CHAPTER 1

A Brief History of Position and Direction

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"The day science begins to study non-physical phenomena, it will make more progress in one decade than in all the previous centuries of existence."

Nikola Tesla

ANCIENT MAPS

"Here are Dragons" (*HC SVNT DRACONES* in the original Latin). These are the words of warning on the Lenox Globe (c. 1510) near the eastern coast of Asia. Such admonitions were common during the early Renaissance, as cartographers laced uncharted regions with hippos, lions, and sea monsters on their maps to scare away explorers. The unknown was terrifying. It still is.

Not knowing a safe way to get to the clean water on the Serengeti can get you killed. Every cave dweller knew that. What they needed to know was where the bad routes lay. Survival, then as now, depended on learning how to get from here to there in one piece.

You do not want to die of thirst. Yet, you do not want to have to guess about how to get to a river in the safest fashion, either. If you are on an isolated hike, something as simple as a badly sprained ankle can be fatal. You may need to deal with the good paths, the obstacles, the predators, the people along the way against whom you compete, and those with whom you conduct commerce—all of them to stay alive. What to do? Where to go? How to do it?

Humans have many capabilities brought on by millions of years of evolution. Our ancestors demonstrated our faculty for abstraction in the Serengeti, where researchers found some of the first stone tools, and animal

remains together, suggestive of early hominin mutual support dating back roughly 2 million years ago. As members from that prehistoric campsite walked together across the often-uneven Olduvai Gorge, they must have seen the dangers of the terrain and the predators. Marches like those going on over the millennia may have forced the hikers to speak for the first time. The first cliff avoided, the lion attack thwarted, or an enemy fought off due to the first vocalized warning must have been quite a heady moment. Language was here to stay. The more information early humans could convey to one another, the better. Clearly, in our digital age, this trend continues.

Proto-languages appeared between 600,000 and 2.3 million years ago, with formal language developing only about 100,000 years ago. Written language, by contrast, only goes back about 5,500 years. In between, people discovered something often equally important. They found the art of map making.

Anthropologists have discovered that maps existed at least 6,000 years ago and may reach back 25,000 years, with the earliest recorded map-like representation of the terrain around Pavlov in the Czech Republic.

Imagine that your tribe has a rudimentary sense of this mapping technology (and none of your modern conveniences) as you live back in the Stone-Age Serengeti. Suppose your slightly older brother had drawn a diagram in the dirt showing the best way to get to the water. Maybe you would not have comprehended the sketch just a few years earlier, but now, with your growing cranial capacity and enhanced imagination, you do. You can understand its meaning. You see what to avoid and where to go. Now instead of having to dodge black mambas as they lunge at you out of their hole in the outcropping beside a ledge, you have a drawing that shows where they live. Where are the lions' dens? What parts of the river should you avoid because the black rhinos and crocodiles like to frequent them? To which location did the warring tribe move? A well-drawn map could show you all of that and more.

Of course, not everyone is out to get you. Maps can show you directions from one place to another and help you determine what you might find when you get there. Once again, suppose you were back in Olduvai Gorge with your brother and the rest of your tribe. You know you are good at making stone hand axes, but you cannot easily access figs. Meeting people at what might have been the first version of a marketplace would allow you to exchange one for another. You have to know where to find the market. It has a position. How do you get there? What are the directions to it?

The earliest maps were local by nature, describing as they did the surroundings near the cartographers who created them, and virtually all of the mapmakers drew their representations of the nearby geography as if from a bird's-eye view, as in Figure 1.1.



FIGURE 1.1 Perhaps the earliest authenticated map in the world is this one depicting a town in west-central Turkey, hard against an erupting volcano. It dates to about 6,000 BCE.[1]

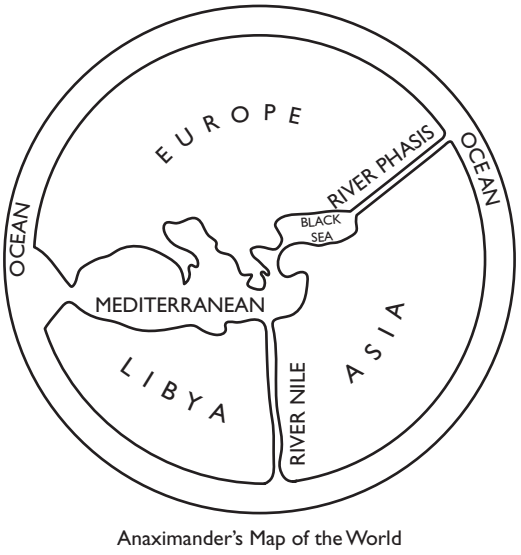


FIGURE 1.2 Anaximander's world map, c. 570 BCE.[2]

While mapmaking graduated to regional and worldwide scales, the tradition of representing the countryside as if we are looking down on them from the sky continues. As we will discover in Hypernomics, however, thoroughly entertained economic landscapes require different types of imagery.

There was a long transition from local to global maps. Credit for inventing the first map of the known world goes to Anaximander of Miletus,

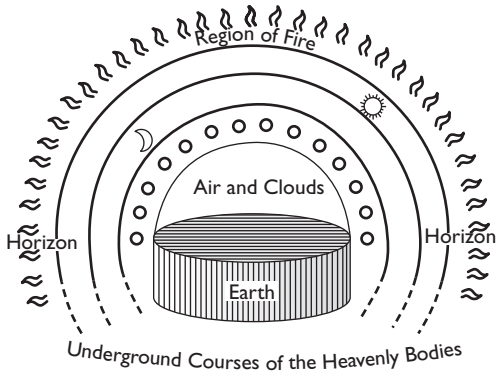


FIGURE 1.3 Side view of Anaximander's worldview, c. 570 BCE.[3]

around 570 BCE. Anaximander imagined the world as cylindrical and drum-shaped, and, when viewed from above, it consisted of Europe, Libya, and Asia surrounded by a circular ocean.

