

THE MACROECONOMIC IMPACTS OF NATURAL DISASTERS

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Introduction

There is, perhaps, no greater shock to an economy than the onslaught of a particularly severe natural disaster. Hurricanes, floods, drought, earthquakes, etc. all display significant impacts on economies all over the world. Given the recent hurricanes Katrina and Rita striking the U.S. coast, the Tsunami striking most of Southeast Asia, the earthquakes striking the Pakistani province of Kashmir, bring to mind the severity of not only the human suffering, but also the lasting effects on the economies of such areas as well as the nation as a whole. Over 700 natural disasters occur all over the world in a given year causing destabilizing effects all across the impacted society (Freeman 1).

Natural disasters have several different varieties which would include avalanches, diseases and pandemics, droughts, earthquakes, famine, floods, hurricanes, impact events (such as meteors), tornados, tsunamis, thunderstorms and volcanic eruptions among others. Of these various types of disasters, three main types account for 90% of the losses: floods, earthquakes, and cyclones (Freeman 1). Furthermore, since these disasters follow geological patterns (for example, earthquakes occur at the edges of tectonic plates, they often repeatedly hit the same geographic location), there may be significant losses to GDP in the region over time as a direct result. There would also exist certain ripple effects that would continue to affect the economy in subsequent years, such as unemployment, inflation, and overall production. This issue is particularly important in developing countries as they are much less equipped to handle disasters on a large scale as compared to developed nations. However, given the devastation caused by hurricane Katrina in the coastal town of New Orleans, even developed nations struggle with losses posted by these shocks.

This article attempts to articulate the significant economic costs imposed by natural disasters on economies in both developed and developing nations. Impacts to the economy are studied in terms of GDP effects, unemployment, and inflation rates with particular emphasis on consumption, government spending, taxation, investment and money supply / demand as a response to the disaster. Policies to offset the losses due to disaster are discussed in an attempt to uncover how developed countries would respond to such exogenous destabilizing shocks and how might they be best coped with in order to incur a minimum level of long term damage to the economy.

Impacts on GDP and Interest Rates

Top 10 estimated damages ('000 US\$)		
Disaster type	Countries	Damage ('000 US\$)
Earthquake (October)	Japan	28,000,000
Typhoon Tokage (October)	Japan	7,500,000
Hurricane Jeanne (September)	United States	7,000,000
Flood (June-August)	Bangladesh	7,000,000
Hurricane Charley (August)	United States	6,800,000
Typhoon Songda (September)	Japan	6,000,000
Hurricane Ivan (September)	United States	6,000,000
Tsunami (December)	Indonesia	4,451,600
Hurricane Frances (September)	United States	4,400,000
Hurricane Ivan (September)	Cayman Isl.	3,340,080

Table 1.1 Source: The OFDA/CRED International Disaster Database - www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium

Significant impacts to the economy are made in terms of costs posted to GDP because of disasters. Table 1.1 above demonstrates the immense cost associated with natural disasters. It is not a coincidence here that the U.S. and Japan have recurring entries, mainly due to them both being highly developed countries, therefore the losses incurred by natural disasters would

naturally be higher. This also supports the argument given earlier that natural disasters have a tendency to recur in the same areas, showing that the geographic location is key to anticipating and averting huge losses associated with calamities.

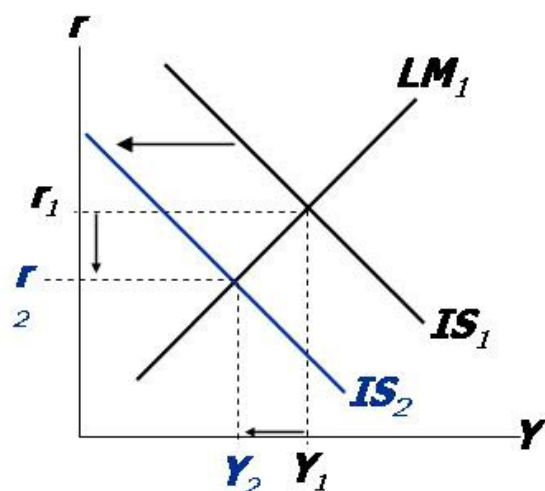


Figure 1.1 Source: Mankiw, N. Gregory. *Macroeconomics*. 5th ed. New York: Worth Publishers, 2005.

