



Malcom McLean, containerization and entrepreneurship

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Abstract

Does the entrepreneurial market process reflect an equilibrating or disequilibrating tendency in the allocation of resources? We address this question by utilizing the case of Malcom McLean, who pioneered and introduced container shipping to international trade. We argue that Schumpeterian and Kirznerian entrepreneurship are distinct, yet complementary activities that drive the market process towards an equilibrating tendency. By realizing containerization as a lower cost method of shipping goods internationally, we argue that McLean acted simultaneously as a Schumpeterian and Kirznerian entrepreneur, illustrating that these two notions of entrepreneurship are different segments of the same equilibrating market process. Containerization had a disruptive effect on previous methods of ocean shipping, but its adoption was introduced through an act of *arbitrage*, namely by redeploying existing resources, such as cranes, ships, ports, and storage facilities from lower-valued uses to perceived higher-valued uses. In the process, McLean was able to realize previously unnoticed profit opportunities by correcting previously existing inefficiencies in intermodal transport.

Keywords Containerization · Entrepreneurship · Malcom McLean

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1 Introduction

Since the publication of Israel Kirzner's *Competition and Entrepreneurship* (1973), there has been a continuously growing literature devoted to comparing and contrasting Kirzner's account of entrepreneurship with Joseph Schumpeter's understanding of entrepreneurship, as well as their implications for economic theory. The Schumpeterian account of entrepreneurship emphasizes the creation of profit opportunities through technological innovation. Economic development, according to Joseph Schumpeter, "is a distinct phenomenon, entirely foreign to what may be observed in...the tendency towards equilibrium" (1934: 64). Therefore, the Schumpeterian entrepreneur is an innovator that has a disequilibrating effect on the market process. The Kirznerian account of entrepreneurship, however, has an equilibrating effect on the market process. In effect, the Kirznerian entrepreneur is an arbitrageur who seizes previously unnoticed profit opportunities by realizing the existence of disequilibrium due to prior entrepreneurial errors in the allocation of resources. When he perceives such inefficiency from unrealized gains from trade, the Kirznerian entrepreneur captures pure profit and exhausts gains from trade by redirecting resources from less valued consumer uses to more valued consumer uses.

Given that these two theoretical approaches have different implications regarding the role of the entrepreneur in the market process, this raises an important empirical question: does the market process reflect a disequilibrating or equilibrating tendency in the allocation of resources? We argue that Schumpeterian and Kirznerian entrepreneurship are distinct, yet complementary activities that drive the market process towards an equilibrating tendency. We do so by utilizing the case of Malcom McLean and the introduction of modern container shipping to international trade.

McLean's introduction of modern container shipping in 1956 makes him, quite arguably, the individual most directly responsible for the modern era of globalization that has surged since then. Yet unlike other entrepreneurs, such as Bill Gates, Steve Jobs, and Mark Zuckerberg, McLean's name remains relatively unknown to the public. However, when we take into account his continued impact on the world economy, he is, perhaps, the most important entrepreneur since World War II. In fact, one could argue that the inventions of other entrepreneurs, such as Gates, Jobs, and Zuckerberg, were only made possible by the extensive gains from productive specialization under the division of labor that containerization made possible.

The impact of containerization on the reintegration of the world economy after the Great Depression and World War II can be seen in two ways, which correspond to the Schumpeterian and Kirznerian accounts of entrepreneurship. First, from a long-term historical perspective, the growth of international trade as a share of world GDP has risen to unprecedented highs (see Fouquin and Hugot 2016). From a Schumpeterian perspective, containerization had a disruptive effect on ocean shipping by unlocking new profit opportunities from innovation and creating new markets that would have not otherwise existed. These changes resulted in the productivity gains in ocean shipping that have corresponded with the growing share of wealth generated through international trade since the 1950s.

Secondly, the effects of containerization have also been measured by the reduction of transportation costs across the globe. For example, controlling for fluctuations in fuel costs, Hummels (2007: 142) provides a conservative estimate that the price of bulk

shipping, measured in real dollars per ton, is roughly half than it had been in 1960, and a third of its price in 1952. However, Levinson ([2006] 2016) estimates that the decline in shipping costs was much larger. Whereas the cost of shipping cargo was roughly \$5.83 per ton in 1956, on the maiden voyage of the first container ship, McLean's *Ideal-X*, the cost of shipping cargo was merely \$0.16 per ton (Levinson [2006] 2016: 68). From a Kirznerian perspective, though Schumpeter's notion of entrepreneurship actively expands the international scope of productive specialization and trade through innovation, this reduction in costs reveals how entrepreneurs perceive and respond to previously unnoticed profit opportunities.

We argue that by realizing containerization as a lower cost method of shipping goods internationally, McLean acted simultaneously as a Schumpeterian and Kirznerian entrepreneur, illustrating that these two notions of entrepreneurship are different segments of the same equilibrating market process. Though this innovation had a disruptive effect by displacing previous methods of ocean shipping, it also reduced the existing inefficiencies in capital and labor allocation devoted to the international transport of goods. Thus, the adoption of containerization as an innovation was introduced through an act of arbitrage, namely by redeploying existing resources such as cranes, ships, ports, and storage facilities from lower-valued uses to perceived higher-valued uses. The previously unnoticed profit opportunities that McLean realized came in the form of eroding the high transaction costs associated with intermodal transport, specifically those costs associated with the definition, transfer, and enforcement of property rights over goods between ships, trucks, and trains.¹¹ In effect, McLean's central insight was an alertness to the fact that such existing inefficiencies in intermodal transport could be eroded and transformed into future profit opportunities that had gone previously unnoticed.²²

Our primary contribution will be to the literature on the Austrian theory of the entrepreneurial market process. Though our paper will touch upon entrepreneurship theory more broadly, addressing this voluminous literature in a comprehensive manner would be beyond the scope of our focus. Our contribution specifically addresses that literature which analyzes the relationship between Schumpeterian and Kirznerian entrepreneurship in economic theory (Kirzner 1973, 1979, 1982, 1985, 1997, 1999, 2009; Loasby 1982; McNulty 1987; Boudreaux 1994; Choi 1995; Holcombe 1998; Boettke and Coyne 2003, 2009; Klein and Bylund 2014; Manne 2014; Sautet 2010, 2017).

