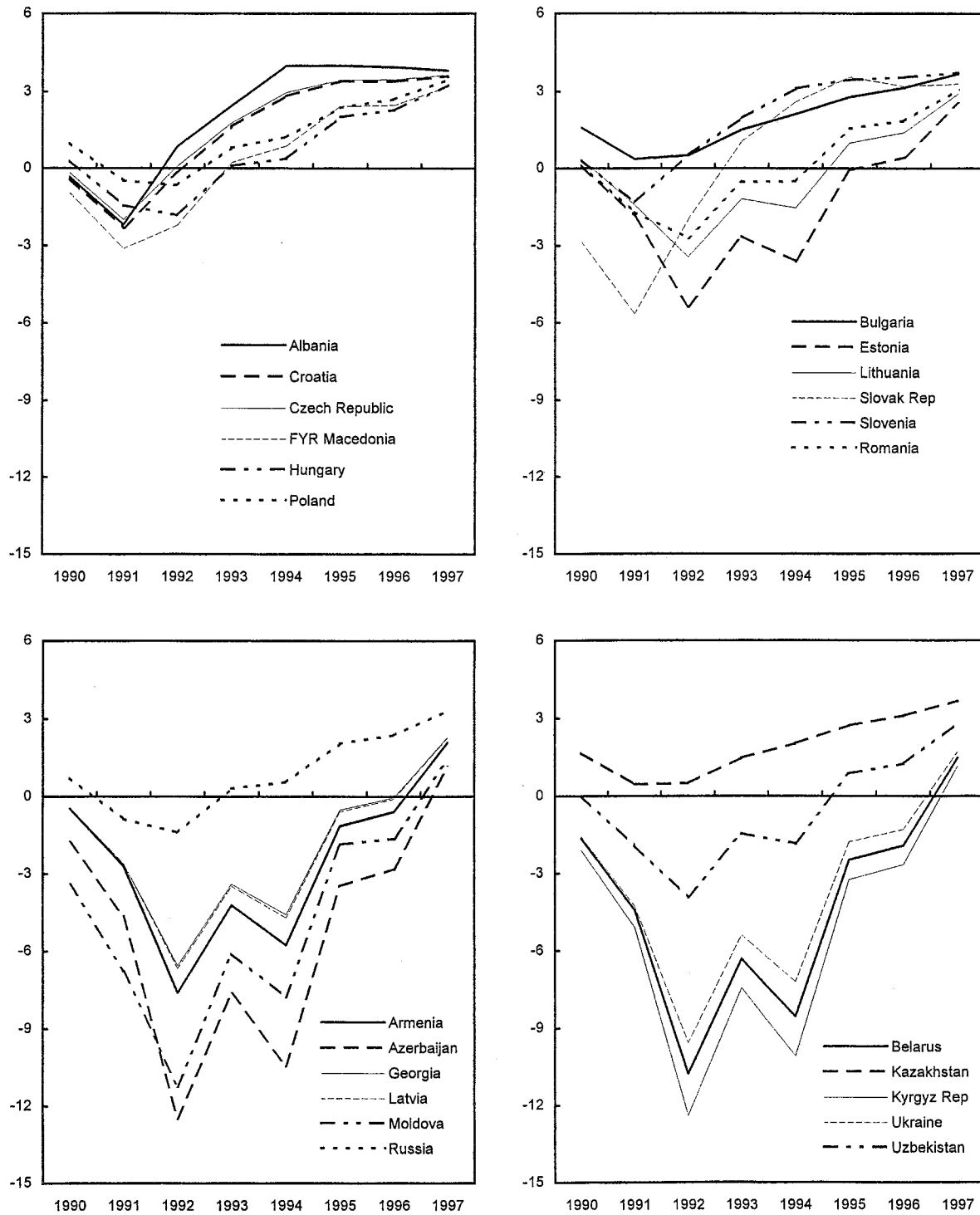
None investigate whether the relationship between inflation and growth is kinked—that is whether inflation impairs output only above an inflation threshold—though there is increasing evidence of this pattern for non-transition economies.<sup>13</sup> Sarel, using a panel of industrial and developing countries, finds that inflation above 8 percent significantly impedes output growth, while growth is unaffected by inflation below that, and Ghosh and Phillips also find a significant threshold, which they estimate in the low single digits for their full sample. They both find that if the kink is ignored, the output costs of inflation above the threshold are significantly understated. In the transition context, it becomes increasingly important to address this issue as inflation falls to low levels.

The variety of results on fiscal policy may reflect that the fiscal measure is misspecified in regressions which also have inflation (or a proxy for it) as an independent variable. It is possible that in transition panels, a large, but highly variable part of the fiscal impact on output

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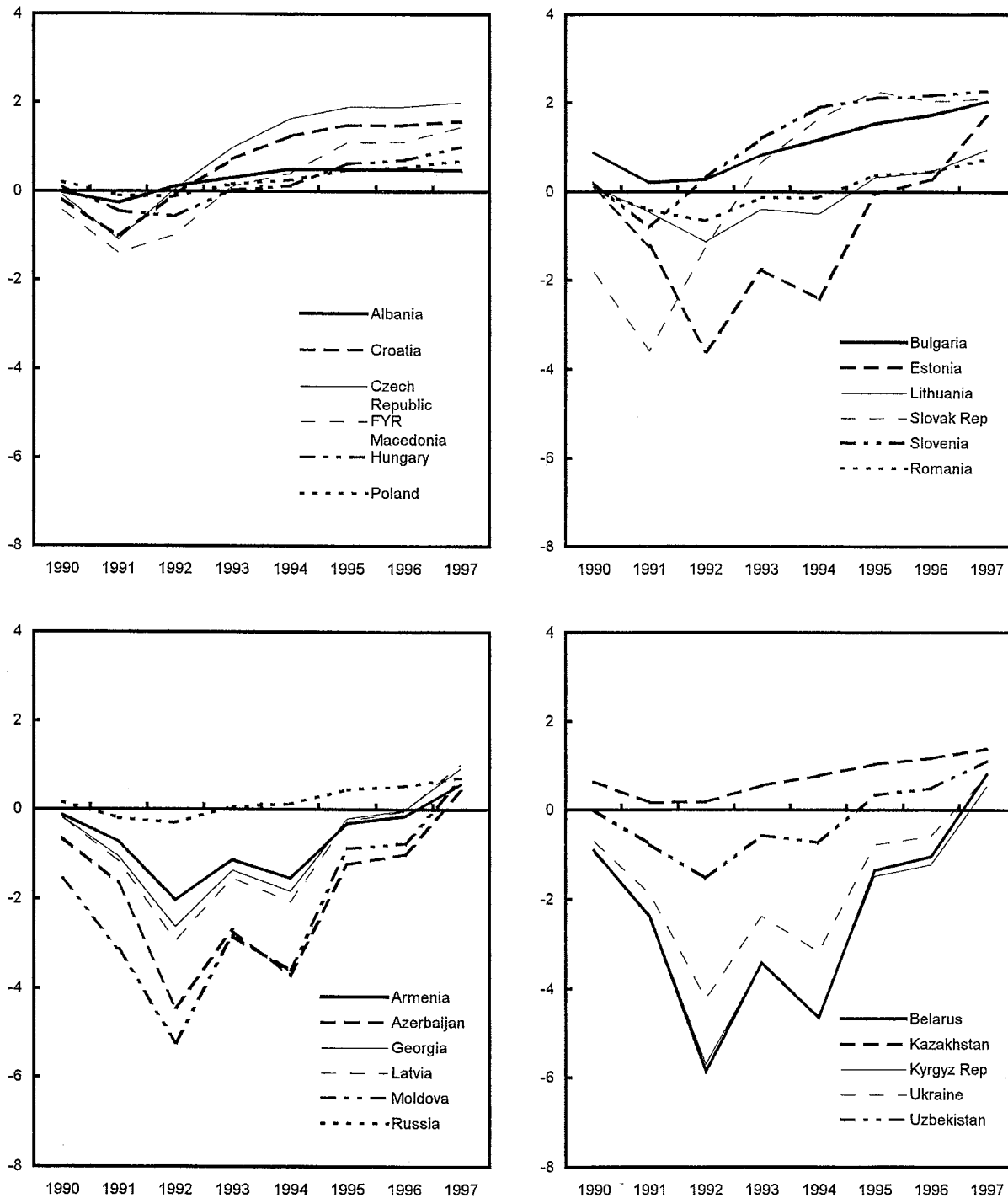
<sup>13</sup> Fischer (1993), Bruno and Easterly (1995), Sarel (1996), IMF(1998), Ghosh (1998), and Ghosh and Phillips (1998).

