Law and Macroeconomics: An Application to Optimal Tort Law

Abstract:

This paper introduces macroeconomic effects into the canonical law and (micro)-economic model of optimal tort law. When an economy suffers from inadequate aggregate demand and expansionary monetary policy is constrained by the zero-lower bound on interest rates, expenditures on precautions to avoid injuries have "aggregate demand externalities". In addition to reducing damages from injury, expenditures on precautions raise incomes for the sellers of precautions (e.g. car brake mechanics). With higher incomes, the sellers, in turn, consume and invest more. This "multiplier" effect of the original expenditure on total spending and output can be modelled as an aggregate demand externality and introduced into the standard economic model of tort law. When we introduce aggregate demand externalities into the economic model of tort law, we reach very different conclusions. Specifically, a strict liability rule and the Hand Rule for negligence both produce inefficient outcomes with respect to expenditures on precaution and activity levels. Instead, negligence rules with more stringent standards of care than the Hand Rule become more efficient. If standards of care get too high, however, then an enhanced negligence rule no longer yields a better outcome than strict liability or the Hand Rule. Optimal tort law therefore looks very different when we introduce aggregate demand externalities. If efficient tort law changes when we introduce macroeconomic effects, then we can presume that our law and microeconomic conclusions regarding other areas of law will change as well.

I. Introduction

Law and economics should really be called "law and microeconomics." Our models aim to make law as micro-economically efficient as possible; we assume that macroeconomic effects, such as aggregate demand shortages, either do not exist or can be handled with other instruments.

These assumptions were reasonable approximations before 2008. During the "Great Moderation" of the post-World War II era, it seemed that the periodic but prolonged output declines that characterized the economic history of advanced economies in the 19th and early 20th centuries were a thing of the past.[1] Overcoming small macroeconomic fluctuations caused by inadequate or excess "aggregate demand" (a fancy word for the desire to spend on consumption or investment) was a task for the Central Bank. As a result, there was no need to make law and economics more complicated by introducing macroeconomic considerations.

The Great Recession of 2008-2009 and its painful aftermath undermined these conventional wisdoms. Central Banks around the world proved unable to mitigate an intense and prolonged period of inadequate aggregate demand, with worldwide costs in the tens of trillions. In addition, the textbook backup policy for promoting aggregate demand, fiscal stimulus, was hardly tried, in part because of high debt levels. In the face of these policy failures, macroeconomists are "rethinking macroeconomic policy."[2] New instruments for macroeconomic stabilization are being considered.

Law offers one hitherto unexamined tool for stabilizing aggregate demand. Like government spending and monetary policy, laws and regulations can stimulate or inhibit spending. Indeed, law plays a role in almost every spending decision. With the failure of traditional macroeconomic policy, the time has come to consider adding law to the macroeconomic policy toolkit. And to understand the implications of law and macroeconomics, we need to add macroeconomic effects to our standard law and (micro)economic models.

In this paper, I develop one method for introducing macroeconomic considerations into one of the canonical models of law and economics, the microeconomic model of tort or "accident" law. I focus on tort law not because tort law is the area of law with the most important macroeconomic implications. Rather, I use tort law because economic analysis of tort law produced some of the seminal

[1] See, e.g., Ben Bernanke, "The Great Moderation", available at http://www.federalreserve.gov/boarddocs/speeches/2004/20040220/ ; Davis, Steven J., and James A. Kahn. 2008. "Interpreting the Great Moderation: Changes in the Volatility of Economic Activity at the Macro and Micro Levels." *Journal of Economic Perspectives*, 22(4): 155-80.

[2] This has been the title of three conferences hosted by the IMF. See Olivier Blanchard, "Ten Take Aways from the "Rethinking Macro Policy: Progress or Confusion?", available at https://blog-imfdirect.imf.org/2015/05/01/ten-take-aways-from-the-rethinking-macro-policy-progress-or-confusion/.

thinking about the economic effects of law.[3] Moreover, the economic model of tort law formed the basis for many other economic models of law, including regulation.[4] If adding macroeconomic considerations changes our conclusions about tort law, then it is likely that macroeconomics will change many of our standard law and microeconomic conclusions.

In particular, I introduce macroeconomics into the model of accident law by assuming that, during recessions, market transactions cause "aggregate demand externalities".[5] According to Keynesian macroeconomic theory, a purchase does not just affect the buyer and seller. Instead, a purchase may have "multiplier" effects. The income that the seller earns from a purchase causes the seller to consume more, helping third party sellers. In turn, these third party sellers, their incomes increased, buy more from still other sellers. Thus, the original purchase entails aggregate demand "externalities" on many third parties.

The introduction of macroeconomics via aggregate demand externalities alters many of the canonical results of the economic analysis of tort law. My analysis demonstrates that we need different tort law rules in zero lower bound recessions than we use in ordinary economic times. Tort standards should be business cycle sensitive. In addition, precautions purchased in market transactions (which cause aggregate demand externalities in deep recessions) should have different standards of care than non-market precautions. And when activity levels are fixed and injurers choose only precautions, a tort rule of strict liability yields inefficient precaution. So do does a negligence rule set according to the "Hand Rule." Instead, we need a more demanding standard of care to achieve socially efficient precautions in the presence of aggregate demand externalities.

The introduction of aggregate demand externalities also negates the canonical optimal tort law results with respect to activity levels. The standard model predicts that strict liability produces efficient activity levels, while negligence rules yield excessive activity levels. With aggregate demand externalities, neither negligence rules nor strict liability produce efficient activity levels. Indeed, the activity level with a negligence rule may be preferred to a strict liability rule. When activity levels can vary, we also cannot derive simple conclusions about the optimal negligence rule. If aggregate demand externalities are very high, a less stringent negligence rule may yield the best outcome because it encourages the highest aggregate demand externalities. But if aggregate demand externalities are not too large, then a negligence rule stricter than the Hand Rule yields better outcomes than the Hand Rule.

---

[3] See, e.g. Guido Calabresi, *The Costs of Accidents: A Legal and Economic Analysis* (1970); Steven Shavell*, Economic Analysis of Accident Law*, (1987).

[4] See, e.g., Shavell, Steven and A. Mitchell Polinsky. "The Economic Theory of Public Enforcement of Law." *Journal of Economic Literature* 38, 1 (March 2000): 45-76 (applying a variant of the economic model of tort law to "regulators, inspectors, tax auditors, police, prosecutors").

[5] For a summary of "aggregate demand externalities", see, e.g., N. Gregory Mankiw, "New Keynesian Economics", The Concise Encyclopedia of Economics, available at http://www.econlib.org/library/Enc/NewKeynesianEconomics.html. For a more recent rethinking of macroprudential policy and redistribution policy in light of aggregate demand externalities, see Emmanuel Farhi & Iván Werning, "A Theory of Macroprudential Policies in the Presence of Nominal Rigidities, NBER Working Paper No. 19313 (2013).

In total, my analysis suggests that law and macroeconomics yields results very different from the standard law and microeconomic analysis. Accordingly, we need to develop a robust law and macroeconomics to complement our existing literature.

II. Aggregate Demand Externalities

What are aggregate demand externalities? They are externalities imposed on others through their effect on macroeconomic variables rather than their effects on specific non-parties to a transaction. To illustrate, consider a firm's pricing decisions for its products. When a firm decides to change its prices, it has a direct effect on the firm's profits and the welfare of the firm's customers. If the firms's products do not cause environmental externalities, then we would not think that the firm's pricing decision affects all participants in the economy.

With price rigidities, however, an individual firm's pricing decision has a macroeconomic effect.[6] The firm's price is one of many prices that help determine the aggregate price level, P. If the firm lowers its price, the aggregate price level goes down slightly. In turn, the aggregate price level helps determine the "real money supply" of the economy, which is defined as the nominal value of money divided by the price level. ($\frac{M}{P}$). Keynesian macroeconomics predicts that a greater real money supply increases aggregate demand by lowering interest rates and encouraging investment. Indeed, this prediction (and its empirical confirmation) justifies Central Bank Interventions in the money supply (M) to stabilize aggregate demand.

When the firm lowers its price, the price decrease (very) slightly increases the real money supply, lowers the interest rate, and raises aggregate demand and output. Thus, the firm's decision to lower its price causes an aggregate demand externality.

As with other externalities, firms will ignore aggregate demand externalities. Firms choose prices to maximize their own profits, rather than cumulative economic output. As a result, private price setting may lead to inefficient outcomes, such as inadequate aggregate demand and output. Monetary policy tries to offset these externalities. If aggregate demand is inadequate and firms aren't cutting prices by enough to enable full employment (P is too rigid), then the Central Bank can raise the money supply, M, to enable an increase in real money balances that was unattainable due to the aggregate demand externality.

In ordinary times, we rely on Central Banks to enact policies to offset aggregate demand externalities. As a result, the relevance of these externalities in ordinary times is limited. Law and economics can reasonably ignore aggregate demand externalities under these circumstances.

At times, however, monetary policy is constrained. For example, at the "zero lower bound" to nominal interest rates, the Central Bank's ability to stimulate the economy by raising real money

[6] See Blanchard, Olivier Jean and Nobuhiro Kiyotaki, "Monopolistic Competition and the Effects of Aggregate Demand," *American Economic Review*, September 1987, 77 (4), 647–66.

balances and lowering interest rates loses traction. The Central Bank has done all it can do without resorting to controversial "unconventional" monetary policy such as quantitative easing.

At the zero lower bound, positive aggregate demand externalities become large, as the Central Bank cannot offset these externalities via monetary policy. . At the zero lower bound of interest rates, spending "multipliers" can exceed 1.5.[7] This means that a dollar of additional government spending increases total output by more than $1.50. A dollar of spending causes fifty cents of externalities in addition to its direct effects of one dollar of economic activity.[8]

The textbook response to the zero lower bound constraint is expansionary fiscal policy.[9] With monetary policy impotent, the government should spend more during recessions characterized by the zero lower bound because such spending has a high positive aggregate demand externality. If aggregate demand externalities are high at the zero lower bound but low during ordinary times, then a government policy to spend more now but reduce spending in the future to repay the debt incurred will have a positive net effect on total output. Raising government spending and lowering tax rates provides an alternative source of aggregate demand stimulus.

Expansionary fiscal policy faces its own set of constraints. At many levels of government (such as states and municipalities), government cannot run a deficit. If government revenues go down, then these jurisdictions must reduce, rather than expand, government spending. And even governments that can run deficits face other constraints, such as worries about the bond markets or legislative inertia, that prevent fiscal policy from correcting the inefficiencies associated with high aggregate demand externalities.

