Cross-Validation of production and consumption data of fruits and vegetables

Bedi, Jatinder

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There are wide discrepancies in the available data on estimates of production of fruits and vegetables, fresh (unprocessed) and processed, on the one hand, and their consumption, on the other. The comparison of production and consumption data (in terms of quantity and value) shows that the main causes of the discrepancies are the very high farm gate prices used for the valuation of fresh fruits and the overestimation of the quantum of fruits production. With revisions in prices and quantities, this paper re-estimates the total value of fruits production at the farm gate/ex-factory price as well as the share of processing in the production (processed and unprocessed) of fruits and vegetables. The quantity estimates turn out to be 46.6 per cent of the original estimates and the value of fruit production is 19.9 per cent of the original unrevised estimates.

JATINDER S BEDI

The Indian statistical system has, over the years, built an elaborate statistical infrastructure to capture a wide variety of data on production of commodities and their use in the economy. On the supply side of agricultural commodities, statistics of crop production – both area and yield – are based on scientifically designed methodologies. These designs have evolved through considerable experimentation over the years and discussions among scholars of international repute.[1] On the demand side, estimates of households' final consumption are available from the household consumption expenditure survey (HCES) of the national sample survey organisation (NSSO). The major problem, in this context, relates to the widening divergence between the estimates of private final consumption expenditure (PFCE) of fruits and vegetables derived by the central statistical organisation (CSO) from the estimates of production and the estimates of household consumption based on HCES.[2]

This study is essentially an attempt to make a comparison of production statistics with consumption estimates. The validation of estimates attempted in this paper rests on the basic identity representing the product flow relative to fruits and vegetables. Out of the total production of fruits and vegetables, a part goes as input or intermediate consumption for processing in manufacturing sector and another to hotels and restaurants. The final domestic consumption of fruits and vegetables consists of consumption by households of fresh or unprocessed fruits and vegetables, the processed fruits and vegetables that are the output from manufacturing and fruits and vegetables served in different forms in hotels and restaurants and consumption by the government and non-profit institute serving household sectors (NPISHs). The present study sets the estimates of production of fruits and vegetables (on the supply side) against the estimates of fresh fruits and vegetables consumption in household sector, intermediate consumption of fruits and vegetables in manufacturing and hotel and restaurants and net exports (on the demand side) to examine their validity.

To put the present study in the perspective of earlier attempts, a brief review of literature on the subject is undertaken in Section I. The analysis to cross validate the data on production and consumption of fruits and vegetables products in this study is undertaken in terms of quantity, value and per unit values. The method is described in some detail in Section II on methodology. Section III contains an analysis of data on fruits and vegetables for year 2000-01. The year 2000-01 is chosen as it is the latest year for which data on the unorganised manufacturing sector is available. Moreover, this is very close to 1999-2000 for which NSSO and household consumption data are available. The paper closes with some concluding remarks in Section IV.

I
Review of Literature

The national accounts statistics (NAS) are compiled using various sources of data that are generated by using disparate statistical methodologies. In particular, the estimates of PFCE that are derived as they are from the estimates of production are subject to many potential sources of error. Moreover, the estimates of household consumption obtained from the HCES have their own limitations. There exist several studies on these issues. Most of these studies are essentially concerned with the comparison of the estimates of PFCE compiled from the production data collected by the CSO, with the set of estimates of household consumption expenditure available from the HCES. Some of the findings of the more recent among these studies are briefly discussed below.

The report of the expert group on non-sampling errors *Cross-Validation Study of Estimates of Private Consumption Expenditure Available from Household Survey and National Accounts* prepared by the National Accounts Division (NAD) of the CSO and the Survey Design and Research Division (SDRD) of the NSSO observed that the estimates of consumption of fruits and vegetables from the two sources, namely, NAS data on value of production and NSSO data on value of consumption have wide divergence. A similar study is undertaken by Sundaram and Tendulkar (2001). Minhas et al (1986) attempt to assess the magnitude of discrepancy accounted for by the different reference

time frames of the NAS and NSS estimates by using the crop season-wise data of food grains production of the current and preceding agricultural years.

Mukherjee and Chaterjee (1974) and Minhas (1988) point out that some degree of difference is bound to be there in HCES, NSSO and NAS data since the HCES data excludes the houseless and institutional population such as inhabitants of orphanages, prison and hospitals, while the consumption of these persons are included in NAS estimates. Also included in the NAS estimates is the consumption expenditure of NPISHs, which are not covered by the HCES. Nevertheless, the NSS estimates of average per capita consumption expenditure, in conjunction with the estimated total population of the country, provide a valid aggregate estimate of the consumption expenditure of the households, despite being subject to the limitation of non-coverage of houseless and institutional population in the HCES. So far, as the comparability between the two sets of estimates is concerned, this limitation is virtually of no consequence, as the proportion of the houseless and the institutional population in the total population is almost negligible. In studies like those by Ravallion (2000), the share of NPISHs in the estimate of PFCE has been assumed to be 10 per cent.

