

The sea conditions worsened during Jose Sandoval's first command watch on the Very Large Crude Carrier *Early Dawn*. The waves broke against, not over the bow. From the bridge, the ship's size made its blunt prow appear more like a stationary sea wall than the bow of an ocean going ship. The ship is so big that were Tiger Woods to stand beside Jose, he would be hard pressed to drive a ball as far as the *Early Dawn*'s bow.

Jose was not alone. Miguel, an experienced seaman, manned the steering station. It was ironic that such a large ship was commanded by an occasional key stroke, the information from the autopilot, charts, GPS and radar consolidated Electronic Chart Display and Information System. While manual control was possible, their course was plotted at the start of their voyage, a course deemed safe and efficient. Deviation was only required in the event of traffic or weather.

Their Cargo—2.0 million barrels of Arab Light crude oil—was loaded at the Saudi Arabian port of Ras Tunura. The ship left harbor three days ago, and the tension on the bridge as they passed through the four-mile wide Strait of Hormuz was palpable. A small speedboat armed with a rocket-propelled grenade could do serious damage, and the same small boat filled with explosives would undoubtedly sink them. Jose overheard the captain and the first officer's conversation. "The threat is not from Iran, no matter what they say, to hit us in the Straits would be economic suicide. What I'm worried about is the individual or group that wants to hurt all the area's economies, including the U. A. E., Qatar, Kuwait and the Saudis."

The ship's destination is the Louisiana Offshore Oil Port, where their oil will help supply the 20% of total US consumed oil that originates outside the western hemisphere. This course has been modified by necessity to reduce the chance of attack from Somali Pirates and has taken longer than hoped, but finally the captain deemed the situation safe enough to allow Jose to stand watch alone. As he scanned the horizon, Jose thought about the news program he had watched before coming on duty. CNN international reported that crude prices fell by five dollars per barrel, based on the lessening tension in the region as well as other explanations he neither understood nor believed. The value of this ship's cargo just fell by \$10 million dollars.

Staring over 1000 feet of walkways and transfer piping to the ship's bow, Jose's tension had certainly not lessened on this, his first solo watch. *I wonder who pays for the \$10 million?* he thought as he scanned the horizon once again.

There is an implicit assertion in my paper's topic, "Gasoline—Who Profits—Is Speculation Bad?" Are there are bad actors afoot? After all, gasoline prices were a frequent topic during the recent Republican primary, with the candidates offering differing opinions about the cause of the recent rise in gasoline prices. Newt Gingrich promised that under his presidential leadership, gas prices would be reduced to \$2.50 per gallon. While Speaker Gingrich's offer may have sounded promising to many voters, the President of the United States has few tools with which to affect the short-term price of any commodity. As I started to research the subject, I thought that all I had to do was uncover an authoritative analysis of the role of the futures and derivative markets for gasoline and oil. Certainly, I thought, all the discord was the result of interest groups and

politicians bending the truth to meet their partisan agendas. As I researched the subject and spoke with colleagues, I moved, as the plaque above my mother's stove said, from cocksure ignorance to thoughtful uncertainty. In reality, factors affecting the gasoline market, production, pricing, and regulation are inextricably intermeshed with our national and global economy, and are influenced continuously by sometimes predictable but often-random externalities.

What is Gasoline?

Gasoline is a most unappealing mixture of chemicals; it smells bad, it is toxic and it is highly flammable. We go to great lengths to avoid contact with it, and are upset if we spill gasoline on our shoes. Pumping gas on hot days is discouraged because the fumes can directly and indirectly harm air quality. It can be weaponized by adding benzene and polystyrene to make Napalm. Breathing the fumes for a prolonged period results in severe neurological damage. Nevertheless, our way of life has become dependent on an affordable and abundant supply of this foul smelling chemical.