With the exception of John and Storr (2018), who illustrate how culture and institutions differentially affect Schumpeterian and Kirznerian entrepreneurship in the context of Trinidad and Tobago, the discussion in this literature remains almost entirely abstract and theoretical. Our contribution builds directly on this literature by providing an empirical illustration of how Schumpeterian entrepreneurship is a *distinct, though not separate* activity of an overall tendency towards equilibration in the entrepreneurial market process. For example, Boudreaux (1994: 60) argues that the competitive market process as a concept should be broadened to include not only equilibrating tendencies

¹¹ See Langlois (1992), Baird (2000), Foss and Klein (2009), and Piano and Rouanet (2020) on the overlapping distinctions in the Austrian tradition and the transaction-cost tradition of market process analysis.

²² The erosion of transaction costs, regulatory barriers, and other inefficiencies in the market process is further illustrated in the case of lighthouses and lightships in England prior to the nineteenth century (see Candela and Geloso 2018, 2019, 2020).

in price adjustments, but also to “include quality adjustments and technological and organizational improvements in addition to price adjustments.” By incorporating non-price variations in technology and economic organization into a broader concept of competition, both “Kirzner’s *and* Schumpeter’s entrepreneur are equilibrating in this broader sense” (emphasis original; Boudreaux 1994: 57).

Building on these insights, we contribute to this literature by providing an empirical case study that illustrates the complementarity of Schumpeterian and Kirznerian entrepreneurship. To the extent that falling transportation costs allow alert entrepreneurs to realize profit opportunities in international trade via *arbitrage*, such arbitrage opportunities and potential gains from trade were made available by a transaction-cost reducing *innovation*, namely containerization. Yet, such an innovation itself was based on McLean’s alertness to exploit a profit opportunity via arbitrage in transportation resources, therefore subsuming both Schumpeterian and Kirznerian entrepreneurship into an overall equilibrating tendency.

This paper proceeds as follows. Section 2 provides an overview of the literature on the relationship between Schumpeterian and Kirznerian entrepreneurship, and in doing so, provides a basis for engaging the literature on the economics of containerization. Section 3 provides an overview of the historical context in which Malcom McLean entered the transport industry. Our primary focus will be on McLean’s entrepreneurial alertness to devise container shipping as a transaction-cost reducing innovation. In Section 3, we also trace out that transformation of the transport industry that resulted from McLean’s entrepreneurial alertness, with a particular focus on the transaction costs and other barriers to entry in shipping and transport that were eroded as a result of containerization. Section 4 concludes with implications for future research.

2 Entrepreneurship as creative arbitrage

In order to understand the nature of the entrepreneurial exploits of Malcom McLean, it is important to first break down the distinction between Schumpeterian and Kirznerian entrepreneurship. According to Kirzner, the perpetual motion of the market process is comprised of two distinct groups of variables. The first group of variables are characterized by *exogenous changes*, changes in preferences, population, resource availabilities and technical possibilities. Kirzner refers to these as *underlying variables* (UVs). The second group of variables, which Kirzner refers to as *induced variables* (IVs), are characterized by *endogenous changes*, which are systematically induced by entrepreneurs who drive the equilibrating tendency in the market process at any given moment. Induced variables consist of the prices, methods of production, and quantities and qualities of outputs, which the market at any given time generates, given the underlying variables (Kirzner 1992: 38–43). Under conditions of equilibrium, the values of the UVs predetermine the values of IVs, squeezing out economic profits and obviating the role of the entrepreneur. Under such conditions, the price of inputs and the methods of production reflect not only the full cost of production, but also reflect that the least-cost technological possibility has been exploited, given the preferences of individuals. Disequilibrium is characterized by discrepancy in the market values of the IVs and UVs, reflecting that from the array of the available resources and technological possibilities available, there remain a subset of *economically feasible possibilities* that

are *unperceived and not yet embraced* by the entrepreneur. “When profitable capital-using methods of production are technologically available, where the flow of savings is sufficient to provide the necessary capital,” it is nevertheless the case that “entrepreneurship is required to ensure that this innovation will in fact be introduced” (Kirzner 1973: 74).

This dichotomization of the forces that drive the market process lends itself to the distinction of Schumpeterian and Kirznerian entrepreneurship. “Whereas Schumpeter highlighted those activities that change the givens, Kirzner’s focus is on the activities that actually establish equilibrium prices given the particular givens” (Boudreaux 1994: 57). As a Walrasian, Schumpeter’s point of analytic departure was a state of general equilibrium. “For Schumpeter,” as Rothbard puts it, “general equilibrium had to be the overriding reality: the realistic starting point as well as the end point of his attempt to explain economic change” (1987: 98). Since, by logical construction, there are no profit opportunities under conditions of equilibrium, the “*only* role for entrepreneurship, by logical deduction, is to innovate, to disrupt a preexisting equilibrium” (emphasis original; Rothbard 1987: 102). The Schumpeterian entrepreneur, therefore, is a disequilibrating force that disrupts the prevailing status quo via a change in UVs.

However, “in the Austrian tradition of von Mises and Kirzner,” where the analytic point of departure is a state of disequilibrium, “the entrepreneur harmoniously adjusts the economy in the direction of equilibrium” (Rothbard 1987: 102). The Kirznerian entrepreneur generates the equilibrative tendency via a change in IVs by the entrepreneurial alertness and discovery of previously unnoticed profit opportunities. “Only in disequilibrium,” Kirzner writes, “are there opportunities for entrepreneurial profit, for the purchase of inputs at a cost lower than the revenue obtainable from the sale of their potential output” (1979: 110). To be clear, Kirzner does not claim that real-world market processes are not interrupted by UV changes or that each and every entrepreneurial discovery will be corrective, and therefore equilibrating (1992: 45). Rather, Kirzner claims that the equilibrating tendency of the market process will continue to occur, even if changes in UVs cease to occur, precisely because no entrepreneurial decision will have perfect foresight to achieve a profit-maximizing outcome,³³ and therefore no entrepreneurial decision will ever completely exhaust profit opportunities in the market process. “None of these processes can be expected to proceed to completion. All that we claim is that the forces for mutual discovery, and for the elimination of ignorance, are constantly at work” (Kirzner 1992: 45).

