

Price Controls

October 25, 2022

While there are certain goods (housing, labor) which tend to have persistent arguments for controlling prices, in periods of relatively low and stable inflation, price controls are not generally recommended because they distort the signalling function of prices. However, when inflation is high and variable, price controls have been used as an attempt to provide stability. They were implemented in various markets in the U.S. in the 1970s and have been implemented elsewhere over time. We will review the fundamental results of implementing price controls using the supply and demand model and discuss further implications that could occur that are outside the scope of that model.¹

1 Price Ceilings and Floors

A price control takes one of two forms. A price ceiling is a maximum price that is legally allowed to be paid for a good, while a price floor is the minimum price that is legally allowed to be paid for a good. We will use rent control as an example of a price ceiling and the minimum wage as an example of a price floor.

1.1 Price Ceiling – Rent Control

A price ceiling is a maximum price that is legally allowed to be paid for a good. If a price ceiling is going to be effective, it needs to be placed at a lower price than the equilibrium price.² Figure 1 shows the supply and demand for units of housing in a subdivision. The underlying inverse supply and inverse demand functions are $P = 6Q_S + 650$ and $P = 1500 - 4Q_D$, respectively, with an equilibrium price and quantity of \$1160 and 85 units. The price ceiling is placed below the equilibrium price at \$800, meaning the most that can be charged for a unit is \$800. At a price of \$800, the quantity that individuals are willing to supply is 25 units, but the quantity that individuals demand is 175 units. Those quantities are denoted by the red dashed lines.

In the market with the price ceiling, how many units would be traded? While there are 175 units demanded at a price of \$800, only 25 units are supplied, so only 25 units can be traded. That leaves 150 people who would like a unit at that price without one. The price ceiling creates an inefficiency in the market as supply and demand are not equal at that price. Figure 2 shows the decomposition of the maximum gains from trade and minimum deadweight loss after this price ceiling is imposed. We say the maximum gains from trade and minimum deadweight loss because Figure 2 assumes that the 25 highest valued users get the 25 available units. However, it is possible that much lower valued users receive the units – if an individual with a value of \$805 displaces an individual with a value of \$1405, then the gains from trade will decrease and the deadweight loss will increase.

One argument against this particular model could be that it assumes that the quantity of housing can immediately respond to the price incentives. But what if the quantity of housing was already fixed at 85 units? Figure 3 shows a fixed supply of housing at 85 units. In this scenario, it is possible that producer surplus is simply shifted to consumer surplus and there is no deadweight loss, but that only occurs if the highest valued users receive the items.

¹There are many references listed throughout this set of notes. You do not need to read these papers, but the references are provided to (1) give the authors credit and (2) provide you with some research papers on these topics.

²Students oftentimes get confused because a ceiling is placed below while a floor is placed above. But the type of control is named after the effect – a ceiling stops prices from going higher, while a floor stops prices from going lower.

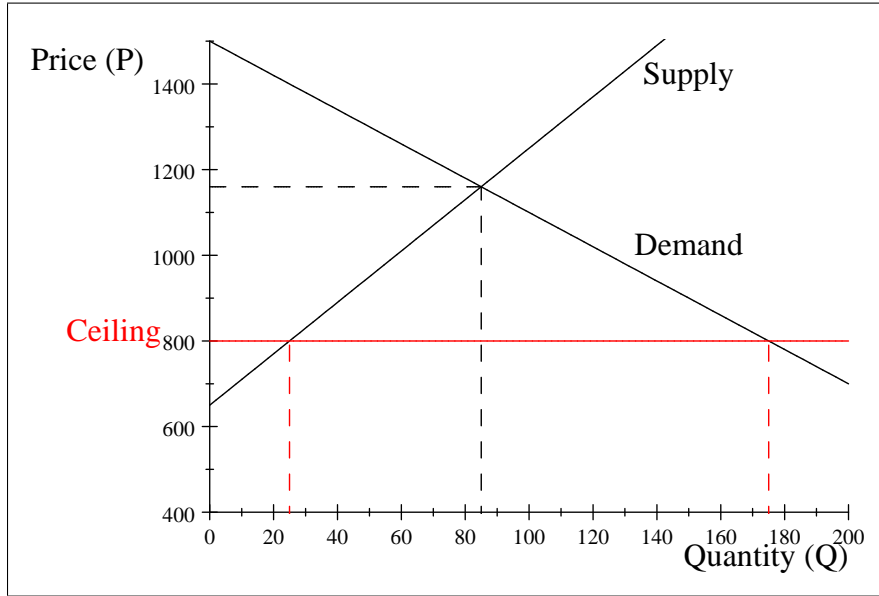


Figure 1: Supply and demand for units of housing in a subdivision. The equilibrium price and quantity are \$1160 and 85 units. A price ceiling, in red, is placed below the equilibrium price at \$800.