The report of the expert group on non-sampling errors seems to be of the view that item-wise comparison is difficult because the classification schemes for grouping commodities and services adopted by the two agencies at the data collection and compilation stages as well as those used for presentation of results differ considerably in many respects. It is well known that the NAS estimates of consumption for most of the commodities, namely, cereals and pulses, vegetables and meat, fish and eggs are much higher than those estimated by the NSSO. The NAS estimates of "fruits" consumption certainly deserves a closer scrutiny, particularly because the discrepancies in this case between the two estimates is much greater. The report's main findings are that in terms of magnitude, the divergence between the NAS and NSS estimates of consumption expenditure is the widest for "fruits and vegetables and their products" among the item-groups of food consumption. This is consistent with the observations made in the earlier studies [Minhas et al 1986; Srinivasan et al 1974] on the estimates for 1957-58, 1972-73 and 1977-78; the NSS estimates for this sub-group are found to be considerably lower than the corresponding NAS estimates for 1993-94. The most worrisome picture is that the gap between NAS data and HCES and NSSO data on fruits and vegetables is widening over time. After-purchase wastage is not recorded in the HCES and there is a possibility that the reporting of fruits suffers severely from recall lapse in the HCES. Fruits consumed outside home, whether purchased or collected free are most likely not captured by the HCES. Apprehending the possibility of non-reporting of fruits consumption, especially by the upper segment of income population, in which fruits are mainly consumed, a set of probing questions did not help. Thus, on the one hand the NAS estimates of fruits consumption appear to be on the higher side, while on the other the NSS estimates seem to suffer from under-estimation.

In many earlier studies, comparison of estimates of consumption of fruits and vegetables from the two sources were merely based on comparison of value estimates. The estimate of value of consumption of fruits obtained from the HCES were compared to the corresponding PFCE estimates, notwithstanding the multiplicity of rates and ratios used for deriving the latter from the production estimates. The PFCE estimates of the CSO are not based on direct observation but are derived. There is considerable adjustment made for the production estimates, especially for data on the unorganised manufacturing sector.[3]

I
Methodology Adopted and Data Sources

The validation of the estimates of fruits and vegetables attempted here is founded on the macroeconomic identity equating total supply and uses at the most aggregate level. This comparison is made both in terms of quantity and value for fruits and vegetables separately.

Quantity

In terms of quantity, the total supply is the sum of output Q and imports M. Total demand is the sum of intermediate consumption Z, final consumption by the households, government and NPISHs C, capital formation K, and exports X:

$$Q + M = Z + C + K + X.$$

The capital formation is not relevant here and K refers to only changes in stock.

There are two main sources of statistics on the production of horticultural crops. The first is the directorate of economics and statistics, ministry of agriculture (DESAg). The DESAg estimates forecast crops, which cover most major crops and for which regular estimates are issued at the state level. On the other hand, unlike its estimates of forecast crops, the DESAg estimates of non-forecast crops, which include horticulture crops are ad hoc in nature. The DESAg estimates of non-forecast crops do not have the same degree of accuracy as the forecast crops, as the method of estimation used is questionable. To deal with this problem, DESAg initiated a centrally sponsored scheme for crop estimation surveys on fruits and vegetables and minor crops in 11 states covering seven fruits and seven vegetables to improve the production statistics of these crops. The fruits covered under this scheme are mango, banana, apple, citrus, grapes, pineapple and guava. The coverage of vegetables in the scheme includes potato, onion, tomato, cabbage and cauliflower. This method initiated by these states is expected to improve the production statistics of these crops. The limitation however was that some of the horticultured crops were apparently not covered [National Statistical Commission 2001].

Thus, for the remaining horticultural crops and states, the second source of data, i e, the national horticulture board (NHB) of the ministry of agriculture data is used in this study. The NHB is the main source of data on production and price of fruits and vegetables not covered in the area and production statistics of the DESAg. For the crops, like apple, sweet lemon ('mosambi'), lemon, orange, lichi, pineapple, 'sapota', brinjal, cabbage, cauliflower, ('okra') and tomato, for which data are either partially available or unavailable from DESAg, the database of NHB has been used to derive the value of output of fruits and vegetables crops.[4] The methodology followed by NHB for estimating area and production is not clearly spelt out.[5] These estimates are apparently based on the informed assessment of local level officials dealing with horticulture and the reports of market arrivals in major wholesale fruits and vegetable markets. According to the NSC, the estimates furnished by the NHB relate to

the entire country but are of doubtful reliability, being essentially based on subjective reports received from the ground level staff.

For this study, the estimates of Q, are derived from DESAg and NHB data as simple sums of quantity of production separately for all fruits and all vegetables. For X and M, the data on quantity of fresh and processed fruits and vegetables items exported and imported, as available from the directorate general of commerce intelligence and statistics (DGCIS), have been used.