The overall tendency in the literature that has analyzed the differences between Schumpeterian and Kirznerian entrepreneurship has progressed from treating Schumpeterian and Kirznerian entrepreneurship as *mutually exclusive* forms of entrepreneurship, to *identical* kinds of entrepreneurial changes to the market process. For example, Loasby wrote “that Schumpeter’s theory stands in sharp contrast to...that associated with the neo-Austrian school of economists, and expounded in Israel Kirzner’s *Competition and Entrepreneurship* (1973)” (1982: 242). Young Back Choi, however, has written that the “difference between Schumpeter’s entrepreneur-innovator and Kirzner’s entrepreneur-arbitrageur, it appears, is mainly a difference in perspective” which is “similar to the debate of whether a glass is half-full or half-empty” (Choi

³³ On the relationship between profit-seeking and uncertainty, see also Alchian (1950).

1995: 62). Moreover, Holcombe explicitly states that “there is no difference between the actions of Kirznerian and Schumpeterian entrepreneurs” (1998: 57).

Much of the overview that we have provided regarding the relationship between Schumpeterian and Kirznerian entrepreneurship has been developed in greater detail elsewhere,⁴ not to mention that Kirzner himself has already attempted to clarify the relationship between his own theory of entrepreneurship and that of Schumpeter (see Kirzner 1982, 1999, 2009). Therefore, our goal here is neither to question the theoretical validity nor to adjudicate the theoretical distinction between the two theories of entrepreneurship per se. Rather, what we wish to highlight is that facts are theory-laden, and therefore the theoretical nature of the entrepreneur that we apply will have important implications for how we understand economic change driven by entrepreneurship at a particular time and place in history. If we remove the distinction between these two types of entrepreneurship, their analytical significance in helping the theorist distinguish a technological change via innovation (i.e. change in UVs) from a discovery of previously unnoticed technological possibilities via arbitrage (i.e. change in IVs) loses its relevance in understanding economic history. The implications of this analytical ambiguity are best revealed when we redirect our attention to the nature of containerization and the role that entrepreneurship played in unleashing the productivity gains in ocean shipping from containerization.

3 Thinking outside the box to discover “the box”

The story of Malcom McLean as the North Carolina truck driver who revolutionized container shipping provides an excellent illustration not only to reframe the relationship between Schumpeterian and Kirznerian entrepreneurship, but also to illustrate the overall, equilibrating nature of the entrepreneurial market process. Though there is indeed a broad consensus that the productive impact of containerization has been significant from an entrepreneurial perspective, the sources of the increased productivity generated by containerization are generally lumped together under the category of technological change.⁵

Though containerization’s overall effect on the costs of international trade has drawn the attention of scholars in managerial economics for decades (see Tombari 1979), some international trade economists (see Krugman 1995; Baier and Bergstrand 2001) have dismissed its impact. In more recent years, however, the excellent economic and historical analysis of McLean and containerization by Levinson ([2006] 2016) has coincided with subsequent research that attempts to quantify the overall effect that containerization had in reducing the costs associated with transporting goods internationally (Hummels 2007; Bernhofen et al., 2016; Coşar and Banu 2018).

Implicitly, the nature of McLean’s entrepreneurial exploits has been filtered through a Schumpeterian lens. For example, Hummels states that the “decades since World War II have also witnessed significant technological change in shipping, including...the use of containerization in ocean shipping” (Hummels 2007: 131). Like other international

⁴ See also Boettke and Coyne (2003, 2009) for a thorough exposition of this distinction between Schumpeterian and Kirznerian entrepreneurship in the context of economic development.

⁵ The exception to this is Levinson ([2006] 2016).

trade economists, Bernhofen et al. (2016) identify two broad explanations for the growth in world trade: trade liberalization in the form tariff reductions and “technology-led declines in transportation costs” (2016: 36). They also state that “containerization resulted in far reaching complementary technological and organizational changes in port and railway services that affected economies’ entire transportation sectors” (2016: 38).

However, there is an important distinction to be made, with regard to gains in productivity in ocean shipping, between *technological change* and *organizational change*, which Douglass North identified in his own study of productivity gains in ocean shipping between 1600 and 1850 (North 1968; see also Geloso 2020).⁶ Given that technological change reflects a change in UVs while an organizational change reflects a change in IVs, collapsing one onto the other creates an analytical ambiguity that not only fails to distinguish between the two types of changes, but also fails to distinguish between Schumpeterian and Kirznerian entrepreneurship. We will therefore reframe our understanding of the source of the productivity gains in ocean shipping generated by containerization, specifically by combining Schumpeterian and Kirznerian entrepreneurship into a unified theoretical framework illustrated by McLean’s entrepreneurial exploits. Before doing so, it is important to contextualize the state of the transport industry that existed when McLean pioneered containerization.

3.1 The transportation industry prior to containerization

From a Schumpeterian lens, it was indeed the case that the introduction of containerization had a massively disruptive effect on the status quo in ocean shipping. Yet, reframing such “disruption” through a Kirznerian lens sheds light on the fact that the prevailing status quo was “nothing but a seething mass of unexploited maladjustments crying out for correction” (Kirzner 1979: 119). Therefore, the innovative effect that McLean had on the transport industry was to expose inefficiencies in existing methods of transporting cargo, such as extensive time in port, dockworker unions, theft and cargo damage, and industry regulation.

Shipping in the 1950s was overwhelmingly done with break bulk cargo. Cargo was placed in canvas bags, tied down to wooden pallets, or packed into barrels. There was no standard weight or shape – every piece of cargo was unique. Longshoremen, also known as dockworkers or stevedores, loaded this cargo by hand into the ship’s hull (Talley 2000: 993). This time intensive process forced ships to stay in port for up to 2/3 of their total transit time, causing hefty transport fees and congested ports (Hummels 2007: 241).

