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# Does Labelling Differentiate Products and Create Price Premiums? The Case of Tomatoes from Northeast Nigeria

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December 2024



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## Abstract

This note describes a labelling experiment introduced to crates of tomatoes cool transported from the northeast region of Nigeria to Lagos or Port Harcourt. A label was attached to a random sample of crates to ensure that the quality of tomatoes is orthogonal to the labels and the destination market was not informed of the experiment. The label contained the information on (a) the project (IFPRI), (b) the transportation method (cool transportation), and (c) the origin of tomatoes (Jos or Gombe), as shown below. The experiment was conducted in the first rounds from Jos and Gombe (Lagos), and the fifth round from Jos (Port Harcourt). As expected, the labeled crates were priced higher than the unlabeled crates. About 9 to 33% of the sale price is attributed to improved information on the quality of tomatoes via the labels.



## 1. Introduction

The information on product quality is often imperfect. Horticultural products are not an exception. For example, consumers often do not know when tomatoes were harvested, in what way they were packaged, transported, and stored, and so on. All these postharvest stages affect the quality of tomatoes.

If they are transported from a distant region, it is also important for consumers to know where exactly the products originated from. Whether or not cool transported significantly matters too. Consumers or marketers in the destination market cannot distinguish between high quality and low-quality products if additional information is not provided to help them assess the quality. If they fail to distinguish, we go in so called pooling equilibrium in which high-quality and low-quality products are given the same price.

Producers and marketers in the origin market will be worse off in a pooling equilibrium if they produced and supplied a high-quality product. On the other hand, those who produced and supplied a low-quality product may be better off.

It is still an empirical question whether more information, e.g., via labelling, successfully differentiates a high-quality product from a low-quality product, and if yes, what types of information effectively achieves this goal. What information effectively signals to consumers and marketers in the destination market about product quality so that separating equilibria can emerge in the market?

We introduce a labelling experiment in an empirical setting that high quality tomatoes are cool transported to a large market in a distant location, where tomatoes are supplied from many different origins. Though the market agents in the destination market know the origins of tomatoes, they are packaged in plastic crates and once they are circulated in the market, it is hard to distinguish one from the other.

In the next section, we describe the empirical setting. Section 3 describes the labelling experiment, which was built in a randomized controlled trial on cool transportation. The product transported in the experiment is considered high quality and excessively demanded in the destination market. In Section 4, we show that labels signal the quality of tomatoes and as a result, price premiums are observed in the destination market.

## 2. Empirical Setting

In many developing countries, including Nigeria, much of fruit and vegetable production is lost largely because of lack of an adequate cold chain, including postharvest handling, cold storage and temperature-controlled transportation. As a result, not only the availability of fish, fruits, vegetables, milk, eggs and meat but also the safety and nutritional content of the food are affected. Under such conditions, all agents in the supply chain including farmers suffer from income reduction, while consumers face unstable and lower-quality supply of normally more nutritious foods. Inadequate development of value chains and deficiencies in high costs associated with cooling systems are main causes of such losses.

