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DATA SOURCE COMPARISONS FOR AGRICULTURAL PRICES. RICE PRICES FROM THE DEPARTMENT OF AGRICULTURAL MARKETING AND THE DIRECTORATE GENERAL OF FOOD.

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International Food Policy Research Institute (IFPRI)
Bangladesh Food Policy Project

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1. INTRODUCTION

Rice, wheat, and paddy prices are reported by two different institutions in Bangladesh. Both the Department of Agricultural Marketing (DAM) and the Directorate General of Food (DGF) collect and report weekly prices on these commodities for each of the 64 new districts (zilas).

A wide range of organizations, both domestic and international ones, use these price series, ranging from government to research. A need to have accurate and prompt information is strongly felt in order to improve policy decisions and monitoring. This is especially the case in the new environment characterized by active public support of the private sector. A reliable source of information on price signals is a *public good* that represents one of the most appropriate functions for the government.

However, very little is known outside DAM and DGF about the methodology used in collecting the price data, and about the relative properties of the series collected by the two institutions. Questions relative to their comparability arise, especially insofar as the series refer to the same commodity.

The objective of this paper is to present some information on the main issues involved in comparing and using the two sources of data. The special case of rice prices is considered. The organization is as follows. Section 2 reports about the methodology of data collection of the two agencies. Section 3 studies the time series characteristics of the two data sources. Section 4 gives some general properties that emerge from studying the percentage differences between the two series. Section 5 introduces a model of incentives to misreport prices. Section 6 gives the conclusions and some suggestions to improve upon the current system of data collection.

2. METHODOLOGY OF DATA COLLECTION

This section will summarize the main features of each data source (see table 1) and highlight the relative advantages and disadvantages (see table 2 an 3)

Methodology of Data Collection by DAM

The Department of Agricultural Marketing is engaged in market intelligence service, i.e. in the dissemination of the current price data over radio and newspapers for information of the growers, traders, and consumers. Market information is collected by the field staff of the DAM by visiting the markets, observing the actual transactions and discussing with the traders and growers operating in the markets.

District Marketing Officers in charge of districts report weekly wholesale and retail prices and other market information such as market arrivals for 68 important markets. Four Divisional Deputy Directors supervise the work of the District officers and verify the information supplied by them. Weekly wholesale and retail prices of about 200 items of farm products are collected from 82 important centers of which 64 are district headquarters markets and 18 are markets of national importance outside the district headquarter.

Price data and other market information is collected by the Marketing Officers from their assigned markets by visiting the same on every Wednesday or last market day of the week. Prices prevailing on that particular day are collected and reported in a prescribed form. In the case of Dhaka market the average of six working days prices are quoted as the weekly average price worked out from the Daily Price Bulletin of Dhaka market. Wholesale prices of some items like paddy, jute, oil seeds, pulses, etc. which may not be available in the daily wholesale market, are collected on the weekly 'hat' (market) day either in the headquarter market or in the neighboring rural markets. The reporting staff collect the price information by interviewing at least 3-6 wholesalers/aratdars/beparis of each item. They are also required to observe actual transactions of each item to verify the prices reported by the traders. The reporting staff are frequently confronted with difficulties in quoting prices especially of rice, paddy, etc., because of the presence of different varieties and qualities of each item. To cover all prices prevailing at a particular day (Wednesday or last weekly market day) the reporting staff quotes the lower and upper range of prices of a particular item (variety-wise); they also quote the simple arithmetic mean from the range.

The weekly statements report market arrivals of major items, such as paddy, rice, wheat, pulses, oilseeds, which are estimated in consultation with the growers and sellers, with various types of middlemen such as beparis, wholesalers, aratdars, and visual observations. The weekly price statements are sent by ordinary mail to the Research Officer in charge of the weekly price bulletin in the national headquarter. The information contained in the price statement are checked in Dhaka headquarter for cases of abnormal variation of prices from the previous week. Attempts are made over telephone or by writing letters to get suitable clarifications. After the clarifications are obtained, the prices are compiled and the weekly Bulletin is issued by the concerned officer. The bulletin contains the un-weighted average wholesale price of 120 major agricultural items.

There are several nice features of the DAM source (see table 2). First, this is the only data set available in Bangladesh, on comparable agricultural commodities, for quite a long period of time. The methods of data collection have been consistent throughout this period. Second, the disaggregation in terms of commodities is considerable; especially for rice there is a clear attempt to capture various qualities. Third, this office has been involved in this data collection activity, since its inception. Human capital has been accumulated in the process, even though still enormous work has to be done, in view of the advance in information technologies. Fourth, there is no incentive at misreporting, since the agency responsible for this data collection is not directly involved in operations prone to rent seeking activities. Moreover, even though the pay for the field officers is not high, the amount of work requested is not excessive, and it is well defined, so that sloppiness and inaccuracy are negligible. Fifth, the prices series compiled by DAM go back in time until the early 1970's. It is possible to dig at least 20 years of weekly data at Zila headquarter level, for the most important commodities. Finally, the cost of operations is quite low, since it has involved a minimum of technology and working expenses.

There is a number of disadvantages, however. First, the prices are basically urban prices. There is not a consistent series of rural prices, because the visits of field officers to rural markets are limited by the unavailability of resources. Second, the information is not made available quickly

enough to be relevant for policy monitoring of short term price movements. More than two weeks are usually necessary to know what has happened to prices overall the country. This is a consequence of the system not being automated. The absence of automation also makes the detection of missing values and outliers extremely difficult. Finally, it is not clear the rationale behind the current practice of reporting only maximum and minimum prices, and their average. Since field officers do visit to different shops, getting a maximum and minimum price for each shop, they should use all this information. It would be less prone to error to take the mean of the average prices, as quoted by each shop, or, if possible, the weighted average, with the weights given by the actual sales.