Figure 2. Export Market Growth, 1990-97  
(GDP growth in export markets, weighted by direction of exports in the base period)



Sources: DOTS; National authorities; and staff estimates.

Figure 2 concluded. Export Market Growth, 1990-97  
(Adjusted for the share of exports in GDP)



Sources: DOTS; National authorities; and staff estimates.

occurs through inflation.<sup>14</sup> But since inflation appears as a regressor, the fiscal variable should (theoretically) exclude that part of the balance that generates inflation in a single equation approach. Such a corrected fiscal variable could be the operational balance—to extract the impact of inflation on interest payments—less seignorage in excess of money demand—to extract that part of fiscal policy already reflected in inflation,<sup>15</sup> and would bear little relation to the fiscal variables actually used. However, none of the studies even discuss how their findings should be interpreted in light of the implicit misspecification problems in the fiscal variables used.

Issues arising from the poor quality of the data are passed over relatively lightly, largely because there is little that can be done about them. But biases in stock building measures may at least warrant further thought: excessive stocks were common, rates of stock turnover were therefore generally low, and none of these countries had in place effective statistical means of ensuring that inflation-based holding period gains would be fully extracted from their stock building data. Failure to extract holding period gains from inflation in stocks data may therefore have caused a substantial exaggeration of recorded GDP when inflation was high, and overstated recorded growth when inflation was rising and vice versa. The latter could explain Berg et al.'s finding that inflation appears to benefit the state sector.

Finally, none of the studies discuss the role of terms of trade changes in affecting their findings. The issue has been noted elsewhere in studies of the output-inflation relationship,<sup>16</sup> and most of these addressed it by including the terms of trade as a control to eliminate spurious correlations between inflation and output generated by terms of trade changes. While including the terms of trade would likely fail to eliminate the consequent spurious correlation

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<sup>14</sup> Real demand for base money has been highly volatile as inflation has accelerated and decelerated. And seignorage revenues have been very high, in both contexts—seven of the 15 high inflation BRO countries recorded seignorage in excess of 10 percent of GDP in 1993 (Ghosh (1997)) while Croatia recorded seignorage of some 3 percent of GDP in 1994 after its disinflation.

<sup>15</sup> Further refinements may be necessary depending on how the profits of the central bank are treated in the overall balance and on the speed with which seignorage revenues are passed to the budget.

<sup>16</sup> Fischer (1993).

between output and inflation,<sup>17</sup> none of the studies of output in transition noted even recognize the issue. Yet, terms of trade changes were large—notably as imported oil from transition oil exporters was repriced towards world prices in the early 1990s—and were broadly correlated with inflation. Omission of this variable probably results in some overstatement of the negative impact of inflation on output, because of its (probable) correlation with inflation.

#### IV. OUTPUT AND INFLATION IN TRANSITION REVISITED

Given these concerns, this paper returns to the methodology of the pre Berg et al. work, seeking broad associations between variables to characterize the data rather than attempting to establish a basis for conclusions about causality and policy.

##### **Data and variable construction**

The panel is unbalanced, and the longest series runs from 1990–1997. We obtained annual real GDP data, population, and the share of exports in GDP from IMF desk officers (with their estimates for 1997), data on the transition reform index from De Melo et al and updated it using the data from EBRD transition reports, information on the direction of trade to 1996 from the Direction of Trade Statistics of the IMF, and the war dummy was kindly provided by Berg et al. and is described in their paper.<sup>18</sup> Following Sarel (1996), 2 negative 12-month inflation rates were converted into small positive numbers in order to allow logs to be taken.

The export market growth series for each country in the panel was constructed as follows. Three export markets were defined: the CEE; the BRO; and the rest of the world. The growth of each as an export market was represented by the growth of its GDP.<sup>19</sup> These growth rates were weighted according to the share of each in the exports of goods for each country in the panel. That share was taken from the earliest annual direction of trade statistics data available

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<sup>17</sup> Fischer suggests that terms of trade gains boost output and prices. So if the terms of trade are omitted from regressions of output on inflation, the implied cost of inflation for output will be biased downward. However, if the terms of trade gain arises from a fall in import prices, rather than a rise in export prices, the reverse bias will occur because the terms of trade will boost output and reduce prices. Hence, both export and import prices should be used as controls for spurious output-inflation correlations, not just the terms of trade series.

<sup>18</sup> To construct the inflation rate for 1991 in the BRO countries from CPI index series that begin in January 1991, the December 1990 index level was estimated by applying the growth rate in February 1991 to the January 1991 index to yield December 1990.

<sup>19</sup> Import volume growth was not used due to weak data on this for transition countries.

for each country in the sample from 1990 onwards.<sup>20</sup> The resulting export market growth series were then multiplied by the average ratio of exports to GDP for each country in the panel to control for openness. The results are reported in Figure 2.<sup>21</sup>

Several approaches to estimating the association between growth and disinflation were examined. Dummies were defined taking the value 1 when 12-month period end inflation fell by at least 20 percent (note, this is not percentage points) from the previous year. The exercise was repeated for inflation falling by at least 50 percent from the previous year. The former gave 84 disinflation episodes, while the latter gave 56 episodes. In a further exercise, disinflation dummies were defined according to the disinflation episodes identified by Fischer et al. (1996).<sup>22</sup>

In all cases, these disinflation episodes were divided into episodes in the context of fixed exchange rates—defined as fixed, de facto fixed, or currency board arrangements—and other exchange rate regimes. The fixed exchange rate dummy is reported in Annex 1. The definition of a pegged exchange rate is strict, and excludes a number of cases where some suggest that de facto pegs were operated.<sup>23</sup>

All observations for Turkmenistan, Tajikistan, and Uzbekistan were discarded, either because data on the direction of trade were unavailable or because the data seemed unreliable, even by the not very exacting standards of the rest of the data set. This left a panel of 22 CEE, FRY, and BRO countries.

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<sup>20</sup> Where data on the shares was available over several years, the weights were defined only on the basis of the share in the first year for which data were available.

<sup>21</sup> Note the variety of circumstances. For example, Albania and Russia experience low export market shocks, a result both of the high concentrations of exports to the non-transition area and their relative autarky. At the opposite extreme, Belarus and Georgia experience major export market shocks, being both open and heavily exposed to the BRO. The CEE group show lower export market shocks than the BRO group because much of their exports to the transition area were to other CEE countries, which had smaller output declines than the BRO.

<sup>22</sup> In this case, when a stabilization program was reported to be implemented in the first 5 months of a year, 1 was assigned to that year. But it was assigned to the following year if the stabilization was introduced later than May. This rule was an attempt to capture possible delayed effects on disinflation on output.

<sup>23</sup> Fischer et al. (1998) suggest that de facto pegs operated as of 1995 in Armenia, Azerbaijan, Georgia, Kazakhstan, and the Kyrgyz Republic during the sharp disinflations in that year. However, while nominal bilateral exchange rates with the U.S. dollar were relatively stable in these cases during 1995, they moved markedly in all cases bar Georgia thereafter.

## Methodology

The dependent variable is growth per capita, and was selected in preference to GDP levels on the grounds that unrecorded activity may affect officially reported output levels more than growth rates.<sup>24</sup> Since most populations in the sample were stagnant, the use of per capita estimates rather than simple growth estimates was probably insignificant, but it formally followed the approach of panel estimates of growth determinants using kinked functional forms for inflation. All regressions used 149 observations, and incorporated country fixed effects.