Gasoline is in fact a family of hydrocarbon mixtures formulated to be burnt in internal combustion engines. Its composition varies based on octane levels, regional regulations, and the time of year. We are currently switching from the summer blends to the slightly less costly winter blends. Contrary to popular belief, gasoline is not fungible. Gasoline formulated for Indiana at 87 octane cannot, more than likely, be sold in New York, because each region has specific requirements based on environmental concerns.

Gasoline is distilled from non-replenishable petroleum oil. The oil represents carbon naturally sequestered millions of years ago deep in the ground. As this oil is extracted, refined, and burnt, we release this ancient carbon into our environment.

One barrel of oil contains 42 gallons, and, depending on the source of the oil and the technology deployed by the refinery, produces 28 gallons of gasoline and 14 gallons of diesel and kerosene (jet fuel) as well as other products. This is not an exact ratio, as there is a great deal of variation in crude oil compositions. Refineries can be designed to maximize the production of any one of these specific products.

Who Pays for Gasoline

Who pays for gasoline? The obvious answer is that all consumers pay. They pay directly when they fill their tanks, or indirectly, when the cost of transportation is passed along through higher prices for food, manufactured goods, and transportation. Of equal or greater importance are the secondary effects of higher transportation costs. Gasoline, petroleum, and heating oil are traded as commodities, but unlike many commodities, such as orange juice, grain, gold and silver, the demand curve is sluggish. In other words, if a worker lives 20 miles from work and has no alternate means of transportation, he or she has little choice but to continue to consume gasoline. When an increasing percentage of US families' disposable incomes are spent on gasoline, there is less money to spend on goods and services locally, reducing economic growth and increasing unemployment. Nationally, higher priced oil also hurts our balance of payments internationally.

A more interesting discussion, and one necessary in order to prepare to answer the second topic question, “Who Profits—is Speculation bad?” is to ask who receives the money paid by consumers when they fill their tank.

Who Gets Paid

The Energy Information Agency or EIA is part of the Department of Energy. I have had the opportunity to interact with many of these people over the years. I have always been impressed with their professionalism and their ability to resist the winds of political change that influence so many other departments at the DOE. The agency acts as our nation’s energy economists, collecting, organizing, and disseminating data on our country’s energy production and use. The EIA publishes a generalized breakdown of what it costs to bring a gallon of gas to market. As of August 20, 2012 in California (And Yes, I did not lack for data when preparing this paper), a gallon of gas had the following cost breakdown:

- Crude Oil accounted for 65% of the selling price at the pump.
- The refineries cost and profit amounted to 12%.
- State Taxes and Fees contributed 11%.
- The distributor and retailer collected 8% and lastly,
- Federal taxes amounted to 4 % of the sale price.

The two largest cost components, the cost of crude oil and the wholesale gasoline cost, are traded as futures.

The refineries profitability is controlled by the market price of the refined products, gasoline, diesel, jet fuel, etc., and the market price of the petroleum feed stocks. This difference is known as the crack spread. In recent years, the crack spread has been very favorable for refineries. Even though we haven't built a new significant refinery in the US since 1977, existing refineries have been continually upgraded. Our 144 refineries in the US operated at an average utilization of 97%. Last year, for the first time since 1949, the US exported more gasoline and transportation fuels than it imported.

If the oil is extracted from land controlled by the Federal Government, a 12.5% royalty is paid. In some instances, for high risk deep well drilling, there is no royalty paid. The Congressional Budget Office projects that the royalties for all federal leases for gas and oil will average \$15 billion dollars per year for the next decade.

We, as Americans, pay an invisible cost for the oil we consume. Senator Richard Lugar, as part of his support for domestic bio-fuel production, included the cost of securing international sea-lanes in the estimated cost to America per barrel of crude. While it is difficult to account for the potential reduction in our defense outlays if we were not to defend the sea-lanes to and from oil producing regions, studies suggest that the savings to be in the range of \$ 50 billion dollars per year, or roughly \$11.50 per barrel at our current rate of imports. Unfortunately, reducing our dependence on foreign oil will not reduce the need for the US to continue to ensure the free movement of petroleum.

