Technical
Report

Food Riots: An Analysis of Price
Movements of Essential Commodities
1971-73 with Tools for Policy
Analysis

by

J G Krishnayya

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          April 1974

     Indian Institute of Management
            Ahmedabad

No. 29

To

Chairman (Research)
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Technical Report

Title of the report Food Riots. An Analysis of Prices Movements of
Essential Commodities 1971-73 with Tests for Policy Analysis

Name of the Author ..... J. G. KRISHNAYYA .....
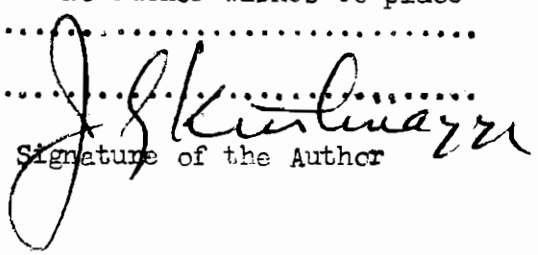
Under which area do you like to be classified? Systems Analysis

ABSTRACT (within 250 words)

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Commodities 1971-73 with Tools for Policy Analysis.

J G KRISHNAYYA

Abstract

Data Analysis techniques must be appropriate to the purpose
of the analysis. Policy analysis, in particular, requires analytic
techniques which are parsimonious and robust.

Data available on the prices of 22 essential commodities in
May 1971 and in December 1973 was subjected to analysis with a view
to extracting information on the geographical pattern of price changes.
The pattern reveals (a) that wheat behaved differently from all other
commodities in 1973, (b) that a concentration of price pressure deve-
loped on Ahmedabad and Bombay and away from Delhi and Calcutta,
(c) that unexpectedly small price increases took place in two commo-
dities (rice and wheat) in Kanpur.

The tools used were Information Theory - leading to a
measure of "uneveness", and Cluster Analysis, leading to a simple
Guttman scale.

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Information analysis which are undertaken with a view to evaluating

current or proposed policies require robust and parsimonious techniques.

Robustness protects the analyst from too great dependence upon the accuracy

of every single number he uses. Parsimony ensures that the analysis does

not get buried in a welter of detail, but rather stops when the policy-

relevant issues have been illumined (Ilchman, 1969). To this end it is

necessary that the results of the analysis be presented in a tabular or

graphical form which should cause the reader to feel the conclusions reached

are "obvious". Indeed the skilled systems analyst will make his thought

processes appear "elementary". A good example of such an analysis is found

in Averch et al, (1970).

    We agree with the view that too much of the social and economic

research in India has had an academic rather than a policy orientation

(Raj Krishna, 1974). To some extent this may be due to the techniques

currently used in the social sciences. The statistical methods adopted

by the West prior to 1960 - regression analysis, ANOVA etc - are accepted

and used in India. These are generally data-intensive, and their results

tend to be in the form of 'numbers' rather than patterns. Newer methods,

which have become convenient with the coming-of-age of the computer, such as Cluster analysis, non-metric analysis, smallest space analysis, etc. have not found a clientele yet in India.

However these tools can use non-metric or categorical data, even ordinal scales. As a result they can be applied to data which has been 'screened' to make it less sensitive to errors, distortions and mutilation. Effective policy-oriented information analysis which is needed today in planning and administration will depend upon wide use of these techniques. (Krishnayya, 1974). The present note illustrates their use in an elementary way.

Parsimony in analysis and presentation is less a matter of technique than of style. However, the aim is to present the relevant facts in a minimal, logical sequence. In addition, since the pattern-recognising capability of the human mind is better developed than its 'reckoning' or arithmetic capability, there are advantages to a picture presentation of analysis results. These could be one, two or higher-dimensional patterns (Lingoes, 1970) but they provide the reader with a gestalt, an all-in-one complete picture shorn of its confusing details.

COMMODITY PRICES

Price information on 22 essential commodities is now available (The Economic Times, March 28, 1974) for eight major cities and a rural average, for May 1971 and December 1973. (Table I, Appendix) We present below the results of analyses which are focussed on the inter-city variation of the price movements. These analyses highlight the distortions in the distribution and price system of wheat in December 1973 as compared with 1971. The price picture in the nine cities is found to differ in a way that may also provide some support for the view that economic factors explain the vehemence of, and the popular support for, the anti-government agitations in Ahmedabad and Gujarat during the winter of 1973-74.