Levinson ([2006] 2016: 44) documents a U.S. National Research Council study of the S.S. Warrior cargo ship that contained 194,582 bundles of cargo of various type (e.g. case, carton, drum, bag) weighing 5015 long tons. This lack of cargo

⁶ To reinforce our point, Hummels cites North (1968) as evidence of how economic historians “have documented how *technological change* led to substantial reductions in shipping costs from 1850 to 1913” (emphasis added; 2007: 131). However, North argued *the opposite*. As he states, the objective of his paper was “to identify as precisely as possible those sources of productivity usually lumped into the general category of technological change. The conclusion which emerges from this study is that a decline in piracy *and an improvement in economic organization account for most of the productivity change observed*” (emphasis added; 1968: 953).

standardization led to a great deal of uncertainty and waiting. Ships would often be stuck at port for a week before they were reloaded and sent back out (Levinson [2006] 2016: 44; Talley 2000: 936). Vigarié (1999: 4) reported that longshoremen gangs in Antwerp needed 15 hours spread over two different shifts to handle 300 tons. He also points out that there was large variance in this number due to the different cargo brought in by different ships. This often led to longshoremen pulling all the cargo out on to deck, sorting it, and putting it in its proper place to be moved to trucks, other ships, or inspected by lengthy customs checks. This costly waiting period had a secondary effect of nullifying the benefits associated with economies of scale of large ships. A ship too large would require several days of shifts, which would increase waiting times even more. Unlike the costs associated with transportation, which benefit the customer by transforming goods spatially, the costs associated with sitting in the port were beneficial to no one. Rather, it was a time where neither the seller nor the buyer was able to take advantage of a mutually beneficial exchange. The heterogeneous and uncertain nature of breakbulk shipping therefore was a maladjustment, which imposed a significant barrier to transactions, providing an unnoticed profit opportunity to McLean.

The uncertainty associated with the size of loads and the length of loading times also incentivized the formation of labor unions, which further created more maladjustments in the form of transaction costs. The relatively low amount of training required to move cargo led to an abundance of workers, both professionals and laymen, showing up to the docks hours before the workday started in search of work (Levinson [2006] 2016: 28–29; Vigarié 1999: 4). To solve the problems associated with lay competition and uncertain working hours, longshoremen formed powerful unions to act on their behalf. Registration processes limited competition from laborers who did not belong to the union. In New York, hiring for the day was done by a drawing starting with the “A” men who were the most senior members of the union (Levinson [2006] 2016: 30). Due to the perishable and time-sensitive nature of the items being shipped, the unions were able to impose very high costs on shippers. In 1954, just two years before the launch of McLean’s *Ideal-X*, union strikes resulted in a loss of 1.3 million man-days of labor (Levinson [2006] 2016: 35). By successfully limiting outside competition, unions exacerbated the issue of waiting costs even further. The aforementioned study of the S.S. *Warrior* found that cargo handling made up 36.8% of the total cost of the voyage (Levinson [2006] 2016: 45).

The high cost of moving cargo was not strictly limited to time spent in port. Two risks, theft and cargo damage, were also pervasive in the era of break bulk shipping. New York was especially notorious for theft of items including radios, liquor, and coffee (Levinson [2006] 2016: 37). With ships that held nearly 200,000 bundles of items, it was simply too costly to enforce property rights. Damage to items was equally hard to trace back to its cause. Breakable crates, bags prone to tearing, and easily bruised fruits were frequently the victims of unloading. However, damage was not limited to mistakes made while loading and unloading the cargo. Poorly packed ships often led to damage of cargo in transit that could have been avoided. Levinson ([2006] 2016: 26) points out that if ships were poorly packed such that the weight could shift, a boat could capsize. Theft and damaged goods straightforwardly decreased the gains from trade and increased the cost of insurance, inviting a profit opportunity to minimize such costs.

The term “container ships” was coined to describe a ship with the purpose of transporting cargo via container, dubbed “the box” amongst shippers. Besides the inefficiencies associated with loading and unloading cargo, the world McLean entered with the box was one of heavy regulation. The Interstate Commerce Commission (ICC) in the 1950s had regulatory authority over all domestic cargo being carried in the United States. This authority extended to railways, trucking routes, and domestic shipping. The ICC had strong oversight and was the ultimate authority on approving 1) what commodities could be carried, 2) what routes companies were allowed to use 3), and what prices (or rates) the companies were allowed to charge. This authority often stifled innovation that would have otherwise led to lower shipping rates. For example, in 1931 the ICC stifled the containerization of railways. The North Shore Line railroad began to offer a purely weight-based rate in their railway containers, rather than the commodity-based rates. This made sense, as the railways mainly spent money hauling commodities due to their weight rather than the individual characteristics of the commodity. However, the ICC ruled against this method as it was deemed unfair that railways be able to charge lower rates for commodities. Thus, the containers would need to be priced at minimum according to the highest rate commodity in the container. As a result of the ICC’s regulations, truckers would often have to bring their trucks back empty (rather than hauling cargo the second half of the trip) because the ICC would approve cargo transport for the initial delivery route but not for the route back (Levinson [2006] 2016: 51). Businesses who wanted new routes had to engage in expensive legal processes to acquire the rights to routes. Shipping rates were allowed to be significantly lower than truck and rail rates, but an individual who owned a trucking company needed permission to buy a shipping company (Levison [2006] 2016: 57). This oversight gave a significant scope for arbitrary political assignment of property rights, and, again, raising transaction costs.

Regulation and rate fixing were not limited to domestic shipping. International shipping, though significantly smaller at the time McLean entered the industry, was governed by organizations called conferences. Sjostrom (2004) provides a comprehensive survey of the different models of shipping conferences. “Conferences” numbered over one hundred and had a primary role in setting fixed rates and allocating output to their members in the form of “quotas”. Governments sometimes required international shippers to be involved with the relevant conference, but more often conferences were voluntary. However, conferences would often engage in practices to drive independent shippers out of their routes. Commonly, conferences would cut rates when competing independent shippers entered their routes, which drove the independents off the route or out of business (Sjostrom 2004: 120). Rate structures in the world before container shipping were also very different. Before widespread use of containers, rates were determined on the basis of commodities measured in tons (Levinson [2006] 2016: 300–301). This sort of structure would be prohibitively costly for wide-scale containerization as it would require mixed commodity containers to be opened up and commodities to be removed, reweighed, and replaced. All of these misallocations in transport resources presented a set of profit opportunities waiting to be monetized by an alert entrepreneur.

3.2 Containerization: Creative destruction born from the womb of arbitrage

According to Kirzner, entrepreneurial decision-making “reflects not merely the manipulation of given means to correspond faithfully with the hierarchy of given ends, but also *the very perception of ends-mean framework* within which allocation and economizing is to take place” (emphasis original; Kirzner 1973: 33). Indeed, the disruptive effect that McLean would have by introducing new methods of transport were a form of what Schumpeter would refer to as “creative destruction” (Schumpeter [1942] 1947: 83), but this creative act of destruction was born out of reshuffling existing means of transportation in a more efficient manner. What McLean perceived was that “railroads, trucks, and ship lines were in the same business – moving freight” (Levinson [2006] 2016: 227). Given that McLean perceived that the common end of these different modes of transport was hauling freight, he perceived the container as a means by which to introduce an organizational change in hauling freight, this change being the unifying of trucks, railcars, and ships into an uninterrupted, intermodal form of transporting freight. Thus, like Kirzner’s pure and penniless entrepreneur, McLean’s role was not defined by ownership of trucks, ships, containers, or other transport resources, but by his alertness to the fact that ownership of such resources could be purchased at a price lower than the price he would secure from the sale of output produced by these inputs, the output in the case being transport services (see Kirzner 1973: 43–52).