Methodology of Data Collection by DGF

Thana Controller of food collects maximum and minimum prices of rice, paddy, wheat, atta, sugar, salt, and edible oil by visiting major markets under his jurisdiction throughout the week and report to district controller of food on or before the first day of the following week. District Controllers of Food compile all data received from different thanas and by doing simple average they report in prescribed form the district level price data on or before the third day of the week to regional Controller of Food in division level. In the fourth day the district level data are entered into computer diskettes. The diskettes with hard copies are sent to the Management Information System (MIS) of DGF on or before the fifth day of week. MIS of DGF publishes District level weekly Public Food Distribution System (PFDS) activity data (stock, procurement, etc.) with district level open market price (maximum and minimum) of rice, paddy, wheat and atta. MIS of DGF maintains database and hardcopy of price and other data for future reference.

Most of the advantages inherent in the DGF data depend on the availability of a computerized information system that allows prompt availability of information, a negligible amount of missing values and outliers, and a good dissemination system. Moreover, the logistic support available to the DGF, involving transportation and communication facilities, and the Management Information System allows to obtain a massive amount of information on grains in a short period of

time. Finally, because of the way prices are collected, that is mostly in rural markets, at Thana level, the DGF prices are probably the only proxy for rural prices of foodgrains, on a consistent basis for the last 5 years.

These positive aspects are balanced by a few disadvantages. First, there is a high cost of maintenance of the system, not possible for many other government agencies in Bangladesh. Second, since price collection is just one among many tasks of the DGF officers, they are less likely to be accurate. Finally, it may be the case that some incentives to misreport are built in the system. Since the same reporting officers are either directly or indirectly responsible for the management of food operations, this concentration of function in the same officer is a source of rent seeking activities.

3. ANALYSIS OF DATA WITH MISSING OBSERVATIONS

The analysis of DGF and DAM prices is complicated by the presence of missing data, and outliers. This problem is particular severe for DAM data. For some important markets, data on rice prices are missing inexplicably. Not only the weekly bulletin reports often fail to report these data, but also the research compilation bounded books, compiled at the end of the month and which constitute the most complete and reliable source of price data of the DAM, are of only limited help in cleaning the series. The important market of Bogra, for example, has missing data for coarse rice AMAN of 1991/92. This is the case for other districts in Rajshahi region as well, even though Aman rice is actively traded. From this point of view, DGF data are much more consistent source of information, as a result of the use of a Management Information System.

Many missing data were encountered in the DAM data set. A *fitting procedure consisting of three steps* was used to arrive at a data set of wholesale coarse rice price (see also Goletti and Naser 1993 for an application of the same procedure). The fitting procedure outlined below is an initial attempt to produce a unified weekly price time series at district level for Bangladesh. In the first step, four rice prices series compiled by the Department of Agricultural Marketing were considered: Aman HYV, Aman local coarse, Aus HYV, and Boro HYV. For each series a linear interpolation

of missing data was used whenever no more than 4 consecutive weeks were missing. In the second step, the four weekly series were put together to create a series of weekly coarse prices. For each week of the year, the minimum price available among the four series was chosen. In the third step, a new interpolation of missing data, as in the first step, was undertaken on the series constructed in the second step.

Even after applying such a fitting procedure, the number of missing data for DAM prices is considerable (see table 4). However, it is possible to start to conduct some analysis based on those observations that are not missing.

For each of these markets, a simple procedure of computing trends and seasonality around trend was undertaken. The symbols τ^{DAM}_{it}, τ^{DGF}_{it} refer to the quadratic trends for DAM and DGF prices of market i, respectively. A correlation between these two trends will give an indication of the *congruence* of information obtained by the two data sources. Similarly, let σ^{DAM}_{it}, σ^{DGF}_{it} be the seasonal factors (there will be 52 for weekly data) obtained by averaging deviations around the trend for the two data sources. Again, the correlation between the seasonal factors will give an indication of the congruence of information. The results are reported in table 5. The main conclusion is that whereas trends are highly correlated, with an average value of 96.1, the seasonal congruence is only about 49.5 percent. When similar congruence of trend and seasonality is undertaken for average weekly prices, that is with the means DAM_t and DGF_t of the DAM and DGF prices, where the means are taken over the various markets, the congruence is even higher, respectively 98.7 percent and 80 percent, as also visualized in figure 1.

Therefore, contrary to largely accepted wisdom, both DGF data and DAM data are relevant sources of information about prices of foodgrains in Bangladesh. If, as sometimes is claimed, there are incentives to mis-report, then these incentives are quite difficult to detect just by looking at the analysis of seasonality and trend. The general characteristics of trend and seasonality seems to be common to both sources, suggesting that the consequence of misreporting in terms of the analysis of price series is quite limited.

4. DIVERGENCES BETWEEN THE TWO SOURCES OF DATA

Let us denote by DAM^i_t the price of rice at week t in district i, as obtained by DAM; DGF^i_t denotes the price of rice at week t in district i, as obtained by DGF. We are interested in understanding the difference between DAM and DGF. In order to study this problem let us consider the percentage difference

$$\delta^i_t = (DAM^i_t - DGF^i_t)/DGF^i_t \qquad [1]$$

As seen in a previous section, DAM prices represent a proxy for urban prices in the district, and DGF prices represent a proxy for rural prices in the district.

On average, we would expect urban prices to be higher than rural prices, given that most of rural Bangladesh is producing rice.

$$(\Sigma_i \Sigma_t \delta^i_t)/(I \cdot T) > 0 \qquad [2]$$

where I is the number of non missing districts and T is the number of non missing weeks.