On the demand side, final consumption C consists of government final consumption expenditure (GFCE), final consumption of the households and that of the NPISHs. In this study, the GFCE and NPISHs' consumption of fruits and vegetables has been assumed to constitute an insignificant part of the total production and is thus, ignored. The data on item-wise per capita consumption of fresh (unprocessed and processed domestically) fruits and vegetables for rural and urban populations is available in terms of quantity and value from the HCES. This is multiplied by respective rural and urban populations for the relevant years to arrive at an item-wise aggregate consumption both in quantity and value terms.

Further, K constituting change in stocks, has been assumed to be negligible as the perishable nature of fresh fruits and vegetables preclude their storing for long periods. Thus, the storing of processed fruits and vegetables has not been reckoned with in this study.

For arriving at the estimate of intermediate consumption Z, the estimates of raw materials used for processing in the manufacturing sector and in the hotel industry are arrived at separately using data from the annual survey of industries (ASI), surveys on unorganised manufacturing (NSSO 2000-01) and NSSO household consumption data.

The estimates of the quantum of fruits and vegetables used as raw materials for processing in the manufacturing sector have been arrived using the unit-level ASI and NSSO unorganised manufacturing data on raw materials input by the product classification ASICC used for these surveys.

The NSSO data provide information on consumption of fruits, juices and shakes, cooked meals, pickles and other processed foods. In items like cooked meals, the raw material used is not only fruits and vegetables but also cereals and pulses and hence, the share of fruits and vegetables in raw material needs to be included. The estimate of raw material inputs of fresh fruits and vegetables in the hotel industry are derived from the estimates of household consumption of cooked meals and other processed food, which are presumably consumed in restaurants. An estimate of Z is arrived at as the sum of raw material inputs of fresh fruits and vegetables in manufacturing and hotel industry.

Values and Per Unit Price

The value of output of fresh fruits produced in the country is available from NAS using the quantity data from DESAg and from NHB for the remaining crops. The NHB compiles and publishes estimates of prices of all important fruits and vegetable based on reports furnished by the state directorates of horticulture and agriculture. NAS uses these prices with some adjustments. Thus, the average per unit ex-farm gate price of fresh fruits and vegetables could be obtained separately. The same average price could be applied on the respective quantity of fresh fruits and vegetables separately available (total production minus processed) for gross consumption to obtain their total values.

The values thus obtained need to be added into their respective values of manufactured and processed output and then aggregated to find the total output value for fruits and vegetables (fresh and processed). The data regarding total value of output of fruits and vegetables being manufactured could be obtained from unit-level ASI and NSSO data on unorganised manufacturing sector for detailed NIC'98 classification. This, along with the quantum of raw material used for manufacturing, is used to estimate the per unit ex-factory value of manufactured output. The same price is applied to the quantum of processed fruits in hotel industry to estimate the total processed output of fruits and vegetables separately in the hotel industry at ex-factory price.

Thus, the total value of output (fresh and processed) obtained separately for fruits and vegetables needs to be compared with the respective gross consumption of fresh and processed fruits at each stage. The per unit ex-factory/ex-farm price of fresh and processed fruits thus obtained is also compared to the respective per unit price for the consumer (market price) to look at the reliability of these prices and have an idea of extent of total wholesale and retail margins.

Year of Study

The detailed analysis has been undertaken for the year 2000-01 as this is the latest year for which NSSO data on unorganised manufacturing sector is available. However, household consumption data from NSSO is available for latest year 1999-2000.[6] The NSSO data on consumption is also available for 1993-94. The quantities and per unit values for year 1993-94 and 1999-2000 from NSSO data are used to extrapolate quantities and per unit price for year 2000-01 and these in turn are used to estimate item-wise consumption of fruits and vegetables for year 2000-01.

III
Comparison of Production and Consumption Data for Fruits and Vegetables for 2000-01

The consumption of fruits and vegetables can be segregated into the consumption of manufactured products, processed products in hotels and restaurants and fresh products. The fresh consumption includes processing taking place at home, i e, non-commercially. These estimates then need to be compared with similar heads of production.

Thus, the consumption/production estimates in this study are divided into the following three categories: (a) raw material consumed for manufacturing of fruits and vegetables products, (b) raw material consumed for processing of fruits and vegetables products in hotel and restaurant industry, (c) gross consumption of fresh (fresh or processed at home) fruits and vegetables needs to be compared with its availability.

The analysis for these three categories has been undertaken in both quantity and value terms and is discussed in detail below:

Analysis in Terms of Quantity

Raw material consumed for manufacturing fruit and vegetable products: The period of study undertaken is the year 2000-01, the latest year for which data on the unorganised manufacturing sector is available. The quantum and value of raw materials consumed for fruits and vegetables are obtained separately by using ASI and NSSO data on the unorganised

manufacturing sector. This data is detained by adding the quantities and values for all the ASICC codes relevant to fruit and vegetable products. There are some problems associated with this data as for a few fruit and vegetable items, data is only available in value terms. The unit of quantity is either unavailable or only mentioned in terms of numbers, pieces, etc, and not in terms of weight. The problem for a few such items is resolved as there exist other entries for the same ASICC classification for which per unit price data is available. In case there is no other entry for same ASICC, the nearest ASICC classification prices per unit is taken as approximation.