Price-Disorder

First an analysis was done for each commodity to determine the extent of geographic unevenness in the countrywide price picture. The measure used was related to the "entropy" of the set of nine numbers representing prices in the eight cities and rural India. Entropy is used in engineering & physics to measure the extent of disorder or random fluctuations in some process. (Fano, 1961) The maximum entropy of a set of numbers is achieved when they are all equal. For our measure we use the difference between the entropy of our sets of nine numbers (prices for a commodity) and the entropy of nine equal numbers. This gives a measure of unevenness, expressed in 'bits' the unit of information, which is independent of the actual

Appendix Table I

HOW RETAIL PRICES COMPARE IN BIG CITIES*

Commodity	Unit	Bombay		Calcutta		Delhi		Madras	
		1971	1973	1971	1973	1971	1973	1971	1973
Rice (Med)	kg.	1.50	2.80	1.24	2.0	1.87	3.50	1.34	1.77
Wheat (Med)	"	1.04	2.20	0.95	1.50	1.05	1.50	1.35	5.15
Pulses- Arhar	"	2.08	3.07	1.88	2.49	1.69	2.42	1.95	3.12
Masoor	"	1.52	2.49	1.50	2.33	1.47	2.39	1.44	2.00
Moong	"	2.32	3.90	1.88	3.04	1.62	3.21	1.95	3.27
Gram	"	1.50	2.62	1.29	2.27	1.16	2.13	1.26	2.57
Groundnut	"	4.66	9.15	4.43	9.00	4.43	9.15	4.44	9.00
Coconut	"	7.45	10.36	10.23	11.52	9.06	10.52	7.19	10.15
Vanaspati	"	6.32	9.27	5.85	9.13	6.38	9.25	6.48	9.15
Potato	"	0.94	1.46	0.77	1.20	0.68	1.05	0.94	1.31
Onion	"	0.41	0.97	0.53	0.98	0.42	0.70	0.45	0.93
Milk (Buffalo)	litre	2.45	3.18	2.10	2.36	1.39	3.00	1.72	2.94
Meat (goat)	kg.	6.62	8.75	6.74	9.00	5.54	8.00	6.54	8.00
Fish (big)	"	5.48	7.53	8.40	10.93	6.02	6.88	4.09	6.87
Sugar	"	2.07	4.25	2.08	4.05	2.11	4.30	1.84	3.56
Gur	"	2.04	3.41	1.42	2.26	1.31	2.14	1.54	2.37
Kerosene Oil	litre	0.54	0.81	0.60	0.81	0.59	0.81	0.56	0.81
Charcoal	40 kg.	13.68	16.00	14.74	16.50	17.25	22.63	20.24	20.77
Shirting(fine)	metre	4.50	4.90	3.40	4.00	3.45	5.05	3.70	4.83
Long cloth	"	3.90	4.38	2.75	3.90	2.30	3.85	3.39	3.67
Washing soap	cake	0.65	0.70	0.66	0.76	0.68	0.76	0.63	0.94
Toilet soap	"	0.74	1.00	0.80	1.00	0.72	1.00	0.74	1.00

Table I, Appendix Contd.