However, the divergences between DAM and DGF prices may change over time. During periods of crises, such as floods, and other natural calamities that affect the supply of rice, rural markets may be even more severely affected than urban markets. The reason is that in rural areas there is generally less market integration and government support than in urban areas. During such periods, *rural prices may be consistently higher than urban prices.*

Table 6 and figures 3 and 4 help to understand what has happened in Bangladesh in the past four years. First, the average price divergences between the two sources are not significantly different from zero, both for the overall period and for each of the five years in the sample. However, the major floods that have occurred in 1987/88 and 1988/89, just before the Boro crop, are reflected in the troughs of the difference between DAM and DGF prices. The crisis is highlighted by a shooting

up of rural prices (proxied by DGF prices) that brings down the price divergences. Rural prices were about 15 percent above the urban prices during this period. As the crisis subsided, the divergences became mostly positive, especially at the beginning of fiscal year 1990/91, when an extraordinary Boro production took place.

Apart from movement above and below the trend, we expect also some *normal seasonal movement* of the divergences δ. While after harvest we expect rural prices to fall more than urban prices, during the lean period we expect rural prices to increase by more than urban prices. The seasonal movements of δ around the trend confirm these intuitions. In fact, as figure 4 shows, the seasonal peak occurs during the boro harvest with a 4 percent movement above trend, and the trough is before the boro harvest with a 5 percent fall below trend.

5. MISREPORTING

It is often heard that DGF data are not good because there are incentives to misreport. A recent field visit conducted in the month of February and March 1993 in over 25 districts all over the country (see Goletti 1993) leaves quite unclear about the rationale for misreporting. Respondents gave often contrasting explanations, when asked about incentives to misreport on the part of DGF.

As an example of the flavor of explanations presented by some respondents, we report the case of price mis-reporting in conjunction with Open Market Sales (OMS).

i) DGF tends to over-report prices during lean periods, in order to distribute more OMS.

ii) DGF tends to under-report prices during lean periods, because it can impute bigger losses.

iii) DGF tends to under-report prices after initial OMS have been distributed, to claim success of operations.

iv) DGF tends to over-report prices so that bigger future allocation of public distribution.

A similar array of contrasting explanations was given for harvest periods. If there is an incentive to misreport, it is quite complicated to detect, as the analysis of trend and seasonality of specific districts conducted in the previous section has shown. Moreover, a rational misreporting

officer will have to solve a complicated problem, that may not be worthwhile undertaking, since there are generally simpler ways of rent seeking activities.

Let us denote by Q the quantity of grains that is either distributed or procured by the Government, as part of its overall stock policy. The assumption is that Q is affected by the reporting agency, namely by DGF. The gain from misreporting is proportional to the market value of the quantity Q. If P is the true price, then DGF is able make a profit equal to a fraction α of the value P•Q. However, this misreporting has some costs. Misreporting will be penalized and will also become more apparent according to the extent of the divergence between the true price P and the reported price P_r. Let us denote this penalty by $\pi(P-P_r)$. Moreover, the reported price will affect the quantity Q and, indirectly, the true price P. If Q refers to public offtakes, then we may assume that Q is an increasing function of the reporting price, because the government will try to stabilize price by releasing grains in the market. If Q refers to domestic procurement, then Q will be a decreasing function of the reported price, signifying an attempt by the government to support prices.

The model can then be formalized as follows

$$\max_{\{P_r\}} \quad \text{Rent} = \alpha \cdot [P_t \cdot Q - \delta(P - P_r)] \qquad [3]$$

such that

$$Q = \phi(P_r) \qquad [4]$$

and

$$Q = \psi(Q) \qquad [5]$$

The functions ϕ refers to the response of the policy intervention Q to the reported price P_r. If Q refers to procurement then this function is decreasing, that is $\phi' < 0$; if Q refers to offtakes, then this function is increasing, that is $\phi' > 0$.

The function ψ refers to the response of market price P to the policy intervention Q. If Q refers to offtakes then this function is decreasing, that is $\psi' < 0$; if Q refers to procurement, then this function is increasing, that is $\psi' > 0$.

The first order conditions, are given by:

$$\psi \cdot \phi' \cdot' + \psi \cdot \phi' = \pi' \cdot [\psi' \cdot \phi' - 1] \qquad [6]$$

which can be interpreted as the equality of the marginal benefit and the marginal cost of misreporting. Misreporting will both affect the quantity Q, and the true price P. The effect on the price will be countercyclical though. As an example, if Q refers to offtakes, then an over-reporting of true prices (that is $P_r > P$) will increase offtakes, suggesting more opportunities for rent. At the same time, it will put a downward pressure on market prices, lowering the marginal value of the rent.

It is clear from the previous model of behavior of the hypothetical misreporting agency that if Q refers to offtakes than the correlation between $(P - P_r)$ and Q is negative. An increase in Q triggered by an increase of P_r will put a downward pressure on the price P, lowering the gap between P and P_r. Similarly, if Q refers to procurement, there is a positive correlation between $(P - P_r)$ and Q.

What evidence can be obtained about the possibility of misreporting on the part of DGF? First of all let us try to study how both procurement and offtakes are related to the two price series. Both offtakes and procurement are a function of market prices. Offtakes are expected to respond positively to current prices, whereas procurement is expected to respond negatively (see Goletti 1993). How does the response vary between the two data sets?. An analysis of this questions leads to the estimation of offtakes and procurement equations as a function of seasonal factors, prices and lagged values of the variable under considerations. The results are reported in table 7. The main conclusion is that *both offtakes and procurement react more strongly to DGF data than to DAM data*. This indicates that the link between reporting agency and policy implementation is a possible source of misreporting.