Estimated damages here would have severe negative impacts on GDP (though not by the same amount), with most of the costs absorbed by government spending on relief funds. Ordinarily, increased government spending would result in overall increases in GDP; however, a couple of things offset this spending. First, shocks such as these (disasters), increase uncertainty about the future, causing households to spend less thus leading to declining consumption levels. Furthermore, firms respond to this uncertainty by reducing their spending and investment levels until the uncertainty is resolved (Mankiw 289). Figure 1.1 displays this change under the IS-LM model, this uncertainty would cause the IS curve to shift to the left from IS_1 to IS_2 , assuming the level of government spending remains constant. This shift would have depressing implications on the interest rate (as r_1 goes to r_2) and depressing effects on the output level as Y_1 goes to Y_2 ceteris paribus.

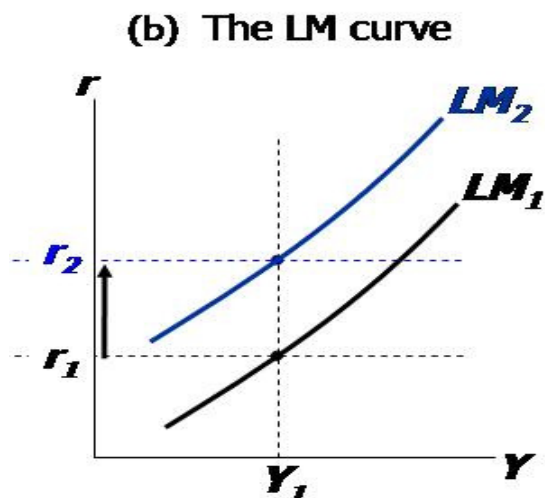


Figure 1.2 Source: Mankiw, N. Gregory. *Macroeconomics*. 5th ed. New York: Worth Publishers, 2005.

Similarly, on the LM schedule, the uncertainty associated with disasters would cause an increase in the money demand (since it can be inferred from the fall in consumption and uncertainty that people will choose to hold more money) hence leading to a leftward shift in the LM curve as shown in figure 1.2. This shift from LM_1 to LM_2 is due to the theory of liquidity preference, which states that the increases in money demand cause the equilibrium interest rate to be higher in the money market (Mankiw 271). This shift would cause interest rates to rise and output to fall as well. Assuming policy makers take no action to offset these exogenous shocks, the overall income and output levels would fall causing a reduction in overall GDP.

Following the model through, contractionary shifts in both the IS and LM schedules imply a lowered level of output, but no change in the interest rate at the equilibrium level (assuming that the shifts in both the IS and LM schedules have equal impacts). Due to the stable equilibrium interest rate we would expect the investment levels to remain unchanged, however, due to the uncertainty caused by the disaster, firms would be expected to reduce their investment

levels until the uncertainty passes and stabilization is reached as stated earlier, causing an exogenous impact on the level of investment.

Impacts on Prices, Inflation, and Unemployment

Natural disaster shocks affect the economy on both the IS and LM schedules. Over the short run, we would expect aggregate demand to fall (shift left) as a response to the lower output at current price levels. Due to the nature of the natural disaster shock, both the IS and LM curves contract causing the AD curve to shift further leftward meaning lower demand at the given price level.

