IMPACT OF CUSTOMS INSPECTIONS OF REEFER CONTAINERS ON FOOD LOSS IN THE PORT OF ROTTERDAM

R.B. Castelein, CoE HRTech (Rotterdam University of Applied Sciences)

D.W. Bollard, Port of Rotterdam

1. Introduction

In the Port of Rotterdam, two major societal challenges are intertwined. On the one hand, Rotterdam is one of the major ports of entry for drugs (specifically cocaine) trafficked from Latin America to Europe – an issue on which law enforcement efforts as well as societal debate have been intensifying. On the other hand, within the Port there are intensifying efforts to become more sustainable as well as maintaining and enhancing competitiveness.

Despite a recent slight decrease in the volume of illegal drugs intercepted by Dutch customs (in part probably due to criminals shifting their supply chains to other European ports and routes through Africa), Rotterdam is still a major destination for drug shipments from Latin America, with over 45,000 kilos of cocaine intercepted in 2023, and 25,900 in 2024 (with a value of approximately €917mln) (Openbaar Ministerie, 2025). To maximize the chance of seizing drug shipments with limited time and resources, Dutch customs selects samples of import containers to be scanned and/or physically inspected, based on an elaborate risk analysis. Customs notifies relevant stakeholders (carrier, terminal operator, agent) relatively shortly before the ship's arrival - customs has recently experimented with reducing the notice period from 72 to 24 hours before ETA to reduce the risk of drugs being taken out before inspection (Douane, 2024). Selected containers are scanned at one of the container terminals or a standalone scanner and/or moved to a dedicated inspection area or the central customs inspection terminal (RIT, Rijksinspectie Terminal) for a physical inspection. When everything is in order, the container is released as usual. Customs strives to release containers within 36 hours after unloading – as also part of a service level agreement – and has been successful in reducing lead times (Port of Rotterdam, 2023), with some excessive lead times still occurring. Although necessary, these inspection activities and associated delays negatively affect shippers, who have to deal with uncertainty and delays. Regardless, a few years ago, the mayors of Rotterdam and Antwerp proposed to scan 100% of all incoming containers from Latin America to crack down on cocaine trafficking (AGF.nl, 2022). The practicality of this demand was hotly debated: customs would need significantly more resources, and even then excessive delays could be expected, hurting port competitiveness and impacting negatively on the shelf life of the perishable products which are often inside the containers as well (Parool, 2023). This is due to the fact that – although not at the level of scanning every incoming container – a disproportionately large share of containers selected by customs are from Latin America, either from cocaine producing countries (Colombia, Peru) or major transit countries (Ecuador, Costa Rica, Brazil), trade flows that predominantly consist of reefer containers with fruit and vegetables. Therefore customs needs to be particularly stringent in inspecting containers with predominantly fresh food, but also wants to do their part in operating sustainably and not unduly contribute to food loss.

Food loss is defined as the "decrease in quantity or quality of food resulting from decisions and actions by food suppliers in the chain, excluding retailers, food service providers, and consumers [in which case it would be referred to as food waste]" (FAO, 2025). Roughly one third of all food produced for human consumption ends up lost or wasted before reaching the consumer (e.g. Gustavsson, 2011; Guo et al. 2020). This is undesirable considering the number of people being malnourished worldwide, and the environmental impact: land and resources are used to produce ultimately unconsumed food, and an estimated 8-10% of global greenhouse gas emissions are due to unconsumed food (UNEP, 2021). Food loss can occur due to a variety of factors at the chain stage, supply chain, and system level (HLPE, 2024; Soethoudt et al., 2021). Often it is combinations different factors that cause food loss, but inherently the perishable nature of food products and inevitable quality decay over time make managing food supply chains a race against the clock. This varies considerably between product categories, but is particularly the case for fresh fruit and vegetables – highly sensitive products with limited shelf life. Substantial research into food quality decay has provided with a good insight in shelf life expectations and optimal storage conditions for a wide range of products (Defraeye et al. 2021). These insights are directly applied in the usage of reefer containers for perishable produce: the insulated containers with a reefer unit maintains an optimal climate for the product inside, monitoring and controlling temperature and increasingly also gas conditions (notably O_2, CO_2 and ethylene) (Castelein et al., 2020; Lukasse et al., 2023). A vision for the future is the idea of a 'smart reefer', continuously providing real-time information on its internal conditions which – combined with quality decay prediction models or 'digital twins' of food products (Defraeye et al., 2021) – allows smarter, quality-based decision-making in food supply chains leading to better performance and less waste (Guo et al., 2021; Lukasse et al., 2023). Currently however, the reefer container remains mostly a black box. Tracking technology is becoming more widespread but is still in its infancy, and there is no way yet to provide reliable quality estimates based on reefer shipment data – for a large part due to natural variation in food products, and unobserved factors at the growth, harvest, and postharvest stage that determine remaining shelf life and quality downstream.

