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Varietal growth and gains from trade in Indian dairy imports: a quantitative introspection§

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Abstract Indian dairy sector has witnessed a sharp increase in imports of diversified dairy products subsequent upon the economic reforms in the 1990s. The imports of dairy products stemmed from different countries (dairy varieties) surged almost 3 times since then. Also there was a 6-fold increase in the number of product varieties imported. Considering a monopolistic competition framework and applying the constant elasticity of substitution utility function, we find Indian consumers have benefitted about 4% in terms of the total value of output of dairy industry. An exploration of elasticity of substitution at highly disaggregated HS 8-digit level shows that higher imports in product lines having higher elasticity of substitution limit varietal gains to consumers, while import diversification towards less substitutable products like whey-based products (HS 0404) and cheese and curds (HS 0406) enhances gains to consumers.

Keywords Gains from variety, Dairy imports, Monopolistic competition, India

JEL classification F12, F14

1 Introduction

International trade acts as an engine of economic growth. It promotes competition, flow of knowledge, capital and technologies, and hence the efficient allocation of resources. With expanding markets the trade promotes specialization on a large-scale and enhances availability of goods at competitive prices leading to increase in real income and consumption. Several researchers (e.g., Helpman 1981; Krugman 1979, 1980, 1981; Lancaster 1980) have conceptualized sources of gains from trade via reduction in firms' mark-up due to increased competition, industrial productivity and number of product varieties available to consumers (Feenstra 2010). Product variety is, therefore, predicted to play an important role in determining gains from trade.

From the 'Golden Summer' of 1991, India embarked upon a liberal policy framework that was further reinforced with the signing of Uruguay Round Agreement on Agriculture (AoA) in 1994. Before 1991, like most commodities, imports of agricultural products were subjected to licensing and were prohibited, restricted or canalized (government monopoly purchase). The protectionist environment began to dismantle in the mid-1990s and the coverage of Open General License (OGL) or free list that was restricted to about 10% of all commodities in the pre-reform period was subsequently increased to over 60% in 1996, and further to 92% in 2001. The expectations regarding gains from the enforcement of AoA have been particularly high for dairy products, as India had low cost of milk production while the world dairy

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markets were heavily distorted on account of subsidies in the OECD countries. Indian dairy exports have increased from US$ 2.65 million in TE 1992-93 US$ 145.26 million in TE 2017-18. During the same period, dairy imports also increased from US$ 9.76 million in TE 1992-93 to US$ 42.40 million in TE 2017-18. Although the increase in imports has been slower as compared to the exports, the changes in composition of import basket towards whey-based and cheese products are strikingly evident. This suggests that increasing access of Indian consumers to newer varieties of dairy products.

The growing consumption of milk and milk products has been propelled by rising incomes leading to diversifying of diets away from cereals towards high-value nutrient-rich products including dairy products. The underlying forces driving these changes are set to continue, and the potential for increased demand for dairy products remains is huge in the developing world. Average per capita daily energy intake in the developing countries increased from 1861 kcal in 1961 (64% of the average energy intake in developed countries) to 2651 kcal in 2007 (78% of the average energy intake in developed countries) (FAOSTAT 2011). The demand for milk and dairy products has grown significantly in several Asian countries, partly because of population growth but also because people are spending more disposable income on dairy and livestock products. Delgado et al. (1999) estimated that milk consumption in the Asia–Pacific region would double to 231 billion litres of liquid milk equivalent (LME) by 2020, but it actually reached to 240 billion litres by 2007. With such high potential demand, there are significant opportunities for consumers of dairy products to access a wider variety of value-added and diversified dairy products.

In this backdrop, the paper examines the gains to consumers from increased varietal imports of dairy products in India.

2 Consumer gains from variety: theoretical framework

Variety in the economic literature on trade is defined as "A particular good coming from a particular country" (Feenstra 1994; Broda & Weinstein 2006; Mohler 2009). It is plausible that in a situation of increased competition and growing markets the firms will differentiate their products and that trade allows consumers to purchase more varieties. The change in domestic price index due to incoming varieties is considered for computation of the gains from variety.

