Arbitrage: it isn’t an often-heard word when discussing the economy. In fact, I consulted the indices of 6 textbooks in economics, covering micro or macro or both, and ranging from mostly qualitative to strongly mathematical, and found not a single entry; but its importance to markets can be hardly overstated. In order to understand why this is, we need to first think a little about how markets work and the role of information in the marketplace.

A key observation is that markets work most efficiently when they are at a natural equilibrium, and their approach to equilibrium or even the equilibrium they assume can be impeded by insufficient information about the goods and services being sold.

For example, in Chapter 18 of his book *Principles of Economics: Economics and the Economy Version 2.0*, Timothy Taylor discusses how imperfect information can impede economic participation in each of the markets for goods and services, labor, and finance. A person seeking to buy a used car is naturally wary about the quality of the car, about which they know very little and the seller knows far more. An employer looking to hire a new employee is also naturally wary about the quality of the employee, because all that he can discern comes from a résumé and an interview. (As a side note, this is why the coding interview, in which prospective computer programmers are given real problems to solve, exists as a hiring gate.) Finally, a person seeking a loan from a bank has to contend with the bank’s inherent skepticism about the soundness of their repayment prospects, even if the person has an impeccable character where borrowing money is concerned.

These reluctances serve to slow down economic participation, push the equilibrium away from where it would sit in a market with perfect knowledge, and can lead to unintuitive situations where raising prices can actually raise demand rather than the other way around (that, however, is a post for another day). Collectively, economists term all these ‘non-ideal’ market behaviors as inefficiencies.

A sad but powerful example of the kind of havoc uncertainties can wreak is summarized in Jamie Goldberg’s article [*Downtown Portland businesses, derailed by pandemic, say protests present a new challenge*](https://www.oregonlive.com/coronavirus/2020/07/downtown-portland-businesses-derailed-by-pandemic-say-protests-present-a-new-challenge.html). In the article, Goldberg quotes Andrew Hoan, president and CEO of Portland Business Alliance, as saying of downtown Portland:

“It’s unique, it’s boutique, it has the best of all kinds of experiences for customers and for employees and for employers, and it’s devoid of that now because of the uncertainty.”

Markets have developed lots of different ways of dealing with inefficiencies and the risks that follow. Some of the more well-known ones are guarantees, certifications, and insurance and premiums. Interest rates on loans are structured to provide the lender some insurance against the default of the loan as seen in the usual formula:

<Interest Rate = Risk Premium + Expected rate of inflation + Time value of money.>

The last two terms collectively account for the simple fact that a dollar spent today provides more utility than a dollar spent tomorrow because 1) inflation eats away at the purchasing power of money (‘Expected rate of inflation’ term) and 2) the enjoyment derived from a good or service is less when one has to wait for it (‘Time value of money term representing delayed gratification). Since both of these effects are known beforehand, they attach to any transaction. The first term (‘Risk Premium’) represents all of the uncertainty brought on by the lack of knowledge about the transaction (does the good have high quality? is the borrower going to pay it back? and so on).

The mechanism of [arbitrage](https://en.wikipedia.org/wiki/Arbitrage) is another powerful way for the markets to deal with some of these inefficiencies by making it profitable for traders to equalize information between all parties. It just isn’t as broadly familiar.

In a nutshell, arbitrage is the purchase and subsequent sell of some good (typically called an asset) in order to profit from a positive difference between the final market’s price and the asset’s price in the original market.

In theory, the exercise of arbitrage offers zero risk because the resell is instantaneous and the receiving market can accommodate the amount being resold. In reality, nothing is truly risk free, and a number of complications can arise that blunt the attractiveness of arbitrage.

For example, suppose that bananas sold for $1.00/pound in Joe’s Market but $1.40/pound in Fred’s Market elsewhere in town. Then a person can possibly make money by purchasing a supply of bananas at Fred’s and transporting them to Joe’s market. In this fashion arbitrage eliminates or, at least, helps to lessen imbalances in the economy caused by a lack of information (since if shoppers knew they could get bananas cheaper at Joe’s than Fred’s they would, all other things being equal, shop for bananas at Joe’s). Arbitrage also facilitates a better match between supply and demand, again smoothing out imbalances caused by lack of information and other factors. However, it is important to realize that arbitrage is distinct from distribution by a middle man even if they share some aspects.

Many real world factors contribute to making this typical introductory example more complicated than it might seem at first glance. The primary complication is that the time needed to purchase, transport, and subsequently resell the goods must make it worthwhile engaging in this form of arbitrage. The profit earned on the resell must be great enough to outweigh the transportation cost, regulatory fees, and the opportunity costs in order for people to engage in it. These barriers are why we don’t typically see parties engaged in retail arbitrage.

As the internet-of-things has made the flow of information incredibly easier, it is now possible to find people talking about their retail arbitrage efforts moving product from brick-and-mortar shops for resell on Amazon and Ebay.

<iframe width="560" height="315" src="https://www.youtube.com/embed/T-u0W7n324Q" frameborder="0" allow="accelerometer; autoplay; encrypted-media; gyroscope; picture-in-picture" allowfullscreen></iframe>

Of course, retail arbitrage is still a rare thing not only because of the resell risk but mostly there are more efficient ways for most of us to make money without the ‘hustle’. Far more common and more important is the use of arbitrage in a macroeconomic setting where it is used smooth out inefficiencies in the financial markets.