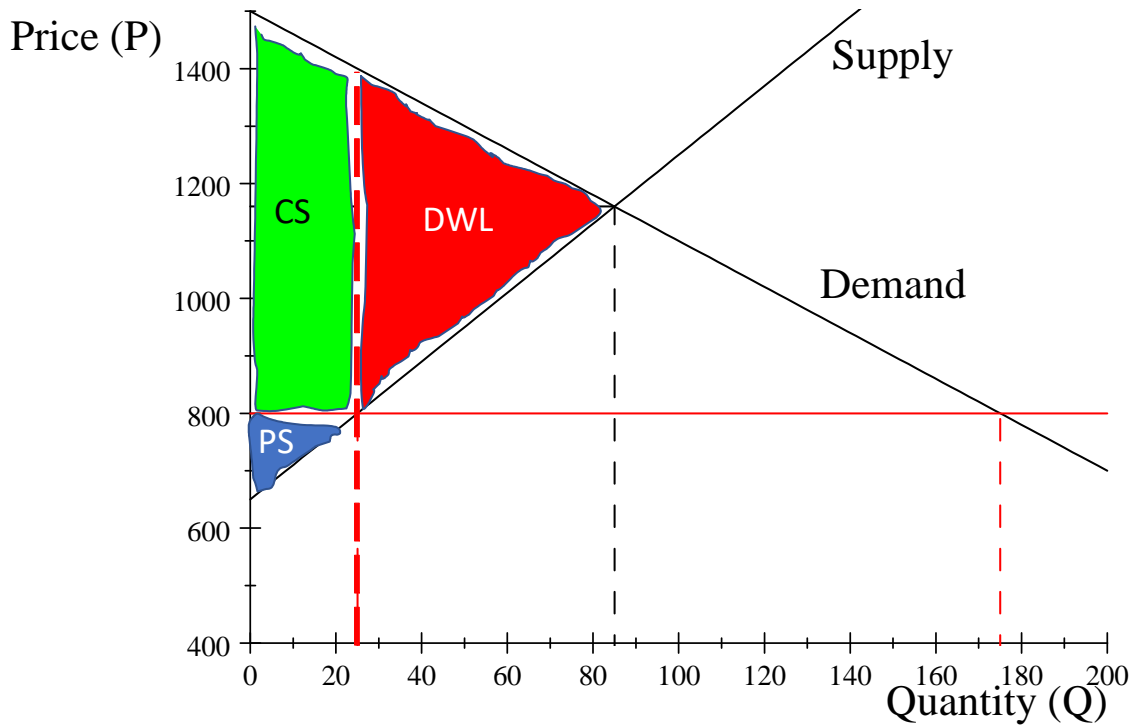


Figure 2: The decomposition of gains from trade after a price ceiling is imposed. Note that this picture shows the maximum amount of gains from trade captured and the minimum amount of deadweight loss.

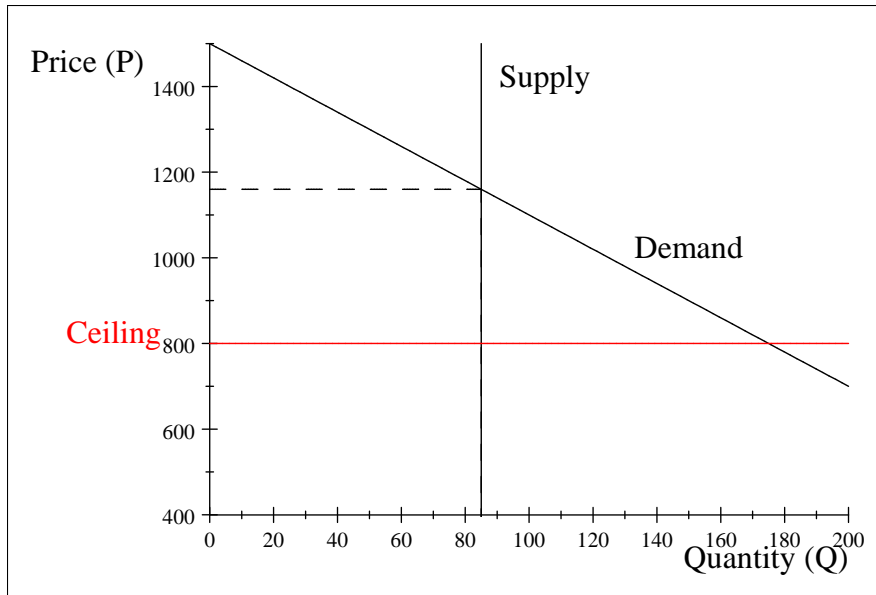


Figure 3: Supply and demand for units of housing in a subdivision with a fixed supply. The equilibrium price and quantity are \$1160 and 85 units. A price ceiling, in red, is placed below the equilibrium price at \$800.

1.1.1 Potential Secondary and Dynamic Effects

The proponents of rent control have an understandable goal: affordable housing.³ The preceding section shows a static model of the market with both a fixed and responsive supply curve and the resulting decomposition of the gains from trade. However, that analysis neglects secondary or dynamic effects. If prices of housing are capped by a price ceiling, but related markets are not, it is possible that the prices of those related but uncapped markets adjust so that the total value of the housing reflects the equilibrium price. For instance, if simply the price of the apartment is controlled, but the price of renting furniture in the apartment is not, a landlord could require the tenant to rent the furniture in addition to the apartment. There is also additional potential for corruption or discrimination – with a limited quantity traded in the market, suppliers may rely on non-market factors to determine who can rent the unit.

There are also potential long-term effects of the policy. One is that the quality of the units may decline over time as the owners cannot receive the full market amount. The incentive to keep the quality level high is not as present if the price is capped so the rent controlled units may end up being lower quality, reflecting their below market price. If the price ceiling is applied on a broad level (it is not simply a price ceiling on particular units or a particular apartment complex or subdivision), then the inability to receive the market price could deter future investment, further exacerbating housing supply constraints.

