Semeter-IV (Geography Honours)

Paper Code: GEOACOR09T

TOPIC: CONCEPT OF ECONOMIC DISTANCE AND TRANSPORT COST

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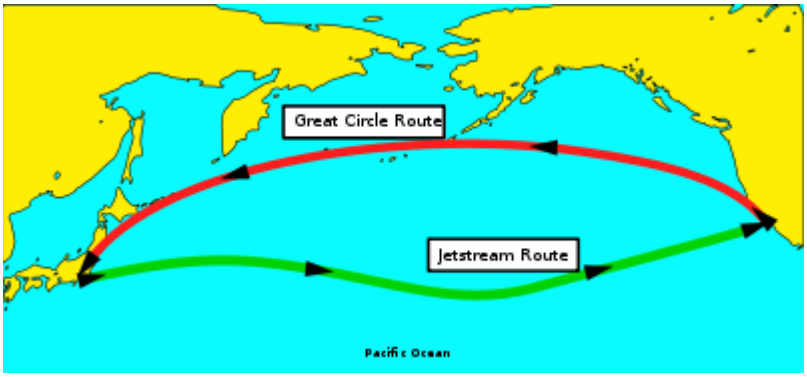
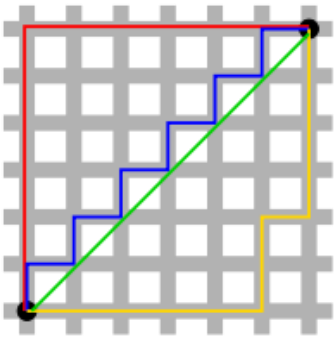
Distance:

Distance is a numerical measurement of how far apart objects or points are. In physics or everyday usage, distance may refer to a physical length or estimation based on other criteria (e.g. "two counties over"). In most cases, "distance from A to B" is interchangeable with "distance from B to A". In mathematics, a distance function or metric is a generalization of the concept of physical distance, a way of describing what it means for elements of some space to be "close to" or "far away from" each other. In psychology or social sciences distance is a non-numerical measurement; Psychological distance is defined as "the different ways in which an object might be removed from" the self along dimensions such as "time, space, social distance, and hypothetically.

Physical distances



Airline routes between Los Angeles and Tokyo approximately follow a direct great circle route (top), but use the jet stream (bottom) when heading eastwards. Note that the shortest route appears as a curve rather than a straight line because this map is a Mercator projection, which does not scale all distances equally compared to the real spherical surface of the Earth.



"Manhattan distance" on a grid

A physical distance can mean several different things:

- Distance Travelled: The length of a specific path travelled between two points, such as the distance walked while navigating a maze
- Straight-Line (Euclidean) Distance: The length of the shortest possible path through space, between two points, that could be taken if there were no obstacles (usually formalized as Euclidean distance)
- Geodesic Distance: The length of the shortest path between two points while remaining on some surface, such as the great-circle distance along the curve of the Earth
- The length of a specific path that returns to the starting point, such as a ball thrown straight up, or the Earth when it completes one orbit.

A board showing distances near Visakhapatnam

"Circular distance" is the distance traveled by a wheel, which can be useful when designing vehicles or mechanical gears. The circumference of the wheel is $2\pi \times$ radius, and assuming the radius to be 1, then each revolution of the wheel is equivalent of the distance 2π radians. In engineering $\omega = 2\pi f$ is often used, where f is the frequency.

Unusual definitions of distance can be helpful to model certain physical situations, but are also used in theoretical mathematics:

- "Manhattan distance" is a rectilinear distance, named after the number of blocks north, south, east, or west a taxicab must travel on to reach its destination on the grid of streets in parts of New York City.
- "Chessboard distance", formalized as Chebyshev distance, is the minimum number of moves a king must make on a chessboard to travel between two squares.

Distance measures in cosmology are complicated by the expansion of the universe, and by effects described by the theory of relativity such as length contraction of moving objects.

Theoretical distances

The term "distance" is also used by analogy to measure non-physical entities in certain ways.

In computer science, there is the notion of the "edit distance" between two strings. For example, the words "dog" and "dot", which vary by only one letter, are closer than "dog" and "cat", which differ by three letters.

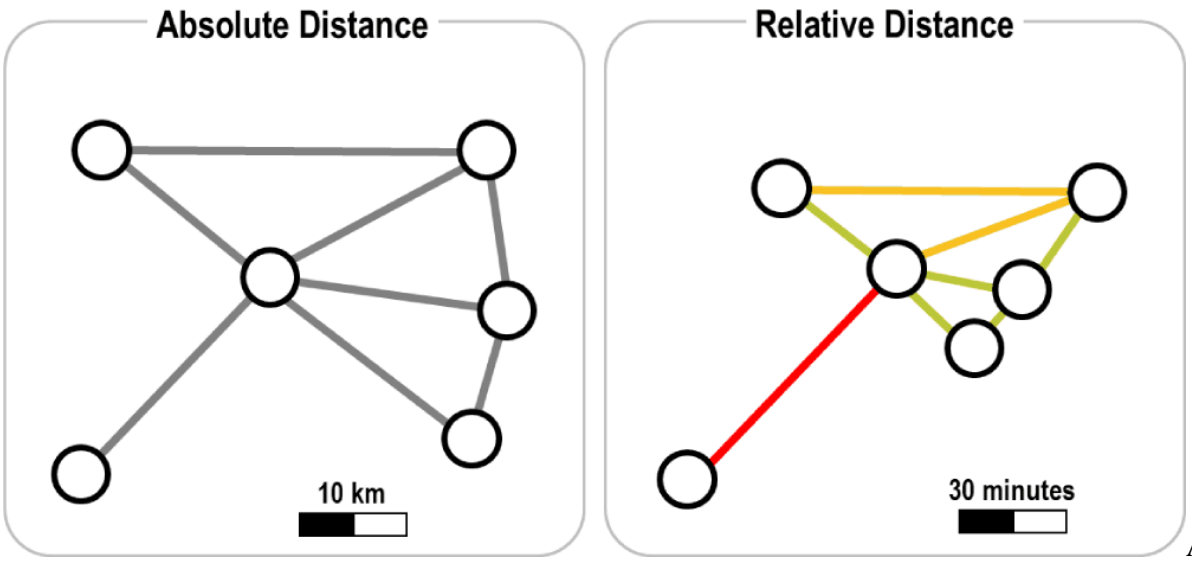
This idea is used in spell checkers and in coding theory, and is mathematically formalized in several different ways, such as:

- Levenshtein distance
- Hamming distance
- Lee distance
- Jaro–Winkler distance

In mathematics, a metric space is a set for which distances between all members of the set are defined. In this way, many different types of "distances" can be calculated, such as for traversal of graphs, comparison of distributions and curves, and using unusual definitions of "space" (for example using a manifold or reflections). The notion of distance in graph theory has been used to describe social networks, for example with the Erdős number or the Bacon number, the number of collaborative relationships away a person is from prolific mathematician Paul Erdős or actor Kevin Bacon, respectively.

In psychology, human geography, and the social sciences, distance is often theorized not as an objective metric, but as a subjective experience

Absolute and Relative Distance in a Network



Absolute and Relative Distance in a Network

In an **absolute context**, distance in a network is a fixed attribute that does not change. For instance, the absolute distance between New York and Boston is about 310 km. The location of the nodes of such a network is also absolute and fixed. The absolute distance between two places can be small, but the relative distance between those places can still be vast.

In a **relative context**, distance is a variable attribute that depends on numerous factors, such as the mode being used, its efficiency, regulations (e.g. speed limits) and congestion. Under such circumstances, some nodes of the network are “closer” when that are considered from a relative distance perspective instead of an absolute distance. So, while it took about 44 hours to travel between New York and Boston around 1800, by the end of the 20th century this figure was just above an hour using air travel (excluding time to go to and from airports).

Geometry

In analytic geometry, the distance between two points of the xy-plane can be found using the distance formula. The distance between (x_1, y_1) and (x_2, y_2) is given by:

$$d = \sqrt{(\Delta x)^2 + (\Delta y)^2} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$

Similarly, given points (x_1, y_1, z_1) and (x_2, y_2, z_2) in three-space, the distance between them is:

$$d = \sqrt{(\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}.$$

These formula are easily derived by constructing a right triangle with a leg on the hypotenuse of another (with the other leg orthogonal to the plane that contains the 1st triangle) and applying the Pythagorean theorem. In the study of complicated geometries, we call this (most common) type of distance Euclidean distance, as it is derived from the Pythagorean theorem, which does not hold in non-Euclidean geometries. This distance formula can also be expanded into the arc-length formula.

Distance in Euclidean space

In the Euclidean space $\mathbf{R}^n$, the distance between two points is usually given by the Euclidean distance (2-norm distance). Other distances, based on other norms, are sometimes used instead.

For a point $(x_1, x_2, ...,x_n)$ and a point $(y_1, y_2, ...,y_n)$, the **Minkowski distance** of order p (***p*-norm distance**) is defined as:

For a point $(x_1, x_2, ...,x_n)$ and a point $(y_1, y_2, ...,y_n)$, the **Minkowski distance** of order p (***p*-norm distance**) is defined as:

$$\begin{aligned}
\text{1-norm distance} &= \sum_{i=1}^{n} |x_i - y_i| \\
\text{2-norm distance} &= \left(\sum_{i=1}^{n} |x_i - y_i|^2 \right)^{1/2} \\
\text{p-norm distance} &= \left(\sum_{i=1}^{n} |x_i - y_i|^p \right)^{1/p} \\
\text{infinity norm distance} &= \lim_{p \to \infty} \left(\sum_{i=1}^{n} |x_i - y_i|^p \right)^{1/p} \\
&= \max \left(|x_1 - y_1|, |x_2 - y_2|, \ldots, |x_n - y_n| \right).
\end{aligned}$$

p need not be an integer, but it cannot be less than 1, because otherwise the triangle inequality does not hold.