Since the seminal contributions of Krugman (1979, 1980), economists have tried to quantify gains from trade in the framwork of monopolistic competition. In such a model, the gains from variety stem from three sources: (i) price reduction due to increasing returns to scale, (ii) increased product variety for consumers, and (iii) self-selection of firms upon trade liberalization.

The models developed by Spence (1976) and Dixit and Stiglitz (1977), and applied to trade by Krugman (1979, 1980) have impacted theoretical as well as empirical works. In a monopolistic competition setting, consumers value additional varieties depending on the degree of substitutability among these, as captured by the elasticity of substitution. This dependence on a single parameter and the tractability explains empirical success of these models. Though it is comparatively a new concept but gradual developments in this field started in the early 1990s. One of early attempts to apply this framework to quantify the value of new varieties upon trade liberalization was made by Romer (1994) who concluded that as a consequence of trade barriers and the fixed costs of introducing a new variety into a foreign market, some goods are not profitable enough to be exported, and this leads to limited varieties being offered in the importing country. Klenow and Rodriguez-Clare (1997) provided some empirical evidence from Costa Rica, with gains from trade liberalization estimated upto 2% of the gross domestic product (GDP). These gains incorporate gains from variety that could raise the overall gains from trade substantially.

The most influential work to date, however, has been done by Feenstra (1994). Using CES(constant elasticity substituion) production function, he has developed a price index for imports corrected for new and disappearing product varieties. New varieties lower unit costs depending on their substitutability with other varieties and their expenditure shares. This allows quantifying upward bias in the conventional import price indices that ignore changes in the set of imported varieties. This approach has been used by Broda and Weinstein (2006) to estimate the gains from imported

varieties in the United States between 1972 and 2001. They find that the upward bias of the conventional import price index to the extent of 1.2% a year.

Hummels and Lugovskyy (2005) argue that the less than proportional increase in the imported varieties with respect to market size can be explained by falling marginal benefit of importing additional varieties. In their model, this is due to "crowding" in the variety space. Taking a somewhat different approach, Ardelean (2009) argues that the standard Krugman (1980) model overstates the gains from variety since it assumes that larger countries export more only at the extensive margin, while the models in the vein of Armington (1969) assume that countries' exports grow only at the intensive margin. She develops a more general model that nests Krugman and Armington style models and concludes that the gains from variety is 44% lower than in Krugman's CES model. Mohler (2009) proposed a lower and an upper bound for the bias in the aggregate import price index of Feenstra (1994). The upper bound case assumes more growth at the extensive margin than observed in the conventional trade data-sets. This assumption is supported by the empirical literature. Using these bounds, the gains from variety were estimated for Switzerland and the United States for the period from 1990 to 2006. In Switzerland, the gain amounted to 0.3% to 5.0% of GDP, while in the United States, these were in the range of 0.5% to 4.7%. Later, Mohler and Seitz (2010) estimated gains from imported variety for 27 countries of the European Union using highly disaggregated trade data at HTS-8 for the period 1999 to 2008. The results highlight that within the European Union, especially "newer" and smaller member-states exhibit high gains from newly imported varieties. Positive welfare gains went up to 2.8% of GDP in case of small European countries like Estonia. Further, the most gains from variety for consumers stemmed from intra-European Union trade.

3 Analytical framework

We follow Broda and Weinstein (2006) and Mohler (2009) to estimate varietal gains to consumers from India's imports of dairy products. Destination-wise data on dairy imports in quantity and value (in US$) for the period 1990-91 to 2009-10 were collected from the electronic database of the Director General of Foreign Trade, India (DGFT); United Nation's Commodity Trade Statistics (UNCOMTRADE) and WITS-TRAINS at Harmonized System (HS[1]) 4/6/8-digit level.