In sum, there is public pressure on customs to implement more stringent inspections of (particularly reefer) containers from Latin America to combat drug trafficking. On the other hand, there is an economic interest to not unduly delay or disrupt supply chains through ports such as Rotterdam. Also, there is a sustainability dimension in that delays of perishable reefer cargoes can lead to food quality deterioration, and undesirable food losses with associated environmental footprint. Customs organizations perform a balancing act between these interests, with finite resources at their disposal. This stresses the need for smart risk assessments of incoming containers, streamlined inspection processes and information exchange with supply chain actors, and an understanding of the sustainability implications of the way they organize their inspection processes of containers with perishable cargoes. Major steps have been made on the first two of these aspects. The third aspect is becoming more and more relevant as also within the customs organization (and the ministry of finance which it falls under) there is a growing ambition to contribute to sustainability where possible. To do this in the case of food loss, it is necessary to better understand how customs procedures and their lead times relate to food quality decay and food loss.

In this project, we investigate whether we can specify (and ideally quantify) the impact of customs inspection processes and associated delays on the fresh food supply chain, with a specific focus on food (quality) loss and associated environmental footprint, addressing the question: What is the impact of the lead time of customs inspection processes on food loss in reefer shipments?

This paper is structured as follows: Chapter 2 outlines the data and method used. Chapter 3 presents the results of our research. Chapter 4 concludes, discusses the study findings, and offers recommendations for further research as well as supply chain actors.

2. Data and method

This issue will be addressed with a mixed-methods study design. First, we use a quantitative analysis of product quality data from a large number of reefer container shipments (some delayed at customs, some not) to quantify the relationship between delay at customs and product quality upon arrival. Second, interviews were conducted with stakeholders on the importing side of the supply chain, to understand the impact of customs inspections and associated delays on the fresh food supply chain, including operational and commercial implications, and possible food losses and waste downstream.

2.1 Quantitative analysis of food quality data

While recognizing that delay at customs is only one aspect of the wide array of factors that determine food product quality upon arrival (see above), it is still desirable to investigate how customs inspection processes and their lead times are related to product quality upon arrival. For individual shipments it remains difficult to identify what exactly determines quality upon arrival, but we can investigate whether in the aggregate containers delayed at customs show significantly lower product quality (all else equal). This is analyzed using a dataset of 78,961 unique fresh food container shipments in the period 2022-2023, for which the food quality upon arrival as well as the lead time of inspection processes are known.

For the years 2022-2023, we have 78,961 unique quality inspection reports, assigning an (average) quality grade to the fresh food products in the container. These reports are made by independent agencies at the moment containers are opened, usually at the importer's facility. The quality grades are used to inform the companies' own decision-making (Which product can go to which clients?; Which products need to be shipped the soonest?; etc.) and in communication with suppliers and clients. The main variable of interest in this dataset is the average quality grade of the shipment, ranging from 1 to 6, along the scale described in table 1 below.

Table 1. Product quality grades. Source: personal communication.

Grade	Quality	Common destination
1 & 1.5	Excellent	Supermarket
2 & 2.5	Good	
3 & 3.5	Acceptable	
4 & 4.5	Mediocre	Shipment will be sorted: large part still up to supermarket standards, other products sorted out for day markets or industry.
5 & 5.5	Bad	Shipment will be sorted: small part up to supermarket standards, largest share sorted out for day markets, industry or non-food applications.
6	Total loss	Shipment must be disposed of. Some residual streams may be suitable for industry or non-food applications.