At present, finding alternative avenues of aggregate demand stimulus when both fiscal policy and monetary policy are constrained is an urgent public policy concern.[10] I now explore law as a solution to the problem of aggregate demand externalities.

---

[7] In 2009, the non partisan Congressional Budget Office estimated that the fiscal multiplier for government spending from the 2009 ARRA ranged between .5 and 2.5. The midpoint of these estimates is 1.5. https://www.cbo.gov/sites/default/files/114th-congress-2015-2016/workingpaper/49925-FiscalMultiplier_1.pdf. . For theoretical accounts of why the fiscal multiplier is so high at the zero lower bound, see . Lawrence Christiano & Martin Eichenbaum & Sergio Rebelo, When is the Government Spending Multiplier Large?, 82 *Journal of Political Economy* 78 (2011); Eggertsson, G B (2011), "What Fiscal Policy is Effective at Zero Interest Rates?" *NBER Macroeconomics Annual* 25: 59–112. For empirical estimates showing high multipliers at the zero lower bound, see, e.g., Auerbach, A. J. and Gorodnichenko, Y. 2012. Measuring the output responses to fiscal policy. *American Economic Journal: Economic Policy*, 4, 1–27.

[8] According to classical assumptions, output should not even rise one for one as government spending increases. Instead, the additional spending demand from the government should crowd out other spending so that total output remains unchanged while prices go up. See, e.g., N. Gregory Mankiw, *Macroeconomics* 324-325 (7th ed. 2010).

[9] See, e.g., J Bradford Delong & Lawrence Summers, Fiscal Policy in a Depressed Economy, *Brookings Papers on Economic Activity* (2012).

[10] For example, the Brookings Institution hosted a March 21 2016 conference entitled, "Are We Ready for the Next Recession?", available at http://www.brookings.edu/events/2016/03/21-are-we-ready-for-the-next-recession. The conference considered "which fiscal and monetary policy tools will be available in the event of a recession—

III. An Economic Model of Tort Law With Aggregate Demand Externalities

A. Precautions with Activity Levels Constant

I begin with the "textbook" model of torts as presented by Miceli.[11] First, I will assume that "activity levels", other than precautions are constant. I relax this assumption in the next section. Assume that there is an injurer, who can take precautions, denoted by x, to avoid causing an injury. There is also a potential victim. The victim cannot do anything to prevent injury. (This is a model of "unilateral" care.) The victim suffers damages expressed in dollar terms, $D(x)$, that are, in the relevant range, a decreasing function of the precautions taken by the injurer $D'(x) < 0$. The marginal value of precautions in preventing injuries decreases as more precautions get taken, $D''(x) > 0$. At some extreme level of precautions, additional precautions start to become counterproductive, $D'(x^{extreme}) > 0$.

The precautions taken by the injurer, x, may or may not have an aggregate demand externality, $A(x) \geq 0$. Precautions will have aggregate demand externalities if they are market transactions that occur during a recession where monetary policy is constrained by the zero lower bound. Non-market decisions do not produce aggregate demand externalities, even if they take place at times of inadequate aggregate demand with a high Keynesian multiplier.

Consider a car driver taking precautions to avoid harming others. Some of the driver's precautions, call them x_1, are typically purchased in a market (e.g., keeping the car's brakes in good repair and replacing them when they get worn out.[12]) Assume that the economy is in a recession and that market expenditures have positive and proportional aggregate demand externalities given by, $A(x_1) = kx_1$, that equals the external multiplier effects of economic activity minus one. ($m = k - 1 \geq 0$). Thus, a fiscal multiplier of 1.5, the midpoint of the CBO's estimate during a recession, corresponds to a 50% aggregate demand externality ($k = .5$). When a driver pays for brake repair during a recession, this becomes the service worker's income. In turn, the service worker spends the additional money on consumption, which becomes a third parties income, and so on.

Other precautions, termed (x_2), such as the level of attention the driver gives to the road, are non-market decisions. There are no aggregate demand externalities associated with these transactions. Without any money changing hands, there is no external increase in consumption. As a result, $A(x_2) = 0$.

Alternatively, we can understand x_2 to refer to market transactions in periods without aggregate demand externalities. This means that the resources that are not spent on precautions get devoted in their entirety to something else, so that additional expenditures on x_2 do not raise overall

and which won't—and how effective additional fiscal and monetary stimulus is likely to be, along with new ideas to make fiscal policy more effective." The conference did not consider stimulus policies, like law, that are outside of monetary and fiscal stimulus—in large part because such alternative policies have not been explored.

[11] See Thomas J Miceli, *Economics of the Law: Torts, Contracts, Property, and Litigation*, 15-38 (1997) at Chapter 2.

[12] For simplicity, I will assume that all potential injurers either purchase a good in a market or not (goods are either market or non-market goods). Thus, the model assumes that no one repairs their own brakes.

output and resource utilization. This is the state of the economy that is examined in existing law and microeconomic models such as the model of torts.

1. Socially Optimal Precautions

A social planner aims to maximize social welfare, where welfare is given by the sum of precautions by injurers, damages from injuries to victims and aggregate demand externalities from precautions.

$$\min_x x + D(x) - A(x) \qquad \textbf{(1)}$$

a) Non-Market Precautions

For non-market or non-recession period precautions, there are no aggregate demand externalities, $A(x_2) = 0$. Therefore, the social planner's problem is identical to the standard problem. The social planner spends on precautions so long as precautions provide at least a dollar for dollar reduction in the costs of injuries. Thus, the first order condition becomes

$$1 + D'(x_2^*) = 0 \qquad \textbf{(2)}$$

Where x_2^* denotes the socially efficient level of non-market precautions.

b) Market Precautions

For a market precaution with an aggregate demand externality, however, the social planner chooses precautions until the marginal costs of precaution equal the combined value of the reduction in injuries and the positive aggregate demand externality associated with more precaution expenditures. The social planner thus chooses greater precautions than without aggregate demand externalities because precautions now have an added benefit—precaution expenditures increase aggregate income, aggregate consumption, and aggregate demand. The social planner's first order condition becomes

$$1 + D'(x_1^*) - k = 0 \text{ or } D'(x_1^*) = k - 1 > -1. \qquad \textbf{(3)}$$

As we would expect with any positive externality, the socially optimal level of precaution with positive aggregate demand externalities rises relative to the optimal level of precaution without such externalities. $x_1^* > x_2^*$.[13]

Because expenditures on the same good can have different aggregate demand externalities depending on the state of the business cycle, tort law should depend on the business cycle. When aggregate demand externalities are high (as with x_1), the standard of care should be stricter than when aggregate demand externalities are zero (as with x_2).

2. Precautions Under Strict Liability

A strict liability rule requires the injurer to pay for all damages incurred on the victim. A strict liability rule means that the injurer chooses precautions to minimize the sum of the damages associated with injuries and the costs of precautions to avoid injuries.

---

[13] Comparing equation (**3**) with equation (**1**), $D'(x_1^*) = k - 1 > -1 = D'(x_2^*)$. Since $D''(x) > 0$, $x_1^* > x_2^*$.

$$\min_x x + D(x) \quad \textbf{(4)}$$

Under a strict liability rule, the injurer invests in precaution until the marginal value of precaution equals the marginal cost of the reduction in injuries associated with more precaution. The first order condition is

$$1 + D'(x^{SL}) = 0 \quad \textbf{(5)}$$

When precautions have no aggregate demand externalities (as with x_2) , $A(x_2) = 0$, the cost of injuries and of precautions are the only relevant costs and benefits for socially optimal precaution decisions. Thus, the injurer faces the same problem as the social planner when there are no aggregate demand externalities. (Equation **(1)** is the same as **(4)** when $A(x) = 0.$) The injurer and the social planner choose the same amount of precaution.($x_2^{SL} = x_2^*$). This is the well-known result that strict liability produces socially optimal incentives for precaution.

Strict liability yields an inefficiently low level of precaution when precaution causes an aggregate demand externality. Under strict liability, the injurer minimizes the costs of precaution and injury. The injurer does not internalize the aggregate demand externality associated with precautions. (Equation **(1)** differs from Equation **(4)** when $A(x) > 0$.) Because the injurer does not account for a positive benefit associated with precautions, the injurers chooses too little precaution. $x_1^{SL} < x_1^*$. [14]

3. Precautions Under a Negligence Rule

Under a negligence rule, an injurer pays for harm caused to the victim if and only if the injurer's precaution falls short of a level defined as the negligence standard. Otherwise, the injurer incurs only precaution costs, even if injuries still occur. That is, the injurer solves the problem:

$$\min_x x + D(x) \qquad x < z$$

$$\min_x x \qquad x \geq z \qquad \textbf{(6)}$$

Where z is the negligence standard. Without aggregate demand externalities for precaution, a negligence rule produces efficient precaution so long as the standard for negligence is set at the efficient level. The negligence standard of care should be set at the point at which the marginal costs of precaution equal the marginal reduction of injuries associated with the additional precaution. If the negligence rule is set at this level, (known as the marginal "Hand Rule" level), then a negligence rule produces efficient levels of precaution. That is, if $z_2 = x_2^*$, then $x_2^{Neg} = x_2^*$.

Now consider the possibility of aggregate demand externalities for precautions purchased in the market, $A(x_1) > 0$. The injurer's problem, given by (**6**), becomes very different from the social planner's problem, given by (**1**). The injurer ignores aggregate demand externalities and focuses only on

[14] $x_1^{SL} = x_2^*$. In the previous footnote, we established that $x_1^* > x_2^*$.

precautions and possible damages. If the negligence standard is set at the marginal Hand Rule level—as if there were no externalities-- then the negligence rule yields too little precaution. Injurers choose inadequate precaution because they minimize the private costs of precaution and damages and ignore the aggregate demand externalities associated with purchasing precaution. That is, if $z_1 = x_2^*$, (where x_2^* represents the marginal Hand Rule standard of care), then $x_1^{Neg} = x_2^* < x_1^*$.

Both conventional negligence standards and strict liability rules generate inadequate incentives for precautions when precautions cause aggregate demand externalities. The negligence standard, however, does not have to be set at the marginal Hand Rule level. Instead, the negligence standard should be set to account for the aggregate demand externality. If the court sets a higher negligence standard than the marginal Hand Rule in order to account for the positive aggregate demand externality associated with precaution, then the injurer will take additional precautions. Thus, the optimal negligence standard for precautions with aggregate demand externalities is higher than the marginal Hand Rule. If the negligence standard is set at a precaution level that fully accounts for aggregate demand externalities, $z_1 = x_1^*$, then the social optimum may be reached. If aggregate demand externalities are high enough, however, then the social optimum may not be reached.

