A Comparison of Marketing Margins Across Sectors, Users, and Regions

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**Abstract:**

Because of the important role that transportation, wholesaling, and retailing activities, commonly referred to as distribution or marketing activities, play most economies, a project is underway to develop a GTAP model and database that includes domestic margins. This paper reports on the type of margin data that has been collected and draws some general conclusions that will be useful in developing a margin inclusive database. Margins do vary considerably across different uses with margins on goods consumed by private households tending to be higher than margins on intermediate inputs and margins on exported commodities. For most commodities, wholesale and retail trade activities comprise the majority of the total margin regardless of use. While the average margins on processed food products tend to be similar, except for beverages and tobacco which is significantly higher, there is substantial variation in these margins across countries. The Spearman rank correlation coefficients between all processed food products, except for beverages and tobacco, are all positive and significantly different than zero indicating that for processed foods, countries tend to have either relatively high or relatively low margins for all processed food products. Finally, the size of the processed food margins are in general negatively related to per-capita GDP and positively related to per-capita energy consumption.

# A Comparison of Marketing Margins Across Sectors, Users, and Regions

Transportation, wholesaling, and retailing activities, commonly referred to as distribution or marketing activities, play an important role in most economies. Having estimates of the magnitudes of these marketing activities and how they vary across products, users, and regions is important for the analysis of a variety of policies. For example, margins play a crucial role in the analysis of energy policy in two ways. First, information on margins is essential in putting together a credible energy data base because the IEA data reports prices paid by users while the GTAP data are at producer prices. Second, when conducting carbon tax experiments, the impact of a specific tax on consumer prices will depend on the level of the margin. Another example where margins play an important role is in assessing the impact of trade liberalization on poverty. How a change in the world price will affect consumer and producer prices in a given region will depend on the size of the margins. As the size of the margins increase, a smaller amount of the changes in world prices are transmitted to consumers. In addition, larger margins will accentuate changes in producer price because a larger producer price change is required to achieve the same consumer price change.

The objective of this paper is to determine the extent to which marketing margins differ across GTAP sectors, intermediate and final users, and GTAP regions. For example, does the magnitude of marketing margins differ between intermediate and consumer goods? Are there large variations in the size of the marketing margins between different processed food products and do these margins vary substantially across regions? To what extent do the marketing margins vary across countries? To answer these questions, information on marketing margins is collected from a variety of sources, which are discussed in the next section.

*Margin Data*

Because the national input-output accounts are the underlying foundation of the GTAP data base, the best source of margin data would be from these accounts. For example, the input-output accounts for the United States contains information on both trade and transportation margins for all intermediate transactions, purchases by consumers, and purchases by federal and state governments for all domestically produced and imported commodities. It also contains trade and transportation margins for all goods that are exported. However, this type of data is not publicly available for all regions. At this time, in addition to the United States, full margin data from the input-output accounts are only available for Australia, and Japan. The margin data for The Netherlands does not distinguish between trade and transportation margins. Margin data is also available for France for a limited number of sectors and not for all intermediate transactions.[1]

A second type of margin data based on national accounts does not identify separate trade and transportation margins or separate margins for intermediate and final users. Instead, total margins are available for each sector for domestically produced goods, imported goods, and exported goods. This type of margin data is available for five African countries, Mozambique, South Africa, Tanzania, Zambia, and Zimbabwe, based on Social Accounting Matrices (SAMs) developed by the International Food Policy Research Institute (IFPRI). Even though full margin data are not available for these regions, the available margin data will allow useful comparisons on the magnitude of marketing margins across different regions.

A third source of margin estimates based on national input-output accounts is based on the ratio of consumer price to producer price for goods sold to private domestic final demand for 125 product categories from nine countries: Australia, Belgium, Canada, Germany, Italy, Japan, The Netherlands, United Kingdom, and the United States.[2] These data were developed from input-output tables with varying sectoral disaggregation and reference periods between 1990 and 1995. The input-output tables used for Canada, Japan, and the United States contained several hundred sectors; the tables for Australia and the United Kingdom contained about 100 sectors; the tables for Belgium, Italy, and the Netherlands contained 30 to 60 sectors; and the table for Germany was highly aggregated with only ten sectors.

A unique secondary source of margin estimates is available from the Euromonitor International Integrated Market Information System.[3] This database covers 95 percent of global retail and food service sales. Industry average mark-ups as defined by Euromonitor include wholesaler, distributor, and retailer or horeca markets. Mark-up estimates are derived from a combination of official statistics and secondary sources such as trade interviews with companies at all levels of the supply chain. Data on the average ratio of retail to manufacturer prices for seven GTAP processed food products (bovine meat products, meat products nec, vegetable oils and fats, dairy products, processed rice, food products nec, and beverages and tobacco products) is available for 52 regions (see table 1) for the year 2001. This data will be used to compare differences in marketing margins between different processed food products and regions.

## *Margin Data from Input-Output Accounts*

### *Comparison of Margin Across Users*

Table 2 provides a comparison of the ratio of the retail (or margin inclusive) price to the producer price for all intermediate transactions, consumption purchases, and exports for Australia, Japan, The Netherlands, and the United States. For ease of comparisons, the 57 GTAP sectors have been aggregated into fifteen sectors in table 2: crops; livestock; forestry and fishing; minerals; processed foods; beverages and tobacco textiles, wearing apparel, and leather products; wood and paper products; petroleum; chemical and other mineral products; metal products; motor vehicles; electronics; other manufacturing; and services. With the exception of crops and livestock in Australia, the average margins on goods purchased by the private household for consumption are higher than the average margins on intermediate inputs purchased by firms in all four regions. In many cases, the relative differences in magnitudes of the marketing margins between intermediate and final goods are substantial. For example, in Australia the average marketing margin on chemicals purchased by consumers is 2.3 times larger than the margin for chemical purchased by firms. There are a few instances where the marketing margins for consumption and intermediate uses are similar. For example, the marketing margin on motor vehicles in the United States is virtually the same whether sold to consumers or firms. Overall, margins on consumption goods are approximately 50% higher than margins on intermediate goods in Australia, Japan, and the United States. In the Netherlands, the margins on consumption goods were one-third higher than the margins on intermediate inputs.

The domestic marketing margins on exports only includes the trade and transportation services that are required to get the commodity in question from the domestic producer to the border. Overall, the average export margins are slightly lower than the margins on intermediate goods in Japan (6.5%), The Netherlands (4.7%), and the United States (2.8%) while slightly higher in Australia (0.6%). However, the relative difference between margins on exports and intermediate goods does vary substantially across sector and regions. For example, the export margin on motor vehicles in Australia is 17% lower than the margin on motor vehicles purchases as intermediate inputs by Australian firms. Conversely, the export margin on livestock from

Australian is 12% higher than the margin on livestock purchased as intermediate inputs by Australian firms.

Wholesale and retail trade activities compose the majority of the total marketing margin for most goods. Table 3 reports the percentage of the total domestic marketing margin accounted for by wholesale and retail trade activities by different users for Australia, Japan, and the United States. (Trade and transportation margins are not separately identified for the Netherlands.) For most goods, wholesale and retail trade activities account for at least 70% of the total marketing margins across users. Transportation activities tend to be relatively more important for unprocessed goods, such as minerals and agricultural commodities.