For each shipment, this quality grade is known, as well as the product, country of origin, date of arrival, cargo ship used and container number. This additional information is used to match these quality scores to data on the lead time of customs processes. For each container customs scans and/or inspects, customs records the time of unloading from the deep sea vessel and time of release with timestamps, as well as the inspection activity performed (scan, physical inspection), registered by container number, cargo ship, and date of arrival. The latter information is used to check for which of the containers with a known quality grade, there is also a registered customs inspection activity with recorded lead time. This yields a final dataset for analysis of 78,961 containers with quality grades for the perishable product inside, of which 13,521 were held up at customs in some capacity (scan and/or physical inspection), the other containers not being delayed at customs. For analysis, the following variables are used:

Table 2. Variables used

Variable	Description
Quality	Quality of perishable products inside the reefer container, as assessed upon opening of the container, recorded on a scale from 1 to 6. The quality grade is assigned as described above.
LeadTime	The time elapsed (in hours) between the unloading of the container and customs release, for containers for which a inspection activity (scan or physical inspection) indicated.
Commodity	The food product inside the container that is graded (e.g. Bananas, Avocados, Grapes).
Origin	The country of origin of the container
Month	Month of the year in which the container arrives in Europe

We are especially interested in the relationship between the LeadTime and Quality variables. In the regression analysis used, we also include include some dummy variables. First for the commodity, including the interaction effect with LeadTime, due to some products being known to be more sensitive and deteriorate faster (e.g. blueberries) than others (e.g. apples), even when stored under optimal conditions. Second for the country of origin, with which we aim to capture variation in the quality of growing, harvest, and post-harvest conditions between countries, and (in absence of good data on transit time from the country of origin to Europe) approximation of the transit time. Third, for the month of the year to capture seasonal variation in quality (all else equal), knowing from the interviews conducted that product quality tends to be lower towards the end of the harvest season.

The relationship between lead time and quality is estimated using a regression model, shown here in its most elaborate specification:

$$Quality = \alpha + \beta_1 LeadTime + \lambda LeadTime*Commodity + \gamma Commodity + \delta Origin + \theta Month + \varepsilon$$

Where α is a constant, β_1 as the coefficient of the lead time variable is the effect which we are interested in. We include three vectors of dummy variables to capture other (unobserved) drivers of variation in quality and time sensitivity of products. ε is an error term.

Despite the large sample of containers, the data still covers only a small part of the supply chain. Customs processes are by far not the only possible cause of delays, and delays anywhere in the chain can cause (or contribute to) quality decay and food loss. While the data concerns lead times of customs processes, it is reasonable to assume that similar delays at other chain stages would have a similar relationship with quality upon arrival.

2.2 Interviews with supply chain stakeholders

To contextualize the results from the quantitative analysis, and to explore the broader impact of delays at customs on the fresh food supply chain semi-structured interviews were conducted with stakeholders in the (containerized) fresh food supply chain in the Netherlands. In our respondent selection, we attempted to interview respondents from organizations with large numbers of reefer imports and a variety of product categories covered. Table 3 shows the overview of respondents.

Table 3. Interview respondents and their organizations

Respondent	Organization	Major products	Volumes (import reefers)
1	Importer	Plantains, sweet potato, yams, cassava, garlic, ginger	~800 containers p/y
2	Importer	Citrus, melons, pineapples	~3500 containers p/y
3	Importer	Citrus, grapes, avocados, mangos	>2000 containers p/y
4	Quality assessor	Quality assessment	Over 40k inspections per year
5	Importer	Bananas, citrus, grapes, avocados	~5000 containers p/y
6	Importer	Organic produce	~1200-1300 containers p/y
7	Importer	Melons, pineapples, citrus, deciduous fruit	~4000-5000 containers p/y
8	Forwarder	Animal products (poultry, beef, lamb, horse)	~6000 containers p/y

The interviews covered the following topics:

- Own organization, products, and supply chain(s)
- Definition, registration, and incidence of food loss
- Impact of customs processes and delays (operational, commercial and financial impact, and impact on food quality and food loss (also downstream)), and how companies deal with this

This comes with the caveat that these respondents have a limited view on aspects outside of their organization and supply chain, and are potentially biased in their responses and estimates. Therefore we cross-reference estimates between different interviews and with the findings from the quantitative analysis. On the other hand, the quantitative analysis is limited in scope, with important factors pre-arrival remaining unobserved, and the absence of a view on impact further downstream that can be clarified through interviews (e.g. if the quality is good upon arrival, but the delay of inspection disrupts the supply chain leading to losses later on, this is not included in the quantitative analysis, but respondents can estimate the extent and severity of the problem).