The 2-norm distance is the Euclidean distance, a generalization of the Pythagorean theorem to more than two coordinates. It is what would be obtained if the distance between two points were measured with a ruler: the "intuitive" idea of distance.

The 1-norm distance is more colourfully called the *taxicab norm* or *Manhattan distance*, because it is the distance a car would drive in a city laid out in square blocks (if there are no one-way streets).

The infinity norm distance is also called Chebyshev distance. In 2D, it is the minimum number of moves kings require to travel between two squares on a chessboard.

The *p*-norm is rarely used for values of *p* other than 1, 2, and infinity, but see super ellipse.

In physical space the Euclidean distance is in a way the most natural one, because in this case the length of a rigid body does not change with rotation.

Mahalanobis distance:

The **Mahalanobis distance** is a measure of the distance between a point P and a distribution D, introduced by P. C. Mahalanobis in 1936.[1] It is a multi-dimensional generalization of the idea of measuring how many standard deviations away P is from the mean of D. This distance is zero if P is at the mean of D, and grows as P moves away from the mean along each principal component axis. If each of these axes is re-scaled to have unit variance, then the Mahalanobis distance corresponds to standard Euclidean distance in the transformed space. The Mahalanobis distance is thus unitless and scale-invariant, and takes into account the correlations of the data set.

Mahalanobis distance is preserved under full-rank linear transformations of the space spanned by the data. This means that if the data has a nontrivial nullspace, Mahalanobis distance can be computed after projecting the data (non-degenerately) down onto any space of the appropriate dimension for the data.

We can find useful decompositions of the squared Mahalanobis distance that help to explain some reasons for the outlyingness of multivariate observations and also provide a graphical tool for identifying outliers.[4]

Mahalanobis's definition was prompted by the problem of identifying the similarities of skulls based on measurements in 1927.[6]

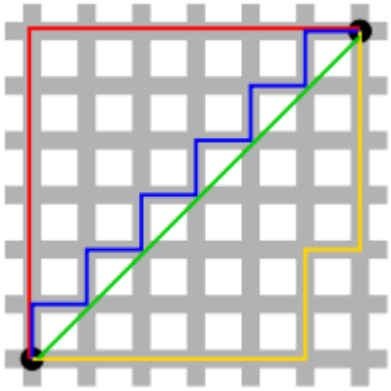
Mahalanobis distance is widely used in cluster analysis and classification techniques. It is closely related to Hotelling's T-square distribution used for multivariate statistical testing and Fisher's Linear Discriminant Analysis that is used for supervised classification.[7]

In order to use the Mahalanobis distance to classify a test point as belonging to one of N classes, one first estimates the covariance matrix of each class, usually based on samples known to belong to each class. Then, given a test sample, one computes the Mahalanobis distance to each class, and classifies the test point as belonging to that class for which the Mahalanobis distance is minimal.

Mahalanobis distance and leverage are often used to detect outliers, especially in the development of linear regression models. A point that has a greater Mahalanobis distance from the rest of the sample population of points is said to have higher leverage since it has a greater influence on the slope or coefficients of the regression equation. Mahalanobis distance is also used to determine multivariate outliers. Regression techniques can be used to determine if a specific case within a sample population is an outlier via the combination of two or more variable scores. Even for normal distributions, a point can be a multivariate outlier even if it is not a univariate outlier for any variable (consider a probability density concentrated along

the line , for example), making Mahalanobis distance a more sensitive measure than checking dimensions individually.

Manhattan or Taxicab distance:



Taxicab geometry versus Euclidean distance: In taxicab geometry, the red, yellow, and blue paths all have the same shortest path length of 12. In Euclidean geometry, the green line has length and is the unique shortest path.

A **taxicab geometry** is a form of geometry in which the usual distance function or metric of Euclidean geometry is replaced by a new metric in which the distance between two points is the sum of the absolute differences of their Cartesian coordinates. The **taxicab metric** is also known as **rectilinear distance**, L_1 **distance**, L^1 **distance** or **norm** (see L^p space), **snake distance**, **city block distance**, **Manhattan distance** or **Manhattan length**, with corresponding variations in the name of the geometry.[1] The latter names allude to the grid layout of most streets on the island of Manhattan, which causes the shortest path a car could take between two intersections in the borough to have length equal to the intersections' distance in taxicab geometry.

The geometry has been used in regression analysis since the 18th century, and today is often referred to as LASSO. The geometric interpretation dates to non-Euclidean geometry of the 19th century and is due to Hermann Minkowski.

Definition of Relative Distance

Most of us know what distance is. It's the total space between two things or places, usually measured infeet, yards, miles or even city blocks. In geography, when measured in a standard unit of length, this isreferred to as absolute distance. What is relative distance, then? Relative distance is a measure of thesocial, cultural and economic relatedness or connectivity between two places - how connected ordisconnected they are - despite their absolute distance from each other.

Relative Distance versus Relative Location

It can be easy to confuse the terms relative distance and relative location, but they are actually verydifferent concepts. Relative location is the location of a person, place or thing in relation to another. Forexample, you could say that your friend is seated in the second row from the back in the movie theater.Or, you could say that the location of the pencil is to the left of the computer.

Example of Relative Distance

Many Floridians admit that Miami is like its own state compared to the rest of Florida. Almost 66 percentof the population in Miami is Hispanic, whereas only 24 percent of the population in all of Florida isHispanic. The contrast to Florida's largest city, Jacksonville, is even more stark. Miami is a largely liberalmetropolis, politically, which is very different from the very conservative Jacksonville, where only 8percent of the population is Hispanic.So, we can say there is a pretty far relative distance between Miami and Jacksonville; the citizens ofboth of these cities are very different culturally, ethnically and politically.

The four dimensions of distance

If distance were only defined as the miles between my office and the target market, this would be a very short post. Instead, there are four key elements of "distance" that provide the foundation for determining the best way to approach (or not approach) a market. The four measures of distance that I use (as does Mr. Ghemawat) are cultural, administrative, geographic and economic (sometimes referred to as the CAGE framework).

Cultural distance refers to how similar the underlying culture is, and language often has a strong effect on this variable. Other key variables in the social gaming space are ethnicity (does the target market share the same ethnicity as your home market?), religion(s), values, norms and the target market's overall insularity (openness to foreign entertainment products).

Administrative distance is primarily about political systems and how tied/similar they are to your home market. A common currency (do they use, either officially or unofficially, dollars or Euros) would also lessen administrative distance. Also, whether the target government takes an active or passive role in the social or gaming space would affect this variable.

Geographic distance is what it sounds like: How far is the target market from your home market? That is, if you are based in California, China is a lot farther away than is Canada (yes, I know, the value of a graduate degree). Other things than can affect geographic distance are difference in climate (e.g., inverted seasons between North and South America), transportation links, communication infrastructure, and differences in time zones (though many of these are tied to absolute distance).

Economic distance is last, but not least. This measure refers to how similar the economic system and metrics are between the home country and target market. That includes rich-poor differences, per capita GDP (not necessarily the same, as you could have a bifurcated economy with a similar GDP to a country with a more level income distribution), access to natural resources, etc.

A couple of quick examples can show, on a high level, how this framework can be used to analyze a market. Let's use California as the "home territory" in this example. When analyzing Japan, the cultural distance is quite high: there's a different history, language, religion and cultural norms (e.g., less individualistic). The administrative distance is actually quite small, as much of their system was created by the US after World War 2. The geographic distamce is medium: it's about the same as Europe and obviously more than Canada. And the economic distance is also pretty low, as both countries have relatively free markets and comparable income levels and wealth distribution.

Now let's look at Russia. The cultural distance is actually medium to low. Americans and Russians often share the same values and norms; both are Judeo-Christian cultures and Russia is actually very open to US games and movies. Administrative distance is medium; although both are considered free markets, each approach is slightly different. Geographic distance is medium: it's not exactly a quick flight from the US. The economic distance is high. Russia is a much more stratified economy than the US and is more reliant on natural resources.

Although you might ask how many of these factors could affect the social gaming sector in a market, they often do in subtle ways that provide opportunities for you to optimize for the market by changing your approach. In the weeks and months ahead, I will discuss some of the strategic options for social game companies in tackling different markets and how these four key measures of distance help determine what strategy is appropriate for a particular market.

Distance not only refers to geographic distance probably the most obvious barrier, but also includes cultural, political and economic dimensions.

1. **Cultural distance**
    - Different languages, ethnicities, lack of connective ethnic or social networks, religions and social norms.
2. **Political distance**
    - Absence of colonial ties and shared monetary or political association.
    - Political hostility, govenrment policies and institutional weakness.
3. **Geographic distance**
    - Physical remoteness, lack of a common border, lack of sea or river access.
    - Size of country, weak transportation or communication links and difference in climates
4. **Economic distance**
    - Differences in consumer incomes.
    - Differences in cost and quality of: natural resources, financial, human resources, infrastructure, intermediate inputs, information/knowledge

CAGE Analysis

The Inputs into CAGE Analysis

Pankaj "Megawatt" Ghemawat is an international strategy guru who developed the CAGE framework to offer businesses a way to evaluate countries in terms of the "distance" between them.Pankaj Ghemawat, "Distance Still Matters," *Harvard Business Review* 79, no. 8 (September 2001): 1–11. In this case, distance is defined broadly to include not only the physical geographic distance between countries but also the cultural, administrative (currencies, trade agreements), and economic differences between them. As summarized in Table 8.2 "The CAGE Framework", the CAGE (cultural, administrative, geographic, and economic) framework offers a broader view of distance and provides another way of thinking about location and the opportunities and concomitant risks associated with global arbitrage.Pankaj Ghemawat, "The Forgotten Strategy," *Harvard Business Review* 81, no. 11 (September 2003).