*Marketing Margins in Southern African SAMs*

Table 4 provides a comparison of the marketing margins for domestic users from the SAMs for Mozambique, South Africa, Tanzania, Zambia, and Zimbabwe to those from Australia, Japan, the Netherlands, and the United States. Because the SAMs do not contain margin information by domestic user (e.g., firms and consumers), the margins for Australia, Japan, the Netherlands, and the United States are aggregated across domestic users to make the margins comparable. While there are no cases where all of the margins from the African countries are strictly higher or lower than the other four countries, there are differences in the averages across the countries, shown in the last two columns of table 4. Except for livestock and metal products, the average margins for the African countries are lower than the average margins for the other four countries. Based on the averages, it would appear that margins on domestically produced goods in these African countries tend to be lower than the margins on similar goods in Australia, Japan, the Netherlands, and the United States.

Table 5 shows that the average margins on exports are more similar between these two regions. In nine of the fourteen aggregate commodities, the average export margins were higher for the African countries. Although the magnitude of the differences in the average margins were much less than the differences in the average margins in table 4.

*Other Input-Output Account Based Margin Data*

Table 6 provides information on the consumer to producer price for good sold to private domestic final demand aggregated to the appropriate GTAP commodity definitions. Because there is country overlap between these data and input-output accounts with full margin information discussed earlier, only the margin data for Belgium, Canada, Germany, Italy, and the United Kingdom are included in table 6. These are the non-overlap regions.

### *Comparison of Margins for Processed Food Products*

Table 7 provides summary statistics for the ratio of retail to manufacturer prices for seven GTAP processed food commodities from the Euromonitor data. The average margins are fairly similar for bovine meat products (cmt), meat products nec (omt), vegetable oils and fats (vol), dairy products (mil), processed rice (pcr), and food products nec (ofd), ranging from 1.34 to 1.44. However, the average margin for beverages and tobacco (b_t) is substantially higher at 2.13.

While there may be similarities in the average margins for several processed food products, there is a large amount of variation in the margins across countries. For example, with the exception of dairy and food products nec, the maximum margin is approximately two times or more larger than the minimum margin. Figures 1 through 7 provide kernel density estimates of the distribution of margins across countries for each of the seven processed food products.

The Epanechnikov kernel density estimator is utilized with the bandwidths chosen by visual inspection.

Because the margins for process food products do vary across countries, a question arises of whether countries tend to have relatively high or low margins overall or if countries have a mix of relatively high and low margins. To address this question, the Spearman rank correlation coefficients are computed between each pair of processed food products and are reported in table 8. This procedure ranks the margins for each processed food product from highest to lowest and then computes the correlation coefficients. With the exception of beverages and tobacco, the Spearman rank correlations coefficients are all positive and statistically different from zero at the 1% level. The values of the correlation coefficients range from 0.47 between processed rice and dairy products to 0.97 between bovine meat products and meat products nec. The correlation coefficients between beverages and tobacco and all other processed food products are not statistically different from zero at the 10% (or greater) significance level. Thus, countries tend to have either relatively high or low margins for all processed food products, with the exception of beverages and tobacco products.

A final topic in this section is a preliminary investigation of why margins for processed foods differ across countries. Of course, the factors that determine of the size of the marketing margin for processed foods are many and complex. Some of these factors include the structure of the wholesale and retail sectors (e.g., smaller specialty retailers and wholesalers versus large diversified retailers); the competitive nature of the wholesale and retail sectors (e.g., many firms versus few firms); the level of additional marketing services provided by wholesalers and retailers to meet customers' requirements (e.g., retailers providing deli-style prepared meat products); and input costs (e.g., labor costs and transportation costs from manufacturers to retailers).

To account for some of these factors, the following general relationship is specified:

$$margin = f\left(region, pgdp, pelect, area\right), \tag{1}$$

where *margin* is the ratio of retailer to manufacturer price (i.e, the size of the marketing margin), *region* is the geographic region where the country is located (e.g., Europe, North America), *pgdp* is the per-capita GDP measured in US dollars, *pelect* is the per-capita kilowatt hours of electricity consumed, and *area* is the surface area of the country measured in square kilometers. The variable *region* is included in the model because there may be similarities in the structure of the wholesale/retail sector and in consumer preferences for countries located in the same geographic region. Eight different geographic regions are identified: North America; Central and South America; Australia and New Zealand; Higher Income Asia (Hong Kong, Japan, Singapore, South Korea, and Taiwan); Rest of Asia; EU-15; Eastern Europe; and the Middle East and Africa. Binary variables are created for each geographic region that are equal to one if the country is located in the specified geographic region and zero otherwise. Per-capita GDP is included in the model because consumers in higher income countries may demand more wholesale and retail services, such as convenience, resulting in higher margins. Conversely, because more processed foods are sold in higher income countries, the wholesale and retail markets for these products may be large enough to accommodate more firms, implying greater competition, than in lower income countries. Finally, the variables *pelect* and *area* are proxies to represent potential differences in input costs across countries. Consumers in countries that consume more electricity may demand more or better services from retailers, such as better refrigeration to preserve freshness, thereby increasing the size of the marketing margin.

Transportation costs may be higher in geographically larger countries also leading to larger margins. Transportation costs are likely more important for bulk commodities such as fluid milk and milled rice than more highly processed food products.

Because little empirical or theoretical evidence exists on the appropriate functional form for equation (1), a generalized Box-Cox functional form is specified. The generalized Box-Cox is defined as:

$$margin_j^* = \beta_0 + \beta_1 pgdp_j^* + \beta_2 pelect_j^* + \beta_3 area_j^* + \sum_{k=1}^{7} \alpha_k region_{kj} + \varepsilon_j \ , \qquad (2)$$

where the independent variables *pgdp**, *pelect**, and *area** symbolize the Box-Cox transformation defined as:

$$x^{\lambda} = \frac{x^{\lambda} - 1}{\lambda} \text{ if } \lambda \neq 0 \text{ and } \ln(x) \text{ if } \lambda = 0 .$$

In addition, the dependent variable *margin** symbolizes the Box-Cox transformation defined as:

$$y^{\theta} = \frac{y^{\theta} - 1}{\theta} \text{ if } \theta \neq 0 \text{ and } \ln(y) \text{ if } \theta = 0 .$$

The unknown parameters to by estimates in equation (2) are $\theta$, $\lambda$, $\beta$, and $\alpha$ and the error term $\varepsilon_j$ is assumed to be normally distributed with mean of zero and constant variance $\sigma^2$. Note that because an intercept term is specified, only seven regional binary variables may be included in the empirical model. One advantage of using a Box-Cox specification is that it nests several popular functional forms. If $\theta = \lambda = 1$, 0, or -1 then the appropriate model is linear, log-linear, or an inverse specification respectively. Another advantage is that the Box-Cox transformation may make the residuals more closely normally distributed and therefore allow all classical inference tests to be utilized.

Equation (2) is estimated for each process food product and the results are listed in table 9. The independent variables *pgdp, pelect,* and *area* have been normalized by dividing by their respective sample means. Thus, the transformed sample means of each of these variables is equal to one. In all models, per-capita GDP is negatively related to processed food margins. In all models except beverages and tobacco, per-capita electricity consumption is positively related to the processed food margins. (Although, the estimated coefficients for *pgdp* for ofd, cmt, and mil are not statistically different than zero at the 10 percent significance level.) The result that margins decrease as income increase may suggest that there is more competition in processed food wholesaling and retailing in the higher income countries. Also because electricity consumption and margins are positively relate may suggest higher input costs (from providing more services) in countries that consume more electricity. The coefficient for the other input cost variable, *area*, was only statistically different than zero in the processed rice margin equation. In that equation, the negative sign of the estimated was opposite of the expected positive sign. However, the value of this coefficient is an order of magnitude smaller than the coefficients for per-capita GDP and electricity consumption, implying a very small impact on the margin for processed rice.