McLean’s journey to tackling the transaction costs born from uncertainty, unions, damage and theft, and regulatory oversight began with his experience as a trucker. McLean, born 1913 in Maxton, North Carolina, started Mclean Trucking Company in 1934. At that time, his company transported oil twenty-eight miles to gas stations from one town to another. By the end of World War II, McLean had grown his one-man operation into a trucking empire consisting of 162 trucks (Levinson [2006] 2016: 49–50). McLean quickly demonstrated his ability to work around regulations when he opted to buy companies who had approval for the routes he wanted rather than requesting approval from the ICC (Levinson [2006] 2016: 52–53). He continued to work against regulations in 1953 by planning to drop his truck cargo on ships, which would allow him to capitalize on the lower rate allowed by the ICC for shipping (relative to trucking). In order to do this, McLean gave up control of the trucking empire he built and purchased Pan Atlantic Steamship Corporation in order to avoid seeking permission from the ICC, which would have likely been denied (Levinson [2006] 2016: 58–60).

It was at this point “the box” came into view and became a reality. McLean’s vision evolved from putting full truck trailers on ships to creating containers that were detachable from the truck trailer, allowing containers to be stacked on the decks of container ships. April 26, 1956 marks the date for the maiden voyage of the *Ideal-X*, sailing from Port of Newark, New Jersey to Houston, Texas. The *Ideal-X* was the first of McLean’s fleet of many “container ships” which brought 58 containers of assorted cargo safe and dry to its destination (Mayo and Nohria 2005: 205). The containers carried by ships have varied greatly in appearance and function over the years. For example, the ships that inspired the name “container ship” were designed to transport wheeled railcars by moving them from track to ship via crane (Klose 2015: 42–43). The containers utilized by McLean’s *Ideal-X* were very different, however. Instead of wheeled railcars, McLean’s containers were flat and stackable. This allowed the 33’

steel containers to be stacked and secured to the retrofitted *Ideal-X*. The containers' lack of wheels required that they be moved onto the ship another way. The solution, which has evolved over the years, was a system whereby adjacent trucks' containers were unloaded and then immediately loaded onto ship via crane (Levinson [2006] 2016: 67; 73–75). After the *Ideal-X* proved container ships to be worthwhile, “cells” were included to hold containers in place in such a way that they could be stacked higher. The second group of ships, C-2 ships, would be able to utilize these cells to carry 226 containers (Levinson [2006] 2016: 73).

From that point on, McLean continued to aggressively discover the lowest cost containerization operation possible. Levinson ([2006] 2016) comprehensively documents McLean's innovations which include, but are not limited to, those surrounding the material of the container (Levinson [2006] 2016: 66), cranes and chassis (Levinson [2006] 2016: 67; 73–75), modifications to store more boxes (Levinson [2006] 2016: 73), ship designs (Levinson [2006] 2016: 76; 290–291; 312–315; 324), routes (Levinson [2006] 2016: 94–96; 217–218; 291), and stacking designs (Levinson [2006] 2016: 74). These modifications, occurring over the course of several years, were designed in part to combat the costly nature of shipping caused by the conditions highlighted in Section 3.1.

Containers continued to evolve over time. In 1964, the International Standards Organization adopted 20' and 40' container length standards (Klose 2015: 51–54). The height and width standards came to be 8'6" and 8', respectively (Levinson [2006] 2016: 184–185; 196), and they now had locking mechanisms that bound them to other containers in a stack. Container varieties still include all-steel boxes, but have also taken on the forms of open top steel containers, flat racks, refrigerated containers, insulated containers, and plywood containers with steel frames. Ultimately, all containers have the same function. They standardize largely heterogeneous bundles of goods in order to streamline the process of moving them.

The increasing utilization of containers and container ships led to the phenomena of containerization, which is the organization of intermodal shipping to and by sea based around a standard container unit. Containerization can be seen plainly in the numbers. Today, there are 10 million containers being transported at any given time, and 400 to 450 million containers were moved in 2007. Container ships also grew in size and number (Klose 2015: 24–25). Today, container ships called “Panamax” ships can hold up to 10,000 20' containers or 5000 40' containers weighing in at over 200,000 tons of cargo (Levinson [2006] 2016: 5; 315). A single ship carrying this much cargo was unimaginable when *Ideal-X* sailed to Houston with its 58 containers in 1956.

Due to the large volume of international shipping, containerization is widely recognized as one of the key elements in the movement towards globalization. Most of what containers carry are not consumer goods but, rather, intermediate goods (Klose 2015: 23). Levinson illustrates this by pointing to how modern Barbie dolls are created in several different locations across China and Taiwan using machines from Japan, Europe, and the United States. McLean discovered something that was truly revolutionary, not only in terms of the manner in which goods are transported, but also the manner in which such goods are manufactured in the first place. The shift in the global division of labor fostered by containerization is what Douglas Irwin refers to as *vertical specialization*, which is “the fragmentation of the production process as intermediate goods and components become a greater part of world trade” (2015: 18). Vertical

specialization not only accounts for about half of the growth in U.S. trade since the 1960s, but also roughly a third of the increase in world trade since 1970 (Irwin 2015: 18).

With this historical context in mind, it is clear what Malcom McLean's contribution was. Klose (2015: 57) puts succinctly in his analysis of the container in shipping that McLean's main entrepreneurial achievement was the "organizing element" in transporting cargo. McLean's entrepreneurial alertness did not occur with regard to the physical invention of the shipping container itself, but, rather, McLean discovering a way to organize resources such that they cut the costs of shipping. McLean's constant innovation to use the container system to cut costs documented above reflected his "fundamental insight" that "the shipping industry's business was moving cargo, not sailing ships" (Levinson [2006] 2016: 70).

