
Andreas Krause
Hedging and market crashes
NEW YORK STOCK EXCHANGE
NYSE
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LIVERMORE

- Stock market crashes are often seen as the result of overvalued stocks correcting their prices and aligning again with their fundamental value.
- However, the reason for such a sudden change in the stock price is not easily identified.
- We will here discuss a model based on the demand for stocks that includes hedging by uninformed investors.

Demand for assets by informed and uninformed investors

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- Informed investors will have signals about the value of the stock, and we assume these signals to differ. The higher the price, the fewer informed investors will have a signal that suggests an even higher fundamental value. Thus the demand for stocks will decrease the higher the price is.
- If the stock price is particularly high, uninformed investors, who maximize their utility and are thus not noise traders, will see substantial risks in that the value of the stock is below this price. To avoid large losses, they might want to hedge their risks from a falling stock price.
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  - However, this hedging is ideally such that they can still make gains if the stock price increases further,
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- With informed investors buying put options, the seller of such options, often banks, hedge funds, pension funds, or insurance companies, may want to hedge the exposure the selling of the put option has caused them.
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- This expression is negative and will hence create a negative demand for shares and how big this demand is can be obtained from Δ_P.
- The more put options are bought by informed investors, the more hedging demand exists, thus the more short selling can be observed.
- The nature of Δ_P is such that the demand will depend on the price of the underlying stock, but it will do so on a nonlinear way.

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Increasing hedging demand

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→ Let us consider what happens if we increase the demand for hedging.
- We look at the relationship between the stock price and the demand.
- The demand by informed investors we argues was having a negative slope as indicated here.
- We now introduce the hedging demand. This demand was negative.
- If the amount of put options bought by uninformed investors is low, the hedging demand will be low.
- We take this hedging demand off the demand by informed investors as we interpret the demand as the overall net demand.
- We can now increase the number of put options bought, increasing the hedging demand. Note that the hedging demand is non-linear.
- This will reduce the total demand further and we see that the total demand also becomes non-linear.
- We increase the number of options bought even further.
- This reduces the bet demand even more.
- However, now we see in the circle that the slope of the total demand become very high at one point. We will now sow what happens if we increase the number of bought options further.
- We increase the hedging demand again.
- Now the total demand become highly non-linear.
- In the circle area, the demand curve becomes backwards sloping. Thus the demand curve is not always having a negative slope, there is a small area where the slope is positive; a higher price increases demand for the stock.
- We can now increase the demand further.
- We see that the backward sloping part becomes more pronounced and covers a larger area.
- A final increase in hedging demand.
- This gives us a clearly non-monotonous demand function.

→ We therefore see that if hedging demand is sufficiently large, that is there are enough uninformed investors seeking to hedge their positions, the demand for the stock becomes non-monotonous.

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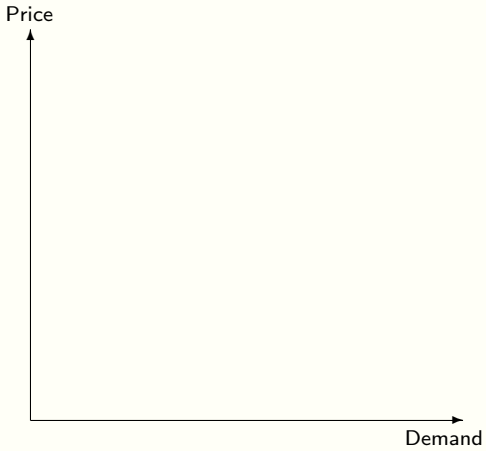

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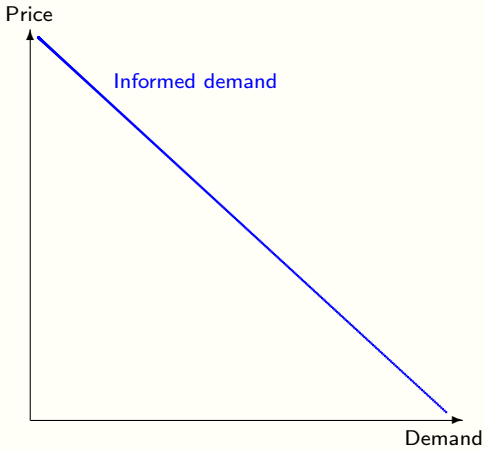

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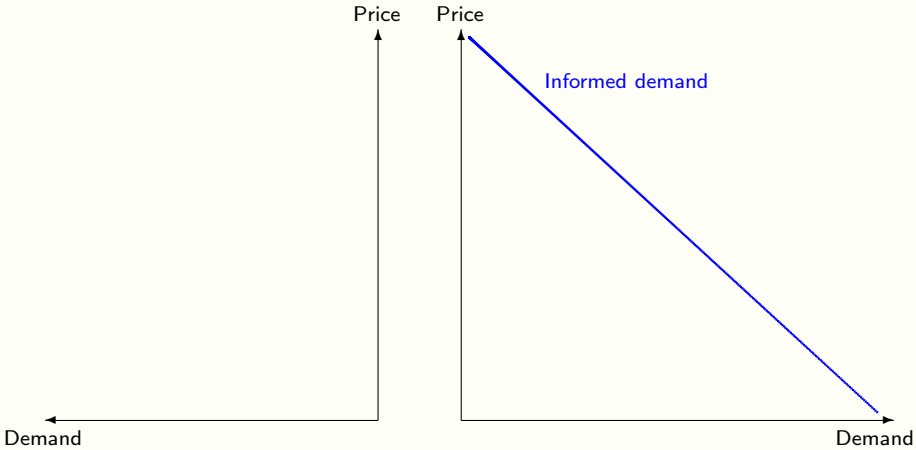

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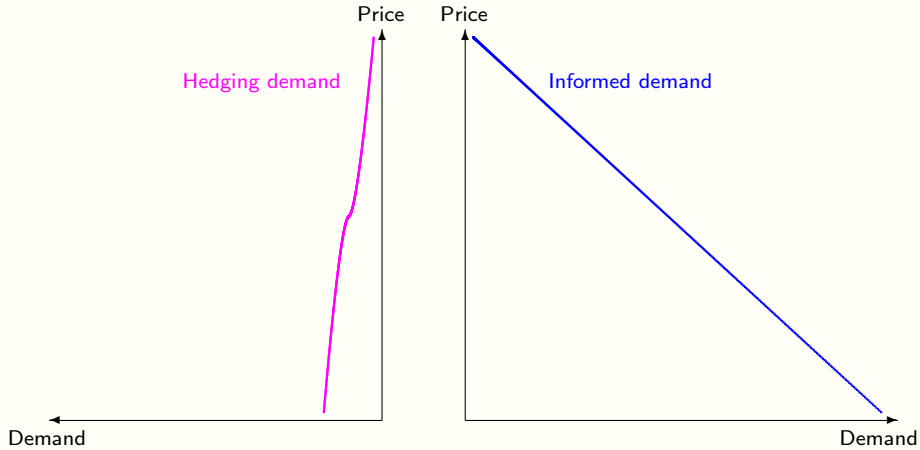

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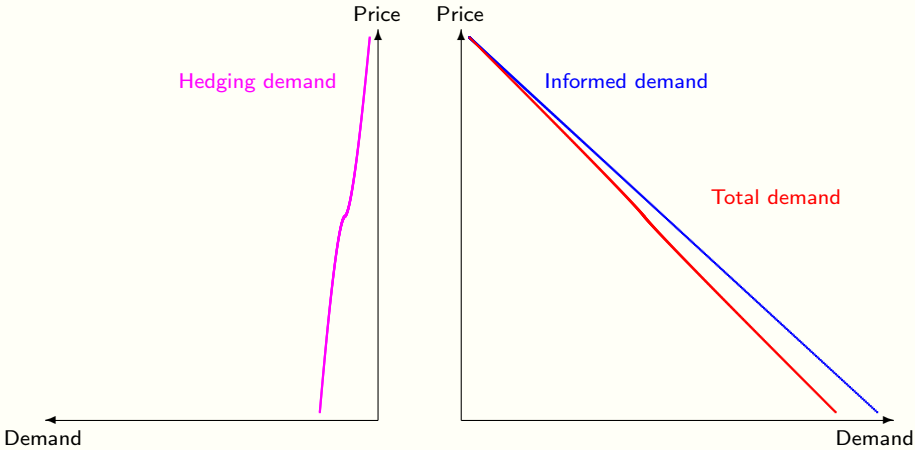

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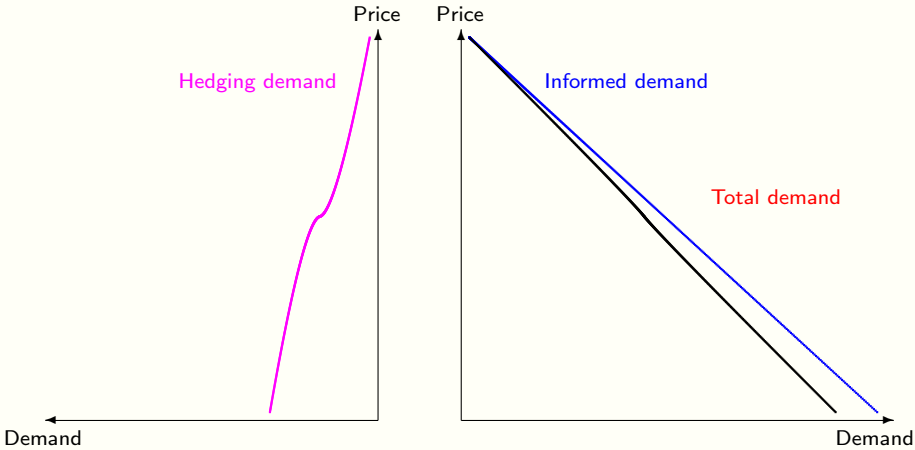

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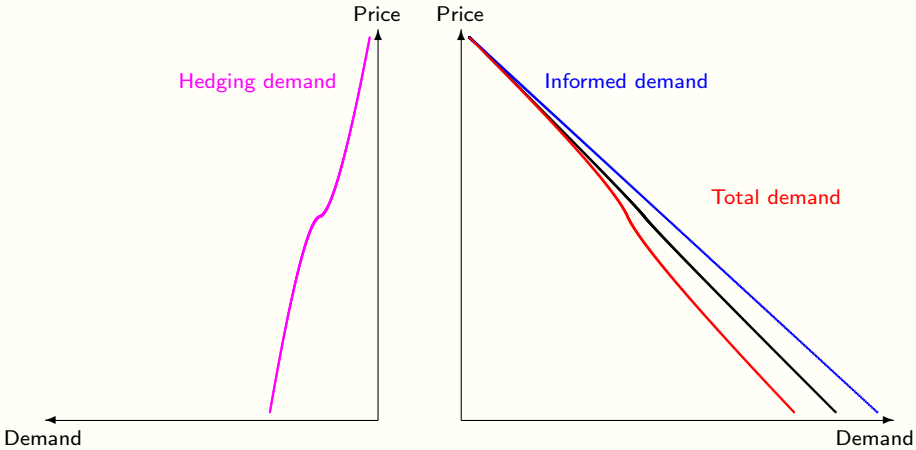