The imported varieties (dairy for instance) 'c' are grouped into goods 'g' and we estimate varietal gain following the CES utility function as below:

$$M_{gt} = \left(\sum_{c \in C} d_{gct}^{\frac{1}{\sigma_g}} m_{gct}^{\frac{(\sigma_g - 1)}{\sigma_g}} \right)^{\frac{\sigma_g}{(\sigma_g - 1)}} ; \sigma_g \rangle 1 \forall_g \in G \quad \ldots(1)$$

where, $\tilde{o}_g$ is elasticity of substitution between varieties of good 'g'. G is the set of goods and C is the set of all potential varieties. d_{gct} represents taste or quality parameter. Utility is separable and homothetic. The unit-cost function for a good g is then given by:

$$\Phi_{gt}^{M}(I_{gt}, \vec{d}_{gt}) = (\sum_{c \in I_t} d_{gct} p_{gct}^{1-\sigma_g})^{\frac{1}{(1-\sigma_g)}} \quad \ldots(2)$$

where, I_{gt} is the set of varieties available at time t and p_{gct} is the unit price of an imported variety.

These unit cost functions are building blocks of the price index.

More specifically, the cost of living index (COLI) is set up. It measures total cost to consumers in achieving the maximum possible utility level at a given level of income. With homothetic preferences, the cost function for every consumer is independent of the level of income. Diewert (1976) defines an exact price index as the fraction of the unit cost:

$$P_g^M(\vec{p}_{gt}, \vec{p}_{gt-1}, \vec{x}_{gt}, \vec{x}_{gt-1}, I_g) = \frac{\Phi_{gt}^{M}(I_g, \vec{d}_g)}{\Phi_{gt-1}^{M}(I_g, \vec{d}_g)} \quad \ldots(3)$$

The exact price index for the CES unit-cost function is:

$$P_g(\vec{p}_{gt}, \vec{p}_{gt-1}, \vec{x}_{gt}, \vec{x}_{gt-1}, I_g) = \prod_{c \in I_g} \left(\frac{p_{gct}}{p_{gct-1}}\right)^{w_{gct}}$$

[1] The HS system is used by 177 countries as a basis for their customs tariffs and collection of international trade statistics. Almost 98% of the merchandise in international trade is classified in terms of the HS.

Where,

$$w_{gct}(I_g) = \frac{(s_{gct} - s_{gct-1})/(ln\, s_{gct} - ln\, s_{gct-1})}{\sum_{c\in I_g}((s_{gct} - s_{gct-1})/(ln\, s_{gct} - ln\, s_{gct-1}))}$$

and

$$s_{gct}(I_g) = \frac{p_{gct}x_{gct}}{\sum_{c\in I_g} p_{gct}x_{gct}}$$

Thus, the price index is geometric mean of all price changes with weights being expenditure shares S_{gct}. The exact price index demands that all the varieties should be available at all the times. It is due to Feenstra (1994) that the exact price index for a non-constant set of varieties, I_{gt}, can be written as:

$$\pi_g(\vec{p}_{gt}, \vec{p}_{gt-1}, \vec{x}_{gt}, \vec{x}_{gt-1}, I_g) = \frac{\Phi^M_{gt}(I_{gt}, \vec{d}_g)}{\Phi^M_{gt-1}(I_{gt-1}, \vec{d}_g)} \quad \ldots(5)$$

$$= P_g(\vec{p}_{gt}, \vec{p}_{gt-1}, \vec{x}_{gt}, \vec{x}_{gt-1}, I_g)\left(\frac{\lambda_{gt}}{\lambda_{gt-1}}\right)^{1/(\sigma_g-1)} \quad \ldots(6)$$

$$\lambda_{gt} = \frac{\sum_{c\in I_g} p_{gct}x_{gct}}{\sum_{c\in I_{gt}} p_{gct}x_{gct}} \quad \ldots(7)$$

$$\lambda_{gt-1} = \frac{\sum_{c\in I_g} p_{gct-1}x_{gct-1}}{\sum_{c\in I_{gt-1}} p_{gct-1}x_{gct-1}} \quad \ldots(8)$$