Because the estimated $\beta$'s are applicable to the transformed independent variables rather than the original variables, the margin elasticities with respect to the independent variables are reported at the bottom of table 9. For the general Box-Cox model, the formula for the margin elasticities is as follows:

$$\frac{\partial margin^*}{\partial pgdp^*}\frac{pgdp^*}{margin^*} = \eta_1 = \frac{\beta_1 pgdp^\lambda}{margin^\theta},\ \eta_2 = \frac{\beta_2 pelect^\lambda}{margin^\theta},\ \text{and}\ \eta_3 = \frac{\beta_3 area^\lambda}{margin^\theta}. \quad (3)$$

The margin elasticities reported at the bottom of table 9 were computed at the sample mean of the normalized data. The margin elasticity with respect to per-capita GDP ranges from -0.062 to

-0.015.  The margin elasticity with respect to per-capita electricity consumption ranges from-0.029 to 0.092.

The estimated coefficients for the regional binary variables represent differences in the processed food margins compared to the base region, the Middle East and Africa.  In all models, there are statistically significant differences in the margins across geographic regions.  However, there is not a consistent pattern across all process food products of how the margins vary by geographic region.  For example, the margin on beverages and tobacco is substantially higher in North America than in the Middle East and Africa, but the margins are slightly lower for processed meat products.  Since most of the regional coefficients that are statistically significant at the 10 percent level of better are positive, this indicates that most margins for processed food products are the lowest in the Middle East and Africa region.

### *Summary*

Because of the important role that transportation, wholesaling, and retailing activities, commonly referred to as distribution or marketing activities, play most economies, a project is underway to develop a GTAP model and database that includes domestic margins.  However, margin data is only always publicly available.  This paper reports on the type of margin data that has been collected and draws some general conclusions that will be useful in developing a margin inclusive database.

The first general observation is that while margins do vary considerably across different uses, margins on good consumed by private households tend to be higher (significantly higher for some commodities) than margins on intermediate inputs and margins on exported commodities.  Domestic margins on intermediate inputs and exports have similar magnitudes.

Second, for most commodities, wholesale and retail trade activities comprise the majority (over 70%) of the total margin regardless of use (e.g., intermediate versus final demand). The exceptions to this are the commodities that less processed or unprocessed, such as minerals and agricultural commodities. Third, margins for commodities purchased by domestic users tend to be lower in Africa and the Middle East than in other regions. However, there are little differences in the export margins between African and other countries. Fourth, while the average margins on processed food products tend to be similar, the exception being beverages and tobacco which is significantly higher, there is substantial variation in these margins across countries. The Spearman rank correlation coefficients between all processed food products, again except for beverages and tobacco, are all positive and significantly different than zero indicating that for processed foods, countries tend to have either relatively high or relatively low margins for all processed food products. Finally, the size of the processed food margins are in general negatively related to per-capita GDP and positively related to per-capita energy consumption.

While these general observations will be useful in developing a margin inclusive database, the best source of information would be directly from the national input-output accounts of all individual regions in the GTAP database. When possible, it is hoped that in the future, contributors of input-output tables to the GTAP project will include whatever margin information is available to improve the quality of the margin inclusive GTAP database.

*Endnotes*

1. Margin data for the United States was obtained from the Bureau of Economics Analysis of the U.S. Department of Commerce. Japanese margin data was obtained from the Statistics Bureau of the Ministry of Public Management, Home Affairs, Posts and Telecommunications. Australian margin data was provided by Patrick Jomini of the Productivity Commission. Dutch margin data was provided by Nico van Leeuwen from the CPB Netherlands Bureau for Economic Policy Analysis. The French margin data was provided by Alex Gohin from the Département d'Economie et Sociologie Rurales, Institut National de la Recherche Agronomique (INRA).
2. This data has been generously provided by Scott Bradford from the Department of Economics at Brigham Young University.
3. The Euromonitor data is provided by Mark Gehlhar from the Economic Research Service, United States Department of Agriculture.

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Table 1. Countries Included in Euromonitor Processed Food Margin Data

| Country | Country |
|---|---|
| Argentina | Mexico |
| Australia | Morocco |
| Austria | Netherlands |
| Belgium | New Zealand |
| Brazil | Norway |
| Bulgaria | Philippines |
| Canada | Poland |
| Chile | Portugal |
| China | Romania |
| Colombia | Russia |
| Czech Republic | Saudi Arabia |
| Denmark | Singapore |
| Egypt | Slovakia |
| Finland | South Africa |
| France | South Korea |
| Germany | Spain |
| Greece | Sweden |
| Hong Kong, China | Switzerland |
| Hungary | Taiwan |
| India | Thailand |
| Indonesia | Turkey |
| Ireland | Ukraine |
| Israel | United Kingdom |
| Italy | USA |
| Japan | Venezuela |
| Malaysia | Vietnam |

Table 2. Ratio of Retail Price to Producer Price Across Different Uses

| | Intermediate Goods | | | | Consumption Goods | | | | Exports[c] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sector[a] | Aust[b] | Japan | Neth.[b] | USA | Aust[b] | Japan | Neth.[b] | USA | Aust[b] | Japan | Neth.[b] | USA |
| Crops | 1.530 | 1.297 | 1.514 | 1.280 | 1.301 | 1.887 | 2.422 | 2.093 | 1.449 | 1.241 | 1.258 | 1.325 |
| Livestock | 1.217 | 1.156 | 1.034 | 1.020 | 1.198 | 1.556 | 1.372 | 1.375 | 1.361 | 1.193 | 1.201 | 1.024 |
| Forestry, Fishing | 1.149 | 1.284 | 1.133 | 1.062 | 1.659 | 1.955 | 1.895 | 1.280 | 1.154 | 1.166 | 1.149 | 1.102 |
| Minerals | 1.141 | 1.246 | 1.038 | 1.170 | 1.567 | 2.060 | 1.716 | 2.561 | 1.056 | 1.241 | 1.012 | 1.257 |
| Processed Food | 1.093 | 1.332 | 1.150 | 1.123 | 1.375 | 1.692 | 1.552 | 1.516 | 1.112 | 1.201 | 1.105 | 1.126 |
| Beverages, Tobacco | 1.198 | 1.382 | 1.086 | 1.341 | 1.332 | 1.607 | 1.303 | 1.697 | 1.287 | 1.191 | 1.055 | 1.086 |
| Textiles, Apparel, Leather | 1.109 | 1.279 | 1.173 | 1.095 | 2.117 | 2.237 | 1.692 | 2.062 | 1.228 | 1.167 | 1.117 | 1.111 |
| Wood, Paper Products | 1.124 | 1.230 | 1.118 | 1.195 | 1.778 | 1.820 | 1.283 | 1.670 | 1.185 | 1.167 | 1.055 | 1.183 |
| Petroleum | 1.294 | 1.265 | 1.073 | 1.339 | 2.056 | 1.540 | 1.191 | 2.175 | 1.231 | 1.082 | 1.036 | 1.156 |
| Chemicals, Other Minerals | 1.170 | 1.269 | 1.315 | 1.229 | 2.708 | 1.929 | 1.605 | 1.777 | 1.193 | 1.135 | 1.074 | 1.170 |
| Metal Products | 1.066 | 1.162 | 1.111 | 1.168 | 1.750 | 1.666 | 1.322 | 1.989 | 1.024 | 1.112 | 1.060 | 1.152 |
| Motor Vehicles | 1.350 | 1.064 | 1.290 | 1.196 | 1.832 | 1.735 | 1.839 | 1.226 | 1.120 | 1.078 | 1.158 | 1.096 |
| Electronics | 1.378 | 1.139 | 1.137 | 1.141 | 2.050 | 1.654 | 1.470 | 1.703 | 1.493 | 1.071 | 1.095 | 1.150 |
| Other Manufacturing | 1.219 | 1.211 | 1.157 | 1.233 | 2.112 | 1.882 | 1.320 | 2.053 | 1.199 | 1.104 | 1.089 | 1.132 |
| Services | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