Of greater concern to a great many people is the cost of the rapidly rising carbon dioxide levels in the earth's atmosphere. The costs of climate change are at this stage incalculable. Once again, reducing emissions in the US will have a very limited effect if China's emissions of CO2 continue to rise at its current rate.

Speculation—Good or Bad

Because the price for the raw resource, oil, as well as the final product, gasoline, is traded as commodities, understanding the role these markets play in setting prices is critical to our discussions. Participants in the futures market can be broken into two categories: hedgers and speculators. A hedger is a person or more likely a firm that produces or consumes large quantities of gasoline, diesel, or Jet Fuel in their operations. A hedging program acts to insure the future cost or price of the commodity. A great many large organizations use hedging to bring predictability to their future earnings, ensuring a more predictable financial performance. Hedging is a useful tool that can mitigate risk and encourage businesses to invest and expand during times of market uncertainty. The oil and transportation fuels market is always uncertain. The Airline Industry is an excellent example of firms that use hedging as a means to control future costs. Southwest Airlines, the subject of many business school case studies because of its active and generally successful hedging strategy, spent nearly \$6 Billion on Jet Fuel last year, or 38% of the company's \$15.6 billion in revenues. In 2008, its strategies saved the company nearly \$1 billion, at a time when crude oil reached \$147 per barrel. When oil prices fell later in the year, an event the company had not properly anticipated or timed, the company experienced several losing quarters. It is worth noting that Southwest is also actively engaged in improving

the efficiency of its fleet of aircraft, adding winglets, which reduce lift-induced drag and save over 100,000 gallons of jet fuel per year per jet converted.

A speculator, as opposed to a hedger, may not use or produce the commodity, but engages in trades simply for financial gain. Without some level of speculation, the market would certainly lack the necessary liquidity. When a hedger takes a position, for instance, if an airline wants to protect itself from an increase in the price of oil, it is important that some counter party is on hand to take the other side of the bet. From this perspective, the speculator provides a valuable service—in other words, speculation is necessary, and like so many things in life, good when present in the proper proportion.

The question of good or bad is better stated as, “does speculation drive the price of oil and transportation fuels to an irrational level not based on supply and demand fundamentals?” This question creates debate not only among politicians and pundits, but among respected economists as well.

In late 2008, the Congressional committee on Homeland Security heard testimony on the impact of speculation on the price of critical commodities. Of particular concern was the large increase in the volume, and how long-only commodity index funds contributed to a rise in futures prices and subsequently, the spot price of oil.

In June 25, 2008, Noble laureate Paul Krugman, following the common economic theory that speculation generally does not affect the price but does contribute to price volatility, argued that there is no evidence that speculation was driving the spot price higher because there was no evidence of an increase in oil inventories. In other words, oil was not being withheld from sale in anticipation of a higher future value. However, by July 2009, a year later, when the telltale inventory buildups were in evidence, Krugman had reversed his position.

However, there are countervailing opinions that link the rise of both the futures and spot price to real-world market drivers. They conclude that the futures price does not drive the actual price, but that instead conclude that both prices are driven by the same concerns—that demand, long term, is rising faster than supply.

To better research the relationship between speculation and pricing, The U.S. Energy Information Administration (EIA) launched its Energy and Financial Markets Initiative (EFMI) in September 2009. In a resulting report “Contango in Cushing,” the researchers were able to establish a credible link between future prices, inventories, and the spot price for oil. It is also important to remember that the financial industry was and remains an attractive political target.

Of the two prevailing opinions, the opinion that speculation does drive oil prices seems to have gained the widest following. If we accept that speculation affects the price of oil, the next question is how this happens.