The idea that a ring of ocean circled the known dry land dates back to Homer, though he never recorded it.[4] This map, shown in Figures 1.2 and 1.3, may seem crude by modern standards. However, it offered its users some information they never had before in a single document: its worldview offered physical relationships between landmasses and seas and oceans, thus highlighting physical borders for all to see. It spelled out the relative positions of Europe, the Black Sea, Asia, and the Nile River and indicated the perceived sizes of all its landmasses and oceans. It, of course, lacks many of the features we have come to expect in modern maps. It has poorly defined coastlines; its proportions are inaccurate; the map shows rivers running from one sea to another. Moreover, the Earth's shape is more like a sphere than a drum.

Importantly, though, it offers a view of the world. Just because it is not nearly as accurate in its view of what we now call modern maps does not mean it was not extremely important in its time. As the biologist Richard Dawkins points out, "Vision that is 5 percent as good as yours or mine is very much worth having in comparison with no vision at all. So is 1 percent vision better than total blindness. And 6 percent is better than 5, 7 percent better than 6, and so on up the gradual continuous series."[5] With Anaximander's map, people knew the relative positions of Greece to Italy and Greece to Egypt and Turkey, the main rivals of that era along the Mediterranean. Knowing competitors' positions is always vital.

GEOGRAPHY BEGINS

Centuries later, Eratosthenes (275–195 BCE), in addition to being the first person to use the word *geography* as he invented the field, devised meridians, or north to south lines, and "parallels," imaginary east to west lines, which divided the Earth into sectors. We see his map in Figure 1.4. Eratosthenes spent a significant effort figuring out the distance between his home in Alexandria, Egypt, and the ancient Egyptian city of Swenet (now known as Aswan), which he believed to lie on the Tropic of Cancer. Using the distance between the two towns and a gnomon that he placed in Alexandria at noon at the summer solstice, he worked out the circumference of the Earth. He may have been accurate to within 1% of the actual figure. His earth grid system allowed people to calculate their position globally for the first time. Every point on the planet would forever have its place designated by its latitude and longitude.

MATH AND POSITION PROBLEMS

Mathematics took quite a bit longer to work out an analogous coordinate system. In 1637, working independently, René Descartes and Pierre de Fermat came up with the ideas that formed the bases for the Cartesian coordinate systems.

From Descartes' standpoint, the story (or myth) of its discovery was that he was lying in bed and observed a fly enter his room. Wondering how he could portray its position as it crawled across a wall, he envisioned the two-dimensional system. He came up with the three-dimensional design as it flew about the room. When other mathematicians enhanced these fledgling systems, they became the two-dimensional and three-dimensional Cartesian coordinate systems displayed in Figures 1.5 and 1.6, respectively. These systems allowed the development of calculus by Sir Isaac Newton and Gottlieb Leibnitz, who each separately derived this new branch of mathematics. Newton started his work in about 1666, but published nothing about it until 1693 and only gave his complete account of it in 1704. Meanwhile, Leibnitz offered his full description of the subject in 1684. The legendary dispute over who should have credit for the discovery of calculus has ended as both men have had their contributions recognized.

John von Neumann said, "The calculus was the first achievement of modern mathematics, and it is difficult to overestimate its importance. I think it defines more unequivocally than anything else the inception of

