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DISCUSSION PAPER NO. 20

MACROECONOMIC CRISES AND POVERTY MONITORING: A CASE STUDY FOR INDIA

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ABSTRACT

Assessment of the welfare impacts of low-frequency events, such as macroeconomic crises and stabilizations, are often confounded by sampling and nonsampling errors that generate fluctuations in household survey-based welfare indicators; they are also limited by our ability to explain fluctuations in terms of other available data. Basing policy on short-term movements in welfare indicators can thus be hazardous. There was a sharp increase in India's poverty measures in the aftermath of the mid-1991 crisis and the ensuing stabilization reforms. However, only one-tenth of the increase in measured poverty is explicable in terms of the variables one would expect to transmit the shock. Poverty measures soon returned to their pre-reform levels, belying the notion of a reforms-induced structural break.

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1. INTRODUCTION

The period since about 1980 has seen macroeconomic crises and subsequent stabilization efforts in most low- and middle-income countries—countries with a high incidence of absolute poverty. The impacts of these macroeconomic events on poor people have been much debated. Some have said that poverty rose sharply, and have blamed the stabilization programs; some defenders of the programs have denied that the poorest strata—typically found in the rural sector—would be much affected; other defenders of the programs have agreed that poverty rose, but deemed the impact to be short-lived and inevitable, claiming that the poor would suffer even more without the programs. It would be fair to say that most less-developed countries and certainly all regions have had such debates, and they have often been heated.

Objective monitoring of poverty impacts would hopefully be able to resolve the issue. However, poverty monitoring has proved to be difficult. Poverty data are scarce or often unreliable. Comparability of measures over time is often a serious problem. Both sampling and nonsampling errors can entail that measures of poverty fluctuate over time in ways that do not have much to do with reality. Even though fluctuations due to these factors are (presumably) independent of macroeconomic fluctuations, coincidences of the two in time will almost certainly happen. That fact

throws doubt on efforts to interpret new information from a single extra survey after the crisis. Yet a single post-crisis survey is typically all that available.

This paper is a case study in assessing the poverty impacts of macroeconomic crises and stabilization in a low-income country where the poor are heavily concentrated in rural areas. In response to severe external and domestic macroeconomic imbalances, the Government of India launched a macroeconomic stabilization program in mid-1991. Seemingly reliable survey data indicate that there was a sharp increase in measured poverty in 1992. Some observers have blamed this on the stabilization and subsequent reform program (see, for example, Gupta 1995). Others have argued that these had a relatively minor role, and have pointed, instead, to the fact that 1992 was a relatively bad agricultural year (Tendulkar and Jain 1995). In this paper, we hope to throw light on why measured poverty rose so much in the aftermath of India's crisis and stabilization response. We ask whether the observed fluctuations in measured poverty are explicable in terms of the economic variables that one would expect to be involved in linking such a macroeconomic crisis to living standards at the household level. We present evidence on how poverty measures responded to changes in key economic variables in the period leading up to the stabilization. The results are used to assess what role those same variables played in the increase in poverty measures in 1992.

The following section provides a descriptive background to the econometric modeling in Section 3, where we give our estimates of the effects of a range of variables on both average consumption and various poverty measures for India. Section 4 looks at the implications for understanding the measured changes in living standards immediately after the reforms began. Section 5 discusses various extensions to the model. Our results on the maximum contribution to poverty of reform-induced changes in economic variables are presented in Section 6. Section 7 offers some conclusions.

2. BACKGROUND

The year following stabilization saw a disturbing rise in India's rural poverty measures. Our estimates indicate that the all-India rural head-count index (*H*), poverty gap index (*PG*), and squared poverty gap index (*SPG*) for 1992 (based on the 48th round of the National Sample Survey [NSS]) increased by 19, 26, and 30 percent, respectively, when compared to 1990-91 (the 46th round of the NSS) (Table

1).[1] For the urban sector, however, we find virtually no change in poverty. But given the high rural share in total population (74 percent in 1992), the increase in rural poverty measures is strongly reflected in the change in national poverty measures. Compared to 1990-91, the national *H*, *PG*, and *SPG* in 1992 were higher by 15, 20, and 23 percent, respectively. The same is also generally true of the changes in rural poverty for individual states. In 12 of the 14 major states, real mean consumption declined and rural poverty rates increased (Table 2). The magnitude of change however does show considerable diversity across states.[2]

The sample sizes for rounds 44 to 48 of the NSS were appreciably lower than the main quinquennial surveys. For example, the quinquennial survey done for 1987-88 (round 43) had an all-India sample size of 128,019 (82,661 in rural areas),

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[1] The estimates are discussed further below, and in greater detail in Datt (1995) and Ravallion and Datt (1996a). Also see Ozler, Datt, and Ravallion (1996) for further discussion of data sources. The head-count index is given by the percentage of the population who live in households with a consumption per capita less than the poverty line. The poverty gap index is the mean distance below the poverty line expressed as a proportion of that line—giving the "proportionate poverty gap"—where the mean is formed over the entire population, counting the nonpoor as having zero poverty gap. The *SPG* is defined as the mean squared proportionate poverty gap. Unlike *PG*, *SPG* is sensitive to distribution among the poor (Foster, Greer, and Thorbecke 1984).

[2] Notice that the "all-India" aggregates are a good deal lower than the population-weighted means of the estimates for individual states given in Table 2. The all-India numbers include some smaller states. But that is not the main reason (since the 14 states account for 97 percent of the population in 1991). Rather, the all-India distribution of nominal consumption leads to a sizable underestimation of the overall poverty measures due to the way in which the state-level cost-of-living indices vary with the level of poverty. Such differences have been observed before; Minhas, Jain, and Tendulkar (1991) reported the direct all-India and the weighted-average rural head-count indices for 1987-88 to be 44.9 percent and 48.7 percent, respectively.