Another confounding characteristic of the petroleum market is that it is difficult, even in hindsight, to define what the rational price for a barrel of oil would be. This is due to the many external forces exerting pressure on the supply side of the market. I had the opportunity to meet with an economist from the Energy Information Agency a few years ago. Not only does the Agency collect and analyze historic energy consumption and production data, but they also provide forward-looking estimates of consumption and price. At the time, I was working with an ad hoc group of DOE energy auditors to set a common price we would use to estimate energy savings resulting from the projects we help large industrial users define. I asked the EIA economist how accurate the agencies projections are. She replied to the effect that they are very accurate, “except for all the damn externalities.” You get a model element really humming, and some idiot in some South America does something unexpected and bam – the math goes crazy. Let us assume for a minute, that Jose’s tanker, the Early Dawn unexpectedly runs aground off the coast of Madagascar. That externality would play havoc on every attempt to rationally project what should be the selling price of a barrel of oil. The word “externality” as applied to energy markets has stayed with me ever since that meeting. A great deal of the world’s oil production occurs in the Middle East, and the Middle East is the very definition of an externality that makes the models go crazy.

As to how the futures market can distort the price, two possibilities exist – one, the emergence of a dominant player, or two, herding. Given the size of the market, it is unlikely that a single player can establish a large enough position to control the direction of the market. The second possibility, herding, is far more likely. Herding is easier to observe than to define, but in general

terms it means copying the behavior of others rather than examining the market fundamentals for oneself. Is the trader worried about the effect on oil production by the unrest in Iran, or is he watching to see how other traders react to this externality? If the leader in the herd is trading based on fundamentals, these market moves may be rational, but it is impossible, given the speed of communication, to know who is leading the herd. Furthermore, to extend the analogy, herding can quickly lead to a stampede, resulting in entirely irrational price movements. The price movements of 2008 certainly appear to have been a stampede rather than an appropriate reaction to the fundamentals.

In their Paper “Commodity Markets: Rational Expectations in Markets With Irrational Investors,” Teddy Wong and Aaron Smith state:

The financialization of commodity markets have become a concern for policy makers and market participants. What was once a market for the hedging of holding physical commodities has expanded to become a market for the diversification of financial assets. When financial assets diversification goals are decoupled from the fundamental factors that affect producers and consumers of physical goods, futures markets may not be as efficient in aggregating information concerning the economics of the underlying commodity.

It appears that such a decoupling has indeed occurred. Combine the shortcomings of the futures market with an influx of new money, and there is compelling evidence that speculation is driving the price of oil and transportation fuel from their rational price points. The magnitude of this upset, just how much this activity is costing the American people, continues to be debated.

While appearing before a Senate hearing, the CEO of Exxon-Mobile, Rex Tillerson, told those present that speculation was driving up the price of a barrel of oil by as much as 40%. Mr. Tillerson's assertion was echoed by Ben Hirst of Delta Airline, as well as experts from Goldman Sachs. The testimony given by these business executives is difficult to deny or confirm, but they are certainly in a position to understand how these markets function. Given a price of \$100 per barrel, the \$40 extra per barrel of crude oil amounts to as much as \$500 per-family per-year spent on gasoline directly.

Is it possible to reduce the price of Gasoline?

Increased spending for transportation fuels crowds out other spending, and this can be especially devastating for a family of with a modest income. A reduction of the price of gasoline also stimulates local economies. Therefore, it would be desirable to act to reduce the price of oil, and by extension all transportation fuels. In short, the obvious answer is yes, but only if the reduction in transportation expenses is sustainable.

Can we limit this speculative oil premium, the \$40 per barrel mentioned above? The Commodity Futures Trading Commission (CFTC) can limit the number and type of positions any one firm can hold, although some of their rulings are currently tied up in court. While in theory this action by the CFTC will limit the ability of one or a few firms to control the market, if the inability of the market to react rationally is due to herding, these actions will have limited benefit. In other words, it is doubtful the CFTC has the statutory means to change the behavior

that is contributing to this price run-up. It will, on the positive side, prevent market participants such as Citibank and Goldman Sachs from becoming over exposed to the risks inherent in this market, but it will have little impact on the movements of the herd.