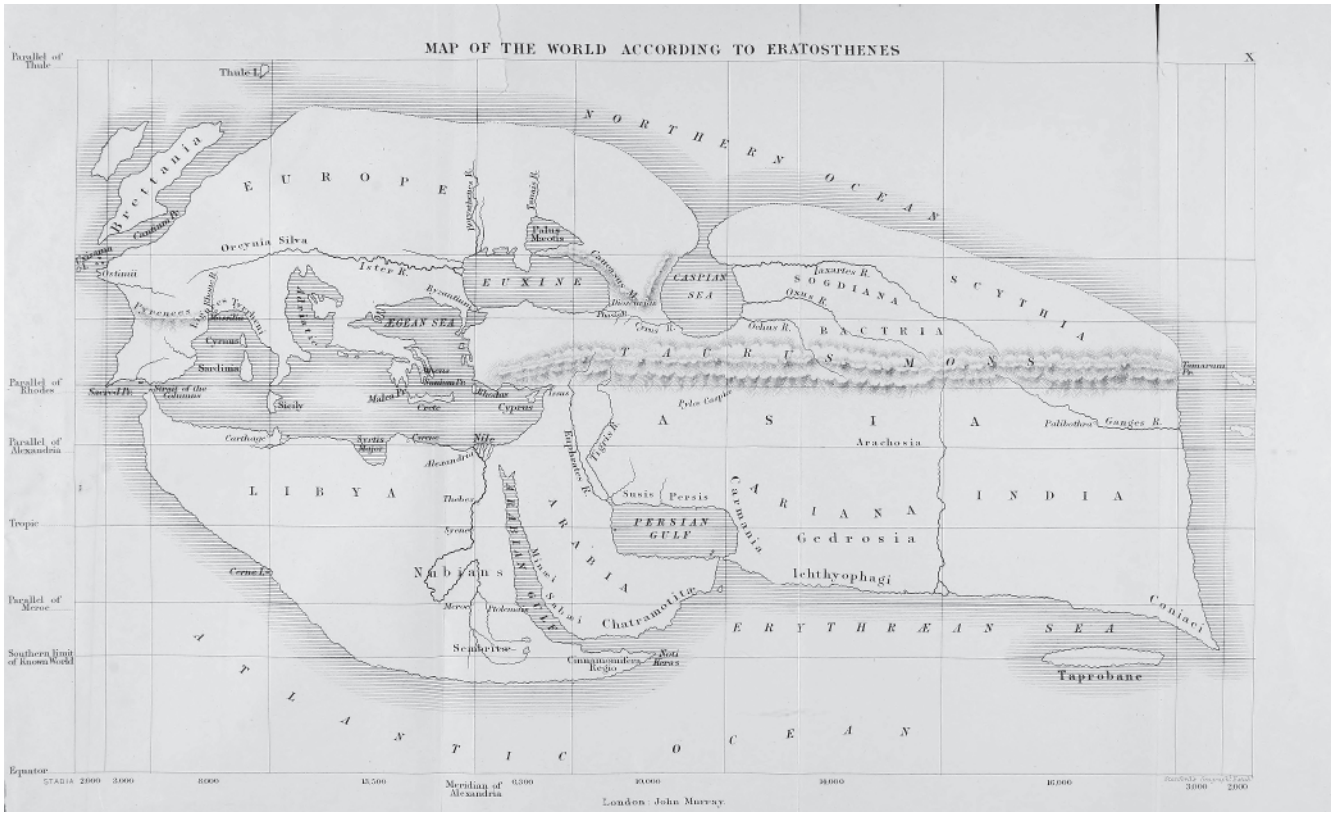


FIGURE 1.4 Here is a world map by Eratosthenes, c. 194 BCE. Note the use of parallels and meridians, an invention by Eratosthenes and a first in mapmaking.[6]

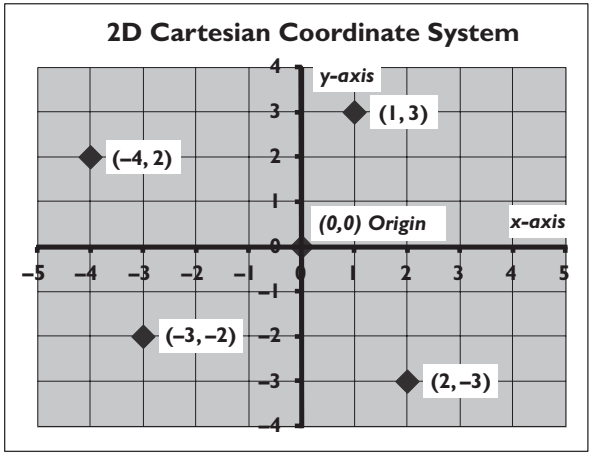


FIGURE 1.5 The 2D Cartesian coordinate system.[7]

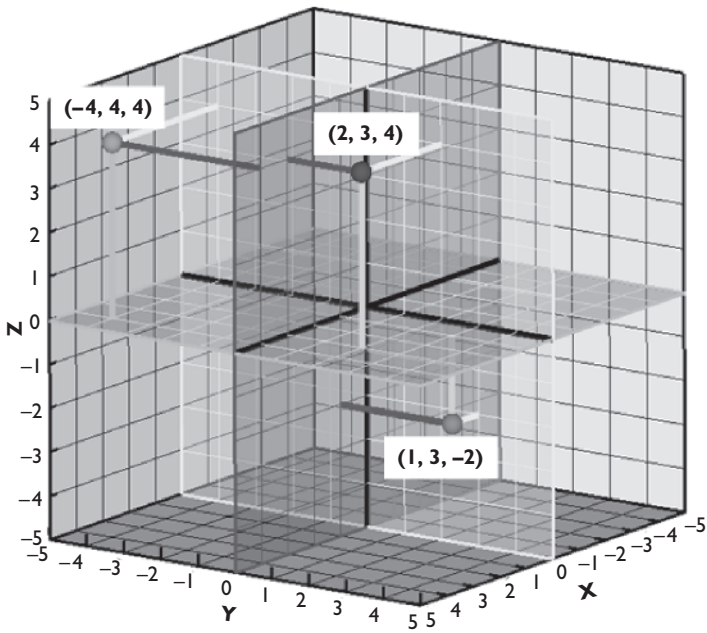


FIGURE 1.6 The 3D Cartesian coordinate system.[8]

modern mathematics, and the system of mathematical analysis, which is its logical development, still constitutes the greatest technical advance in exact thinking."[9]

While "exact thinking" is not always possible in using the principles from Hypernomics, given that it studies the statistics and analytic geometries of consumer and producer behaviors, the drive to be *more exact* is always a goal. As we will discover later, exactness is a function of our accuracy (how far away from our target are we?) and precision (how broad are our errors?). We shall strive to improve both. Goods and services face competing products with a wide variety of features. It is not enough to design and build a product and see "what the market will bear." Many companies do that. Many products fail. But what if we could *map competitors' positions* and *determine customers' directions* about product features in advance? If we could do that, we could minimize competition while offering clients what they want, do not have, and can afford. This may seem impossible, but it is really at the heart of this book—and it turns out that we can do just that. However, we first need to know positions and directions in an economic space to enable that.

As sailors have long known, having a position is not the same as knowing your place. Understanding one's location and heading on the ocean is incredibly crucial. While determining latitude was relatively easy on the sea centuries ago, finding longitude was not. Oceans do not offer the stable, immovable surfaces that dry land affords, and calculations of east-west locations were often fraught with significant errors. Given that the Earth rotates 360° per day or 15° per hour (in mean solar time), time and longitude have a direct relationship. With the prime meridian (0° west longitude) in Greenwich, United Kingdom, and Denver, Colorado, at 105° west longitude, we know that if it is noon in Greenwich, it is 5:00 a.m. in Denver. We know this not only concerning the time within each city's time zone but also, more significantly, in the sense that the sun will be at its highest point in the sky on any given day in Denver seven hours after that happens in Greenwich. Because of this phenomenon, knowing one's longitude with the requisite exactitude to navigate effectively and avoid known obstacles is possible *if* one has a chronometer with sufficiently high precision. In the early 1700s, however, sea-faring timepieces could not regularly offer the accuracy needed to avoid disaster.