If we assume that the DAM price are closer to the "true" prices than DGF prices, then the divergence between DAM and DGF prices can be related to both procurement and offtakes, to test the hypothesis of misreporting. From the discussion above, we expect is that there must be a positive correlation between these divergences and procurement, whereas the correlation is expected to be

negative between divergences and offtakes. The results are reported in table 8. The regression shows significantly positive coefficients for the offtakes, and not significatively different from zero coefficients for procurement, suggesting that some misreporting is more likely to be induced by distribution of public foodgrains than by domestic procurement activities.

6. CONCLUSIONS AND SUGGESTIONS

The main conclusions of this paper follows.

1. Both DGF and DAM data supply relevant information about the rice prices in Bangladesh. To a large an extent the information provided by each series is *complementary* to the other. Whereas the *DGF data are more representative of rural markets, the DAM are more representative of urban market.* Within the current state of information about prices in Bangladesh, DGF and DAM data are the only available source of information to study the price relation between rural and urban markets of foodgrain in Bangladesh.

2. The difference between DAM and DGF prices exhibits a *seasonality* highlighting the fact that during the lean season, rural prices increase by more than urban prices, whereas during harvest season, rural prices decrease by more than urban prices. The hypothesis of a constant relation between DAM and DGF prices could not be accepted.

3. The argument that there are incentives to misreport on the part of an agency that is responsible for both price collection and the implementation of programs that depend on the price information reported was spelled out. Some evidence in support of a misreporting hypothesis was provided. However, the extent of misreporting is likely to be negligible, since the congruence analysis of trend and seasonality suggests that both sources are consistent with each other.

We conclude highlighting some suggestions for both organizations. First, the DAM needs to introduce a computerized information system that would allow to process information more promptly and accurately than what is done at present. Second, as the leading agricultural price collection agency in Bangladesh, DAM needs to collect information at rural markets in a consistent

way. That will imply the availability of resources to field officers to make periodic field trips to Thana headquarters. Third, both agencies need to be collecting more accurate prices, reporting not only the ranges between maximum and minimum, but an indication of the prices of the commodity mostly traded, or a weighted average, with an explicit methodology spelled out. Fourth, the DGF needs a more consistent way to collect data at Thana level, separating the task of price collection from other tasks of the collecting agent. The information collected at Thana level should also be maintained in some form, allowing later checking. Fifth, given that the DGF has access to the Management Information System, it is appropriate to expect to develop formal method for data diagnostics, using available computer software.

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Table 1_ Methodology of Data Collection for weekly agricultural prices

	DAM	DGF
# of Markets	82	64
Number of Commodities	170-200	4 (rice, paddy, wheat, atta)
Stage of marketing	Wholesale, retail, zila level	Hat price at Upazila level
Number of Visits	3-6 shops, once per week	"Several", within the week
Day of Visit	Every Wed. or last hat day	Not specified
Method of Transmission to headquarter	Mail	Special Messenger from Upazila to Zila, and from Zila to Division Headquarter, then messenger with diskette and hardcopy to Dhaka Headquarter
Time needed to publish report	2-3 weeks	7 days
Monitoring Method	Manual check of abnormal variation	District level: manual check; Divisional level: PC entry
Price Reported	Min, Max, and Average of the min and max	Min, Max
Data Base Maintenance	Hardcopy	Hardcopy + Computerized Database
Manpower	64 zilas headquarter officers 4 Division Directors 15 officers Dhaka office	460 Thana inspectors + 64 Zila Inspectors + 12 Division level staff + 4 National level staff
Number of Hours spent by the responsible officer in data collection and compilation activities	4-5 hours/day-officer at zila level	1-2 hours per day per UZ officer

Table 2__ Advantages and disadvantages of the DAM data source

DAM PRICES

ADVANTAGES

1. Consistent series of prices at urban areas (zila headquarters)
2. Disaggregation by crop, and variety.
3. Specialization in data collection.
4. No incentive at misreporting.
5. Long time series available.
6. Low cost of operations and maintenance.

DISADVANTAGES

1. No consistent data on rural prices.
2. The information is not prompt.
3. Many missing data.
4. Insufficient monitoring mechanism to detect missing and outliers.
5. The system is not automated.
6. The average price reported is average of Max and Min, not necessarily reflecting most representative price.

Table 3__ Advantages and disadvantages of the DGF data source.

DGF PRICES

ADVANTAGES

1. Prices are more indicative of rural markets (Thana level).
2. Prompt availability.
3. Good logistics support (transportation, communication, and MIS).
4. Good dissemination system.
5. Negligible amount of missing and outliers.

DISADVANTAGES

1. Only minimum prices and maximum prices are reported.
2. Price collection is just one among many tasks of the officer.
3. Indirect incentives to misreport.
4. High cost of maintenance.

Table 4 __ Missing Data of the DAM and DGF data sets, after fitting procedure.