Hence, the exact or corrected price index with variety change is a conventional price index times an additional term lambda (λ) or Feenstra ratio (Broda 2005). The numerators of λ_{gt} and λ_{gt-1} comprise of the expenditure on the common varieties at time t and t-1. In the denominator of λ_{gt}, the new varieties are included additionally, while in the denominator of λ_{gt-1} the disappearing varieties are included additionally. Hence, the lambda (λ) ratio gets smaller if there are many new varieties, and it gets larger if there are many disappearing varieties. This is determined entirely by the expenditure on these new and disappearing varieties. This ratio is then weighted by a term negatively related to the elasticity of substitution. Thus, there is a greater correction in the price index if the elasticity is low. If the elasticity is high the lambda (λ) ratio converges to one. Now that the exact price indices for the imported goods are known, these are aggregated into the aggregate exact import price index:

$$\prod^M(\vec{p}_t, \vec{p}_{t-1}, \vec{x}_t, \vec{x}_{t-1}, I) = \prod_{g\in G}[P_g(I_g)\left(\frac{\lambda_{gt}}{\lambda_{gt-1}}\right)^{1/(\sigma_g-1)}]^{w_{gt}} \quad \ldots(9)$$

$$= CIPI(I)\prod_{g\in G}\left(\frac{\lambda_{gt}}{\lambda_{gt-1}}\right)^{w_{gt}/(\sigma_g-1)} \quad \ldots(10)$$

CIPI(I) is a conventional import price index that does not account for the change in variety. The ratio of the corrected import price index and the conventional price index expresses the bias from ignoring the change in variety. This ratio is called the end-point ratio (EPR) and it is defined as:

$$EPR = \frac{\prod^M}{CIPI(I)} = \frac{CIPI(I)}{CIPI(I)}\prod_g\left(\frac{\lambda_{gt}}{\lambda_{gt-1}}\right)^{w_{gt}/(\sigma_g-1)} = \prod_g\left(\frac{\lambda_{gt}}{\lambda_{gt-1}}\right)^{w_{gt}/(\sigma_g-1)} \quad \ldots(11)$$

Thus, EPR is the weighted average of the lambda (λ) ratios weighted by a term incorporating the elasticity of substitution. Assuming a simple Krugman (1980) structure, the overall price index of the economy can be written as

$$\prod = \left(\frac{p^D_t}{p^D_{t-1}}\right)^{w^D_t}\left(\prod^M\right)^{w^M_t} \quad \ldots(12)$$

Where, w_t^M is the log-change weight of the imports, w_t^D is the weight of the domestic sector and P_t^D is the price of the domestic good. Since this structure admits a separation between the domestic and the import markets, the gains from imported variety result in:

$$GFV = \left[\frac{1}{EPR}\right]^{w^M_t} - 1 \quad \ldots(13)$$

Hence, the welfare gains can be calculated by weighting the inverse of the weighted aggregate lambda ratios with the fraction of imported goods relative to total economic activity.

Table 1. Trend in varietal imports of dairy products (TE 1993-TE 2010)

	No. of dairy goods imported (HS 8 digit)	Average exporting countries per good	Total varieties (country-good pairs)
TE 1993	18	2.61	47
TE 2010	29	9.55	277
Common in both periods	18	-	28
Present in TE 1993 but not in TE 2010	0	-	19
Present in TE 2010 but not in TE 1993	11	22.64	249

Source: Authors' calculation

4 Results and discussion

India witnessed a 6-fold surge in varieties of dairy products imported; from imports of 47 varieties in TE 1993 to 277 in TE 2010 (table 1). Of the total 32 product lines available at HS 8-digit level, India imported only 57% in TE 1993, which increased to 90% in TE 2010. Eighteen product lines that were common in both the periods, and additionally 11 new product lines were added to the import basket in TE 2010. In TE1994, there were 47 varieties that were coming into the country implying that on an average 2.61 countries were exporting 18 product lines to India. The growth in varieties took place not only due to more number of product lines (29) but also more countries were exporting these products (9.55). The growth in varieties during this period can confidently be ascribed to the economic liberalization, coupled with numerous trade agreements from 1991 onwards. Nineteen varieties that were imported during TE1993 stopped making inroads subsequently, while 249 new varieties were imported that were not available to the domestic consumers earlier.