After leaving Gibraltar on September 29, 1707, less than a month later, on October 22 (November 2 on the new calendar), some of the 21 ships returning to Portsmouth, England, led by Commander-in-Chief of the British Fleets Sir Cloudesley Shovell, found themselves badly off course. Believing they were nearly 100 nautical miles south-southeast of where they were, four ships crashed into the low rocks off the Isles of Scilly and sank.

At least 1,400 and perhaps over 2,000 marines, sailors, and officers died in the disaster.

In the aftermath of this catastrophe, finding that errors in navigation were the root cause of the event, the British government passed the Longitude Act in 1714, which established the Board of Longitude and offered large cash prizes to anyone who could accurately determine longitude at sea. John Harris, an English carpenter turned clockmaker, largely solved this problem with his series of timepieces developed over four-plus decades. King George III tested one of the later versions in 1772 and found it accurate to within one-third of a second per day. At sea level, one minute of angle along the equator or a meridian is approximately equal to one nautical mile, which is exactly 1,852 meters or about 6,076 feet by international agreement. With 60 seconds per minute, each second is about 101 feet. With John Harris's chronometer to King George III, a third of a second error translates to about 34 feet per day. Had that instrument been available to Sir Cloudesley Shovell's navigators and properly used, the east-west course error over the 23 days since they began their voyage and crashed into the rocks would have been about 780 feet, not the error measured in dozens of miles that they had.

Note that the position problem for the Scilly misadventure was not only one of mistaken longitude but one of errant latitude as well. The badly miscalculated estimate of their north-south position may have been due to human error that added to the miscalculation in predicted longitude and prevented ships from finding safe passage through the English Channel. History shows that that combination on the high seas was deadly.

By contrast, when the latest product goes bust in the market, people seldom die over it. Fortunes dedicated to its development may be forever lost, and companies funding such products are placed under deep financial stress. They wonder what went wrong. Mariners discovered they had to know their positions and headings and compare them to their charts to make it safely to their destinations. Mathematicians found they could describe instantaneous points in space, direction, speed, and acceleration for various objects. At the same time, companies have long speculated: What must we do to become more profitable? What position and direction should we take?

At the same time King George III wandered about London with John Harris's chronograph, a Scottish philosopher wondered about economics. In 1776, after 10 years of working on it, Adam Smith published *An Inquiry into the Nature and Causes of the Wealth of Nations* (usually shortened to *The Wealth of Nations*). This was the first deep look into the subject, and because of that, many modern scholars hail Adam Smith as the "father of modern economics."

As the field was wide open as he invented it, he focused his study on what most now call *macroeconomic* behaviors. This field addresses the structure and behavior of a national, regional, or world economy. This contrasts with *microeconomics,* which studies the component elements of national economies, including firms, households, and consumers.

While Smith addressed many topics, we shall concentrate on one of his most enduring points. This is his notion of "an invisible hand," or, more broadly and less figuratively, the enlightened self-interest of producers to give the public what it needs.

Smith described that idea in this way:

> *As every individual, therefore, endeavours as much as he can, both to employ his capital in the support of domestic industry, and so to direct that industry that its produce maybe of the greatest value; every individual necessarily labours to render the annual revenue of the society as great as he can. He generally, indeed, neither intends to promote the public interest, nor knows how much he is promoting it. By preferring the support of domestic to that of foreign industry, he intends only his own security; and by directing that industry in such a manner as its produce may be of the greatest value, he intends only his own gain; and he is in this, as in many other cases, led by* an invisible hand *to promote an end which was no part of his intention. Nor is it always the worse for the society that it was no part of it. By pursuing his own interest, he frequently promotes that of the society more effectually than when he really intends to promote it.*[10]*. . . . It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner but from their regard to their own interest. We address ourselves, not to their humanity but to their self-love, and never talk to them of our own necessities but of their advantages.*[11]

That there are forces afoot that allow producers to maximize their gain and promote positive outcomes for their customers is a firmly held tenet in this book. In this regard, Hypernomics aligns itself with *The Wealth of Nations*. As we march further into the work at hand, however, we will discover those producers *must* promote their customers' interest in particular ways. Those ways will vary from market to market but always involve specific, *visible* product points relative to Value Space and Demand. Businesses can succeed to the fullest extent possible through the deliberate satisfaction of their clients. With this tenet, this book is diametrically opposed to *The Wealth of Nations*.

It was hard to understand until Hypernomics's observation that "visible hands" work throughout the economy. Consumers place values and limits on goods, which are readily discernible. The economic forces at work were not fully apparent to Smith, given his era's lack of data and mathematical modeling techniques. In modern times, however, we can make manifest "visible hands" within and across markets with enough research and mathematics. Correctly displayed, they allow us to see what had been previously unseen.

A previously invisible atmospheric occurrence became apparent after the 1883 eruption of the Krakatoa volcano. Observers noted that ejected ash went high into the atmosphere and flew in a fast, thin meandering river of air running west to east.[12] Initially called the "Krakatoa easterlies,"[13] we now call these phenomena the jet streams, as depicted in Figure 1.7. These air currents range in altitude from 23,000 to 52,000 feet, are one to three miles thick, up to hundreds of miles wide, and may run in length for thousands of miles. Once discovered, pilots from World War II flying from the United States to the United Kingdom could use these air columns to their advantage. They are powerful enough to add 100 miles per hour or more of ground speed from high-flying aircraft flying west to east or remove an equivalent amount for vehicles moving east to west. Predicting jet stream movements and strength is vital in modern aviation and weather forecasting. Knowing that jet streams are forceful, movable, and real are reasons to study them if your livelihood depends on them, even if you cannot always see them.