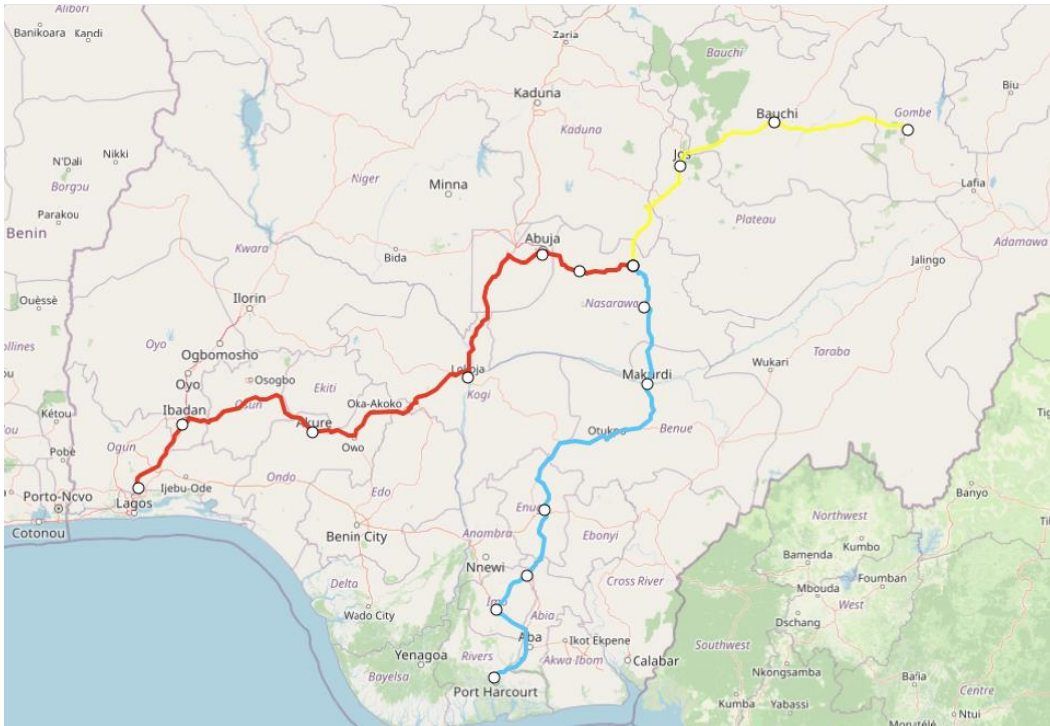
In Nigeria, significant production shares of major food items originate from the northeast and surrounding regions, e.g., onion (47%), tomato (38%), cowpea (35%), etc. Several local horticulture varieties can grow under rainfed conditions, and the growers possess knowledge of basic irrigation that enables dry-season horticulture production in the region. In contrast, large demand centers are concentrated in the southern part of the country.

Still, seasonal and spatial variations of horticultural production and therefore of supplies to the economy are significant, which is one of the main causes that explain large spatial gaps between production and demand for horticultural products, and a large amount of food loss in the economy.

To reduce spatial allocative inefficiency, cool transportation is crucially important. The comparative advantage of cool transportation over cold storage is its mobility. In a previous intervention of solar powered cold storage introduced at northeast markets, the accessibility to the storages is spatially fixed, and thus the users and beneficiaries are limited in

certain locations. In contrast, cool transportation opens the possibility of reaching out to distant markets where sales prices are sufficiently high. Ideally, the mobile nature of refrigerating trucks also would enable to combine different origin and destination markets in response to dynamically changing market conditions.

**Figure 1 Jos/Bauchi/Gombe to Lagos/Port Harcourt**



We introduced a randomized controlled trial in three vegetable markets in the northeast region of Nigeria. These markets are Farin Gada, Muda Lawal, Yan Gwari vegetable markets in Jos, Bauchi and Gombe, respectively. Table 1 shows descriptive statistics of the baseline sample marketers in the three markets. Tomatoes are transported in temperature-controlled trucks to Lagos or Port Harcourt. Access to the service is randomly assigned to marketers in the origin markets. The intervention also uses plastic crates. The 20 ton truck carries approximately 700 crates of tomatoes (each crate contains 20 kg of tomatoes).

International Food Policy Research Institute, with support from the Government of Japan, has collaborated with the Federal Ministry of Agriculture and Food Security, ColdHubs (Phase 1), DARJHAS Health and Agric Development, University of Jos, and the market unions to introduce the intervention and assess the impacts.

Figure 1 shows the geographic locations of the origin markets and destination markets. The yellow part is a common route for the two destinations. The red part shows the route to Lagos; the blue part, the route to Port Harcourt. The treatment group can compare market prices between the two markets and decide the destination (Phase 2).