Sarel's (1996) approach to modeling the kinked relationship between inflation and output was adopted. Thus, two inflation terms are used: log inflation, and log inflation less a threshold. This second series is set to zero below the threshold. Ghosh and Phillips (1998) find that the log formulation of the twin inflation terms is accepted by their data, and it was adopted on that basis.<sup>25</sup>

Sarel further proposed that the threshold in the second term should be estimated using a grid search. The value of the threshold that maximizes the explanatory power (R-squared) of the overall equation would determine the value of the threshold. If, after the grid search over R-squared, the second term in the regression that maximizes the explanatory power of the equation is insignificant, there is no kink apparent in the data. If it is significant and negative, and if the coefficient on log inflation is positive and significant, the threshold identifies the rate of inflation that maximizes output growth. If, however, the second term is significant and negative, while the coefficient on log inflation is insignificant, then the threshold identifies the point above which the output costs of inflation become apparent in the data.

The assessment of output costs associated with disinflation controls for structural and other factors affecting output. The decomposition of the disinflation dummies into pegged and other exchange rate regimes allows some insight into the association between the exchange regime and the sacrifice ratio.

The first step was to replicate the key findings of the earlier work, and, if possible, encompass it. The second step was to investigate how disinflation affected output, as described above. The third step was to conduct robustness tests, checking how parameter estimates were effected by inflation outliers, and by the exclusion of countries one at a time

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<sup>24</sup> There does not appear to be a clear case in favor either of GDP levels or growth rates arising from distortions from inflation holding period returns in stock building since inflation was both high and very variable in many of the countries in this panel.

<sup>25</sup> Regressions with the two inflation terms in levels showed clear signs of misspecification in this data-set.



from the panel. The reported p-values are all computed from White's heteroskedasticity-consistent standard errors.

### **Results (1): Replication and encompassing**

GDP growth per capita was regressed on log inflation, the transition index, the change in the transition index, the war dummy, and dummies for 1992 and country specific fixed effects. The parameter estimates on the 1992 dummy were insignificant and were dropped. The equation was re-estimated. The results are reported in Table 2 as regression 1. This replicates earlier findings associating low inflation and structural reform with growth.

Then, export market growth was added to this regression, with results reported in Table 2 as regression 2. In this regression, inflation appears insignificant, while export market growth appears highly significant and powerful. This suggests that the earlier results concerning inflation may have reflected the omission of the export market growth variable.

To complete the encompassing exercise, we then added the term for log inflation less log threshold to regression 2. This is reported as regression 3 in Table 2.<sup>26</sup> The results of the associated grid search underlying regression 3 are shown in Figure 3, and the errors for each country in the panel are shown in Figure 4.

The key results are:

- Export market growth, adjusted for the share of exports in GDP, is significant at the 1 percent level, and is strongly associated with growth.
- The inflation-output threshold appears at 13 percent. The output losses associated with inflation above that level are significant at just above the 1 percent level and the term on log inflation is positive but insignificant.
- The transition index is significant at the 1 percent level and is strongly associated with growth, though not as strongly as is implied in regression 1.
- The estimate on the change in the transition index is negative, is highly significant, and is large, though not as large as in regression 1.
- The war dummy is significant at 1 percent, and is large.

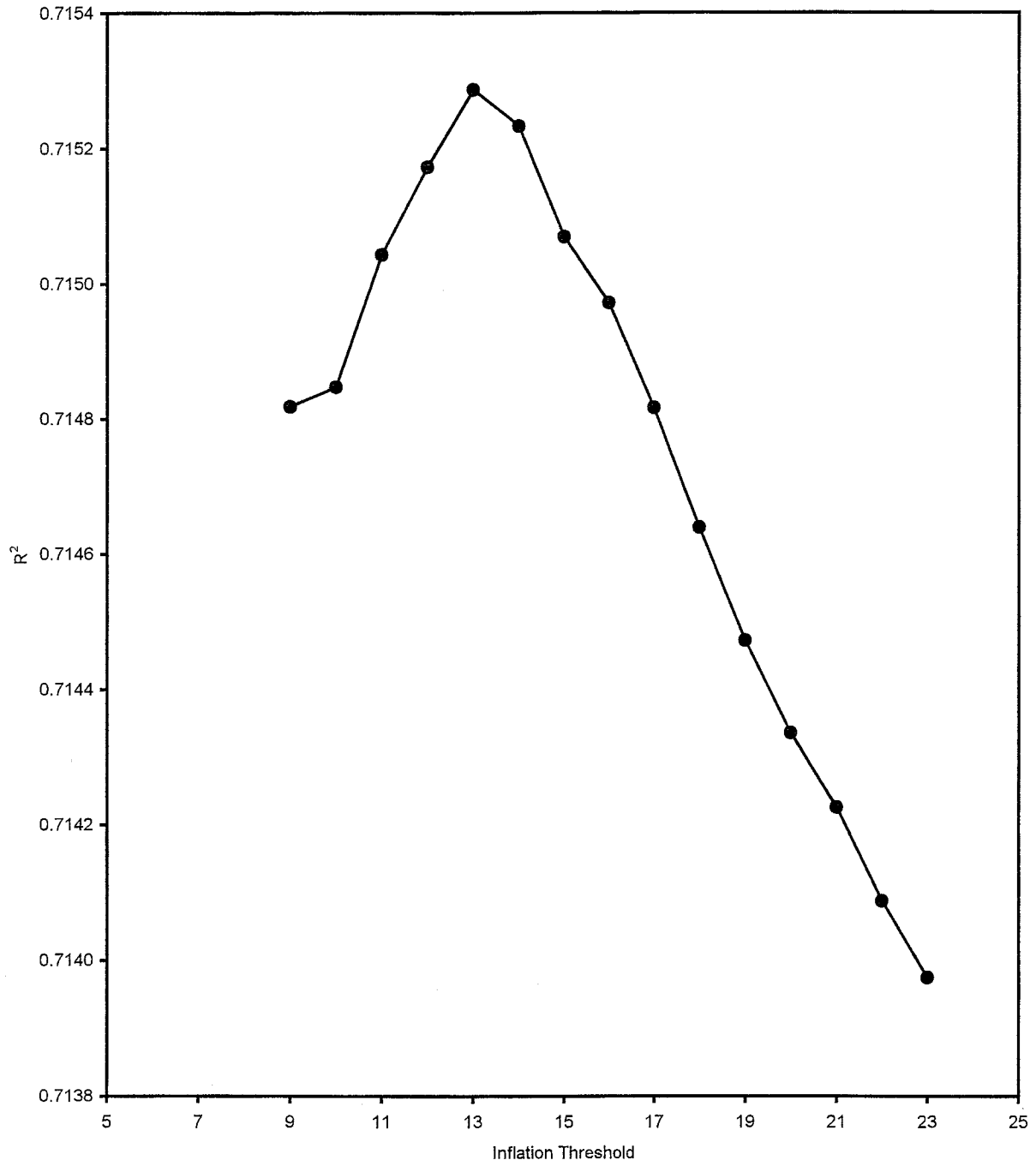
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<sup>26</sup> If the primary balance of general government is included in this regression, the parameter estimate is small and positive, but statistically significant. However, it was excluded on the grounds that it is misspecified and is therefore difficult to interpret economically.