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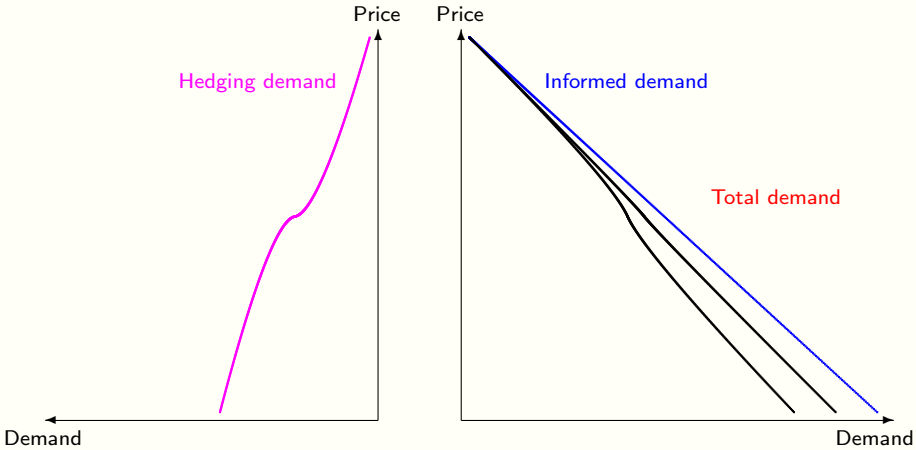

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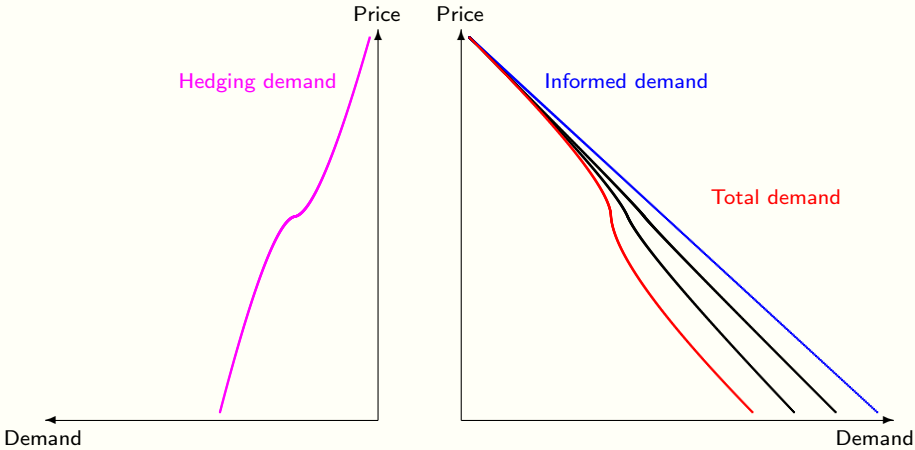

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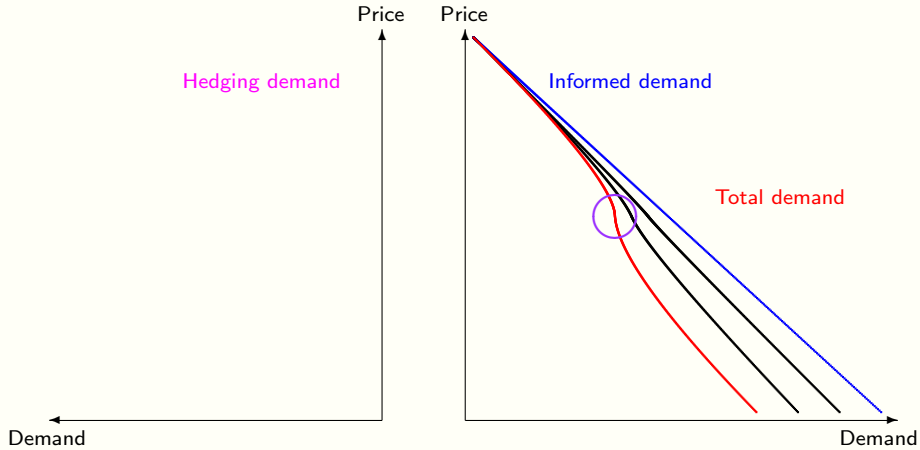

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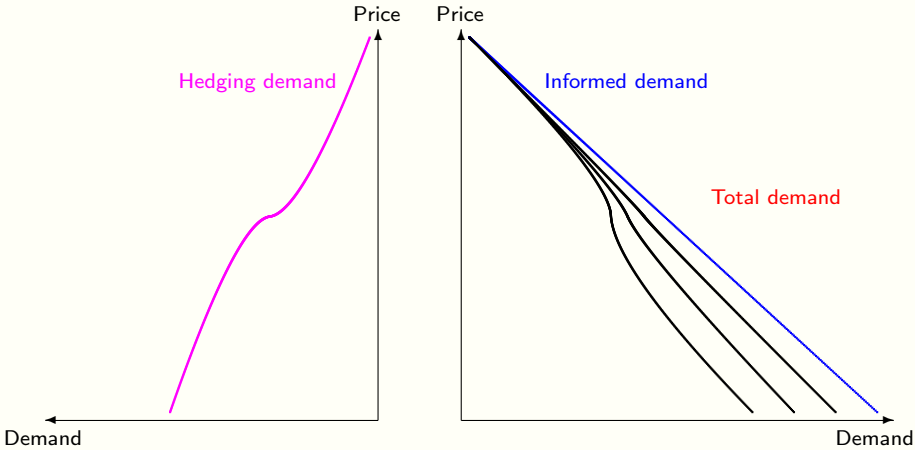

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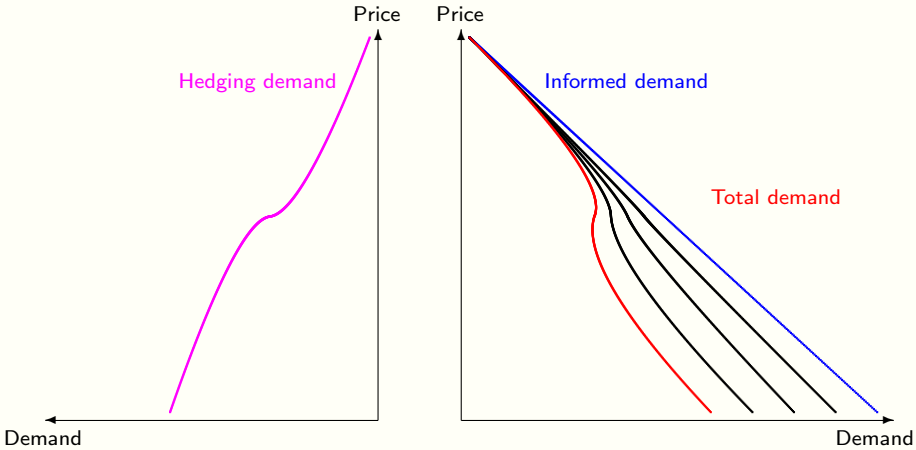

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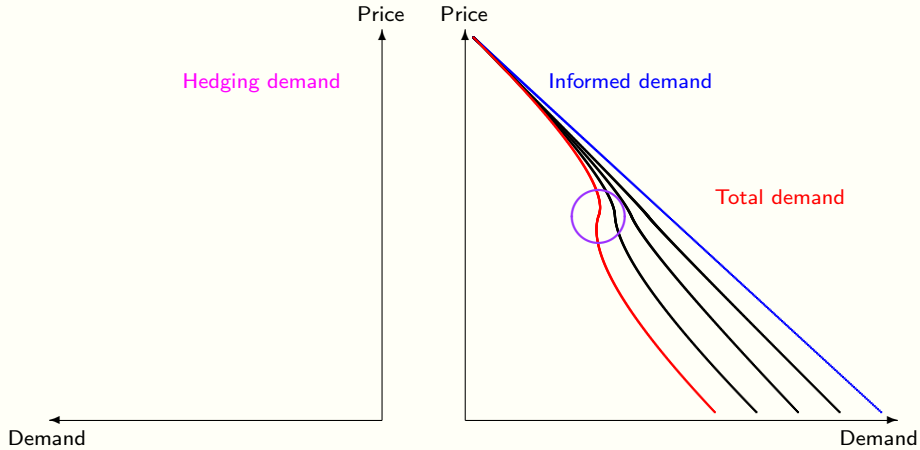

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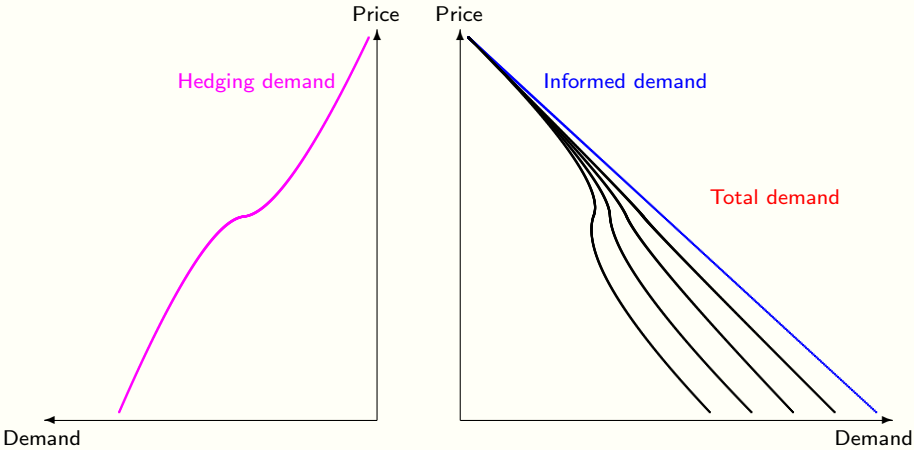

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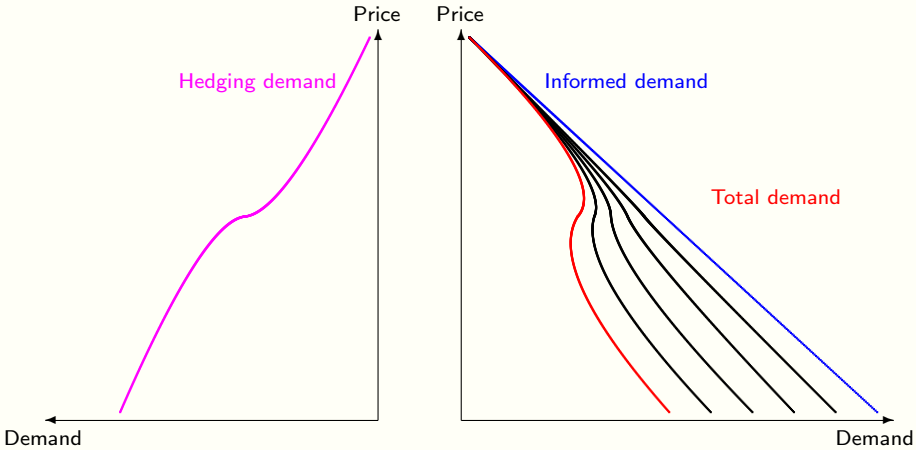