With these modifications, using unit-wise ASI and NSSO data on the unorganised manufacturing sector, the raw material consumed in the form of fruits and vegetables for manufacturing is estimated from ASICC classifications. The total fruits and vegetables consumed in the manufacturing sector is estimated at 1.85 million tonne in both organised and unorganised sector, which is equal to 1.3 per cent of total official estimates of agriculture production of fruits and vegetables (Table 1).

Raw material consumed for processing of fruits and vegetables products in hotel and restaurant industry: To calculate the household consumption of fruits and vegetables in the hotel and restaurant industry, the household consumer surveys data on cooked meals, other processed foods, pickles, salted refreshments, fruits, juices and shakes, cold beverages, etc, is used. The data for most of these items are available both in quantity and value terms but units are not always in weights.[7] For example, the unit for cooked meals is the number of meals taken, etc. A rough approximation of per unit market price and per meal weight, etc, are used to sort out such problems to arrive at their quantity figures. The other problem in the case of cooked meals is that it not only includes processed fruits and vegetables but also cereals, pulses, meat products, etc. The share of vegetables in value terms is taken at 50 per cent of the total cooked meals based on discussion with key persons in a few restaurant units. To arrive at the share fruits and vegetables in pickles, a 70:30 ratio is used respectively. The quantum of various processed items thus obtained is added into the net exports of processed items.

The data in Table 2 is arrived at from gross consumption estimates of processed items (both in manufacturing sector and the hotel and restaurant industry) worked out using NSSO data on the basis of assumption specified above. The main products processed in the restaurant industry are cooked vegetables (17,97,802 tonne), which are a part of cooked[8] meals in NSSO data, pickle[9] (1,25,220 tonne), and other processed food items including beverages (28,94,713 tonne).

The gross consumption of processed items needs to be split into consumption of manufactured products and consumption of processed items in restaurant and hotel industry. This needs to be done by subtracting quantum of fruits and vegetables manufactured (Table 1 data) from total quantum of processed fruits and vegetables consumption. The total processing (manufactured and in hotel and restaurant industry) of fruits is estimated at 4.2 per cent, vegetables 3.2 and that of fruits and vegetables (combined) 3.5 per cent of their respective production in terms of quantity. The left over after taking out processing from production is available for fresh consumption both for domestic use and for net exports and is estimated in Table 2 data.

Consumption of fresh fruits and vegetables: The gross consumption (domestic and exports) of fresh fruits and vegetables is estimated from HCES, NSSO data (for the year 1999-2000 and is converted to 2000-01 by using per annum growth rates between 1994-95 and 1999-2000 as explained above) in the methodology. The domestic household consumption of fresh

Table 1: Raw Material in terms of Fruits and Vegetables Consumed in Organised and Unorganised Manufacturing
(Tonne)

Product	Raw Material Used for Manufacturing as Per Cent of Agriculture Production	Agriculture Production	Consumption of Raw Material in the Organised and the Unorganised Sector	Consumption of Raw Material in the Organised Sector	Consumption of Raw Material in the Unorganised Sector
1	2	3	4	5	6
Fruits	2.4	43148000	1028574	327129	701445
Vegetables	0.9	93890000	819350	763920	55430
Fruits and vegetables	1.3	137000000	1847924	1091049	756875

Source: Derived from ASI, CSO data on the organised sector, NSSO data on the unorganised manufacturing sector (2000-01) and *Agricultural Statistics at a Glance,* DESAg, ministry of agriculture and horticulture board, 1997.

Table 2: Processed Fruits and Vegetables Consumption and Availability of Fresh Consumption

Items	Units	Total Fruits Processed	Total Vegetables Processed	Total Processed Fruits and Vegetables
Processing in manufacturing industry	Tonne	1028574	819350	1847924
Processing in restaurant and hotel industry	Tonne	769228	2200583	2969811
Processing in manufacturing and restaurant and hotel industry	Tonne	1797802	3019933	4817735
Processing in manufacturing and restaurant and hotel industry share in agriculture production	Per cent	4.2	3.2	3.5
Availability for fresh consumption	Tonne	41350198	90870067	132182265
Agriculture production	Tonne	43148000	93890000	137000000

Source: Derived from NSSO, Report No 457(55/1.0/3), ASI, CSO data on the organised sector and NSSO data on the unorganised manufacturing sector (2000-01) and *Agricultural Statistics at a Glance*, DESAg, ministry of agriculture and horticulture board, 1999 and DGCI&S.