Table 1 All-India poverty measures and other variables for 1989-90 to 1992

Variable	Units (Population-Weighted Average Over 14 States)	National Sample Survey Round 45 1989-90	Round 46 1990/91	Round 48 1992
Rural real mean consumption	Rs/person/month at 1973-74 all-India rural prices	64.41	62.49	60.32
Rural head-count index	Percent	39.35	40.95	48.24
Rural poverty gap index	Percent	9.53	9.99	12.78
Rural squared poverty gap index	Percent	3.26	3.49	4.71
Real agricultural output per hectare of net sown area	Rs/hectare/year at 1973-74 all-India rural prices	3,037.89	3,150.56	3,142.42
Real nonagricultural output per person	Rs/person/year at 1973-74 all-India rural prices	885.93	920.76	853.92
Real per capita state development expenditure	Rs/person/year at 1973-74 all-India rural prices	154.74	172.53	161.15
Rural inflation rate	Percent per year	7.74	11.20	17.24
Real male agricultural wage	Rs/day at 1973-74 all-India rural prices	6.43	6.49	6.27

Note: Population weighted averages.

Table 2 Change in mean consumption and poverty measures for rural areas between 1990-91 and 1992

State	Mean Consumption		Head-Count Index		Poverty Gap Index		Squared Poverty Gap Index		Gini Index	
	46th Round 1990-91	48th Round 1992	46th Round 1990-91	48th Round 1992	46th Round 1990-91	48th Round 1992	46th Round 1990-91	48th Round 1992	46th Round 1990-91	48th Round 1992
	(Rs/person/month)		(percent)		(percent)		(percent)		(percent)	
Andhra Pradesh	69.07	61.97	36.90	41.85	7.843	9.422	2.351	3.148	29.46	26.78
Assam	56.28	49.05	42.40	56.61	8.850	13.914	2.748	4.770	20.27	19.66
Bihar	51.13	47.22	58.29	67.81	12.292	19.663	3.875	7.665	18.90	25.73
Gujarat	57.51	56.85	43.13	46.78	8.006	13.528	2.148	5.745	20.40	27.81
Karnataka	58.63	51.93	42.73	56.94	13.304	15.759	5.587	6.023	26.29	26.12
Kerala	68.81	77.70	33.80	34.15	8.246	8.635	2.789	3.099	27.24	34.70
Madhya Pradesh	59.52	61.70	47.93	56.09	12.834	13.945	4.662	4.766	29.07	34.55
Maharashtra	63.56	52.05	43.05	60.63	11.951	18.071	4.498	7.073	30.18	29.23
Orissa	69.70	68.23	27.14	36.57	5.376	8.195	1.532	2.530	24.92	29.37
Punjab-Haryana	81.99	88.41	18.61	18.14	3.456	3.474	0.961	0.988	28.46	30.75
Rajasthan	64.53	57.46	38.96	50.90	12.097	13.761	5.045	5.249	28.54	28.93
Tamil Nadu	61.16	60.52	42.02	46.65	11.573	12.888	4.377	4.910	27.29	29.65
Uttar Pradesh	62.40	61.80	36.88	46.67	9.079	12.694	3.255	4.681	25.61	30.53
West Bengal	65.40	68.54	39.11	28.15	9.520	5.311	3.083	1.417	27.62	24.21
Population-weighted average for 14 states	62.49	60.32	40.95	48.24	9.991	12.783	3.488	4.710		
All-India	66.73	63.80	36.43	43.47	8.644	10.881	2.926	3.810		

Note: Mean consumption is at 1973-74 all-India rural prices.

while the sample for 1992 covered 13,132 households, of which 8,324 were in rural areas. The 1990-91 sample was 28,555, of which 13,750 were in rural areas. If these were simple random samples, then the increase in aggregate poverty measures for rural India between 1990-91 and 1992 could not plausibly be attributed to sampling error alone.[3] However, these are not simple random samples, but more complex sample designs involving stratification and spatial clustering of sample points. While stratification typically reduces standard errors, clustering increases standard errors.[4] Unfortunately, the information needed to calculate the corrected standard errors is not publicly available. Even if we treated these as simple random samples, it is clear that sampling error is worrying for a number of states; we shall return to this point. We do not know if there were unusual nonsampling errors in the 1992 survey. There is very little information on this. The NSS does, however, have a good reputation among consumption-based survey instruments, and has few of the comparability problems over time that have plagued other surveys used for poverty monitoring.

Can other evidence be brought to bear on this issue? A common and defensible approach to assessing survey-based information is to ask whether the results are corroborated by independent *nonsurvey* data. Is the change in the survey-based

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[3] The standard error of the difference in the rural head-count index between 1990-91 and 1992 would be about 0.7 percent under these assumptions.

[4] For an exposition of the theory and methods of sampling, and formulae for the standard errors of various poverty measures taking account of sample design, see Howes and Lanjouw (1996).

poverty measure explicable in terms of the variables that normally influence the evolution of India's rural poverty measures? This too can be difficult to answer. Various proximate determinants of poverty—such as real wages for unskilled workers—can be identified. But even when they are found to have moved in the "right" direction, one still does not know how much of a movement would have been necessary to generate the observed data. A better approach is to use econometric methods to test whether the data are consistent with the past relationship between these variables. That is the approach we follow here.