Adam Smith understood that fundamental forces are at work in the economy and created a landmark book to describe them. We now call his brand of study classical economics. While he addressed the idea of economic position little, if at all, he understood the notion of economic direction from the beginning. He noted, "[W]hen cultivation is extended over the greater part of the country...[then t]here is then more bread than butcher's meat. The competition changes its direction, and the price of butcher's meat becomes greater than the price of bread."[14] Mathematical explanations of the economy's position and direction were not yet apparent in Smith's era. Had they been, Smith likely would have employed those devices.

The ability to describe position and direction mathematically took a significant leap forward with the advent of regression analysis. Invented by Adrien-Marie Legendre in 1805[15] and refined by Carl Friedrich Gauss in 1809[16] and 1821,[17] regression analysis allows forecasters to find trends in data. Legendre and Gauss were tracking celestial bodies and needed a way to predict where those objects would be, based on where they had been. To do that, they had to invent and refine a process known as least squares regression.

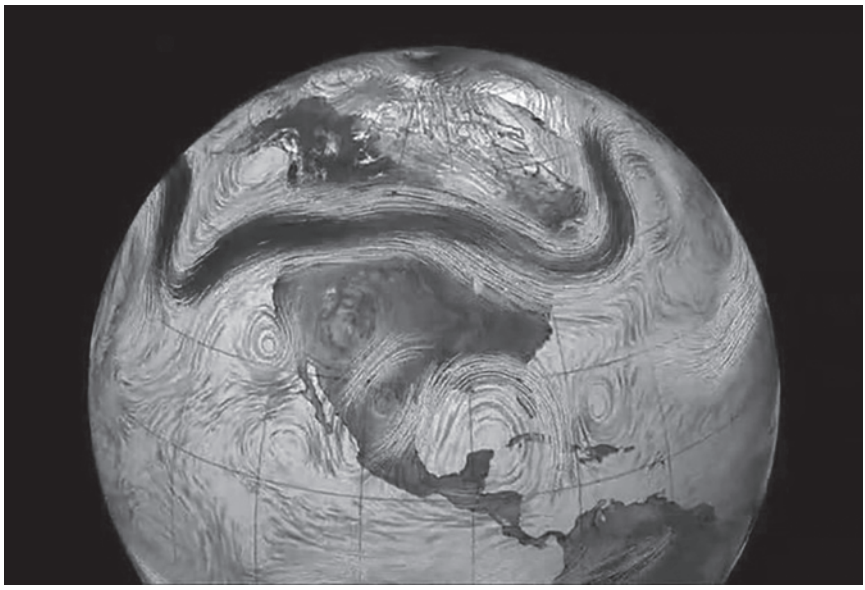


FIGURE 1.7 Usually invisible but always real: there are prevailing wind currents across the globe; the fastest of these are the jet streams capable of speeds of 200 miles per hour, which were unknown until 1883.
Note: NASA/Goddard Space Flight Center, 24 January 2012
This file is in the public domain in the United States because it was solely created by NASA. NASA copyright policy states that "NASA material is not protected by copyright **unless noted**".
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Regression analysis considers the position of the points in a data set and finds the mathematical direction through them.

As shown in Figure 1.8, given a series of independent variables (in this case, engine size in cubic centimeters) and dependent variables (All-Terrain Vehicle or ATV prices) depicted as a series of ordered pairs (every dot on the figure represents the engine displacement as the horizontal component and price as the vertical element of a single ATV model), regression analysis finds the line of best fit through the data.[19] If that line satisfies specific established criteria, as does the one in Figure 1.8, we say it is statistically significant, meaning we can use it for predictions.[20]

Decades later, Alfred Marshall, with his 1890 book *Principles of Economics,* founded the field we now call neoclassical economics. Because of that, many recognize him as the father of modern economics (thus taking it from Smith). Along with Keynesian economics (which addresses macroeconomics), neoclassical economics (primarily concerned with microeconomics) dominates the mainstream study of the field today. As a practical matter,

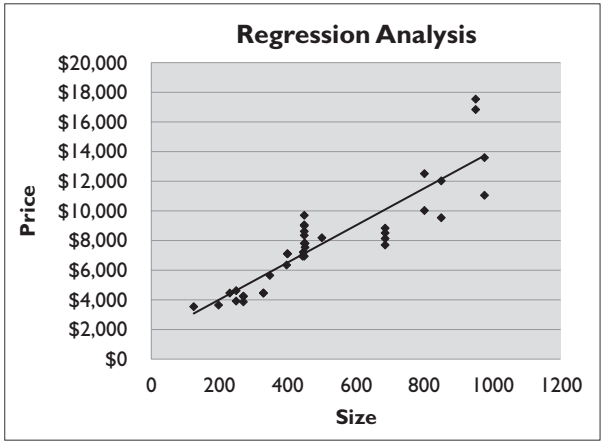


FIGURE 1.8 Making the invisible visible: regression analysis finds data trends that permit statistically significant predictions and forecasts.[18]

when most commentators talk about mainstream economics, they usually mean neoclassical economics for microeconomics and some mix of neoclassical and Keynesian economics for macroeconomics. (Some economists, Marshall included, believed that economics should take up philosophical questions in addition to those dealing purely with the math of markets. In his preface, Marshall argued, "Ethical forces are among those of which the economist has to take account.)"[21]

Hypernomics prefers to leave issues of fairness to the markets themselves, as it shows how buyers sort out their ways and means within and between markets, ultimately establishing value responses, demand curves, and prices. While many prefer beef to bombers, quantifiable markets exist for both when we do the analysis. In this respect, this book has no opinions, only observations and outcomes. It does think that losing money is a bad idea, however. It believes that diligent research produces less loss and more profit.