Table 8.2 The CAGE Framework

Cultural Distance	Administrative Distance	Geographic Distance	Economic Distance
Attributes Creating Distance			
Different languages	Absence of colonial ties	Physical remoteness	Differences in consumer incomes
Different ethnicities; lack of connective ethnic or social networks	Absence of shared monetary or political association	Lack of a common border	Differences in costs and quality of the following: • Natural resources • Financial resources • Human resources • Infrastructure • Intermediate inputs • Information or knowledge
Different religions	Political hostility	Lack of sea or river access	
Different social norms	Government policies	Size of country	
	Institutional weakness	Weak transportation or communication links	
		Differences in climates	
Industries or Products Affected by Distance			
Products have high-linguistic content (TV).	Government involvement is high in industries that are • producers of staple goods (electricity), • producers of other "entitlements" (drugs), • large employers (farming), • large suppliers to	Products have a low value-of-weight or bulk ratio (cement).	Nature of demand varies with income level (cars).

Cultural Distance	Administrative Distance	Geographic Distance	Economic Distance
	government (mass transportation), • national champions (aerospace), • vital to national security (telecommunications), • exploiters of natural resources (oil, mining), and • subject to high-sunk costs (infrastructure).		
Products affect cultural or national identity of consumers (foods).		Products are fragile or perishable (glass or fruit).	Economies of standardization or scale are important (mobile phones).
Product features vary in terms of size (cars), standards (electrical appliances), or packaging.		Communications and connectivity are important (financial services).	Labor and other factor cost differences are salient (garments).
Products carry country-specific quality associations (wines).		Local supervision and operational requirements are high (many services).	Distribution or business systems are different (insurance).
			Companies need to be responsive and agile (home appliances).

To apply the CAGE framework, identify locations that offer low raw material costs, access to markets or consumers, or other key decision criteria. You might, for instance, determine that you're interested in markets with strong consumer buying power, so you would use per capita income as your first sorting criterion. As a result, you would likely end up with some type of ranking. Ghemawat provides an example for the fast-food industry, where he shows that on the basis of per capita income, countries like Germany and Japan would be the most attractive markets for the expansion of a North American fast-food company. However, when he adjusts this analysis for distance using the CAGE framework, he shows that Mexico ranks as the second most attractive market for international expansion, far ahead of Germany and Japan.Pankaj Ghemawat, "Distance Still Matters," *Harvard Business Review* 79, no. 8 (September 2001): 1–

11. Recall though, that any international expansion strategy still needs to be supported by the specific resources and capabilities possessed by the firm, regardless of the picture presented by the CAGE analysis. To understand the usefulness of the CAGE framework, consider Dell and its efforts to compete effectively in China. The vehicles it used to enter China were just as important in its strategy as its choice of geographic arena. For Dell's corporate clients in China, the CAGE framework would likely have revealed relatively little distance on all four dimensions—even geographic—given the fact that many personal-computer components have been sourced from China. However, for the consumer segment, the distance was rather great, particularly on the dimensions of culture, administration, and economics. For example, Chinese consumers didn't buy over the Internet, which is the primary way Dell sells its products in the United States. One possible outcome could have been for Dell to avoid the Chinese consumer market altogether. However, Dell opted to choose a strategic alliance with distributors whose knowledge base and capabilities allowed Dell to better bridge the CAGE-framework distances. Thus the CAGE framework can be used to address the question of where (which arena) and how (by which entry vehicle) to expand internationally.

CAGE Analysis and Institutional Voids

While you can apply CAGE to consider some first-order distances (e.g., physical distance between a company's home market and the new foreign market) or cultural differences (e.g., the differences between home-market and foreign-market customer preferences), you can also apply it to identify institutional differences. Institutional differences include differences in political systems and in financial markets. The greater the distance, the harder it will be to operate in that country. Emerging markets in particular can have greater differences because these countries lack many of the specialized intermediaries that make institutions like financial markets work. Table 8.3 "Specialized Intermediaries within a Country or Other Geographic Arena" lists examples of specialized intermediaries for different institutions. If an institution lacks these specialized intermediaries, there is an institutional void. An institutional void refers to the absence of key specialized intermediaries found in the markets of finance, managerial talent, and products, which otherwise reduce transaction costs.

Table 8.3 Specialized Intermediaries within a Country or Other Geographic Arena

Institution	**Specialized Intermediary**
Financial markets	• Venture-capital firms • Private equity providers • Mutual funds • Banks • Auditors • Transparent corporate governance
Markets for managerial talent	• Management institute or business schools • Certification agencies

Institution	Specialized Intermediary
	• Headhunting firms • Relocation agencies
Markets for products	• Certification agencies • Consumer reports • Regulatory authorities (e.g., the Food and Drug Administration) • Extrajudicial dispute resolution services
All markets	• Legal and judiciary (for property rights protection and enforcement)

Three Strategies for Handling Institutional Voids

When a firm detects an institutional void, it has three choices for how to proceed in regard to the potential target market: (1) adapt its business model, (2) change the institutional context, or (3) stay away.

For example, when McDonald's tried to enter the Russian market, it found an institutional void: a lack of local suppliers to provide the food products it needs. Rather than abandoning market entry, McDonald's decided to adapt its business model. Instead of outsourcing supply-chain operations like it does in the United States, McDonald's worked with a joint-venture partner to fill the voids. It imported cattle from Holland and russet potatoes from the United States, brought in agricultural specialists from Canada and Europe to improve Russian farmers' management practices, and lent money to farmers so that they could invest in better seeds and equipment. As a result of establishing its own supply-chain and management systems, McDonald's controlled 80 percent of the Russian fast-food market by 2010. The process, however, took fifteen years and $250 million in investments."McDonald's in Russia: Accept or Attempt to Change Market Context?," *Economic Times of India*, April 30, 2010, accessed February 17, 2011, http://economictimes.indiatimes.com/features/corporate-dossier/McDonalds-in-Russia-Accept-or-attempt-to-change-market-context/articleshow/5874306.cms; Tarun Khanna and Krishna G. Palepu, *Winning in Emerging Markets: A Road Map for Strategy* (Cambridge, MA: Harvard Business School Press, 2010).

An example of the second approach to dealing with an institutional void—changing the institutional context—is that used by the "Big Four" audit firms (i.e., Ernst & Young, KPMG, Deloitte Touche Tohmatsu, and PricewaterhouseCoopers) when they entered Brazil. At the time, Brazil had a fledgling audit services market. When the four firms set up branches in Brazil, they raised financial reporting and auditing standards across the country, thus bringing a dramatic improvement to the local market.Tarun Khanna, Krishna G. Palepu, and Jayant Sinha, "Strategies That Fit Emerging Markets," *Harvard Business Review* 83, no. 6 (June 2005): 2–16.

Finally, the firm can choose the strategy of staying away from a market with institutional voids. For example, The Home Depot's value proposition (i.e., low prices, great service, and good quality) requires

institutions like reliable transportation networks (to minimize inventory costs) and the practice of employee stock ownership (which motivates workers to provide great service). The Home Depot has decided to avoid countries with weak logistics systems and poorly developed capital markets because the company would not be able to attain the low cost–great service combination that is its hallmark.Tarun Khanna, Krishna G. Palepu, and Jayant Sinha, "Strategies That Fit Emerging Markets," *Harvard Business Review* 83, no. 6 (June 2005): 2–16.

Ethics in Action

Nestlé's Nespresso division is one of the company's fastest-growing divisions. The division makes a single-cup espresso machine along with single-serving capsules of coffees from around the world. Nestlé is headquartered in Switzerland, but the coffee it needs to buy is primarily grown in rural Africa and Latin America. Nespresso set up local facilities in these regions that measure the quality of the coffee. Nespresso also helps local farmers improve the quality of their coffee, and then it pays more for coffee beans that are of higher quality. Nespresso has gone even further by advising farmers on farming practices that improve the yield of beans farmers get per hectare. The results have proven beneficial to all parties: farmers earn more money, Nespresso gets getter quality beans, and the negative environmental impact of the farms has diminished.Michael E. Porter and Mark R. Kramer, "The Big Idea: Creating Shared Value," *Harvard Business Review*, January–February 2011, accessed January 23, 2011, http://hbr.org/2011/01/the-big-idea-creating-shared-value/ar/pr.

Key Takeaways

- CAGE analysis asks you to compare a possible target market to a company's home market on the dimensions of culture, administration, geography, and economy.
- CAGE analysis yields insights in the key differences between home and target markets and allows companies to assess the desirability of that market.
- CAGE analysis can help you identify institutional voids, which might otherwise frustrate internationalization efforts. Institutional differences are important to the extent that the absence of specialized intermediaries can raise transaction costs just as their presence can reduce them.

Transport Costs

Transport costs are a monetary measure of what the transport provider must pay to produce transportation services.

