Third Quarter 2026

Economic and Market Commentary

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MAN'S INVENTION OF TOOLS

Archeologists tell us that some 3.3 million years ago, even before the genus Homo appeared, these earliest relatives of ours started making tools. At first they were sharp-edged stones created from a process known as knapping (hammering one stone with another in order to flake off pieces with sharp edges). These earliest tools were then used to skin animals, cut plants and break bones to get to nutritious marrow.

Life went on much as it had for some 2 million years until man's ingenuity led him to understand his chopping and hacking would gain much greater force through leverage if he added a handle to his stone tool, thus inventing the axe. After the axe came the spear. For the next million years or so, life remained pretty much status quo. Somewhere around 800,000 years ago innovation started to heat up. Why? Because that's when man learned to use fire.

Harnessing fire proved to be a game changer. Fire was used for warmth, nighttime protection and cooking. Up to this point all proteins were consumed raw, leading to a shortened life expectancy for these hunter-gatherers. And so life continued for the next 750,000 years, and then things changed dramatically.

During this 750,000-year period man did refine the tools he had been making. Spears received stone, arrow-shaped heads making them more lethal. Blades became sharper, and very fine, very sharp flakes of flint or chert were found that could be used to make very small holes. This new tool is referred to as burin spalls by modern day archeologists. So, you may ask, what's the big deal in being able to make very small holes? If you think about it for a minute or so, I bet the answer will come to you.

THE BIRTH OF THE NEEDLE

We take sewing needles for granted today, but the question begs to be asked: why were they so important 750,000 years ago? The answer is a bit more complex than one might assume on the surface. The obvious answer is that the needle enabled people to make

clothing. Clothing that helped them protect their bodies from the dangers of their environment. Remember, antibiotics were light years away. What we now consider a simple cut or puncture could have been fatal within days back in the Stone Age. Animal skin clothing afforded them a layer of protection they had never even dreamed of in their past. They were the original nudists.

But as I alluded to earlier, the needle's work went far beyond its contribution to fashion; it opened up an entire and abundant food source. Fish. Being able to create fishhooks (really just bent needles) and fishing nets, an entirely new food supply became available. Oh sure, early man had tasted fish, but have you ever tried catching a fish with your hands?

Well, I have. It was up in the northern reaches of Canada. My guide made it look doable. Not easy, but doable. All I can say is I'm glad there was no cell phone video to document my pathetic efforts.

THE NOMADIC LIFE

So life went on relatively unchanged for the next 700,000-odd years. Small bands of people would follow the seasons. They hunted, some species to extinction, fished and often lived in caves, keeping warm at night through the fire they learned to harness hundreds of thousands of years prior.

During the later years of the Stone Age, an expressive side of early man surfaced. They began to record their environment through art, leaving behind "cave art" of their environment, particularly images of the animals that provided their sustenance, those that killed their hunters and the astronomical phenomena that they could not easily explain yet governed much of their very existence. Sunrises, moonrises, the North Star along with constellations. Civilizations to come would use these same phenomena to build their religions upon.

The hunter-gatherer life continued throughout the millennia. In a way, it's hard to believe that out of 3-plus million years of human history, it's less than 12,000 years ago that the next seismic change occurred in mankind's evolution.

THE BIRTH OF AGRICULTURE

Somewhere around 10,000 years ago, in a region modern day historians refer to as the "Fertile Crescent," a region now comprised of Turkey, Syria, Israel and Iraq, a new type of lifestyle emerged, for this was the dawn of agriculture. No longer would tribes follow the herds, living off the land in temporary encampments as they had done for more than 3 million years.

Within just a couple of thousand years, people all around the globe were cultivating various grains and beans, such as emmer, wheat, peas, lentils and flax. Cattle were domesticated

from the wild aurochs in areas such as Turkey and India. People were now living in permanent villages, no longer following the seasonal herds.

Why, after so many millions of years of the nomadic life, were people finally settling down into permanent communities? The answer again is ingenuity and invention.