Table 3: Comparison of Availability and Consumption of Fresh Fruit and Vegetable Products

Items	Units	Total Fruits Processed	Total Vegetables Processed	Total Processed Fruits and Vegetables
Fresh consumption or processed at home (domestic and net exports)	Tonne	14337542	77992953	92330495
Availability for fresh consumption	Tonne	41350198	90870067	132182265
Fresh consumption as percentage of its availability	Per cent	34.7	85.8	69.9

Source: Derived from NSSO, Report No 457(55/1.0/3), ASI, CSO data on the organised sector and NSSO data on the unorganised manufacturing sector (2000-01), *Agricultural Statistics at a Glance*, DESAg, ministry of agriculture and horticulture board, 1997 and DGCI&S.

fruits and vegetables is then added to the net export of fresh fruits and vegetables (Table 3) and is then compared to its total availability. The results show that the consumption of fresh fruits is 34.7 per cent of its availability. This is a very wide difference and needs to be investigated. However, the difference in the case of vegetables is not much and may be explained by causes such as wastage, etc.

Comparison of Total Production and Household Consumption of Fruits and Vegetables

Various types of consumption are then added and the share of each is worked out in total consumption. The share of processed items in consumption as worked out in Table 4 is different compared to the one worked out in the total production in Tables 1 and 2 as total consumption estimates widely differ from production estimates especially in the case of fruits.

The quantum of processed fruits taken in Tables 1 and 2 and Table 4 is identical. Nevertheless, since the estimated quantity of total production and total consumption are different in the two sets, information on the share of processing differ widely in the two estimates. The fact that production has been overestimated in Tables 1 and 2 makes the share of processing look very small, which is not the case (Table 4).

This means that the share of manufactured processing accounts for 6.4 in case of fruits and 1.0 per cent in the case of vegetables of the total consumption (Table 4) as against 2.4 and 0.9 per cent respectively seen earlier (Table 1). The share of processing (manufacturing, hotels and restaurants) accounts for 11.1 in the case of fruits and 3.7 per cent in the case of vegetables in total consumption (Table 4) as against 4.2 and 3.2 per cent in terms of their respective productions (Table 2).

The total consumption is estimated at only 37.4 per cent of the total fruit production estimates in terms of quantity. It is more comparable in terms of vegetables and consumption accounts for 86.3 per cent of the total production. The 13.7 per cent gap in production and household consumption in the case of vegetables could be due to the wastage and consumption by the government and NPISHs, etc. The larger gap in case of fruits compared to vegetables is mainly linked to four factors, namely, (i) overestimation of production data on fruits, (ii) consumption by household members outside home (during office hours) generally remain unaccounted in the HCES, (iii) memory lapse is also an important factor in case of fruits as it is not a routine consumption item for all households and the characteristics of various fruits available throughout the season differ widely,[10] (iv) wastage in case of fruits is likely to be higher compared to vegetables as most fruit items are generally grown on tree and birds take heavy toll of them.

There is possibility that approximately 10 per cent of fruit consumption is underreported in terms of quantity. This includes around 5 per cent of fruits consumed outside the house and around 5 per cent due to higher recall lapse. In case the wastage is assumed at 1.5 times that of vegetables, the share of total wastage and consumption by the government and NPISHs in case of fruits may not be more than $20 (13.7 + 6.3)$ per cent of actual production. Thus, around $30 (10 + 20)$[11] per cent of the actual fruits production could be explained by wastage, recall lapse and consumption outside house and by government and NPISHs. This means that the remaining unexplained fruit production of $46.6 (100 - 53.4)$[12]

per cent could be attributed to overestimates of production data in quantity.

Analysis in Terms of Value and Per Unit Value

The data regarding total value of output of fruits and vegetables being manufactured is obtained from unit-wise ASI and NSSO data on unorganised manufacturing sector at a detailed NIC'98 classification. Thus, the per unit ex-factory value of manufactured

Table 4: Share of Various Items in Total Consumption of Fruits and Vegetables

Items	Units	Total Fruits Processed	Total Vegetables Processed	Total Processed Fruits and Vegetables
Processing in manufacturing industry	Tonne	1028574	819350	1847924
Processing in manufacturing industry share in total consumption	Per cent	6.4	1.0	1.9
Processing in restaurant and hotel industry	Tonne	769228	2200583	2969811
Processing in restaurant and hotel industry share in total consumption		4.8	2.7	3.1
Processing in manufacturing and restaurant and hotel industry	Tonne	1797802	3019933	4817735
Processing in manufacturing, restaurant and hotel industry share in total consumption		11.1	3.7	5.0
Household consumption (HCES) and net exports	Tonne	14337542	77992953	92330495
Total consumption	Tonne	16135344	81012886	97148230
Household consumption as per cent of production		37.4	86.3	70.9
Agriculture production	Tonne	43148000	93890000	137000000

Source: Derived from NSSO, Report No 457(55/1.0/3), *Level and Pattern of Consumer Expenditure in India 1999-2000*, NSS 55th Round, (July 1999-June 2000), ASI, CSO data on the organised sector and NSSO data on the unorganised manufacturing sector, 2000-01 and *Agricultural Statistics at a Glance*, DESAg, ministry of agriculture and horticulture board, 1999 and DGCI&S.