DISTRICT	Missing data in DAM series	Missing data in DGF series
DINAJPU	41	0
THAKURG	57	0
PANCHAG	22	0
RANGPUR	36	0
LALMONI	48	0
NILPHAM	17	0
KURIGRA	30	0
GAIBAND	0	0
BOGRA	12	0
JOYPURH	9	0
RAJSHAH	8	0
NOAGAON	11	0
NATORE	5	0
NAWABGO	8	0
PABNA	7	0
SERAJGA	14	0
KUSHTIA	18	0
CHUADAN	0	0
MEHERPU	12	0
JESSORE	41	0
JHENAID	0	0
MAGURA	0	0
NARAIL	0	0
KHULNA	0	1
SATKHIR	31	1
BAGERHA	22	1
BARISAL	5	1
JHALOKA	6	0
PIROJPU	8	0
BHOLA	14	0
PATUAKH	16	0
BARGUNA	9	0
MYMENSI	0	0
NETROKO	0	0
KISHORE	0	0
JAMALPU	0	0

DISTRICT	Missing data in DAM series	Missing data in DGF series
SHERPUR	6	0
TANGAIL	0	0
FARIDPU	0	0
RAJBARI	34	0
MADARIP	9	0
GOPALGO	12	0
SHARIAT	0	0
DHAKA	8	0
GAZIPUR	21	0
NORSHIN	0	0
NARAYAN	4	0
MUNSHIG	6	0
MANIKGO	7	0
SYLHET	9	0
MOULVIB	8	0
HOBIGON	16	0
SUNAMGO	24	0
COMILLA	26	0
B.BARIA	10	0
CHANDPU	34	0
NOAKHAL	23	0
LAKSHMI	102	0
FENI	6	0
CHITTAGO	17	0
COX'SBA	20	0
RANGAMA	25	0
KHAGRAC	85	0
BANDARB	85	0

Table 5 __ Congruence of trend and seasonality of the DAM and DGF data sets.

DISTRICT	Correlation between Trend	Correlation between Seasonality
DINAJPU	99.7	38.9
THAKURG	100.0	86.1
PANCHAG	91.4	33.4
RANGPUR	99.4	57.6
LALMONI	99.4	76.5
NILPHAM	98.2	64.8
KURIGRA	77.0	44.1
GAIBAND	99.8	68.6
BOGRA	97.0	61.1
JOYPURH	99.5	51.3
RAJSHAH	99.3	18.2
NOAGAON	100.0	58.2
NATORE	99.9	35.5
NAWABGO	99.8	49.4
PABNA	99.7	63.4
SERAJGA	100.0	64.8
KUSHTIA	99.9	57.3
CHUADAN	99.7	69.8
MEHERPU	99.0	82.6
JESSORE	90.1	78.2
JHENAID	97.8	83.1
MAGURA	98.6	66.5
NARAIL	92.5	35.7
KHULNA	99.9	56.0
SATKHIR	99.9	56.7
BAGERHA	99.9	50.1
BARISAL	73.1	49.6
JHALOKA	95.2	47.8
PIROJPU	98.8	15.6
BHOLA	94.7	50.2
PATUAKH	81.8	28.1
BARGUNA	69.5	65.6
MYMENSI	99.8	60.8
NETROKO	96.2	77.2
KISHORE	98.1	62.1

DISTRICT	Correlation between Trend	Correlation between Seasonality
JAMALPU	99.4	67.9
SHERPUR	99.8	56.9
TANGAIL	97.1	28.6
FARIDPU	99.8	67.7
RAJBARI	88.3	69.1
MADARIP	97.2	58.9
GOPALGO	82.6	41.4
SHARIAT	97.2	51.3
DHAKA	96.3	57.9
GAZIPUR	98.5	28.3
NORSHIN	100.0	30.5
NARAYAN	100.0	16.5
MUNSHIG	95.9	46.4
MANIKGO	94.7	30.7
SYLHET	99.7	25.3
MOULVIB	98.5	42.9
HOBIGON	99.7	64.9
SUNAMGO	99.6	50.5
COMILLA	90.8	21.4
B.BARIA	100.0	76.5
CHANDPU	98.3	16.6
NOAKHAL	92.3	29.0
LAKSHMI	89.5	24.0
FENI	99.8	57.8
CHITTAGO	99.0	51.4
COX'SBA	98.9	64.6
RANGAMA	97.6	22.9
KHAGRAC	99.4	-12.7
BANDARB	97.6	16.4
Average	96.1	49.5
δ_1	98.7	80

Table 6__ Average and Standard deviation of deviations between DAM and DGF.

Year	Yearly average of δ^1_t (percent)	Yearly standard deviation of δ^1_t (percent)
1987/88 to 1991/92	1.44	5.53
1987/88	-1	4.49
1988/89	-0.25	2.91
1989/90	1.2	5.51
1990/91	0.98	1.99
1991/92	3.01	1.17

Table 7__ Offtakes and procurement equations.

	OFFTAKE EQUATION				PROCUREMENT EQUATION			
	DAM		DGF		DAM		DGF	
	Coefficient	T-statistic	Coefficient	T-statistic	Coefficient	T-statistic	Coefficient	T-statistic
Constant	215.4	0.9	-372.2	-1.4	-24.5	-0.1	635.5	1.2
August	212.2	1.9	193.0	1.8	75.6	0.3	69.9	0.3
September	562.1	5.1	537.2	5.0	292.9	1.3	313.3	1.5
October	578.9	5.3	521.4	4.8	234.0	1.1	223.8	1.0
November	-688.3	-6.2	-677.9	-6.3	535.4	2.4	553.5	2.6
December	-618.1	-5.6	-610.0	[illegible]	1612.6	7.3	1604.8	7.5
Janauary	809.3	7.4	800.0	7.4	416.6	1.9	412.4	1.9
February	5.4	0.0	-7.3	-0.1	28.1	0.1	70.7	0.3
March	-158.7	-1.4	-198.4	-1.8	231.9	1.0	283.6	1.3
April	-773.2	-6.9	-838.7	-7.5	876.7	4.0	995.3	4.5
May	-621.4	-5.7	-623.9	-5.7	1766.9	8.1	1773.6	8.2
June	-952.8	-8.7	-976.2	-9.1	1751.6	8.0	1796.8	8.4
Price	0.2	0.7	0.8	2.9	-0.4	-0.8	-1.1	-2.0
Lagged dependent	0.9	147.2	0.9	149.8	0.7	57.3	0.7	57.9
Valid Cases	3603		3776		3603		3776	
R^2	0.86		0.86		0.50		0.50	
Durbin-Watson	2.31		2.32		1.73		1.69	