[a] The commodity aggregation for each sector is as follows. The crop sector includes paddy rice; wheat; cereal grains; fruits, vegetables, and nuts; oil seeds; sugar cane and beet; plant-based fibers; and crops nec. The livestock sector includes bovine cattle; animal products nec; raw milk; and wool. Minerals includes coal, oil, gas, and minerals nec. Processed foods includes bovine meat products; meat products nec; vegetable fats and oils; dairy products; processed rice; sugar; and food products nec. Chemical and other minerals includes chemicals, rubber, plastic products and mineral products nec. Metal products includes ferrous metals; metals nec; and metal products. Electronics includes electronic equipment. Other manufacturing includes transport equipment nec; machinery and equipment nec; and manufactures nec.

[b] The regions included in this table are Australia, Japan, The Netherlands, and the United States.

[c] For all exported commodities, only the domestic trade and transportation services that are required to get the goods from the domestic producer to the border are included. The GTAP model all ready contains transport margins for all traded commodities.

Table 3. Trade Margins as a Percentage of Total Domestic Marketing Margins Across Different Uses

| | Intermediate Goods | | | Consumption Goods | | | Exports | | |
|---|---|---|---|---|---|---|---|---|---|
| Sector[a] | Australia | Japan | USA | Australia | Japan | USA | Australia | Japan | USA |
| | | | | | Percentage | | | | |
| Crops | 47.5 | 72.1 | 64.8 | 59.1 | 90.9 | 83.4 | 52.9 | 86.7 | 71.0 |
| Livestock | 38.8 | 85.9 | 64.4 | 62.7 | 94.2 | 92.8 | 67.7 | 79.7 | 15.8 |
| Forestry, Fishing | 29.5 | 83.4 | 42.6 | 70.2 | 95.4 | 97.9 | 32.2 | 84.9 | 62.9 |
| Minerals | 5.9 | 16.5 | 13.3 | 7.7 | 69.4 | 55.1 | 30.8 | 12.9 | 8.3 |
| Processed Food | 83.0 | 79.8 | 69.5 | 94.2 | 94.1 | 94.7 | 84.7 | 86.8 | 65.6 |
| Beverages, Tobacco | 95.7 | 85.3 | 89.2 | 99.1 | 92.7 | 97.4 | 97.1 | 81.1 | 89.8 |
| Textiles, Apparel, Leather | 86.8 | 85.1 | 74.0 | 99.3 | 94.6 | 99.1 | 98.2 | 96.3 | 88.6 |
| Wood, Paper Products | 84.3 | 70.2 | 71.2 | 99.7 | 91.3 | 94.0 | 95.9 | 59.7 | 61.9 |
| Petroleum | 81.6 | 83.0 | 81.7 | 90.1 | 93.2 | 95.0 | 80.9 | 77.5 | 60.7 |
| Chemicals, Other Minerals | 90.3 | 83.1 | 64.3 | 99.3 | 94.2 | 93.7 | 97.3 | 78.1 | 61.9 |
| Metal Products | 98.0 | 69.1 | 81.7 | 100.0 | 93.8 | 97.1 | 98.8 | 90.5 | 84.0 |
| Motor Vehicles | 99.1 | 76.0 | 84.4 | 97.7 | 96.6 | 88.5 | 93.9 | 78.7 | 71.7 |
| Electronics | 95.8 | 91.8 | 94.3 | 98.3 | 97.8 | 98.1 | 96.3 | 85.3 | 93.8 |
| Other Manufacturing | 96.7 | 89.7 | 83.1 | 98.6 | 95.1 | 98.3 | 97.0 | 90.5 | 85.3 |
| Services | 47.5 | 72.1 | 64.8 | 59.1 | 90.9 | 83.4 | 52.9 | 86.7 | 71.0 |

[a] The commodity aggregation for each sector is as follows. The crop sector includes paddy rice; wheat; cereal grains; fruits, vegetables, and nuts; oil seeds; sugar cane and beet; plant-based fibers; and crops nec. The livestock sector includes bovine cattle; animal products nec; raw milk; and wool. Minerals includes coal, oil, gas, and minerals nec. Processed foods includes bovine meat products; meat products nec; vegetable fats and oils; dairy products; processed rice; sugar; and food products nec. Chemical and other minerals includes chemicals, rubber, plastic products and mineral products nec. Metal products includes ferrous metals; metals nec; and metal products. Electronics includes electronic equipment. Other manufacturing includes transport equipment nec; machinery and equipment nec; and manufactures nec.

Table 4. Average Ratio of Retail to Producer Price of Domestically Produced Commodities Across Different Countries

| | Countries[a] | | | | | | | | | Averages[b] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Commodity | Aust. | Japan | Nether | USA | Moz | S.A | Tanz | Zambia | Zim | Region1 | Region2 |
| Crops | 1.519 | 1.479 | 1.773 | 1.454 | 1.531 | 1.078 | 1.064 | 1.205 | 1.113 | 1.556 | 1.198 |
| Livestock | 1.216 | 1.185 | 1.037 | 1.035 | 1.121 | 1.078 | 1.044 | 1.257 | 1.204 | 1.118 | 1.141 |
| Forestry, Fishing | 1.335 | 1.422 | 1.440 | 1.082 | 1.145 | 1.078 | 1.039 | 1.306 | 1.175 | 1.320 | 1.149 |
| Minerals | 1.150 | 1.246 | 1.039 | 1.170 | 1.014 | 1.009 | 1.039 | 1.055 | 1.061 | 1.151 | 1.036 |
| Processed Food | 1.282 | 1.570 | 1.323 | 1.355 | 1.450 | 1.282 | 1.028 | 1.284 | 1.293 | 1.383 | 1.267 |
| Beverages, Tobacco | 1.304 | 1.561 | 1.232 | 1.630 | 1.520 | 1.366 | 1.101 | 1.284 | 1.293 | 1.432 | 1.313 |
| Textiles, Apparel, Leather | 1.648 | 1.817 | 1.451 | 1.672 | 1.111 | 1.551 | 1.033 | 1.237 | 1.152 | 1.647 | 1.217 |
| Wood, Paper Products | 1.219 | 1.276 | 1.154 | 1.275 | 1.340 | 1.117 | 1.024 | 1.322 | 1.118 | 1.231 | 1.184 |
| Petroleum | 1.467 | 1.312 | 1.105 | 1.665 | 1.000 | 1.349 | 1.040 | 1.360 | 1.118 | 1.387 | 1.173 |
| Chemicals | 1.352 | 1.345 | 1.325 | 1.345 | 1.310 | 1.145 | 1.024 | 1.651 | 1.286 | 1.342 | 1.283 |
| Metal Products | 1.085 | 1.170 | 1.112 | 1.185 | 1.110 | 1.059 | 1.023 | 1.360 | 1.118 | 1.138 | 1.134 |
| Machinery & Equipment | 1.411 | 1.243 | 1.193 | 1.309 | 1.055 | 1.197 | 1.022 | 1.360 | 1.118 | 1.289 | 1.150 |
| Other Manufacturing | 2.012 | 1.625 | 1.209 | 1.893 | 1.297 | 1.441 | 1.000 | 1.360 | 1.118 | 1.685 | 1.243 |
| Services | 1.000 | 1.000 | 1.003 | 1.001 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

[a] The countries included are Australia, Japan, the Netherlands, the United States, Mozambique, South Africa, Tanzania, Zambia, and Zimbabwe.