What are the channels through which stabilization might have resulted in an increase in poverty in India?[5] There was a sharp *fiscal contraction* in 1991 and 1992, to reduce aggregate excess demand. Some observers have argued that this would have had its greatest effect on the urban sector (Bhagwati and Srinivasan 1995; Tendulkar and Jain 1995); the rural sector was not the main focus of economic reforms—indeed, agriculture has seen little reform effort. Yet, as we show below (confirming conclusions reached by Gupta [1995] and Tendulkar and Jain [1995]), the increase in India's poverty rate stemmed mainly from the rural sector. Possibly, there were large spillover effects from the urban sector to the rural sector, as Dev (1995) and others have argued. But it would still be odd that there was so little direct impact on the

[5] For a further discussion of the possible impacts of policy reform on poverty and human development in India, see Ravallion and Subbarao (1992). For a more general discussion in the context of past debates over the social impacts of adjustment programs, see Lipton and Ravallion (1995).

urban sector. Also the aggregate time-series evidence suggests that the spillover effects tend to go in the other direction, from rural to urban areas (Ravallion and Datt 1996a). It has been argued that India's rural poor did benefit directly from government spending in the 1980s and so would have lost from its contraction (Sen and Ghosh 1993). Even so, from the point of view of either the urban or rural poor, it would seem unlikely that an aggregate fiscal contraction could have had such a rapid impact on household consumption. Later, we test that conjecture.

Possibly, there were adverse effects on rural welfare of changes in the *composition* of public spending. Central allocations to the targeted antipoverty programs—mainly the Integrated Rural Development Program (IRDP) (a means-tested credit scheme), and various centrally-funded rural public works—were cut in line with other components of spending (Gupta 1995). It is unclear how much impact this had. Tendulkar and Jain (1995, 1377) argue that

> The squeeze on the central antipoverty programmes during the fiscal compression can be directly attributed to economic reforms. . . .However, without denying the need for such programmes, the importance of this factor in the present context needs to be tempered by three considerations, namely (a) the scale of these central programmes even in years without fiscal squeeze has never been of the magnitude that could have prevented

> a sharp increase in poverty; (b) organizational factors and problems with delivery systems have further limited the effectiveness of these programmes; and (c) our earlier work suggests that it is the drought-relief works organized by the severely drought-affected states which have been much more effective in alleviating rural poverty in years of dip in agricultural harvest than the central rural employment-generation programmes.

This is a credible argument. The numbers do not suggest that the measured increase in poverty in 1992 had much to do with the cuts to these programs. Our estimates imply that an extra 9.4 million rural households fell below the poverty line in 1992, compared to 1990-91. The cuts to IRDP—by far the largest antipoverty program—entailed a drop of 0.6 million in the number of families assisted between 1990-91 and the average of fiscal years 1991-92 and 1992-93 (based on Gupta 1995). So, we can explain only 6 percent of the increase in the number of the poor, even if *all* of those families fell below the poverty line because of the cuts to IRDP, itself an

unlikely condition, given what we know about IRDP leakage.[6] Clearly, something else was going on.

Other things were happening in 1991-92 (related to the reforms) that may well have had a more sizable, and rapid, adverse impact on the poor. There was a sharp *devaluation*, which added to the rate of inflation, particularly in foodgrain prices (by forcing higher procurement prices of foodgrains). Between the 46th round (July 1990-June 1991) and the 48th round (January-December 1992), all-India rural prices increased by 28 percent as measured by the Consumer Price Index for Agricultural Laborers (CPIAL).[7]

There was also a drop in nonagricultural output per capita. The year 1991-92 was a year of industrial stagnation; the index of industrial production in 1992 was virtually the same as in 1990-91. This may have been due in part to the short-term effects of reform, though it probably also reflected the continuing effects of the crisis that led to the need for reform. There was also a fall in agricultural output per hectare in some parts of the country, due to less than ideal weather conditions. The

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[6] IRDP does not appear to be effective in screening out nonpoor participants; see Drèze (1990) and Ravallion and Datt (1995). Estimates for the (seemingly well-targeted) Maharashtra Employment Guarantee Scheme suggest that its impact on the head-count index of poverty in two villages was modest (Ravallion and Datt 1995); the national schemes are widely thought to have even less impact.

[7] We have corrected for the fact that the published CPIAL assumes a constant price of firewood. We have used the average all-India rural retail price of firewood for the adjustment. The increase is about 29 percent using the uncorrected CPIAL. For details on the method of adjustment, see Datt (1995).

agricultural production index declined from 143.7 in 1990-91 to 137.6 in 1991-92 (triennium ending 1981-82=100), largely reflecting the decline in *kharif* foodgrain output from 99.4 million tons in 1990-91 to 91.6 million tons in 1991-92. There was also a decline in the yield per hectare of *kharif* foodgrains from 1,231 to 1,174 kilograms over the same period. Real agricultural wages also fell, due to both the higher inflation and the fall in agricultural yields (India 1994a).

Farm yields, per capita nonfarm output, per capita development spending, and real wages all fell in the aggregate, while the inflation rate rose (Table 1). It is important to see how these changes generalize to the state level. Table 3 gives data at the state level on the following variables: (1) real agricultural state domestic product per hectare of net sown area in the state;[8] (2) real nonagricultural state domestic product per person; (3) per capita real state development expenditure,

[8] Two alternative sets of estimates are available on the State Domestic Product (SDP): (1) the estimates prepared by the state governments, though published by the Central Statistical Organization (CSO), and (2) the "comparable estimates" of SDP compiled and published by the CSO. The latter set of estimates, though methodologically superior in ensuring comparability across states, are only available for a shorter period, 1962/63 to 1985/86. Hence, we have used the SDP data from the former source; the comparability across states may be less of a concern for tracking *growth* in SDP and its agricultural component over time. See Choudhry (1993) for further discussion.

