How increased inefficiency explains falling oil prices

Since about 2001, several sectors of the economy have become increasingly inefficient, in the sense that it takes more resources to produce a given output, such as 1000 barrels of oil. I believe that this growing inefficiency explains both slowing world economic growth and the sharp recent drop in prices of many commodities, including oil.

The mechanism at work is what I would call the *crowding out effect*. As more resources are required for the increasingly inefficient sectors of the economy, fewer resources are available to the rest of the economy. As a result, wages stagnate or decline. Central banks find it necessary lower interest rates, to keep the economy going.

Unfortunately, with stagnant or lower wages, consumers find that goods from the increasingly inefficiently sectors are increasingly unaffordable, especially if prices rise to cover the resource requirements of these inefficient sectors. For most periods in the past, commodities prices have stayed close to the cost of production (at least for the “marginal producer”). What we seem to be seeing recently is a drop in price to *what consumers can afford* for some of these increasingly unaffordable sectors. Unless this situation can be turned around quickly, the whole system risks collapse.

**Increasingly Inefficient Sectors of the Economy**

We can think of several increasingly inefficient sectors of the economy:

**Oil.** The problem with oil is that much of the easy (and thus, cheap) to extract oil is gone. There seems to be a great deal of expensive-to-extract oil available. Some of it is deep under the sea, even under salt layers. Some of it is very heavy and needs to be “steamed” out. Some of it requires “fracking.” The extra extraction steps require the use of more human labor and more physical resources (oil and gas, metal pipes, fresh water), but output rises by very little. Liquid extenders to oil, such as biofuels and coal-to-liquid operations, also tend to be heavy resource users, further exacerbating the problem of the rising cost of production for liquid fuels.

I have described the problem behind rising costs as *increasing inefficiency of production*. The technical name for our problem is *diminishing returns*. This situation occurs when increased investment offers ever-smaller returns. Diminishing returns tends to occur to some extent whenever resources of any kind are extracted from the ground. If the extent of diminishing returns is small enough, total costs can be kept flat with technological advances. Our problem now is that diminishing returns have grown to such an extent that technological
advances are no longer keeping pace. As a result, the cost of producing many types of goods and services is growing faster than wages.

**Fresh Water.** This is another increasingly inefficient sector of the economy, in terms of the amount of fresh water that can be produced with a given amount of resource investment. In some places deeper wells are needed; in others, desalination plants. Water from deeper wells may need additional treatment to remove the harmful minerals and radiation found in water from deeper wells.

As a result of the extra investment required, the price of fresh water is rising in many parts of the world. The higher cost is often justified as necessary to encourage conservation of a scarce resource. But from the point of view of the buyer, what is happening is an increasing price for the same product, or diminishing returns.

**Grid Electricity.** The price of grid electricity has been rising faster than inflation in many parts of the world for a variety of reasons. If nuclear plants are planned, they are being made in ways that are hopefully safer, but are more expensive. Adding solar PV and offshore wind is expensive, especially when grid changes to accommodate them are considered as well. Functioning plants of various kinds (coal, nuclear) are being replaced with other generation because of pollution problems (CO2) or feared pollution problems (radiation). The cost of producing electricity then rises because the cost of electricity from a fully depreciated plant of any kind is extremely low. Building any kind of new facility, no matter how theoretically efficient over, say, the next 40 years, requires physical resources and people’s time, in the current time period.

As these changes are made, the amount of grid electricity output does not rise very much compared to the resources and human labor required in the current period. The user experiences a higher cost for the same product. From the perspective of the user’s pocketbook, the result looks like diminishing returns.

**Metals and Other Minerals.** In the same manner as oil, we extract the easiest (and cheapest) to extract minerals first. These minerals include metals and other substances such as uranium, lithium, and rare earth minerals. Part of the problem is that ores of lower concentration must be used, leading to a need to move larger amounts of extraneous material that later must be disposed of. These ores may be found deeper in the ground or in more remote locations, adding to extraction costs. Furthermore, oil is generally used in the extraction of these minerals. As the cost of oil cost rises, this adds to the cost of mineral extraction, making minerals increasingly unaffordable.

**Advanced Education of Would-Be Workers.** If 20% of the work force needs college educations, it makes sense to provide 20% of young people workers with college educations. If the percentage of workers requiring college educations rises to 30%, it makes sense to provide 30% of young people with college educations. Small percentages of more advanced degree recipients are needed as well.