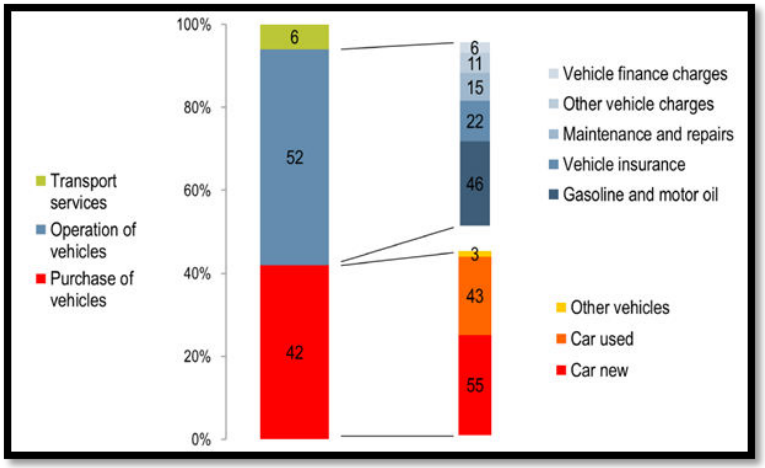
1. Transport Costs and Rates

Transport systems face requirements to increase their capacity and to reduce the costs of mobility. All users (e.g. individuals, corporations, institutions, governments, etc.) must **negotiate** or **bid** for the mobility of passengers and freight because supplies, distribution systems, tariffs, salaries, locations, marketing techniques as well as fuel costs are constantly changing. There are also costs involved in gathering information, negotiating, and enforcing contracts and transactions, which are often referred to as the cost of

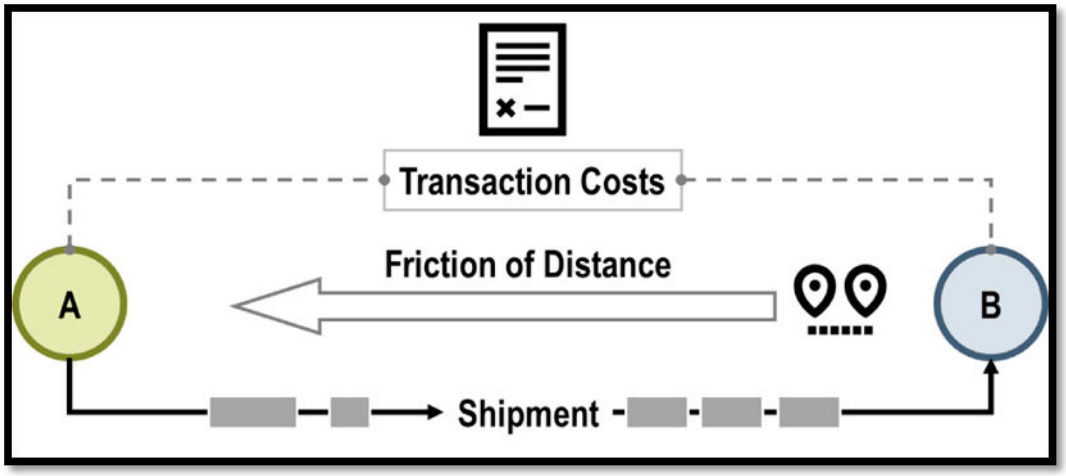
doing business. Trade also involves transaction costs that all agents attempt to reduce since transaction costs account for a growing share of the resources consumed by the economy.

Frequently, corporations and individuals must make decisions about how to route passengers or freight through the transport system. For passengers, this choice has been considerably expanded in the context of rising incomes and the availability of modes. For freight, the production of light and high-value consumer goods, such as electronics, and less bulky production techniques has expanded the locational choice of production and distribution. It is not uncommon for transport costs to account for **10% of the total cost of a product**. This share also roughly applies to personal mobility where households spend about 10% of their income for transportation, including automobile ownership which has a complex cost structure. Thus, the choice of a transportation mode to route passengers and freight between origins and destinations becomes important and depends on several factors such as the nature of the goods, the available infrastructures, origins and destinations, technology, and particularly their respective distances. Jointly, they define **transportation costs**.

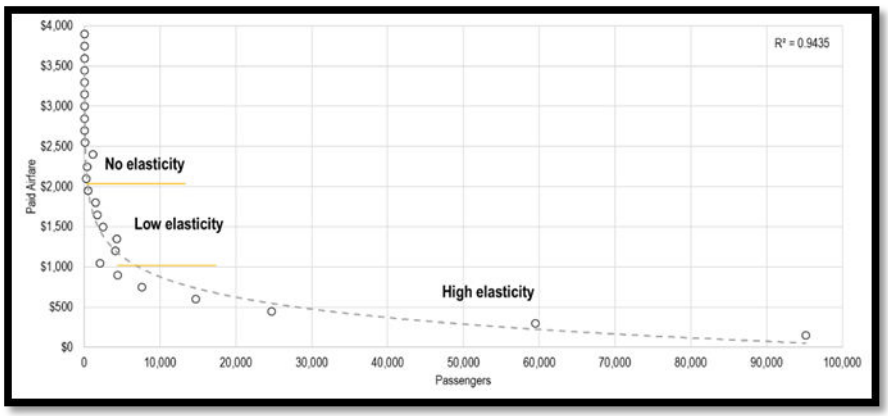
Transport costs are the costs internally assumed by the providers of transport services. They come as fixed (infrastructure) and variable (operating) costs, depending on a variety of conditions related to geography, infrastructure, administrative barriers, energy, and on how passengers and freight are carried. Three major components, related to transactions, shipments and the friction of distance, impact on transport costs.



- Household Expenditures on Transport, United States, 2005



- Components of Transport Cost

- 

- Average Fares Disbursed for JFK–LAX Route, 2009 (April to July)

Transport costs have significant impacts on the structure of economic activities as well as on international trade. Empirical evidence underlines that raising transport costs by 10% reduces trade volumes by more than 20% and that the general quality of transport infrastructure can account for half of the variation in transport costs. In a competitive environment where transportation is a service that can be bid on, transport costs are influenced by the respective **rates** of transport companies, the portion of the transport costs charged to users. **Rates** are the price of transportation services paid by their **users**. They are the negotiated monetary cost of moving a passenger or a unit of freight between a specific origin and destination. Rates are often visible to the consumers since transport service providers must provide this information to secure transactions. They may not necessarily express the real transport costs.

The difference between costs and rates either results in a loss or a profit from the service provider. Considering the components of transport costs previously discussed, the rate-setting is a complex undertaking subject to constant change. For public transit, rates are often fixed and the result of a political decision where a share of the total costs is subsidized by society. The goal is to provide affordable mobility to the largest possible segment of the population even if this implies a recurring deficit (public transit systems rarely make any profit). It is thus common for public transit systems to have rates that are lower than costs and targeted at subsidizing the mobility of social groups such as students, the elderly or people on welfare.

For freight transportation and many forms of passenger transportation (e.g. air transportation) rates are subject to **competitive pressure**. This means that the rate will be adjusted according to the complex interactions between supply and demand. They either reflect costs directly involved with shipping (cost-of-service) or are determined by the value of the commodity (value-of-service). Since many actors involved in freight transportation are private, rates tend to vary, often significantly, but profitability is paramount.

2. Costs and Time Components

Transportation offers a spectrum of costs and level of services, which results in substantial differences across the world. The price of a transport service does not only include the direct out-of-the-pocket money costs to the user but also includes time costs and costs related to possible inefficiencies, discomfort, and risk (e.g. unexpected delays). However, economic actors often base their choice of transport mode or route on

only part of the total transport price. For example, motorists are biased by short-run marginal costs. They might narrow down the price of a specific trip by car to fuel costs only, thereby excluding fixed costs such as depreciation, insurance, and vehicle tax.

Many shippers or freight forwarders are primarily guided by direct money costs when considering the price factor in the modal choice. The narrow focus on direct money costs is to some extent attributable to the fact that time costs and costs related to possible inefficiencies are harder to calculate and often can only be fully assessed after the cargo has arrived. There are significant conditions affecting transport costs and thus transport rates.

a. Distance and time

The impacts of geography mainly involve distance and accessibility. Distance is commonly the most basic condition affecting transport costs. The more it is difficult to trade space for a cost, the more the friction of distance is important. It can be expressed in terms of length, time, economic costs or the amount of energy used. It varies greatly according to the type of transportation mode involved and the efficiency of specific transport routes. Landlocked countries tend to have higher transport costs, often twice as much, as they do not have direct access to maritime transportation. The impact of geography on the cost structure can be expanded to include several rate zones, such as one for local, another for the nation and another for exports.

The transport time component is also an important consideration as it is associated with the service factor of transportation. They include the transport time, the order time, the timing, the punctuality, and the frequency. For instance, a maritime shipping company may offer a container transport service between several North American and Pacific Asian ports. It may take 12 days to service two ports across the Pacific (transport time) and a port call is done every two days (frequency). In order to secure a slot on a ship, a freight forwarder must call at least five days in advance (order time). For a specific port terminal, a ship arrives at 8 AM and leaves at 5 PM (timing) with the average delay being six hours (punctuality).

b. Type of product

Many products require packaging, special handling, which are bulky or perishable. Coal is obviously a commodity that is easier to transport than fruits or fresh flowers as it requires rudimentary storage facilities and can be transshipped using rudimentary equipment. Insurance costs are also to be considered and are commonly a function of the value to weight ratio and the risk associated with the movement. As such, different economic sectors incur different transport costs as they each have their own transport intensity. With containerization, the type of product plays little in the transport cost since rates are set per container, but products still need to be loaded or unloaded from the container.

For passengers, comfort and amenities must be provided, especially if long-distance travel is involved. These amenities have a cost but can also be a source of revenue such as for retail and restoration.

c. Economies of scale and Energy

The larger the quantities transported, the lower the unit transport cost. Economies of scale or the possibilities to apply them are particularly suitable for bulk commodities such as energy (coal, oil), minerals and grains if they are transported in large quantities. A similar trend also applies to container shipping with larger

containerships involving lower unit costs. For the transportation of passengers economies of scale are salient for public transit systems. They are however limited by the demand as the maximum sized transport unit that can be assigned on a route cannot exceed the available demand without impairing its profitability.