Table 2. Regression Results

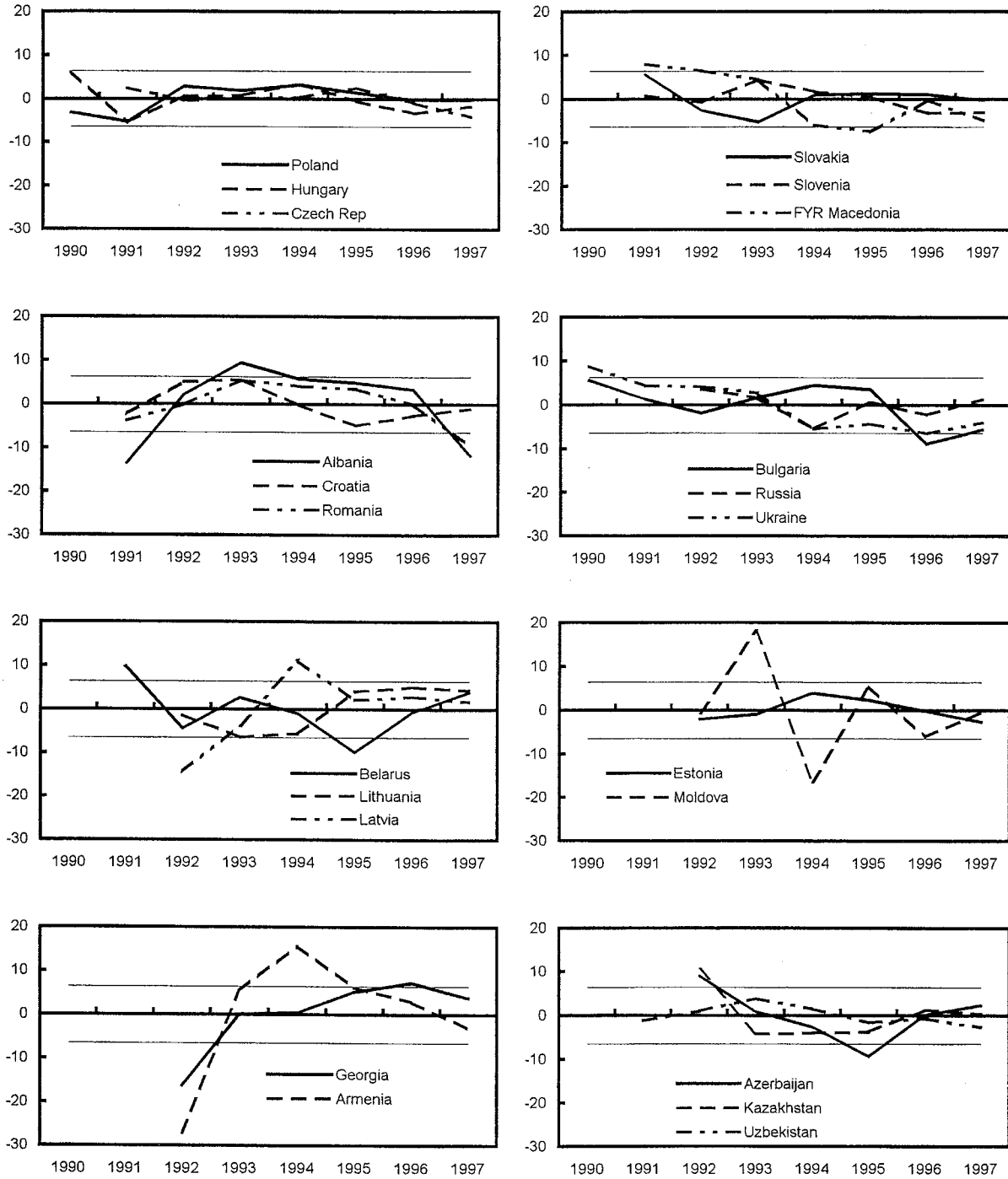
Regression	1.	2.	3.	4.	5.	6.	7.	8.
The dependent variable is the percentage growth rate of GDP per capita. The p values use White heteroskedasticity consistent standard errors and covariance.								
Independent Variables								
l infl	-0.93	-0.31	1.25	1.74	1.24	1.26	0.84	0.87
p value	(0.077)	(0.537)	(0.100)	(0.020)	(0.105)	(0.090)	(0.240)	(0.237)
l infl - l thr			-2.00	-2.28	-2.04	-2.06	-1.56	-1.64
p-val			(0.017)	(0.006)	(0.016)	(0.013)	(0.076)	(0.047)
ExMkGr		2.50	2.44	2.38	2.41	2.45	2.47	2.44
p-val		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Transition	2.98	2.31	2.09	2.03	2.11	2.09	1.98	2.01
p-val	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Ch transition	-2.17	-1.47	-1.42	-1.42	-1.39	-1.19	-1.41	-1.38
p-val	(0.000)	(0.007)	(0.008)	(0.009)	(0.014)	(0.060)	(0.013)	(0.008)
War	-14.1	-13.7	-14.3	-14.0	-14.4	-14.8	-14.9	-14.9
p-val	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Disinfl (>20 percent)				1.21				
p-val				(0.306)				
Disinfl (>50 percent)					-0.45			
p-stat					(0.729)			
Disinfl (Fischer)						-1.76		
p-stat						(0.303)		
Disinfl (> 50 percent, peg)							-3.63	-3.70
p-val							(0.040)	(0.037)
Disinfl (> 50 percent, other)							0.48	
p-val							(0.766)	
Infl threshold			13.0	5.0	13.0	14.0	13.0	13.0
No. of inflation observations below the threshold			36	10	36	40	36	36
Adj R-squared	0.612	0.647	0.652	0.651	0.649	0.652	0.652	0.654
Std. Error	6.746	6.435	6.395	6.403	6.419	6.392	6.390	6.366

Figure 3. Grid Search Across Inflation Thresholds - Regression 3  
(without peg)



Source: Staff estimates.

Figure 4. Residuals from Regression 3 1/



Source: Staff estimates.

1/ The bands report the standard error of the regression.

- The range of individual country error terms is large. For example, Georgia and Armenia have large negative errors in years of conflict, as do Albania, Bulgaria, and Romania in 1996–97 during the financial crises in those years.

Hence, regression 3 encompasses the earlier findings in regard to the effect of inflation on output. It also suggests lower output costs from the change in the transition index and a weaker relationship between the level of the transition index and growth than is implied by the approach adopted by earlier researchers. Hence, the short run output costs and long-run benefits of structural reform, while substantial, appear to be lower than earlier reported.

### **Results (2): The impact of disinflation on output**

The various disinflation dummies were added in turn to regression 3.

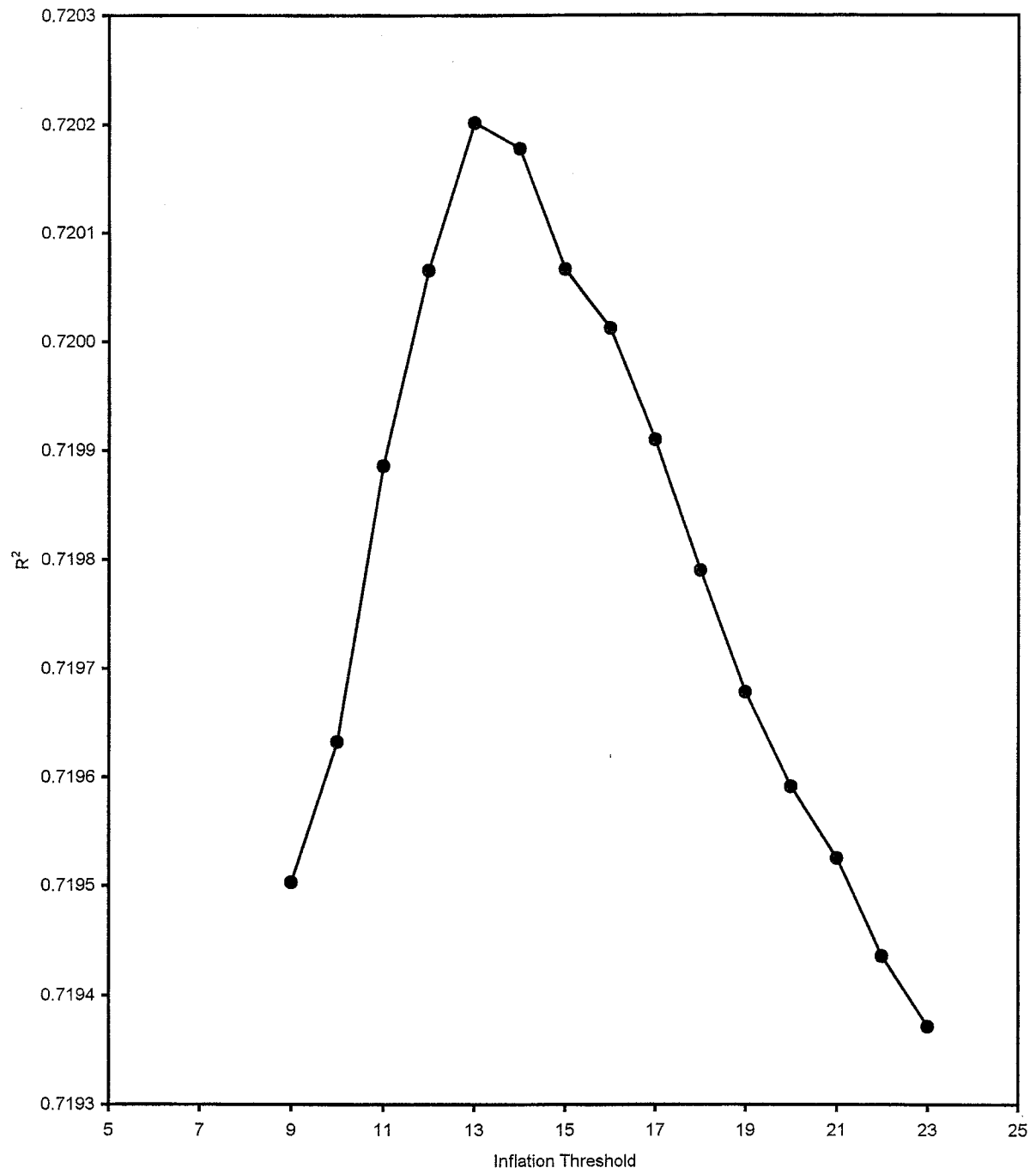
First, the disinflation dummy for a decline of more than a fifth in the 12-month rate of inflation, along with its one-year lag, were added to regression 3. The latter was insignificant and was dropped. The regression was then re-run, and is reported as regression 4. This suggests no evidence of output loss arising from disinflation, either in the year that disinflation occurs or the following year. When the dummy was split into episodes with fixed exchange rates and other regimes, and the regressions re-run, both dummies had highly insignificant coefficients.