In *Principles,* Marshall laid out one of his most enduring ideas that neoclassical economics holds to this day, the equilibrium (or Law) of Demand and Supply, as shown in Figure 1.9 (which Marshall denoted).

In it, we have a downward sloping (from left to right) demand curve D.D.′, which is indicative of people being willing to buy more of anything (in the horizontal direction, which modern neoclassical economists now denote as Q) if the price drops (along the vertical axis, which economists designate P). Simultaneously, we have an upward sloping (from left to right) supply curve S.S.′. Marshall and neoclassical economists find equilibrium at Point A, where the supply curve intersects the demand curve.

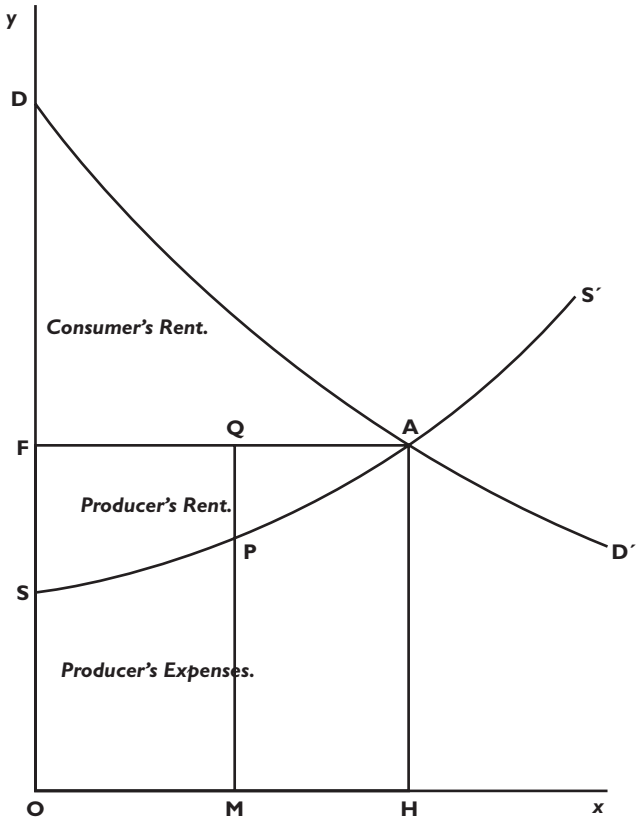


FIGURE 1.9 Alfred Marshall popularized the idea of supply and demand curves intersecting at a single sustainable equilibrium point with this diagram.[22]

This has been a primary modeling tool for economists for over 125 years at the time of this writing. The rationality of the model fits our expectations. Concerning demand, it makes sense that people buy less as the price increases and more when it falls. On the supply side, Figure 1.8 reveals, in one interpretation, that producers would like to make more products if they can sell them for a higher price. Who wouldn't, we wonder. In Marshall's words, the intersection of the two curves is a "typical case of stable equilibrium."[23]

Since this approach appeals to and develops through logic, we should take particular notice. Even though Legendre and Gauss offered ways to discover trends in data decades earlier, Marshall did not attempt to gather observations concerning demand or supply. We have none of Marshall's

market positions (as ordered pairs in Figure 1.8) from which we can accurately determine direction. Given that demand deals with quantity and price, he could have gathered data on quantities sold, and prices received for the beef market. Had he done that, he could have proven that demand has a downward slope.

Hypernomics takes no issue with downward-sloping demand curves as the book proposes and then proves their existence, slopes, and intercepts using the techniques that Legendre and Gauss offered us. It is not enough, however, to "strike a line" representing demand and then propose that it has mathematical meaning. As we will observe, significance comes from statistical studies wrought from carefully constructed databases.

On the other hand, upward-sloping supply curves, thought by Marshall and others as ubiquitous, are much more disquieting. Think about what curves such as these mean. Since supply curves reflect producers' outlays, with quantity on the horizontal axis and dollars on the vertical axis, a rising supply curve means that costs increase as quantities increase. In the case of automobiles, since labor is the most significant cost component, if curves like this reflected reality, this would mean that workers, on average, take more time to accomplish tasks the more they perform them. Yet, study after study shows the opposite—they indicate that workers become *more* proficient with additional quantities produced. Costs *fall* over time. Exceptions may exist for the total expenses required to gather and deliver some refined elements (such as the purest silver, gold, and platinum, for example). However, when we combine material and labor expenses for virtually every other type of market, *costs decrease with added quantities*.

Thus, the notion of an upward-sloping supply curve is incorrect for most markets.

Because of this, the perception that stable equilibria form at the intersection points of supply and demand curves is also without merit. Much enamored with thermodynamics, some economists believe that economies work like fluid systems. Add hot red dye to the cool green dye and produce a lukewarm yellow tint. Both the resultant temperature and color are the inevitable results of equilibrium effects. Markets are similar to such systems, they believe. What holds for these systems should hold for the markets as well, they argue.

Once we plot competitors' positions and examine markets' directions provided to us by their customers, however, we discover something entirely different. The neoclassical view is unsupportable and unsupported. Markets do not resemble containers of miscible fluids.

Markets look like maps.

More precisely, markets look like battlefield maps.