Table 8 __ Misreporting equation

Independent Variable	Coefficient	T-statistic
Constant	0.0	8.3
August	-0.0	-1.9
September	-0.0	-3.7
October	-0.0	-4.0
November	-0.1	-8.8
December	-0.0	-5.1
January	-0.0	-4.6
February	-0.0	-4.9
March	-0.0	-5.3
April	-0.1	-10.6
May	-0.1	-9.9
June	-0.0	-4.4
$\delta_{i,t-1}$	0.6	40.6
Procurement	0.0	0.4
Offtakes	-0.0	-2.3
Valid cases	3530	
R^2	0.37	

FIG.1__ DAM and DGF PRICE TRENDS

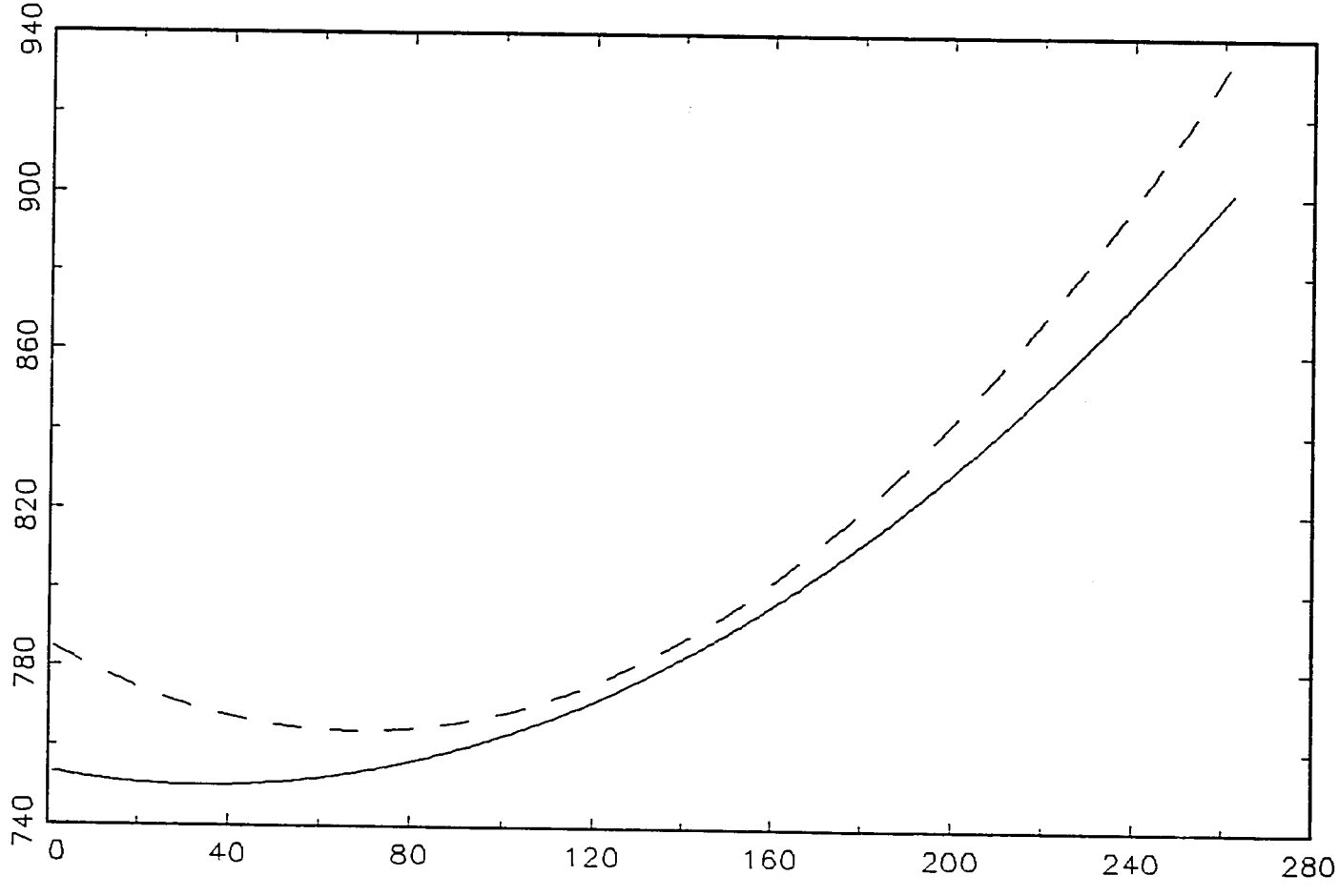

FIG.2__ DAM AND DGF PRICE SEASONALITY