Transport activities are large consumers of energy, especially oil. About 60% of all global oil consumption is attributed to transport activities. Transport typically accounts for about 25% of all the energy consumption of an economy. The costs of several energy-intensive transport modes, such as maritime and air transport, are particularly susceptible to fluctuations in energy prices since energy accounts to close to half their operating costs.

d. Empty backhauls

Many transport interactions involve empty backhauls since it is uncommon to have a perfect match between an inbound and a return trip. Commuting patterns involve imbalanced flows and empty return trips. For international trade, imbalances between imports and exports have an impact on transport costs. This is especially the case for container transportation since trade imbalances imply the repositioning of empty containers that must be taken into account in the total transport costs. Consequently, if a trade balance is strongly negative (more imports than exports), transport costs for imports tend to be higher than for exports. Significant transport rate imbalances have emerged along major trade routes. The same condition applies at the national and local levels where freight flows are often unidirectional, implying empty backhaul movements.

e. Infrastructures and modes

The efficiency and capacity of transport modes and terminals have a direct impact on transport costs. Poor infrastructures imply higher transport costs, delays, and negative economic consequences. More developed transport systems tend to have lower transport costs since they are more reliable, connected and can handle more movements.

Different modes are characterized by different transport costs since each has its own capacity limitations and operational conditions. A core aspect concerns the suitability of modes according to the distance involved and the nature of what is being carried. When two or more modes are directly competing for the same market, the outcome often results in lower transport costs and the development of niches. Containerized transportation permitted a significant reduction in freight transport rates around the world by allowing relatively small transport units (containers) to be carried in massified loads.

f. Competition, regulation, and subsidies

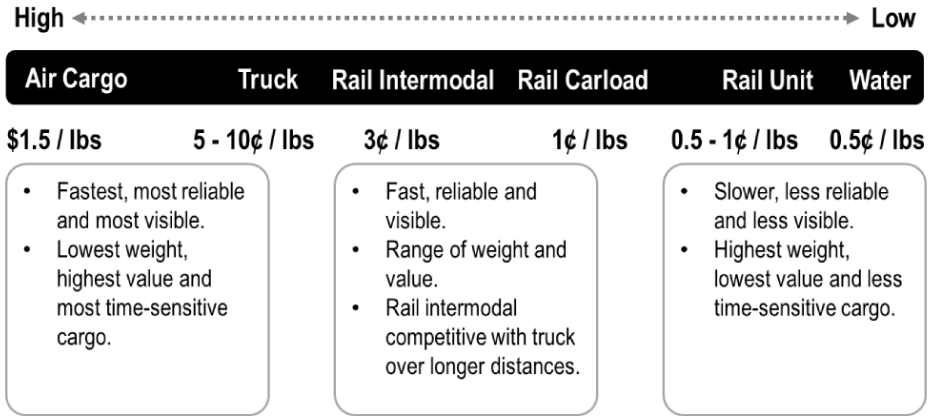
Concerns the complex competitive and regulatory environment in which transportation takes place. Transport services taking place over highly competitive segments tend to be of lower cost than on segments with limited competition (oligopoly or monopoly). International competition has favored concentration in many segments of the transport industry, namely maritime and air modes. Regulations, such as tariffs, cabotage laws, labor, security, and safety impose additional transport costs, particularly in developing economies.

If the infrastructure is expensive to develop and maintain, this cost should be reflected in fares to cover the amortization of the asset. Publicly available roads are a form of cross-subsidy since they offer their users free infrastructure. Still, freedom of access can be misleading as sales and fuel taxes are paid by users and these funds are used for road infrastructure construction and maintenance. If a government or a corporation uses other sectors of its activities to subsidize the full costs of transport infrastructure, then this cross-subsidy is having an impact on its costs. Taxes and tolls are commonly used to cross-subsidize public transit.

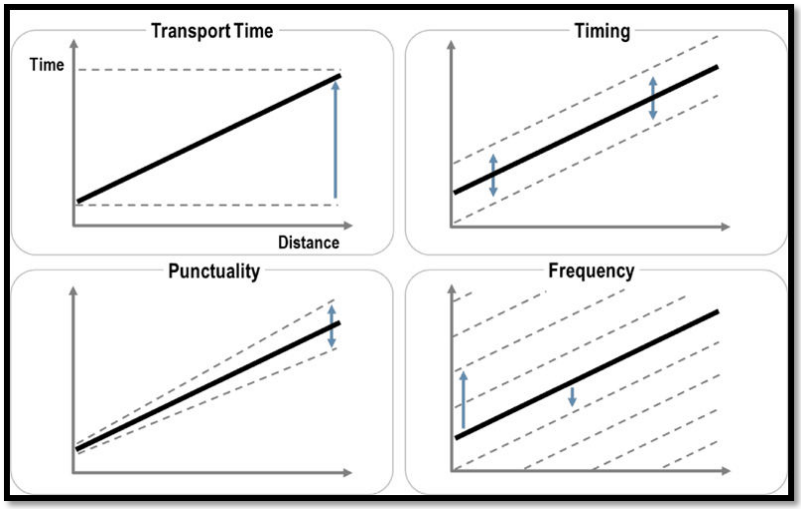
g. Surcharges, taxes and tolls

Surcharges refer to an array of fees, often set in an arbitrary fashion, to reflect temporary conditions that may impact on the costs assumed by the transporter. They also take place when fares are regulated, leaving the operator to find alternative sources of revenue. The most common are fuel surcharges, security fees, geopolitical risk premiums and additional baggage fees. The passenger transport industry, particularly airlines, has become dependent on a wide array of surcharges as a source of revenue for operators. Yield management is another form of surcharge where a transport service provider changes its rate according to fluctuations in the demand.

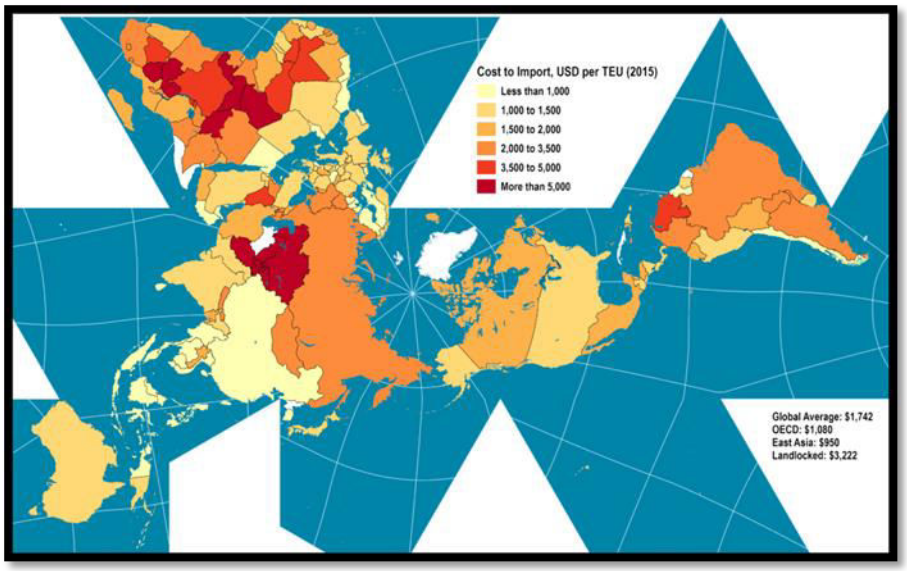
Transport activities are often taxed, such as vehicle sales taxes and registration fees. Fuel taxes are the most significant form of taxation levied by governments with revenues often used to cover maintenance and infrastructure investment costs. Tolls are also commonly levied on the usage of transportation assets, particularly at bottlenecks such as bridges and tunnels.