Instead of following a common sense approach of educating only the number of workers who need a given amount of education with that amount of education, in the United States we have gotten onto a treadmill of encouraging increasing numbers of young people to pursue bachelors, masters, and Ph.D. degrees. To make
matters worse, universities have established requirements that faculty do more research and less teaching, whether or not research in a particular field can be expected to benefit the economy to any significant extent. To accommodate this research-intensive approach, a layer of deans is added to work on obtaining funding for research. In addition, students are often provided more comfortable dorms with private rooms and private baths, adding costs to obtaining advanced education but not really enhancing future job prospects.

All of this produces an incredibly expensive higher education system, with costs way out of proportion to the increased wages a student can expect to earn from attending the university. Students are expected to pay for much of the cost of this system through debt to be paid back after graduation (or after dropping out). In some ways, the system might be viewed as an extremely expensive system of sorting out would-be job applicants, with widget makers with a college degree or master’s degree viewed more favorably than ones without, even if there is little use for an advanced degree in that particular job.

**US Medical System.** The US Medical system is particularly affected by the trend toward more advanced degrees. This approach results in a system where patients need to visit a variety of specialists to handle fairly common ailments, such as a broken arm or dementia in old age. To compensate for the high cost of their advanced education, specialists charge high fees. Hospitals have a large number of testing instruments at their disposal and use them whenever there is even slight justification.

Health outcomes in the US are remarkably bad compared to other developed countries, based on a study by the US Institute of Medicine called *U.S. Health in International Perspective: Shorter Lives, Poorer Health.*
According to this study, the US is falling farther and farther behind other developed countries in terms of health outcomes and life expectancy, despite healthcare spending that is more than twice as expensive as that of some other developed countries.

The higher cost is not entirely the fault of the healthcare system. The food production system provides food that is increasingly processed (so is convenient), but is not well adapted to our bodily needs. Food portions tend to be oversized, raising profits for fast food companies, but adversely affecting health of consumers. Transportation is set up in ways that deprive us of the exercise we need. Also, part of the reason for the adverse health outcomes is the fact that not all people are covered by health coverage, even with the recent addition of Obamacare.

Regardless of whose “fault” the problem is, the healthcare sector is becoming increasingly inefficient. In some sense, we are reaching diminishing returns here as well.

**Effects of Inefficient Sectors on Business Operations**

Businesses have a number of costs of operation. Unless wages are rising, they can’t easily raise prices without losing customers. So if costs rise in one area of their operations, they tend to try to cut costs in other areas of operations to offset this rise. This is the *crowding out* principle at work.

Among the sectors described above as having increasingly inefficient operations, the ones that directly affect
How increased inefficiency explains falling oil prices | Our Finite World

businesses are

- Oil
- Fresh water
- Electricity
- Metals and other minerals
- Healthcare

Areas where costs can be cut to make up for rising costs in the above areas include:

**Lower interest rates.** If interest rates are low, this reduces expenses for businesses. It also makes customers more able to tolerate higher costs of say, automobiles and houses and education, because the “monthly payment” can still appear reasonable, even if total cost rises. Lower interest rates help reduce needed government taxes as well, further helping both businesses and consumers. Because of these multiple favorable effects, it is not surprising that central banks have been lowering interest rates in recent years.

**Reduced wages for workers.** Wages often constitute a major share of a business’s costs. If the cost of oil or electricity or health insurance rises, a common work-around seems to be to transfer jobs to parts of the world where wage costs are lower. If energy costs are also lower in the alternative part of the world, this increases the attractiveness of moving jobs. Another work-around is computerization of job functions, using computers to replace jobs formerly done by workers. In fact, simply the possibility of sending work elsewhere or of computerization tends to hold wages down.

I have shown that, in fact, US wages tend to stagnate when oil prices are above $40 or $50 per barrel. This result is as we would expect, if high oil prices tend to crowd out wages.

![Average US Wages Compared to Oil Price](http://ourfiniteworld.com/2014/12/29/how-increased-inefficiency-explains-falling-oil-prices/)
Transfer of more health care costs to workers. Businesses can cut their costs by moving part of healthcare costs to workers, either through higher deductibles or through higher monthly payments for coverage. This approach has a similar effect as a wage cut.