3. Results

3.1 Quantitative analysis results

We estimate the regression model introduced above in different specifications, gradually including more variables in the model. The results from these analyses are presented in Table 4 below:

Table 4. Regression results

	1 Baseline	2 LeadTime / commodity interaction	3 Commodity dummies	4 Commodity and country of origin dummies	5 Commodity, country of origin and month dummies
LeadTime	0.00416*** (0.006)	0.00041 (0.00052)	-0.0002 (0.00067)	0.00112* (0.00068)	-0.00123 (0.00068)
LeadTime*Commodity		Insig.			
Constant	3.78388*** (0.00078)	1.29493*** (0.00078)	1.31534*** (0.0034)	1.64109*** (0.11405)	1.64308*** (0.114)
Commodity dummies	Nee	Ja	Ja	Ja	Ja
Country of origin dummies	Nee	Nee	Nee	Ja	Ja
Month dummies	Nee	Nee	Nee	Nee	Ja
N	78961	78961	78961	78961	78961
R-squared	0.00055	0.049320	0.05013	0.07148	0.07406

Standard errors in parentheses, *** p<0,01, ** p<0,05, * p<0,1

In the most simple model (1), the lead time at customs has a significant negative effect on product quality. $B_1 \approx 0.004$, indicating that a 1-hour increase in lead time at customs is associated with a 0.004 point decrease in quality on the product grading scale explained above (1 being excellent, 6 being a total loss). This would mean that a 125h lead time (5 days) is associated with a half-point quality decrease (all else qual). However, with an average lead time of approximately 30 hours (for those containers selected for scan and/or physical inspection), and a standard deviation of 39 hours, this is already an extreme scenario. It should also be noted that this result is derived from the total dataset of 78,961 containers, making no distinctions between sensitive and less sensitive products. Model 2 introduces the interaction terms of the lead time and commodity dummies, producing a separate effect estimate for the lead time for every product category included. The direct effect of lead time becomes insignificant in this model, and the coefficients of the interaction are mostly statistically insignificant, and where they are significant not very meaningful to interpret: some positive, some negative, and all with very limited magnitude (λ <0,001). Models 3-5 use the same basic specification as model 1, but introduce dummy variables for each commodity, country of origin, and month. This results in a model with greater explanatory power (R^2 increases from 0.0055 (model 1) to 0.074 (model 5)), but does not find a significant (models 3 and 5) or meaningful (model 4) effect of lead time on quality.

In sum, a longer lead time is shown to have a significant negative (but quantitatively limited) effect on the expected product quality. Unobserved factors related to the product, country of origin, and season lead (captured with dummy variables) to a better prediction of the quality, but with the inclusion of these the lead time is hardly or no longer significant. It should be noted that the factors included in the model explain only a small part (7.4%) of the total variation in quality.

3.2 Findings from interviews

In addition to the quantitative analysis presented above, 8 interviews were conducted with supply chain stakeholders, on the impact of customs processes.

All respondents indicated product quality to be a top priority, and all were making efforts to maximize quality and prevent losses. In principle, they prioritize distribution of those products with the shortest remaining shelf life (first expire, first out), to make sure these products closest to expiry reach the customer first. Also, importers serve different types of markets and clients with different quality standards (e.g. premium retail, supermarkets, other retail, spot market, industry), and try to find the highest-value destination possible for their products given the quality.

Respondents indicated that total loss of cargo rarely occurs (<1% of shipments), and when it occurs importers can usually identify the cause such as equipment malfunction or human error, using loggers and reefer unit readouts. Rates of partial cargo loss or commercial loss (product is still suitable for consumption, but no longer for the highest-value market) vary considerably between companies and product categories: respondents give average total loss estimates between 1-15%, and estimate to discount (at a commercial loss) some 10-25% of products based on quality and/or market factors.

Not all organizations have a clear view on disruptions and quality decay and loss in their supply chains. This is due to for example supply management falling under a different department than sales (where complaints from clients come in when there are quality issues downstream) or the handling of rejections and claims, and a lack communication and systems integration between these functions. Also delays in the supply chain are not actively monitored: commonly the ETA of containers in information systems is continually updated, and deviations from the original ETA are hard to trace back afterwards. Moreover, importers will usually only investigate a shipment thoroughly (including tracing transit and lead times, delays, reading loggers etc.) if this is relevant to a claim, which rarely occurs (see above).

Related to these observations on monitoring of delays and food loss, from respondents' experience it was hard to see a direct relationship between delays at customs and product quality upon arrival. Some respondents did notice a trend in communication with their clients: when it comes to particularly sensitive products (e.g. blueberries, avocados): when the container can be stripped and the produce distributed without delay, the product is usually always accepted, but when more days of delay (occurring at sea, in port, at customs, or in their own facility) add on to the original planning, they see an increase in complaints and rejection of batches. No importer performed quantitative analyses on these trends, but the majority uses rules of thumb based on experience (e.g. "blueberries need to be at the client within 4-5 days after arrival to still have sufficient shelf life by the client's standards").