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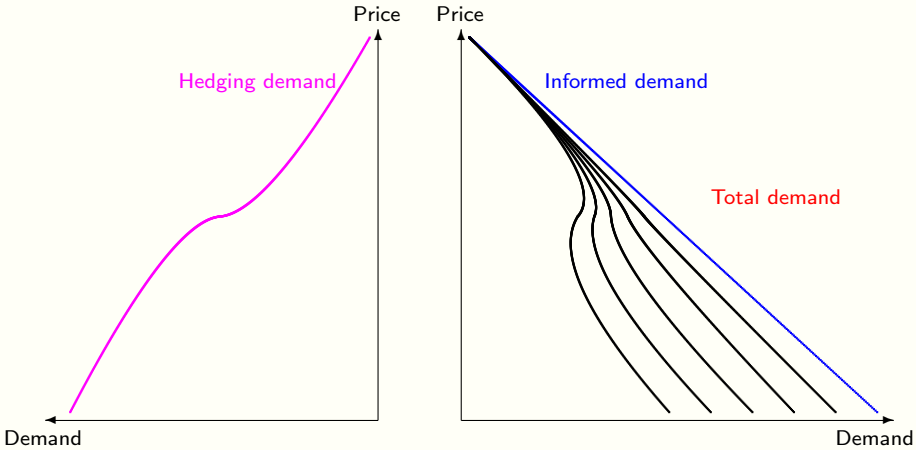

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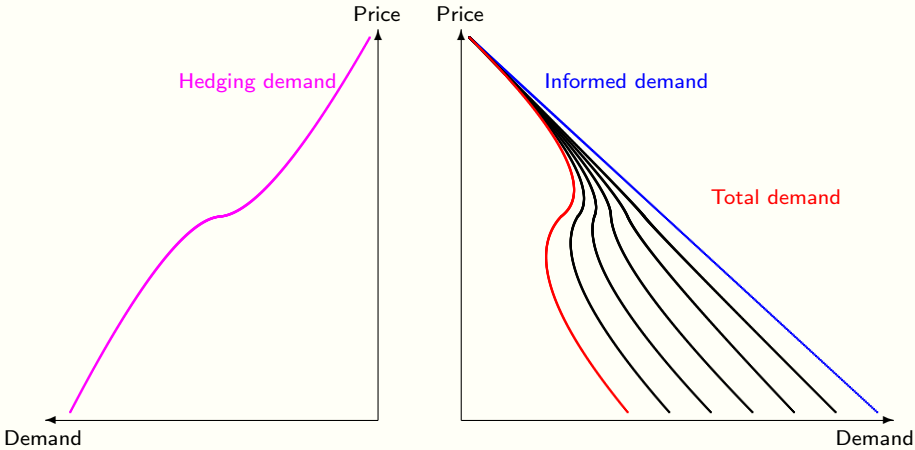

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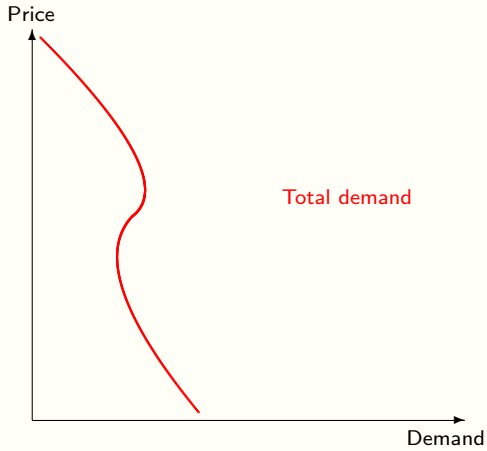
- The demand by informed investors we argues was having a negative slope as indicated here.
- We now introduce the hedging demand. This demand was negative.
- If the amount of put options bought by uninformed investors is low, the hedging demand will be low.
- We take this hedging demand off the demand by informed investors as we interpret the demand as the overall net demand.
- We can now increase the number of put options bought, increasing the hedging demand. Note that the hedging demand is non-linear.
- This will reduce the total demand further and we see that the total demand also becomes non-linear.
- We increase the number of options bought even further.
- This reduces the bet demand even more.
- However, now we see in the circle that the slope of the total demand become very high at one point. We will now sow what happens if we increase the number of bought options further.
- We increase the hedging demand again.
- Now the total demand become highly non-linear.
- In the circle area, the demand curve becomes backwards sloping. Thus the demand curve is not always having a negative slope, there is a small area where the slope is positive; a higher price increases demand for the stock.
- We can now increase the demand further.
- We see that the backward sloping part becomes more pronounced and covers a larger area.
- A final increase in hedging demand.
- This gives us a clearly non-monotonous demand function.

→ We therefore see that if hedging demand is sufficiently large, that is there are enough uninformed investors seeking to hedge their positions, the demand for the stock becomes non-monotonous.

Increasing hedging demand



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→ We have thus established that with sufficient hedging demand, the demand curve for a stock becomes back-ward sloping, that is has an area with a positive slope.

- The reason for this backward-sloping demand curve is that the short-selling of the stock due to hedging is non-linear and it will in general have a (positive) slope that is larger than the (negative) slope of the demand by uninformed investors in some area, giving rise to this feature. This backward sloping part is usually near the strike price of the options.
- For this to occur, we need that many uninformed investors hedge their positions, thus it is not something that happens in all cases.
- Having such a demand curve has significant impact on the equilibrium prices that emerge.

→ We will now assess the implications of such a demand curve for equilibrium prices.

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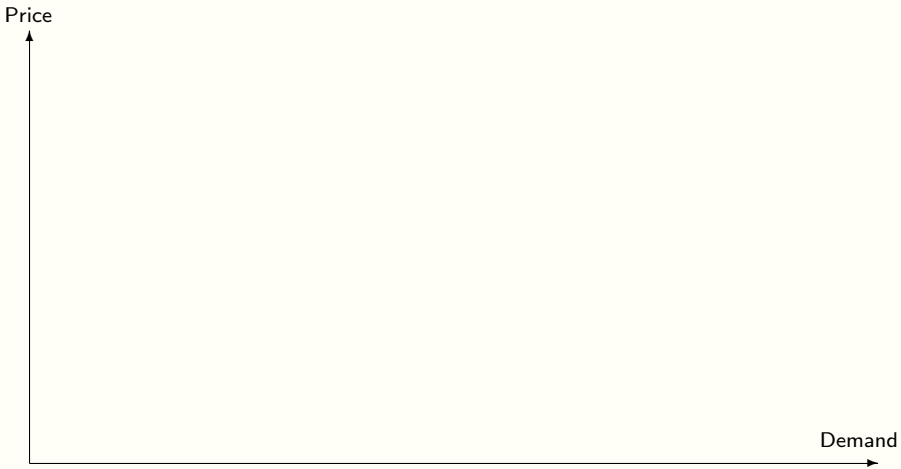

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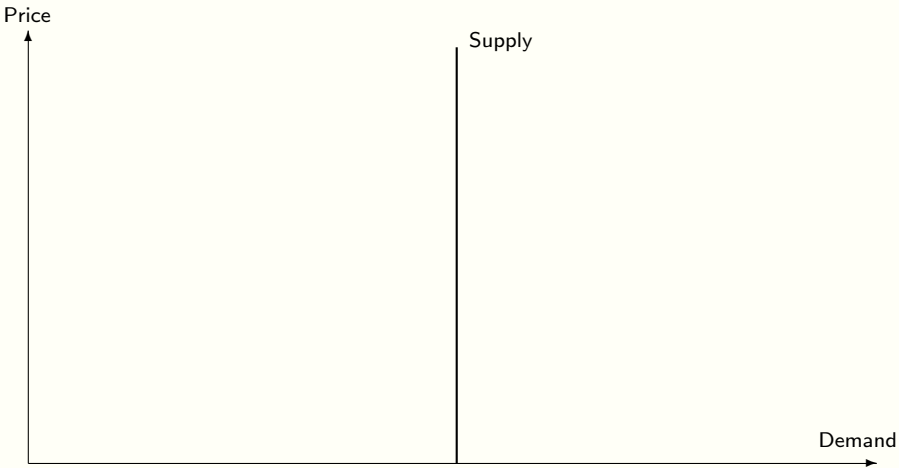

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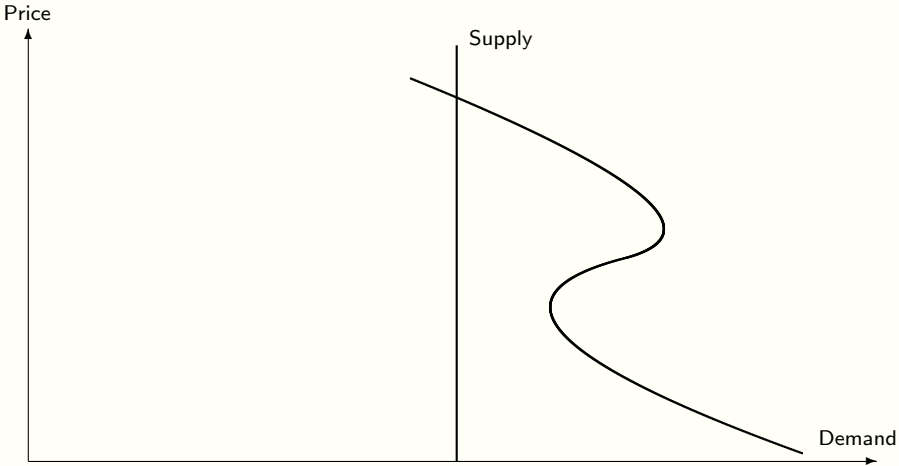

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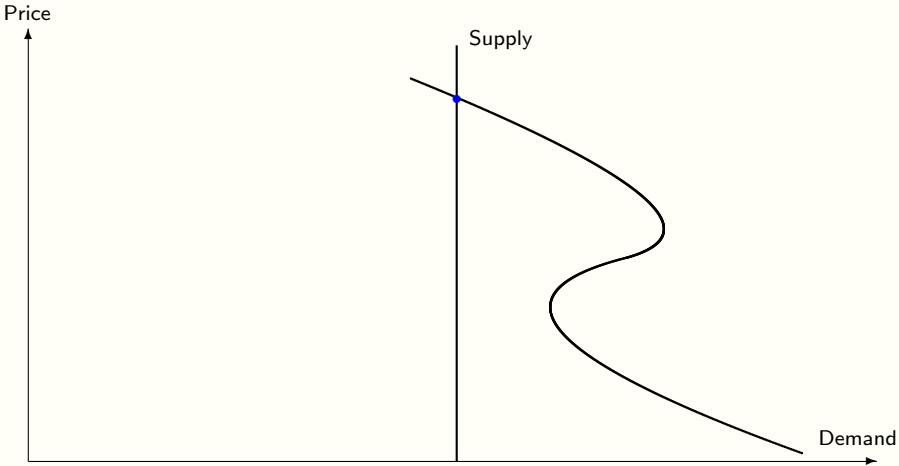