Commodity	Unit	Ahmedabad 1971	1973	Kanpur 1971	1973	Bangalore 1971	1973	Hyderabad 1971	1973	Rural Ind 1971	197
Rice (Med)	kg.	1.39	3.00	1.37	1.82	1.32	1.97	1.22	1.89	1.28	2.0
Wheat (Med)	"	1.03	2.10	0.96	1.33	1.25	2.47	1.20	2.00	0.86	1.4:
Pulses – Arhar	"	1.91	3.05	1.51	2.25	1.78	2.82	1.67	2.67	1.70	2.49
Masoor	"	1.44	3.00	1.29	2.22	1.44	2.10	1.41	2.20	1.42	2.29
Moong	"	1.47	8.10	1.84	3.32	1.86	3.38	1.73	3.19	1.80	3.12
Gram	"	1.18	2.15	1.08	2.19	1.22	2.32	1.20	2.23	1.30	2.47
Groundnut	"	4.45	9.28	4.43	9.00	4.30	9.00	4.28	9.15	4.77	9.00
Coconut	"	8.34	9.00	8.34	9.88	7.73	10.14	8.34	10.00	7.65	11.32
Vanaspati	"	6.40	9.10	6.46	9.15	6.43	9.15	6.36	9.27	6.15	9.47
Potato	"	0.81	1.20	0.50	1.19	0.88	1.26	0.94	1.20	0.68	1.20
Onion	"	0.47	0.84	0.29	0.79	0.38	0.98	0.26	0.73	0.44	1.11
Milk (Buffalo)	litre	1.50	2.90	1.54	2.95	1.48	2.50	1.40	2.25	1.17	1.50
Meat (goat)	kg.	5.85	7.50	5.00	7.00	6.29	7.50	5.26	7.00	5.11	7.00
Fish (big)	"	3.76	4.54	6.00	7.52	2.54	3.25	2.63	3.44	2.55	3.50
Sugar	"	1.99	4.20	2.01	4.25	1.87	4.25	1.96	3.75	2.02	4.30
Gur	"	1.77	3.14	1.22	2.24	1.66	2.02	1.39	2.39	1.19	2.44
Kerosene Oil	litre	0.55	0.81	0.65	0.82	0.60	0.81	0.60	0.81	0.72	0.82
Charcoal	40 kg.	15.92	20.00	15.43	20.12	9.64	15.84	15.82	15.78	9.54	15.00
Shirting(fine)	metre	4.80	5.20	4.25	6.50	4.27	5.25	6.00	6.65	2.02	2.94
Long cloth	"	3.13	5.00	3.00	3.70	3.15	3.90	2.40	3.00	2.10	2.95
Washing soap	cake	0.67	0.75	0.68	0.93	0.64	1.75	0.63	0.84	–	–
Toilet soap	"	0.75	1.00	0.72	1.00	1.00	1.00	0.73	1.00	0.72	0.92

Note: The price data presented in this table are based on data collected by the National Sample Survey Organization and are based on 36 quotations in respect of each of the commodities in the case of Bombay and Calcutta and 24 quotations in the case of other centres. The data for 1971 relate to averages for the month of May while that of 1973 relate to December (collected by our correspondent). For rural India, the data for 1973 relate to the averages for the month of October.

* Economic Times, March 28, 1974

values of the numbers. As a result one can directly compare the uneven-
ness in bits of different sets of numbers.

We computed 22 unevenness measures for prices in 1971 and 22 for
prices in 1973. We then computed the 1973:1971 price _ratios_, and computed
22 unevenness measures for these ratios. These are plotted separately in
Figure Ia, b, c. The high-variability commodities are specifically la-
belled. The rest fall below 1 on the scale.*

A low measure for a commodity in the price-ratio unevenness
scale means that the ratios town-wise for that commodity were quite simi-
lar. That is, the prices moved up by similar percentages in all the
places, broadly preserving any relative price differentials between towns
which might have existed earlier. On the other hand, a high measure of
unevenness in price ratios would mean that different cities suffered
markedly different price increases. On the 71 and 73 price scales, how-
ever, a high measure of unevenness in prices-themselves would be associated
with a commodity for which the market is less than perfect, as with Fish,
due to local peculiarities of demand and supply, storage difficulties, and
high costs of transport.

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*They are, in ascending order from least inter-city variation in price-
ratio to greater variation: Groundnut, Vanaspati, Gram, Sugar, Meat (goat),
Arhar (dal), Kerosene, Moong (dal), Toilet-Soap, Coconut, Fish, Gur,
Masoor (dal), bar soap.