At its core, the underlying goal is laudable – we want individuals to be able to afford places to live. The question is whether controlling the prices is the best method of achieving this goal.

1.2 Price Floor – Minimum Wage

The other type of price control is a price floor, which is a minimum price that is legally allowed to be paid for a good. The price floor is placed above the equilibrium price so that the price in the market cannot drop to the equilibrium price. The standard example of a price floor is the minimum wage. Figure 4 shows equilibrium in the wage market using the inverse supply and inverse demand functions of $P = 0.01Q_S + 2.6$

³For those interested in the conditions affecting the local Charlotte housing market, the Childress Klein Center for Real Estate in the Belk College recently began providing a State of Housing in Charlotte Report.

https://issuu.com/belkcollege/docs/2020_housingreport

The 2021 report should be available in November, with the State of Housing Summit on November 17th.

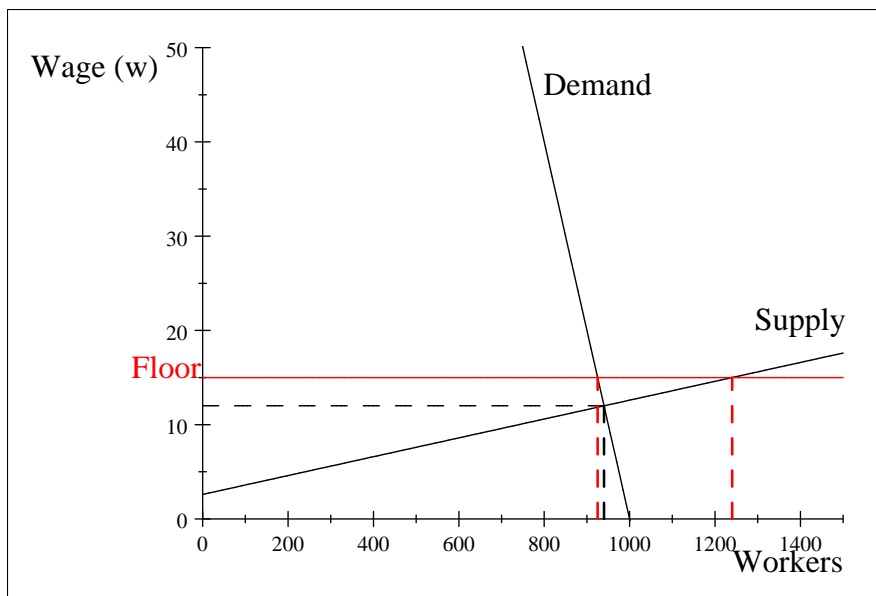


Figure 4: Supply and demand for workers. The equilibrium price and quantity are \$12 and 940 workers. A price floor, in red, is placed above the equilibrium price at \$15.

and $P = 200 - 0.2Q_D$, respectively. The equilibrium price and quantity are \$12 and 940 workers. The price floor is placed at \$15. At that price, 1240 individuals want to work but there are only 925 jobs available, shown by the red dashed lines. In this market, as there are only 925 jobs available, only 925 of the 1240 individuals who are willing to work at this wage will receive a job. The minimum deadweight loss is actually fairly small given the way that I have drawn the picture – there are only 15 workers who are displaced which is about 1.5%. However, there is now a larger pool of workers, so it is possible that many more of the 940 individuals who were working when the wage was \$12 have been displaced by those who were not even seeking work when the wage was \$12.

1.2.1 Potential Secondary and Dynamic Effects

As with rent control, proponents of a minimum wage have an admirable goal: they want people to earn enough money to sustain themselves. But also as with rent control, there are potential secondary effects. One has already been mentioned – some individuals who were working at the lower wage may be displaced by those individuals who were unwilling to work at the previously low wage, but are now willing to work at the higher minimum wage. This change of who is employed could be substituting one low income individual for another, which could be a net societal gain because one low income individual is now earning more money. But it could also be substituting someone who was not in the labor force (a teen, a retiree, a spouse/partner who was not working) because they were unwilling to work for the previously low wage for a low income individual. Who stays employed, who becomes employed, and who becomes unemployed is important for distributional and equity purposes.

We have focused on the minimum wage potentially replacing one group of people with another group of people. However, there is also the possibility that workers are replaced with capital (machines). In our discussion of the consumer we mentioned that a consumer optimizes when $\frac{MU_A}{P_A} = \frac{MU_B}{P_B}$. In our discussion of firms and market structure we focused on the end goal of maximizing profits and choosing the quantity such that $MR = MC$. However, the firm faces an underlying problem, which we did not cover in detail, that is similar to the consumer – the firm must choose factor inputs to minimize cost for a particular production quantity. In that analysis, there is a similar result at equilibrium: $\frac{MP_L}{P_L} = \frac{MP_K}{P_K}$, where MP stands for "marginal product" (how much additional quantity is produced when employing an additional resource