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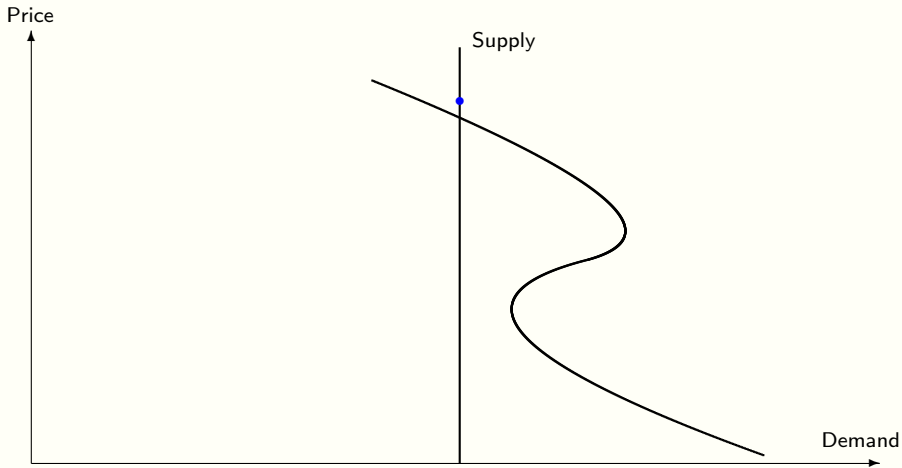

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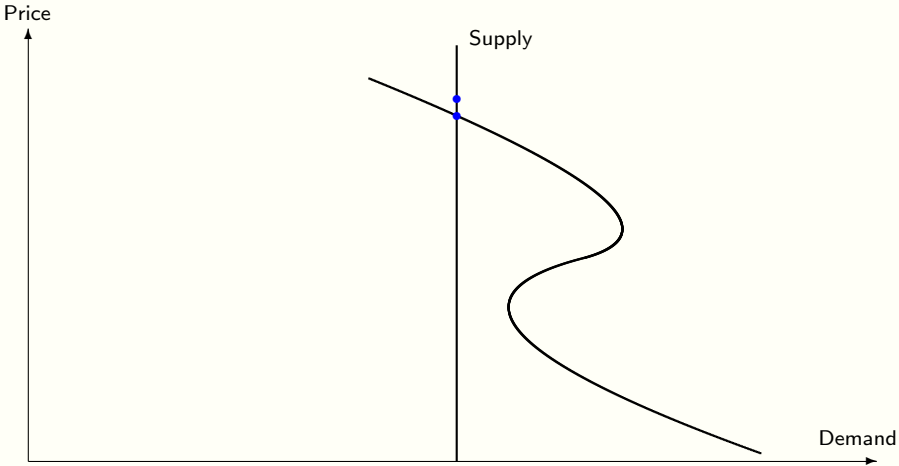

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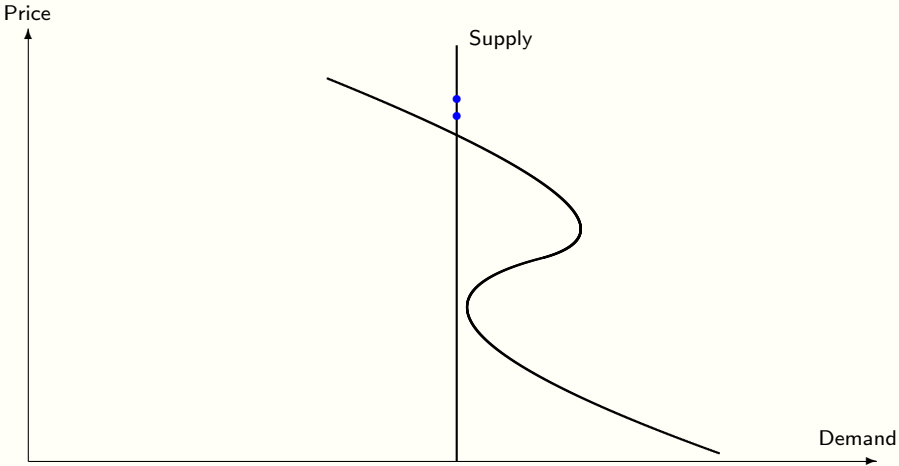

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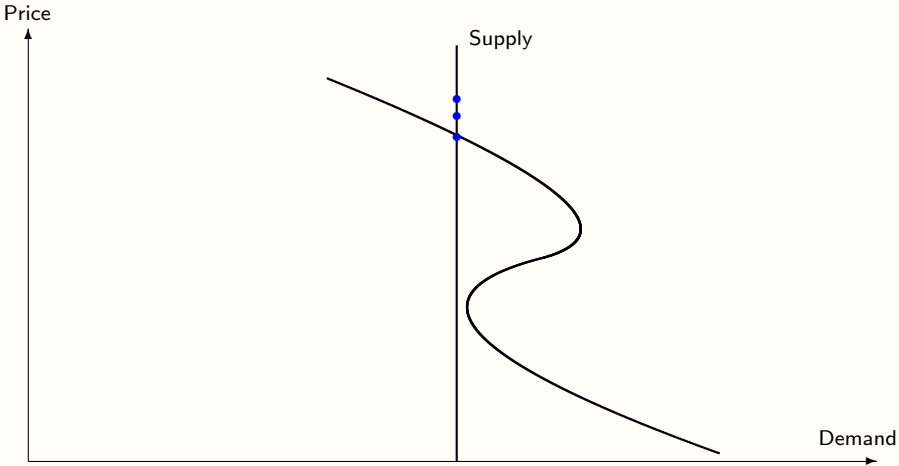

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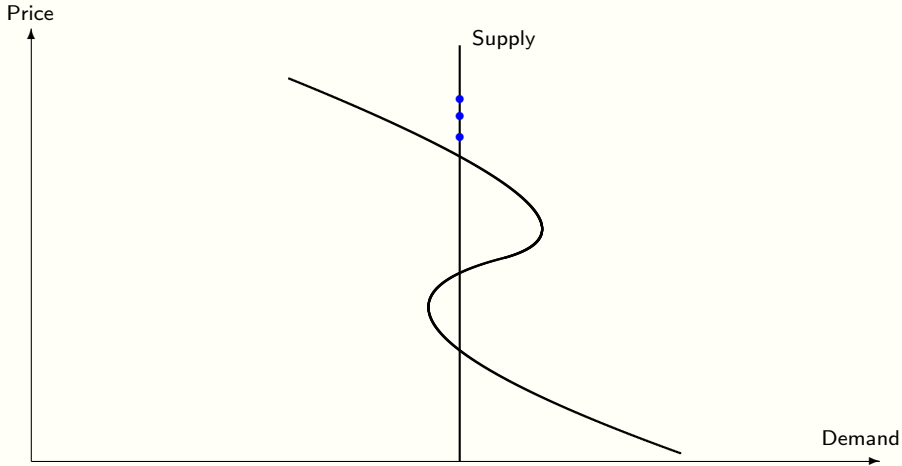

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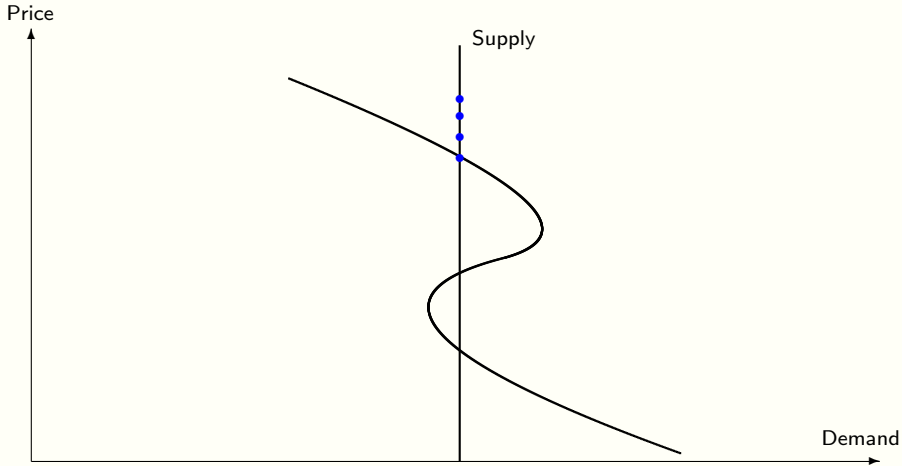

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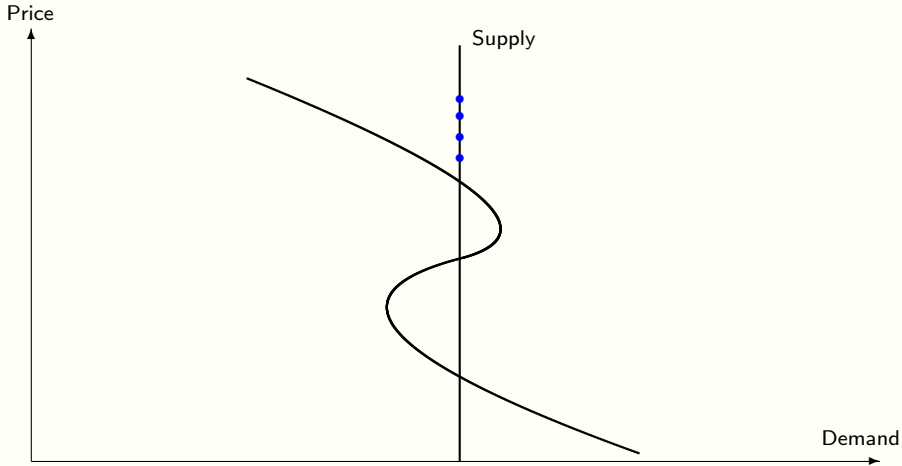