As for fundamentals, the largest cost component for transportation fuels is oil. If it were possible to reduce the price of oil, in time, we would expect to see a proportional drop in the price of gasoline. The problem is that China, India, and Brazil represent the few bright spots in world economic expansion, and unfortunately this expansion will create an increase in the demand for transportation fuels and by extension, the demand for oil. In Beijing in 2010, only 27 percent of cars were more than 8 years old. At the same time, the average car in the US was over 10 years old, with 63% of Americans planning to hold on to their primary cars for 10 years or more. In other words, the Chinese are rapidly expanding the number of cars on the road while the US' car population growth is nearly flat. The Chinese are buying cars and light vehicles at the rate of 18,000,000 per year. Many of these cars are going to first time owners. The result is a dramatic increase in the demand for gasoline. Only a significant economic downturn stands to blunt this incredible growth.

Can we drill our way to lower cost oil? An expansion in US production will certainly provide downward pressure on oil prices. If we assume the potential increase of drilling on currently prohibited land to be 500,000 barrels per day, a difficult number to substantiate, it would increase domestic production by 8.6% from our current daily production of 5.8 million barrels a day. Its effect on world production is just 0.7%. What effect would an additional 500,000

barrels per day production have if instability in Iran threatened its 4,000,000 barrel per day output? Unless we wish to withdraw completely from the international market for oil, we will remain susceptible to prices based on the world oil supply. Expanding our domestic oil production has benefits, but it is certainly not the solution to high oil prices.

Gasoline Redefined

On May 15 of this year, the well-known investment personality Jim Kramer wrote, “We won't see long-term relief until we see a concerted move toward natural gas.” He argues that an increase in the use of natural gas, both to power over-the-road trucks and converting homes to natural gas, will bring down the price of oil. This would be certainly the case if there were only a US market for oil, but unfortunately it is the worldwide demand for oil that ultimately drives the price. It would perhaps reduce demand for refinery capacity, and in doing so reduce the crack spread, but it does not represent enough of a reduction to influence oil prices. Kramer's ideas do have merit, however, if we refocus our frame of reference.

The value of gasoline, diesel, and jet fuel is in their ability to transport people or goods. If we redefine our objective from reducing what a family or business spends on transportation fuels to reducing what the family or business spends on transportation, a great many actionable items emerge.

We can purchase more fuel-efficient automobiles. Hybrid automotive technology can reduce a family's fuel consumption by 20% or more with virtually no changes in the vehicle's size or

function. New CAFÉ standards are driving the auto industry to increase the availability of Hybrid technology in everything from a Lincoln Sedan to a GMC Yukon.

With the increased production of natural gas resulting from advanced drilling technologies, it is desirable to expand the distribution of natural gas to areas currently heating with oil or propane. Furthermore, it is economically feasible to convert a large number of over-the-road trucks to compressed natural gas and expand natural gas refueling stations.

Barring a dramatic international economic slowdown, and given the current fundamentals, evidence suggests that high gasoline prices are here to stay. However, currently available technology can dampen the blow to businesses or individual families if they have the means to invest in it.

In Conclusion

Is speculation bad? In principle, speculation in the oil and transportation fuel markets serves a very real social benefit – it allows large consumers of fuels to bring predictability to an otherwise unknown cost of doing business, and in doing so, encourages investment and economic expansion. However, excess speculation increases volatility and ties up financial resources that would be better spent on more productive activities that enhance our national wealth.

Is the oil and gasoline market rational?

If Jose Sandoval's tanker could count on loading oil at the same port and transporting it safely over the same routes to Louisiana, the oil and gasoline market would be rational, but this is not the case. I believe that in the long term the forces of supply and demand will drive the price of these critical commodities to an appropriate level. However, I believe that in the short-term political unrest in oil producing regions and unpredictable acts by governments make it impossible to arrive at rational investment decisions. Without a rational underpinning, recent history suggests we are at risk of a speculative bubble, but unlike the tulip mania in 17th century Holland, we are dealing with a commodity that is critical to our very way of life.