With respect to optimal negligence standard in the presence of aggregate demand externalities, we can say with certainty that the optimal negligence standard in the presence of aggregate demand externalities should be higher than it is without externalities, that is $z_1 > z_2$. The standard should adjust upwards to account for aggregate demand externalities. We cannot say, however, that the negligence standard should be set as high as the precaution level that the social planner would ideally dictate--the first-best level of precautions. If the social planner sets the precaution standard too high, then the injurer may decide to violate the standard.

Figure 1 demonstrates why the negligence standard should require higher precautions when there are aggregate demand externalities, $z_1 = x_1^{AD} > z_2 = x_1^{HR}$, but cannot always achieve the first best (x_1^*).

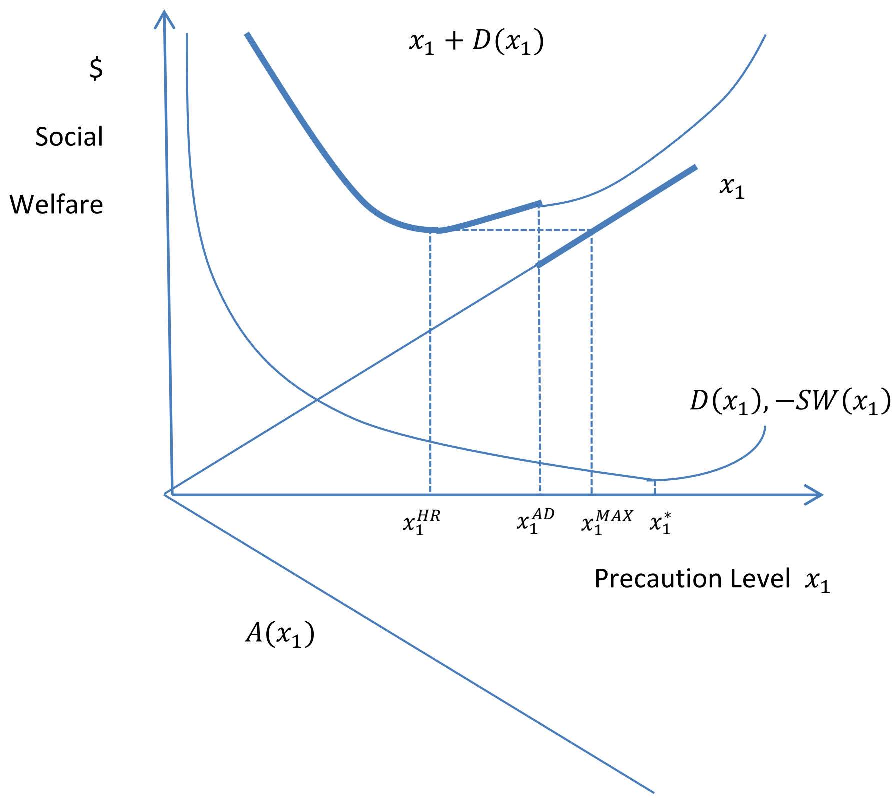
There are two curves and two lines in Figure 1. The upward sloping line from the origin reflects the costs of precautions (x). The downward sloping line from the origin reflects the positive aggregate demand externalities (negative social costs) associated with precautions. For simplicity, I assume that aggregate demand externalities are 100% ($k = 1$). The aggregate demand externalities exactly equal the private costs of precautions, so that spending on precaution is, from a social perspective, free.[15] As a result, damages as a result of injuries, the curve given by $D(x_1)$, represents the entire social cost curve. The fourth, U-shaped curve, $x_1 + D(x_1)$, shows the private costs of precautions and damage payments to the injurer.

We established above that if the negligence standard is the Hand rule, x_1^{HR}, then the injurer will choose a level of precaution just above the standard. This precaution level keeps the injurers from

[15] This corresponds to the Keynesian prescription of paying people to dig holes and then fill them up as a socially useful policy. In reality, aggregate demand externalities are probably smaller, but this assumption makes the exposition simpler without changing any of the intuition.

owing damage payments while minimizing the injurer's costs of precaution. This level of precaution, however, is not the socially optimal level, given by (x_1^*) . Instead, total social costs will be lower when precaution levels are higher because of the aggregate demand externalities associated with taking precaution.

Figure 1: Injurer Precautions Under a Negligence Rule



The darkly shaded curves depict the injurer's private costs with a negligence standard set to be above the Hand Rule level of precaution to reflect the aggregate demand externalities associated with precaution. ($z_1 = x_1^{AD} > x_1^{HR}$). For precaution levels below the heightened negligence standard, the injurer pays both the costs of precaution and the costs of injury because the injurer owes damages. For higher precaution levels, the injurer pays only the costs of precaution because the injurer is not negligent. As the literature discusses, this creates a discontinuity in costs around the negligence standard, $z_1 = x_1^{AD}$. When precautions are just below this level, the injurer owes damages for injuries. When precautions are just above this level, the injurer does not owe damages.

The injurer will choose a precaution level to minimize the total costs given in the darkly shaded regions of the two curves. Because of the discontinuity created by the negligence rule, the injurer will choose precautions at or just above the heightened negligence standard. x_1^{AD} . This represents the lowest point on the darkly shaded regions of the two curves. Even though the marginal private costs of precaution exceed the marginal reduction in injury costs at this level of precautions, the injurer chooses to meet the heightened standard so as to avoid being liable for damages.

The heightened standard of care gives higher social welfare than the Hand Rule standard of care. $D(x_1^{AD}) < D(x_1^{HR})$. The heightened standard also brings higher welfare than a strict liability rule (in which the injurer minimizes $x_1 + D(x_1)$ and also chooses $x_1 = x_1^{HR}$. Social welfare is higher with a negligence rule with the heightened standard of care because higher precautions are extremely (socially) valuable due to the aggregate demand externalities associated with precautions. And the heightened negligence rule creates incentives for the injurer to comply with the heightened standard. As a result, a heightened negligence standard improves social welfare in the presence of aggregate demand externalities from pre

If social welfare increases with precaution expenditures, then why not make the negligence standard exceedingly high and improve social welfare even more? If the negligence standard is too strict, then the injurer will not choose to meet the standard. Instead, the injurer will prefer to accept liability for injury and choose a precaution level that minimizes total costs. In Figure 1, this occurs when the negligence standard is higher than $z_1 = x_1^{MAX}$. At any standard higher than this, the injurer will choose to fail the standard and pay damages. This will result in precautions of x_1^{HR}. At this level of precaution, social welfare is lower than the social welfare with a moderately heightened negligence standard of, for example, x_1^{AD}. Because of this constraint, a stricter negligence does not always achieve the social optimum, x_1^*. Indeed, in Figure 1 the social optimum is unattainable with a negligence rule. Social welfare is maximized in Figure 1 with a negligence rule of $z_1 = x_1^{MAX}$.

Thus, in the presence of aggregate demand externalities from precaution, a negligence rule allows for higher social welfare than a strict liability rule. The negligence rule should be set at a higher precaution level than the standard, Hand Rule level. But the standard of care should not set so high as to make injurers decide that compliance with the stricter standard is not worth the cost.

IV. Aggregate Demand Externalities and Activity Levels

In Section III, I assumed that activity levels were constant. The injurer chose the precaution level, conditional on the activity taking place. With respect to driving, this meant that the injurer was driving no matter what and only chose the level of care with which to drive.

This was a simplification (albeit a standard one in the optimal tort literature). In reality, drivers choose whether or not to drive as well as how much precaution to take while driving. Optimal tort papers therefore consider "activity levels" as well as precautions. In this Section, I explore optimal tort law in the presence of aggregate demand externalities when we allow activity levels to vary.

A. Activity Levels Without Agggregate Demand Externalities

First, lets review the optimal tort literature on activity levels without aggregate demand externalities. Let n be the amount of activity (e.g. how many driving trips) and redefine x to mean the amount of precaution, in dollars, per activity (per trip) and $D(x)$ to mean the amount, in dollars, of injury per activity (trip). Let $w(n, x)$ be the injurer's profit or personal benefit (in dollar terms) from taking n trips at a precaution level of x per trip. Assume that $w_x < 0$, $w_{xx} \leq 0$—precautions reduce profits and become increasingly unprofitable. $w_n > 0$ at first, meaning that the injurer wants to do some of the activity, and ultimately becomes negative, so that $w_{nn} < 0$—there are decreasing marginal profits from undertaking more activities. Therefore, there is a positive but not infinite activity level associated with each level of precaution where the injurer's profit is maximized. Finally, $w_{nx} < 0$, as the level of precautions go up, the marginal benefit of additional activity goes down.

With no aggregate demand externalities. The social welfare function is:

$$\max_{n,x_2} w(n, x_2) - nD(x_2) \qquad (7a)$$

Solving for the optimal precaution level gives the analogue to equation (**2**) above.

$$w_x - nD'(x_2) = 0 \qquad (7b)$$

The injurer should choose precaution until the marginal profit loss associated with precaution equals the marginal reduction in total damages.[16] Call this precaution level x^*.

Choosing the optimal activity level yields:

$$w_n = D(x_2) \qquad (8)$$

At the socially optimal activity level, the injurer's marginal profits associated with more activity should be equal to the amount of damages caused by the activity. Call this activity level n^*.

[16] The marginal reduction in damages equals the reduction in damages per trip associated with higher precautions times the number of trips.

Under a strict liability tort regime, the injurer's problem is the same as the social welfare function. Thus, strict liability yields efficient outcomes, (x_2^*, n^*) with respect to both precaution levels and activity levels when there are no aggregate demand externalities.

Under a negligence regime, the injurer's problem becomes:

$\max_{n,x_2} w(n,x_2) - nD(x_2)$ if $\quad x_2 < x_2^{Neg}$ and

$\max_{n,x_2} w(n,x_2)$ if $\quad x \geq x_2^{Neg}$ **(9a)**

Assume that the negligence standard is set at the Hand Rule level (where the marginal costs of additional precautions equal the marginal reduction in damages), $x_2^{Neg} = x^{HR} = x_2^*$.

As established in Section III, when the negligence standard of care is equal to the Hand Rule, the injurer takes efficient precautions.

The injurer's chooses activity level under a negligence to rule to maximize:

$$\max_{n} w(n)$$

Yielding the first order condition, $w_n = 0$ **(9b)**

The injurer chooses to undertake additional activities until the marginal benefit from the activities is zero. Call this level of activity n^p.

As is well known, the injurer takes too much precaution under a negligence regime. $(n^p > n^*)$.[17] So long as the injurer meets the negligence standard, the injurer does not have to pay for damages caused. As a result, the injurer ignores the costs of the damages associated with additional activity because the injurer does not have to pay for them. Instead, the injurer keeps doing additional activities until they have no private benefit. The injurer therefore chooses too much activity because the injurer does not internalize the injury costs associated with additional activities.