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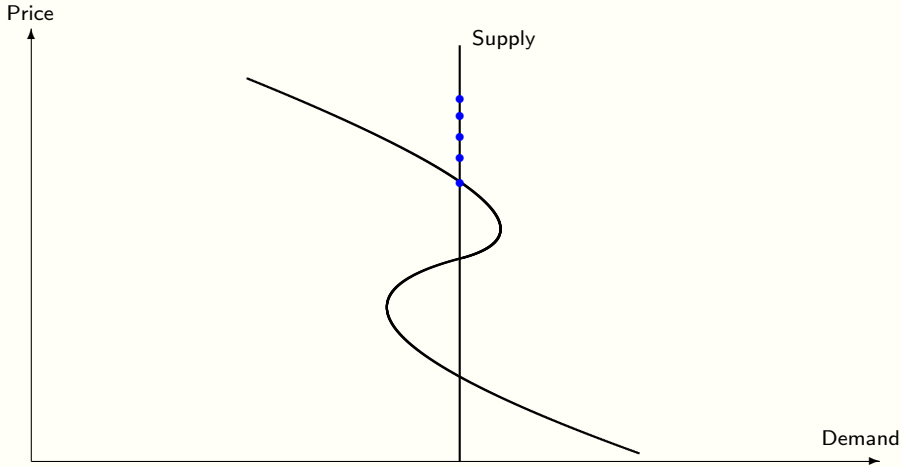

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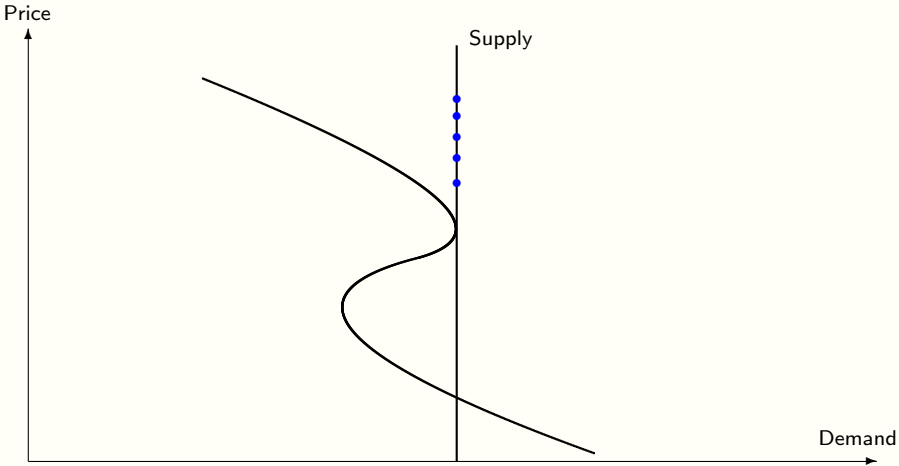

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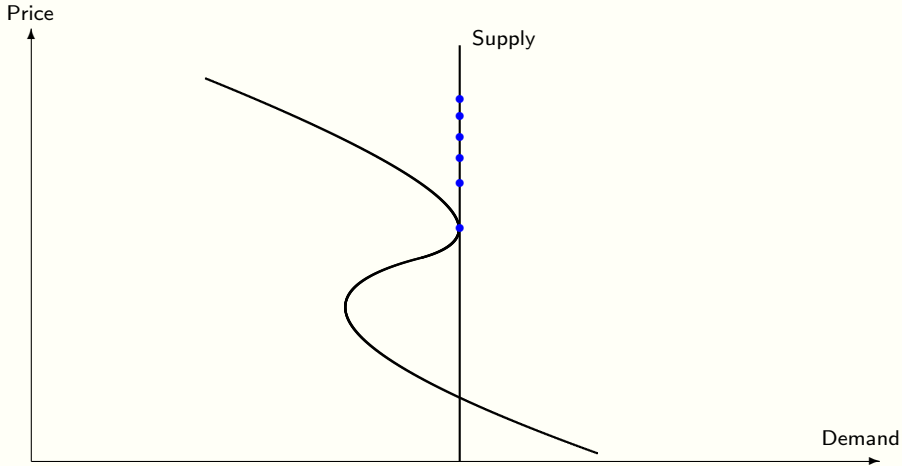

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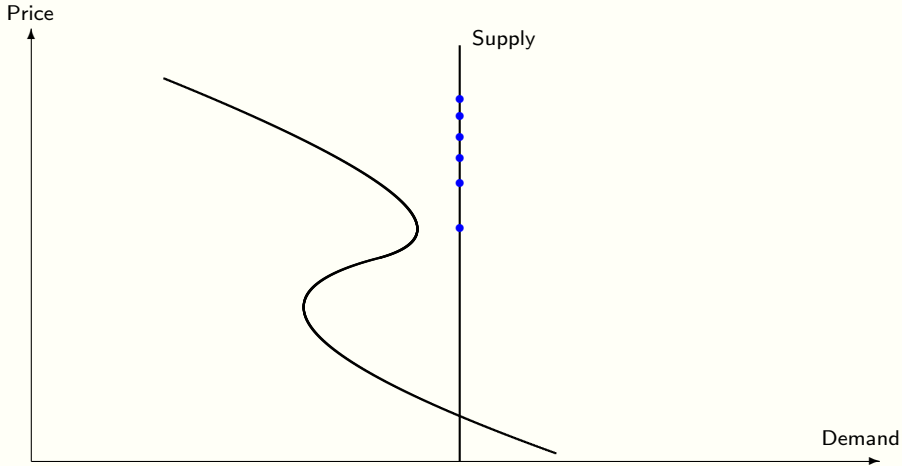

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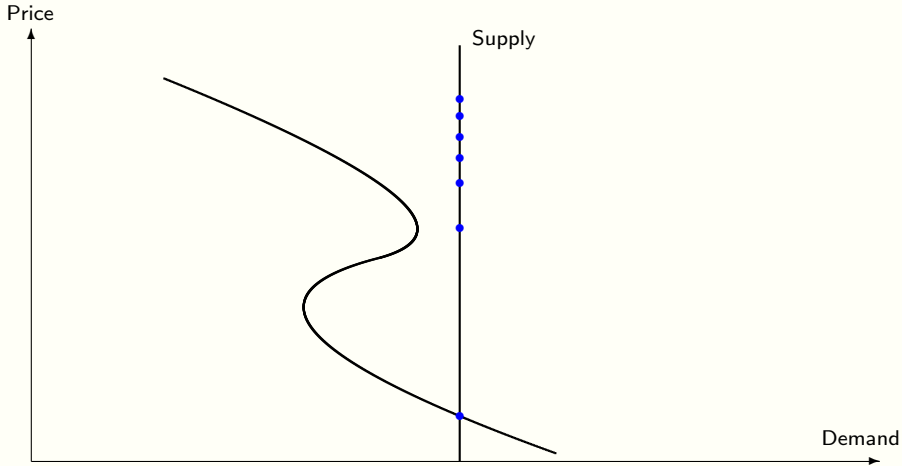

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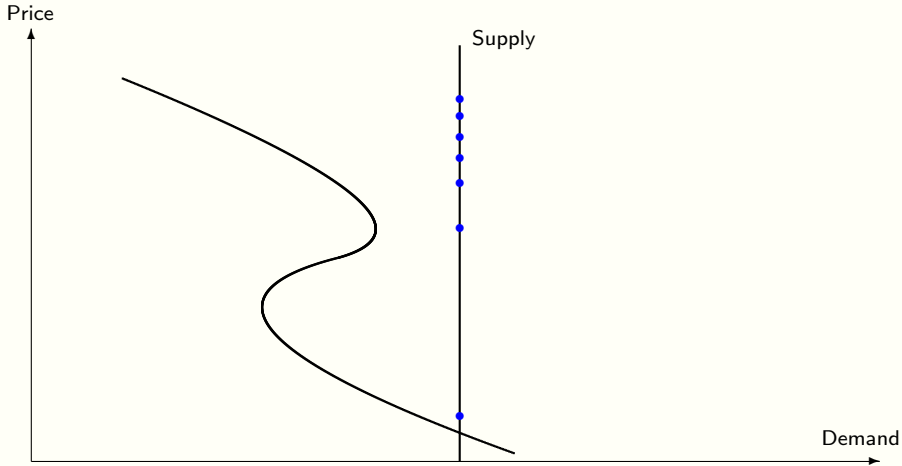

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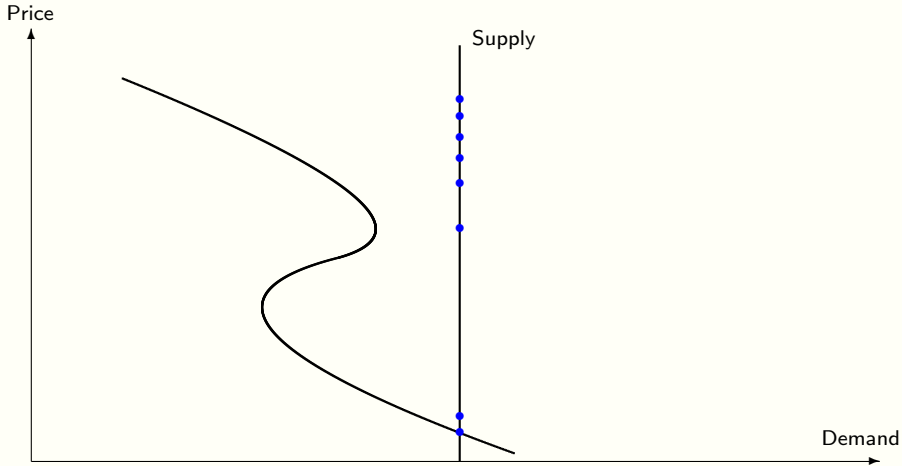

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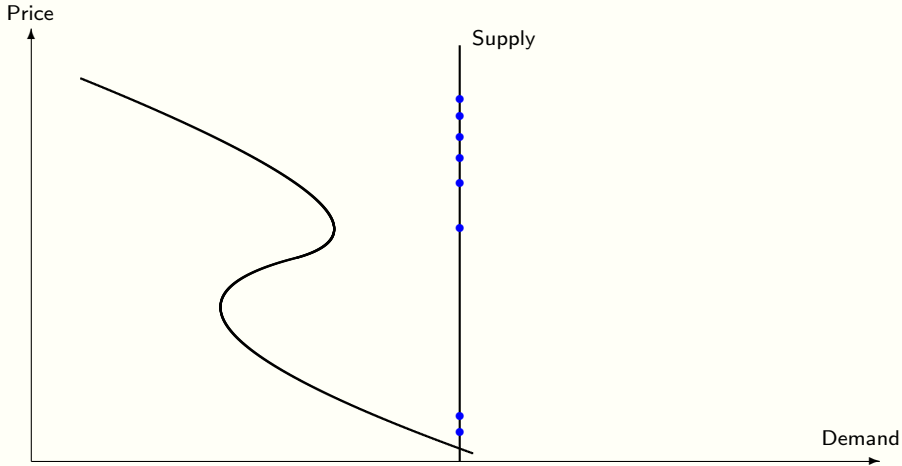