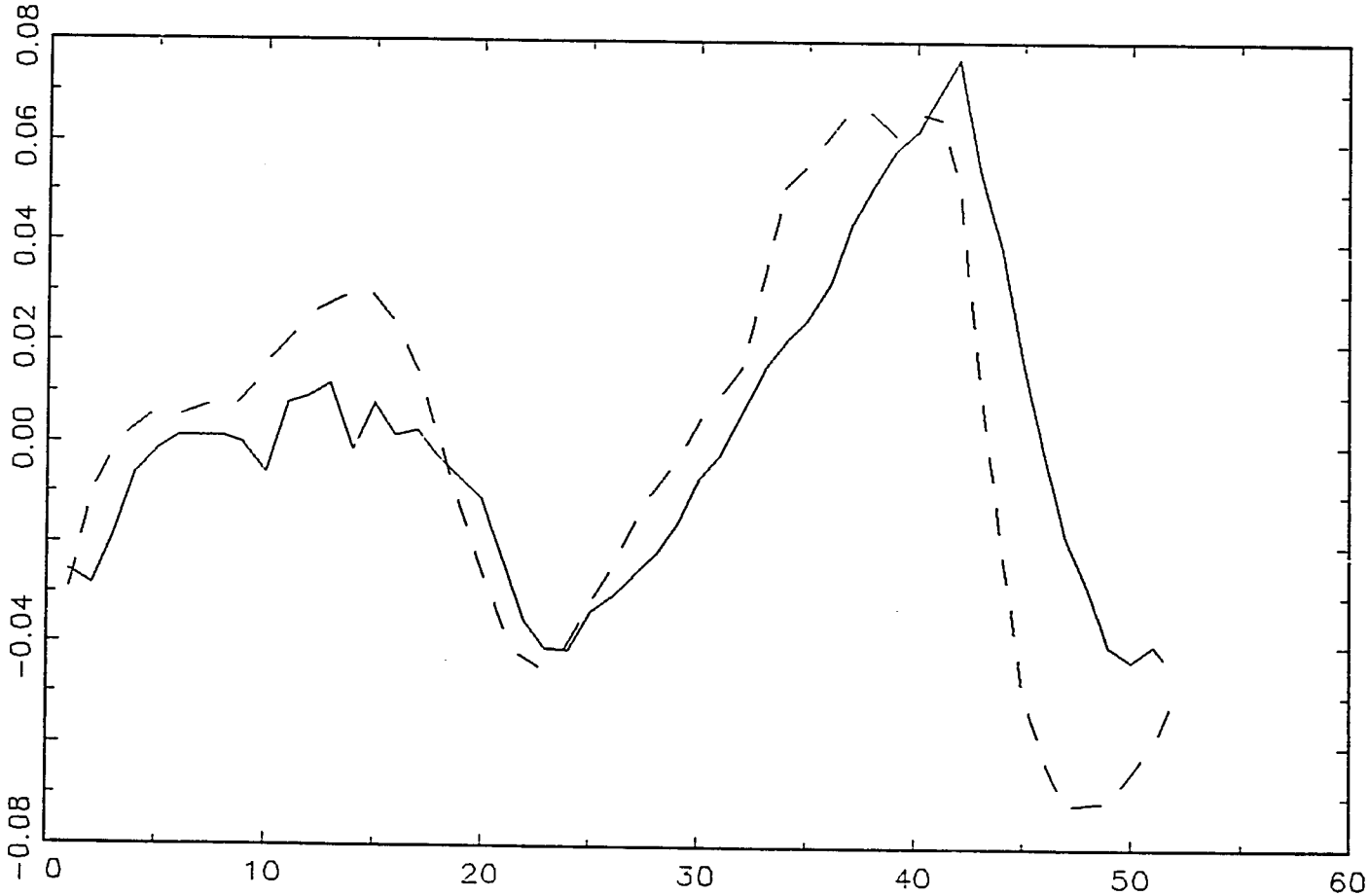

FIG. 3__ % DIFFERENCE BETWEEN DAM AND DGF PRICES

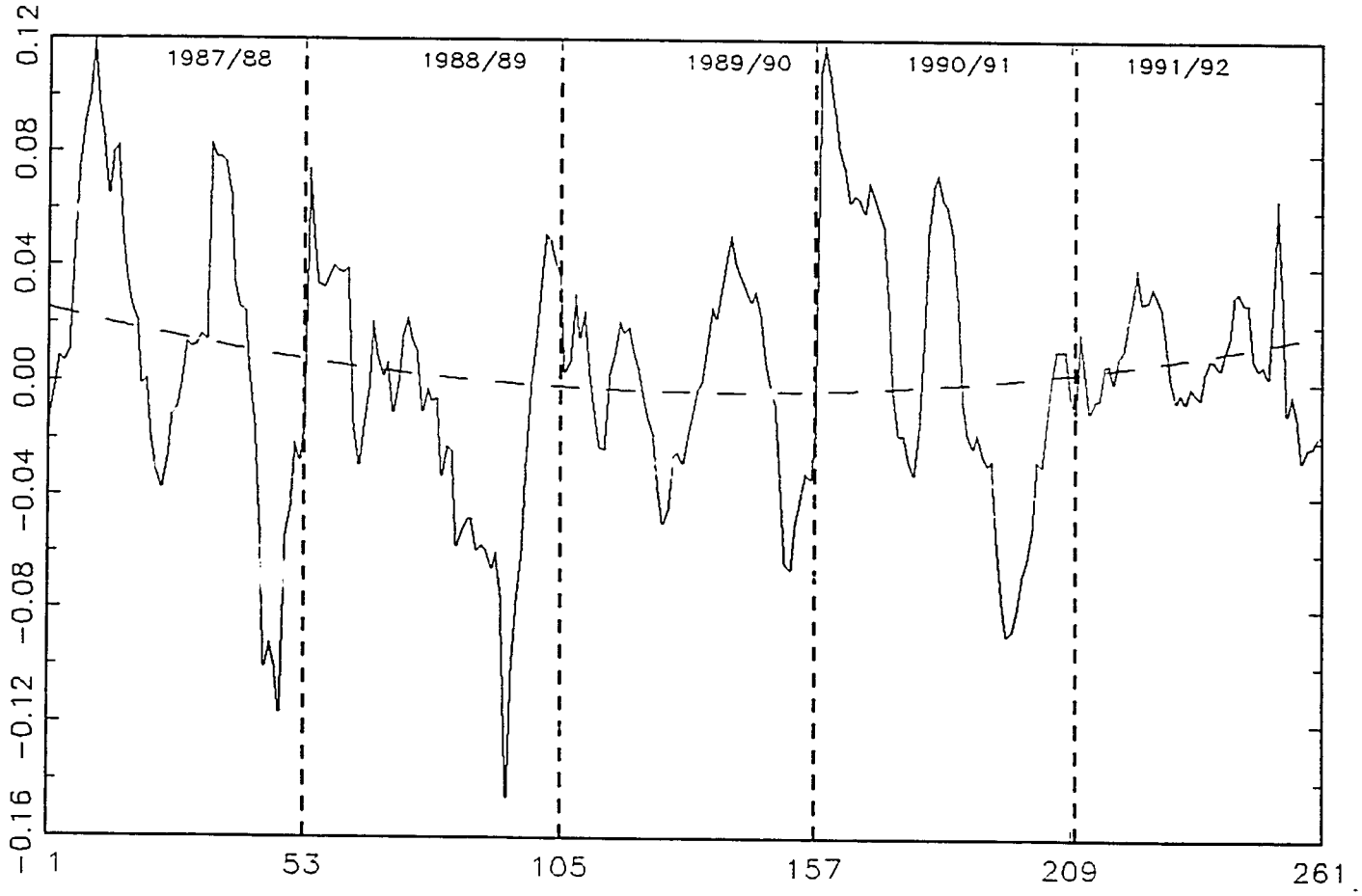
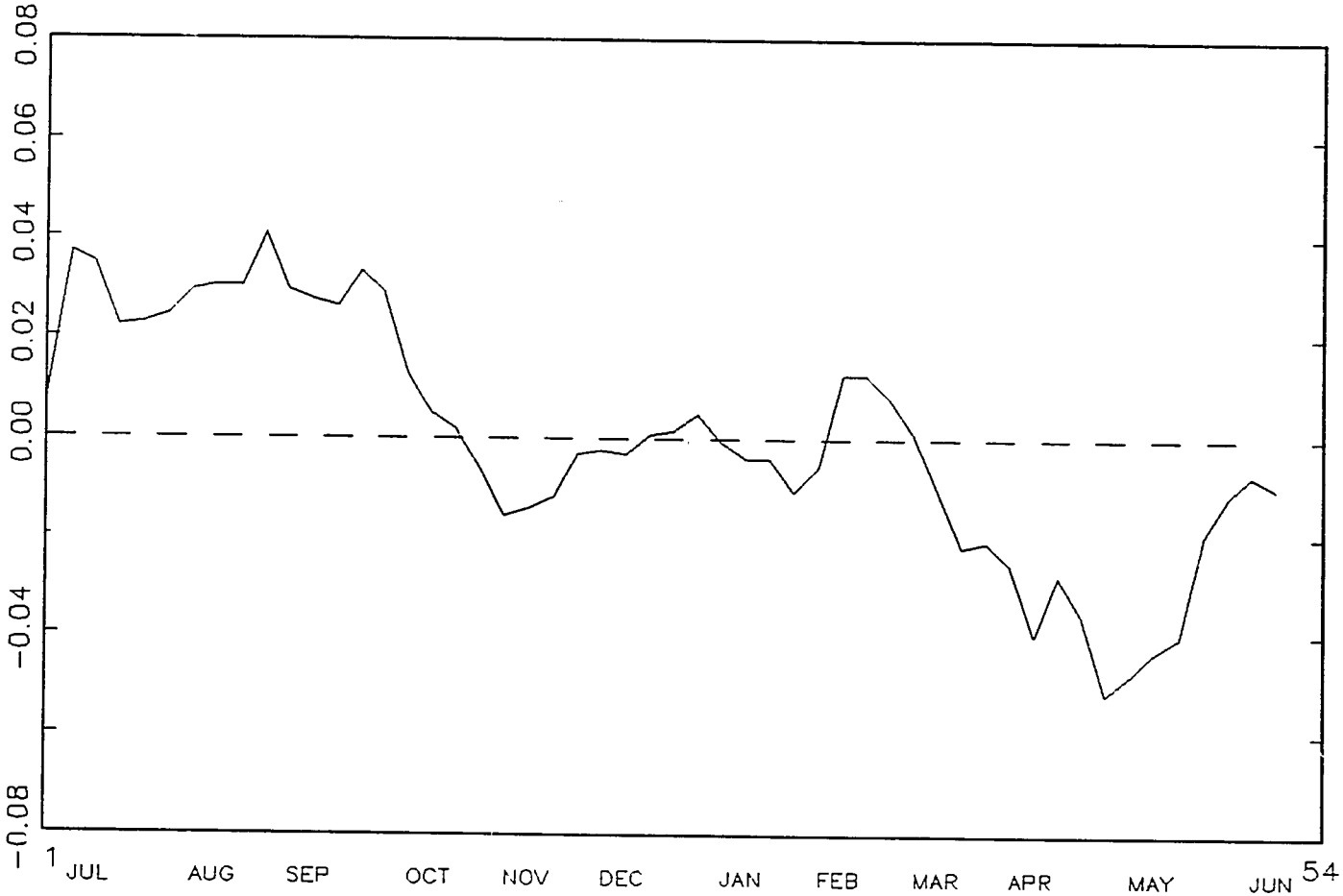
FIG. 4__ SEASONALITY OF DIFFERENCES BETWEEN DAM AND DGF PRICES