This exercise was repeated for a disinflations where inflation more than halved in one year. The results are reported as regression 5 in Table 2. Again, the estimate is insignificant, though eliminating the slower disinflations (of between 20 and 50 percent) has changed the sign on the parameter to negative. The results using the Fischer et al. disinflation dummy are reported as equation 6 in Table 2. Again, there is no significant evidence of output loss associated with these disinflations.

However, when we split the dummy for disinflations of more than half into pegged and other exchange rate regimes, significant and large output losses were found in the presence of exchange rate pegs. This result is reported in Table 2 as regression 7. This regression was re-run eliminating the “non-peg” dummy. The results are reported as regression 8 in Table 2. The grid search results and individual errors for regression 8 are reported in Figures 5 and 6 respectively.

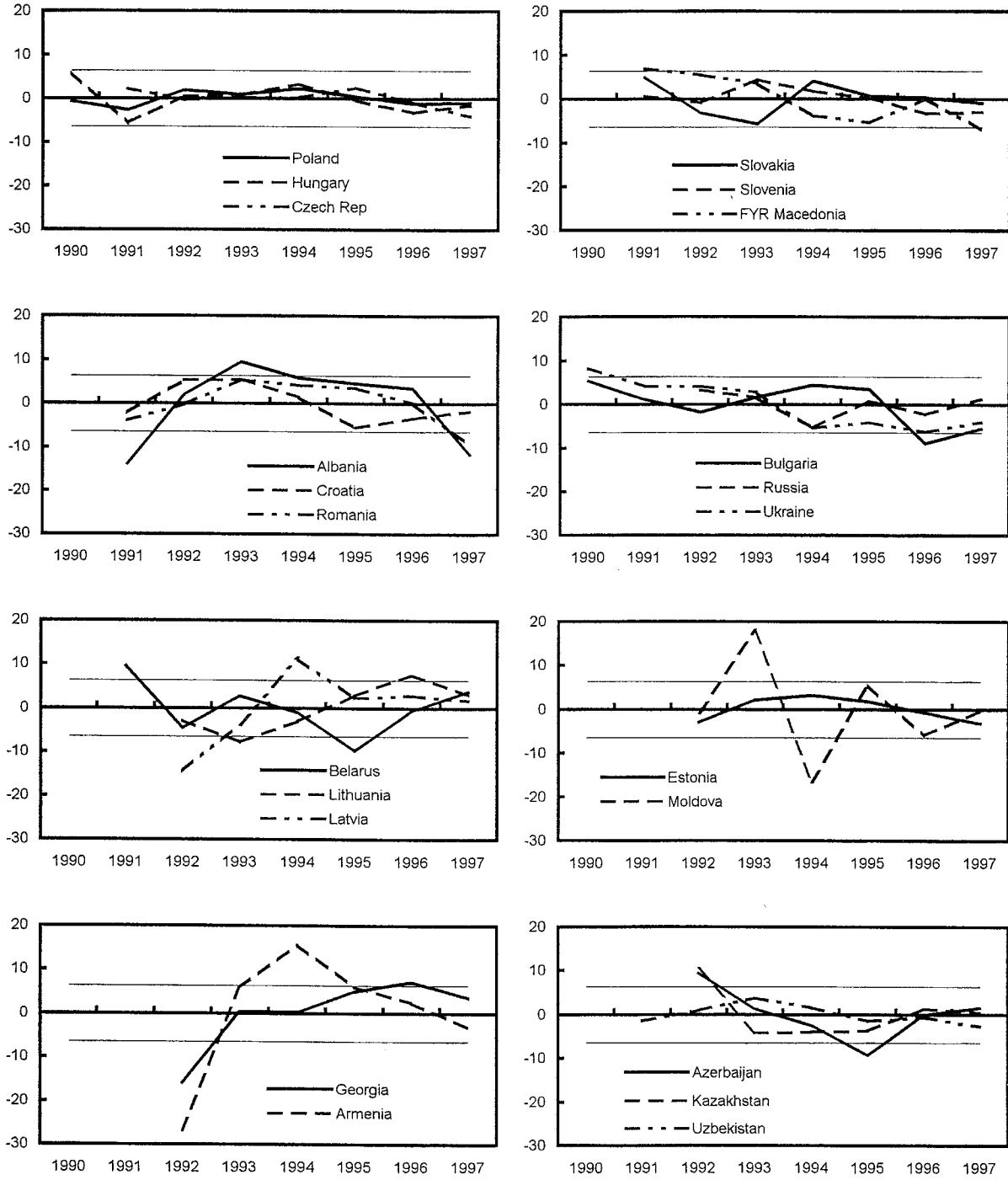
As a final exercise, the dummies for disinflations of more than a half were decomposed by the inflation rate being stabilized. Thus, the disinflation dummies were decomposed by prior year inflation: the first dummy included all disinflations of prior year inflation of more than 10 percent, the second included all disinflations of prior year inflation of more than 25 percent, and dummies for prior year inflation of more than 50 percent, more than 100 percent, and more than 500 percent were also formed. Regression 8 was re-run with each of these dummies included one at a time, with each dummy decomposed into pegged and other exchange rate regimes. In all cases, the non-pegged dummy was insignificant and was eliminated. The results from all the

Figure 5. Grid Search Across Inflation Thresholds - Regression 8  
(with peg)



Source: Staff Estimates.

Figure 6. Residuals from Regression 8 1/  
(with peg)



Source: Staff estimates.

1/ The bands report the standard error of the regression.

regressions indicated that as the prior year inflation cutoff increases, the negative output effects associated with pegged exchange rates decline sharply, becoming insignificant for stabilizations of inflation above 500 percent. This implies that the output losses during disinflations with pegged exchange rates tended to occur most with disinflations of more moderate inflation.

On this evidence, rapid stabilization in the presence of pegs has been associated with a large loss of output that are not accounted for by other regressors, except where very high inflation was stabilized. Equally rapid stabilization of similar inflation rates under other monetary regimes has not been associated with a similar loss of output.

### **Results (3): Robustness tests**

Two sets of robustness tests were run to assess the possible effect of outliers. First, the panel was redefined excluding all observations with inflation of 150 percent or more, and these observations were added back to the panel one at a time; and second, individual countries were dropped from the panel one at a time and the regressions were rerun.