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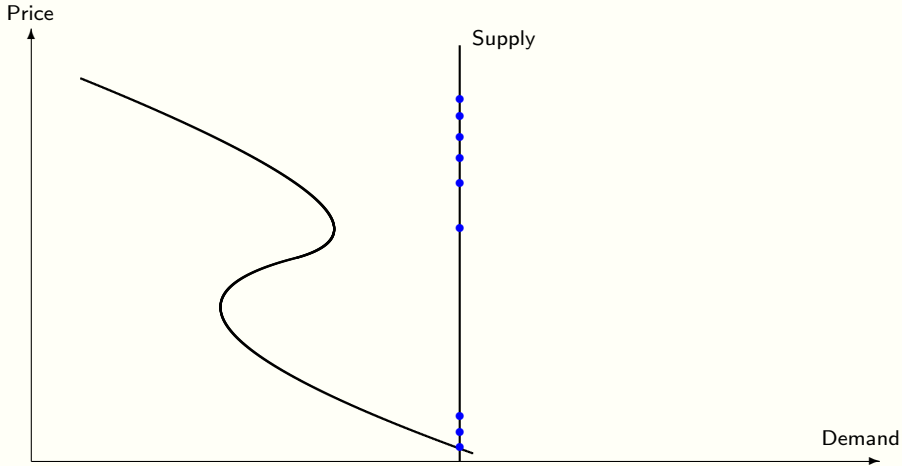

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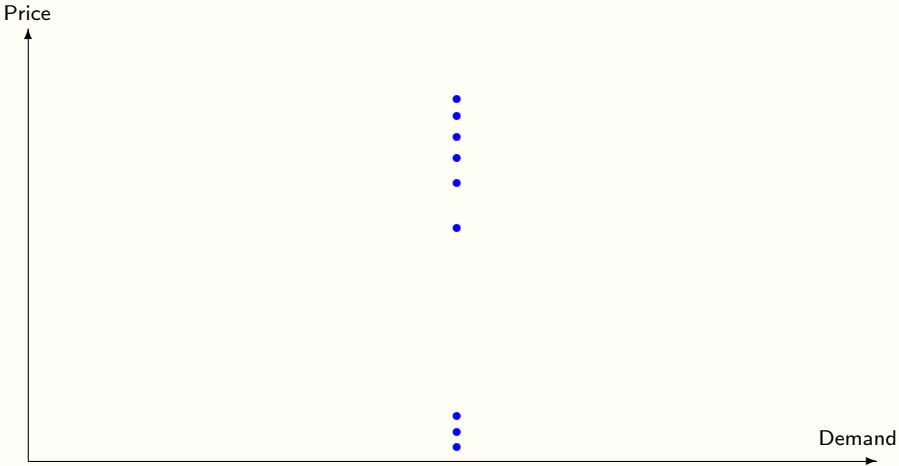

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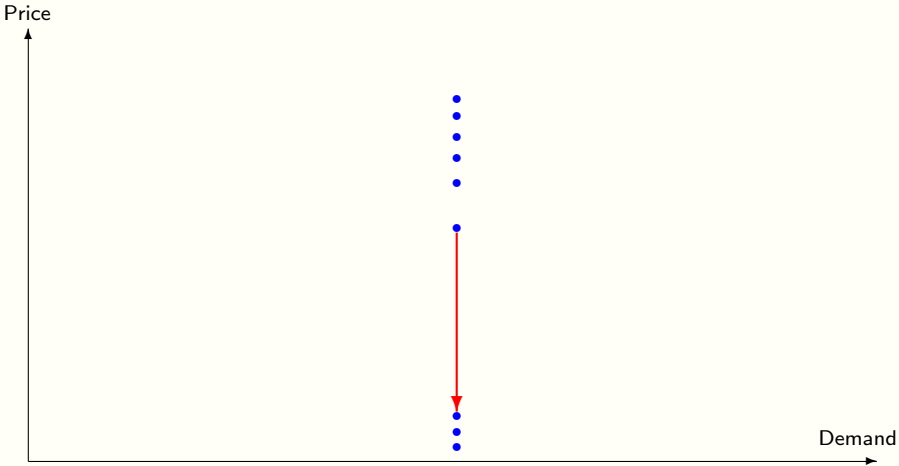

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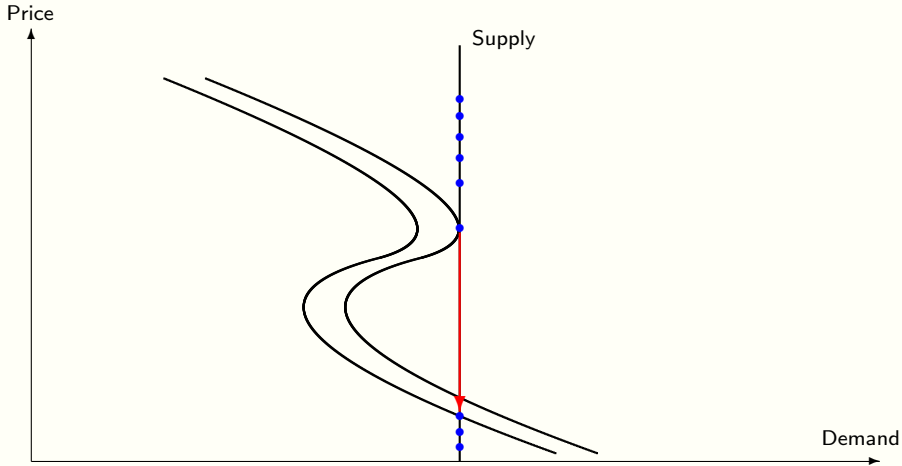

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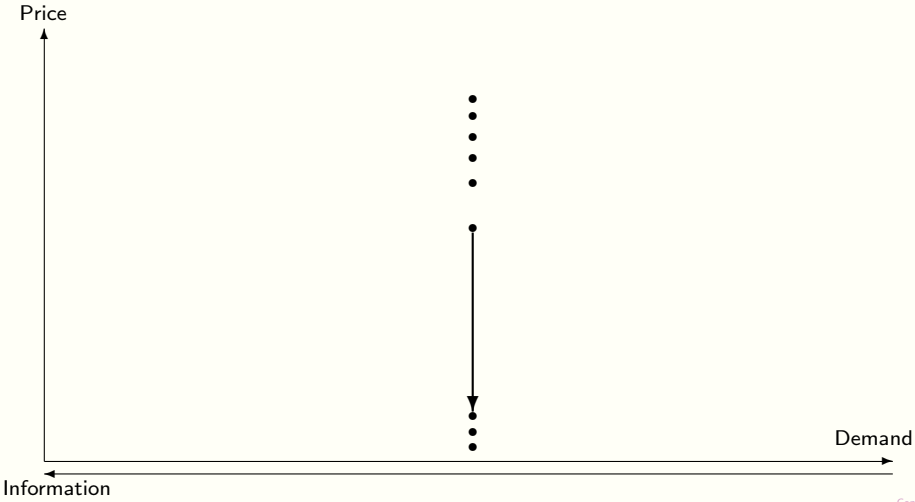

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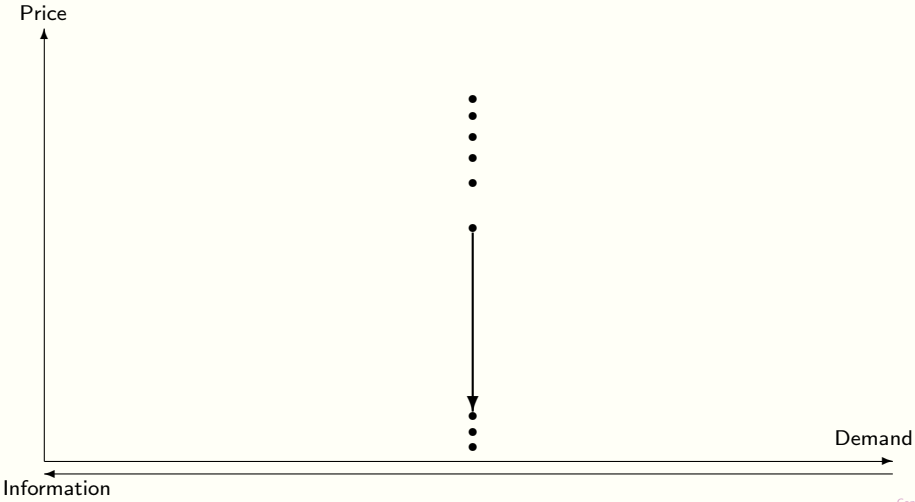

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- A small reduction in the demand by informed investors, for example due to slightly negative information, can give rise to a large change in the stock price. This change in the stock price is compatible with the information received, the information suggests a much smaller reduction in the stock price.
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  - The price drop (crash) is not the result of a sudden change of demand or information.
  - A small change might be sufficient to have this effect. This is due to the hedging demand and the resulting backwards-sloping demand curve.
- There is a strong relationship between demand and information, more positive information results in higher demand by informed investors. Thus we can use these two expressions synonymously.

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- This increase in equilibrium prices would necessitate a price jump; this is essentially an 'inverse market crash'.

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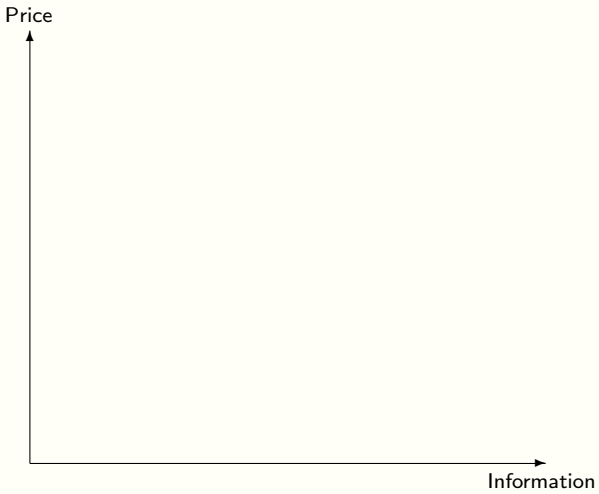

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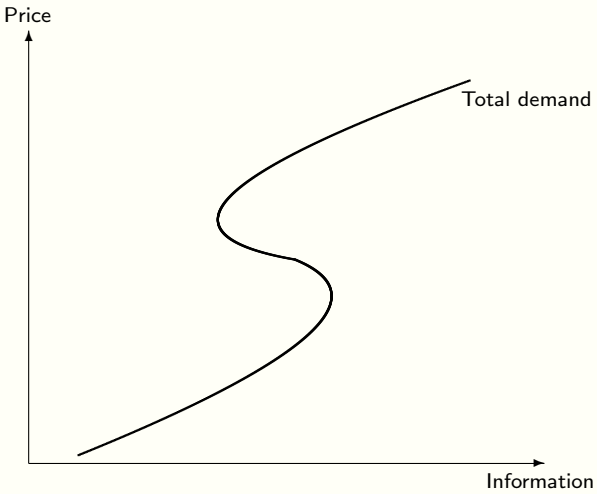