In addition to the quality aspect, we distinguished three main types of impact of customs processes: additional costs, operational impact, and commercial risks.

Additional costs are relatively straightforward to quantify. Table 5 below shows the different cost components and range of estimates given by respondents. First these include the direct costs incurred when a container is selected for scan or inspection or is delayed. Every day of delay results in additional costs for demurrage/detention, storage and plugin costs, the exact cost depending on which carrier or terminal is used. Secondly, when a container is selected for scan or inspection (whether at the destination or in the country of origin or a transit country), the importer will be billed for this. From the importers' perspective, the container being scanned in the country of origin or a transit country does not seem to influence the likelihood of the container being selected (again) at arrival. In case a container shipment is a total loss (regardless of whether it was delayed at customs), the importer incurs the cost of scrapping the lost cargo. These costs can vary considerably, from some €1,700-2,000 for fruit or vegetables, to some €10,000 for a shipment of meat, which needs to be disposed as animal by-product.

Table 5. Respondents' estimates of costs incurred due to customs inspections and/or total loss of cargo

	Costs per day (€)		One-off costs (€)	
	Min	Max	Min	Max
Demurrage + detention	130	150		
Storage	130	150		
Plugin	50			
Scan			275	
Fyco			150	
Scan in country of origin/transit			250	
Scrapping container			1700	10000

In addition, there is the operational impact on logistics processes. Importers often work with (weekly) programs of shipments, coordinated with suppliers and buyers. The unpredictability of inspection processes makes planning difficult and sometimes leads to significant disruptions and holdup in the supply chain. If containers are delayed for a longer period (e.g. over a weekend), importers are first faced with a shortage (containers of that week are not released yet by customs) and then with a surplus (the delayed shipment arrives later and overlaps with the shipments of the following week). This creates significant puzzles for importers, who need to a) serve their customers despite a shortage of product, b) find a good market for excess products when they have a surplus, and c) continually monitor product quality of the different batches (a mix of delayed and on-time shipments) and decide which products have the shortest remaining shelf-life and need to be shipped to the client first. In general, importers manage this quite effectively, albeit with considerable effort and sometimes additional cost. In doing so, they find the best destination for the product within a reasonable timeframe given the quality, hence mitigating the risk of food loss, even when delays or disruptions occur in their supply chain.

Last, importers run a commercial risk when delays occur in their supply chain. Importers with fixed delivery agreements face penalties from clients when they cannot deliver as agreed. To still deliver as agreed, they sometimes need to buy additional produce from others (at a premium). For importers who sell their products on the spot market (where prices can fluctuate greatly from day to day), delays can have distorting effects on competition: importers who can immediately pick up their containers can profit from a favorable market, while importers with delayed containers encounter a saturated market with lower prices. These importers tend to be more in favor of scanning all containers from a certain ship or origin, as this would create a more level playing field in their market.

4. Conclusion, discussion & recommendations

To our knowledge, this is the first large-scale study into (one of the many) determinants of product quality in reefer containers. Where previous studies on this topic relied on experiments and/or simulations, this study adds an aggregated perspective, illustrating the complexities of translating understanding of product quality decay into actionable insights for supply chain actors.

The research comes with a careful conclusion. In general, longer lead times of customs inspection processes are associated with lower product quality – as is to be expected. However, the effect is relatively small and only makes a meaningful difference in quality grade with extreme lead times (5 days and longer). It should be noted here that although the data measures delay at customs, the effect is not unique to delay due to customs inspections. Any delay of similar magnitude at this stage of the chain – whether at sea due to a delayed ship, or in port due to holdup at the terminal or other inspections (e.g. phytosanitary or veterinary) – would likely have a similar impact. With the data and models used, it was not possible to estimate product-specific effects, even though earlier research (as well as the experience of our respondents and common sense) shows that products indeed differ considerably in how sensitive they are to delays and deviations from optimal storage conditions. This suggests that the data covers too small a part of the entire supply chain (a delay of a few days at most on a journey of several weeks) and/or is too noisy. Moreover, the overall explanatory power of the models used is low, even when including product, country, and month dummies – reflecting that other (unobserved) factors and random variation are very important drivers of quality decay.