[b] The averages are simples averages across the two regions. Region 1 contains Australia, Japan, the Netherlands, and the United States. Region 2 contains Mozambique, South Africa, Tanzania, Zambia, and Zimbabwe.

Table 5. Average Ratio of FOB to Producer Price of Exports Across Different Countries

| | Countries[a] | | | | | | | | | Averages[b] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Commodity | Aust. | Japan | Nether | USA | Moz | S.A | Tanz | Zambia | Zim | Region1 | Region2 |
| Crops | 1.449 | 1.241 | 1.258 | 1.325 | 1.643 | 1.090 | 1.108 | 1.300 | 1.243 | 1.318 | 1.277 |
| Livestock | 1.361 | 1.193 | 1.201 | 1.024 | 1.118 | 1.090 | 1.048 | 1.585 | 1.277 | 1.195 | 1.224 |
| Forestry, Fishing | 1.154 | 1.166 | 1.149 | 1.102 | 1.005 | 1.090 | 1.047 | 1.268 | N/A | 1.143 | 1.103 |
| Minerals | 1.056 | 1.241 | 1.012 | 1.257 | 1.112 | 1.024 | 1.049 | 1.246 | 1.183 | 1.142 | 1.123 |
| Processed Food | 1.112 | 1.201 | 1.105 | 1.126 | 1.647 | 1.282 | 1.031 | 1.343 | 1.330 | 1.136 | 1.327 |
| Beverages, Tobacco | 1.287 | 1.191 | 1.055 | 1.086 | 1.779 | 1.277 | 1.116 | 1.343 | 1.330 | 1.154 | 1.369 |
| Textiles, Apparel, Leather | 1.228 | 1.167 | 1.117 | 1.111 | 1.370 | 1.345 | 1.036 | 1.504 | 1.183 | 1.156 | 1.288 |
| Wood, Paper Products | 1.185 | 1.167 | 1.055 | 1.183 | 1.249 | 1.131 | 1.025 | 1.264 | 1.183 | 1.148 | 1.171 |
| Petroleum | 1.231 | 1.082 | 1.036 | 1.156 | 1.000 | 1.216 | 1.041 | 1.326 | 1.183 | 1.126 | 1.153 |
| Chemicals | 1.193 | 1.135 | 1.074 | 1.170 | 1.718 | 1.104 | 1.026 | 1.293 | 1.183 | 1.143 | 1.265 |
| Metal Products | 1.024 | 1.112 | 1.060 | 1.152 | 1.169 | 1.094 | 1.023 | 1.326 | 1.183 | 1.087 | 1.159 |
| Machinery & Equipment | 1.226 | 1.083 | 1.109 | 1.127 | 1.150 | 1.173 | 1.024 | 1.326 | 1.183 | 1.136 | 1.171 |
| Other Manufacturing | 1.413 | 1.207 | 1.077 | 1.230 | 1.313 | 1.502 | 1.000 | 1.326 | 1.183 | 1.232 | 1.265 |
| Services | 1.007 | 1.000 | 1.001 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

[a] The countries included are Australia, Japan, the Netherlands, the United States, Mozambique, South Africa, Tanzania, Zambia, and Zimbabwe.

[b] The averages are simples averages across the two regions. Region 1 contains Australia, Japan, the Netherlands, and the United States. Region 2 contains Mozambique, South Africa, Tanzania, Zambia, and Zimbabwe.

Table 6. Average Retail to Producer Price Ratio for Goods Sold for Private Domestic Final Demand

| | Country | | | | |
|---|---|---|---|---|---|
| GTAP Commodity | Belgium | Canada | Germany | Italy | United Kingdom |
| v_f | 1.569 | 1.641 | 1.390 | 1.520 | 1.205 |
| ocr | 1.620 | 1.752 | 1.390 | 1.520 | 1.139 |
| cmt | 1.626 | 1.544 | 1.423 | 1.605 | 1.390 |
| omt | 1.626 | 1.456 | 1.417 | 1.605 | 1.390 |
| vol | 1.237 | 1.508 | 1.423 | 1.477 | 1.830 |
| mil | 1.389 | 1.360 | 1.417 | 1.566 | 1.550 |
| pcr | 1.237 | 1.867 | 1.423 | 1.549 | 1.511 |
| sgr | 1.237 | 1.522 | 1.423 | 1.477 | 1.691 |
| ofd | 1.282 | 1.580 | 1.419 | 1.541 | 1.462 |
| b_t | 1.335 | 1.568 | 1.423 | 1.288 | 1.640 |
| tex | 2.997 | 1.664 | 2.039 | 1.593 | 1.835 |
| wap | 1.845 | 1.836 | 2.039 | 1.562 | 2.005 |
| lea | 1.563 | 1.618 | 2.039 | 1.676 | 1.959 |
| ppp | 1.497 | 1.424 | 1.968 | 1.799 | 1.647 |
| p_c | 1.503 | 2.052 | 1.597 | 1.162 | 1.216 |
| crp | 1.565 | 1.894 | 1.697 | 1.762 | 1.733 |
| fmp | 1.169 | 1.434 | 1.466 | 1.631 | 1.529 |
| mvh | 1.157 | 1.213 | 1.263 | 1.324 | 1.128 |
| otn | 1.075 | 1.216 | 1.197 | 1.288 | 1.067 |
| ele | 1.275 | 1.215 | 1.492 | 1.732 | 1.379 |
| ome | 1.336 | 1.498 | 1.511 | 1.536 | 1.560 |
| omf | 1.524 | 1.588 | 1.855 | 2.240 | 2.113 |

Table 7. Summary Statistics

| Variable | N | Mean | Std Dev. | Min | Max |
|---|---|---|---|---|---|
| Retail to Manufacturer Price Ratios | | | | | |
| Bovine meat products (cmt) | 51 | 1.43 | 0.20 | 1.16 | 2.17 |
| Meat products nec (omt) | 50 | 1.44 | 0.19 | 1.16 | 2.18 |
| Vegetable oils and fats (vol) | 52 | 1.35 | 0.22 | 1.12 | 2.58 |
| Dairy products (mil) | 52 | 1.34 | 0.12 | 1.15 | 1.68 |
| Processed rice (pcr) | 52 | 1.39 | 0.16 | 1.15 | 2.03 |
| Food products nec (ofd) | 52 | 1.37 | 0.13 | 1.16 | 1.87 |
| Beverages and tobacco (b_t) | 52 | 2.13 | 0.46 | 1.27 | 3.36 |
| | | | | | |
| County Specific Variables | | | | | |
| Per-capita GDP ($US) | 52 | 12523.83 | 11230.97 | 416 | 37783 |
| Per-capita electric power consumption (kwh) | 52 | 5116.09 | 4560.12 | 285.52 | 24421.7 |
| Surface area (square km) | 52 | 1697677 | 3424858 | 620 | $1.71*10^7$ |

Sources:

Retail to manufacturer price ratios are based on data from Euromonitor supplied by Mark Gehlhar, Economic Research Service, U.S. Department of Agriculture.