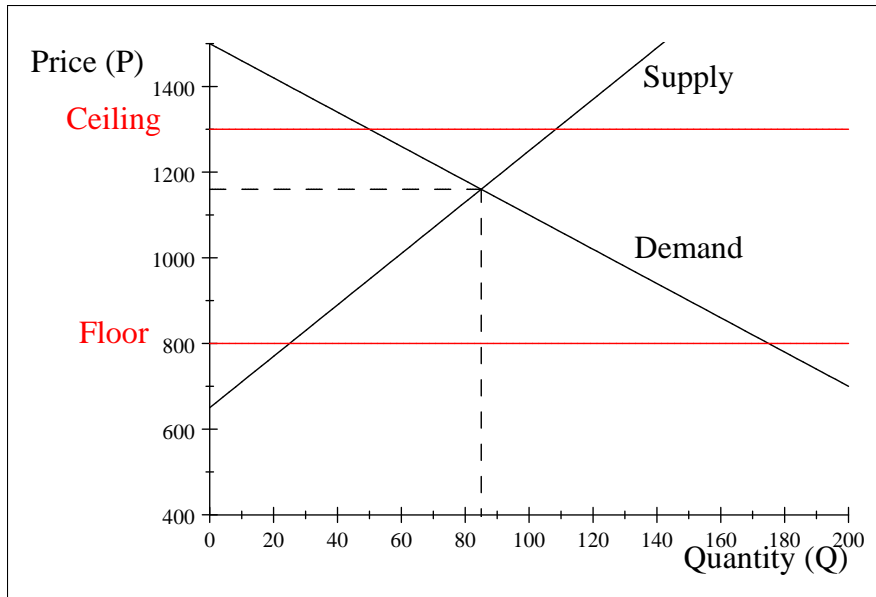


Figure 5: Supply and demand in a market with nonbinding price controls. The price ceiling is set above the equilibrium price and the price floor is set below the equilibrium price.

input) and L and K represent labor and capital, respectively.⁴ When P_L , the price of labor, increases, this increase should cause the producer to substitute some capital for the now relatively higher priced labor.⁵

Note that substitution of capital for labor over time is not solely caused by higher labor prices – it could be caused by lower capital prices or, more likely, a higher marginal product of capital, but increasing wages beyond the equilibrium price could cause that shift to happen sooner. In grocery stores and retail stores the checkout lanes all used to have cashiers. Over time that has shifted to more self-checkout lanes and one cashier overseeing six to ten lanes.⁶

As with rent control, the goal of a minimum wage is laudable. But also as with rent control, the question is whether setting a minimum wage is the best method of achieving this goal.

1.3 Nonbinding Controls

Suppose that a price ceiling is set above the equilibrium price or a price floor is set below the equilibrium price. Figure 5 shows an example of a market with a price ceiling set above the equilibrium price and a price floor set below the equilibrium price. If the ceiling is set above the equilibrium price then there should be no effect on the market – price can adjust downward so that quantity supplied can equal quantity demanded. Likewise, if a price floor is set below the equilibrium price, then price should be able to adjust upward to equilibrate quantity supplied and quantity demanded.

However, what should be a nonbinding price control could end up becoming a focal point for one side of the market. If a price ceiling on rent in the housing market is imposed above the equilibrium price of the market, suppliers of housing could use the price control as a means of coordinating prices to keep them

⁴The problem is similar to the consumer choice problem, only we now have labor and capital listed on the axes instead of Good 1 and Good 2. In the producer problem, the budget constraint becomes the isocost (same cost) line and the indifference curve becomes the isoquant (same quantity as opposed to same utility). The general concept, that the isoquant is tangent to the isocost, is the same as the indifference curve being tangent to the budget constraint.

⁵Dr. Paul Gaggl in the Department of Economics has a line of research that examines how firms choose to substitute capital (mostly technological capital) for labor.

⁶I have been told by a colleague that when visiting an overseas university years ago the university had many people with brooms working to sweep leaves from the sidewalk. I have never seen that – all I see on campus here is one person with a leafblower who alone clears a good bit of the sidewalk in about 5 minutes.

higher than the market equilibrium. Likewise, a price floor on wages that is below the equilibrium price could serve as a focal point for employers offering wages. While the tendency in the market should be to push prices towards equilibrium, if the consumers in the rental market and the suppliers in the labor market are large and not well-informed about the market dynamics, the nonbinding controls themselves might affect the market. Lee (1978) discusses nonbinding price ceilings in the market for petroleum products. Cottle and Wallace (1983) and Zorn (1984) provide further discussion.

2 Additional Considerations

The analysis of price ceilings and price floors using supply and demand is fairly straightforward. They restrict the quantity traded in the market, there is either excess demand or excess supply, and there is some deadweight loss. However, that analysis is static – we consider the imposition of a price control in a market today and the effect that control has on the market today. We have already discussed some potential longer-run consequences of price controls, as well as the possibility that nonbinding price controls serve as a focal point in a market, but now we discuss additional considerations.⁷

2.1 Historical Discussion and Analysis

Price controls have been implemented throughout history in an attempt to control the markets for certain goods. Schuettinger and Butler (1979) provide detail about historical implementation of price controls dating back to ancient Sumeria and Babylon.⁸ Written over 4,000 years ago, the Code of Hammurabi⁹ has specific price provisions for certain tasks – a specified amount of corn is to be given for one task, an amount of silver for another task, etc. They also discuss price controls in the Roman Empire and Medieval periods. Some discussion of the concept of "just price" is provided. The basic idea behind just price is that each good has some specific inherent value, typically based on cost of production, and that value is the same for everyone. If the cost of making a shirt is \$15, then that shirt has a value of \$15 regardless of the consumer's preferences for the shirt. The concept of just price tends to treat value as objective based on the item, and not as subjective based on what each individual believes the value of the item to be, which is how we have structured our consumer choice and supply and demand models. Recall that consumer surplus is the additional benefit a consumer receives from the purchase of the good and that surplus may vary among individuals even if two individuals buy the same good for the same price. If one uses just price as the basis for economic modeling, the imposition of price controls seems more applicable because there is a belief that a good has a certain value to all.