Thus, the optimal torts literature concludes that a strict liability regime is superior to a negligence regime with respect to activity levels. Strict liability produces the socially efficient level of activity while negligence produces too much activity.

B. Activity Levels With Aggregate Demand Externalities

Now assume that activity levels, as well as precaution expenditures, have aggregate demand externalities. In the driving accident context, if an injurer does more driving, then they spend more. For example, many driving trips go to stores to purchase goods. In a recession at the zero lower bound, these extra trips causes aggregate demand externalities as described in Section II.

[17] Under negligence, $w_n = 0$. At the social optimum, $w_n = D(x)$. Because $w_{nn} < 0$, $n^p > n^*$.

When activity levels as well as precaution expenditures can vary, the social welfare problem with aggregate demand externalities becomes

$$\max_{n,x_1} w(n,x_1) - nD(x_1) + knx_1$$

The first order condition with respect to precaution becomes

$$w_x(\quad) - nD'(\quad) + kn = 0 \qquad (10)$$

The injurer should choose precautions until the marginal costs of these precautions in terms of lost profits equal the benefits associated with more precaution, which are both reduction in damages and aggregate demand externalities. Call this level x_1^* . Because there are greater benefits associated with precautions with aggregate demand externalities, the injurer should take more precautions at the social optimum than without such externalities., $x_1^* > x_2^*$.[18] This result is the analogue of our results with respect to precaution in the previous section.

With respect to activity levels, the first order condition with aggregate demand externalities becomes

$$w_n(\quad) - D(\quad) + kx_1 = 0 \qquad (11)$$

Call this activity level n^{AD}. Because more activity produces aggregate demand externalities in addition to private benefits to the injurer, the socially optimal level of activity is higher in the presence of aggregate demand externalities that it would otherwise be. That is, $n^{AD} > n^*$.[19]

I now examine the efficacy of strict liability and negligence regimes in the presence of aggregate demand externalities. As with the existing literature, I will assume that negligence rules can be applied to levels of precaution, but cannot be applied to activity levels. (i.e. there is no such thing as a negligent amount of driving.)

When there are aggregate demand externalities, a strict liability regime (see equations 7a and 7b) yields too little activity. As shown above, the strict liability regime produces activity level, n^*, which we have already shown is less than n^{AD}, the optimal activity level with aggregate demand externalities. Intuitively, the injurer does not internalize aggregate demand externalities associated with more activity under a strict liability regime. As a result, the injurer chooses too little precaution.

Now consider a negligence regime with the rule set to the Hand Rule standard, x^{HR}, as in equations 9a and 9b above. We already showed that this regime produces a high activity level, n^p, where the injurer's private marginal benefit from more activity is equal to zero. $n^p > n^*$.

---

[18] Compare the first order condition with aggregate demand externalities, equation 7 with the first order condition with aggregate demand externalities, equation 10. Because $w_{xx} < 0$, $x_1^* > x_2^*$..

[19] Compare the first order condition with aggregate demand externalities, equation 8, with the first order condition with aggregate demand externalities, equation 11. Because $w_{nn} < 0$, $n^{AD} > n^*$.

Without aggregate demand externalities, negligence produced too much activity relative to strict liability. But in the presence of aggregate demand externalities, the incentives negligence creates for additional activity may be a good thing. Activity has positive aggregate demand externalities that are not internalized by the injurer. From a social perspective, we want more activity, but we can't use a negligence rule to set activity levels. Therefore, the "excess" activity level associated with a negligence rule may be just what we need to prompt more activity. If $n^{AD} \geq n^{p}$, then the "excess" incentives created by the negligence rule for activity improve social welfare relative to the incentives provided by a strict liability rule.

We cannot be sure that a negligence rule is superior to a strict liability rule with respect to activity levels when there are aggregate demand externalities. The excess activity incentives associated with the negligence rule may be so great that the negligence rule produces activity levels that are too high even after we account for the aggregate demand externalities. ($n^{*} < n^{AD} < n^{p}$). In these cases, either a negligence rule or a strict liability rule can be superior. The greater the aggregate demand externality, the more likely it is that the negligence rule is superior to the strict liability rule.[20]

With respect to the negligence standard of care, we cannot say generically that a stricter standard of care is better than a more lenient one in the presence of aggregate demand externalities. If the aggregate demand externalities are very large, so that $n^{AD} > n^{p}$, and the activity level is very sensitive to the standard of care, then we might want to lower the standard of care. Even though more precautions have aggregate demand externalities and reduce injuries, more precautions may hurt activity levels so much that enhancing the standard of care is not worth the trouble.

Suppose, however, that the negligence rule yields too much activity, even after considering aggregate demand externalities. That is, $n^{*} < n^{AD} < n^{p}$ when the negligence standard is set at the Hand Rule level,x_1^{HR}. In this case, the negligence standard should be stricter than the ordinary hand rule level. To see this, start with the Hand Rule negligence level, x_1^{HR}. By the envelope theorem, a small increase in the required precaution level produces minimal costs with respect to the combined value of precautions and damages (we are near the social optimum with no aggregate demand externalities). Additional precautions yield an aggregate demand externality benefit (for a direct welfare gain). This small increase in x also induces the injurer to reduce activity levels below their current excessive level of $n^{p} > n^{AD}$.[21] Because activity levels are too high by assumption, this indirect effect of raising the standard of care also raises welfare. Thus, an increase in the negligence standard above the Hand Rule is welfare enhancing. The toughened standard of care raises aggregate demand and lowers excessive activity levels, while only slightly distorting the level of precaution per activity. The optimal negligence standard should therefore demand more care than the Hand Rule standard.

This does not mean, however, that the standard of care should be raised until the activity level reaches its social optimum. If an excessively high standard of care induced the injurer to violate the

[20] Equation 11 shows that n^{AD} is increasing in k. As n^{AD} increases, its gets closer to (or may even exceed) n^{p}. This makes n^{p} more attractive relative to n^{*}.

[21] Because $w_{nx} < 0$, equation (9) is no longer satisfied. Because $w_{nn} < 0$, n must go down in order for equation 9 to be satisfied. Thus, an increase in x above the Hand Rule level yields less activity, lower (n).

standard rather than comply (As discussed in Section III), then we cannot attain the optimal activity level.

To sum up, with aggregate demand externalities, we can no longer claim that a strict liability rule creates better activity level incentives than a negligence rule. Instead, the negligence rule's "excess" activity incentives may be efficiency enhancing, as it produces more activity with aggregate demand externalities. And if the aggregate demand externalities from activity levels are not too large, then a negligence rule with a heightened standard of care yields a better outcome than a negligence rule with the Hand rule standard.

The optimal negligence level can be characterized as follows: raise the standard of care above the Hand Rule level until the private inefficiencies associated with the additional care and the loss of aggregate demand externalities associated with lower activity levels exceed the social benefits of reducing the excess activity level and the aggregate demand externalities that come with higher levels of care.[22]

V. Conclusion

When we introduce macroeconomic aggregate demand externalities from precaution expenditures and activity levels, our economic model of tort law changes dramatically. Specifically, both the Hand Rule for negligence and a strict liability tort regime yield inefficient outcomes with respect to both precaution levels and activity levels. Instead, negligence rules with more stringent standards than the Hand Rule become more attractive. Optimal tort law therefore looks very different when we introduce aggregate demand externalities. If efficient tort law changes when we introduce macroeconomic considerations, we can presume that our law and microeconomic conclusions regarding other areas of law change as well.

We should thus develop a law and macroeconomic analysis of law to complement our robust law and microeconomic literature. Macroeconomic considerations needs to be introduced into law because a. aggregate demand externalities can be very large b. alternative policies to address aggregate demand shortages (such as monetary and fiscal policy) are not always up to the task and c. law cumulatively effects almost every economic decision—if law makes a sustained effort to stimulate aggregate demand, it can plausibly make a difference, d. the stakes are enormous—the Great Recession was associated with tens of trillions of dollars of lost output and threatened and continues to threaten longstanding political orders and e. the optimal legal policy when aggregate demand externalities are high is very different from the optimal legal policy when there are no externalities.

Indeed, the model of tort law presented here has applications for other areas of law, such as regulation. Suppose that, instead of accidents, the damages under consideration are harms to the environment. For example, suppose that the EPA is setting standards or rules for pollution from power plants. The EPA can choose to impose strict liability for environmental harm on the power plant or

[22] We know that this condition is satisfied at n^p, x_1^{HR}

require the power plant to comply with rules (or standards) that are analogous to negligence rules. The results derived here suggest that, in deep recessions, the EPA should favor incrementally stricter environmental rules so long as the stricter rules do not cause the power plant to shut down.

Introducing macroeconomic effects makes law, and law and economics, more complicated. After further analysis, we may decide that the complications are not worth the gains. But before we can reject law and macroeconomics, we need to know where it leads us. I hope that this paper helps facilitate this conversation.

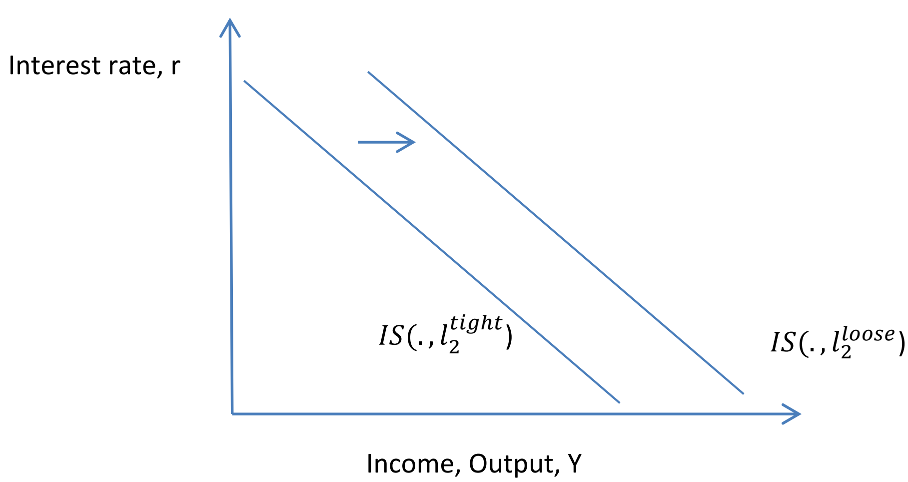
I. Appendix

This appendix demonstrates the existence of "aggregate demand externalities" by using longstanding models of the macroeconomy. The goal of the appendix is twofold. First, I hope to provide a more rigorous sense of many of the macroeconomic assertions made in the text. Law and economics scholars who may have forgotten their macro can find a quick refresher here. Second, I hope to give economists a more precise sense of how law interacts with macroeconomics by placing some legal variables in one of macroeconomics' "workhorse" models.