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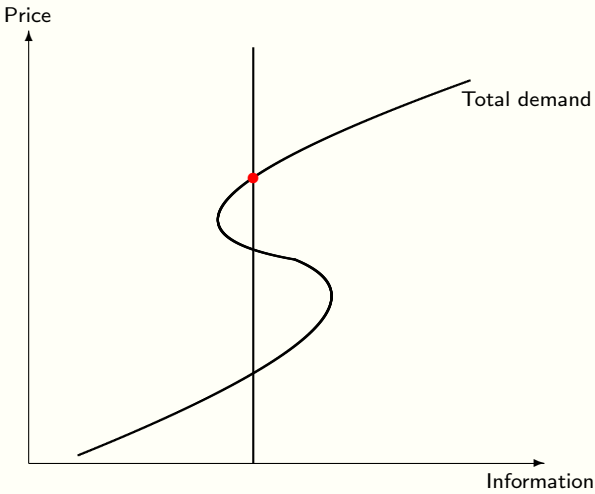

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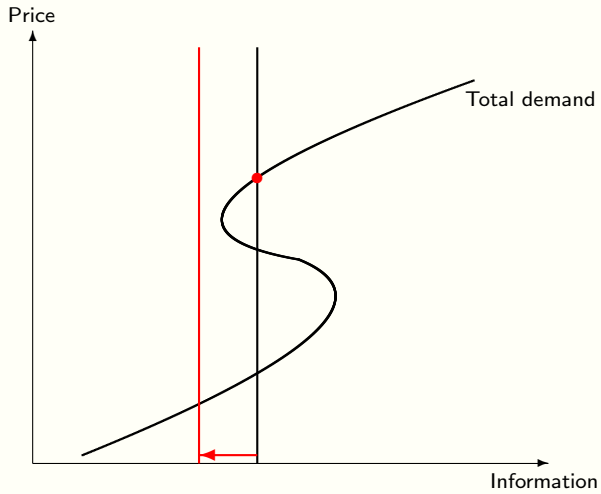

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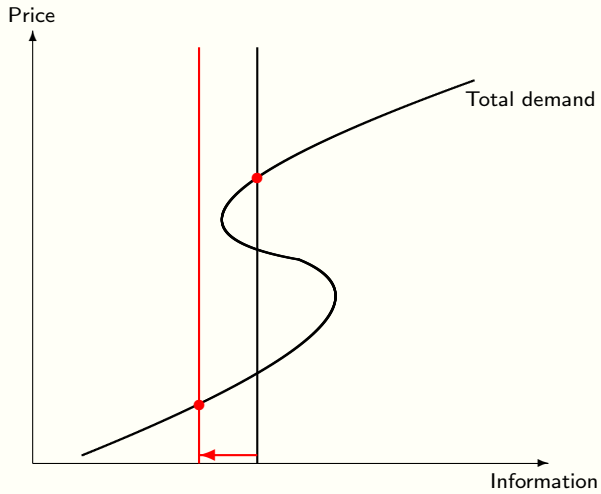

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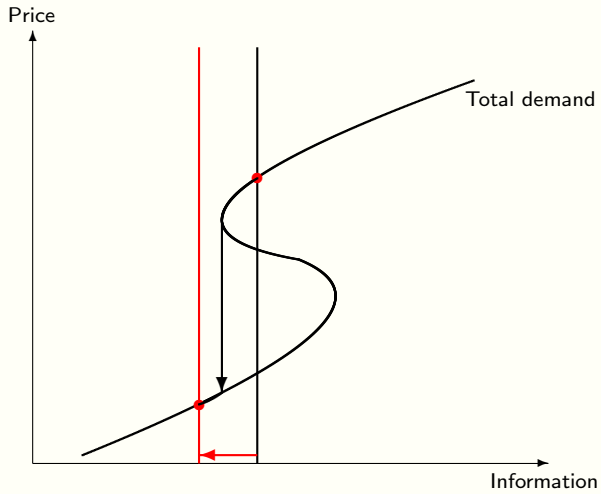

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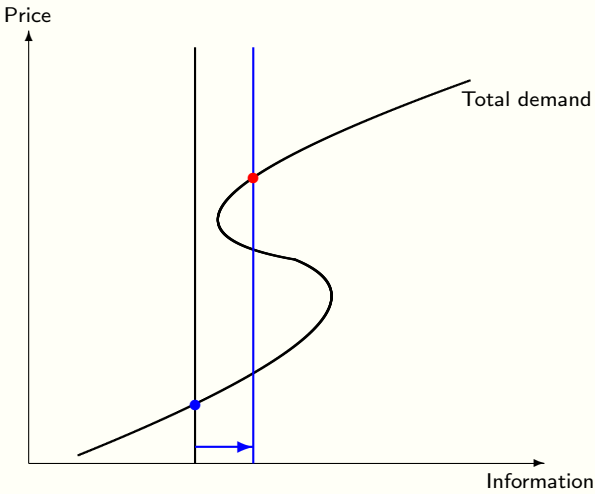

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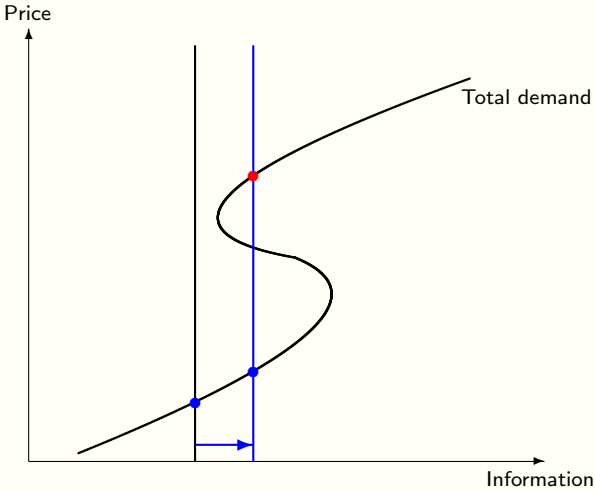

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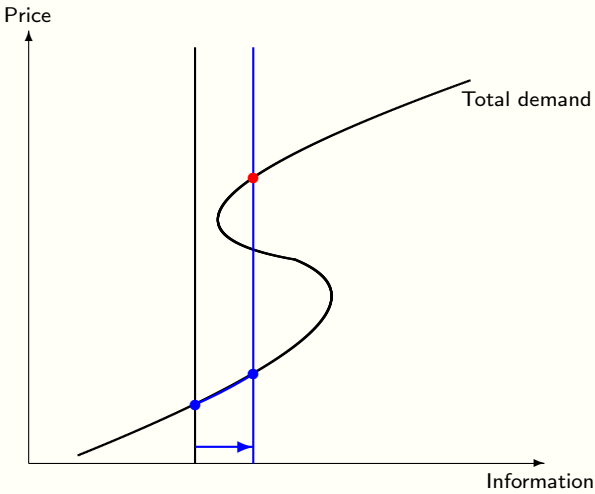

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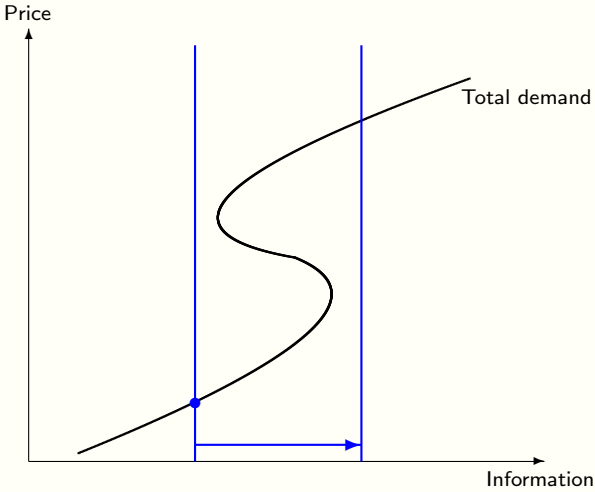

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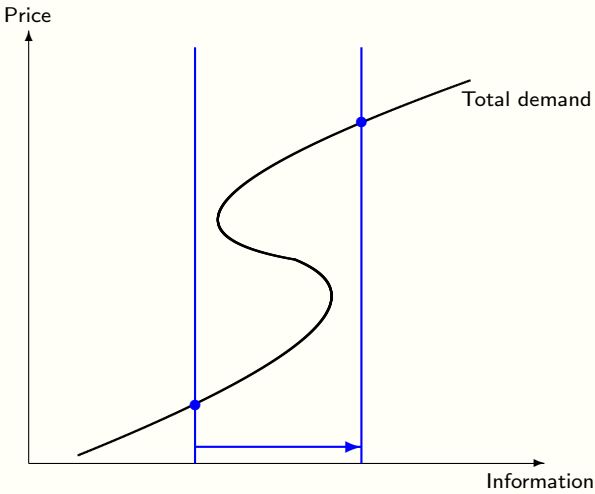

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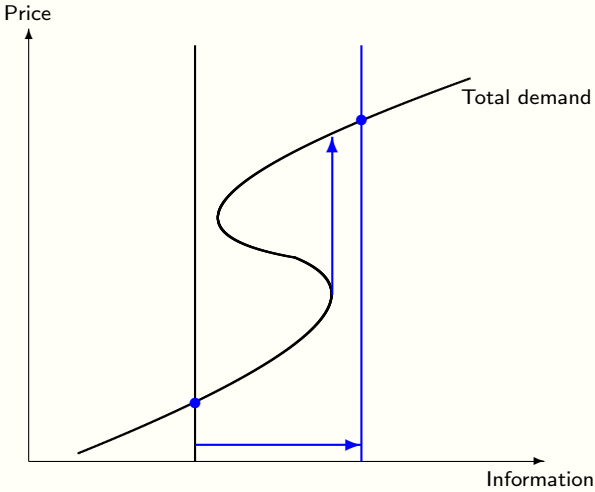

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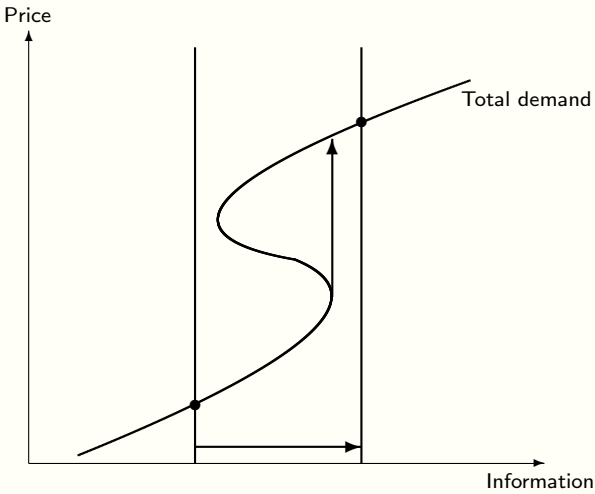

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→ We will now summarize the result on what might happen if we see a change in information, which is subsequently reversed.