The concept of price gouging is related to the idea of a just price. When there is an unanticipated shock that leads to a shortage of a key resource, there are usually calls for temporary limits on how high prices can be. The shock can be due to a natural disaster, such as a hurricane devastating a region, or some type of other disaster, like a cyberattack on a pipeline.¹⁰ However, for those who have experienced a disaster, there are tradeoffs to higher prices. One is that the good may not be available – as mentioned at the beginning of the course, prices serve to ration goods, and if prices are prohibited from reflecting subjective value then the ability to ration goods by prices is diminished. So the goods may not be available to the highest-valued users because someone else has already purchased the good. Second is that prices are only one part of the cost of obtaining a good. We generally do not consider time costs when purchasing goods because typically we show up to a store or go online to purchase a good, pay for the good, and then take it home with us or have it shipped reasonably quickly to us. But when there is a shortage and prices are restricted, the time cost of obtaining the good could be nontrivial. Wait times tend to increase dramatically and if there is a shortage and prices are restricted because people will stockpile goods.

⁷An indirect effect of this section is that most of the standard types of analysis used by economists are introduced.

⁸Cameron (1967) provides some general discussion about historical lessons for developing nations. In the section on *The Role of the State*, price controls are briefly mentioned. Durant, Legge, and Moussios (1998) provide lessons from the privatization of British Telecom.

⁹The Code of Hammurabi is likely better known for the concept of "an eye for an eye" but there is more to the document than that.

¹⁰<https://www.wcvb.com/article/biden-warns-against-gas-price-gouging-after-colonial-pipeline-cyberattack/36421397#>

I cannot find prices of gasoline in Charlotte for May 2021, but it seems like the prices stations wanted to charge in May 2021 are lower than those being charged in October 2021.

Fast-forwarding to the 19th and 20th centuries, long-term price controls in developed nations were usually only implemented in times of war.¹¹ Galbraith (1943) discusses some of the lessons learned from his experience in the Office of Price Administration during World War II. He has four primary lessons. First, understanding market structure is important for price analysis. For instance, he finds that it is easier to control prices in markets with limited sellers because it is easier to engage with the sellers to make sure they do not sell their products to speculators. Second, the time dimension is typically ignored by theorists but is an important element that deserves further study. Third, too little analysis has been done on perfectly competitive seller markets in which buyers are not perfectly competitive.¹² Finally, he believes that the role of price controls in the ability to control inflation "is a more strategic one than economists have usually accorded it." Mills and Rockoff (1987) examine the extent of price control evasion in the United States and United Kingdom during World War II. They conclude that individuals in the United Kingdom were more compliant than those in the United States in following price controls during WWII, likely due to the degree of monitoring done by those in the UK. They also indirectly provide some qualification to Galbraith's fourth lesson, noting that individuals in both countries were likely more compliant with the price controls because of WWII.

In the 1970s, the United States implemented price controls in an effort to hold down inflation. Milton Friedman, in many Newsweek columns in the 1970s and 1980s, was a critic of this approach. His belief is that inflation is directly caused by failure to control the money supply.¹³ Bernanke (2004)¹⁴ provides a review of Friedman's monetary *framework*. Mills (1975) examines price controls in the United States during 1971-1973. He finds that price controls did not contribute to economic stabilization in markets that were competitive and had a reasonably elastic supply, but that in markets that were noncompetitive or had inelastic supply and excessive demand, the price controls did help to stabilize the market in the short run. These results are consistent with Galbraith's lessons. Waterhouse (2013) provides a detailed historical account of the period.

2.2 Laboratory Economic Experiments

A significant problem in testing partial equilibrium models with naturally occurring data is that there are the aforementioned general equilibrium effects. It is difficult to isolate the particular hypothesis we wish to test because there can be many confounding factors. We can attempt to control for these confounding factors with our empirical analysis, but then there is a second significant problem. The predictions of these models are based on information that we may not know and may not be able to obtain. Producers should be able to provide their costs of production, but unless the firm is producing one very specific good it may not be possible to assign those costs to the production of a particular type of good. Even if producer costs are available, it is unlikely that the researcher will have access to consumer values. The researcher may know what each consumer paid, but that amount may not be an accurate reflection of the value of the good for that consumer.

Laboratory economic experiments attempt to address these problems by employing a methodology used in other disciplines – controlled experiments. These are not the natural experiments you might read about in traditional empirical work,¹⁵ but laboratory experiments where human participants interact (possibly with each other) according to preset rules of interaction. Vernon Smith¹⁶ is generally considered the seminal contributor in this area. Economic experiments have two main rules. One rule is that participants should be provided monetary incentives that are based on the decisions they (and possibly others) make. These incentives are not necessarily the same scale as those faced in non-laboratory decision-making, but they serve

¹¹As prices serve a rationing function, other forms of rationing were also used in times of war.

¹²This market structure is known as monopsony and has been studied extensively since that time.

¹³We will not discuss inflation at length as it has not been a major concern for the United States because it has generally been between 1%-4% per year since 1990. However, that has likely changed in 2021, making the discussion of inflation and price controls more timely.

¹⁴There is much more than just Bernanke's view of Friedman's monetary framework in that conference proceeding.

