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Investigating the impacts of time delays on trade

Lan Liu [a], Chengyan Yue [b,*]

[a] Department of Applied Economics, University of Minnesota, United States
[b] Departments of Applied Economics and Horticultural Science, University of Minnesota, United States

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ABSTRACT

Time delays due to inefficient customs and administrative procedures have become a leading non-tariff barrier (NTB) that restrict international trade and impair social welfare. This paper investigates how time delays affect product quality, product price, trade flow, and social welfare, using data on the days it takes to clear customs in 96 countries. We explore the impacts of time delays on product quality and price with different levels of perishability. We find that longer time delays at the border would significantly decrease highly perishable agricultural products' quality and price. We also find that for highly perishable agricultural products, improved and simplified customs delays would increase trade flows and social welfare of importing countries.

Introduction

Customs and administrative procedures are meant to smooth the trade across country borders. The procedures cover customs valuation, customs classification procedures, and customs clearance procedures such as inspections and documentation. However, inefficient customs and administrative procedures have become a leading non-tariff barrier (NTB) that restricts international trade and impairs social welfare (Beghin, 2008; OECD, 2005). In some countries, customs clearance is reported to be deliberately delayed to increase the transaction cost and thus reduce competition for similar domestic products. Cumbersome and lengthy customs and administrative procedures would lead to time delays at the border, which would not only increase the trade cost but also, for perishable agricultural products such as leafy greens and cut flowers, impair the product quality and reduce the prices of the products. For most global manufacturers that are heavily dependent on frequent and timely delivery of imports of raw material and intermediary goods for their production processes, inefficient customs procedures would add to costs and delivery times, which in turn lowers the competitiveness of the products. The long and complex customs clearance process, the lack of consistency and transparency of procedures for inspection and valuation, the non-automated customs procedures and administration, the limitations of working hours at the customs and the lack of customs officers, and the shortage of gates for receiving cargo are some of the problems that cause time delays at customs.

Exporters may suffer from some direct costs due to border time delays such as inventory-holding costs. In addition, time delays caused by lengthy customs and administrative procedures can impose some indirect cost on shippers. For example, for highly perishable agricultural goods such as fresh produce and cut flowers, time delays could severely deteriorate product quality, which in turn decreases the product market prices in the importing countries. If the market prices for lower quality products are too low in the importing countries to make the trade profitable, the exporters would not be able to enter the market in the importing country and lose the business opportunities. In this paper, we call the impact of border time delays on product quality the "quality effect." Quality effect would lower the competitiveness of the producers of the exporting countries, restrict the trade volume, and reduce social welfare of importing and exporting countries. Quality effect may further lead to "price effect", i.e. the reduction of product quality reduces the selling price of the imported product at the marketplace. Additionally, price effect decreases the profits of the exporters. As a result, quality effect and price effect generate welfare losses for consumers and producers in importing and exporting countries.

However, the magnitude of these two effects may differ depending on the characteristics of the products traded. For highly perishable products, time delays at the border can lead to product weight or volume losses, product quality losses, and increased storage and treatment costs. For some other products such as

* Corresponding author. Address: 458 Alderman Hall, University of Minnesota – TC, 1970 Folwell Avenue, St. Paul, MN 55108, United States. Tel.: +1 612 626 3974; fax: +1 612 624 4941.
E-mail address: yuechy@umn.edu (C. Yue).

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newspaper that can only be consumed during a limited time window, time delays at the border could render the product useless and even drive the product out of the marketplace. Therefore, time delays could be a significant trade barrier for perishable agricultural products. For the products that are not time sensitive, it is expected that the quality effect and price effect of time delays would not be as significant.

Much research has been done to investigate the timeliness in determining trade patterns. Theoretically, Evans and Harrigan (2005) develop a model to investigate the demand for timeliness and its implications for international trade. Their model predicts that products whose timely delivery is important will be imported from nearby countries even with higher monetary costs. Harrigan and Venables (2006) argue that time costs are different from direct monetary costs due to the time costs' uncertainty. They show that the demand for timely delivery is one of the reasons for clustering of manufacturing plants. Empirically, Hummels (2001) finds that an increase in shipping time of 1 day reduces the probability that a country exports manufactures to the United States by 1.5%. He also finds that each day saved in shipping time is worth 0.8% reduction of ad-valorem tariff. Studies by Hausman et al. (2005) and Djankov et al. (2006) introduce time delays into gravity model estimation and find that a 10% increase in time delays would reduce bilateral trade volumes by between 5% and 8%. The research by Nordas et al. (2006) also suggests that time delays are found not only to reduce trade volumes, but more importantly reduce the probability that firms will enter export markets for time-sensitive products at all. Subramanian and Arnold (2001) examine the transportation and logistics networks in South Asia and find that time delays and logistics services are the main problems for traders. Nomura Research Institute (2004) estimates that Japanese trade facilitation measures cut average lead time by 56% between 1991 and 2001 for cargo and that this time reduction saved approximately 39 billion yen total for cargo owners, shipping companies, terminal operators and customs brokers. Eifert and Ramachandran (2004) estimate that average firm-level productivity could increase by 18% if the number of days required to clear customs were halved in Ethiopia.