4.1 Sources of origin

Of 66 different countries exporting their dairy products to India, most prominent were the countries from Europe and North America from where more than 100 varieties were imported during the study period. During 1990 to 2010, the US with 148 varieties has been the leading export of dairy product varieties in India closely followed by Netherland (142 varieties). Besides, a sizeable number (>65) of varieties have also been imported from UAE (97), Singapore (79) and Nepal (66). African countries have minor roles in varietal exports to India. The results indicate that in TE 1993 maximum no of dairy goods were exported by Netherland, and there was slow growth in this during the subsequent period. Though Netherland continued to be among top 10 sources of origin, it ranked seventh in TE 2010. Similarly, the increase in average number of dairy goods sourced from Germany was slow during this period. On the contrary, US and Denmark showed remarkable increase in dairy good exports to India. Both these countries depicted high growth in average number of exporting goods and secured top two positions in the later period. Some notable changes can be observed in the later period with dropping out of some countries like Switzerland, Nepal, Australia and Belgium. An absolute growth can be observed in number of exporting goods from all these countries, for instance, average number of exported dairy goods increased from 2.67 to 4.0 in case of Switzerland, still slower rate of growth drops them out in later period. Besides these, some new countries like France, UK and UAE have emerged later, having very high growth in exported dairy goods. UK, for instance, did not export a single good in TE 1993 but this number increased to 10 in TE2010. Though some of the countries were traditionally not substantial producer of milk and milk products, economic partnership agreements with these aided to reduce the import costs of dairy products, and trade diverted from a traditionally dairy producer-country to a non-producer one. However, some countries even offer tax holidays to specific goods and services and chances of re-exports by such countries cannot be eluded. In either of the case, there are substantial chances of gains through increased number of varieties coupled with reduced costs of imports from earlier.

4.2 Gains from variety

The two important estimates that are generated in the process of estimating welfare gains from increased

Table 2. Top 10 countries supplying dairy products to India

Rank	TE 1993		TE 2010	
	Country	Average number of exported goods	Country	Average number of exported goods
1	Netherlands	4.00	USA	14.00 (10.00)
2	Germany	3.00	Denmark	13.67 (9.21)
3	Switzerland	2.67	France	11.33 (8.68)
4	Nepal	2.33	UK	10.33 (8.16)
5	Denmark	2.00	UAE	8.00 (6.32)
6	Singapore	2.00	Germany	7.33 (3.42)
7	Australia	1.67	Netherlands	6.67 (2.11)
8	Italy	1.33	Singapore	5.33 (2.63)
9	USA	1.33	Italy	5.00 (2.89)
10	Belgium	0.67	New Zealand	5.00 (3.95)

Source: Authors' calculation
Notes: Figures in parentheses are percentage contributions in total varietal increase.

imports are elasticity of substitution between the varieties of each imported commodity ($ó_g$) and the Feenstra or lambda ratio (λ_g) that captures the extent of change in variety in monetary terms.

4.2.1 Elasticity of substitution

High elasticity of substitution means that goods are very good substitutes, implying these are less differentiated. On the contrary, greater differentiation means less possibilities of substitution; hence low elasticity of substitution.

As the level of disaggregation increases, the degree of substitutability also increases, because goods in broad product groups are substitutable only to a limited extent. For instance, varieties in HS 4-digit category (e.g., concentrated and sweetened milk products HS 0402), are less substitutable than more disaggregated products within the product line like skimmed milk powder (HS 04021020). Our results substantiate this. The mean elasticity of substitution for dairy products (HS-2digit) is 3.29 while the average across product groups at HS-4digit level is 3.45. A handful of economic literature studying the gains from varietal imports has also found increasing substitutability of varieties with level of disaggregation of products. For instance, Broda & Weinstein (2006) have studied gains from varietal imports in US economy from 1972 to 2001 and reported the mean elasticity of substitution during 1972 to 1988 to be 17.3 at 7-digit and 7.5 at 5-digit and 6.8 at 3-digit level.

Among the five product groups the elasticity for HS 0401 was not computed as imports in this group was sporadic and computation of reference country was not possible. $ó_g$ is relatively higher for whey-based dairy products (HS 0404) and fat-based products (HS 0405) suggesting that products in these groups are less differentiated. On the other hand, low $ó_g$ for HS 0406 (cheese and curd) shows that products in this group are quite specific and have large number of varieties (618) for imports.