Table 3 State-level changes in the determinants of rural poverty

State	Real Agricultural Output			Real Nonagricultural Output			Real Development Expenditure			Inflation Rate		Real Agricultural Wage	
	45th Round 1989-90	46th Round 1990-91	48th Round 1992	45th Round 1989-90	46th Round 1990-91	48th Round 1992	45th Round 1989-90	46th Round 1990-91	48th Round 1992	46th Round 1990-91	48th Round 1992	46th Round 1990-91	48th Round 1992
	(Rs/hectare at 1973-74 prices)			(Rs/person at 1973-74 prices)			(Rs/person at 1973-74 prices)			(percent/year)		(Rs/day at 1973-74 prices)	
Andhra Pradesh	3,194.85	3,689.36	3,204.23	1,007.07	1,123.73	930.18	206.54	219.76	179.29	7.25	27.67	6.90	6.03
Assam	3,066.08	3,194.24	3,044.30	706.44	724.97	742.84	161.56	168.68	157.38	9.97	16.29	7.48	6.70
Bihar	3,291.05	3,673.74	3,358.18	464.28	478.21	435.90	97.36	111.27	105.60	8.65	17.31	6.08	5.54
Gujarat	2,742.33	2,042.91	1,637.16	1,248.44	1,259.70	1,048.49	216.03	204.94	209.65	11.64	22.35	5.19	5.02
Karnataka	1,904.21	2,087.08	2,201.38	932.47	973.65	914.67	181.38	190.88	181.21	6.66	22.86	4.99	3.79
Kerala	4,028.94	4,115.20	5,466.53	772.80	783.68	822.29	148.84	163.22	162.07	10.90	10.40	8.49	9.73
Madhya Pradesh	1,432.49	1,687.37	1,457.99	739.65	813.42	740.68	142.00	164.56	150.04	8.99	17.47	5.39	5.24
Maharashtra	1,764.02	1,864.64	1,512.95	1,594.61	1,730.08	1,483.11	211.22	230.88	166.82	7.35	26.90	5.29	4.43
Orissa	2,514.66	1,922.76	2,125.27	814.43	789.12	802.28	161.33	180.91	176.52	7.99	16.53	5.79	5.96
Punjab-Haryana	4,324.51	4,431.12	5,018.86	1,177.92	1,196.13	1,206.25	208.76	216.28	251.64	12.49	11.03	9.57	10.05
Rajasthan	1,068.84	1,260.58	1,179.66	532.32	574.19	554.96	114.66	133.15	135.45	13.74	14.24	5.34	5.44
Tamil Nadu	3,030.26	3,022.38	3,159.50	1,217.04	1,335.01	1,254.67	213.67	236.97	290.51	8.42	17.45	5.11	5.07
Uttar Pradesh	3,611.05	3,748.90	3,753.16	667.87	639.66	635.89	134.25	140.43	126.95	18.07	11.78	6.84	6.95
West Bengal	5,492.13	5,465.82	6,049.70	1,120.82	1,117.62	1,072.81	93.83	169.47	138.19	14.16	12.21	9.11	9.09

Source: Authors' calculations.

comprising expenditure on all economic and social services;[9] (4) the rate of inflation in the rural sector measured as the change per year in the natural log of the (adjusted) CPIAL;[10] and (5) the real agricultural wage rate (average nominal wage deflated by the CPIAL). We see that agricultural yields (output per hectare) fell in half of the states between the 46th and 48th rounds of the NSS; for 10 out of 14 states (though not necessarily the same ones each time), nonagricultural output per capita and real development spending per person fell, and the rate of inflation rose. The real agricultural wage rate fell in 9 states. So we should not be surprised that measures of rural poverty worsened. But can the full extent of this worsening be attributed to these factors alone?

It is difficult to address this question with analysis at the all-India level, which is limited by the relatively small number of time periods over which comparable consumption and other data are available for analysis. Fortunately, it is possible to disaggregate to the level of 14 major states, which allows for enough combined spatial and temporal variation in poverty measures to enable a richer modeling of their

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[9] The economic services include agriculture and allied activities, rural development, special area programs, irrigation and flood control, energy, industry and minerals, transport and communications, science, technology, and environment. The social services include education, medical and public health, family welfare, water supply and sanitation, housing, urban development, labor and labor welfare, social security and welfare, nutrition, and relief on account of natural calamities.

[10] We use the state-specific Consumer Price Indices for Agricultural Laborers (CPIAL) as the deflator, which are corrected for the constant price of firewood. See Datt and Ravallion (1995) for further details on this deflator.

determinants. State-level analysis is also important in its own right for incorporating regional variations in the evolution of poverty measures.

3. MODELING FLUCTUATIONS IN INDIA'S POVERTY MEASURES

Our aim is to explain changes in India's poverty measures by state. Using a time series of poverty measures and other data by state, we estimated the following model for observed poverty measure (P_{it}) in state i at date t:

$$\begin{aligned}\ln P_{it} = {} & \phi_1(\ln YPH_{it} + \ln YPH_{it-1}) + \phi_2(\ln YNA_{it} + \ln YNA_{it-1}) + \phi_3 INFL_{it} \\ & + \phi_4 \ln DEVEX_{it-1} + \phi_5 \ln WAGE_{it} + \sum_i \gamma_i t + \eta_i + \epsilon_{it},\end{aligned} \tag{1}$$

where *YPH* is the real agricultural state domestic product per hectare of net sown area, *YNA* is the real nonagricultural state domestic product per person, *INFL* is the rate of inflation in the rural sector, measured as the change per year in the natural log of the (adjusted) CPIAL, *DEVEX* is the per capita real state development expenditure, *WAGE* is the real male agricultural wage, γ_i are the estimable state-specific trend growth rates in the poverty measures, η_i are time-invariant state-specific effects, and ϵ_{it} is an error term that is assumed to follow an AR(1) process,

$$\epsilon_{it} = \rho^{\tau_t} \epsilon_{it-\tau_t} + u_{it}, \tag{2}$$

in which u_{it} is a standard (independent and identically distributed) innovation error and τ_t is the time interval between surveys. Since the surveys are unevenly spaced, the autocorrelation parameter, ρ, is raised to the power of τ_t, so as to consistently define an AR(1) process.