Some other studies (e.g., Wilson et al. (2003, 2005), Persson (2008), Martinez-Zarzoso and Márquez-Ramos (2008)) center around a broader notion of "trade facilitation", i.e. "expediting the movement, release and clearance of goods, including goods in transit (WTO, 2001)." They focus on estimating the extent to which the reform of trade procedures would affect aggregated trade volumes and find significant impacts.

However, the existing literature is mainly based on gravity models and only look at the aggregated effects of time costs on trade volumes without distinguishing the compositional effects. Relatively little research has been conducted to explore the underlying mechanisms, the economic linkages, or sources of causation. This paper provides new empirical enhancements. Specifically, we focus on time delays' quality effect and price effect – how time delays impact quality and price of traded products, which in turn affect the trade flow and social welfare. This issue is especially important for agricultural produce since many fresh produce is highly perishable and time delays would reduce the shelf life, quality, and selling price of the product. In this article, we use an extended CES model to investigate the quality effect and price effect of time delays at the border. We focus on the impacts of time delays on agricultural products rather than on general manufactured products categories that are investigated in the existing literature. Since we expect that the more time-sensitive the product is, the larger the quality effect and price effect would be, we analyze the impacts of quality effect and price effect of time delays on three different agricultural products: lettuce (which is highly perishable,) apple (which is medium perishable,) and groundnuts (which are not as perishable.) Due to the date restriction, we focus on the time delays at the border rather than the whole lead time. Our estimation suggests that for highly perishable produce (such as lettuce) the time delays' quality effect and price effect are both significant, which means that the time delays significantly decrease the product's quality and in turn decrease the product's price. For medium perishable product (such as apple) time delays have significant quality effect but no significant price effect, which means that the time delays decrease the product's quality, but the quality decrease is not large enough to reduce the selling price of the product. Finally for less perishable products (groundnuts) we find neither significant quality effect nor price effect, which is consistent with the fact that the product is not as perishable and therefore not time sensitive. By investigating the impacts of time delays on the trade flow and social welfare, we find that for perishable agricultural produce, if the time delays are reduced, the trade flow and social welfare would significantly increase.

The rest of the article is organized as follows. First we introduce our analytical framework. Then the second section covers the data set used in this article. In the third section, estimation results are presented. Finally, the last section contains the conclusion, where important policy implications based on our estimation results are discussed.

Analytical framework

We employ a CES model that is similar to the model used by Yue et al. (2006) and Liu and Yue (2009). We introduce possible quality effect and price effect (changes in product quality and price due to time delays at the border) to the basic CES utility function that incorporates the heterogeneity in quality of domestic and imported products. Domestic and imported goods quantities are defined as D and I, respectively. A representative consumer maximizes the following utility function, subject to a budget constraint:

$$\underset{D,I}{Max}\, U(D,I) = [\alpha D^{\rho} + (1-\alpha) I^{\rho}]^{\frac{1}{\rho}} + \mathrm{AOG} \quad s.t.\ P_D D + P_I I + \mathrm{AOG} = M_T \tag{1}$$

M_T is the expenditure on all goods; P_I and P_D are prices of imported and domestic goods, respectively; AOG is the aggregate numéraire good; α and $1-\alpha$ are indicators of quality of domestic and imported goods, respectively. They capture the combination of all product characteristics other than the price of a product. The indirect utility function is

$$V(P_D, P_I, M_T) = (M_T - \mathrm{AOG}^*)[\alpha^{\sigma} P_D^{1-\sigma} + (1-\alpha)^{\sigma} P_I^{1-\sigma}]^{\frac{1}{\sigma-1}} \tag{2}$$

and the corresponding expenditure function is

$$e(P_D, P_I, u) = (u - \mathrm{AOG}^*)[\alpha^{\sigma} P_D^{1-\sigma} + (1-\alpha)^{\sigma} P_I^{1-\sigma}]^{\frac{1}{1-\sigma}} \tag{3}$$

The expenditure function and indirect utility function are used to estimate consumer welfare. The associated Marshallian demand functions are

$$D = \frac{M_T - \mathrm{AOG}^*}{P_D + P_I^{1-\sigma} P_D^{\sigma} \cdot \left(\frac{1-\alpha}{\alpha}\right)^{\sigma}} \tag{4}$$

$$I = \frac{M_T - \mathrm{AOG}^*}{P_I + P_D^{1-\sigma} P_I^{\sigma} \cdot \left(\frac{\alpha}{1-\alpha}\right)^{\sigma}} \tag{5}$$

$\rho = 1 - 1/\sigma$, with σ measuring the elasticity of substitution between domestic and imported goods, and AOG* being the optimal consumption amount of the numéraire good. The marginal rate of substitution equals the relative price of the substitute goods or

$$MRS = \frac{MU_D}{MU_I} = \frac{P_D}{P_I} \tag{6}$$