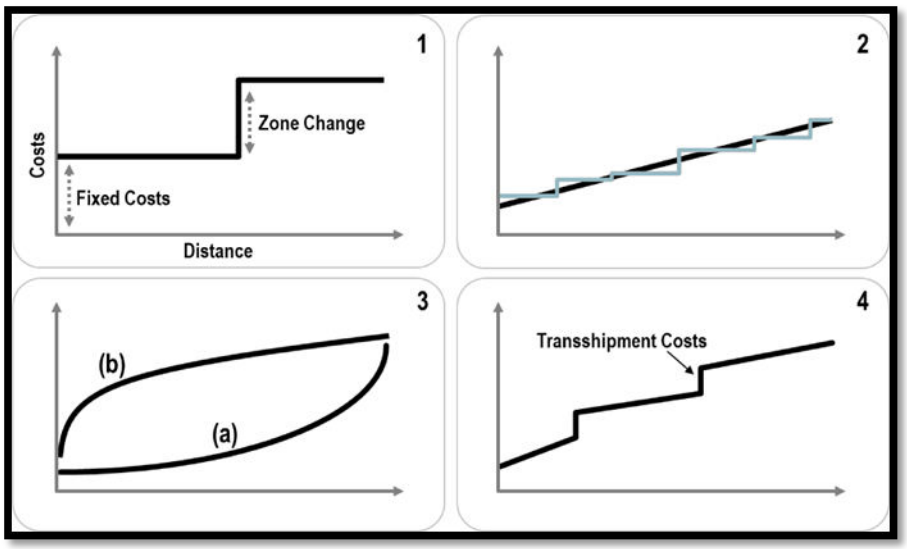


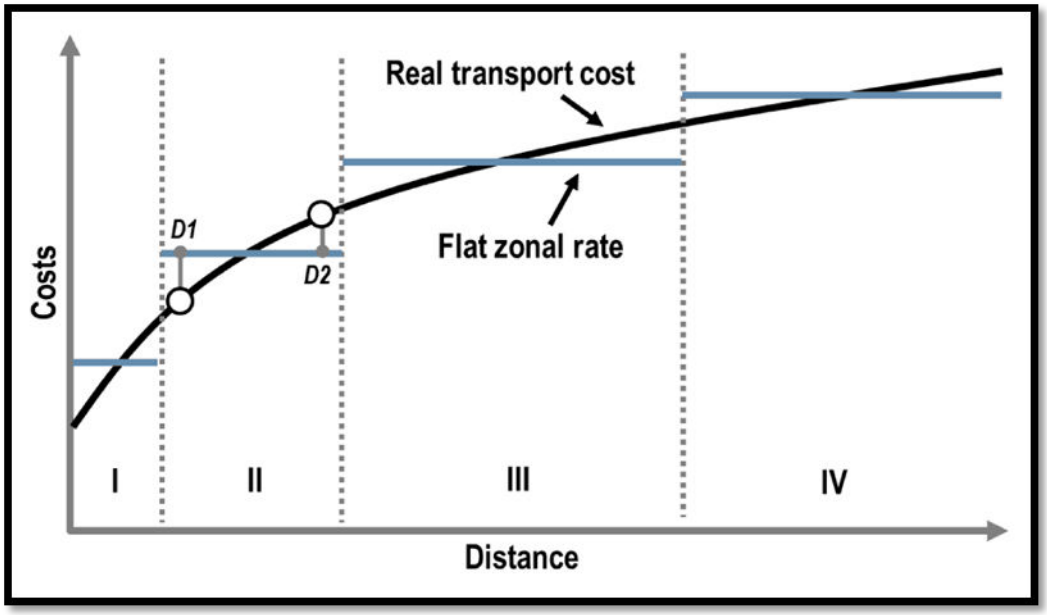
- Freight Transportation Service Spectrum



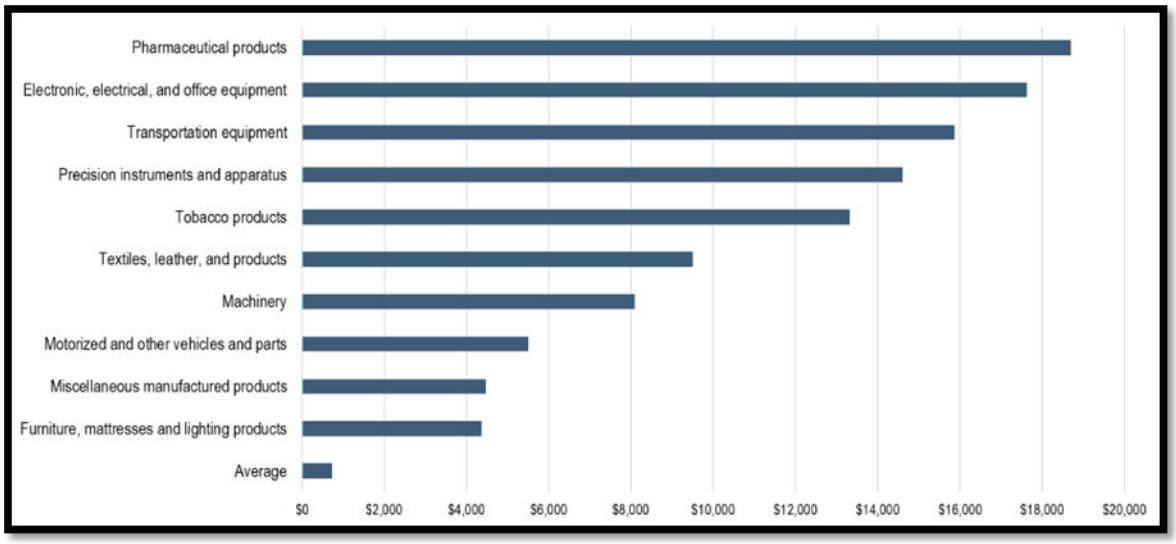
- Different Components of Transport Time

- 

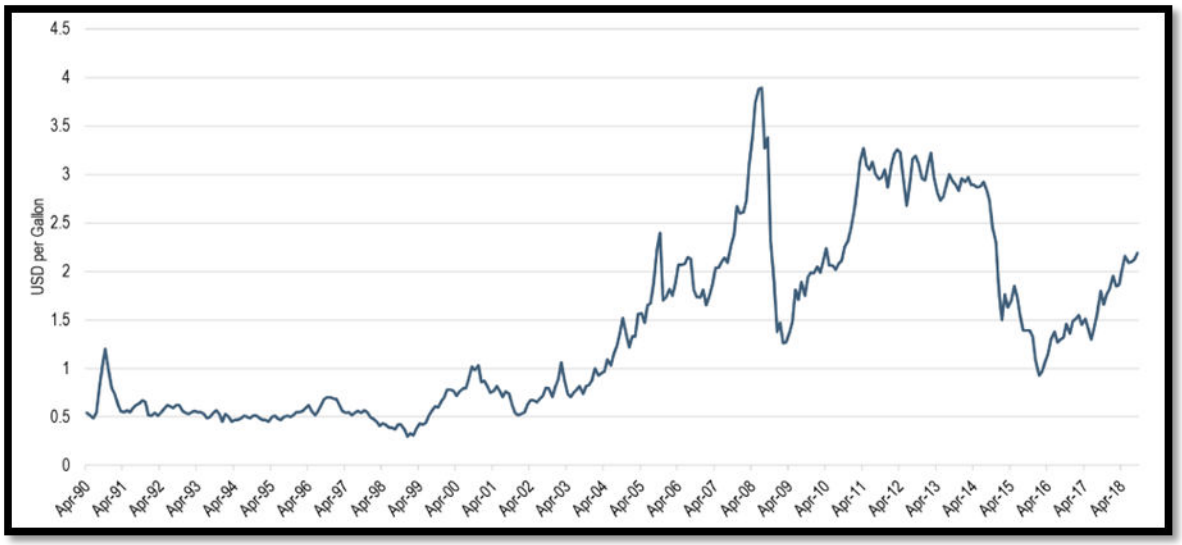
- Cost to Import a 20 Foot Container, 2015
- 

- Friction of Distance Functions
- 

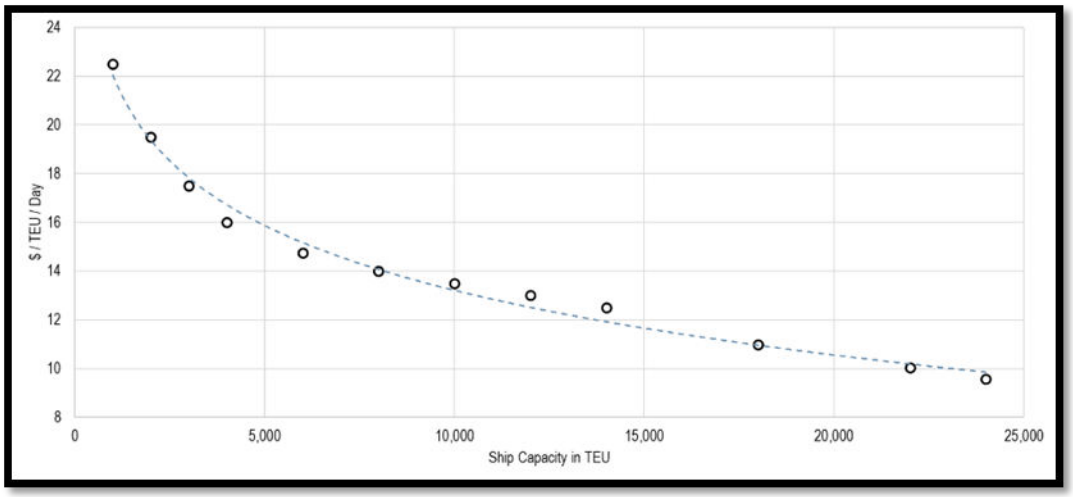
- Zonal Transport Rates



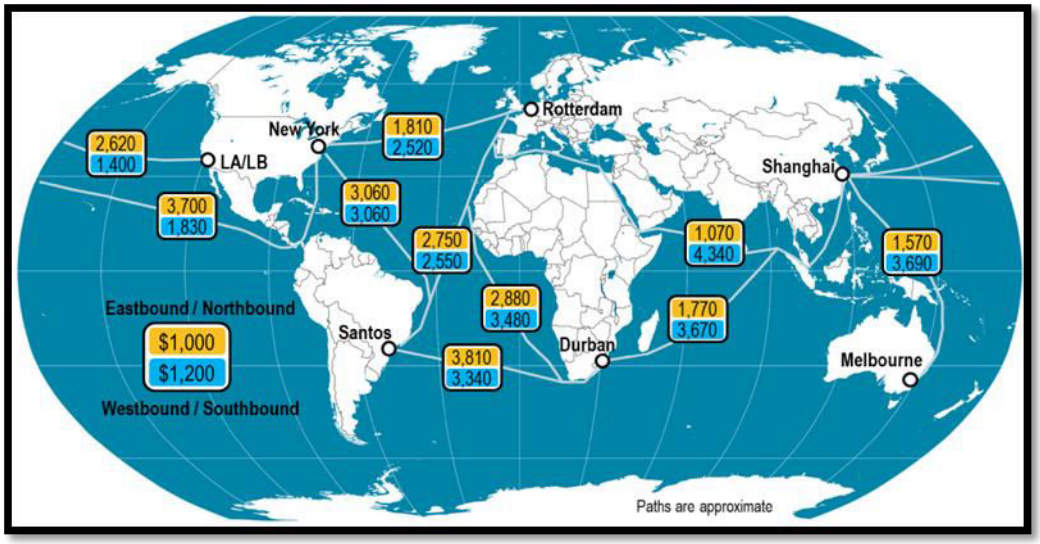
- Top 10 Commodity Groups Ranked by Value Per Ton, United States, 2002