I assume a closed economy—no imports or exports. I add law to a standard IS-LM and AD-AS model.

A. The IS Curve when Expenditure is a Function of Law

$$Y = C(Y - T, \boldsymbol{l}) + I(r, \boldsymbol{l}) + G(\boldsymbol{l}) \qquad \text{(IS)}$$



The IS curve graphed here is downward sloping. Higher interest rates mean lower investment and thus lower output. Each IS curve provides a set of output, interest rate combinations in which savings is equal to investment.

1. Law and the Consumption Function

In addition to this standard downward sloping IS equation, I add ***l*****.** ***l*** is an *n* dimensional vector that measures law on *n* dimensions. Different elements of law will affect different components of the IS equation. Debtor and creditor law (l_1) for example, affects the consumption function. For a given amount of disposable income, laws that distribute wealth to debtors from creditors will raise consumption because debtors have higher marginal propensities to consume than creditors. Thus, $\frac{\partial C}{\partial l_1} < 0$ where a higher l_1 indicates that the law is more favorable to creditors.

2. Law and the Investment Function

Investment is also a function of law, as well as the interest rate. . For example, an investment in housing construction that was marginally profitable with permissive zoning and a given interest rate will become unprofitable with more restrictive, and less profitable, zoning requirements. If l_2 measures zoning restraints, with higher l_2 meaning tougher zoning, then for investments on the margin, $\frac{\partial I}{\partial l_2} < 0$.[23] For investments not on the margin, however , $\frac{\partial I}{\partial l_2}$has an ambiguous sign. For example, a developer of an inframarginal housing project may choose to comply with costly historic preservation requirements, raising spending on investment.

3. Shifting the IS Curve

The graph above demonstrates the shift in the IS curve when zoning requirements, l_2, get looser for marginal investments. Because $\frac{\partial I}{\partial l_2} < 0$, a move towards looser zoning requirements shifts the IS curve given above to the right.

As discussed in the text, many other legal variables affect desired expenditure. Any law that affects any of the elements of the IS equation presented above should add a dimension to the law vector, ***l*****.**

B. The LM Curve

The second equation in the IS-LM model is

$\left(\frac{M}{P}\right) = L(r, Y)$ (LM)

Each LM curve provides a set of output, interest rate combinations in which the demand for money equals the supply of money.

[23] With inframarginal investments, however, ∂I/ 〖∂l〗 _2 has an ambiguous sign. For example, a developer of an inframarginal housing may choose to comply with costly historic preservation requirements, raising spending on investment.

1. Introduction

This is a standard LM curve, with nothing special from a law and macroeconomics perspective.[24] At equilibrium in the money market, the real money supply, given by $\left(\frac{M}{P}\right)$, must equal the demand for money, $L(r, Y)$.[25] The demand for money is increasing in Y, $\frac{\partial L}{\partial Y} > 0$. When output is high (meaning that there are more total transactions), people want to hold more money to facilitate transactions. The demand for money is decreasing in r, $\frac{\partial L}{\partial r} < 0$. Higher interest rates raise the cost of holding money (which yields no return) as an asset, as opposed to bonds. For a given supply of money and price level, $\left(\frac{\bar{M}}{\bar{P}}\right)^S$ we can draw an LM curve in (r, Y) space. See Figure xxx.

2. The Zero Lower Bound

The LM curve drawn here reflects the existence of a "zero lower bound" on nominal interest rates.[26] Because cash can always be held for no return, interest rates, which represent the price of money, cannot go below zero, even if the normal relationship between interest rate and output implies that interest rates should be negative. (If the interest rate on bonds becomes negative, money dominates bonds as an asset as it facilitates transactions and yields a higher return.) As a result, the LM curve is horizontal when the interest rate is approximately zero. A horizontal LM curve at an interest rate near zero can also be derived from the assumption of infinite demand for money once the return of money equals or exceeds the return of other assets. That is, $\lim_{i \to 0} L(i, Y) \to \infty$. This "liquidity trap" means that, once interest rates are zero, injecting more money into the economy does not change interest rates because the additional money gets held as an asset rather than leading savers to switch to bonds. Policy is trapped by overwhelming demand for the liquid asset.[27]

[24] Although this treatment does not discuss the role of law in determining the money supply, many macroeconomists believe that this is one of the most important roles of law in the macroeconomy. For example, financial regulations and bank reserve requirements effect the money multiplier, which changes the effective money supply, *M*, for any given set of government policies. These effects are indeed important, but they are relatively well understood, so I do not emphasize them here. For a textbook review of this issue, see Mankiw, Macroeconomics, Chapter 19 (Money Supply, Money Demand, and the Banking System).

[25] I conflate the real interest rate, *r,* and the nominal interest rate, *i*, by assuming that there is no inflation.

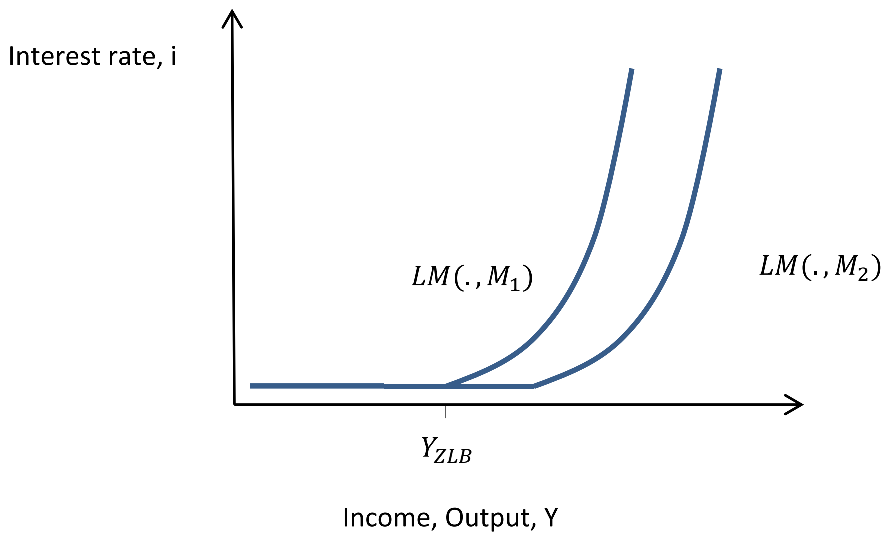
[26] Recent experience demonstrates that short run interest rates can become negative. While cash has a zero lower bound on return, other forms of money, such as checking, are not formally constrained by the zero lower bound. Because cash is not a perfect substitute for these other forms of money (e.g., its expensive and dangerous to store), interest rates on money can go slightly negative. If short term interest rates on other forms of money become too far negative, however, then we would expect widespread substitution from these other forms of money too cash, with considerable disruption to the economy. Thus, the zero lower bound is more accurately characterized as a "slightly negative interest rate" lower bound. For expositional purposes, however, the zero lower bound is a good approximation. For a discussion of negative short term interest rates, see Matthew Rognlie, "What Lower Bound? Monetary Policy with Negative Interest Rates," (2015), available at http://economics.mit.edu/files/11174.

[27] While I use the term liquidity trap in the text, I think the term unfortunate. The phrase does not evoke the problem it signifies as well as the "zero lower bound".

3. Shifting the LM Curve

As can be seen from the LM equation, an increase in the money supply from M_1 to M_2 where $M_1 < M_2$ shifts the LM curve to the right, as shown in the figure. At a given price level, more money increases the supply of real money balances, $\frac{M}{P}$. Money is more abundant, so its price (the interest rate) goes down. For any output level $Y > Y_{ZLB}$ the interest rate associated with equilibrium in the money market goes down. Once the zero lower bound (ZLB) is triggered, however, interest rates are constrained to be zero. Thus, expansionary money policy when output is below the output associated with a zero interest rate, Y_{ZLB} does not shift the LM curve to the right.

For the LM curve, it is the real money balance, $\frac{M}{P}$, that determines interest rates. Thus a decrease in prices is equivalent to a proportionate increase in money supply.



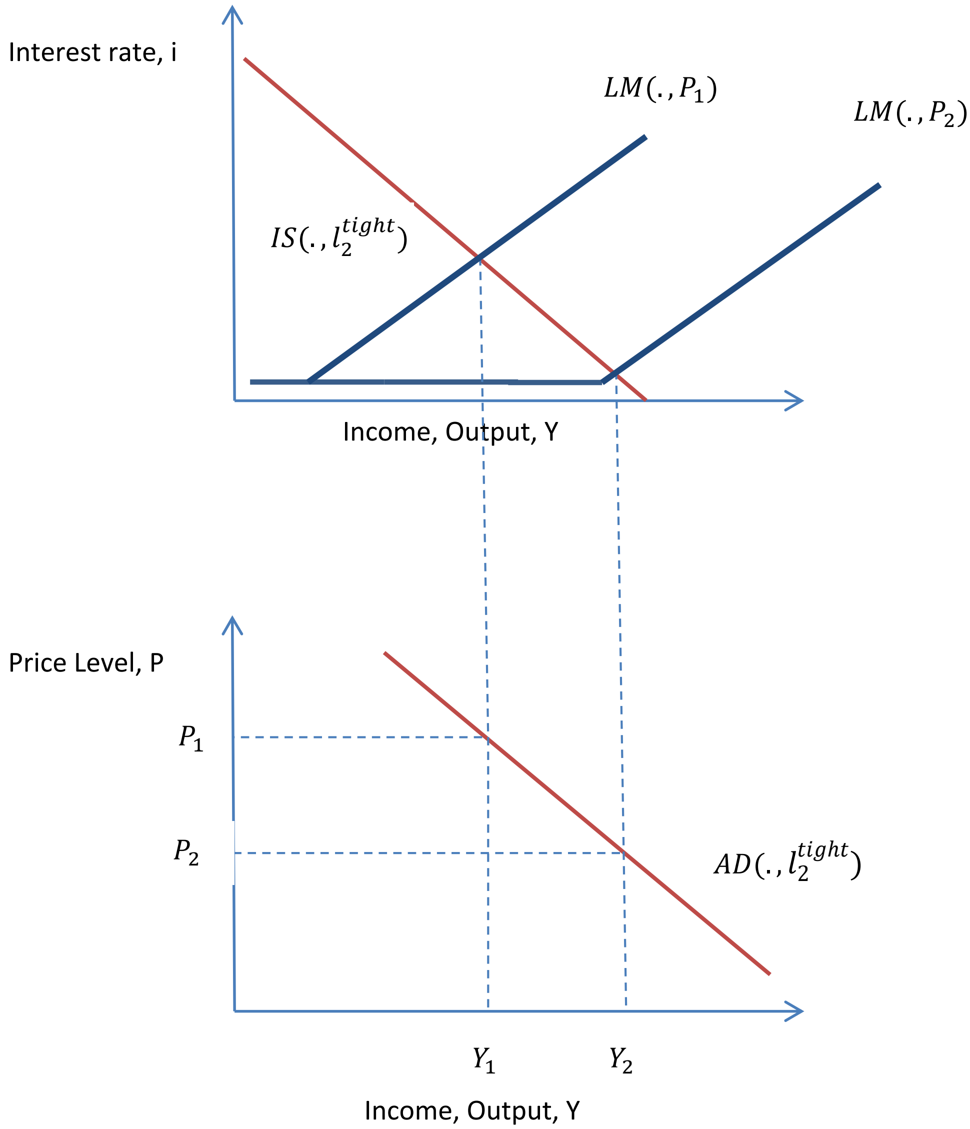
Interest rate, i
$LM(.,M_1)$
$LM(.,M_2)$
Y_{ZLB}
Income, Output, Y

