



Numeracy Nugget #9: Thinking About Income Inequality

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Recent reports on the national income inequality issue (e.g. [‘A Generation of Widening Inequality’](#)) give the casual reader the impression that something unnatural or wrong is going on in the country. In this nugget we take a look at some of the important factors that influence how wages are distributed in an advanced economy today paced by accelerating technology. Since in these short pieces we are primarily concerned with critical thinking tools, discussion of public policy responses to this issue is minimized.

Specifically, understanding the points made here will let the informed reader properly evaluate such inflammatory statements as –

- Recent gains in the economy “have not been broadly shared”,
- Wages have barely kept up with inflation, and
- Low earning workers are not getting their fair share.

First, from basic economics we know that wages are made possible by wealth-generating enterprises. Wages are only paid by such enterprises and by other institutions that derive their income from wealth-generating enterprises. Such other institutions are usually tax-funded government agencies/units and non-governmental organizations funded by the government and/or charitable gifts. Economists tell us and history confirms that governments are not known for successful wealth-generation in any activity – including the extractive industries – they undertake. Market driven societies recognize this and seek to separate government activities into the public sphere and risk/profit enterprises into the private sphere.

To generate wealth requires the investment of capital in any of its several fungible (interchangeable) forms – human, financial, property. Since all such investments involve the risk of losing a part or all of the invested capital, they are made only with the intent of getting a return above that which was invested. The more the anticipated risk, the greater the demanded return. Therefore, in commerce the operational definition of profit is the reward for successful undertaking of risk. It was ever thus.

Since before the Industrial Revolution in the early 1800s, human capital has been applied to first develop and then work in concert with property (capital) based on new technologies. The motivation for bringing such technology driven property into an enterprise is 1) the ability to derive profits from new activities/sources, and 2) the ability to increase profits from existing activities/sources through increasing productivity. This all is pretty basic stuff that still eludes many people in the workforce.

The income inequality issue hinges on productivity that is defined as the amount of product or service that is derived from the investment of a given unit of capital. The invested capital is usually in a mix of human and machine (property). For any given level of productivity – e.g. length of a certain ditch dug in a day – there is always a competition between the different mixes of capital applied. Do we put ten men with shovels on it or one operator with a back hoe? The cost of capital decides the day since in free markets the employing enterprise must operate in a competitive environment, and in a competition the person with a backhoe can take on a lot more than ten men with shovels in terms of productivity. Since this example can serve to illustrate the general case, we'll return to it as necessary.

Now suppose we have our backhoe operator who invested some capital (time, money) in getting trained to work the backhoe. Because the operator/machine system is more productive, the operator should be able to earn a higher wage than any of the ten shovelers. But this is only true if it takes more investment on the part of the operator to get qualified with the backhoe than it does for the competing shovelers to learn how use a shovel. If that is not the case, then the operator may wind up earning less than the shoveler, assuming that certain jobs are still best done with shovels alone. This point is often missed in such explanations. Just because you're the human in a more productive man/machine system doesn't automatically get you a higher wage if there's a long line of equally competent and cheaper people standing in line for the job. We must remember that the individual worker also has to make an investment and undertake risk (correct career choice, time lost training, cost of training) successfully to earn that higher wage. If the worker unwittingly chooses to become one of many, then the supply/demand principle takes over and the worker suffers.

With this background we come to the crux of the income inequality phenomenon. Smarter and better educated people on the whole get paid more to start a career and then go on to get bigger pay increases as the years go by than their less educated and more ignorant competitors. Say, the smart worker starts at \$50,000 a year and manages her career to earn annual increases of 10%, and the more ignorant worker starts at \$25,000 and earns 5% annual pay raises. After twenty years the smart worker is making \$336,374 a year and her less educated compatriot is making only \$66,332. At the start, the smarter worker got double the ignorant worker's wage. After twenty years, that multiplier has grown to over five times. Now when you throw in the entrepreneurial factor that many smart people start/join high earning businesses, then you really see the income inequality gap grow in societies that provide such opportunity.

That's the way the world has always worked. The only exceptions to it have been from governments using their police powers to enforce equalization policies through different wealth redistribution schemes. The result is always the same, overall wealth generating capacity of such nations decreases and all are worse off with the most ignorant, as ever, taking the brunt of it. The smart and educated then emigrate if they can and leave the country even poorer, or, if that's not possible, the country becomes a police state.