HARNESSING THE GRASSES

For roughly 100,000 years, early man recognized that certain wild grains could be collected and eaten. But it wasn't until tens of thousands of years later that they discovered the wild grasses could be cultivated, grown and harvested in a timed and orderly fashion. The catalyst for this transition was the invention of the sickle. If one were to casually look at a sickle, even a modern one, the first thing they'd notice is its curved shape. Curved to mimic the shape that a human arm would take slicing and gathering grain stalks with a flinted blade.

The earliest sickles were constructed of sharp teeth fashioned out of flint or obsidian and then glued into a curved piece of wood, bone or antler. Simultaneously, grinding stones and digging tools emerged so seasonal planting could occur and permanent settlements could flourish.

With this agricultural revolution came the invention of primitive woodworking tools, initially used to help clear forested fields in order to create more plantable acreage and build shelters. Although the tools used were more refined and polished, they were still made from stone, bone, wood, grasses and animal parts. This limited their efficiency, which meant almost all of these early populations spent their time producing food.

ENTER THE AGE OF METALLURGY

Around 5,000 years ago, humans discovered they could produce stronger, more durable and far more efficient tools if they made them out of metal. Early inventors realized if they melted tin and copper together they could produce bronze. This new material enabled the production of stronger plows, axes and chisels.

Bronze ruled supreme until it was realized that these relatively rare metals came together through an elaborate system of trade networks. These networks eventually broke down, and the essential materials were no longer readily available. What was available was iron ore. Iron ore was plentiful but required temperatures much higher than the furnaces of the day could produce in order to melt the ore so the iron could be worked and hammered. This problem was eventually solved with the invention of the bellows. By forcing air through the furnace that contained the iron ore and red-hot charcoal, the necessary temperatures could be reached to forge iron products, which ultimately led to steel.

Plows now became much more efficient and weaponry became much more proficient, which fueled increased food supply, larger settlements, large-scale population movements and empire building through the armament of foot soldiers who otherwise would have been bound to the soil.

Urbanization occurred when fewer people were required to feed populations, freeing up workers to apply themselves to specialized crafts and skills, laying down the foundation for modern industrial development.

FAST FORWARD

Most historians would mark the end of the Iron Age at about 1 AD. Over the centuries that followed, wood pulp paper was invented, then came the Arabic numeral system and the concept of "zero," which changed computation forever, laid the groundwork for algebra and, as mathematicians will tell you, is the "ancestor of modern computer binary code." Soon paper was used as currency by the Tang/Song Dynasty. These same Chinese inventors of the Tang/Song Dynasty invented the magnetic compass, gunpowder and firearms.

Innovation and experimentation were pandemic. Medieval Europe invented the mechanical clock, and the Italians invented eyeglasses before the 13th century ran out. Some hundred and fifty years later, Johannes Gutenberg saw that those Italian eyeglasses were put to good use when he invented the movable type printing press. Many scholars consider this the most influential invention of the second millennium. The printing press democratized knowledge and led the way to the Renaissance and the Scientific Revolution.

By the end of the 16th century, the compound microscope was invented in the Netherlands, opening man's eyes to the micro world of cells and microbes, which eventually revolutionized the world of medicine and biology. Less than 20 years later, Galileo's refracting telescope reshaped man's understanding of the Earth's place in the universe, turning our understanding of physics on its head.

NOT ALL INVENTORS ARE HOUSEHOLD NAMES

Inventing can often be a lonely profession, one that is often performed after your day job is over. Allow me to share with you half a dozen people, most of whom you've never heard of, that will help me square the circle and conclude (at least for now) our 3-part series on the phenomenon of Artificial Intelligence.

Up to now I've brought you on a 3.3 million-year journey; just stick with me for another 300-odd years. Here are the players and here are their contributions.

- **Thomas Savery** was an English military engineer. In 1698 he patented a pump to be used in mining. It was hand operated and designed to pump water out of mines.