C. IS/LM and the Aggregate Demand Curve

The IS Curve is a set of output interest rate combinations that balance the investment/savings market. The LM curve is a set of output/interest rate combinations that equilibrate the money market. When these two curves intersect, we have found a unique output/interest rate combination that balances both the investment savings and money markets—at a given price. If we adjust price, then the interest rate/output combination that balances both markets changes. The aggregate demand curve shows how the dual market balancing interest rate/output combination varies with price. In order to graph the relationship in two dimensions, we suppress the interest rate variable in the AD curve.

1. Deriving the Aggregate Demand Curve from the IS and LM Curves

We can combine the IS-LM equations into an aggregate demand curve. Take the IS curve derived in Part A. Now shift the LM curve by shifting prices from high to low, where $P_1 > P_2$, while keeping the money supply constant. In particular, set the IS curve equal to the LM curve associated with a high price level, $(.\,, P_1)$. This will specify an output level, Y_1 where the IS curve and LM curve at P_1 intersect. Now set the IS curve equal to the LM curve associated with the lower price level, $LM(.\,, P_2)$. This specifies a new equilibrium output, Y_2. We have now specified two points in output, price space. The higher price is associated with lower output and the lower price is associated with higher output—a downward slope. If we imagine doing this for every separate LM curve associated with all prices from 0 to infinity and calculating the associated output levels, then we will have traced out a downward sloping aggregate demand curve.

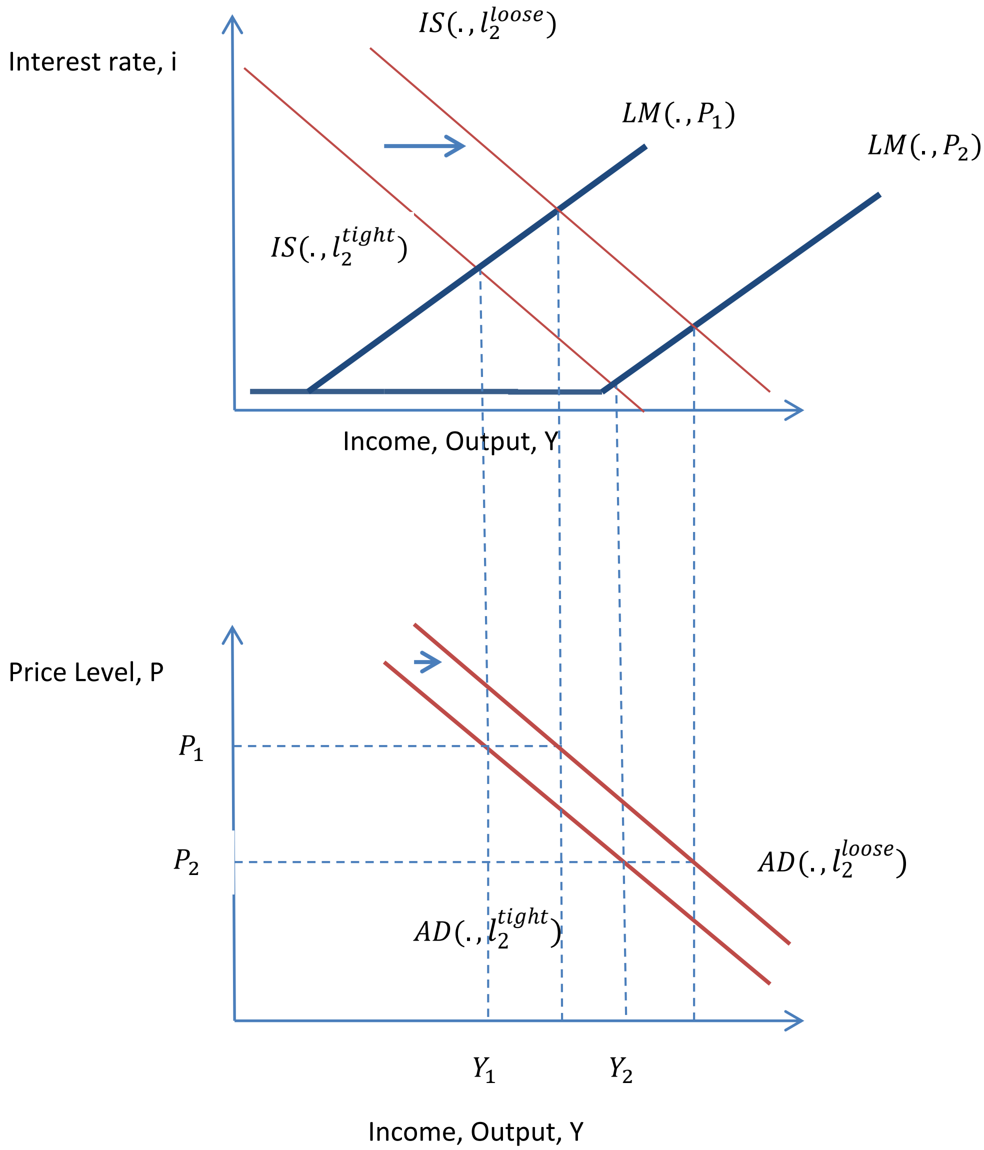

Interest rate, i
$LM(.,P_1)$
$LM(.,P_2)$
$IS(.,l_2^{tight})$
Income, Output, Y
Price Level, P
P_1
P_2
$AD(.,l_2^{tight})$
Y_1
Y_2
Income, Output, Y

2. The Aggregate Demand Curve as a Function of Law

The figure below demonstrates how law shifts aggregate demand. Recall from Section A above that a change in zoning rules from tight to loose promotes investment in construction and shifts the IS curve to the right. This shift is shown again in the top half of the figure below. For any LM curve, this shift in the IS curve leads to a higher level of output for any given price level, as shown in the bottom half of the figure. Thus, the shift in the IS curve as a result of the change in laws causes a rightward shift in the Aggregate Demand curve. In this sense, changes in law change aggregate demand.

Note that the shift in aggregate demand as a result of the zoning change is smaller than the shift in the IS curve as a result of the change in law. Loosening zoning requirements raises desired investment spending. In the IS curve, nothing mitigates this effect. In the AD curve, the increased demand for expenditure doesn't simply lead to more expenditure. It also raises interest rates, which has partially offsetting inhibitory effect on the economy.

It is important to observe that we have made no assumptions about Aggregate Supply. Thus, northing about the analysis so far is specifically Keynesian. Law shifts the aggregate demand curve regardless of our assumptions about aggregate supply.



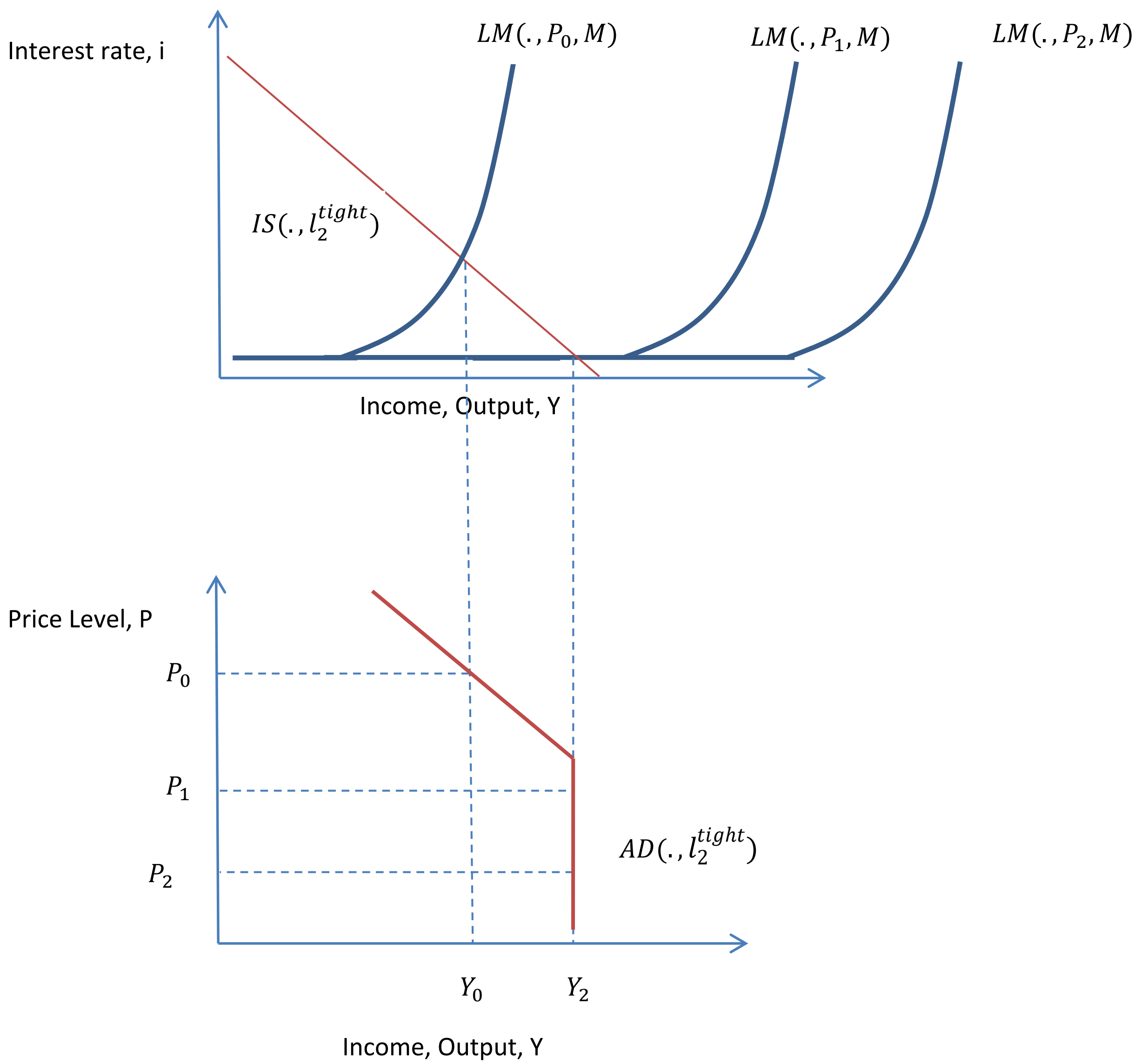
Interest rate, i
$IS(.,l_2^{loose})$
$LM(.,P_1)$
$LM(.,P_2)$
$IS(.,l_2^{tight})$
Income, Output, Y
Price Level, P
P_1
P_2
$AD(.,l_2^{loose})$
$AD(.,l_2^{tight})$
Y_1
Y_2
Income, Output, Y