Lower taxes on businesses. Government provided services can be paid for either by taxes on businesses or by taxes on workers. Many of these services benefit both businesses and workers, so the split as to how these taxes should be collected is not obvious. Businesses, especially international businesses, have the option of moving to locations with more favorable tax laws. The trend in recent years has been toward lower taxes on business revenue, shifting a greater share of taxes to wage earners. Higher taxes on wage earners also acts very similarly to a reduction in wages.

More debt. This is different kind of work-around for higher costs. Instead of reduced expenses, it provides increased revenue for businesses. This revenue is borrowed from a future period, with the promise that it will be repaid with interest. The use of more debt is especially prevalent in the sectors of the economy that are increasingly inefficient. For example, adding new desalination plants is enabled by more debt. Adding more renewable energy and more nuclear plants is enabled by more debt. The increasing the cost of higher education is enabled by more debt. Adding such debt is enabled by the lower interest rates mentioned above.

Effect on Wage Earners of Economy’s Growing Inefficiency

Wage earners find themselves caught in a world with growing inefficiency in many sectors. Their wages are not rising very much, except in a few occupations requiring very high education.

Wage earners find themselves increasingly squeezed. They take out big student loans, only to discover that they really cannot pay them back without deferring buying a home and having a family. Thus the housing industry stagnates. The need for new home furnishing drops as well. Births drop below the “replacement rate.” Young people forego buying cars, because they don’t have good-paying jobs. In fact, many are trying to go to school and work at a low-paid part-time job to support themselves. These jobs do not pay high enough wages to afford a car, so oil use tends to decline.

With wage levels low, women find that it does not make financial sense to join the paid work force if they have children, because the cost of transportation and child care is too high, relative to the wages of, say, a teacher—a job that requires a college education. The situation is similar if an elderly relative or handicapped adult child needs care. As a result, work force participation levels drop. This change started to occur about 2001 in the US.
The Effect of Diminishing Returns (and Crowding Out) on Debt

As the economy becomes less efficient, there are clearly multiple impacts on debt:

- Both businesses and individuals need more debt, because they become less able to purchase the increasingly costly devices they are being asked to purchase (new cars, new factories, new oil extraction facilities requiring significant investment)
- For businesses, the returns on this debt are falling in terms of output measured in units such as barrels of oil or kilowatt hours of electricity; it is only if ever-higher prices for the output can be charged that the debt can be repaid.
- For citizens, wages are becoming less able to cover the cost of needed goods. This both increases the need for debt, and makes debt increasingly difficult to repay.
- Diminishing returns leads to lower economic growth. It is only if interest rates can be kept very low that debt can possibly be repaid. At some point, required interest rates turn negative.

As long as an economy is expanding, it makes financial sense to “borrow from the future”.

Figure 3. US Number Employed / Population, where US Number Employed is Total Non-Farm Workers from Current Employment Statistics of the Bureau of Labor Statistics and Population is US Resident Population from the US Census. (This includes children and others not usually in the labor force.) 2012 is a partial year estimate.
It even makes sense to pay back the debt with interest, because with the growth, there is a reasonable possibility that even with interest, the amount available in the future period will still be increasing, even net of a debt payment.

If we think of interest being paid to what is sometimes called the rentier class (that is banks, insurance companies, pension plans, and rich individuals), then it is the rentier class that is being squeezed by the increased inefficiency that is leading to slow economic growth. In some cases, interest rates are even turning negative, reflecting the poor prospects for the economy. Of course, with negative interest rates, we cannot expect a whole lot of investment—people would rather keep money under their beds than invest it at a negative rate of return.

**Crowding Out of Oil Usage**
World oil consumption has been essentially flat since 1983 on a per-capita basis. Most people have not noticed this change, because world per capita energy consumption has been rising for many years, helping to raise standards of living around the world.¹

The issue we are concerned about in this post is the squeezing out phenomenon, as it relates to oil. As we noted above, there are a number of industries that are becoming less and less efficient, including oil, electricity, metal and minerals, fresh water, higher education, and the medical system. Because of this issue, these sectors are using an increasing share of the world’s oil supply, when direct and indirect usage are included.²

We don’t know exactly how much oil is being devoted to the six increasingly inefficient sectors described in this post, but we do know that the oil consumption per capita devoted to uses other than these six sectors must be falling, because the total is flat. Examples of sectors being crowded out are restaurants, hotels, news media, home building, computer manufacturing, vacation travel, lawn care, and most of the general economy.