Table 5: Total Production of Fruits and Vegetables at Farm Gate and Ex-Factory Prices

Items	Units	Fruits	Vegetables	Fruits and Vegetables
Estimates of fresh production at farm gate price	Rs mn	502492	367213	869705
Processing in manufacturing industry	Rs mn	11695	7595	19290
Processing in hotel and restaurant industry	Rs mn	8746	20400	29146
Processing in manufacturing and hotel and restaurant industry	Rs mn	20441	27995	48436
Total fresh and processed production	Rs mn	522933	395208	918141
Implicit ex-farm gate price estimated	Rs/kg	12.15	4.04	Weighted
Implicit ex-factory price of final manufactured output per unit of raw material used	Rs/kg	11.37	9.27	Weighted
Implicit ex-farm/factory price of fruits and vegetables fresh and processed production per unit of raw material used	Rs/kg	12.12	4.21	Weighted

Source: Derived from NSSO, Report No 457(55/1.0/3), *Level and Pattern of Consumer Expenditure in India 1999-2000*, NSS 55th Round, (July 1999-June 2000), DGCI&S and *Agricultural Statistics at a Glance*, DESAg, ministry of agriculture and horticulture board, 1999.

output that could be obtained as quantity data is worked out above for each category. The average per unit price of manufactured products is applied to the quantum of processed fruits and vegetables in the hotel and restaurant industry to estimate the total output of fruits and vegetables processed in the hotel and restaurant industry at ex-factory price. This needs to be added to the total manufactured fruits and vegetables to obtain the total value of output being processed (in the manufacturing, hotel and restaurant sectors).

The value of output of fresh fruits produced in the country is available from NAS using the quantity data from DESAg and NHB for the remaining crops. The NHB compiles and publishes estimates of prices of all important fruits and vegetables based on reports furnished by the state directorates of horticulture and agriculture. NAS uses these prices with some adjustments. Thus, the average per unit ex-farm gate price of fresh fruits and vegetables could be obtained separately. The same average price could be applied to the respective quantity of fresh fruits and vegetables

Table 6: Total Consumption of Fruits and Vegetables (Household Sector Including Net Exports) at Market Price

Items	Units	Fruits	Vegetables	Fruits and Vegetables
Fresh consumption at market price	Rs million	134787	464651	599438
Processed consumption (manufactured and restaurant) at market price	Rs million	50681	41255	91936
Total consumption (fresh and processed) at market price	Rs million	185468	505906	691374
Fresh consumption at market price	Rs/kg	9.40	5.96	Weighted
Processed consumption (manufactured and hotel and restaurant) at market price	Rs/kg	28.19	13.66	Weighted
Total consumption (fresh and processed) at market price	Rs/kg	11.49	6.24	Weighted

Source: Derived from NSSO, Report No 457(55/1.0/3), *Level and Pattern of Consumer Expenditure in India 1999-2000*, NSS 55th Round (July 1999-June 2000), ASI, CSO data on the organised sector and NSSO data on the unorganised manufacturing sector, 2000-01 and *Agricultural Statistics at a Glance*, DESAg, ministry of agriculture, 1999 and DGCI&S.

separately available (total production minus processed) for gross consumption to obtain their total values.

The total fresh and processed consumption of fruits and vegetables is presented in Table 5.

A similar analysis is undertaken in terms of the value of consumption the data for which is available from HCES.[13] The values of fresh and processed fruits and vegetables consumed are divided by their respective quantities to arrive at their implicit market prices (Table 6).

The market prices for fresh and processed consumption estimated in Table 6 from HCES data are compared with ex-factory prices of fresh and processed products derived in Table 5. The data in Table 5 and Table 6 indicate one major discrepancy, i e, the market prices of fresh consumption of fruits in Table 6 is much lower compared to its implicit ex-farm gate price derived in Table 5. Precisely, the market price for fruits is 23 per cent lower than the farm gate price. Moreover, the farm gate price for fresh fruit is estimated to be higher than the implicit ex-factory price of final manufactured output per unit of raw material used (Table 5). This means the prices of fruits per unit of raw material after value addition in manufacturing sector is lower than the price at which it is purchased from farmers. This indicates that discrepancies are in farm gate price of fruits rather than in consumption data, which needs to be rectified to arrive at the revised estimates.