¹⁵Card and Krueger (1994) analysis of minimum wage is a classic example of a natural experiment. They compare employment in border counties of New Jersey and Pennsylvania after New Jersey raised its minimum wage above the federal minimum wage while Pennsylvania did not.

While there have been some noted issues with this study, the general methodological idea has had enough importance that Card, along with Joshua Angrist and Guido Imbens, won the 2021 Sveriges Riksbank Prize in Economics Sciences in Memory of Alfred Nobel (of the Economics Nobel Prize if you want to be less formal).

¹⁶<https://www.chapman.edu/our-faculty/vernon-smith>

to align laboratory actions with actions in the non-laboratory setting. The participant values for the items are induced, meaning that the experimenter tells the participant how much a particular unit is worth to that participant. The experimenter then essentially guarantees to "purchase" that item from the participant if that unit is involved in a transaction. The second rule is that deception should not be used as it breaks the link between the incentives and the actions being taken.

While there are many studies using this methodology, its popularity began to increase in the late 1970s and early 1980s. That timing, coupled with the price controls in place in the 1970s, led to some early economic experiments investigating the effect of price controls.

Isaac and Plott (1981) examine price controls and auction markets and Coursey and Smith (1983) examine price controls in posted offer markets. While these markets may seem similar, price controls may have different effects depending upon the type of market mechanism (auction or posted offer) used.¹⁷ The auction mechanism used here is like a pit market one would use for trading stocks – there are offers to buy and offers to sell and when those cross there is a transaction. The posted offer market is like that in most retail stores – there is a posted price and the individual can choose to purchase or not. While the experimenter knows the supply and demand curves in each market, the individual buyers and sellers know only their own value or cost information.

Isaac and Plott find that markets with binding price controls behave as expected – trades are near the level of the respective price control, and that is particularly true after participants have some experience with the market. They also find that "markets under price controls exhibit behavioral regularities which are not included in standard analyses and some of which cannot be explained by the 'traditional' competitive model." When the binding price ceilings were removed prices immediately jumped well above the equilibrium price before converging to the equilibrium price from above. The standard model suggests that prices would converge to the equilibrium from below. However, in markets in which there were no price controls, then binding controls, and then no binding controls, the price returned immediately to the equilibrium price when the binding control was removed. These results suggests that information may play a role in how markets perform when a price control is removed. Coursey and Smith find similar results in posted offer markets. They do note however that sellers in the posted offer market do not initially set prices at a price ceiling and conjecture that they may be concerned that by setting their price above the price of other sellers that they will make no sales.

Isaac and Plott also examine the effect of nonbinding price controls. They find that the supply and demand model makes more accurate predictions than the focal point model discussed earlier. Also, when nonbinding price controls are set near the competitive equilibrium, there is inconclusive evidence that these price controls bias prices below the competitive equilibrium (when there is a nonbinding price ceiling) and above it (when there is a nonbinding price floor). Smith and Williams (1981) specifically examine the effect of nonbinding price controls in the double auction market. They find that when there is a nonbinding price ceiling bids tend to converge to the equilibrium from below (meaning that prices start out below the equilibrium and converge to it) and the opposite result (convergence from above) for a price floor. They determine the reason for this convergence pattern is that the price controls limit the bargaining space for buyers and sellers in the market, so when a nonbinding ceiling is in place sellers need to learn to keep prices near the competitive equilibrium price.

While there is not a lot of current research on price controls in the laboratory economic experiment literature, these papers provide some background on how to implement the methodology. They also show how the experiments can be used to confirm or refute predictions from standard models. Finally, the experiments can be used to uncover previously unknown (or unconsidered) dynamic processes in markets.

2.3 Price Controls for Necessities

The call for price controls typically comes about for goods that are considered necessities.¹⁸ Very few people care if the price of one baseball card is vastly higher than the price of a similar card that cost the exact same

¹⁷Galbraith's comment that market structure is important is similar in spirit to this idea, though his focus was more on standard market structures such as perfect competition, oligopoly, and monopoly.

¹⁸I am using the term "necessity" in its common language usage here. In economics, we define a good as a necessity if its income elasticity is between 0 and 1. Income elasticity is defined as the percentage change in quantity demanded divided by the percentage change in income. Generally speaking, goods that we consider necessities in our non-economics speak are also necessities by nature of their income elasticity.

amount to produce. But many people care about the price of energy, medicine, gasoline, food, housing, etc. If prices for these goods become too high, that these goods are needed by individuals leads to the call for price controls. I briefly discuss a few papers related to price controls in energy markets and pharmaceuticals. Regardless of your area of interest, understanding the institutions and regulations in place is important in understanding the decisions individuals make.

2.3.1 Energy

The market for energy is heavily regulated in most countries. Price controls are just one part of that regulation that we will discuss here. Smith and Phelps (1978) provide an early empirical analysis of the effect of price controls on domestic oil production. At the time, price controls were only in place on certain types of oil: old oil (controlled) and new oil (uncontrolled). They find that these controls did not have much short-term impact on oil production, but that the impacts on the decay rate and supply elasticity were significant. They conjecture that the price controls, which were put in place to limit the transfer of income to oil producing countries, could ultimately cause a greater transfer from the U.S. to OPEC in the future than if the prices had been left uncontrolled. Smith (1981) provides a discussion of the welfare effects of removing price controls in the oil industry gradually or quickly as well as the welfare effects of the combination of decontrol and a windfall profits tax. His analysis shows that removing the price control policy is the best solution globally but may incur losses in the U.S. while a gradual decontrol and the windfall profits tax was the worst option.