In the coming months, this column will explore some of the aspects of arbitrage in the macroeconomic setting, how arbitrage activities tend to cause prices in different markets to converge, and what may happen when arbitrage opportunities are frustrated.

not unheard of in certain cases the free flow of information much

However, there The cost to transport the bananas from Fred’s to Joe’s must be less than profit earned on the resell, ththe to In this simplified example (In reality, sever al

Arbitrage

In the classical theory, the asset can be purchased and sold simultaneously thereby producing a profit at zero risk. This idealization is never met in actual trading situations although cer

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Arbitrage Pricing Theory (APT) – Adam Hayes

<https://www.investopedia.com/terms/a/apt.asp#:~:text=Updated%20Jun%2025%2C%202019.%20Arbitrage%20pricing%20theory%20%28APT%29,number%20of%20macroeconomic%20variables%20that%20capture%20systematic%20risk>.

* Arbitrage pricing theory (1976 by American economist, Stephen Ross)
  + Multi-factor asset pricing model
  + Basic idea – an asset’s returns can be predicted using a linear relationship between the asset’s expected return and a number of macroeconomic variables
  + The macroeconomic variables capture or define the systemic risk
  + <R>\_i = <R>\_z + \beta \* (<I> - <R>\_z)
    - <R>\_i – asset’s expected rate of return
    - <R>\_z – risk free rate of return
    - <I> - Risk premium associated with factor i
    - \beta – sensitivity of the asset price to macroeconomic factor n
    - Messed up model – both in concept and embodiment from this website
  + This model is an alternative to the capital asset pricing model (CAPM)
  + CAPM assumes markets are perfectly efficient and only accounts for market risk; APT assumes that markets can and do misprice and accounts for multiple risk/error sources
  + This model is not risk free arbitrage “because investors are assuming that the model is correct and making directional trades- rather than locking in risk-free profits”
  + APT factors are systemic risk that cannot be reduced by diversification
  + APT factors most commonly used
    - GNP
    - Unexpected changes in inflation
    - Corporate bond spread
    - Shifts in the yield curve
    - GDP (lesser)
    - Commodities prices (lesser)
    - Market indices (lesser)
    - Exchange rates (lesser)
  + Example of How Arbitrage Pricing Theory Is Used
    - For example, the following four factors have been identified as explaining a stock's return and its sensitivity to each factor and the risk premium associated with each factor have been calculated:
      * Gross domestic product (GDP) growth: ß = 0.6, RP = 4%
      * Inflation rate: ß = 0.8, RP = 2%
      * Gold prices: ß = -0.7, RP = 5%
      * Standard and Poor's 500 index return: ß = 1.3, RP = 9%
      * The risk-free rate is 3%
    - Using the APT formula, the expected return is calculated as: Expected return = 3% + (0.6 x 4%) + (0.8 x 2%) + (-0.7 x 5%) + (1.3 x 9%) = 15.2%

<https://corporatefinanceinstitute.com/resources/knowledge/finance/arbitrage-pricing-theory-apt/>

* APT aims to pinpoint the fair market price of a security that may be temporarily incorrectly priced
* the APT’s concept of arbitrage is different from the classic meaning of the term; In the APT, arbitrage is not a risk-free operation – but it does offer a high probability of success
* Historical returns on securities are analyzed with linear regression analysis against the macroeconomic factor to estimate beta coefficients for the arbitrage pricing theory formula.
* Example
  + Assume that: You want to apply the arbitrage pricing theory formula for a well-diversified portfolio of equities.
    - The riskless rate of return is 2%.
    - Two similar assets/indices are the S&P 500 and the Dow Jones Industrial Average (DJIA).
    - Two factors are inflation and gross domestic product (GDP).
    - The betas of inflation and GDP on the S&P 500 are 0.5 and 3.3, respectively\*.
    - The betas of inflation and GDP on the DJIA are 1 and 4.5, respectively\*.
    - The S&P 500 expected return is 10%, and the DJIA expected return is 8%\*.

Arbitrage Pricing Theory: It’s Not Just Fancy Math Elvin Mirzayev

<https://www.investopedia.com/articles/active-trading/082415/arbitrage-pricing-theory-its-not-just-fancy-math.asp>

* Inherent to the arbitrage pricing theory is the belief that mispriced securities can represent short-term, risk-free profit opportunities.
* The theory does, however, follow three underlying assumptions:
  + Asset returns are explained by systematic factors.
  + Investors can build a portfolio of assets where specific risk is eliminated through diversification.
  + No arbitrage opportunity exists among well-diversified portfolios. If any arbitrage opportunities do exist, they will be exploited away by investors. (This how the theory got its name.)
* Changes parameters include
  + Changes in inflation
  + Industrial production
  + Risk premiums
  + Interest rates
* Factor sensitivities come from multi-variate regression
* Example – S&P 500 and NASDAQ with 2% risk-free return each and expected return of 7 and 9 respectively

Nice Video

<iframe width="560" height="315" src="https://www.youtube.com/embed/ntKlSsSlumU" frameborder="0" allow="accelerometer; autoplay; encrypted-media; gyroscope; picture-in-picture" allowfullscreen></iframe>

Arbitrage Betting: <https://www.youtube.com/watch?v=TGinzvSDayU>

Retail Arbitrage: <https://www.youtube.com/watch?v=T-u0W7n324Q>