So far so good from our reading of history. Now we throw into the mix two gorilla factors that today impact income inequality – 1) the approaching Singularity (see [NN8](#)), and 2) the fact that half the workers have below average IQs. Nature imposes such a distribution of natural ability on all critters. The effect of this is that as skill levels for jobs increase, the below average workers don't even have the intellectual access to train for the new jobs that technology creates. We are today racing toward the Singularity and can see that all around us in what [Ray Kurzweil](#) has labeled “accelerating technologies”. The bottom line here is that machines are replacing the functions of human workers at a greater pace as each year passes. The greatest productivity gains for such human/machine systems in the workplace comes from reducing the need for marginally capable humans – i.e. the mid-range wage earners. The low wage earners have already been consigned to tasks they can do by mainly handling things and presenting a still-valued ‘human interface’ to the customer (e.g. store clerks). However mid-wage workers directing incoming phone calls, answering frequently asked questions (FAQs), and evaluating credit risks are already being replaced by more productive machines. This contributes to depressing the mid-range of the wage distribution and highlights even more the difference between the smaller number of high-wage earners and the large number of low-wage earners.

The impact on forging social policies to deal with this is primarily not driven by the fact that in such a society even the low-wage earners will be making more and enjoying a better standard of living as time goes on. Instead, it is driven by the seeming social injustice of the whole set-up. Psychologists who study such things tell us that many, if not most, people are so wired as to be satisfied making \$50K when most others are making about \$50K rather than make \$100K when most others are making \$200K, even if the dollar buys the same things in both cases. We all want to be above average or at least average.

So, unless government steps in and forces redistribution by fiat, the income inequality can do nothing but grow as the smarter people learn to build and use ever smarter machines to be more productive. And redistribution by fiat has proven to be a disaster for all. How to find some golden middle ground policy is beyond the scope of this little nugget, but a much more effective educational system is surely the common first step to any workable new public policy that addresses this issue.

With this understanding one can now understand why “broadly sharing” increasing wealth has always been difficult and is now becoming almost impossible. And having wages “keep up with inflation” is a problem that only the government controls by how much money it prints every year to chase the available goods and services. Any competitive industry, especially those competing globally, can only pay on the basis of worker productivity. Finally, no one has figured out a more sustainable way than the market for determining a worker's “fair share” of generated wealth. All imposed arbitrary definitions of ‘fair’ that ignore productivity ultimately lead to the poor house.

NN8 Problem Solution. In NN8 we considered a flat stone slab that is moved by placing it on two parallel cylindrical logs each one foot in diameter as shown in the figure below.



How many feet forward will the slab move (distance D) for each revolution of the logs?

The little ‘Aha!’ in the solution is realizing that as both centers of each log move forward, then at the same time, the slab is also pushed forward an equivalent distance since there is no slippage between the contact points of the ground, the logs, and the slab. In one rotation the log centers move forward the circumference of the log or $\pi 1$. Concurrently the slab is moved forward a distance $\pi 1$ relative to the log centers. Therefore the slab moves a total distance $D = \pi 1 + \pi 1 = 2\pi$ relative to its starting point on the ground.

NN9 Problem – Inflation Adjusted Appreciation. The common formula for calculating inflation adjusted appreciation given by the media and almost all investment advisors is wrong. The common formula known by most people is that the adjusted rate of appreciation of an investment that appreciates $I\%$ over a period, say, one year during which the rate of inflation is $F\%$ is simply $(I-F)\%$. This is a crude approximation that gets worse as the inflation rate increases. Derive the correct formula to use for one period. Hint: Find the buying power of an appreciated dollar that is spent for inflated goods to yield A the actual rate of appreciation. To check yourself assume that $I = 15\%$ and $F = 10\%$. The common answer of $A = I - F$ gives 5% instead of the correct answer 4.55%.

Inflation takes a significantly bigger bite out of invested dollars whether you invest them under your mattress or in some more sophisticated asset. For extra credit derive the formula for N periods where I and F are the periodic rates defined above. Putting $N = 1$ should again give you $A = 4.55\%$. And if you invest for $N = 5$ years with the annual rates $I = 15\%$ and $F = 10\%$, then you should get 24.89% for the total appreciation instead of 27.63% which is the wrong answer using the common formula for annual return compounded over 5 years. Deriving the correct solution requires nothing beyond a bit of high school algebra and clear thinking. You will be amazed at how the error in the common formula grows for actual appreciation of multi-year investments.