A necessary condition for increase in number of varieties to be source of potential gains to importing country is that the elasticity of substitutions should be low. This is so, if the elasticity of substitution is high, then domestic consumers will switch from one variety to other and thus the influence of variety on the price index would be low. In accordance with this, the product group HS 0406 would have larger effect on the consumer welfare.

At HS 8-digit level, the elasticities were worked out for 25 product line and computation for 4 product lines were not possible due to nonexistence of common variety between TE 1993 and TE 2010. The range of $ó_g$ varied widely from 1.06 to 9.56 at 8-digit level for the dairy product lines. Interestingly, almost 68% share of imports at 8-digit were reserved by two product lines, viz. butter oil (HS 04059010) and skimmed milk powder (HS 04021010) that have very high elasticity of substitution ($ó_g$). As mentioned earlier, this high

Table 3. Elasticities of substitution of dairy products: at HS 2 and 4 digits

Level of aggregation	Mean	Median	No. of varieties observed
Total dairy products (HS 2-digit)	3.29 (0.37)	3.10	1682
Major dairy product groups (HS 4-digit)	3.45 (0.58)	3.10	
HS 0402 (concentrated and sweetened dairy products)	3.10 (0.45)	3.05	536
HS 0403 (fermented or acidified milk products)	2.36 (0.51)	2.36	138
HS 0404 (whey, all types)	4.94 (1.56)	3.69	164
HS 0405 (butter & other fats & oils derivatives)	4.71 (1.05)	3.71	183
HS 0406 (cheese an curd)	2.14 (0.06)	2.09	618

Source: Authors' calculation
Note: Figures in parentheses are standard errors

magnitude limits the varietal gains to consumers as both these products are very specific in nature irrespective of their source of origin. On the other hand, there were several product lines under HS 0406 (cheese and curd), viz. fresh cheese (HS 04061000), blue veined cheese (HS 04064000) and processed cheese (HS 04063000) have smaller $ó_g$ and thus a potential source of varietal gains. Similarly, a handful other product lines from HS 0402 (concentrated and sweetened milk products), HS 0403 (acidified milk products) and HS 0404 (whey-based products), HS 04022100 (like milk & cream in powder), HS 04039090 (curdled milk) and HS 04041090 (other whey) also have low $ó_g$, but extremely small share in imports of these product lines restricts scope for gains. An import diversification of the dairy product lines towards the products with low $ó_g$ would be a concrete measure towards higher varietal gains to consumers of dairy products.

4.3 Estimation of varietal gains

Empirical evidence suggest that the number of varieties imported to India have more than doubled from TE 1993 to TE 2010 (i.e. $V_{1993}/V_{2010} = 0.17$). The count data, as the results show, presents a 489% growth in the number of varieties between these two points of time, which is likely to have overestimated growth as a large number of imported varieties have extremely less market shares. To get a reasonable estimate of variety change over time, lambda ratios (λ_g) for each product lines are estimated. The mean lambda ratio (λ_g) is reported for overall dairy product and for each 4-digit category. The lambda ratio can be interpreted as the measure of variety growth; a lambda ratio of 0.77% can be interpreted as variety growth of 29.87% ($1/\lambda_g - 1$). Lower the mean lambda ratio, higher the variety growth in that mean products. The λ_g are quite high for HS 0402 and HS 0405 which limits the varietal growth whereas λ_g are low for HS 0406, HS 0404 and HS 0403 indicating potential growth in variety in these product categories. As mentioned in the previous section, these results validate the fact that higher import in HS 0402 and HS 0405 limit the consumer gains as the specific product lines with highest import shares under these groups, viz. butter oil (HS 04059010) and skimmed milk powder (HS 04021010) have high $ó_g$ and λ_g.