Fig. I : Geographic Unevenness Measure

(a) Prices in 1971   (b) Prices in 1973   (c) Rates of Increase
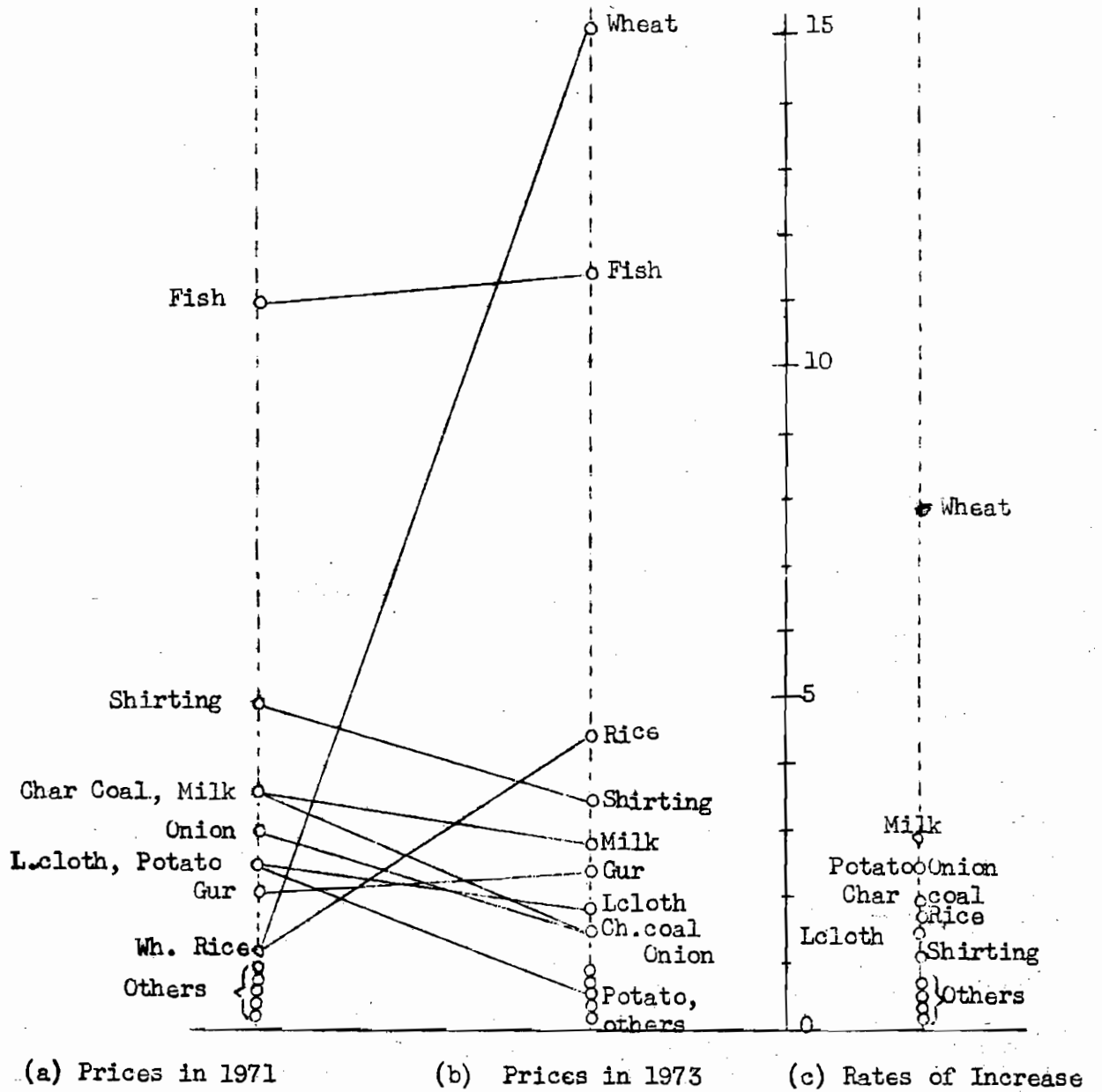
Let us look first at Figure 1c. Analysis of the unevenness in the price-
rises which were experienced at the 9 locations for the twenty-two commo-
dities shows that prices moved up by similar percentages in most of the
locations for 14 essential commodities. The increases in their prices
ranged from an average of 20% for bar soap to a uniform 100% + for sugar
and groundnut. This means that the geographic pattern of prices remained
similar in 1973 to those of 1971 for these commodities. Many of these
commodities are also those whose actual prices in 71 and 73 exhibitted
less unevenness.

On the other hand, great unevenness in the geographic pattern of
price rises occurred in wheat, milk, potato, onion, charcoal and rise.