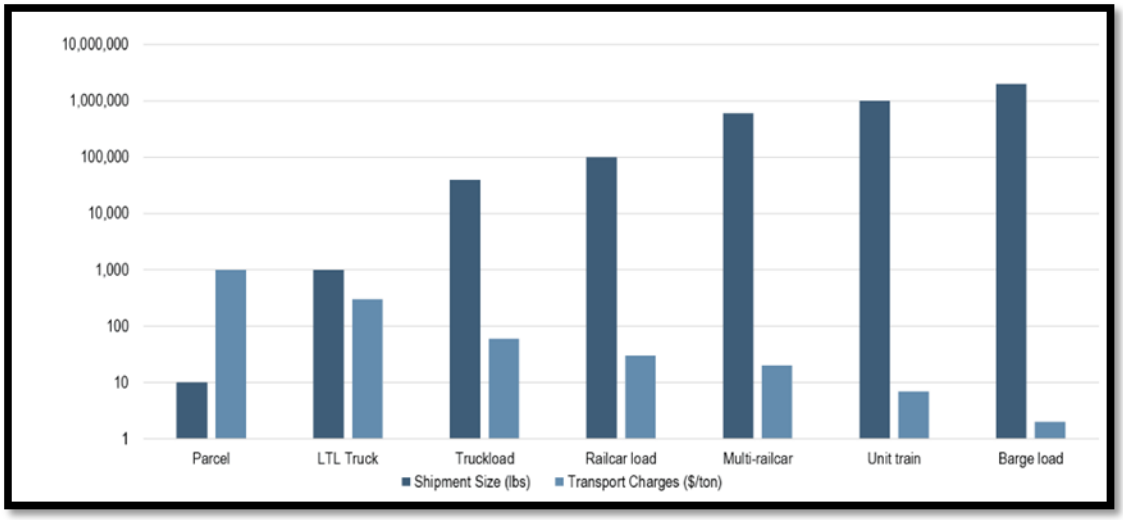
- Jet Fuel Prices, 1990-2019



- Daily Operating Expenses for Containerships per TEU



- Maritime Transportation Rates for a 40 Foot Container between Selected Ports, 2010



- Shipment Size and Inland Transport Costs

3. Types of Transport Costs

Mobility is influenced by transport costs. Empirical evidence for passenger vehicle use underlines the relationship between annual vehicle mileage and fuel costs, implying the higher fuel costs are, the lower the mileage. At the international level, the doubling of transport costs can reduce trade flows by more than 80%. The more affordable mobility is, the more frequent the movements and the more likely they will take place over longer distances. Empirical evidence also underlines that transport costs tend to be higher in the early or final stages of a movement, also known as the first and the last mile. A wide variety of transport costs can be considered.

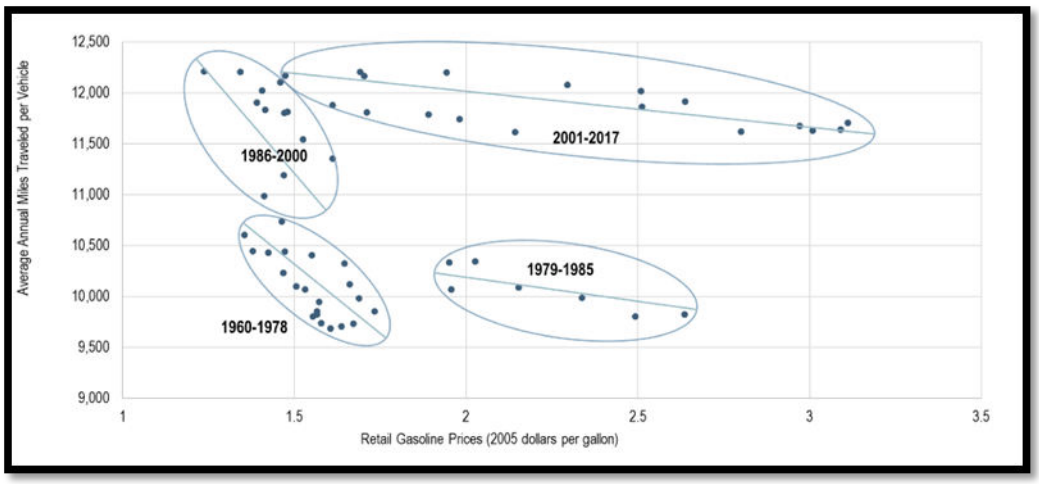
Terminal costs. Costs that are related to the loading, transshipment and unloading. Two major terminal costs can be considered; loading and unloading at the origin and destination, which are unavoidable, and intermediate (transshipment) costs that can be avoided. For complex transport terminals, such as ports and airports, terminal costs can involve a wide array of components, including docking / gate fees, handling charges and pilotage / traffic control fees.

Linehaul costs. Costs that are a function of the distance over which a unit of freight or passenger is carried. Weight is also a cost function when freight is involved. They include labor and fuel and commonly exclude transshipment costs.

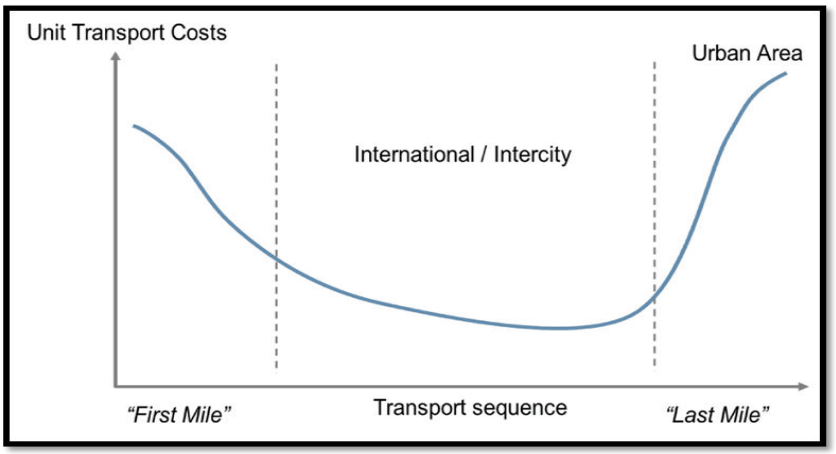
Capital costs. Costs applying to the physical assets of transportation mainly infrastructures, terminals and vehicles. They include the purchase or major enhancement of fixed assets, which can often be a one-time event that can be amortized over several decades. Since physical assets tend to depreciate over time, capital investments are required on a regular basis for maintenance.

Transport providers make a variety of decisions based on their cost structure, a function of all the above types of transport costs. To simplify transactions and clearly identify the respective responsibilities specific commercial transportation terms have been set. While the transport rate plays an important role in the modal choice, firms using freight transport services are not always motivated by notions of cost minimization. They often show "satisfying behavior" whereby the transport costs need to be below a certain threshold combined with specific requirements regarding reliability, frequency, and other service attributes. Such complexities make it more difficult to clearly assess the role of transport rates in the behavior of transport users.

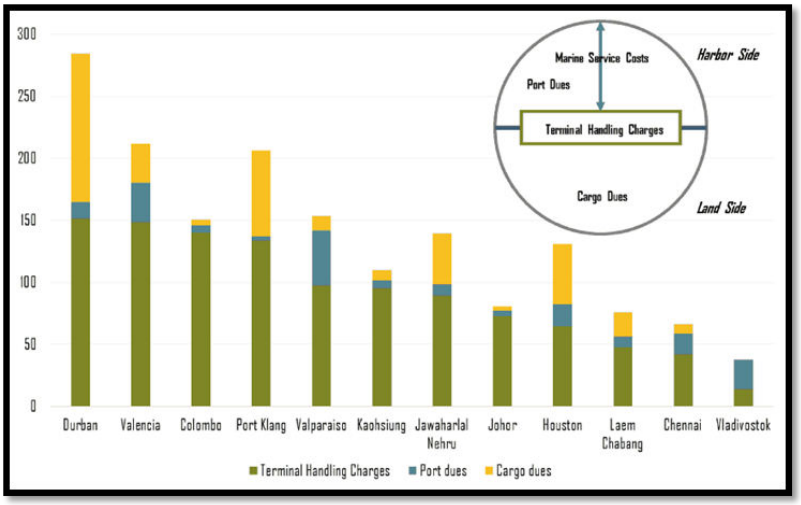
The role of transport companies has sensibly increased in the general context of global commercial geography. Maritime shipping companies, air carriers, and logistics service providers have become multinational corporations. However, the nature of this role is changing as a result of a general **reduction of transport costs but growing infrastructure costs**, mainly due to greater flows and competition for land. Each transport sector must consider variations in the importance of different transport costs. While operating costs are high for air transport, terminal costs are significant for maritime transport. Several indexes, such as the Baltic Dry Index, have been developed to convey a pricing mechanism useful for planning and decision making. Relations between terminal operators and carriers have thus become crucial notably in containerized traffic. They are needed to overcome the physical and time constraints of transshipment, notably at ports.