4.4 Import prices and welfare

The third major step in estimating gains from variety, is the estimation of end-point ratio which computes movement of import price index due to imports of varieties. It is measured as the ratio of the corrected import price index and the conventional import price index weighted by a term incorporating elasticity of substitution. The results of EPR suggest that variety-adjusted unit price of imports fell 62% (1-EPR) faster than the unadjusted price between TE 1993 and TE 2010. In the final step, the gains from variety were estimated by weighting the inverse of EPR with appropriate weights. Literature has mostly used the log change weight of imports to total economic activity (GDP) as the measure of weight to EPR. Imports in all the sectors of an economy were taken into account to measure varietal growth in these studies (Broda 2006; Mohlar 2009) and weight was substantial considering

Table 4. Elasticities of substitutions at HS 8-digit level with import shares

HS codes (8-igit)	Elasticity of substitution (ó)	Average share in import (%)	Description of product codes
4059010	8.76	47.30	Butter oil
4021010	6.65	20.93	Skimmed milk
4041020	4.12	4.67	Whey, dry, blocks & powdered
4059020	3.25	3.47	Melted butter (Ghee)
4022100	1.06	3.11	Milk & cream in powder, granules (Fat >1.5%)
4059090	3.71	2.37	Others
4029990	2.19	2.05	Others
4022910	5.44	1.78	Whole milk
4041010	3.27	1.65	Whey, concentrated evaporated condensed (liquid/semi liquid)
4069000	2.38	1.64	Other cheese
4021090	3.00	1.38	Other milk & cream in powder, granule (fat< 1.5%)
4049000	9.56	0.96	Products other than whey consisting of natural milk constituents
4063000	2.09	0.90	Processed cheese not grated/powdered
4022990	1.64	0.74	Others (e.g. milk cream)
4022920	2.51	0.72	Milk for babies
4041090	2.81	0.69	Other whey
4061000	2.04	0.61	Fresh cheese(incl. whey cheese) not fermented & curd
4021020	2.30	0.51	Milk food for babies
4062000	2.05	0.48	Grated or powdered cheese of all kinds
4051000	3.13	0.45	Butter
4031000	3.23	0.41	Yogurt
4039090	1.48	0.21	Others (curdled milk, cream kephir etc)
4039010	2.36	0.08	Butter milk
4029920	3.10	0.02	Condensed milk
4029110	3.10	0.02	Condensed milk
4029190	3.10	0.02	Other, not containing added sugar or sweetening matter
4064000	2.14	0.02	Blue veined cheese
4029910	3.10	0.02	Whole milk
4052000	4.71	0.00	Dairy spreads

Source: Authors' calculation

Table 5. Estimation of gains from variety

Level of aggregation	Lambda ratio (Mean)	End-point ratio	Gains from variety (%)
HS 04 (Total Dairy)	0.77	0.38	3.94
HS 0402	0.97		
HS 0403	0.76		
HS 0404	0.42		
HS 0405	0.96		
HS 0406	0.40		

total imports. But in this paper, as the extent of dairy imports is small relative to total economic activity (GDP), the weight was considered as log change weight of gross value of output from dairy industry to total manufacturing output of the economy. Final results suggest that gains to consumers of dairy products are 4% higher with respect to the change in value of output from dairy industry through varietal imports between TE 1993 and TE 2010. However, the gains are moderate as most imports are specific to products with high elasticity and imports are not diverse enough to gain substantially from the products with relatively less elasticity.

5 Conclusion and policy implication

India's dairy imports surged with opening up of the economy in 1991 and cleared path for varietal gains to consumers. With growing urbanization and changing demography in favour of youth, the consumer tastes and preferences are gradually shifting towards value-added and functional dairy foods away from traditional products. With the increase in number and volume of dairy varieties, Indian consumers moderately gained through reduction in variety-adjusted price index. However, it is hard to find a benchmark with which to compare the results. All the previous studies have computed gains from variety including all the varieties imported from all the countries or a set of relevant countries and a sector specific evidence is not available in the literature. As the results suggest, gains were moderate mainly due to import confinement in specific product lines of high elasticity of substitution. Government policy targeted in diversification of imports towards lesser substitutable dairy products (e.g., whey-based dairy products, and cheese and curds) from more number of sources will certainly enhance the gains to consumers.

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