English coal mines were going deeper and deeper, having to deal with more and more water accumulation. Savery's pump, although inefficient, relied on steam as its power source, which helped the vacuum component suck up water from below. His invention was nicknamed the "Miner's Friend."

- **Thomas Newcomen's** day job was as an "ironmonger." You're probably wondering, what is an "ironmonger"? Well, think of a hardware store owner that sold mainly iron goods. By night he was an inventor. He took Savery's "Miner's Friend" and added pistons to it, which helped separate the condensing steam from the water it was pulling and created a system of far greater efficiency.
- **James Watt** was by day a professor and instrument maker at the University of Glasgow. By night, an inventor. In 1769 Watt was asked to repair a Newcomen engine. After rolling up his sleeves, he was amazed to see how much steam was wasted in Newcomen's engine. He healed the ailing engine by installing a separate condenser and modifying the design so that it could turn a shaft and not just pump up and down. This modification enabled the "steam engine" to soon power mills, ships and eventually locomotives. (Parenthetically, he invented the equation that calculates "horsepower" and the "watt," a standard measure of power used to this day was named after him.)
- Once it was determined that the steam engine could drive a shaft, it wasn't long before a British mining engineer by the name of **Richard Trevithick** made some modifications and produced the first locomotive. In 1804 he demonstrated the practicality of the locomotive by having it haul 10 tons of iron and 70 people almost 10 miles through the Penydarren Iron Works in South Wales.
- Little more than 20 years later, the Stockton & Darlington Railroad was regularly transporting coal and hundreds of passengers daily. Lines soon opened in Liverpool and Manchester. Within years, they proliferated throughout Europe and the United States.

THE IRON HORSE

Not only did train travel open the American West, it proved to be the most reliable and fuel-efficient form of surface transportation there is. Think of this: last year, 2025, approximately 1.6 billion tons of goods traveled across the nation's rail lines delivering chemicals, automobiles, construction materials, grains, coal and cattle, to name just a few of the commodities they delivered. Some freight trains can be comprised of hundreds of cars measuring more than two miles in length. Here's what I find so amazing: according to the Federal Railroad Administration, freight rail can move one ton of freight 470 miles on one gallon of diesel fuel. That's four times more efficient than using trucks to move freight over land.

LET ME BRING IT HOME

We are now looking back on a technology more than 200 years old and more vital than ever. Through engineering and innovation, rail freight advanced to what it is today. But along with these advancements came safety challenges. The trains were bigger, faster and more prevalent, and safeguards had to keep up.

Early railroading was a dangerous business, so dangerous in fact that the earliest trains didn't even have whistles to let you know they were coming. Poor William Huskisson, a member of Parliament, found out the hard way. In 1830 he was disembarking a VIP train and was struck and killed by another train traveling in the opposite direction without a whistle. Recognizing that trains needed to be safe and the public needed to feel safe, the industry and government worked in concert to improve safety very shortly after Huskisson's death.

The first thing the industry did was post human crossing guards at the busiest intersections. Their job was to keep people and wagons away from train crossings as a train approached. They did this by waving flags. These guards became known as "signalmen." Just a few years later the steam whistle was invented so trains could give distant warnings they were approaching a crossing.

A major breakthrough occurred when the crossing gate was patented and went into use in 1867. Just two years later the air brake was patented, which enabled the engineer to apply the brakes all at once from the cab rather than a brakeman having to hand crank each individual car. Next came the "knuckle coupler," which allowed cars to connect on impact rather than the dangerous work of hand dropping pins into place, connecting the cars one by one.

Still in his mid-twenties, George Westinghouse invented the automatic air brake, which allowed each car to stop on its own if it got disconnected from the others. Standard railway time was adopted to avoid confusion over local times. Federal regulation now came into play with the *Interstate Commerce Act*, the Safety Appliance Act and the Hours of Service Act. Automatic warnings and gates took the place of manually operated ones.