Country specific variables were obtained from the Statistics Division of the United Nations.

Table 8. Spearman Rank Correlation Matrix of Processed Food Margins

| | GTAP Commodity | | | | | | |
|---|---|---|---|---|---|---|---|
| GTAP Commodity | b_t | ofd | pcr | cmt | omt | vol | mil |
| b_t | 1.00 | -0.07 | -0.19 | -0.22 | -0.23 | -0.14 | -0.06 |
| | | (0.63)[a] | (0.17) | (0.12) | (0.11) | (0.32) | (0.67) |
| ofd | | 1.00 | 0.78 | 0.77 | 0.74 | 0.81 | 0.80 |
| | | | (<0.0001) | (<0.0001) | (<0.0001) | (<0.0001) | (<0.0001) |
| pcr | | | 1.00 | 0.84 | 0.79 | 0.58 | 0.47 |
| | | | | (<0.0001) | (<0.0001) | (<0.0001) | (0.0005) |
| cmt | | | | 1.00 | 0.97 | 0.61 | 0.55 |
| | | | | | (<0.0001) | (<0.0001) | (<0.0001) |
| omt | | | | | 1.00 | 0.65 | 0.54 |
| | | | | | | (<0.0001) | (<0.0001) |
| vol | | | | | | 1.00 | 0.74 |
| | | | | | | | (<0.0001) |
| mil | | | | | | | 1.00 |

[a] Values in parentheses are *p* values for the null hypothesis that the correlation coefficient is equal to zero.

Table 9. Parameter Estimates for Processed Food Generalized Box-Cox Models

| Parameter/ Independent Variable | Dependent Margin Variable | | | | | | |
|---|---|---|---|---|---|---|---|
| | b_t | ofd | pcr | cmt | omt | vol | mil |
| $\theta$ | -0.664 | -3.501 | -3.162 | -3.467 | -3.126 | -4.282 | -1.863 |
| | (0.196)[a] | (0.008) | (0.007) | (0.000) | (0.001) | (0.000) | (0.213) |
| $\lambda$ | 2.181 | -0.271 | -0.173 | -0.697 | -0.683 | -0.203 | -0.404 |
| | (0.104) | (0.411) | (0.359) | (0.075) | (0.080) | (0.614) | (0.343) |
| pgdp | -0.009 | -0.009 | -0.022 | -0.006 | -0.007 | -0.012 | -0.014 |
| | (0.018) | (0.140) | (0.024) | (0.135) | (0.107) | (0.096) | (0.614) |
| pelect | -0.017 | 0.018 | 0.033 | 0.017 | 0.017 | 0.014 | 0.019 |
| | (0.037) | (0.045) | (0.024) | (0.052) | (0.035) | (0.062) | (0.118) |
| Area | | | -0.003 | | | | |
| | | | (0.090) | | | | |
| *Regional Variables* | | | | | | | |
| North America | 0.327 | 0.034 | 0.005 | -0.00005 | -0.0005 | 0.010 | 0.063 |
| | (0.012) | (0.131) | (0.862) | (0.099) | (0.081) | (0.647) | (0.123) |
| Central and South America | 0.030 | 0.041 | 0.044 | 0.033 | 0.039 | 0.001 | 0.041 |
| | (0.595) | (0.012) | (0.024) | (1.000) | (0.023) | (0.931) | (0.124) |
| Australia/New Zealand | 0.081 | 0.034 | -0.026 | -0.001 | 0.006 | 0.023 | 0.089 |
| | (0.104) | (0.110) | (0.354) | (0.106) | (0.071) | (0.266) | (0.025) |
| Higher Income Asia | 0.165 | 0.035 | -0.010 | 0.012 | 0.020 | 0.027 | 0.055 |
| | (0.045) | (0.035) | (0.666) | (0.063) | (0.031) | (0.031) | (0.075) |
| Rest of Asia | 0.054 | 0.037 | 0.024 | 0.045 | 0.040 | 0.004 | 0.036 |
| | (0.321) | (0.008) | (0.232) | (0.034) | (0.065) | (0.778) | (1.000) |
| EU-15 | 0.240 | 0.010 | -0.017 | -0.023 | -0.026 | -0.017 | 0.026 |
| | (0.015) | (0.294) | (0.379) | (0.043) | (0.022) | (0.262) | (0.346) |
| Eastern Europe | 0.103 | 0.029 | -0.0001 | -0.003 | 0.001 | 0.002 | 0.031 |
| | (0.046) | (0.037) | (0.994) | (0.100) | (0.059) | (0.081) | (1.000) |
| Constant[b] | 0.455 | 0.164 | 0.184 | 0.197 | 0.208 | 0.156 | 0.180 |
| $\chi^2$ Statistic | 28.19 | 22.24 | 20.74 | 21.73 | 25.19 | 22.96 | 12.09 |
| | (0.002) | (0.014) | (0.036) | (0.017) | (0.005) | (0.011) | (0.279) |
| *Elasticities* | | | | | | | |
| pgdp | -0.015 | -0.027 | -0.062 | -0.022 | -0.021 | -0.043 | -0.024 |
| pelect | -0.029 | 0.055 | 0.092 | 0.059 | 0.053 | 0.052 | 0.033 |
| area | | | -0.009 | | | | |
| *Functional Form Test* | | | | *p*-values | | | |
| $\theta = \lambda = -1$ | 0.017 | 0.018 | 0.006 | 0.007 | 0.017 | 0.000 | 0.242 |
| $\theta = \lambda = 0$ | 0.037 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.085 |
| $\theta = \lambda = 1$ | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 |

[a] *p*-values against the null hypothesis of $\beta_i = 0$ are in parentheses.

[b] No *p*-values are provided for constant by the econometric package Stata.