3. The Zero Lower Bound and the Aggregate Demand Curve

Here we look at the shape of the AD curve when the zero lower bound on interest rates is binding and effects the shape of the LM curve. Assume $P_0 > P_1 > P_2$. As in the previous two graphs, we derive the aggregate demand (AD) by setting IS=LM for all prices. For this particular IS curve, the AD curve has the usual downward sloping shape for all price levels higher above a certain price level, such as P_0.. In this range, a decrease in prices raises real money balances. This makes bonds attractive relative to cash, and the interest rate falls. At the zero lower bound, however, the interest rate cannot fall. For this IS curve, the zero lower bound is binding at prices P_1 and P_2. As a result, the AD curve is vertical in this range. A price fall that increases real money balances does not cause a fall in interest rate in this range. As a result, investment and output do not change as a result of lower price levels in this range.[28]

Expansionary monetary policy is also ineffective in a liquidity trap. As we saw in Section B.2, more money cannot drive the interest rate lower than zero and so cannot raise investment. But we can also show the impotence of monetary policy by analogy with the vertical aggregate demand curve just derived. In the LM curve, a decrease in price level is equivalent to a proportional increase in the money supply. If a decrease in prices from P_1 to P_2 does not lead to more aggregate demand (as shown just above), then a proportionate increase in the money supply while prices remain at P_1 also does not increase aggregate demand in this price range.

[28] The "Pigou Effect", see, e.g., Pigou, Arthur Cecil (1943). "The Classical Stationary State". Economic Journal 53 (212): 343–351; Patinkin, Don (September 1948). "Price Flexibility and Full Employment". The American Economic Review 38 (4): 543–564, contradicts the idea of a vertical aggregate demand curve. Even if decreases in prices don't reduce interest rates and raise investment, a decrease in prices has a wealth effect that should stimulate consumption, and element of demand. As a result, the AD curve should not be vertical at low prices. Others criticize the importance of the Pigou effect. "Debt deflation" effects mean that debtors, who have high marginal propensities to consume, are made poorer by deflation. So even if overall real wealth increases as a result of decreasing prices, overall consumption may not increase. See, e.g. Kalecki, Michael (1944). "Professor Pigou on the "Classical Stationary State" A Comment.". The Economic Journal 54 (213): 131–132.



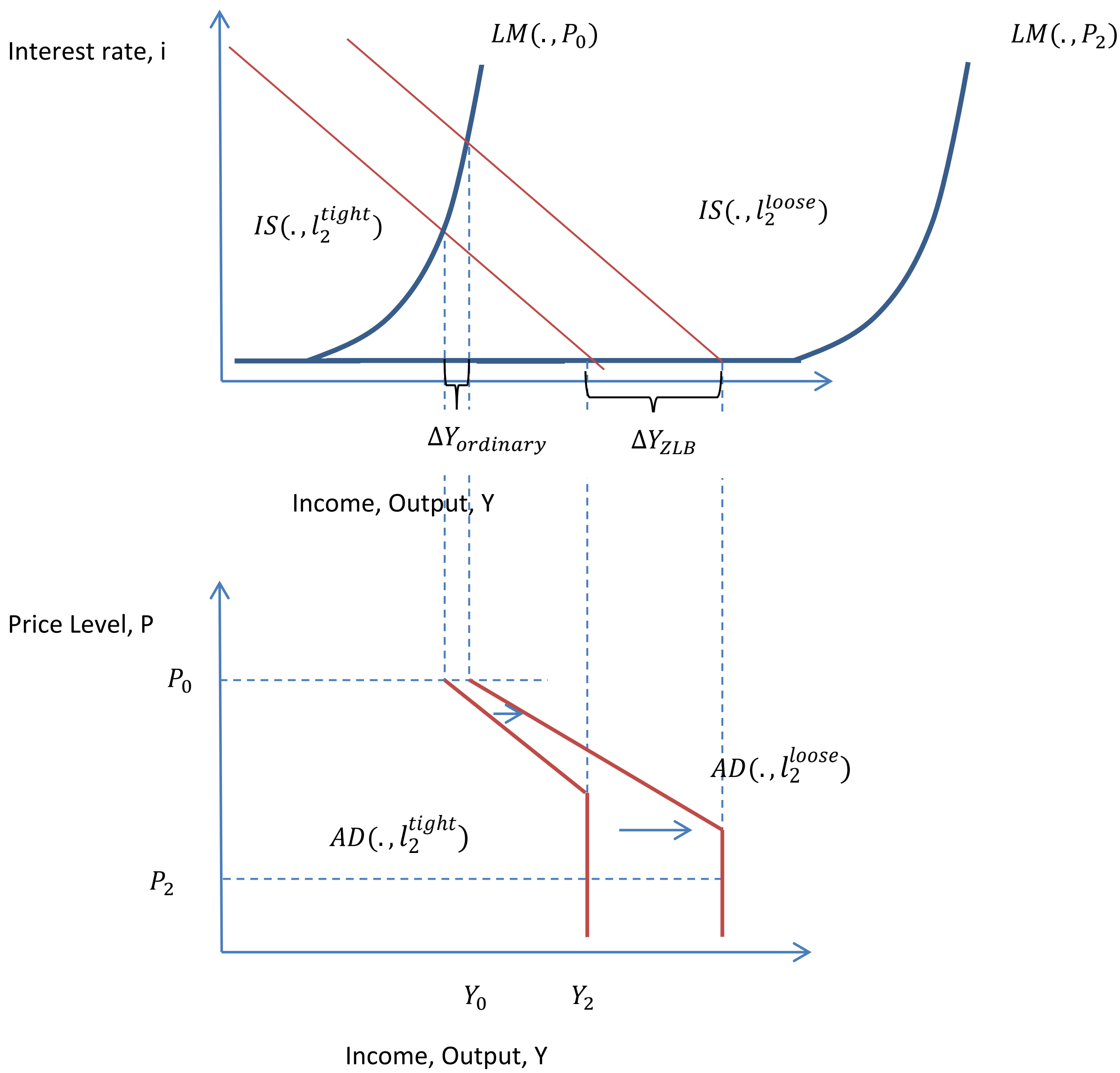
Interest rate, i
$LM(.,P_0,M)$
$LM(.,P_1,M)$
$LM(.,P_2,M)$
$IS(.,l_2^{tight})$
Income, Output, Y
Price Level, P
P_0
P_1
P_2
$AD(.,l_2^{tight})$
Y_0
Y_2
Income, Output, Y

4. The Effects of Law Depend Upon the Zero Lower Bound

Now assume that l_2 , zoning law, shifts from tight to loose. As discussed earlier, this shifts the IS curve outward by increasing investment spending on construction. The impacts of this law induced shift in the aggregate demand curve depend upon the zero interest rate lower bound. If monetary policy is not constrained by the zero lower bound, as it is not when prices are at p0, then a law induced rightward shift in the IS curve produces only a small shift in output, $\Delta Y_{ordinary}$. As a result, the aggregate demand curve at p0 barely shifts right. (The "zoning law multiplier", $\frac{\Delta Y}{\Delta l_2}$, the legal analogue of the fiscal multiplier is small.) Instead of changing aggregate demand and output, the change in law mostly shifts interest rates.

When the LM curve is constrained by the zero lower bound, by contrast, then the law induced rightward shift in the IS curve has a much greater impact on output in the IS/LM model. Thus, ΔY_{ZLB} is much greater than $\Delta Y_{ordinary}$. At the zero lower bound, law provides a much greater shift in the AD curve. At p2, for example, the rightward shift in the IS curve does not change interest rates, which remain at zero. Instead, the shift in the IS curve moves output by ΔY_{ZLB}. As a result, the aggregate demand curve shifts a great deal. (The zoning law multiplier is high.)

The impact of law on aggregate demand depends upon the efficacy of other policy. If monetary policy is constrained by the zero lower bound (as at p2), then a law induced change to investment demand causes big shifts in output levels and aggregate demand at any given price. If monetary policy offsets most or all of any increase in investment with an increase in interest rates (as at p0), then law induces smaller shifts in aggregate demand.



Interest rate, i
$LM(.,P_0)$
$LM(.,P_2)$
$IS(.,l_2^{tight})$
$IS(.,l_2^{loose})$
$\Delta Y_{ordinary}$
ΔY_{ZLB}
Income, Output, Y
Price Level, P
P_0
$AD(.,l_2^{loose})$
$AD(.,l_2^{tight})$
P_2
Y_0
Y_2
Income, Output, Y

D. Law, Aggregate Demand, and Aggregate Supply

1. Determining the Output and Price Level

The previous sections of the appendix demonstrated that the IS curve is a function of law. By combining the IS and LM curves into a theory of aggregate demand, this implied that the Aggregate Demand, *AD*, curve was a function of law. Changes in laws, just like changes in monetary or fiscal policy, shift the AD curve.

$Y = C(Y - T, \boldsymbol{l}) + I(r, \boldsymbol{l}) + G(\boldsymbol{l})$ (IS)

$\left(\frac{M}{P}\right) = L(r, Y)$ (LM)

The resulting AD curve provides a set of price level, *P* , and output levels, *Y*, in which the demand side of the economy is in equilibrium. In order to pin down the economy's final price and output levels, we need a theory of aggregate supply that stipulates when the "supply" side of the economy is in equilibrium. As discussed in the text, the Keynesian model makes the "fixed price" assumption for Aggregate Supply.

That is,

$P = P_1$ (Fixed Price Keynesian Aggregate Supply Curve.).

In the Keynesian model, prices are fixed at P_1 . In order to determine output in the economy, we siply use the output level specified by the Aggregate Demand curve at P_1. $Y_1 = AD(P_1)$.

The Keynesian model is often used to predict how an economy will behave in the "short run."

The classical model makes an alternative assumption about aggregate supply. Instead of prices being fixed, prices are fully flexible and output is fixed. The classical model is often used to predict how an economy will behave in the "long run".

$Y = \bar{Y}$ (Classical Aggregate Supply Curve).

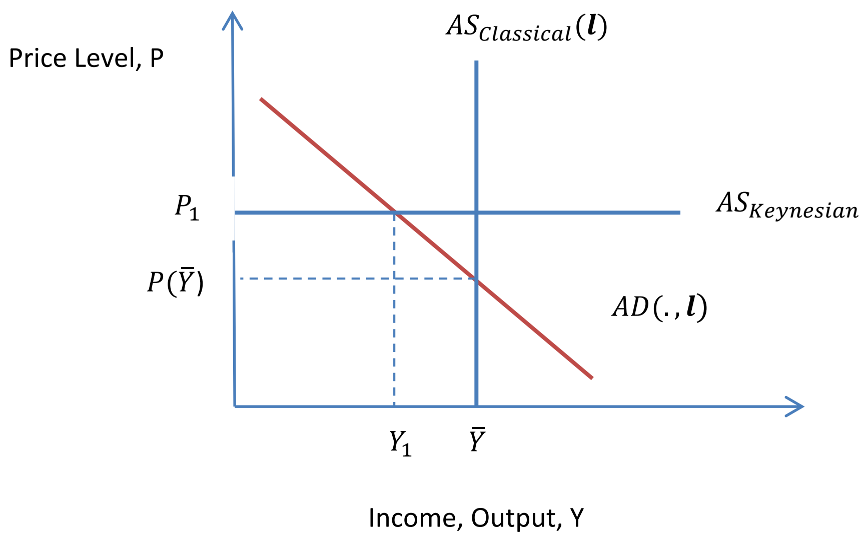
With the classical aggregate supply curve, output is determined by exogenous factors. The price level adjusts so that output equals its natural level.

Figure xxx represents the Aggregate Demand curve (derived from the IS and LM curves) and the Aggregate Supply (AS) curves. The intersections of the AD and AS curves determine the output and price level in the economy. With a Keynesian AS curve, output is at Y_1 and price level is fixed at P_1. With the classical AS curve, output is at $\bar{Y}$, while the price level is determined by the price level determined by the aggregate demand curve at $\bar{Y}$.

The classical AS curve is implicitly adopted by law and (micro)economics. Law and (micro)economics assumes that long run output is a function of law. Efficient laws in all areas, $\boldsymbol{l}$, move output higher. That is $\bar{Y} = Y(\boldsymbol{l})$. In law and microeconomics, law affects output through the aggregate supply, and not the aggregate demand, channel. For example, efficient zoning law that perfectly accounts for externalities caused by construction effectively shifts $\bar{Y}$ to the right.[29] The real value of output to society is higher when zoning law is efficient.[30]

[29] In order to incorporate externalities and long run efficiency, we need to consider *Y* as the value of output including all externalities rather than simply the official value of output.

[30] At present, there are many reasons to think that municipal zoning law is too strict from a microeconomics perspective. Cite to Shoag and Hsieh and Morretti and Ellickson. These arguments may well be right, but they are the province of law and microeconomics and not law and macroeconomics.



Price Level, P
$AS_{Classical}(\boldsymbol{l})$
P_1
$AS_{Keynesian}$
$P(\bar{Y})$
$AD(.,\boldsymbol{l})$
Y_1
$\bar{Y}$
Income, Output, Y

2. The Impacts of Changes in Law on Output and Prices

The Aggregate Supply/ Aggregate demand framework just described enables us to explore the impacts of changes in law that shift the Aggregate Demand curve on macroeconomic variables such as output and prices.

Consider the Aggregate Demand Curves from Appendix Section C.2 above. Aggregate demand is a function of law. When law changes to promote spending, (for example, zoning law becomes looser, enabling more investment spending on construction), the AD curve shifts outwards.

The figure below demonstrates how this change in law changes output and/or the price level, depending on our assumptions regarding aggregate supply.

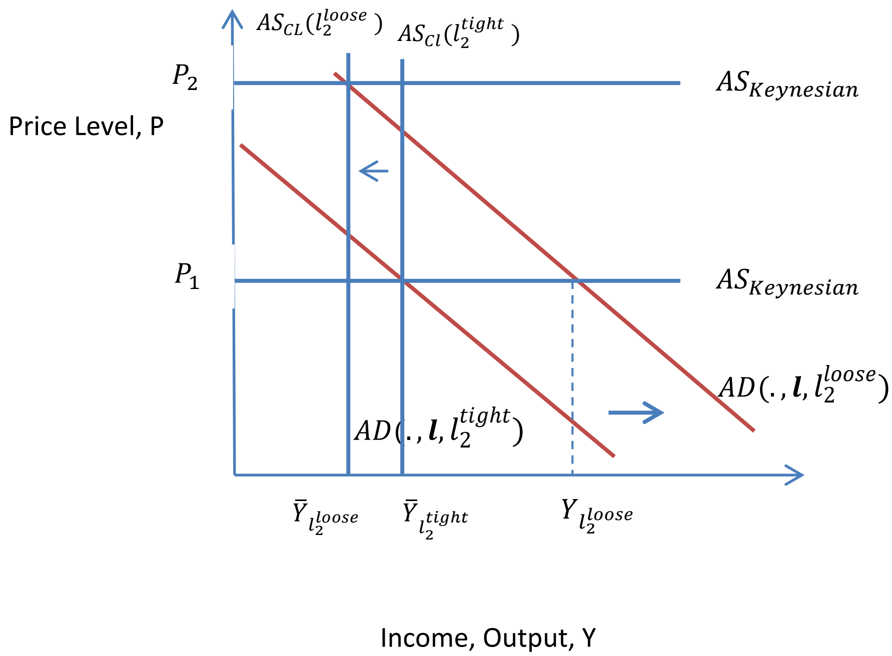
When we make the Keynesian assumption of fixed prices, figure xxx shows how the change in law raises equilibrium output from $Y_{l_2^{tight}}$ to $Y_{l_2^{loose}}$. With a law-induced increase in aggregate demand, output increases to accommodate the increase in demand. Thus, in Keynesian law and macroeconomics, law affects output through the aggregate demand channel and not the aggregate supply channel.

When we make the classical assumption of fixed output, then a law-induced rightward shift in aggregate demand moves prices from $P_{l_2^{tight}}$ to $P_{l_2^{loose}}$ while leaving output unchanged. Higher aggregate demand, caused by looser zoning rules, causes the price level, but not the level of output, to increase.

Even if we make the classical assumptions of flexible prices and fixed output, law changes macroeconomic variables via the aggregate demand channel. In the classical economy, law affects interest rates and prices, but not output, through the aggregate demand channel. Law affects output through the aggregate supply channel.

3. From the Short Run to the Long Run

Assume that the economy is in both short run and long run equilibrium at the current level of law (with tight zoning), as indicated by the point, $(\bar{Y}_{l_2^{tight}}, P_1)$ in Figure xxx. Now suppose that zoning law changes from tight to loose. The change in zoning law shifts the aggregate demand curve rightwards. In the short run, the AS curve is a horizontal Keynesian curve, so the rightward shift in aggregate demand raises output with prices constant, moving the the short run equilibrium to $(Y_{l_2^{loose}}, P_1)$. This short run equilibrium point, however, is not stable. Output is above is long run natural rate. This causes prices to rise. The short run aggregate supply curve is still vertical, but at a higher price. The price will keep rising until the economy is in a new short run and long run equilibrium. In Figure xxx, the change in zoning law from tight to loose did not only increase aggregate demand. It also reduced long run aggregate supply. (I assume that the change in zoning law from tight to loose is inefficient in the traditional law and macroeconomics sense). Thus, the long run, classical, AS curve shifts leftward. After the change in law, the economy reaches a new short run and long run equilibrium point at $(\bar{Y}_{l_2^{loose}}, P_2)$. Because the law has shifted in an inefficient long term fashion, the new long run equilibrium output level is lower than the previous output level.


$AS_{CL}(l_2^{loose})$
$AS_{Cl}(l_2^{tight})$
P_2
Price Level, P
$AS_{Keynesian}$
P_1
$AS_{Keynesian}$
$AD(.,\boldsymbol{l},l_2^{loose})$
$AD(.,\boldsymbol{l},l_2^{tight})$
$\bar{Y}_{l_2^{loose}}$
$\bar{Y}_{l_2^{tight}}$
$Y_{l_2^{loose}}$
Income, Output, Y

4. Efficient Lawmaking in the Short Run and the Long Run

The previous section demonstrated that a change in law can increase short run output but increase long run output. What is the efficient (output maximizing) law in such a case?

The answer depends upon a number of factors. First, we of course want to know the size of the negative impact of the legal change on long run aggregate supply. If the change in law does not change long run efficiency very much, then we can focus on the short term law and macroeconomic effects of the law. But if the legal change causes a sharp decrease in long run equilibrium output, then the change becomes less desirable.

Second, we want to know how long the "short run" lasts. If the short run is only a week, then the quick increase in output is probably not worth its long run output cost. But if the short run lasts many years, then a legal change that raises output in the short run but lowers it in the long run becomes more attractive. If there are hysteresis effects of a depression, then the short run can effect the long run, making the short run even more important.

Third, we want to know the size of the "law multiplier" defined in Section XXX above. In turn, the law multiplier depends on two things— the size of the shift in the IS curve induced by the change in law *and* the shape of the LM curve at the current equilibrium. If the a change in law, such as a zoning change, doesn't increase desired investment spending, then it does not move the IS curve and has no hope of stimulating the economy. But even if the change in zoning law shifts the IS curve, this does not mean that the law multiplier is high. If the LM curve is steeply sloped at equilibrium (as it would be in ordinary times), then even a large law-induced shift in the IS curve will lead to an increase in the interest rate, a small law multiplier and only a small shift in the aggregate demand curve. At the zero lower bound, the LM curve is flat. Thus, a law induced shift in the IS curve will translate into now change in interest rates but a large shift in aggregate demand/output.

To summarize, taking legal decisions for macroeconomic reasons is favored if:

1. The short run is long and recessions are more costly.
2. The microeconomic effects of the legal changes are only slightly negative.
3. The legal change leads to a large change in desired spending.
4. The economy is at the zero lower bound—meaning that the increased spending encouraged by the change in law won't be mostly offset by higher interest rates.