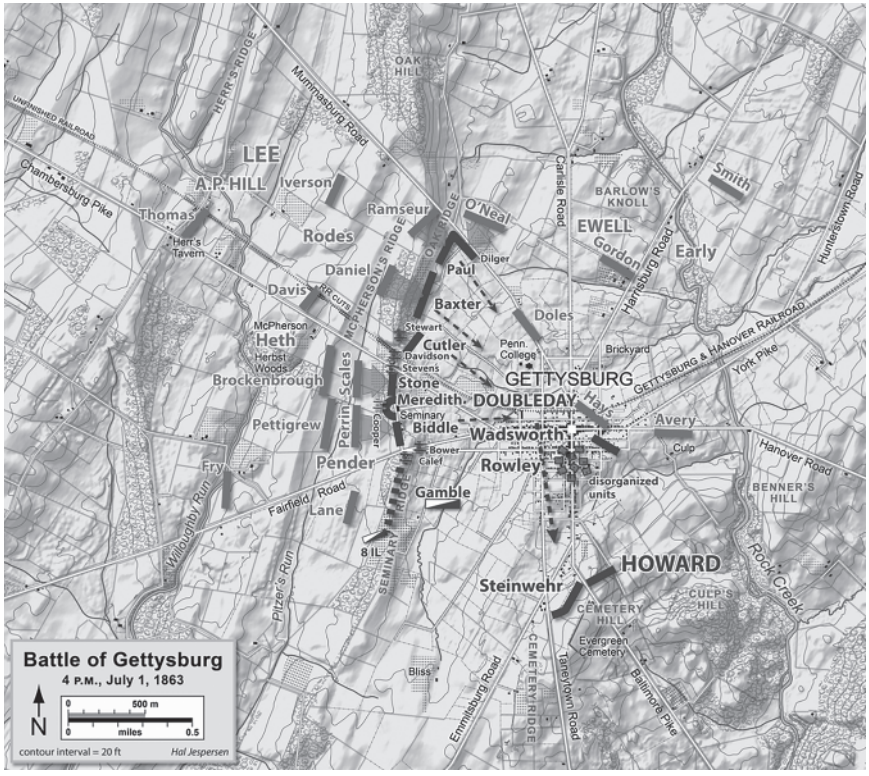


FIGURE 1.10 Confederates east, west, and north, Union in the center.[24]

In war, opposing forces stake out locations. As they line up for battle, their positions reflect their latitudes, longitudes, and altitudes. Armies like to fight from the highlands if possible. From Day 1 of the Battle of Gettysburg, Union and Confederate forces jockeyed for the position (as shown in Figure 1.10), looking for high ground to get to it and any other advantages that the landscape offered them.

Products have multiple features, which reveal their absolute locations on market maps and relative positions relative to their competitors (Figure 1.11). In many markets, however, each firm faces more than one opponent. In the 2013 market for Sport All-Terrain Vehicles (ATVs), eight producers offered various ATV combinations of engine and suspension packages. Some regions in this part of the larger market were highly contested—consider the region between 440 and 450 ccs on the horizontal axis and 17 to 22 inches of total suspension travel on the vertical. In this area, four manufacturers crammed in six models. While other features not pictured here enter into the customers' buying decisions, this region suffered from overcrowding. In

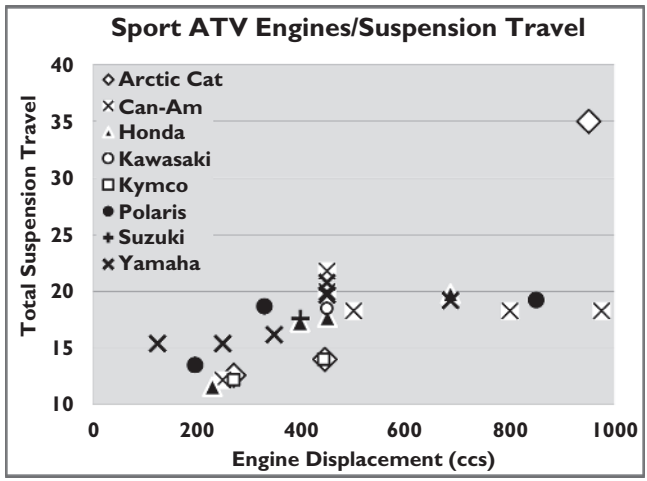


FIGURE 1.11 ATVs have many features; here, we look at two.[25]

a war, people die over disputed territory. In markets, products not valued as highly as their costs disappear. In any market region, customers collectively determine market splits to the producers, as they reward or penalize product features according to their preferences, which we must measure.

Customers care about many features[26] and shop in many markets. While demand curves are crucial, we will soon discover that the product value hinges on not only the quantity purchased but also whatever attributes the customers decide that they want and for which they are willing to pay. However, a critical difference between markets and battlefields is that there are multiple ways for multiple parties to win in the former. Winning in the market means selling products for more than they cost their producers to make them.

Given its conditions, optimizing in a market might mean extracting its maximum possible profit. Occasionally, favorable conditions can occur due to luck or being first in a new and promising market. Alternatively, such outcomes can come from hard work and good research with the proper tools. The latter method improves the chances of success.

A primary observation made possible by mapping the markets in such fashion as Figure 1.11 is that while producers could choose to go head-to-head with competitors and offer virtually the same products, perhaps at lower prices, to attract customers, they could instead decide to avoid their rivals to the fullest extent possible from the beginning. Instead of offering another ATV with 450 ccs of engine displacement and 18 inches of shock travel, producers can decide to make a vehicle that falls into the open market expanse with larger engines and more suspension travel. No one offers an ATV with suspension travel between 22 and 35 inches in this market

segment. If models sell at either end of this range, what might happen for configurations in between?