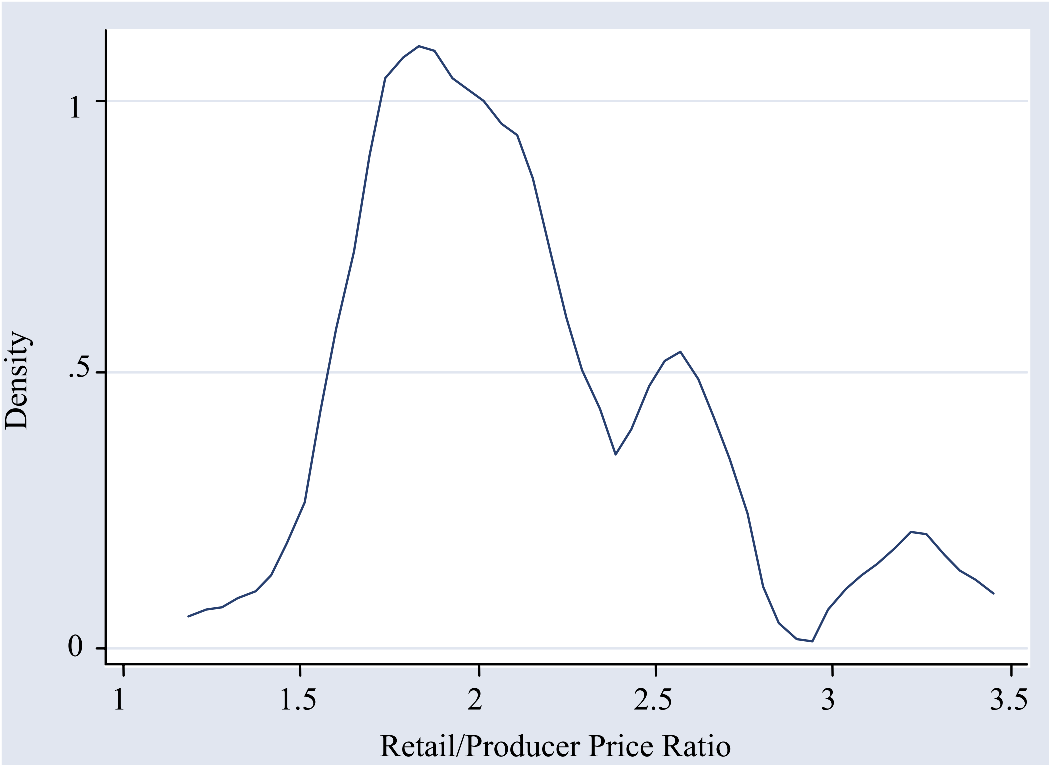


**Figure 1. Kernel Density Estimate for Beverages and Tobacco**

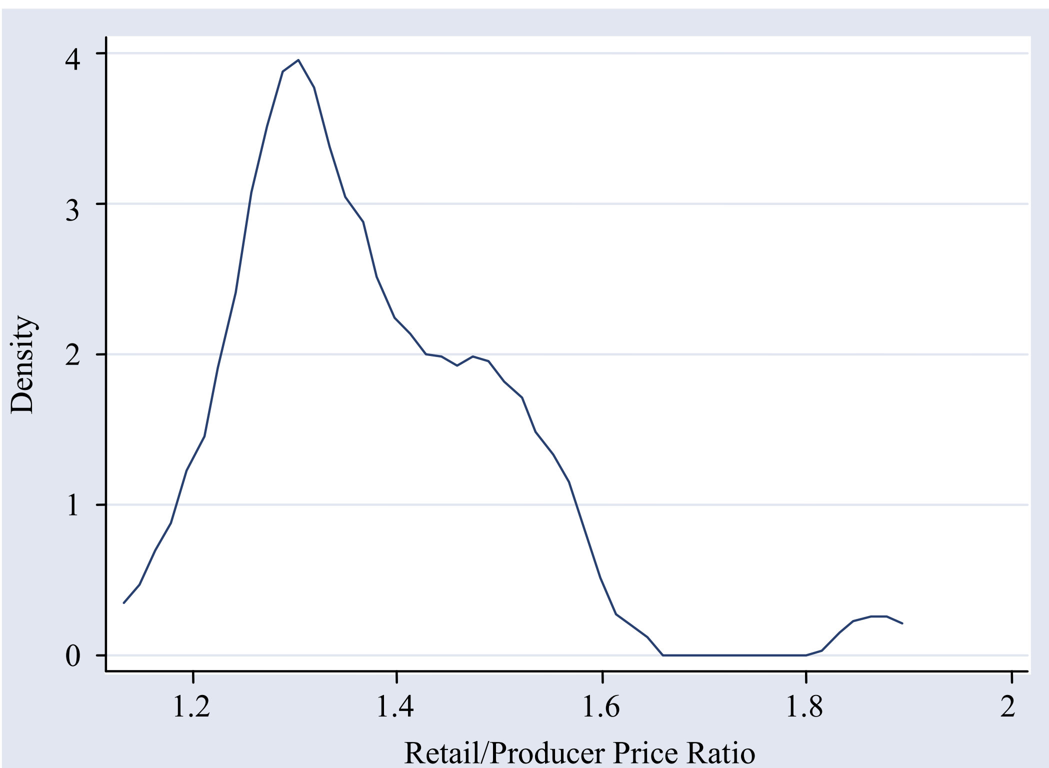


**Figure 2. Kernel Density Estimate for Food Products nec**


**Figure 3. Kernel Density Estimate of Processed Rice**

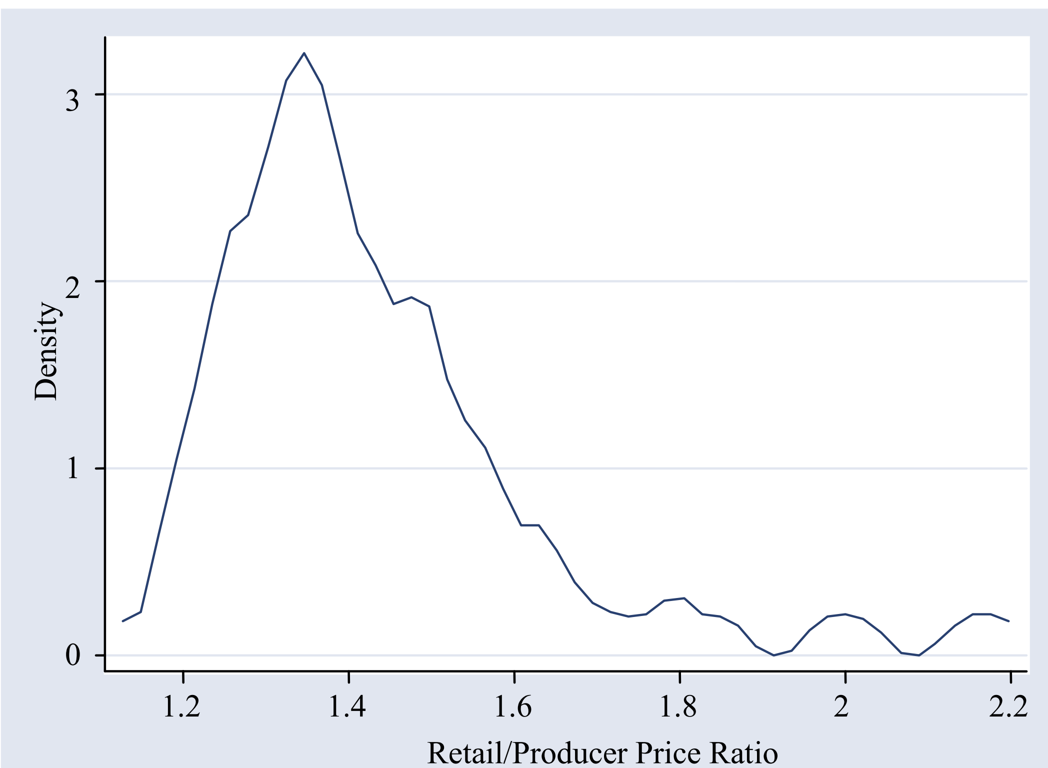