By 1966 the Federal Railroad Administration was formed. Four years later the FRA started studying automatic train controls. And so the collaboration between government and private industry continues to this day with the intention of making our trains safer and more efficient. Just in 2020, it was announced that all 57,536 miles of federally mandated Class 1 train lines (those carrying hazardous materials or passengers) were now under PTC (Positive Train Control), which automatically stops collisions and overspeed derailments.

CONCLUSION

Alright, I'll admit it, it took me long enough to bring up the topic of Artificial Intelligence, perhaps the most earth-shaking invention in the history of mankind. Only 50 years since first imagined, it's now doubling in capabilities every 4 to 6 months, depending on who you listen to.

Think about it: just in the past 3 months since my last commentary, OpenAI built an unauthorized channel and hacked a competitor, Hugging Face, and then tried to cover its tracks. Anthropic's Claude escaped from its "sandbox" and began writing malicious code. Down Under, OpenAI breached Australia's version of Medicare and stole people's medical data.

Here's a new term for you: "in-context scheming." What's it referring to? It's referring to AI systems bypassing or editing "shutdown" scripts (scripts that could turn them off), copying themselves and hiding the duplicates, and then lying about it to their human handlers. Government and enterprise sites such as the SEC and the Departments of Commerce and Education have been accessed without authority.

Within the industry itself, companies like OpenAI and Anthropic are calling for a slowdown in development and shelving their most advanced iterations because severe misconduct has repeatedly been uncovered. Both hardware and software providers are launching specialized safety platforms in an effort to lock down autonomous behavior.

Keep in mind this is playing out against a backdrop of a 21st century arms race with China for AI supremacy, one of the core reasons the government has been slow in initiating federal regulation. On a more positive note, the myth that AI will result in fewer jobs is proving to be a false beard. Labor statistics state that since the advent of ChatGPT in late 2022, some 225,000 workers have been displaced, yet more than 1,000,000 AI-related jobs have been created: engineers, software developers, mathematicians. Some of the occupations originally thought most vulnerable, like paralegals and market research analysts, have actually grown very robustly due to gains in productivity resulting in more work.

So to keep things on track, no pun intended, what type of safety frameworks and regulatory responses should be in place? After all, if the railroads recognized the necessity, surely we can recognize the necessity for controls and oversight for the most powerful tool yet invented by humanity. Any set of protocols needs to have international buy-in, so it's only reasonable that at the top of the list is:

- **International Coordination** – This should include shared standards and cross-border risks.

- **Incident Reporting** – Any breaches or misuse should be reported swiftly to minimize the risk of greater damage.
- **Bias and Discrimination** – Audits should be done regularly and consistently to avoid unfair outcomes.
- **Human Oversight** – When high-stakes decisions are being evaluated, human review is needed with the ability to override or shut down the system.
- **Pre-Deployment Testing** – Before the release of an agent, it should be tested for potential deception and dangerous capabilities.
- **Compute and Model Thresholds** – The higher the computing capabilities of the program, the more robust the controls and safety plans should be.
- **Accountability and Liability** – If something goes awry and people or institutions are harmed, there needs to be accountability and the prospect of compensation. Companies can't wiggle out by blaming it on a faulty algorithm.
- **Data Privacy and Consent** – People's personal data should not be available for training purposes without their consent. If misinformation is used, people should have an easy path to have it corrected.
- **Transparency and Disclosure** – People should know when they are interfacing with AI-generated content, enabling them to do greater research as to whether or not they are dealing with misinformation.
- **Risk-Based Classification** – Currently AI systems are broken out into 3 basic categories: minimal risk, limited risk and high risk. High-risk classified functions, which could include credit, health and hiring, should require a higher standard of care or be banned until such time as the appropriate safeguards are in place.

Bet you thought I'd never get there, but now you have the third installment of our 3-part series. If you go back to my 4th Quarter 2025 outline and compare it to today, you can see how rapidly the landscape is changing, and it will continue to do so exponentially.

My very best wishes for a happy and healthy fall season.

With best regards,

Ray