There are three important features in the above empirical setting. First, the distance is long and, therefore, asymmetric information is significant between the origin and destination markets. Second, in Nigeria, tomatoes produced around the origin markets are considered high quality and excessively demanded in the destination markets. Third, the destination markets in our study attract tomatoes from many different origins, so tomatoes of different qualities are supplied from various locations to the destination markets. In such a situation, it is generally hard to differentiate products of different qualities unless additional and reliable information is attached to the products.

### 3. Experiment

The labelling experiment was conducted in the first rounds from Jos and Gombe (Lagos) and the fifth round from Jos (Port Harcourt). A truck carries approximately 700 crates of tomatoes and crates were randomly labelled (about half of

the crates, say, 350 crates are labelled). Figures 2a and 2b show the labels for Jos and Gombe, respectively. The destination agents were not informed of the experiment, so it is a surprise to the destination market.



**Figure 2 (a) Label for Jos and (b) Label for Gombe**



In theory, we cannot predict the reaction of the destination market, i.e., consumers and marketers, to the label. The labelled crates can be priced higher or lower than the unlabeled ones. However, it is important to note that the labelled crates will be priced uniquely (a single price) and the unlabeled crates are also priced uniquely (a single price). There are no price variations among the labelled crates; similarly, no variations among the unlabeled crates.

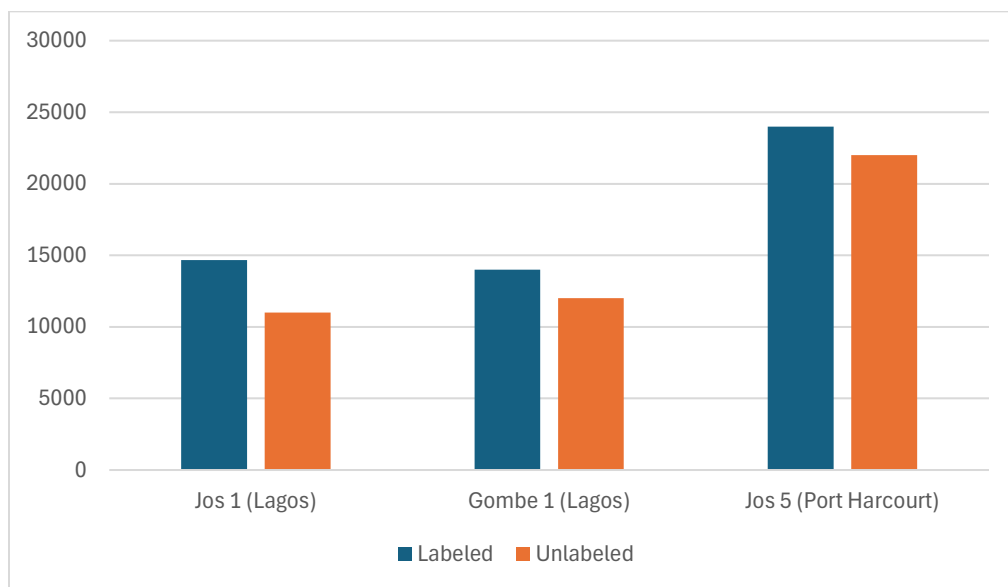
As shown in Figures 2a and 2b, the label contains the information on (a) the project, i.e., IFPRI, (b) the transportation method, i.e., cool transportation, and (c) the origin of tomatoes, i.e., Jos or Gombe in this case. Combined together, the label is considered to signal relatively higher quality of tomatoes.

## 4.Impacts

The findings are summarized in Table 2. Figure 3 graphs sale prices for the labelled and unlabeled crates. The experiment was conducted in the first rounds from Jos and Gombe to Lagos, and the fifth round from Jos to Port Harcourt. Crates were priced differentially, and the labeled crates are priced higher than the unlabeled crates. Note

that the quality of tomatoes is orthogonal to labels as crates were randomly labeled. About 9 to 33% of the sale price is attributed to improved information (price premium).