Notice that this model has state-specific intercepts and time trends. So the differences in initial conditions and time trends are fully controlled for.[11] The role of the other variables is thus to explain the fluctuations in measured poverty. Given that our primary interest is in understanding the factors contributing to the measured increase in poverty in 1992, we estimate equations (1) - (2) for the entire period up to the 48th round. The model is estimated for the 14 major states, accounting for 97 percent of the total rural population in 1991.

The model is estimated using state-level data from 19 rounds of the National Sample Survey (NSS) spanning 1960-61 (round 16) to 1992 (round 48). However, not all 19 rounds of the survey are covered for each state.[12] Altogether, the model is estimated on 252 observations, forming a panel data set that is unbalanced in its

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[11] Elsewhere, we estimate a model that explains the state-specific trends directly in terms of both initial conditions and trends in exogenous variables; see Datt and Ravallion (1995).

[12] For 11 states (Andhra Pradesh, Bihar, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh, and West Bengal), all 19 rounds are covered. Due to gaps in the wage data, only 16 rounds are covered for Punjab-Haryana. (Only from 1964-65 does Haryana appear as a separate state in the NSS data. To maintain comparability, the poverty measures for this and subsequent rounds have thus been aggregated, using rural population weights for Punjab and Haryana derived from the decennial censuses). Similarly, only 14 NSS rounds are covered for Assam, and 13 for Rajasthan. No wage data were available for Jammu and Kashmir, and the state was thus excluded from this analysis.

temporal coverage for different states. The NSS rounds are also unevenly spaced; the time interval between the midpoints of the survey periods ranges from 0.9 to 5.5 years.

For the poverty measures, we use the poverty lines proposed by India's Planning Commission (1993). This is based on a nutritional norm of 2,400 calories per person per day, and is defined as the level of average per capita total expenditure at which this norm is typically attained. This poverty line is given by a per capita monthly expenditure of Rs 49 at October 1973-June 1974 all-India rural prices. The poverty measures are estimated from the published grouped distributions of per capita expenditure, using parameterized Lorenz curves.[13]

We use a nonlinear least squares estimator of model (1)-(2).[14] The estimated parameters for the key time-dependent variables are reported in Table 4 for two versions of the model, with and without current development spending.

In addition to the state-specific intercepts and time trends, the following determinants are indicated to be important in explaining the historical record of rural poverty in Indian states: (1) current and lagged agricultural yield (output per

[13] For details on the methodology, see Datt and Ravallion (1992). A compilation of the data is available, giving detailed sources (Özler, Datt, and Ravallion 1996).

[14] This is formally the same estimation method described in more detail in Datt and Ravallion (1995).

Table 4 Determinants of the fluctuations in rural poverty measures

Variable	Mean Consumption (1)	Mean Consumption (2)	Head-Count Index (1)	Head-Count Index (2)	Poverty Gap Index (1)	Poverty Gap Index (2)	Squared Poverty Gap Index (1)	Squared Poverty Gap Index (2)
	(Rs/person/month at 1973-74 prices)		(percent)		(percent)		(percent)	
Real agricultural output per hectare of net sown area: current + lagged	0.062	0.059	-0.060	-0.059	-0.137	-0.140	-0.195	-0.201
	(3.40)	(3.20)	(2.46)	(2.38)	(3.54)	(3.56)	(3.59)	(3.64)
Real nonagricultural output per person: current + lagged	0.143	0.136	-0.231	-0.229	-0.401	-0.405	-0.531	-0.543
	(5.56)	(5.18)	(6.86)	(6.66)	(7.40)	(7.36)	(6.98)	(6.99)
Real per capita state development expenditure: current	...	0.053	...	-0.029	...	0.052	...	0.122
		(1.24)		(0.44)		(0.51)		(0.87)
Real per capita state development expenditure: lagged	0.205	0.175	-0.222	-0.202	-0.367	-0.402	-0.489	-0.567
	(4.79)	(3.57)	(3.91)	(2.75)	(4.00)	(3.47)	(3.80)	(3.58)
Rural inflation rate: current	-0.310	-0.269	0.317	0.294	0.464	0.507	0.567	0.668
	(5.13)	(3.91)	(3.61)	(2.86)	(3.37)	(3.47)	(2.97)	(3.00)
Real (male) agricultural wage: current	0.070	0.070	-0.169	-0.169	-0.219	-0.220	-0.257	-0.260
	(1.47)	(1.47)	(2.60)	(2.59)	(2.15)	(2.15)	(1.80)	(1.80)
AR(1)	0.262	0.254			0.044	0.056	0.093	0.121
	(2.59)	(2.49)			(0.39)	(0.49)	(0.83)	(1.07)
Root mean square error	0.0637	0.0636	0.0919	0.0921	0.1427	0.1430	0.1977	0.1979
R^2	0.880	0.861	0.915	0.915	0.915	0.915	0.904	0.904

Note: Absolute t-ratios in parentheses. All variables are measured in natural logarithms. A positive (negative) sign indicates that the variable contributes to a higher (lower) rate of increase in the poverty measure or mean consumption. The estimated model also included individual state-specific intercept effects and time trends, not reported in the table. The number of observations used in the estimation is 238.

hectare), (2) current and lagged nonagricultural output per capita, (3) lagged state development expenditure per capita, (4) the real agricultural wage rate, and (5) the rate of inflation.[15] The estimated parameters for the above variables are all statistically significant. While increases in the first four factors are poverty-reducing, a higher rate of inflation contributes to an increase in poverty. The inclusion of *current* development spending does not significantly alter the estimated parameters for other variables. The current level of development spending itself turned out to be insignificant in all equations.

The models in Table 4 explain over 90 percent of the variance across states and over time in the poverty measures. However, a large share of this explained variance is attributable to the state-specific intercepts and time trends (Table 5). It is more difficult to explain the fluctuations. If we calculate, instead, the share of the variance in the fluctuations around the time trends that is explained by the time-varying variables, we get the results in the bottom row of Table 5.[16] We are able to explain about 40 percent of the variance in fluctuations, the rest being attributed to omitted time-varying factors and measurement errors.