Davis and Killian (2011) and Carranza, Clark, and Houde (2015) are more recent empirical analyses of energy markets. Davis and Killian examine the welfare effects of a price ceiling under the case where the highest valued users do not receive the item. They study the U.S. residential market for natural gas from 1954-1989. They note that it is difficult to determine the demand curve as only prices paid are observed, but they use a joint discrete-continuous model in which they model both the amount of energy to purchase as well as the type of heating system. They estimate that allocative cost in the market averaged \$3.6 billion annually from 1950-2000. They also find that consumers who bore a disproportionate share of the burden were exactly the consumers who were supposed to be helped by the policy and that the adverse effects of the price ceilings lasted much longer than the policies themselves. Carranza, Clark, and Houde (2015) focus on the long-run effects of price controls. They study retail gasoline markets in Quebec and find that price floor regulations have a substantial effect on market structure. They find that there were more retail stations in Quebec than other parts of Canada and that those stations in Quebec were more homogeneous in their offerings than other stations in Canada. They also find that even if the price floor does not bind more efficient firms may be blocked from entering.

There are theoretical models of the effect of price controls in energy markets. Lee (1979) provides an inter-temporal analysis of price controls on non-renewable resources. The primary result is that the introduction of a price ceiling in a market with a non-renewable resource may increase extraction of the resource (assuming constant extraction costs), decrease the price below even the price ceiling, and increase the time to exhaustion of the resource. Stocking (2012) examines price controls in a cap-and-trade market. Using a theoretical model and simulations, he shows how price ceilings or floors could serve as a focal point for firms who wish to manipulate the cap-and-trade market. He uses a public goods framework as his theoretical model and shows that all firms could benefit if trades are made at the price ceiling. The free rider problem could be overcome if a few large firms engage in the manipulation. Stranlund and Moffitt (2014) examine how enforcement affects the structure and performance of emissions trading programs when price controls are present. In their model, enforcement may cause abatement-cost risk to be transmitted to enforcement costs through the permit price, which leads to higher emissions and lower permit prices, neither of which are the intended policy goals. They then design an enforcement strategy that ties sanctions to permit prices, and the optimal permit supply and price controls are independent of enforcement costs.

Income elasticity ranges from $-\infty$ to ∞ , so the sign is important. If income elasticity is less than zero the good is inferior (meaning quantity demanded decreases when income increases). If income elasticity is greater than 1 then the good is a luxury. Again, luxury goods as defined by economics tend to match what we consider luxury goods in everyday language.

2.3.2 Pharmaceuticals and Healthcare

Pharmaceuticals are another heavily regulated industry. Slinn (2005) discusses a 20-year period (1948-1967) of pharmaceutical regulation in the UK. The rationale for imposing price controls in the pharmaceutical industry in the UK was that prices were too high and controlling prices would constrain costs. She also notes that while progress has been made on "harmonising national and creating trans-national standards of quality and safety" that "price regulation, however, has remained distinctively national in character and structure." Some countries prohibit certain drug purchases from being reimbursed to discourage their use, some use direct price controls, and some use a combination of methods. Maynard and Bloor (2003) suggest that evidence-based medicine focuses only on the effectiveness of medicine and not on a proper cost-benefit analysis, which would be more complete. They examine a number of policy objectives and regulations in place to achieve those objectives but I will focus only on the price controls. As with Slinn (2005), they note that price controls are implemented to constrain costs and that price control policies vary by country. Perhaps most importantly, they find that if a price control policy is not supplemented with a volume control policy then the policy is incomplete and may not constrain costs as physicians may simply prescribe higher volumes. Antos (2008) reviews a Clinton health reform proposal that was popular at the time of his election but failed to pass. Again focusing on just the price control aspect of this article, his argument mirrors those we have discussed: if prices are kept low, access to care could be limited and the controls may not be strictly enforced nationwide.

Bond and Saggi (2014) and Reisinger, Sauri, and Zenger (2019) provide more rigorous theoretical modeling of price controls in the pharmaceutical industry. Bond and Saggi use a North-South model to examine how price controls and compulsory licensing¹⁹ affect access in developing countries to patented foreign products. Generally speaking, the North-South model examines trade between a developed or core country (North) and a less developed or periphery country (South). If price controls are in place, a domestic company with a patented product may not choose to sell its product in a foreign country if the prices are too low, thus limiting access to the product in the foreign country. They find that compulsory licensing ensures consumers in the foreign country have access to some version of the good, that the potential for compulsory licensing provides a better bargaining position for the foreign producers when engaging in voluntary licensing, and that it can cause the patent holder to directly enter the foreign market, thereby increasing the quality of the product.²⁰ They also show that compulsory licensing and price controls are mutually reinforcing. The possibility of compulsory licensing allows foreign countries to set lower prices and the existence of price controls increase the need for compulsory licensing.

Reisinger, Sauri, and Zenger (2019) examine the effects of parallel trade and price controls on innovation. Parallel trade occurs when producers price discriminate between different countries. Importers then purchase product in the country with the lower prices and resell in the country with the higher prices. The legality of this practice depends on the country and the product.²¹ The standard argument is that parallel trade should reduce innovation. However, Grossman and Lai (2008), using a North-South model, show that innovation is faster under parallel trade when governments can endogenously determine price caps on goods. The key difference between the two models is that Reisinger, Sauri, and Zenger allow the marginal utilities of consumers in the two countries to differ, while Grossman and Lai do not. What seems like a small detail can actually have an important affect on the predictions of the model.