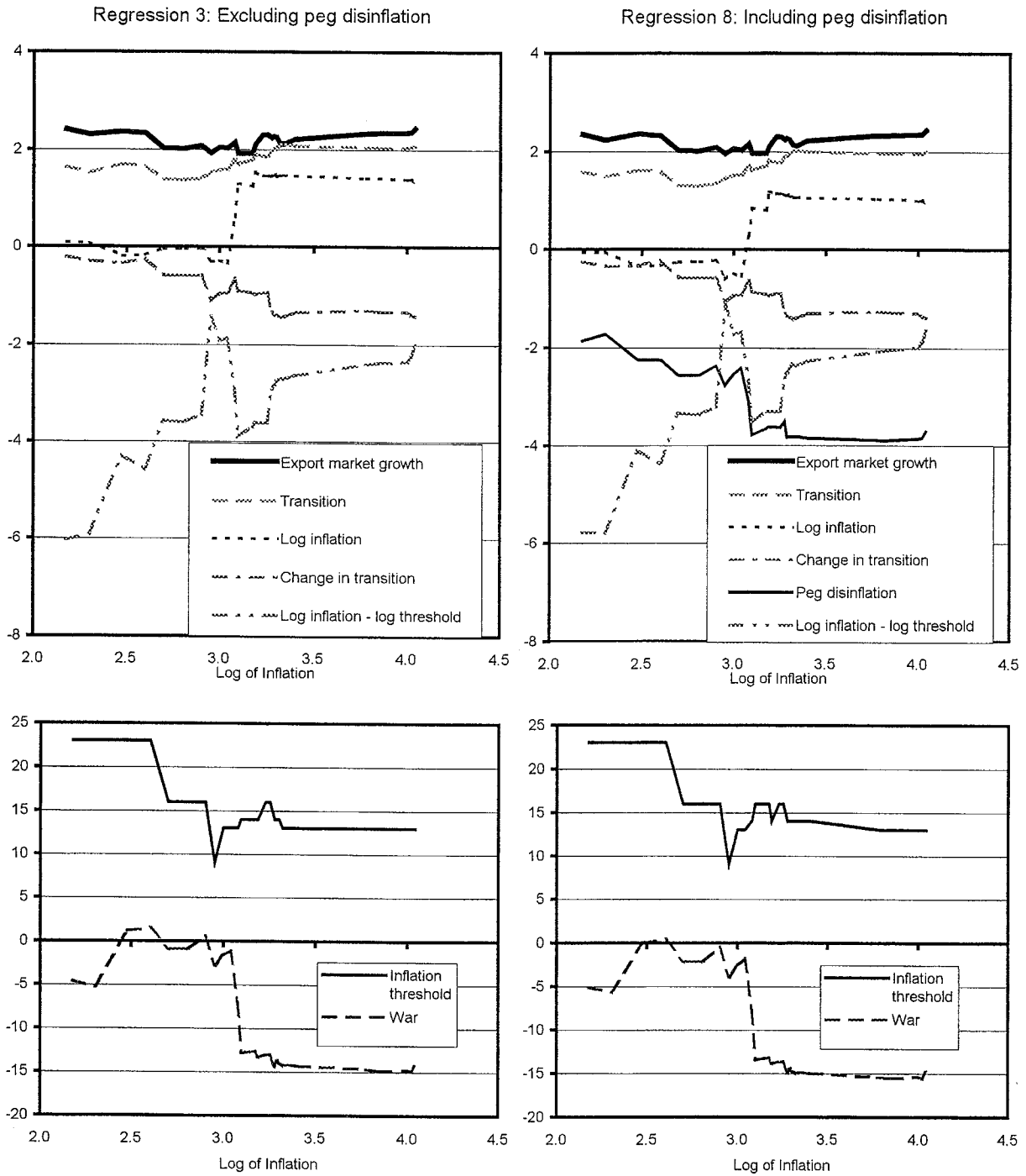
The results of the first test are reported in Figure 7. Three aspects of these results are notable. First, the peg disinflation dummy and the estimated value of the inflation threshold are fairly stable throughout. The key exception is the change in transition, which becomes significantly more negative after observations for inflation up to 1900 percent are included. Second, the parameter estimate on war is the most sensitive to this exercise. This is not simply because military conflict is associated with the highest inflation rates: by the time that inflation of under 1200 percent is included in the panel (roughly one-third of the way through this robustness exercise), half of the war dummy observations are already included. So the instability in the parameter estimate on the war dummy at that point suggests that this dummy is a poor proxy for the impact of war on output. Third, when the war dummy is volatile, so is the parameter estimate for log inflation less log threshold, up to inflation of 1200 percent. Thereafter, the parameter on the latter rises progressively, from around -3.6 to around -2 for the full sample, and the inflation threshold falls slightly over this range. This pattern, alongside that for the log inflation term, suggests that the low estimate of the output costs of inflation for the sample as a whole is strongly affected by the very highest inflation observations. Nevertheless, even for the full data set, the two parameters are jointly significantly different from zero.

The results of the extraction of one country at a time from the panel are reported in Figure 8. Overall, the results are little changed from the full panel, and the estimate of the inflation threshold is particularly stable. This indicates little evidence of major country outliers within the full panel, notwithstanding the range of errors for individual countries for some years.

Two aspects of these results are worth noting. First, the parameter estimate on war appears to be the most volatile. It falls particularly sharply when Georgia and Armenia are excluded, suggesting that the conflicts in these countries had particularly severe effects on output, which are inadequately reflected in the dummy specification, and anecdotal evidence strongly supports

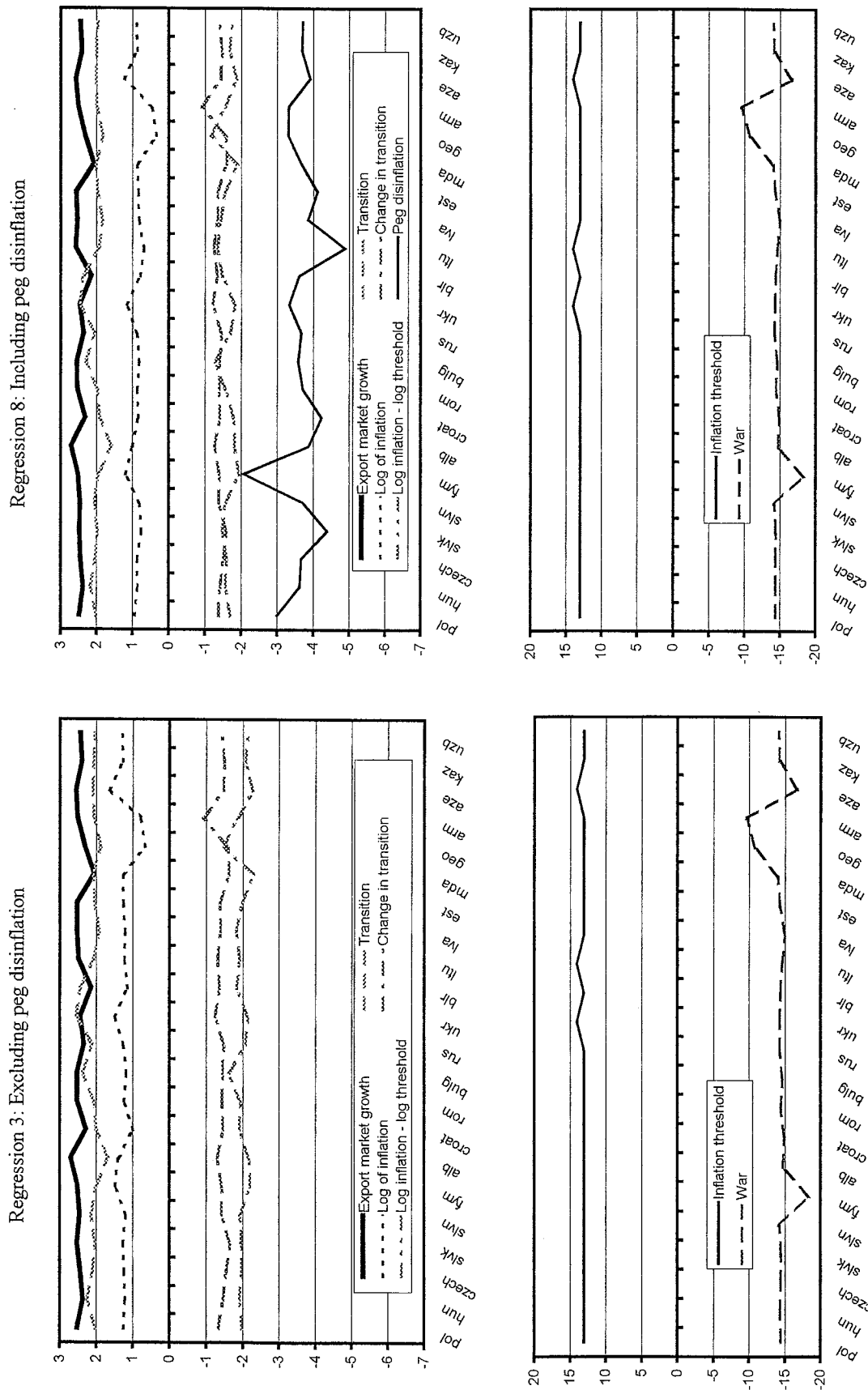


Figure 7. Robustness: Parameter Values as High Inflation Observations are Included