Our main point here is not to highlight how container shipping was a creative innovation, *but that the nature of that innovation was to discover the opportunity to arbitrage from a less efficient form of shipping to a more efficient form of shipping*, both of which had already been technologically available. To say that containerization was not an invention or an act of technological change is not intended to undermine or take away from the importance of McLean's brilliant achievement, but instead to reinforce how shocking it is that such an innovation could have existed, but did not exist until McLean perceived it, grasped it, and implemented it. This is the "essence," as Kirzner puts it, of the entrepreneurial market process. Filtering McLean's entrepreneurial exploits through a Kirznerian lens puts into perspective what a Schumpeterian entrepreneurship cannot, namely that trillions of dollars of wealth were created simply by realizing unnoticed profit opportunities, which are defined out of existence in a Schumpeterian framework. Moreover, such profit opportunities were realized by monetizing the reduction of transaction costs that had previously precluded the gains from trade through containerization.

3.3 Realizing the productivity gains from containerization

Unifying the Kirznerian and Schumpeterian accounts of entrepreneurship not only reframes our understanding of the nature of the discovery that McLean realized. It also has important implications on our understanding of the source of the productivity gains from containerization. As we explained in the previous section, the nature of McLean's entrepreneurial innovation was to arbitrage existing, less-efficient modes of transportation, centered around loading and unloading break bulk cargo, to more efficient modes structured around containerization. Longshoremen were replaced by cranes, storage rooms in passenger ships were replaced by the flat beds of container ships, and heavily trafficked port cities, such as San Francisco and Liverpool, were replaced by newcomers like Oakland and Felixstowe, which offered deep-water clearance and state-of-the-art equipment. Similarly, the quality of services offered by the transportation industry were beyond what shippers could have fathomed in the 1950s. Whereas ocean shipping used to be slow, unreliable, and riddled with fees for lost or broken items, containerization drastically reduced the time and uncertainty involved with ocean shipping. Per Levinson ([2006] 2016: 9), "[Today's] 11,000 mile-trip from the factory gate to the Ohio warehouse can take as little as 28 days, a rate of 400 miles per day, at a cost lower than that of a single business-class airline ticket." McLean's quest for

entrepreneurial profit allowed him to view the transportation industry as an interconnected whole, not as separate sectors such as railroads, trucks, or ships.

The implication here is that the source of productivity gains from containerization arose not from reducing transportation costs per se, but from reducing transaction costs, specifically the cost “of obtaining the information necessary to enter into and complete bargaining negotiations” (Kirzner 1973: 227). While the current literature surrounding the transportation industry credits the container for the gains from trade generated by globalization, we argue that the source of these gains came fundamentally from reducing transaction costs. Before explaining why this distinction is important, let us first make this distinction explicit and clear.

The total cost of producing a good includes not only the cost of transforming inputs, such as land, labor, and capital, into consumable outputs, but also transaction costs. Transportation costs, the cost of moving cargo from point A to point B, are to be considered “transformation” or “production” costs (Wallis and North 1986: 102; see also Candela 2020). An American consumer, for example, does not purchase a watch in Switzerland, but instead a watch in Switzerland *that is to be delivered to the United States*. The Swiss watch is not “produced” or “transformed” into a consumable output until resources are expended to transport it. Transaction costs, on the other hand, are the information costs required to secure and exchange property rights over goods being transported (Kirzner 1973: 227; Dahlman 1979: 148; North 1990: 27). As Allen (1991: 9) put it: “Robinson Crusoe bore many information costs, but dealt with transaction costs only when Friday showed up.” Transaction costs include the resources foregone to discover trading partners, including the price at which they might agree to an exchange, as well as the resources foregone to monitor and enforce compliance to the terms of an exchange. In a world of perfect foresight, such costs could be priced directly into the output being exchanged, in which case the distinction between transaction costs and transformation costs would become irrelevant.

For our purposes, we can consider transportation costs as *the costs of shipping*, such as the use of labor, capital, fuel, and other physical inputs, which are distinct from transaction costs as *the cost of organizing shipping* associated with uncertainty of time spent at port, union strikes, and regulatory barriers. Given that technology required to implement containerization was “out there” waiting to be discovered, the nature of the reduction in costs associated with transporting cargo was one of perceiving that the opportunity to organize shipping more effectively was already available (Kirzner 1973: 230).

Bernhofen et al. (2016) analyze how world trade grew by a factor of 7 from 0.45 trillion dollars in the early 1960s to 3.4 trillion dollars in 1990. Their results, drawn from a panel of bilateral trade flows for 157 countries, find that containerization contributed more to this growth than free trade agreements or GATT tariff cuts. Coşar and Banu (2018) use micro-level Turkish export data to find that the container decreased variable shipping costs between 16 and 22%. Even more conservative studies acknowledge the role that the container played in the global economy. While Hummels (2007: 152) maintains that increasing the share of containerized trade will only reduce shipping costs between 3 and 13%, he stresses that this percentage is heavily impacted by the price of crude oil and that the container’s reduction of indirect costs, such as lengthy port stops, was critical to the rise in international trade that occurred from 1950 to 2004. Admittedly,

however, Hummels points out that decreases in shipping costs may not be fully reflected in the data because:

the real gains from containerization might come from unmeasured quality change in transportation services. Containerships are faster than their predecessors, and for loading and unloading are much quicker than with break bulk cargo. In addition, containers allow cargo tracking, so that firms know precisely where goods are en route and when they will arrive...To the extent that these quality improvements do not show up in measured price indices, the indices understate the value of the technological advance. Still, many of the purported improvements of container shipping should have lowered explicitly measured ocean shipping costs, and apparently did not. Why? (Hummels 2007: 144)

McLean's entrepreneurial vision provides an answer. He understood that his goal was moving cargo as cheaply as possible, not moving his ships as cheaply as possible. Therefore, per Levinson ([2006] 2016: 341), "As Malcom McLean had understood back in 1955, it is the sum of [all] costs, not just the published rate of a ship line or railroad, that matters to shippers." This implies that the real productivity gains from containerization came not from technological change, as Hummels suggests, but by the erosion of transaction costs, which allowed existing technology to be used more effectively. The conflation implicitly made by Hummels, yet alluded to by Levinson, in the distinction between *transportation costs* and *transaction costs* in the total cost of shipping, which the containerization literature uses synonymously, hides the nature of what was perceived and discovered by McLean.⁷

By lowering the high transaction costs associated with uncertainty over unloading time at port, union power, the theft and damage of cargo under the breakbulk system, and the regulatory authorities, containerization allowed ships to take advantage of economies of scale (Tombari 1979). The by-product of exploiting economies of scale through containerization lowered the *costs of shipping* by recalibrating the economics of location and establishing inter-connected global trade routes. In doing so, containerization revealed that profit opportunities could be realized by reallocating land, labor and capital to previously unnoticed, higher valued uses. Altogether, these changes laid the groundwork for just-in-time shipping, a phenomenon that has greatly transformed both the manufacturing and transportation industries and allowed for increased global trade.