An attempt is made in this direction by discounting the consumer market price of fresh products derived implicitly from HCES data with wholesale and retail margins. The comparison of market price in Table 6 and ex-factory price in Table 5 show that margins are as high as 147.9 per cent for processed fruits and 47.4 per cent in case of processed vegetables. The comparatively low margins in the case of vegetables may be due to the fact that roadside 'dhabas' at the outskirts, (where the retail chain is small) are a source of consumption for several poor people. The obvious question that arises is whether we can apply the above (whole sale and retail) margins for the fresh fruits and vegetables. The data available from *Small Trading Units in India: 1997, NSS 53rd Round: January-December 1997* on the one set of wholesale and retail dealer margins indicate that the average margins for fresh products are in fact higher than those of processed products. However, the numbers of intermediaries are

Table 7: Revised Estimates of Fruits and Vegetables Production Using Adjustment in Data for Prices and Quantity

Items	Further Detail	Fruits	Vegetables	Fruits and Vegetables
1 a Estimates of agriculture production available for fresh consumption at farm gate price (Rs million)	Official estimates of agriculture production minus raw material used for processing	502405	367213	869618
b	Revised after price adjustments (using revised ex-farm gate prices)	156717	367213	523930
c	Revised after price and quantity adjustments (1b values revised using revised quantities assuming wastage and other usage)	83687	367213	450900
2 Estimates of processed output at ex-factory price (Rs million)	Manufactured, hotel and restaurant industry	20441	27995	48436
3 a Total Production estimates (unprocessed and processed at farm gate price (Rs million)	3a = 1a + 2	522846	395208	918054
b	Revised after price adjustments 3b = 1b + 2	177158	395208	572366
c	Revised after price and quantity adjustments 3c = 1c + 2	104128	395208	499336
4 Share of total processed and unprocessed production in unrevised estimates (per cent)	Using revised farm gate price (price adjustments)	33.9	100.0	62.3
	Using revised farm gate price and quantity assuming wastage and other usage	19.9	100.0	54.4

Source: Derived from NSSO, Report No 457(55/1.0/3), *Level and Pattern of Consumer Expenditure in India 1999-2000*, NSS 55th Round, (July 1999-June 2000), ASI, CSO data on the organised sector and NSSO data on the unorganised manufacturing sector, 2000-01.

likely to be more in the case of processed products compared to fresh perishable commodities like fruits and vegetables. Therefore, this study uses the overall margins for processed products as substitute for fresh products.

The revised data on fruit and vegetable production (fresh and processed) at farm gate and ex-factory price is obtained by using first price adjustment and then both price and quantity adjustments in Table 7. The price adjustment brings down the availability of fruits for fresh consumption from original estimates of Rs 50,241 crore to Rs 15,672 crore and then the quantity adjustment on it further brings it down to Rs 8,369 crore.[14] The entire impact of quantity adjustments does not translate into proportionate decline in value as most of the wastage is assumed to have taken place at the fresh product stage. The wastage after the processing stage is generally very low.

The revised estimates of fruit production are 33.9 per cent and 19.9 per cent (respectively) of the official estimates of fresh and processed fruits production. These bring down the adjustments in prices and both prices and quantities. With these revisions in prices and quantity, the share of revised estimates of fruits and vegetables is lowered to 54.4 per cent of the official estimates of fresh and processed fruit and vegetable production at exfactory prices.

One could work out share of processed products in production from data in Table 7. The processing share in revised value of production (processed and unprocessed) constitutes 19.6 per cent in case of fruits and 7.1 per cent in case of vegetables.

Concluding Remarks

This study clearly brings out discrepancies in official data of fruit and vegetable production both in terms of quantities and values. Some of the discrepancies, like the high farm prices used for estimating the fruit production, have clearly been shown, which cause around two-thirds of an increase in the value of fruits. The ex-farm gate price taken is higher than the consumer retail price and also the ex-factory price of manufactured fruit per unit of raw material used. The quantity estimates are also revised down as it has been concluded in this study that the NHB data (derived from various sources including DESAg) needs to be brought down by 53.4 per cent of its original estimates. The comparison shows that the main cause of discrepancies is a very high ex-farm gate price along with very high quantity of fresh fruit production. With these revisions in prices and quantities, the total value of fruits production at farm gate/ex-factory price is estimated at 19.9 per cent of the original unrevised estimates. **EPW**

Email: jsbedi@ncaer.org

Notes

1 However, at present, a steady deterioration in the quality of data on crops has occurred due to the failure of the 'patwari' agency to devote adequate time and attention to the 'girdawari' operations (this is the primary source of data for crop area), while yield estimates suffer on account of the poor performance of field operations [Minhas 2000].

2 Report of the expert group on non-sampling errors "Cross-Validation Study of Estimates of Private Consumption Expenditure Available from Household Survey and National Accounts" prepared by the CSO and NSSO.