**Figure 3 Prices for Labeled Crates and Unlabeled Crates**



Average premium in percentage is 19.7 (%). The improved information contributes to about 20% of the sales price in the destination. The label combines three types of information in our case, and it is not clear which part of the information is contributing the most or whether a combination of the information matters.

Based on the midpoint estimates of the cool transportation impact on sales price (Yamauchi, et al., 2024), it is also possible to compute the impact on sales price in the case of labelled crates (Table 3). The computed impacts of cool transportation on sales price are 9285.91 and 13195.07, relative to non-cool transportation and origin market sales, respectively.

## 5. Conclusions

This note summarized preliminary findings in the labelling experiment introduced to crates of tomatoes cool transported from the northeast region of Nigeria to Lagos or Port Harcourt. A label was attached to a random sample of crates to ensure that the quality of tomatoes is orthogonal to the labels and the destination market was not informed of the experiment. The label contained the information on (a) the project (IFPRI), (b) the transportation method (cool transportation), and (c) the origin of tomatoes (Jos or Gombe). The study showed that the labeled crates were priced higher than the unlabeled crates. About 9 to 33% of the sale price is attributed to improved information on the quality of tomatoes via the labels.

## 6. References

Futoshi Yamauchi, Bawa Dauda, Bedru Balana, Hyacinth Edeh and Weilun Shi, 2024, *Impacts of Cool Transportation in Nigeria: Midpoint Analysis*, Technical Note, Rethinking Food Markets Initiative.

## Tables

**Table 1 Descriptive Statistics in Three Markets**

| Variable  | All markets | Jos      | Bauchi  | Gombe   |
|---|-------------|----------|---------|---------|
| <b>Position (Owner)</b>                           | 99.17       | 97.5     | 100     | 100     |
| <b>Used cold storage</b>                          | 27.67       | 11.5     | 51.5    | 20      |
| <b>Using cold storage now</b>                     | 4.67        | 3.5      | 7       | 3.5     |
| <b>Is commission agent</b>                        | 67.83       | 93.5     | 50      | 60      |
| <b>Is Wholesaler</b>                              | 91.33       | 82       | 93      | 99      |
| <b>Grow crops by self</b>                         | 32.83       | 45.5     | 23.5    | 29.5    |
| <b>Sell in other markets</b>                      | 62.17       | 58       | 78      | 50.5    |
| <b>Crop sole ownership (%)</b>                    | 93.67       | 96.5     | 85.5    | 99      |
| <b>Selling experience (years)</b>                 | 16.79       | 16.44    | 15.99   | 17.94   |
| <b>Producing experience (years)</b>               | 3.24        | 4.68     | 1.76    | 3.29    |
| <b>Age</b>  | 40.72       | 40       | 44.16   | 38.02   |
| <b>Household Size</b>                             | 9.19        | 8.56     | 9.72    | 9.28    |
| <b>State Native</b>                               | 86.33       | 71       | 97.5    | 90.5    |
| <b>Education (yrs)</b>                            | 9.08        | 9.63     | 8.23    | 9.26    |
| <b>Is member of trade association</b>             | 91.5        | 79.5     | 99      | 96      |
| <b>Sell tomatoes</b>                              | 60.33       | 86       | 19.5    | 75.5    |
| <b>Quantity of tomatoes sold (kg)</b>             | 7910.58     | 12215.01 | 3647.69 | 4108.52 |
| <b>Purchase from someone</b>                      | 53.5        | 67       | 19.5    | 74      |
| <b>Store in cool transport</b>                    | 2           | 0        | 4.5     | 1.5     |
| <b>Store in cold storage</b>                      | 0.5         | 1        | 0       | 0.5     |
| <b>Store in non-cool transport</b>                | 49.5        | 70       | 15      | 63.5    |
| <b>Own a storage space</b>                        | 41.17       | 14.5     | 81.5    | 27.5    |
| <b>Storage space (tons)</b>                       | 24.09       | 5.66     | 34.96   | 1.56    |
| <b>WTP for cool transport</b>                     | 1592.14     | 1884.64  | 1341.9  | 1549.9  |
| <b>Estimated current price (per crate)</b>        | 9025.5      | 7824     | 10767.5 | 8485    |
| <b>Estimated transportation capacity (crates)</b> | 129.32      | 146.32   | 91.42   | 150.22  |
| <b>Expected price (per crate)</b>                 | 26206.67    | 26030    | 28410   | 24180   |
| <b>Concerned about transportation loss</b>        | 99.83       | 100      | 99.5    | 100     |
| <b>Willingness to participate</b>                 | 55.17       | 64       | 46.5    | 55      |
| <b>Number of observations</b>                     | 600         | 200      | 200     | 200     |