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[15] Note that the data on these determinants is available on an annual basis (for the agricultural or the financial year). This does not necessarily coincide with the period covered by the NSS survey rounds, which, in addition to being evenly spaced, do not always cover a full 12-month period. To match the annual data with those by the NSS rounds, we have thus interpolated the annual data to the midpoint of the survey period of each NSS round.

[16] This is given by $(R^2-R^{2*})/(1-R^{2*})$, where R^{2*} is for the model with only state-specific intercepts and time trends R^2 is for the model with time-varying variables as well.

Table 5 Explained and unexplained variances in the fluctuations

	Mean Consumption	Head-Count Index	Poverty Gap Index	Squared Poverty Gap Index
Model with only state-specific intercepts and time trends	0.806	0.852	0.852	0.843
Model with time-varying variables as well (Table 4)	0.880	0.915	0.915	0.904
Share of variance in fluctuations explained by the time-varying variables	0.381	0.426	0.426	0.388

4. WHY DID MEASURED POVERTY INCREASE IN 1992?

Table 3 showed how the underlying determinants of rural poverty evolved between 1990-91 and 1992. The following observations can be made about the figures in Table 3, in the light of the econometric results in Table 4.

1. We find that current and lagged agricultural yield have the *same* effect on rural poverty.[17] Thus, to locate the sources of change in poverty between 1990-91 and 1992, we need to look at the changes in yield both between the 46th and the 48th rounds as well as between the 45th and the 48th rounds. In 7 of the 14

[17] This is consistent with the findings of Ravallion and Datt (1996b) and other work in the literature reviewed in that paper.

states, agricultural yield per hectare declined between the 46th and the 48th rounds, while between the 45th and the 48th rounds, it declined only in four states: Assam, Gujarat, Maharashtra, and Orissa.

2. Real nonagricultural output per capita enters our model the same way as the agricultural yield variable above, with equal coefficients for the current and lagged values. Thus, again, changes between the 45th and 48th rounds are relevant. These changes are negative for 8 of the 14 states: Andhra Pradesh, Bihar, Gujarat, Karnataka, Maharashtra, Orissa, Uttar Pradesh, and West Bengal.
3. Between the 46th and the 48th round, *lagged* real development spending per capita declined only in the state of Gujarat. There was a widespread decline in current development spending, but current spending is not identified as a significant determinant of state-level poverty in our estimated model.
4. The factor that appears to have contributed the most to the increase in poverty between the 46th and the 48th rounds is the higher inflation rate. Between the two rounds, the inflation rate increased in 10 of the 14 states; in most states, the increase was substantial.
5. The decline in the real agricultural wage also contributed to an increase in poverty in many states. The states witnessing a sizable fall in real wages

between the 46th and the 48th rounds were Andhra Pradesh, Assam, Bihar, Karnataka, and Maharashtra.

The combined effect of all these factors is shown in Table 6 (in the aggregate) and Table 7 (by state). Figure 1 also gives the actual and predicted values for India as a whole (population-weighted aggregates over 14 states).

While the direction of the change after 1990-91 is almost always correctly predicted, the predicted changes are generally smaller than the actual changes (Table 7). The model predictions thus underestimate the increase in poverty for most states. In some states (like Andhra Pradesh), this seems to be due to the underestimation of mean consumption, while in others (Uttar Pradesh), there seems to have been a deterioration in relative inequalities for some states whose effect on the poverty rates the estimated model seems unable to predict.

How much of the observed change in poverty can we predict for the 14 states as a whole? The population-weighted averages of the determinants of poverty (Table 1) give an indication. Echoing the changes noted at the state level (Table 3), we find that there was a modest increase in the average agricultural output per hectare between the 45th and 46th rounds, followed by a modest decline in the 48th round. Similarly, the average nonagricultural output per capita first increased and then declined in the 48th round; there was a modest net decline between the 45th

Table 6 Actual and predicted rural mean consumption and poverty measures: All-India (population-weighted average of 14 states)

	Mean Consumption	Head-Count Index	Poverty Gap Gap Index	Squared Poverty Gap Index
	(Rs/person/month at 1973-74 prices)	(percent)	(percent)	(percent)
46th round: 1990-91 Actual	62.49	40.95	9.991	3.488
46th round: 1990-91 Predicted	63.87	41.64	10.172	3.479
48th round: 1992 Actual	60.32	48.24	12.783	4.710
48th round: 1992 Predicted	61.68	43.91	11.128	3.926
Share of predicted change in actual change (percent)	101.1	31.2	34.3	36.6
Share of *predicted* change explained by changes in *YNA, DEVEX, INFL, WAGE* (percent)[a]	16.0	38.0	32.1	28.6

[a] Holding all other determinants of mean consumption/poverty measures constant.

Table 7 Actual and predicted changes in rural mean consumption and poverty measures for 14 states

State	Mean Consumption		Head-Count Index		Poverty Gap Index		Squared Poverty Gap Index	
	Actual Change	Predicted Change	Actual Change	Predicted Change	Actual Change	Predicted Change	Actual Change	Predicted Change
	(Rs/person/month)		(percent points)		(percent points)		(percent points)	
Andhra Pradesh	-7.10	-8.10	4.95	4.75	1.58	1.64	0.80	0.67
Assam	-7.23	-2.87	14.21	2.63	5.06	0.94	2.02	0.40
Bihar	-3.91	-2.39	9.52	4.68	7.37	1.64	3.79	0.65
Gujarat	-0.66	-8.35	3.65	6.87	5.52	2.91	3.60	1.32
Karnataka	-6.70	-3.30	14.21	5.68	2.46	2.23	0.44	1.06
Kerala	8.89	5.52	0.35	-2.91	0.39	-1.23	0.31	-0.56
Madhya Pradesh	2.18	-3.51	8.16	2.75	1.11	1.11	0.10	0.49
Maharashtra	-11.51	-7.04	17.58	8.25	6.12	3.66	2.58	1.74
Orissa	-1.47	-0.88	9.43	0.89	2.82	0.33	1.00	0.13
Punjab-Haryana	6.42	1.52	-0.47	-0.62	0.02	-0.12	0.03	-0.04
Rajasthan	-7.07	1.04	11.94	-1.29	1.66	-0.52	0.20	-0.28
Tamil Nadu	-0.64	-0.42	4.63	0.53	1.32	0.27	0.53	0.18
Uttar Pradesh	-0.60	-2.48	9.79	0.92	3.62	0.55	1.43	0.32
West Bengal	3.14	5.59	-10.96	-3.74	-4.21	-1.14	-1.67	-0.37