The problem with increased inefficiency has been especially acute since 2001, as evidenced by falling employment ratios (Figure 3) and rising oil and commodity prices since that date. In Figure 7, we show two possible trajectories of oil available to the rest of society, net of use by these increasingly inefficient sectors.

---

¹ http://ourfiniteworld.com/2014/12/29/how--increased--inefficiency--explains--falling--oil--prices/

² http://ourfiniteworld.com/2014/12/29/how--increased--inefficiency--explains--falling--oil--prices/
It is very difficult for the sectors that are getting crowded out by the increasingly inefficient sectors to grow, despite growing energy usage other than oil. Oil has many specialized uses. Even if total energy use grows, it cannot make up for uses where oil is specifically needed, such as operating a diesel truck or operating road paving equipment. Thus costs to say, the newspaper industry, are higher if oil prices are higher, but the disposable income citizens have available to spend on newspapers is lower, resulting in the crowding out phenomenon.

**Conclusion**

We are dealing with a networked economy, which I have represented in the past as this child’s toy:
All parts of our economy are interconnected. If parts of the economy is becoming increasingly inefficient, more than the cost of production in these parts of the economy are affected; other parts of the economy are affected as well, including wages, debt levels, and interest rates.

Wages are especially being crowded out, because the total amount of goods and services available for purchase in the world economy is growing more slowly. This is not intuitively obvious, unless a person stops to realize that if the world economy is growing more slowly, or actually shrinking, it is producing less. Each worker gets a share of this shrinking output, so it is reasonable to expect inflation-adjusted wages to be stagnating or declining, since a stagnating or declining collection of goods and services is all a person can expect.

At some point, something has to “give”. One thing we have seen recently is a sudden drop in oil prices that does not represent a sudden drop in the cost of extraction. Instead, it reflects the fact that current wages are not high enough to pay today’s high cost of oil extraction. There is getting to be a difference between

- The full cost of oil extraction, including governmental services needed to keep the country’s economy functioning well enough for this extraction to continue, and
- The amount the economy can afford, considering both wages and the increase (or decrease) in debt for the economy.

This situation is not simply affecting oil; it is also affecting other commodity prices as well. Clearly we cannot continue indefinitely on this trajectory. Something has to give. So far, what we have seen is a drop in oil prices and other commodity prices to levels that are likely to seriously disrupt production. How this will all play out is
How increased inefficiency explains falling oil prices | Our Finite World

How increased inefficiency explains falling oil prices

Worrisome, if a person understands the dynamics behind what is happening.

Notes:

[1] The mix of fuels has been changing, however, with coal use rising in recent years (as we have shifted manufacturing to coal-producing countries) while oil use per capita has remained nearly flat since 1983 (Figure 6). The big decrease in oil consumption per capita in the late 1970s and early 1980s took place in response to the spike in oil prices in the 1970s and early 1980s. Electricity generation shifted from using oil to using coal or nuclear. Cars were made more efficient. Once the “low hanging fruit” were picked in this period, it has not been possible to reduce world per capita oil usage (including substitutes like biofuels and natural gas liquids).

[2] The oil usage I am counting is this analysis is both (a) direct usage by the industry and (b) usage by employees and contractors working in these industries. With a growing number of workers and high wages, these workers are able to afford nice homes, big cars, and vacations requiring air travel. Usage of oil by governments in oil exporting countries should probably also be included as (c) in this list of directly related types of usage, because this usage is necessary to maintain order in these countries.

Share this:

3 bloggers like this.

Related

Oil Limits Reduce GDP Growth; Unwinding QE a Problem
Low Oil Prices: Sign of a Debt Bubble Collapse, Leading to the End of Oil Supply?
Energy and the Economy - Twelve Basic Principles

About Gail Tverberg

My name is Gail Tverberg. I am an actuary interested in finite world issues - oil depletion, natural gas depletion, water shortages, and climate change. Oil limits look very different from what most expect, with high prices leading to recession, and low prices leading to inadequate supply.

View all posts by Gail Tverberg →

This entry was posted in Financial Implications and tagged commodity prices, diminishing returns, economic growth, inefficiency, networked economy, oil prices. Bookmark the permalink.

223 Responses to How increased inefficiency explains falling oil prices

Avery says: