

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.

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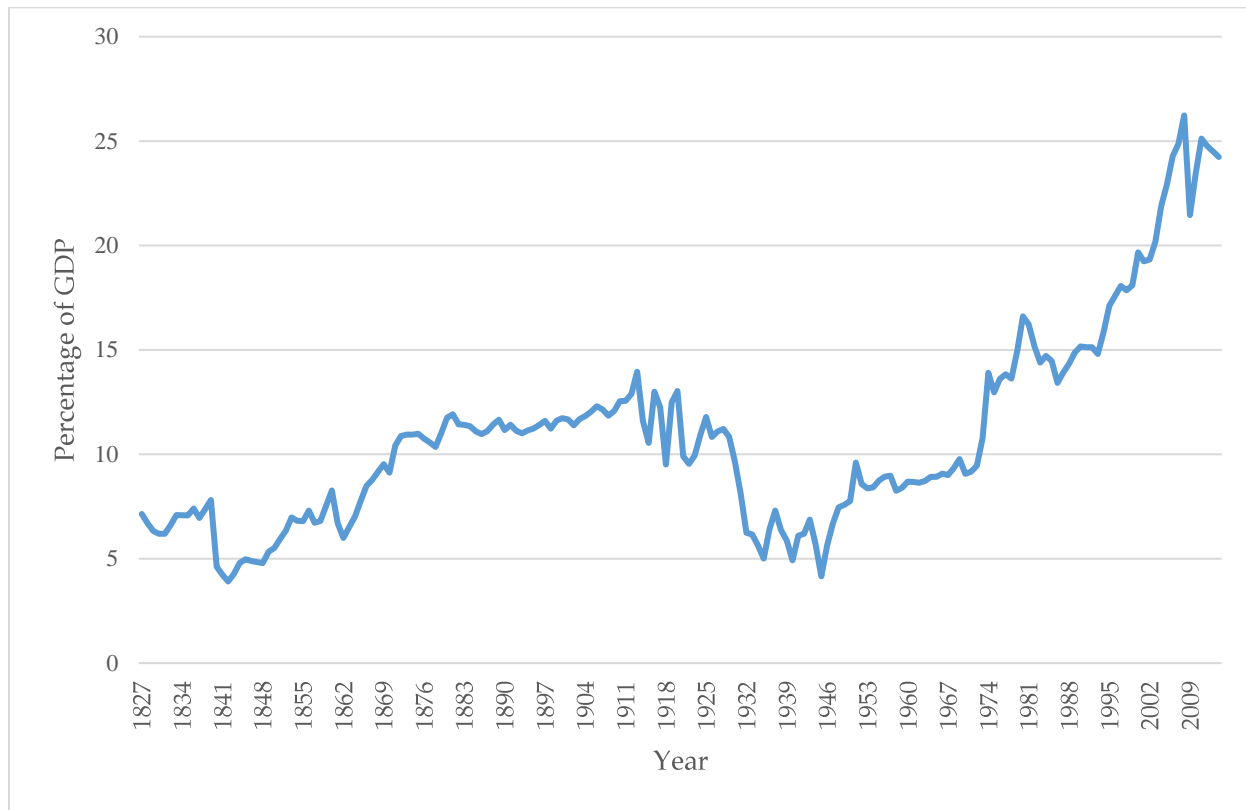
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INTRODUCTION

Malcom McLean was one of the most important entrepreneurs of the 20th century. Yet unlike other entrepreneurs, such as Bill Gates, Steve Jobs, and Mark Zuckerberg, his name remains relatively unknown to the public. However, when we take into account his continuing impact upon the world economy, he is, perhaps, *the* most important entrepreneur since World War II. 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. 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, and therefore opened up markets for inventions and other innovations that might not have otherwise existed.

In recent years, there has been a growing literature that has recognized the impact that McLean has had on international commerce through the introduction of containerization (Anderson and Wincoop 2004; Levinson (Levinson [2006] 2016; Hummels 2007; Bernhofen, El-Sahli, and Kneller 2016; Coşar and Demir 2018). The impact of containerization on the reintegration of the world economy after the Great Depression and World War II is evidenced in two ways. First, from a long-term historical perspective, the growth of international trade as a share of world GDP has risen to unprecedented highs, as illustrated in Figure 1.

FIGURE 1. VALUE OF EXPORTED GOODS AS A SHARE OF WORLD GDP, 1827-2014



Source: Fouquin and Hugot (2016)

Secondly, the effects of containerization have also been measured by the reduction of transportation costs internationally. For example, controlling for fluctuations in fuel costs, Hummels (2007, 142) argues 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. From an entrepreneurial perspective, this suggests two channels by which entrepreneurship drives the market process.

The first channel refers to *Schumpeterian entrepreneurship*, which emphasizes the seizure 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. From a Schumpeterian perspective, containerization had a disruptive effect on ocean shipping by unlocking new profit opportunities from innovation and the creation of new markets that would have not otherwise existed, resulting in the productivity gains in ocean shipping that have corresponded with the growing share of wealth generated through international trade since the 1950s, as indicated in Figure 1.

The second channel emphasizes the role of *Kirznerian entrepreneurship*, which has an equilibrating effect on the market process. In effect, the Kirznerian entrepreneur is an *arbitrageur* that seizes previously unnoticed profit opportunities by realizing the existence of disequilibrium because of prior entrepreneurial errors in the allocation of resources (Kirzner 1973). Perceiving such inefficiency from unrealized gains from trade, the Kirznerian entrepreneur captures pure profit, and exhausts the gains from trade, by redirecting resources from less valued consumer uses to perceived more valued consumer uses. Such reallocation of resources also manifests itself in the utilization of the lowest-cost methods of production, which has resulted in the reduction of costs associated with shipping goods internationally. From a Kirznerian perspective, though Schumpeter's notion of entrepreneurship actively expands the international scope of productive specialization and trade through innovation, what is crucial for Kirzner is that entrepreneurs actually perceive that such possibilities exist and that they respond to them.

These two effects of entrepreneurship raise an important question: does the entrepreneurial 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. 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. Though this innovation had a disruptive effect by displacing previous methods of transporting freight through ocean shipping, it *revealed* 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 was able to realize 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.¹ In effect, McLean's central insight was an alertness to the fact that such existing inefficiencies operating in intermodal transport could be eroded and transformed into future profit opportunities that had gone previously unnoticed.²

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 here. Our contribution specifically addresses that literature which analyzes the relationship between Schumpeterian and Kirznerian entrepreneurship in economic theory (Kirzner

¹ See Langlois (1992), Baird (2000), Foss and Klein (2009), Piano and Rouanet (2018) on the overlapping distinctions in the Austrian tradition and the transaction-cost tradition of market process analysis.

² 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 19th century (see Candela and Geloso 2018a,b, 2019).

1973, 1979, 1982, 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 equilibrating tendencies in price adjustments but should also “include quality adjustments and technological and organizational improvements in addition to price adjustments.” By bringing non-price variations to 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).

Therefore, 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 allows 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 1 provides an overview of the literature on the relationship between Schumpeterian and Kirznerian entrepreneurship, and in doing so, addresses the literature on the economics of containerization. Section 2 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. Section 3 traces out that transformation of 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.

1. ENTREPRENEURSHIP AS CREATIVE ARBITRAGE

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 as well. In doing so, we will also reframe our understanding of the source of the productivity gains in ocean shipping generated by containerization.

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 with it room for the entrepreneur. Under such conditions, the price of inputs and the methods of production utilized 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 those given by 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.

This dichotomization of the forces at work that drive market process lends itself nicely to distinguish Schumpeterian from 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 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). However, the equilibrating tendency of the market process will continue to occur, even if changes in UVs seized to occur, precisely because no entrepreneurial decision will have perfect foresight to achieve a profit-maximizing outcome,³ 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 entrepreneurially driven 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

³ On the relationship between profit-seeking and uncertainty, see also Alchian (1950).

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 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 the 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 particular time and place in history. To the extent that we collapse the distinction between these two types of entrepreneurship onto each other, its 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

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.

the role that entrepreneurship played in unleashing the productivity gains in ocean shipping from containerization.

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 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) has coincided with subsequent research that attempts to quantify the overall effect that containerization in reducing the costs associated with transporting goods internationally (Hummels 2007; Bernhofen, El-Sahli, and Kneller 2016; Coşar and Demir 2018). Though there is indeed a broad consensus that the productive impact of containerization has been significant – the details of which we will discuss in Section 3 – from an entrepreneurial perspective, the sources of the productivity increases generated by containerization are generally lumped together under the category of technological change.⁵ This suggests that, implicitly, the nature of McLean's entrepreneurial exploits have 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 economists, Bernhofen, El-Sahli, and Kneller (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).

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

Our disagreement with this literature is neither semantic nor without precedent. What's surprising is how this literature has overlooked and conflated the distinction made well-known by Nobel Laureate Douglass North between *technological change* and *organizational change*, which he had 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 a UVs, while an organizational change reflects a change in IVs, collapsing one onto another creates analytical ambiguity not only in distinguishing between the two, but also in the distinction between Schumpeterian and Kirznerian entrepreneurship.

Our main point here is to highlight how container shipping was a creative innovation, *but 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

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 1850-1913" (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).

gains from trade through containerization. Therefore, the status quo in ocean shipping that McLean “disrupted” was, in reality, a discovery of a method of transporting freight that had been technologically available, and therefore that status quo was “nothing but a seething mass of unexploited maladjustments crying out for correction” (Kirzner 1979, 119).

2. THINKING OUTSIDE THE BOX TO DISCOVER “THE BOX”

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 term “container ships” was coined to describe a ship with the purpose of transporting cargo via container, dubbed “the box” amongst shippers. 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, 42-3). The containers utilized by McLean’s *Ideal-X* were very different, however. Instead of wheeled railcars, McLean’s containers were flat and stackable. This allows 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, though changing over the years, is a system whereby adjacent trucks’ containers are unloaded and then immediately loaded onto ship via crane. Further, containerships changed after *Ideal-X* proved the concept to be worthwhile. “Cells” were included which held 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, 67, 73-5).

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). They now have locking mechanisms which allow them to be locked on to the 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, they all 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 finally 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 5,000 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* came 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. Truly, McLean discovered something that was revolutionary. This 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).

From a superficial observation, it would seem that there was nothing new about “the box.” As alluded to above, the world already contained shipping containers when McLean pioneered their implementation on a global scale. Levinson ([2006] 2016, 38) recounts how containers were used to ship furniture and were moved from rail cart to horse cart via crane toward the end of the 19th century. Railcar transportation by ferry also dates back to as early as 1874 (Vigarié 1999, 5). Finally, Klose (2015, 42) recounts the use of crane to move cargo from train to ship and back in Rome as early as 1928, which apparently served as inspiration for McLean. This presents a puzzle in itself. If McLean didn’t invent the shipping container, what was his entrepreneurial contribution? Understanding the answer to this question requires taking a deeper look at McLean’s vision and how he perceived a profit opportunity that could be realized through mass containerization.

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). What McLean perceived was that “railroads, trucks, and ship lines were in the same business – moving freight” ([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). However, understanding McLean's alertness to this profit opportunity requires us to first contextualize the state of the transport industry that existed when McLean pioneered containerization.

Shipping in the 1950s was overwhelmingly done with break bulk cargo. In other words, individual items were stacked on to ship decks and unloaded by large crews of dock workers, also known as longshoremen (Talley 2000, 993). In order to load and unload cargo in the era of break bulk shipping, longshoremen needed to move pallets which secured the cargo from the factory in question onto a truck or railcar, unload the pallets onto the dock, move the pallets onto the ship (via crane), and arrange the pallets in such a way as to minimize the damage to the cargo. The loading and unloading of pallets often had to be done one at a time.

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 standardization both between and among ships 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. Often, this 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 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 elevate waiting times even further. 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 imposed a significant barrier to transactions, which provided an opportunity for McLean.

This uncertainty associated with the size of loads and the length of loading times led to high transaction costs in a more roundabout way. That is, uncertainty incentivized the formation of labor unions which further raised transaction costs. The volatile amount of labor demanded required casual labor to sometimes be used in tandem with professional longshoremen (Levinson [2006] 2016, 28-9; Vigarié 1999, 4). This combined with the relatively low amount of training required to move cargo led to an abundance of labor showing up hours early in hopes that there would be available jobs. To solve the problems associated with casual competition and uncertain working hours, longshoremen formed powerful unions to act on their behalf. Competition by laborers outside the Union was limited via a registration process. 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). The already long wait times at ports along with considerations of perishable items being shipped allowed unions to impose very high costs on shippers as consumers of shipped goods. In 1954, just two years before the launch of McLean’s *Ideal-X*, strikes resulted in a loss of 1.3 million man-days of labor (Levinson [2006] 2016, 35). By successfully limiting outside competition, unions gained power to exacerbate 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 limited to strictly the time in port, however. Two certainties, theft and cargo damage, were pervasive in the era of break bulk shipping. Talley (2000) points out that one of the benefits of the move from breakbulk to container shipping was the fall in pilferage. New York was especially notorious for theft of items including radios, liquor, and coffee (Levinson [2006] 2016, 37). With ships of 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 objects 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) also 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 technology which minimized these costs.

The world McLean entered with “the box” was one of heavy regulation. The Interstate Commerce Commission (ICC) in the 1950s had regulatory authority of all domestic cargo carrying 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 otherwise lead to lower shipping rates. For example, in 1931 the ICC stifled the containerization of railways. The North Shore Line 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 proto-“box” 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 (Levinson [2006] 2016, 57). This oversight gave a significant scope for arbitrary political assignment of 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. This sort of system would severely dampen the benefits of containerization.

McLean's journey to tackling the transaction costs in shipping associated with 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 in one town from 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, 52-3). 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 to avoid seeking an approval which would likely be denied (Levinson [2006] 2016, 58-60).

It was at this point "the box" began to come into view. McLean's vision evolved from putting full truck trailers on the beds into having detachable containers from the truck trailer. McLean's first run of shipping with "the box" was a success, with the *Ideal-X*'s maiden voyage occurring in 1956. From that point on, McLean continued to aggressively discover the lowest cost containerization operation possible. Levinson comprehensively documents McLean's innovations which include, but are not limited to, those surrounding the material of the container, cranes and chassis, modifications to store more boxes, ship designs, routes, and stacking designs. 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 above (Levinson [2006] 2016, 66-7, 73-6, 94-96, 217-18, 290-91, 312-15, 324).

With the 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 practical disciplines use the container, "as an organizing element". McLean's entrepreneurial alertness did not occur with regards to the physical invention of the shipping container itself, but, rather, McLean discovered a way to organize resources such that they cut these transaction costs. 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). In summary, McLean used the organizing element of containers to organize resources in a way which cut the cost of moving cargo. McLean's entrepreneurial introduction of the box reduced aforementioned costs relative to breakbulk shipping and, as a consequence, transformed the shipping industry. Section 3 will continue by detailing how McLean's entrepreneurial alertness did just that.

3. REALIZING THE GAINS FROM TRADE VIA CONTAINERIZATION

The gains from trade realized by the transformation of the transportation industry were made possible by Malcom McLean's acute sensitivity to costs and dedication to the bottom line. His 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. Malcom McLean's entrepreneurial risks turned the transportation industry on its head. Just twenty years after the first container was packed and delivered to Houston, Texas by McLean's *Ideal-X* in 1956, both the

technology employed by the industry and the quality of shipping services were unrecognizable. Longshoremen had been traded for cranes, storage rooms in passenger ships were traded for the flat beds of containerships, and heavily trafficked port cities, such as San Francisco and Liverpool, were traded for newcomers that offered deepwater clearance and state-of-the-art equipment like Oakland and Felixstowe. Similarly, the quality and speed 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.”

The literature surrounding the transportation industry credits the container for the gains from trade generated by globalization. Bernhofen, El Sahli, and Kneller (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. Cosar and Demir (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 3-13%, 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 1950-2004. 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? (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. This raises another important issue, which is a 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.⁷

The total cost of producing a good includes not only the cost of transforming inputs, such as land, labor, and capital, into a 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

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).

“production” costs (Wallis and North 1986, 102; see also Candela 2020). The 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 (Dahlman 1979, 148; North 1990, 27). As Allen (1991, 9) put it: “Robinson Crusoe bore many [...] costs, but dealt with only transaction costs 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 monitor and enforce compliance to the terms of an exchange. In a world of perfect foresight, such costs could be price 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 over time and unloading at port, union strikes, and regulatory barriers.

For the remainder of this section, we will discuss how McLean revolutionized the transportation industry by using the container to cut costs. Section 3.1 will discuss how the container lowered the *costs of organizing shipping* by reducing time in port, transforming the role of the dockworker, and confronting industry regulation. 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). As we discuss in Section 3.2, 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 of 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.

3.1 REDUCING THE COSTS OF ORGANIZING SHIPPING

Reducing time in port. As was mentioned in Section 2, before the advent of the container, goods were transported by a method known as *break bulk* shipping. 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. 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). 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, El-Sahli, and Kneller (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 hour, 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, 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

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).

for only six hours.” According to Bernhofen, El-Sahli, and Kneller (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 7,400 (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.

3.2 REDUCING THE COSTS OF SHIPPING

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 its highest valued use and enabled private business 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, El-Sahli, and Kneller 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 abroad in 1958 to Puerto Rico, he did not find another 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.

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