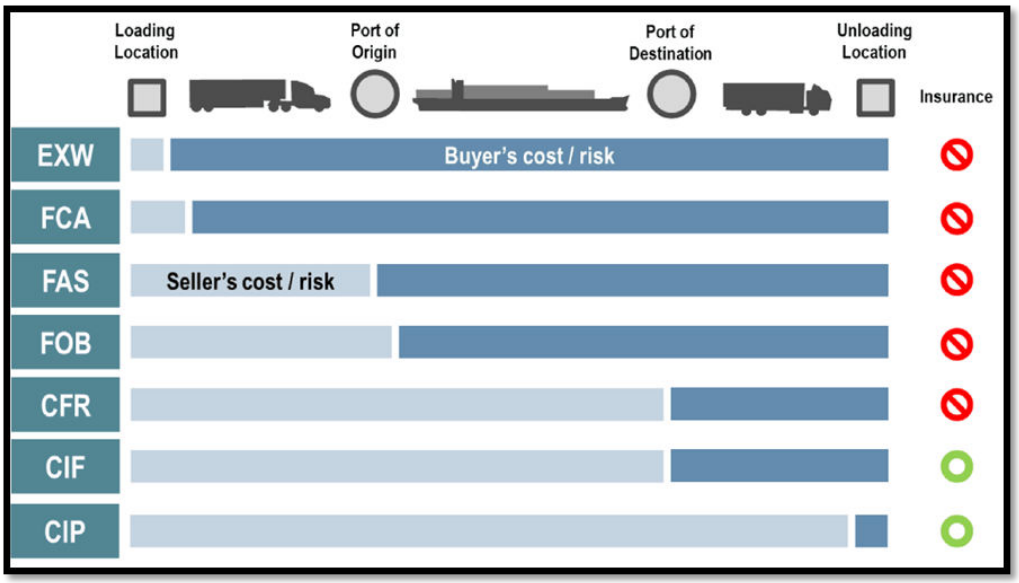
- Retail Gasoline Prices and Annual Vehicle Mileage, United States, 1960-2017



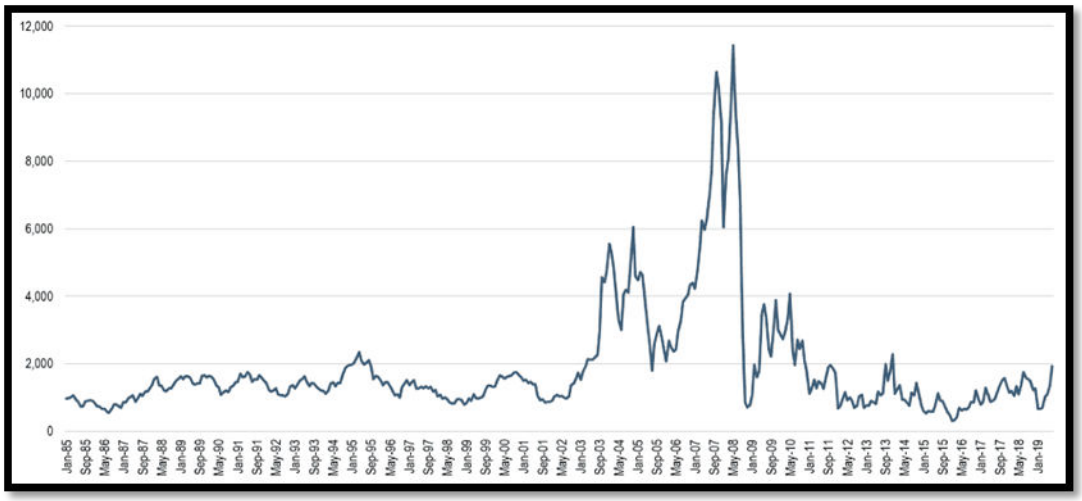
- First and Last Mile Unit Cost Structure



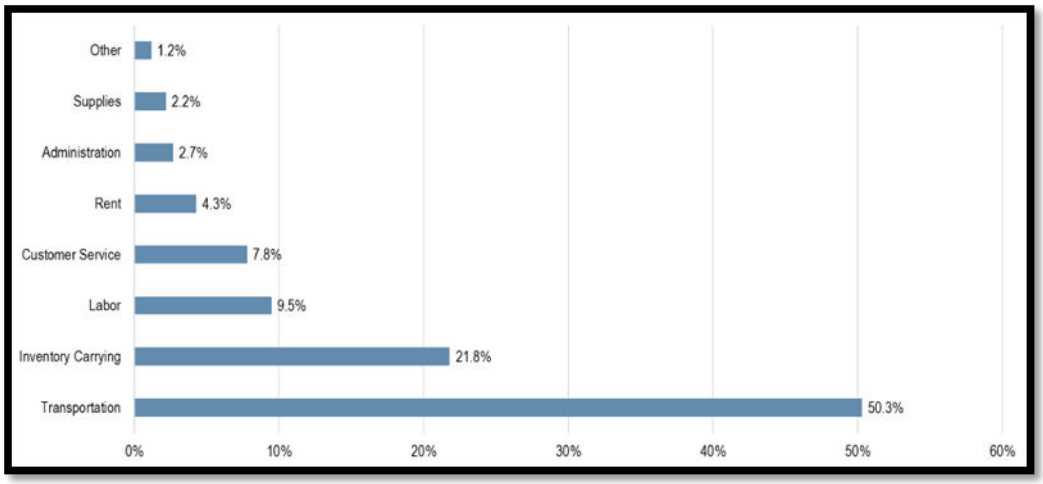
- Port Cost Components and Total Port Pricing per TEU, 2012



- Selected International Commercial Terms (Incoterms)



- The Baltic Dry Index, 1985-2019

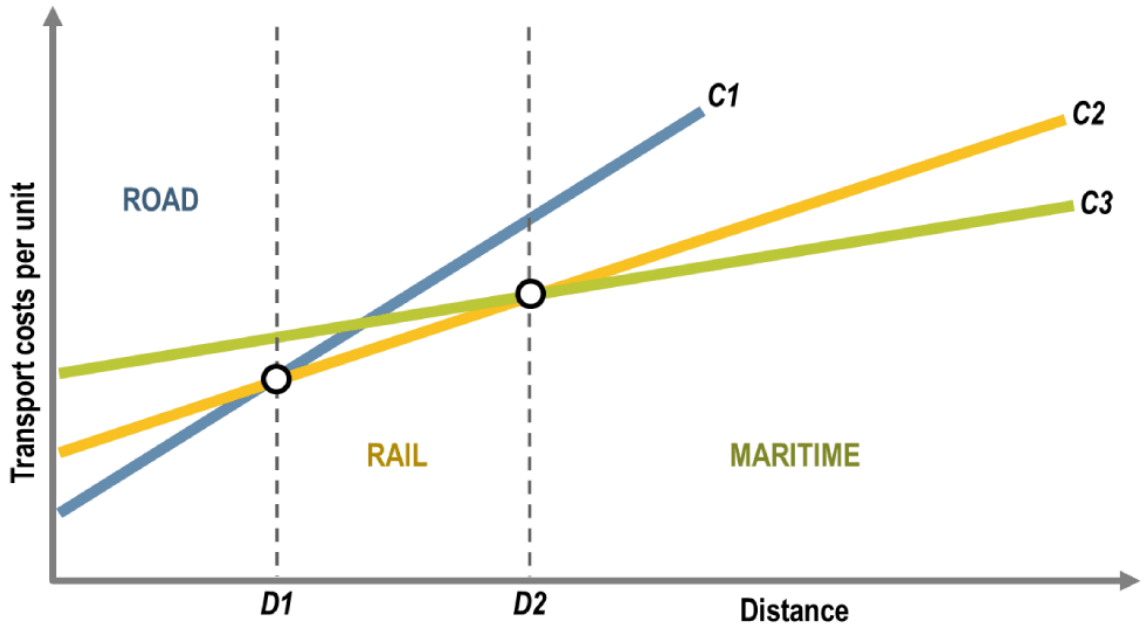


- Composition of Logistic Costs

Technological changes and their associated decline in transport costs have weakened the links between transport modes, terminals, and economic activities. There is less emphasis on heavy industries and more importance given to manufacturing and transport services (e.g. warehousing and distribution). Indeed, new functions are being grafted to transport activities that are henceforward facilitating **logistics** and manufacturing processes. The standard notion of transportation costs is being expanded towards logistics costs.

The requirements of international trade gave rise to the development of **specialized and intermediary firms** providing transport services. These are firms that do not physically transport the goods but are required to facilitate the grouping, storage, and handling of freight as well as the complex paperwork and financial and legal transactions involved in international trade. Examples include freight forwarders, customs brokers, warehousing, insurance agents and banking, etc. Recently, there has been a trend to **consolidate** these different intermediate functions, and a growing proportion of global trade is now being organized by multi-national corporations that are offering door to door logistics services. They are defined as third-party logistics providers.

Distance, Modal Choice and Transport Cost



Distance, Modal Choice and Transport Cost

Transportation modes have **different cost functions** according to the serviced distance. Using a simple linear distance effect, road, rail and maritime transport have respectively a C1, C2 and C3 cost functions. While road has a lower cost for short distances, its cost increases faster than rail and maritime costs. At a distance D1, it becomes more profitable to use rail transport than road transport while from a distance D2, maritime transport becomes more advantageous. These are referred as break-even distances. Point D1 is generally located between 500 and 750 km of the point of departure, while D2 is near 1,500 km. Although the above relation is rather straightforward, it does not fit reality well, mainly for the following reasons:

- It assumes that modal options are **interchangeable**. For many origins and destinations, modal options such as rail or maritime may not be present and thus cannot be considered as an option. Therefore, a modal option with a higher cost will be used.
- Since rail and maritime transportation are discrete networks **only accessible through terminals**, most locations will involve a road transportation segment, which changes the cost structure.

There are also regional differences impacting the break even distance. For Europe, due to higher market densities, the break-even distance is in the range of 650 miles (1050 km) while in the United States it is around 750 miles (1,200 km). For the United States, only around 5% of the intermodal rail traffic concerns distances of less than 750 miles underlining the clear dominance of trucking for such a service range. The average rail haul length is about 1,900 miles (3,050 km), with around 65% involving distances of more than 2,000 miles (3,200 km). Evidence from passenger transport also underlines a similar distance-based behavior.

Questions:

1. Explain what distance is in relation to the CAGE framework.
2. What are the key elements in CAGE analysis?
3. What is an institutional void?
4. How might CAGE analysis help you identify institutional voids?
5. What are three possible choices firms have when they're considering entering a foreign market with large institutional voids?