- We have seen that reversing a change in information does not lead to a reversal of a market crash, the price will remain low, even if the information is reversed after a crash.
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  - It is that prices have reached another equilibrium, which is lower than the original equilibrium.
  - Small changes to this equilibrium will lead to small changes in the price and not a reversal to the old equilibrium.
- Information needs to improve significantly to return to its previous level and then the price would be slightly higher than before, but on much better information.

→ Thus a small change in information can have a substantial impact on prices, leading toa market crash, and a reversal of this change would only have a small impact, not reversing the crash that has been observed.

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Absence of sudden market jumps

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→ We will now seek to address the fact that 'inverse market crashes', that is sudden jumps in prices, are not observed in markets.

- Let us assume that we have positive news about a stock, resulting in a higher demand by informed investors.
- This higher demand of informed investors will increase prices.

- Uninformed investors observe the higher price and they might worry about stocks being overvalued as they do not hold the information; they might be thinking that a bubble has emerged. To limit their risk, some will start to hedge their positions by buying put options, instigating hedging demand.
- If the information improves further, and hence the price increases further, more and more uninformed investors become concerned about making losses; therefore more and more uninformed investors will hedge their positions, increasing hedging demand. If the hedging demand is high enough, the demand curve becomes backwards-sloping.

- Now assume that negative information arrives, reducing the demand by informed investors.
- With the above said, this might cause a market crash.

- Once the stock price has reduced, options are exercised and the hedging demand vanishes; furthermore, uninformed traders are no longer concerned about the high price as the price is now lower. Therefore no new hedging demand builds up once the existing options are expiring.

→ We can now assess this process graphically and based on this reasoning conjecture that jumps in stock prices are very unlikely to occur.

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- Uninformed investors may be concerned about losses if prices are high due to a bubble and commence hedging

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- Once the stock price has reduced, options are exercised and the hedging demand vanishes; furthermore, uninformed traders are no longer concerned about the high price as the price is now lower. Therefore no new hedging demand builds up once the existing options are expiring.

→ We can now assess this process graphically and based on this reasoning conjecture that jumps in stock prices are very unlikely to occur.

Absence of sudden market jumps

- If positive news are received, the demand of informed investors increases, prices increase
- Uninformed investors may be concerned about losses if prices are high due to a bubble and commence hedging
- The higher the price goes, the more hedging is conducted

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→ We will now seek to address the fact that 'inverse market crashes', that is sudden jumps in prices, are not observed in markets.

- Let us assume that we have positive news about a stock, resulting in a higher demand by informed investors.
- This higher demand of informed investors will increase prices.

- Uninformed investors observe the higher price and they might worry about stocks being overvalued as they do not hold the information; they might be thinking that a bubble has emerged. To limit their risk, some will start to hedge their positions by buying put options, instigating hedging demand.
- If the information improves further, and hence the price increases further, more and more uninformed investors become concerned about making losses; therefore more and more uninformed investors will hedge their positions, increasing hedging demand. If the hedging demand is high enough, the demand curve becomes backwards-sloping.

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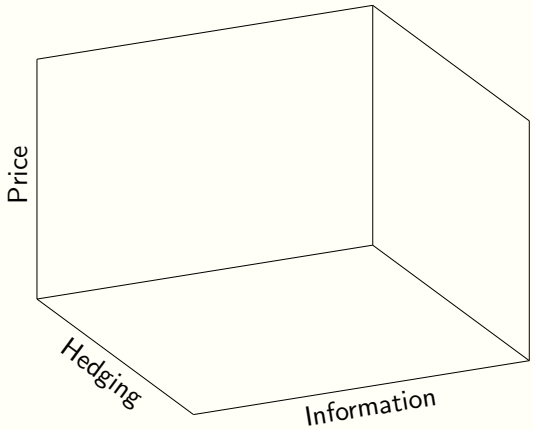

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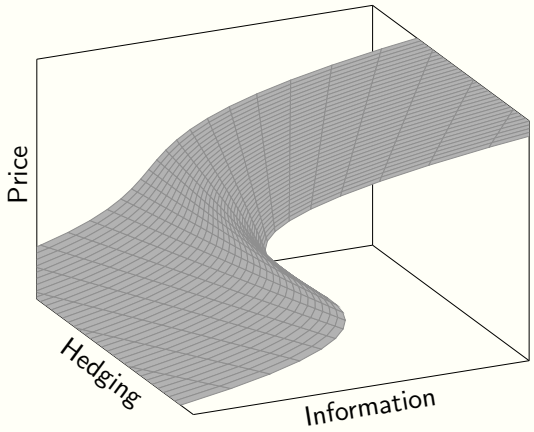

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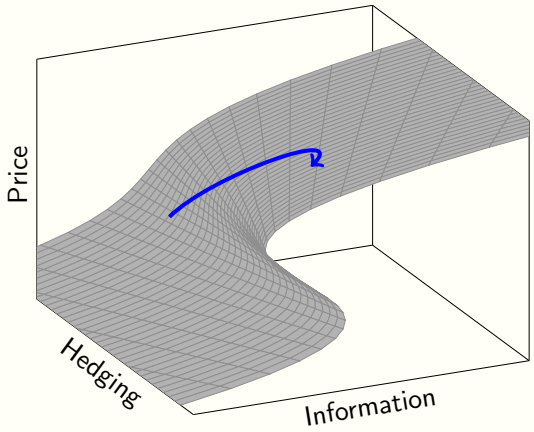

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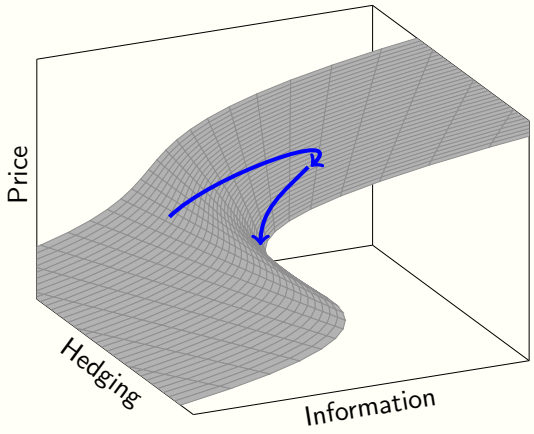

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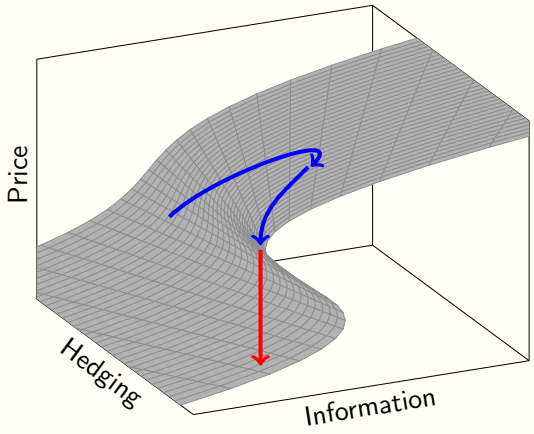

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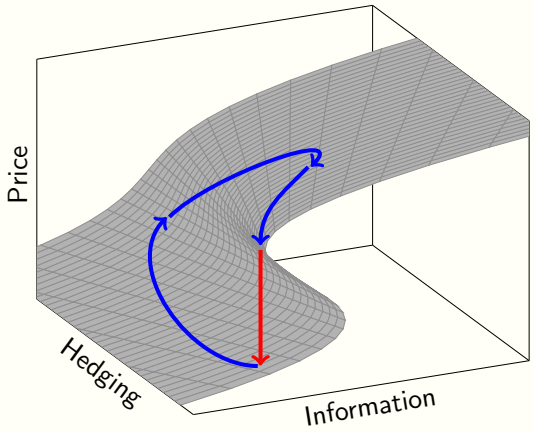

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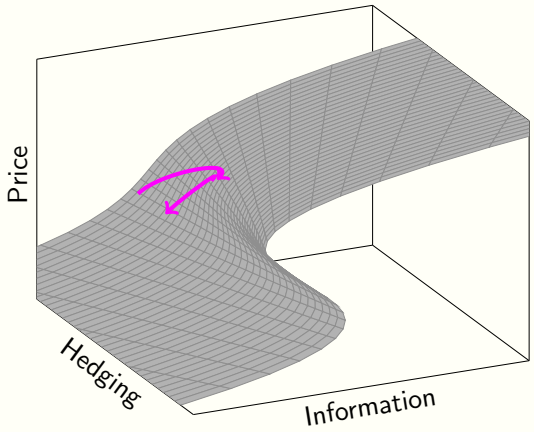

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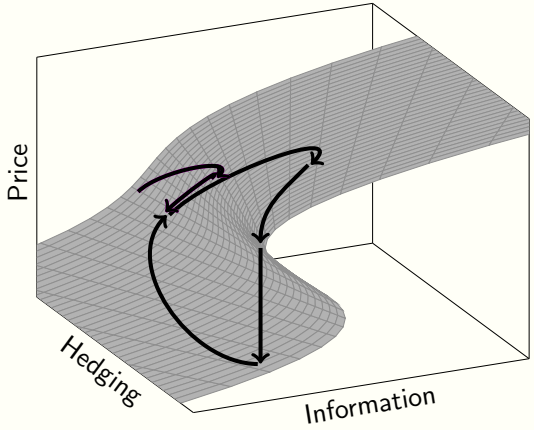

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- If hedging demand is sufficiently high, then this will lead to such a non-monotonicity and crashes can occur; these crashes may occur on informed investors receiving negative information, even if the information was not significant.
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  - We usually see a some accumulation of negative information leading to a small reduction in the stock price,
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→ It is not the 'erratic' behaviour of informed investors or speculators that cause markets crashes, but it is the hedging of uninformed investors seeking to protect the in their view overvalued stocks.

Hedging demand driving market crashes

- The behaviour of uninformed investors hedging their exposure can lead to market crashes
- If hedging demand is sufficiently high, market crashes can occur without significant information being received
- The run-up the a market crash sees some negative information emerging, but not significant enough to justify a market crash

Hedging demand driving market crashes

→ We can now summarize some of the finding from this model.

- We have seen that it is the hedging demand by uninformed investors that ultimately causes market crashes. It is there demand which makes the overall demand for the stock non-monotonous and leads to a stock market crash.
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Market crashes and market jumps

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→ We now argue that in some instances market jumps might nevertheless occur.

- We have argued above that price jumps should not occur, as at low prices, hedging demand will be low.
- In some markets, even after a crash, the hedging demand might remain high. In foreign exchange markets, for example, a crash might have reduced the value of one currency such that those concerned about it being overvalued are no longer hedging.
- But now some investors might feel that the currency is undervalued (or the other currency overvalued) and seek to hedge against adverse movements of the exchange rate.

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- Those hedging against the currency being overvalued will cease to hedge their positions,
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- We also need to remember that a crash in one currency, is a price jump in the other currency.
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- A similar logic might also apply in commodity markets.
- Here a high price would be hedged by producers of the commodity, but not the purchaser, while for low prices, the purchaser would want to hedge while producers are not hedging.

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