Discussion of these unobserved factors remains speculative, but we should mention two variables, that were not included in the analysis, that most definitely would have improved the predictive power of the model. First and foremost the overall transit time of the product: delay at customs is only a relatively small part of the voyage, and delays in the country of origin or at sea also impact on the product's remaining shelf life upon arrival. This could for example be approximated with data on ships' estimated time of arrival and actual time of arrival. Another important piece of information regards temperature and gas conditions in the reefer during transit, reflecting any deviations from optimal storage conditions and the postharvest physiology of the product. This study could be improved upon considerably with the inclusion of these variables, but we recognize this is an ambitious direction to take. With the latter point, the discussion already shifts towards the potential of the smart reefer and quality controlled logistics based on real-time atmosphere data and accurate quality decay models (Defraeye et al., 2021; Lukasse et al., 2023). Aside from these two main aspects of the product supply chain, a host of other growing, harvest, and postharvest factors – as well as natural variation – also influence product quality decay and remaining shelf life.

Aside from the issue of direct impact of delays on product quality, the qualitative part of our research has also identified other ways that customs processes impact on the food supply chain. Importers incur additional costs when containers are delayed due to scanning or inspection by customs. Moreover, when delays are as frequent and unpredictable as is the case for fresh food imports from Latin America, it creates significant challenges and risks for logistics processes and commercial planning. Our interviews with importers suggest that this impact is a bigger headache to them than the direct impact of delays on quality alone. Overall, importers try to minimize losses and find the best destination for products, given the quality. This also means that delays that could have led to food loss (e.g. remaining shelf life is too short to send the product to the intended client; containers are delayed and now arrive in an oversaturated market), rarely lead to total loss of the product, due to the efforts of the importer (who may still incur an economic loss).

In a broader perspective, frequent, unpredictable, and long customs processes do make shippers consider other ports for their cargo, presenting a risk to the competitiveness of, in this case, the Port of Rotterdam as a major reefer port. Over the past few years, several carriers have shifted away from using Rotterdam as first port of call on their Latin American services – respondents attribute this amongst other reasons to stringent customs scrutiny of incoming reefer containers in Rotterdam. This remains speculative however, alongside statements from the same respondents indicating that the service level of customs in Rotterdam has improved considerably, and that customs processes in direct competitor ports (notably Antwerp) are not necessarily smoother. This link between customs processes, shipper and carrier port choice, and port competitiveness is a worthwhile topic for further research.

This study also warrants a few recommendations to customs in the Port of Rotterdam. These come with the caveat that we were quantitatively able to show only a small impact in the aggregate, which provides only a shaky basis for actionable recommendations. Filling in gaps and open questions with findings from the interviews and from literature helps to identify more concretely what customs can do to mitigate the impact of inspection activities – on food loss, as well as supply chain performance and port competitiveness. It should be noted that containers are selected by customs based on an elaborate risk analysis – a process entirely outside the scope of this study. Once containers are selected and processed, this study provides some guidance for customs to mitigate the risk of food loss.

In general, food supply chains benefit from as little delay as possible. Therefore it is worthwhile to reduce lead times as much as possible. However, specific effort is warranted to reduce excessive lead times (multiple days; far beyond the 36 hours customs strives for to conduct their scan). From a food loss perspective, it is reasonable to prioritize reducing the longest lead times, rather than the mean lead time. In addition, there are opportunities to prioritize incoming reefers based on (expected) sensitivity of the product inside, ensuring these are processed and released the quickest. Earlier research as well as industry experience indicates which products are more sensitive than others, and the most sensitive products (e.g. blueberries, with often only a few days remaining shelf life upon arrival) would benefit the most from expedited processing. The same applies to products harvested at the end of the harvest season, which tend to be more vulnerable. Moreover, customs can prioritize containers for which it is known that they already have been delayed in the country of origin or in transit – the ship's ATA versus ETA should give a clear indication of this. These actions can help reduce delays of containers with fresh food, ultimately contributing to a smoother food supply chain and fewer losses. However, containers with dry cargo being inspected by customs also experience delays, with shippers also waiting for their cargo, having to adjust their planning, running the risk they cannot deliver on time etc. Customs prioritizing reefers to mitigate food loss will likely raise some eyebrows among shippers of dry goods, presenting a difficult tradeoff and possibly a broader discussion to be had on sustainability, equitability and competitiveness. Another important tradeoff for customs concerns transparency regarding their processes. The interviews conducted in this study highlight again that importers benefit from predictability and transparency: the more they know, the better they can plan, and the better the outcome will be in terms of footprint and economic performance. On the other hand, customs is reluctant to provide information or insights regarding specific containers or their overall process that would be of use to illicit actors. This will likely remain a careful balancing act for customs, between effective enforcement and transparency towards shippers.

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