LEVELLING-UP

Let us now look at Figure Ia & Ib. Along with a reduction in
unevenness of prices themselves, between 1971 and 1973 we might find con-
siderable unevenness in the price ratios for some commodities. Then we
would say that a 'levelling-up' of prices took place, with the initially
cheaper location having a higher price rise and the initially costly town
having a lower price-ratio. The overall higher price would pay for a
more effective balancing of supply and demand especially in high-demand
areas by covering movements from high-supply areas further away than before.
This can be seen to have happened in the case of potato and onion and milk
prices. In the case of potato prices, the differentials have lessened

dramatically, with the highest increases occurring in rural areas (and Kanpur). The levelling up of milk price probably reflects the increased movement of milk products rather than milk itself.

CHARCOAL

It is disturbing to notice, however, that charcoal prices also exhibit this 'levelling up' pattern, with the price in Bangalore and the rural areas going up the most. Since charcoal is not an agricultural commodity, this levelling-up of its price must mean that wood, from which charcoal is made, is getting scarce in rural and wooded areas. This is an ominous sign of a situation which will only get worse in geometric progression as time passes, because it is due entirely to population growth and the consequent deforestation.

RICE & WHEAT

Rice and wheat, on the other hand, behaved in a manner opposite to the other commodities. In both cases, there was a high degree of unevenness in the price-increases experienced in different towns. However, this unevenness was not due to a levelling-out of prices! In both cases, the unevenness was greater in 1973 than in 1971. Rice prices, for instance, were 3.7 times as uneven in 1973 as in 1971. Rice was subject to severe movement control in 1973.

A full measure of the dislocation of the supply and distribution system for wheat in the latter part of 1973 can be seen by assessing the

difference between the behaviour of wheat and rice prices. Wheat prices
were 1.1 times as uneven as rice in 1971. In December 1973, they were
3.4 times as uneven as rice prices. This amounted to a 11.1 times in-
crease in the unevenness of wheat prices themselves over these 30 months.
Thus far from a levelling out of wheat prices, the disorder increased.
The 1971-73 price-increases experienced in the towns for wheat were more
than twice as uneven as the price increases for milk (the next most vola-
tile item). These appear to warrant a further detailed look.

Unfortunately we do not have price data on other grains, so a com-
parative analysis cannot be made of wheat and coarse grains. Still, the
unique behaviour of wheat prices does suggest that the events of 1972-73,
including the wheat trade take-over, had a powerful establishing effect
on the price pattern of wheat, and one that was by and large not experien-
ced by other essential commodities.

Table II ranks the nine locations in descending order or December
1973 price, separately for wheat and for rice. Only Bombay and Ahmedabad
are to be found in the top half of both lists. Kanpur, in (the wheat sur-
plus & late of) U.P., however is at the bottom of both lists. (It is now
easy to see why wheat and rice might have a high rating on the "unevenness
of price" measure for 1973 since respectively they cost 1.58 and 1.64 times
as much in Ahmedabad as in Kanpur - compared with a less than 8% difference
in 1971.)

Ahmedabad and Bombay can be seen to have suffered the highest

Table IIa : Locations in Descending Order of WHEAT Prices (Rs/Kg) in
            December 1973. (All numbers are rounded off to 2 digits)

May 1971	December 1973	Ratio	Location
1.4	5.2	3.8	Madras
1.3	2.5	2	Bangalore
1	2.2	2.1	Bombay
1	2.1	2	Ahmedabad
1.2	2.0	1.7	Hyderabad
1	1.5	1.4	Delhi
1	1.5	1.4	Delhi
1	1.5	1.6	Calcutta
0.9	1.4	1.7	Rural Areas
1	1.3	1.4	Kanpur

Table IIb : Locations in Descending order of RICE Prices (Rs/Kg) in
            December 1973. (All numbers are rounded off to 2 digits)

May 1971	December 1973	Ratio	Location
1.9	3.5	1.9	Delhi
1.4	3	2.2	Ahmedabad
1.5	2.8	1.9	Bombay
1.2	2	1.6	Calcutta
1.3	2	1.6	Rural Areas
1.3	2	1.5	Bangalore
1.2	1.9	1.5	Hyderabad
1.3	1.8	1.3	Madras
1.4	1.8	1.3	Kanpur