3 NAS applies yearly growth rates on ASI data available for year 2000-01 to estimate the values for the organised manufacturing sector. The growth rates are obtained using IIP for the manufacturing sector (organised). For the unorganised sector, the NAS again does not directly use NSSO data on the unorganised manufacturing sector. Instead, it uses value added per unit ratios from DCSSI data for units belonging to the non-factory sector, SSI and combine the with remaining NSSO unorganised manufacturing data. Thus, it undergoes a complete overhaul of the entire NSSO data and creates a completely new database. Thus, NAS data on manufacturing sector has compounded the problem by combining data from various sources. This study therefore, prefers to use data on fruits and vegetable processing (manufacturing) from ASI and NSSO data on unorganised manufacturing sector rather than using NAS data. There are some limitations such as underreporting in ASI and NSSO data on unorganised manufacturing sector, but these are still the best available primary data sources.

4 For arriving at the estimates for the NAS 1993-94 base series, the value of production of fruits and vegetables for which data is not available from the DESAg, the NHB data is used.
For the revised series of NAS 1999-2000 base year series, [CSO 2006], the source and method used remain largely the same.

5 The NHB compiles data on area, production and productivity through the state horticulture boards (SHB). It has, however, been noticed that there is a sizeable divergence between the figures the SHBs supply to the DES and the NHB.

6 The latest per capita consumption expenditure data is however' available for year 1999-2000 from 55th round of HCES. The per capita consumption of various fruits and vegetables per month for rural and urban areas is available both in terms of quantity and value from HCES. These are converted into total quantity and total value of fruits and vegetables consumed in rural and urban areas in a year by multiplying with their respective population and 12 months.

7 The data on most fruit and vegetable items is available in both quantity and value terms. There are however a few items for which data is either available in value terms alone or the unit of quantity is not in terms of weight. It is either number of pieces, tins, etc. The problem is mainly in the case of banana, orange, lemon and coconut where the unit for quantity was not kg or tonnes but was numbers. It is difficult to work out quantity in kg or tonne from the number of these products but some rough estimation could be made. The visit to a few Mother Dairy and other vegetable and fruit vendors revealed that around six bananas, seven oranges (includes 'kino' and mausmi), 26 lemons and 0.4 coconut separately account for one kg on an average. This helps in deriving the quantity of fresh fruits and vegetables consumed in the country.

8 It is assumed that cooked meals prepared from vegetables are 50 per cent of the total cooked meal. The cooked meal covers roti, rice, meat and vegetables and its estimated consumption is arround 17,97,802 tonne during 2000-01 including exports.

9 It is assumed that 75 per cent of pickles are prepared from fruits.

10 Fresh vegetables (as a broad item group) are a routine consumption item, while fruits are not. This is because the quantum per diet for vegetables does not vary much. The prices of various dals and vegetables per unit also do not differ too much as in case of fruits. Thus, there may be differences in the data for variety-wise consumption of vegetables and pulses, but at the aggregate level the results are likely to be reliable. In the case of fruits, the quantum of fruits consumed widely differs from person to person, variety of fruits, season, etc. There are other problems as well in data on fruits. The fruits are mainly consumed among rich people, who have tendency of underreporting. Moreover, the seasonal aspect causes long time lag and lead to underreporting.
Thus while analysing the fruits data, one need to take care that since fruits is not a routine item, the consumption figures derived from household data are approximate and are not very accurate as in case of routine items such as vegetables, cereals and pulses. In case of non-routine item, the difference is caused mainly due to memory lapse that gets reflected in the reply of households. For the items, which are consumed regularly in a routine, the household answer regarding per capita consumption is generally based on long run experience rather than on the basis of fade memory of items consumed in the past. Thus the consumption at various

marriage and other non-regular parties (seasonal and others) as well as non-regular visits to restaurants is even captured in the per capita consumption estimates of routine items of consumption of households, but not in case of fresh fruits consumption. In the case of non-routine items of household consumption such as fresh fruits, it is difficult to capture even the household consumption with accuracy. There is possibility that approximately 5 per cent of fruit consumption is underreported in terms of quantity due to higher recall lapse and other factors including comparatively higher wastage.

11 30 = 13.7 + 5 + 5 + 6.3

12 Here 37.4 is the consumption share in production explained by household sector. There is wastage of 20 per cent in case of fruits and another 10 per cent could be attributed to the underestimation of consumption. Thus 30 per cent of the explained production is attributed to wastage and other factors. The explained production thus, could be taken at 53.4 (37.4/ 0.70) per cent level of the official estimates in terms of quantity.

13 In case one wants to include unaccounted consumption mentioned above and the consumption by the government and NPISHs, the total fruit consumption in household and other sector needs to be raised by 6 per cent (49.9*10 to 12 per cent). This means total fruit consumption is estimated at Rs 55,430 (52,293*1.06) crore. Thus, the overall fruit and vegetable consumption by the household, government and NPISHs sector is estimated at Rs 94,950 crore.

14 It has been assumed that wastage takes place mainly in fresh products and not in processed one. The 49.9 per cent of total quantum (fresh and processed) means 52.07 (0.499*43148000/41350198) per cent in terms of fresh products.

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