Source: Staff estimates.

Figure 8. Robustness: Parameter Values Excluding Individual Countries



Source: Staff estimates.

this interpretation. However, this weakness in the dummy specification appears to be having little impact on other parameter estimates, except for the change in transition variable: when Armenia is excluded from the full panel, this increases from -1.3 for the full sample to -0.9. The war dummy rises most sharply when FYR Macedonia and Azerbaijan are excluded, indicating that the conflicts in these countries had relatively lesser impacts on output. Second, the parameter estimates on disinflation with pegged exchange rate regimes is robust. However, the exclusion of Poland, the flagship stabilization with a pegged exchange rate, increases the dummy estimate from -3.70 to -2.99. This suggests that the Polish stabilization in 1990–91 was particularly costly in terms of output, even compared to other stabilizations with pegs.

## V. DISCUSSION AND ASSESSMENT

### Export market growth

The association of export market growth weighted by the share of exports in GDP with output is marked and robust. Given the dominant role of Russia as an export market for many of the BRO countries, these findings reflect the importance of developments there for many countries in transition. Earlier studies failed to reflect this feature of transition, and as a result, misspecified the relationship between inflation and output. This omission also causes the short-run output costs of structural reform and its long run benefits to be overstated.<sup>27</sup>

The robustness of the results gives some grounds for confidence that the estimates do not simply reflect the particular construction of the export market growth estimates used here, nor simply the role of common factors, such as the collapse of the CMEA trading arrangements for which the export market growth series may be acting as a proxy. It should be noted, nevertheless, that using GDP rather than import volume growth to measure of export market growth may be distorted if the elasticity between the two shifts in the export markets, and the use of the export share to GDP to scale the export market variable, while intuitive, is imposed.

In addition, data on the direction of trade for the earliest year feasible was used to construct the export market growth series. This has two potential problems. Countries for which data were available early in the period may have underreported their exports to the transition area at that time. And countries where data is only available far into the period may have substantially shifted the direction of their exports by then. These factors may distort the role of export market growth. Furthermore, lack of data prevented control for changes in import or export prices. These were subject to major shocks that were associated with export market growth and inflation for many countries early in the panel, and the omission may be biasing the parameter estimates for both.

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<sup>27</sup> Export market growth has also been ignored in panel data studies of growth in nontransition contexts. It is unclear if that omission is as important as in the transition context.

## **Structural reform**

Notwithstanding the importance of external developments, there is evidence of a strong positive association between progress in transition and output growth, though structural reform is associated with immediate output losses.

These findings reflect, however, the weighting of the structural reform index used by its originators, they rely on the consistency of the at least partly subjective judgements that have been required to formulate the sub-indices, and they overlook the possibly distinctive roles of the various components of the overall index. Ideally, the parameters (weights) for the overall index would be estimated as part of the growth regression, though the high covariance between the subcomponents renders that problematic. In addition, the indices do not capture possibly key qualitative aspects of structural reform, including its perceived permanence and complementarity between different reforms.<sup>28</sup>

The fixed-weight approach used to derive export market growth may also affect this parameter estimate. When switching in the direction of exports is associated with structural reform, then the fixed-weight approach makes sense because these growth enhancing benefits are reflected in the structural reform parameter estimate.<sup>29</sup> But if, after the direction of trade has switched, the new export markets strengthen relative to the old, this will also be reflected in the estimate for the transition index to the extent that this change is under-reflected in the export market growth index being used. To this extent, fixed weights used to construct the export market growth series may exaggerate the role of structural reform.

## **Inflation**

Evidence is found of loss of output at inflation rates above the threshold that is estimated in the low teens for the full sample, but at somewhat higher rates when the inflation outliers are excluded. Two features of the results give grounds for confidence in the estimate of the threshold. First, as reported in table 2, one quarter of the inflation observations occur below the estimated threshold. Accordingly, the estimate is not simply the artefact of a small number of low inflation observations. Second, there is a clear single peak to the R-squares across the grid search, indicating that the threshold is well identified.<sup>30</sup> Nevertheless, the procedure does not

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<sup>28</sup> The relatively high scores for Albania, Bulgaria, and Romania in 1996–97 suggest that these concerns are not merely academic.

<sup>29</sup> See Havrylyshyn and Al-Atrash (1998).

<sup>30</sup> The fact that the differences in the R-squares associated with different thresholds is small does not imply that the “true” threshold lies within a wide band around the central estimate. Large movements in R-squared are only typical when regressors are added to or extracted

(continued...)

define the confidence intervals around the identified threshold, and this counsels against overemphasis on the particular number identified as the threshold.

For the full panel, the output losses associated with inflation above the threshold are lower than has been found in other studies of transition as well as for market economies. For the latter, Sarel finds that doubling inflation, above the threshold, reduces GDP growth by 1.7 percentage points and Phillips and Ghosh find it reduces growth by 0.5 percentage points. In contrast, these results for the full panel imply that doubling inflation above the threshold is associated with reduced growth of 0.2 percentage points. While inflation outliers and measurement problems with stockbuilding may be downwardly biasing this estimate, it is not economically negligible. Recall that Russia halved inflation 7 times, and Armenia by 9 times between the peak and end-1997 inflation rates. Disinflation on this scale is associated with a boost to annual GDP growth rates of 1.4 and 1.8 percentage points respectively, according to this estimate.

These findings—on the output costs of inflation above the inflation–output threshold and on the level of the threshold and—should be interpreted with considerable care, however. First, correlation is not causation. While there are output costs of inflation, output can also affect inflation through the output gap and political economy factors. Second, even if the correlation does reflect causation from inflation to output, these estimates could understate the output costs of inflation now. These estimates reflect the average behavior of transition economies since 1990, and the output costs of inflation may have been rising over time. Planning mechanisms, still in place early in the panel, made poor use of information on relative prices. This suggests that when inflation obscured this information, the associated output losses were relatively low. Any losses that there were may also have been offset if inflation eased growth–boosting relative price changes in the presence of downward nominal rigidities. But with planning mechanisms now absent and the largest of the one–off relative price changes completed, the output cost of inflation may be higher than it was on average in the period covered by the panel. For these reasons, as transition takes root, these economies could be expected to behave more like other market economies, including exhibiting greater output costs from inflation and having lower thresholds above which output costs of inflation begin to appear.

Furthermore, all the threshold means is that the available data, with all its problems, only allows the identification of output costs of inflation above that level for the panel as a whole. Therefore, there is no implication that transition countries should settle for inflation in that range. But if transition economies still have inflation above that range, there is some evidence that disinflation will promote growth. And since no evidence is found of output gains from raising inflation to that

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<sup>30</sup>(...continued)

from regressions, but this is not occurring here. Instead, the grid search adjusts the definition of one of the regressors, the second term in inflation, by adjusting the threshold in that term by 1 percentage point at a time. This is a tiny change each time it occurs and would not be expected to change the R-squared substantially, even if the kink was very marked.

range, there is no implication that transition countries already well below those levels should inflate.