Note that Figure 1.11 offers no insight into the features that ATV buyers likely find helpful. With this view, we have yet to learn how much they like larger engines or better suspensions. Furthermore, there is no mention of the number of seats, wheel options, or possible options such as fuel injection or power steering as they impact vehicle value. Just as importantly, with Figure 1.10, as we examine engine size and suspension travel as our axes, we cannot relate to customer demand, which has quantity and price as axes.

We observe that marrying ourselves to unrelated two-dimensional views limits our insight.

This, in turn, mandates expanding our view of market forces. We will employ some new methods and three new coordinate systems. We call this new approach Hypernomics, or Multidimensional Economics, or ME, for short.

Since Descartes brought the world three dimensions, our next logical step is to move on to four dimensions. Let us see what insights such systems provide us.

SUMMARY

As evinced through maps, position and direction have been necessary to humankind since prehistoric times. Knowing how to get from one place safely to another is a prime concern for everyone. Over 2,200 years ago, Eratosthenes devised the grid system that we use today, where latitude represents position relative to the north and south, and longitude depicts it east to west. Over 1,800 years later, Descartes invented his two- and three-dimensional plotting systems. Combined with Newton and Leibnitz's calculus, those systems allow mathematicians and physicists to depict position and direction. Work by Legendre and Gauss on the ordinary least squares regression method gave analysts the capacity to predict direction given historical positions. Adam Smith coined the term *the invisible hand* to characterize the economy, but had he thought to plot some of the information before him in a meaningful way, he may have revealed the "visible hands" first discussed in this book here centuries earlier. Preferring deduction and induction to observation, Alfred Marshall ignored ordinary least squares regression as he derived the Law of Supply and Demand. While downward-sloping demand curves greatly appeal to reason, upward-sloping supply curves do not. The often-held view that markets represent thermodynamic systems does not hold up under inspection. Markets instead look more like particular types of maps—those depicting battles. Current mapping techniques do not allow us to display all the information we want in one view. Hypernomics offers help in this regard with three new coordinate systems.

VIGNETTE: RESTAURANT MATH

"I was at this restaurant. The sign said, 'Breakfast Anytime.' So, I ordered French Toast in the Renaissance."

Steven Wright

Forget about ordering off the menu; first, you must get a seat.

It was never a slam dunk to get into our preferred local eatery. It was still more complicated once COVID-19 forced all patrons outside with social distancing. We began to fidget as we sat, waiting for some seats to open for us for the third weekend in a row. What to do? In an era where restrictions abounded, sometimes it was hard to see the options.

As it happened, we knew the owner and every boss in the place. I pulled our most-beloved manager aside and asked her if she would be willing to rearrange the furniture and make more money. I explained that a few large tables crowded out several smaller ones. Why not go from your arrangement (which was A) to a new one (which became B)? I asked. If you track the revenue changes, you'll be pleasantly surprised.

As shown in Figure 1.12, she did just that. Revenue went up by over 25% in two months. Unlike A, Setup B recognizes they face a demand curve, with more parties of one or two people than groups of five or more.

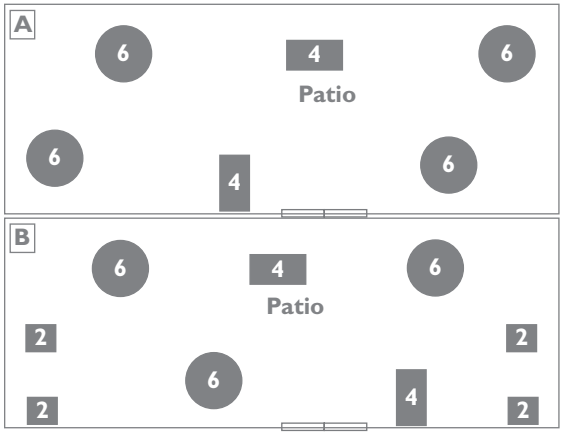


FIGURE 1.12 In May 2020, the COVID-19 pandemic forced our favorite eat-in and take-out restaurant to only seat people on its patio, configured as A. The problem with A was that many of the restaurant's parties consisted of one or two people. The patio filled quickly during peak periods, with many occupied tables mostly empty. To accommodate the small groups and free up the tables with more seats for larger parties, I suggested B. By July 2020, revenues increased by over 25%.[27]

So, the suggestion worked. But why?

The short answer is pattern recognition.

Over years of going there, one could see that there were consistently more parties of two than four or six at this eatery. Ideally, the restaurant might have kept records of party sizes by the day and time they came in, and we could appeal to that; but such accounts were unavailable here. Failing that, we might want to find more global data and see if that offers insight.

It turns out that broader data does give us a better picture of restaurant visits. According to a March 3, 2020, report from NPD.com, "Last year solo diners represented 35% of restaurant visits whereas parties of two represented 27% of visits; parties of three, 14%; parties of four, 12%; and parties of 5 or more, 13%."[28]

When we take that data, we can find a pattern we can observe in Figure 1.13. Significantly, the restaurant in question was over twice as likely to have a party of two versus one of four. Recognizing that fact enabled the establishment to grow its revenues in a down market.

Hypernomics is the study of finding patterns and putting them to work for us. We'll always look for patterns we can discover and employ.

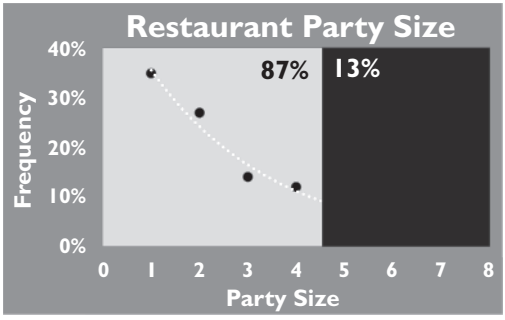


FIGURE 1.13 Restaurant visits.[29]