Kyle (2007) and Stremersch and Lemmens (2009) provide empirical analysis of price controls in pharmaceutical markets. Kyle specifically focuses on whether domestic price controls affect entry strategies of foreign producers. She finds that "price controls delay or reduce the probability of launch in countries that impose them" and that they "negatively affect the extent of international launch for products invented by domestic firms." As Maynard and Bloom suggest, Kyle also suggests a consideration of a more complete cost-benefit analysis, including both the benefits of short-term savings from price controls and long-term costs related to reduced incentives for innovation. She also finds that the affect of a price control is not local and that local price controls may lead to delays in launch on the broader market.

¹⁹For background on compulsory licensing, see: https://www.wto.org/english/tratop_e/trips_e/public_health_faq_e.htm
Essentially, foreign producers can use compulsory licensing to produce patented pharmaceuticals, though they still must pay the patent holder.

²⁰The authors assume that the patent holder produces a higher quality product than any licensed producer.

²¹<https://www.accc.gov.au/business/treating-customers-fairly/selling-parallel-imports>
<https://affordablemedicines.eu/what-is-parallel-trade/>

Stremersch and Lemmens (2009) examines the role of regulation on sales growth. As Maynard and Bloor mention, capping price without capping volume may not reduce sales. While our static supply and demand model does not make that prediction, the marginal cost of producing most pharmaceuticals tends to be low and pharmaceutical producers tend to be monopolists (because of patents) or, at a minimum, in an industry with limited competition. Thus it is possible that the equilibrium price and quantity in the unregulated market is inefficient in that the producer's private marginal benefit does not align with society's so that the producer could produce more and still maintain positive economic profit.²² Stremersch and Lemmens find that reducing price via price controls has a positive effect on sales volume of the pharmaceuticals.

2.4 International Markets

While we have discussed some papers that relate to international markets, the papers in this section do not fit into the energy or pharmaceutical categories, but I find them interesting. Galbraith (1943) and Grossman and Lai (2008) are the only papers we have discussed that suggest price controls could have a positive welfare effect. Ghosh and Walley (2004) examine the pros and cons of price controls on rice in Vietnam. They use a multi-sector multi-household general equilibrium (computational) model to examine the effect of price controls. These computational general equilibrium models are typically based on some underlying microeconomic model of individual agents (a household in this model, which could be rural or urban, as well as firm production for specific sectors). Key parameters are then calibrated so that the predictions of the model match a set of stylized facts. A shock (which could be a policy implementation or the removal of a policy, such as the removal of a price control) is then introduced and new predictions are made using the same underlying models of agents and the calibrated parameters. They find that the price controls on rice could be a revenue generating strategy in low income economies with a large agricultural sector as a substitute to broadening the tax base.²³ Also, price controls could help to insulate the domestic economy from international shocks. While price controls still have their standard distortionary effects in their model, these other benefits may outweigh the costs of the price controls.

Alexeev and Leitzel (2001) also use a computational model for their analysis. In their model, they consider economies transitioning from communist/command economies to more market-oriented economies. While we have discussed the nondistortionary effects of lump sum taxes and payments, they argue that it may be difficult for government leaders to determine which individuals in these transitioning economies should receive these lump sum transfers, which reduces their benefit if they end up being transferred to individuals who are not low income. They argue that having parallel markets – one with price controls and one without – could serve as a mechanism to sort individuals by how much they value time. Those who have a high opportunity cost of time would shop in markets that were not subject to price controls and in which queues do not exist; those with a low opportunity cost of time would shop in markets with price controls, where queues exist, but they save money at the expense of time. This method of sorting individuals may be welfare improving over poorly targeted subsidies.

Finally, Aparicio and Cavallo (2021) examine targeted price controls on supermarket products in Argentina. As mentioned at the outset of these notes, price controls are typically implemented as a means to control inflation. With the collection of electronic data, governments are now more able to enforce targeted price controls on many consumer goods, not just those in highly regulated industries. They empirically analyze prices of goods under price controls and not under price controls. Ultimately they find that these targeted price controls were ineffective at curbing inflation. They did find that shortages were uncommon, perhaps due to software that allowed individuals to report when items were out of stock. They also found that firms would introduce new varieties of products at higher prices to improve their profit margins.

3 Criticisms

The primary criticism of the textbook supply and demand model analysis is that it does not capture dynamic effects nor does it capture effects outside the market. Time effects are mentioned by multiple authors as an important consideration in the implementation of price controls. Also, while our analysis has been using the

²²In later notes on regulation we will discuss average cost and marginal cost pricing which are related to this idea.

²³All rice output is treated as traded through a government agency. (p. 219)

partial equilibrium supply and demand model, general equilibrium effects like substituting capital for labor could be large enough to offset any benefit of implementing the control.

We have ignored the fact that enforcing price controls requires oversight, which is costly. As Mills and Rockoff (1987) mention, the United Kingdom had more compliance with price controls in WWII than the United States, but the UK also had higher regulatory cost due to stricter enforcement. As part of the cost-benefit analysis of implementing a policy, the cost of enforcement of that policy must be included.

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