Figure 1 Actual and predicted poverty measures

Note: Broken line gives model's predicted values.

and 48th rounds. The average development spending per capita increased marginally between the 45th and 46th rounds. (The decline thereafter does not have an impact on predicted poverty.) There was a modest fall in the average real agricultural wage between the 46th and 48th rounds, while there was a substantial increase in the inflation rate.

The overall effect of these changes is ascertained from the population-weighted averages of the actual and predicted values of mean consumption and poverty measures shown in Table 6. In the aggregate, all of the actual decline in mean consumption is predicted, though we can predict only 31 to 37 percent of the increase in the poverty measures (depending on which measure).

So there appears to be a predictive failure in the model for 1992. To test this further, a dummy variable was included for the 48th round; this turned out to be positive and statistically significant in the estimated equations for all the poverty measures, but not for mean consumption. Augmenting the model with *state-specific* dummy variables for the 48th round and testing for the joint significance of these variables showed that the null of no structural break was acceptable for mean consumption, but it was rejected for the poverty equations; the test statistics for mean consumption, *H*, *PG*, and *SPG*, distributed as F(14, 190), were 1.13, 2.05, 1.88, and 1.98 respectively. The fact that the predictive failure is for the poverty measures not

mean consumption suggests that the problem lies in the model's ability to explain distributional changes.[18]

5. EXTENSIONS TO THE MODEL

We also experimented with a number of extensions to the model to see if any of these could track the historical data better and improve predictions for 1992. These extensions included (1) introducing current real development spending as an additional regressor in the model, (2) allowing for a nonlinear (quadratic) state-specific time-trend, (3) including lagged real agricultural wage as an additional explanatory variable, (4) allowing a quadratic term in the rate of inflation, and (5) allowing for state-specific effects of inflation and the real wage rate.

The parameter estimates for the model with current development spending are given in Table 4, which shows the current levels of development spending to be insignificant. The inclusion of this variable did not improve the predictions for 1992 either. These results are typical of all the model extensions listed above. In no case were the unrestricted models found significantly different from the restricted model, nor did they deliver better predictions for the 48th round.

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[18] Quite generally, changes in standard poverty measures can be decomposed into a contribution due to growth in mean consumption and one due to shifts in the parameters of the Lorenz curve; see Datt and Ravallion (1992).

It has been argued that the *composition* of the state development expenditure also matters—that expenditure on social services has a more direct impact on the poor than other categories of public spending. We examined this issue by introducing the (log) share of social services expenditure in total development expenditure for all states as an additional explanatory variable. The composition effects were insignificant; the absolute t-ratios for this variable in the equations for mean consumption, *H*, *PG*, and *SPG* indices were 1.6, 0.3, 0.2, and 0.7, respectively. The introduction of the composition effect also failed to improve predictions for 1992. This does not mean that the composition of spending is unimportant, only that its effects take time to work through to consumption, though there may be more rapid effects on, for example, health and schooling, which would not be evident in consumption poverty.

As a further test, we examined whether an unanticipated contraction in public spending on education somehow accounted for the increase in poverty in 1992. Why that might be so is quite unclear; it would seem implausible that a shock to this category of public spending would have a rapid impact on consumption poverty. Across states, there was no sign of any correlation between the size of the shock to

public spending on education in 1992 and the size of our prediction errors for the changes in poverty measures for that year.[19]

We also looked at the possibility that the crisis induced an unusually higher rate of household savings. Data from the National Accounts Statistics do not support such a conjecture. On the contrary, during 1991-92 and 1992-93, aggregate savings of the household sector fell in real terms (India 1994a). There was also a decline in the rate of household savings as a proportion of the gross domestic product (GDP), from about 20 percent in 1990-91 to 17.8 percent in 1991-92 to 15.5 percent in 1992-93. The National Accounts may not adequately pick up precautionary savings in certain forms, notably gold and silver, though it does not seem very plausible that large numbers of poor people cut their consumption to buy precious metals.[20] An unusually high savings rate does not appear to be the reason for the higher consumption poverty in 1992.

The idea that there was a strong independent effect on the consumption behavior of poor people also sits uncomfortably with anecdotal evidence from

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[19] For this test, we used the forecasts of public spending on education by 13 states in 1992 made by Jalan and Subbarao (1995) (using a time series model calibrated to historical data up to 1991). We measured the size of the shock by the log of the ratio of 1992 budgeted public spending on education to the forecasted value. The correlation coefficients between the measured shock and our model's prediction errors were -0.02, -0.11, and -0.13 for *H*, *PG*, and *SPG*, respectively.

[20] If they had, one would have expected to see an increase in the relative prices of gold and silver; the prices of both rose in 1992, though no more than the rate of overall inflation in the case of silver and only slightly more for gold. The Bombay market price of silver rose 21 percent from March 1991 to March 1992, which was the same as the increase in the CPIAL. The corresponding increase in average gold price was 29 percent (India 1994b).

qualitative field research from a number of rural areas of India, which suggests that poor people are generally unaware of the country's economy-wide reforms—understandably, they are far more aware of the changes in the prices and wages they face than the economy-wide factors underlying them (World Bank 1996).