3.4 Reducing the costs of organizing shipping

When Kirznerian and Schumpeterian entrepreneurship are unified as distinct aspects of the equilibrating market process, such a theoretical framework lends itself to an understanding of how the entrepreneurial market process feeds on itself by expanding

⁷ Hummels (2007: 141) comes close to making this distinction in his discussion of direct shipping costs (storage, port labor, and fuel) and indirect shipping costs (time spent idle in port). However, Hummels' "indirect costs" seem to represent production costs, rather than transaction costs. Moreover, the cost of storage associated with holding inventories corresponds more directly to transaction costs, since in a world of zero-transaction costs, holding inventories would be unnecessary. On this point, see Hutt (1939) as well as Alchian (1969).

the scope of previously unnoticed possibilities by disrupting previous methods of shipping. The growth of trade via containerization occurs not because of the availability of new technological possibilities, “but because of expanded awareness of existing opportunities” (Kirzner 1985: 74) to correct previously unnoticed errors in methods of trade. These include not only correcting the manner in which land, labor or capital were allocated throughout the transport industry, but also correcting previous maladjustments by redirecting global trade routes and eroding the impediments erected by regulatory barriers, all of which were brought about by the introduction of containerization.

Reducing time in port As was mentioned in Section 3.1, goods were transported by a method known as *break bulk* shipping before the advent of the container. McLean, who began his career as a trucker, was used to waiting in long, gridlocked lines before delivering his cargo portside and envisioned the container as a way to alleviate the complicated loading process. His instincts proved correct. While loading loose cargo via longshoremen cost \$5.83 per ton in 1956, loading containers onto McLean’s *Ideal-X* cost a mere \$0.16 per ton (Levinson [2006] 2016: 68). Bernhofen et al., (2016: 38) also affirm the effectiveness of McLean’s solution: “The productivity gains from using this container crane were staggering, as it could handle 400 t per hours, more than 40 times the average productivity of a longshore gang.” Removing this bottleneck enabled ships to spend less idle time in port and less resources on additional docking fees.

Transforming role of dockworkers Longshoremen lived in tight-knit communities and relied on collective action to preserve the high wages and long hours that their large numbers would otherwise reduce. While often glorified in historical literature as a tough, adventurous brotherhood that worked one day and fished or swam the next, their work was anything but glamorous. Per Levinson ([2006] 2016: 23–24):

Copper came from Peru to New York in the form of bars too big for a man to handle. Longshoremen had to move these enormous hunks of metal across the dock, from the incoming ship to a lighter, or barge, which would transport them to a plant in New Jersey. “Because they had to bend over to do that, you’d see this fellows going home at the end of the day kind of like orangutans,” a former pier superintendent remembered. “I mean, they were just kind of bent, and they’d eventually straighten up for the next day.”

And per Vigarié (1999: 5):

Accidents were frequent and between 1955 and 1966 in Le Havre alone, there were 6000 accidents per year on average, with between 26 and 48 fatalities. The Rochdale Report in Britain indicated that there were on average 46 deaths per year in British docks.

Their labor was also costly. Not only did their wages account for up to half the total expense of an ocean voyage (Levinson [2006] 2016: 26), but the risk of broken or stolen items during the loading process contributed to high insurance premiums and an

unexpected dockworker strike could cause a shipper to incur thousands of dollars in fees.⁸ “For the shipper,” Talley (2000: 936) writes, “containerization meant less pilferage. Containers would be sealed at the origin and not opened until they arrived at the consignee. Also, less handling meant less damage to cargo. The delivery of cargo was faster and more reliable, resulting in substantial reductions in inventories. While a break-bulk ship often took a week to unload and reload, a containership might be in port for only six hours.” According to Bernhofen et al., (2016: 39), between 1965 and 1971 alone, the resulting reduction in insurance costs from containerization along the Australia–Europe trade route fell from an average of 24 pennies per ton to 4 pennies per ton. The container reduced these costs from the shipping process, but not without a fight. It took years of negotiations and lawsuits with the longshoreman unions before the role of the dockworker was allowed to evolve from that of the traditional blue-collar laborer to that of the specialized crane technician (Levinson [2006] 2016: 372–374). Between 1970 and 1986 alone, the number of longshoreman employed in the Port of New York fell from 30,000 to 7400 (Talley 2000: 946, fn. 6). By shifting the traditional labor-intensive stevedoring process to a capital-intensive intermodal process, containerization reduced the uncertainty associated with holdups by labor strikes.

Confronting industry regulation The most substantial hurdle that McLean overcame was the tangle of federal regulation in the transportation industry overseen by agencies like the now-defunct Interstate Commerce Commission. Laws such as the Motor Carrier Act of 1935 forbid transportation businesses to move freight via railroads, trucks, and ships – a firm could only choose to engage in one mode of transportation. In order for McLean to cross over from the trucking industry to the shipping industry in 1955, he had to maneuver a complicated legal process that involved McLean forming an entirely new company while legally resigning from McLean Trucking all within one hour (Levinson [2006] 2016: 59). After McLean’s shipping company, McLean Industries, was formed, McLean still had to wait months until the ICC approved his plan to employ the use of containers.

Despite these successes, McLean did not win every battle against the ICC. In 1966, he proposed a new vision: an intermodal company that would combine truck and ship routes with railroad hubs in Chicago and St. Louis that McLean would finance himself. McLean estimated that “shippers’ costs for the domestic leg of their international shipment would fall by half” since “trucks would do the short-haul work for which they are best-suited” and “trains would handle the long haul, where their costs were lowest” (Levinson [2006] 2016: 228). The ICC, strongly swayed by railroad executives, never approved this plan. However, McLean’s dogged pursuit of an interconnected transportation industry countered prevailing norms and laid the groundwork for future deregulation, such as the Railroad Revitalization and Regulatory Reform Act of 1976, the Staggers Rail Act of 1980, and the Motor Carrier Act of 1980 that officially dissolved the ICC.