### **Disinflation**

No systematic evidence that disinflation was associated with declines in output was found. The low inertia of inflation and the determination of the country authorities to stabilize extremely high inflation contributed to making the stabilizations highly credible, when undertaken. Even disinflations of moderate inflation do not generally appear to have incurred output costs, possibly because labor productivity and real wages are often rising rapidly, providing an ideal context for further stabilization.<sup>31</sup> There is no general evidence here to suggest that the output costs of further disinflation now would outweigh the case for further reductions in inflation.

The only evidence found of output costs from disinflation arose when moderate inflation was more than halved in the presence of pegged exchange rates. While measurement problems with stockbuilding may exaggerate these output costs, the fact that no output costs are evident from equally sharp disinflations of similar inflation rates under non-pegged regimes indicates that disinflations with pegs has been associated with real output losses.

Interpreting this result is not straightforward. Output losses would occur during disinflation from moderate inflation with over-depreciated pegs. In such circumstances, stabilization would normally be expected to fail (and hence would not be picked up by the disinflation dummies) because the domestic price level would rise to eliminate the undervaluation. Only if policy directly counteracted this response, by inducing a recession, would pegs be associated both with disinflation and with output losses. This combination of outcomes seems less likely for stabilizations of high inflation with pegged exchange rates. In these cases, inflation could still fall sharply (by more than one-half), while remaining sufficiently above partner country levels to correct the undervaluation in the peg, without the need for a fall in output to render disinflation consistent with this. The latter proposition may underlie the findings that output losses with pegged exchange rates declined as the rate of inflation being stabilized increased.

On this interpretation, output losses are not due to pegs per se, but reflect the rate of inflation being stabilized, the rate at which pegs are set, and the supporting policies. Perhaps significant output losses are found because a number of stabilizations with formally pegged exchange rates were undervalued. However, it proved impossible to test this interpretation of the results directly for lack of a tractable data set on the extent of undervaluation of exchange rates. Note that this difficulty would apply even if a less strict definition of a pegged exchange rate regime was used.

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<sup>31</sup> Deppler (1998).

Even if less severe output losses were found to be associated with pegs when these included de facto pegs, this could simply reflect that de facto pegs happened to be less undervalued than formal pegs.<sup>32</sup>

Note that this finding contradicts earlier predictions to the effect that output losses would be more severe in stabilizations with floating exchange rates (Sachs 1996). The results reported here imply that in practice, monetary authorities operating with floating exchange rates successfully accommodated the increased real demand for money. Instead, the risks to output of stabilizing with undervalued pegs may have been more severe than Sachs and other advocates of formal pegs anticipated. In this regard, it is notable also that when Poland is excluded from the panel in the second of the robustness tests, the Polish pegged disinflation emerges as particularly costly in terms of output. This may be because the Polish peg was particularly undervalued, but it could also reflect backward-looking wage indexation.

## **War**

There is evidence that the simple dummy for war is insufficient. Restricting conflicts to have the same impact on output is a very strong assumption, and it is not even always clear when conflicts are affecting activity. For example, Bulgaria suffered heavily from the blockade of the Former Yugoslavia during that country's conflict, without itself being drawn into the conflict.<sup>33</sup> On the other hand, Albania may have accrued substantial rents by violating that blockade. The individual country error terms and the robustness tests suggest that the data reject the assumptions underlying the war dummy, even though they find that overall, war is highly costly. While the war dummy may be less innocent than it appears, the robustness tests suggest that its problems do not appear to be distorting the estimates of other parameters greatly.

## **Methodological issues**

Omitted variables, including import and export prices, may explain why the error terms often fall far outside the equation standard error.<sup>34</sup> For lack of a proxy, no account is taken of the erosion of planning mechanisms—as opposed to positive steps of structural reform which are reflected in the transition index—to explain output trends early in the panel. For lack of a suitable specification, no direct measure of fiscal policy is included, only what is implicit in the rate of

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<sup>32</sup> In the clearest case of a possible de facto peg, Georgia after 1994, it is notable that the nominal bilateral exchange rate against the US dollar appreciated significantly prior to stabilizing in 1995 and thereafter. This episode, like that in Croatia in 1993, may have eliminated the undervaluation and the associated output losses that might otherwise have been associated with the apparently de facto pegged disinflation in Georgia in 1995.

<sup>33</sup> We are indebted to Luc Everaert for pointing this case out to us.

<sup>34</sup> However, these country errors may be useful to construct measures of output gaps.

inflation itself. But the “non-inflationary” component of fiscal policy may also be important for growth. And no account is taken of “exogenous” political or financial crises. These may account for the large error terms in the regression for Romania, Albania, Bulgaria, and Romania in 1996–97. Each of these omitted variables may be correlated with included regressors.

No use has been made of instruments to address possible simultaneity problems. While these problems are probably most severe for fiscal variables, (which are excluded from the regressions reported here) they may also be present in links from output to inflation as noted above, and in structural reform, if its timing and depth reacts to output growth. Nevertheless, it was not clear that distortions from possible simultaneity would exceed distortions from an instrument that, however carefully chosen, would be somewhat arbitrary. Accordingly, no instruments were used.

## VI. CONCLUSIONS

This paper attempts to address some issues in the existing literature on panel data studies of growth in transition, and to highlight remaining areas of concern.

Export market growth is found to be strongly associated with output in transition. This underscores, once again, the importance of Russia to growth in many transition economies. But equally, the results underscore that structural reform and disinflation, both within the competence even of countries highly exposed to Russia, can stimulate growth. Studies which omit export market growth exaggerate the output costs of inflation, and the short-run output costs of structural reform and its long run benefits.

No evidence is found that countries that are now close to the estimated inflation–output threshold should simply aim to stay there, without proceeding further towards industrial country inflation rates. While there is no evidence of significant output gains from reducing inflation below the threshold, the estimate of that threshold reflects the average structural features of transition economies since 1990 as opposed to their structural features now. The latter, in many cases, more closely resemble those of market economies, and the evidence for those is that the threshold is considerably lower than is apparent from the full panel of transition economies. For countries now well below the estimated inflation–output threshold, no evidence is found that output will be boosted by raising inflation. Such countries should aim to lock in their low rates of inflation.

There is no evidence that disinflation necessarily incurs significant output costs, even at moderate inflation rates. Difficulties only appear to arise when moderate inflation is stabilized in the presence of exchange rate pegs. Even in this context, however, the losses seem likely to be due to undervalued pegs, rather than pegs per se. If so, those countries that have moderated high inflation with pegs may now have difficulty reducing inflation to industrial country levels. With transition countries generally expected to exhibit trend real appreciations, due to Samuelson–Balassa effects and to correct earlier undervaluation, options to render this consistent with low inflation include adopting or widening exchange rate bands, and moving to pure floating exchange arrangements.



**Exchange Rate Dummy**

	1990	1991	1992	1993	1994	1995	1996	1997
ALB	0	0	0	0	0	0	0	0
BULG	0	0	0	0	0	0	0	1
CROAT	0	0	0	0	1	1	1	1
CZECH	0	0	0	1	1	1	0	0
FYM	0	0	0	0	1	1	1	1
HUN	0	0	0	0	0	0	0	0
POL	1	1	0	0	0	0	0	0
ROM	0	0	0	0	0	0	0	0
SLVK	0	0	0	1	1	1	0	0
SLVN	0	0	0	0	0	0	0	0
ARM	0	0	0	0	0	0	0	0
AZE	0	0	0	0	0	0	0	0
BLR	0	0	0	0	0	0	0	0
EST	0	0	1	1	1	1	1	1
GEO	0	0	0	0	0	0	0	0
KAZ	0	0	0	0	0	0	0	0
KGZ	0	0	0	0	0	0	0	0
LTU	0	0	0	0	1	1	1	1
LVA	0	0	0	0	1	1	1	1
MDA	0	0	0	0	0	0	0	0
RUS	1	0	0	0	0	0	0	0
UKR	0	0	0	0	0	0	0	0

Note: The variable takes a value 1 when the exchange rate regime is defined as a peg. This includes formal pegs and narrow band pegs.

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