6. HOW MUCH OF THE INCREASE IN POVERTY WAS DUE TO THE STABILIZATION PROGRAM?

A subset of the variables in our model can be identified as likely channels through which stabilization would impact on the living standards of the poor. Those variables are real nonagricultural state domestic product per person (*YNA*), real state development expenditure (*DEVEX*), the rate of inflation in the rural sector (*INFL*), and the real (male) agricultural wage (*WAGE*). Of course, these variables are changing for other reasons, including the effects of the crisis preceding the reforms and current exogenous shocks (such as the effects of the bad agricultural year on real wages in agriculture). We cannot hope to separate empirically the impact of reform alone. However, it can be argued that these variables would encompass the main impacts of the stabilization program, and so allow us to quantify at least a plausible upper bound to its likely impact on the poor.

To assess the maximum impact of stabilization on poverty in 1992, we assume that (1) the other factors in the model, notably the changes in agricultural yield, the

state-specific time trends, and the (large) unexplained component, reflect other factors with little or nothing to do with stabilization efforts, and (2) the reforms themselves did not entail a structural change in the model generating poverty in India. The latter assumption deserves further comment. The results above suggest a significant structural break in just two states (Assam and Uttar Pradesh). Nonetheless, it may still be argued that reform induced that break, and played a role in the sizable (though not significant) residuals for other states. Against this view, the timing of India's reform process does not suggest that a sharp structural break could have occurred in just one year or so. The bulk of the reforms in late 1991 and 1992 were macroeconomic stabilization rather than deeper structural reforms, which have been on a somewhat slower track. It seems implausible that the stabilization efforts on their own could have entailed a significant structural break in the model determining the evolution over time of India's poverty measures.

Under these assumptions, we can establish at least an upper bound to the adverse impact in 1992 of the stabilization program, given by the share of the measured increase in poverty attributable to the combined impact of changes in *YNA*, *DEVEX*, *INFL*, and *WAGE*. We give the results in the bottom row of Table 6. We find that these variables account for 16 percent of the *predicted* drop in mean consumption, and for 38 percent, 32 percent and 29 percent of the *predicted* increase in the head count, poverty gap, and squared poverty gap indices, respectively. In

other words, the maximum impact of the stabilization program would have entailed increases in the rural *H*, *PG*, and *SPG* indices of the order of 2, 3, and 4 percent instead of the actual increases of 18, 28, and 35 percent, respectively. Thus the vast bulk (about nine-tenths) of the measured deterioration in rural living standards in India during 1992 does not appear to be accountable to the reform process that started in mid-1991.

As already mentioned, this, of course, assumes the absence of a structural break in 1992. Some further light on this issue is shed by the results from a new survey round, which became available after this study was completed, namely the 50th round, from July 1993 to June 1994. This was a much larger sample, with 115,350 households interviewed, of which 69,200 were in rural areas. When we estimated the rural poverty measures at the all-India level on a comparable basis to the numbers in Table 2, we found a sharp reduction—roughly comparable to the sharp increase from 1991 to 1992. Comparing the 48th and 50th rounds, the rural head-count index fell from 43.5 percent to 38.7 percent; the poverty gap index fell from 10.9 percent to 9.1 percent; the squared poverty gap fell from 3.8 percent to 3.1 percent. The poverty measures thus fell back to roughly their pre-reform levels. It is hard to interpret the post-reform period as the harbinger of a structural break.

7. CONCLUSIONS

The impact of macroeconomic crisis and stabilization efforts on poverty can be hard to predict for most countries. This is as much an issue of the availability of consistent data on indicators of living standards as of constructing empirically tractable models of their determinants. High quality survey data will typically generate fluctuations in measures of household living standards. While some of the observed fluctuations can be directly traced to fluctuations in the underlying determinants, there will also be a part attributable to sampling and nonsampling errors that are impossible to avoid. Even in countries that have relatively good data, the short-term welfare impacts of low-frequency events associated with crises and stabilization reforms can thus be hard to assess.

In this case study for India, we find that we can explain well the drop in average household consumption in rural areas that occurred in the year following the beginning of the stabilization program to deal with a macroeconomic crisis. A number of factors contributed to falling average living standards, including inflation, a drop in agricultural yields, and contraction in the nonfarm sector. These same factors resulted in higher poverty measures, though there is also a sizable unexplained distributional shift. From an unusually rich database, we are unable to account for a large share of the increase in measured poverty, and we cannot rule out the possibility that it was the result of sampling or nonsampling errors. But, in part, it also reflects the limits of our ability to model the determinants of changes in poverty with available

data. Our estimated model, though well-specified for tracking accurately the historical poverty data across states, is nonetheless not rich enough to successfully predict isolated large fluctuations in poverty (not caused by any obvious shocks, such as due to exceptionally bad weather).

But, perhaps more significantly, our results suggest that the bulk of the sharp increase in measured poverty in the aftermath of a macro crisis and stabilization had little to do with the latter. About two-thirds of the predicted increase in the poverty rate is unexplained by the variables one would expect to matter. Or, only about one-tenth of the observed increase in poverty measures is attributable to variables that could be the potential channels for the reforms-induced impact. The argument can be made that the impact is underestimated because there was a structural break associated with the reforms, but the recent recovery of the poverty measures to their pre-reform levels belies the notion of such a structural break.

Users of survey-based welfare indicators must be warned not to read too much into a single survey, particularly when (as in this case) its results are very difficult to explain in terms of other data at hand. There should, however, be no doubt about the usefulness of objective socioeconomic survey data for poverty monitoring and analysis. Indeed, our judgments on how much we can or should read into individual episodes of fluctuations in living standards will critically depend on the availability of such data.

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