**Table 2 Sales Price**

| <b>Origin</b> | <b>Round</b> | <b>Destination</b> | <b>Labelled</b> | <b>Unlabelled</b> | <b>%</b> |
|---------------|--------------|--------------------|-----------------|-------------------|----------|
| <b>Jos</b>    | 1            | Lagos              | 14,660          | 11,000            | 33.3     |
| <b>Gombe</b>  | 1            | Lagos              | 14,000          | 12,000            | 16.7     |
| <b>Jos</b>    | 5            | Port Harcourt      | 24,000          | 22,000            | 9.1      |

**Table 3 Midpoint Impacts - Labelled Crates**

|                                | <b>Sales price</b><br><b>(control: non-cool)</b> | <b>Sales price</b><br><b>(control: origin market)</b> |
|--------------------------------|--|---|
| <b>Cool transportation</b>     | 7757.65***                                       | 11023.45***   |
| <b>[Yamauchi, et al. 2024]</b> | (294.42)   | (374.77)  |
| <b>Labelled Crates</b>         | 9285.91  | 13195.07  |

## Annex

### **Randomized Controlled Trial on Cool Transportation**

The study sample comprises of randomized 56 marketers for each of the markets in Jos, Bauchi and Gombe. A random sample of 40 tomato wholesalers in each of the markets in Jos, Bauchi and Gombe will participate in the RCT, while a random sample of 16 wholesalers per market will serve as the pure control sample.

The 40 wholesalers in each of the markets were further grouped into five groups comprising of 8 wholesalers per group. Each group serves as a round specific treatment group i.e. the wholesalers who will be sending their products to the destination market, Mile 12 vegetable market in Lagos, whereas the remaining 4 groups will stand by as control. The process will be repeated each week, and the target number of rounds per market is 15 (approximately, 15 weeks).

The follow-up survey is conducted in each round, that is, approximately every week. The data are collected from the agents at the destination market on trading activities of perishable horticulture crop in the most recent transaction cycle, which covers (i) prices of the products delivered to the destination market, (ii) sales of the products delivered to the destination market, (iii) food loss/spoilage and (iv) relationships. We also collect data from the sample marketers in the origin markets in each round.

The RCT has been implemented through two phases in 2024. Phase 1 was implemented in January and February, and Phase 2 has been implemented since October 2024. In Phase 1, as a pilot implementation, the destination market was Mile 12 in Lagos only, but we expanded the scope in Phase 2 to include Port Harcourt as an option. Thus, price comparison between the two destinations is possible in Phase 2.

The project completed one round in Jos and four rounds in Gombe in February and March 2024. The first trip from Gombe had two trucks but one of them resulted in total loss of tomatoes due to lack of proper maintenance (the cost of tomato purchases at Gombe was compensated). Unfortunately, there was no operation offered to the marketers in Bauchi. The second phase started in October, and we are scheduled to complete the 15 round trips in January 2025, depending on the actual circumstances.



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