**Figure 4. Kernel Density Estimate of Bovine Meat Products**

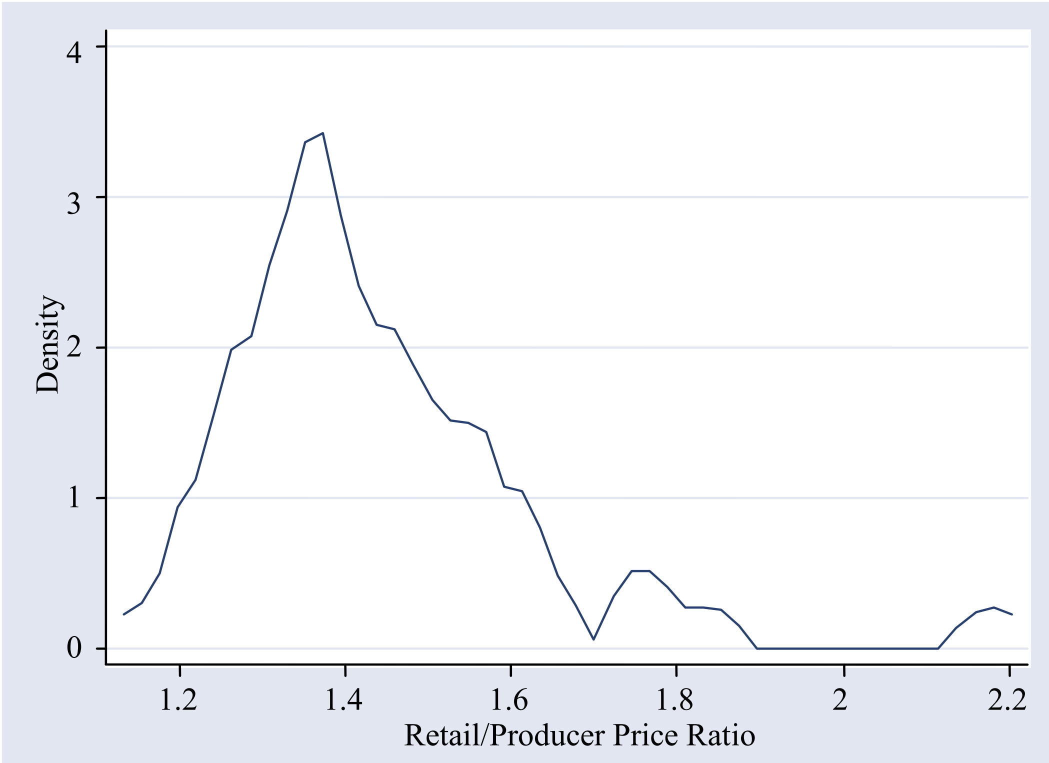


**Figure 5. Kernel Density Estimate for Meat Products nec**

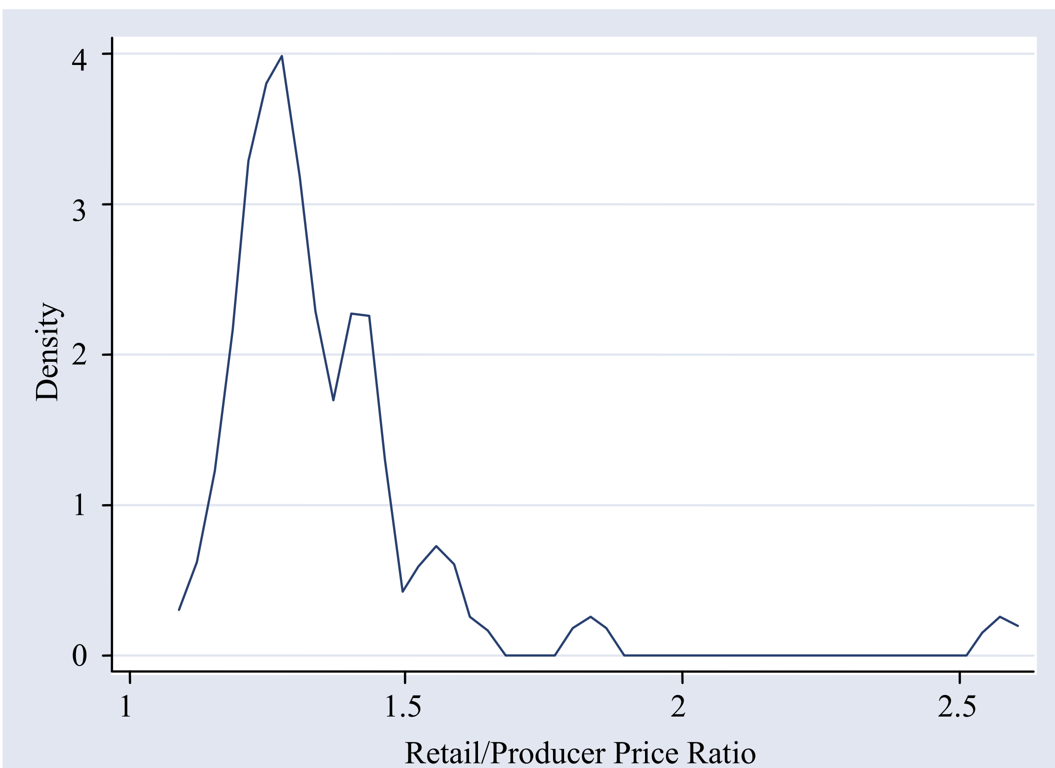


**Figure 6. Kernel Density Estimate for Vegetable Oils and Fats**

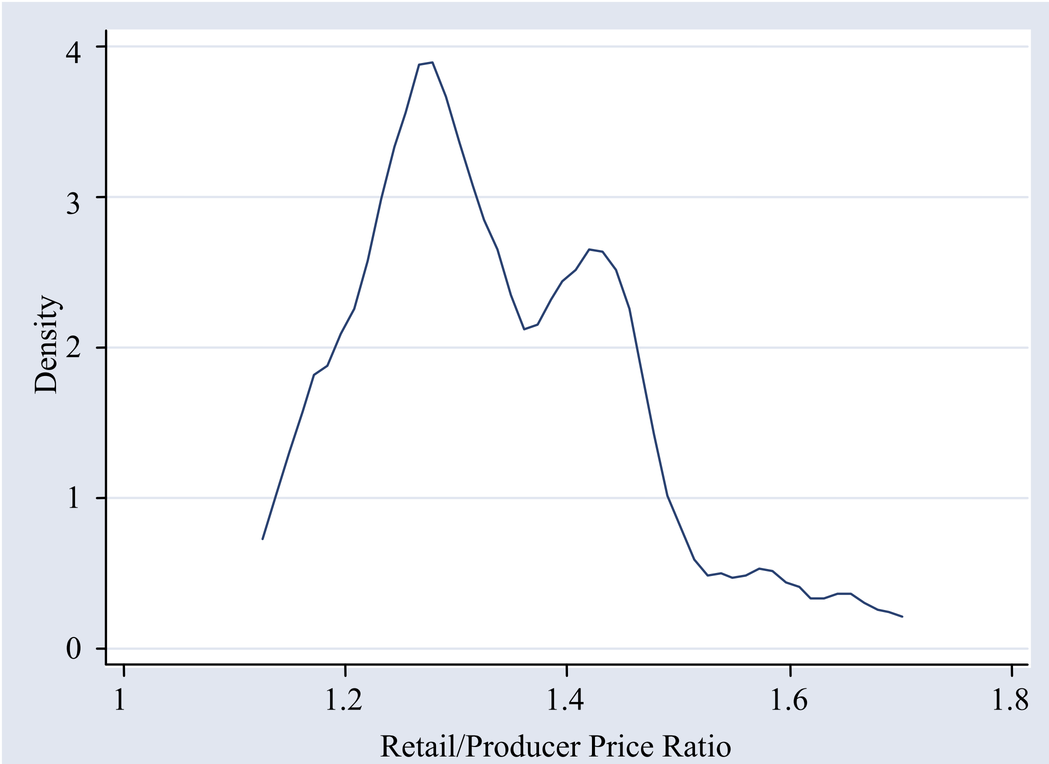


**Figure 7. Kernel Density Estimate for Dairy Products**