⁸ When McLean first attempted to expand his containership route to Puerto Rico, longshoremen in San Juan protested for four months and did not unload the ships until McLean agreed to use union-approved twenty-four man longshoreman gangs to unload containerships – even though the role of the longshoreman was obsolete in the process. (Levinson [2006] 2016: 77)

Recalibrating the economics of location The container reduced transportation costs by relieving the manufacturing industry of the need to have coastal operations and plants. Instead, firms could now move inland and cheaply transport goods to the coast:

The container turned the economics of location on its head. Now, a company could replace its crowded multistory plant in Brooklyn or Manhattan with a modern, single-story factory in New Jersey or Pennsylvania, could enjoy lower taxes and electricity costs at its new home, and could send a container of goods to Port Elizabeth for a fraction of the cost of a plant in Manhattan or Brooklyn (Levinson [2006] 2016: 133).

This simultaneously allowed coastal property to be allocated to higher valued uses and enabled private businesses to enjoy larger, less costly facilities. Containerization also enabled ports to economize on scale and concentrate freight within a few key terminals:

Whereas in 1965 ships in the (southbound) Australian trade called at any of 11 loading ports in Europe, by 1972 the entire trade was shared among the three ports of Hamburg, Rotterdam and Tilbury” (Bernhofen et al., 2016: 39).

The emergence of super ports enabled shippers to reduce not only the mileage of their trade routes but also the time spent sourcing freight on the spot market.

Establishing global trade routes While McLean first took business outside the contiguous U.S. to Puerto Rico in 1958, he did not find a major opportunity to enter foreign markets until the Vietnam War. In the early stages of the war, the United States military struggled with navigating the logistics of Vietnam’s narrow ports. Inbound ships stocked full of supplies were forced to wait months in open water until space was made available at the makeshift docks. In need of a solution, the federal government asked leading shipping executives to create proposals for the private handling of military logistics (Levinson [2006] 2016: 238). McLean lunged for the opportunity, outbid the competition by offering to provide the necessary capital (chassis, trucks, and terminals), and saved the Navy over half the cost per ton ([2006] 2016: 245). While each round trip from the United States to Vietnam generated \$20,000 per day ([2006] 2016: 249), McLean was not satisfied. Ships sailed to Vietnam with cargo, but sailed back empty. McLean knew there had to be another profit opportunity, and he found it in negotiations with Japan. Before long, his ships were sailing back from the East loaded with cargo, and he had tapped a new foreign market. Thus, containerization finally pierced global markets – all as a way to minimize overhead costs per voyage.

Altogether, the cost-reducing innovations yielded by the container made it possible for McLean to experiment with around-the-world shipping routes in the 1980s. While such routes had never been attempted due to the risk of delay caused by poor weather or mechanical problems, McLean took a calculated risk in efforts to solve what he considered the “inherent problems” of the industry (Levinson [2006] 2016: 312): “the imbalanced flow of freight that left some ships sailing full in one direction and half-empty in the other.” In 1982, McLean placed an order for fourteen containerships that would circumnavigate the globe in an eastbound direction. While his new trade route suffered delays and struggled to remain profitable, it shattered the preexisting notions

of what many shippers once thought possible. Other companies began to follow suit, and the logistical precision developed by these shippers laid the groundwork for just-in-time shipping, which enabled manufacturers to reduce inventories and experience huge cost savings. Now, countries that have chosen to access these global trade routes boast massive economic gains:

In 2004, the World Bank estimated that if Peru were as effective at port management as Australia, that alone would increase its foreign trade by one-quarter. The Peruvian government took that warning seriously, arranging \$2 billion in port investments over the ensuing decade, which made possible a very large increase in foreign trade. Tanzania, on the other hand, staunchly resisted modernization. If only the port at Dar es Salaam had been as efficient as the nearby port at Mombasa, in Kenya, the average Tanzanian family in 2012 would have saved a stunning 8.5 percent of its annual expenses (Levinson [2006] 2016: 368).

Thus the simple container, paired with McLean's entrepreneurial vision for an interconnected transportation sector, unleashed a series of innovations that not only transformed the way freight was moved across the world but also generated wealth in sectors far beyond the transportation industry itself.

4 Conclusion

It is no exaggeration to state that McLean's pioneering innovation changed the face of international trade and fostered the integration of the world economy in the post-WWII era. However, the entrepreneurial brilliance of McLean that we wish to highlight here is that his innovation did not introduce a technological change that had not existed before per se. Rather, the productivity gains that were created by modern container shipping were generated by *discovering and revealing* the massive inefficiencies that had existed in the organization of international shipping before modern containerization. As Levinson states this point, "Malcom McLean's real contribution to the development of containerization, in my view, had to do not with a metal box or ship, but with a managerial insight. McLean understood that transport companies' true business was moving freight rather than operating ships or trains. That understanding helped his vision of containerization succeed where so many others had failed" ([2006] 2016: xii). Moreover, the very simplicity of McLean's idea, and the inefficiencies it exposed, seemed so obvious *ex-post* that it should puzzle us to realize it had not been implemented before, *when the technology and resources had already existed*. Understood this way, an analytic exposition of McLean as an entrepreneur is uniquely suited to illustrating the entrepreneurial market process developed by Israel Kirzner, and how the distinct nature of Schumpeterian entrepreneurship fits into the equilibrating tendencies of the market process.

Our argument has an important implication for future research on the impact that containerization has had on the cost of shipping. To the extent that economists have implicitly filtered the economics of containerization through a Schumpeterian lens, and therefore have regarded it as a technological innovation, the primary focus of analysis

has been on measuring the decline of explicit shipping costs due to technological improvements realized through economies of scale, which – as alluded to by Hummels (2007) – underestimates the real productivity gains generated from containerization. Redirecting our analysis through a Kirznerian lens, additional research can be conducted that measures the reductions in transaction costs, the impact of which indirectly allowed McLean to reorganize existing transportation technology on a massive scale. Though the most recent literature on the economics of containerization has begun to move in this direction through measurements in the decline of insurance costs and waiting time at port, there are two additional avenues of research. One possibility is to take an event study approach that illustrates the Kirznerian rendition of the market process via arbitrage through tendencies towards equalization of world market prices in goods traded internationally. Another possibility would be to observe, after the introduction of containerization, the qualitative effects of containerization through the expanded basket of goods, not only in terms of quantity and variety traded on the international market, but also in terms of the availability of goods less seasonally.

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