PATTERN OF COMMODITIES AND LOCATIONS

Most food items experienced price increases of 30-80%; sugar doubled in price everywhere. Others were in between. In an attempt to clarify this picture, to find a pattern, we selected ten dry food items for closer study. A Guttman scale, Table III, was constructed from the price-increase matrix, where an X represents a price increase of over 75%. We took it that people would "feel the pinch" and react to the increase in price rather than just to high prices as such. The Guttman 'scale' is a clustering process which generates a heirarchy of towns and commodities in two dimensions. It is one of the 'parsimonious' data analysis tools mentioned earlier, for it enables quick focussing of attention on these situations which appear to be "Out-of-Kilter" in the full context. One of the 'exceptions' in the pattern are Potato prices where, as mentioned earlier, a strong levelling-up took place, at the cost of the rural areas and Kanpur. Other exceptions are the Madras and Bangalore wheat squares, and the Delhi rice square, which we can ignore as explained earlier. Otherwise we have a regular pattern - which throws into sharp relief the blank Kanpur rice and wheat squares. Bombay had had relatively high prices of lentils in 1971; this explains why the rate of increase was under 75% there. On the other hand, Kanpur wheat and rice prices were among the lowest in 1971.

We can see also that Calcutta and Delhi "suffered" less in these two years, in the sense that they experienced price increases in very few items. On the other hand, Ahmedabad saw large price increases in almost

felt rates of price increase for these two cereals. Wheat is not the common-man's food in Madras and Bangalore, just as rice is not in Delhi, so the high prices there do not concern this analysis.

T A B L E — III

Guttman—Scale Showing Food items & Regions
with price rise of over 75% in 1971-73

	Sugar	Onion	Gram	Moong	Wheat	Rice	Potato	Gur	Masoor	Arhar
Ahmedabad	x	x	x	x	x	x	·	x	x	
Kanpur	x	x	x	x	·	·	x	x		
Bombay	x	x	·	·	x	x				
Bangalore	x	x	x	x	x					
Madras	x	x	x	·	x					
Hyderabad	x	x	x	x						
Delhi	x	·	x	x		x				
Rural	x	x	x				x			
Calcutta	x	x	x							

all the foods listed. For more dramatic evidence, see Table IV, where only price increases of over 100% between May 1971 and December 1973 are taken into account. Calcutta suffered no price increase of over 100%, and Delhi only in sugar. Ahmedabad had five food items in which the prices doubled, including both wheat and rice.

A more detailed analysis, which includes more commodities, especially bajra and other wheat-substitutes, is needed before we can draw any firm conclusions from the type of analysis presented here. What we have does however support the view that there were basic economic, rather than merely political, reasons behind the anti-government upsurge in Ahmedabad and Gujarat in January and February of 1974, behind Bombay City election victory of the CPI candidate, Mrs R Deshpande, and also behind the relative quietness of Delhi, Calcutta and towns like Kanpur during the fateful winter of 1973-74.

Applications

The political economy of food in a developing country of India's physical size is too serious a matter to be left either entirely to market forces or to fixed and frozen positions taken by bureaucrats or political experts. A frequent, pattern-oriented analysis of the type conducted above can provide a continuous 'moving picture' of the price-stresses experienced

Table IV: Prices increases over 100% through December 1973 over May 1971

C	Sugar	Onion	Gram	Wheat	Rice	Moong	Masoor	Potato	Gur	Arhar
Ahmedabad	x	O	O	x	x	x	x	O		
Kanpur	x	x	x	O	O	O	O	x		
Bombay	x	x	O	x						
Madras	O	x	x	x						
Bangalore	x	x								
Rural	x	x								
Hyderabad	O	x								
Delhi	x									
Calcutta										

by the public* (with very little effort needed for data collection) before the populace takes to the streets.

Monitoring and policy analyses of other process variables in the social development or economic life of the country are also required, which are available quickly and which are less susceptible to data errors. Foreign trade, the Core Sector and Transportation are appropriate fields where today the conventional statistical or accounting information flows are so slow as to be of archival or judicial interest only. Much work remains to be done in linking policy studies and data analysis through proper selection of the analytic tools.

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*We should admit that items for which an open market does not exist, such as Kerosene and Vanaspati, are troublesome, since there the lack of a price rise does not signal a surplus of supply.

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Acknowledgements