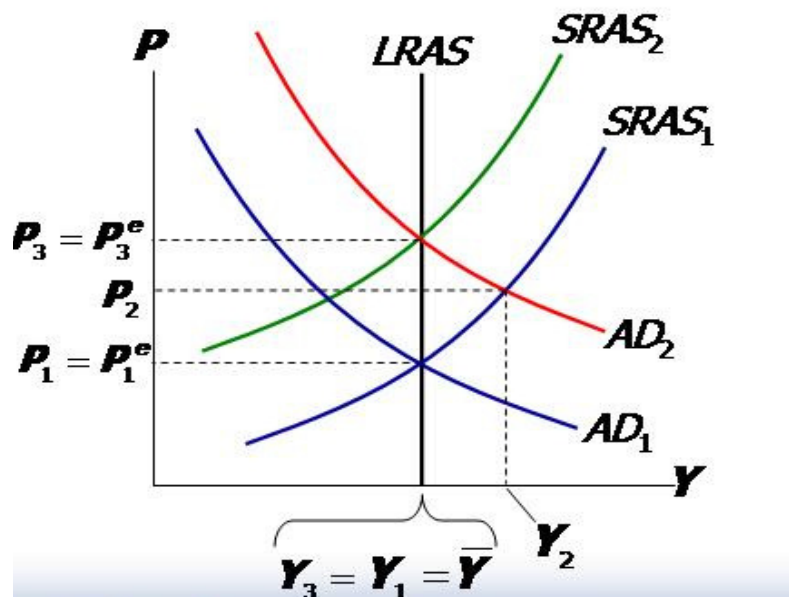


Figure 1.3 Source: Mankiw, N. Gregory. *Macroeconomics*. 5th ed. New York: Worth Publishers, 2005.

Using figure 1.3, we see that as the aggregate demand falls, AD_2 shifts to AD_1 at the new equilibrium output level (roughly) Y_3 . Hence, in the short run the equilibrium price falls from P_3 to (roughly) P_2 . Note that the expected price level is still at P_3 . In the long run the expected price level will drop to P_1 causing the short run aggregate supply to shift rightward from $SRAS_2$ to

SRAS₁, making the final equilibrium price at P₁, as output returns to its natural rate (Mankiw 358). The result is a lowering of overall prices in the economy, which would indicate a recession.

The lowering of prices unexpectedly would cause disinflation, which has a destabilizing effect on the economy due to its nature of actually lowering overall income. The debt-deflation theory (Mankiw 299) states that as disinflation and falling prices occur than the real amount of debt owed increases. This would cause debtors to spend much less than the creditors would spend more, causing a reduction in consumption, leading to a contractionary shift in the IS curve and hence, lower national income. The observed disinflation would have impacts on unemployment as well. One can reasonably expect a severe natural disaster to reduce employment in any case, due to damages taken by firms in the affected area and no longer being able to employ their workers etc. such that the inference of rising unemployment may be rationally drawn, but disinflation would have a further impact on unemployment.

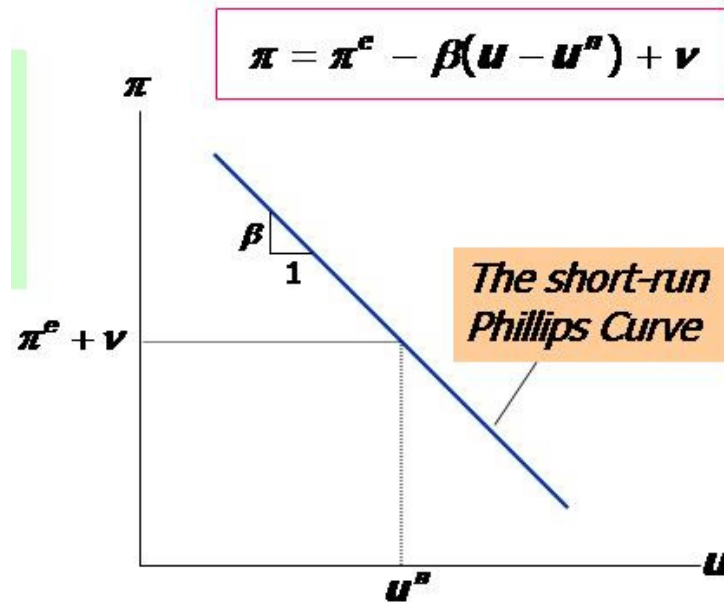


Figure 1.4 Source: Mankiw, N. Gregory. *Macroeconomics*. 5th ed. New York: Worth Publishers, 2005.

Figure 1.4 above displays the short run Phillips Curve, which shows the trade-off relationship between unemployment and inflation. This relationship can hence be applied to the current natural disaster impacts on the AS and AD curves and falling prices (and therefore disinflation) to deduce the deviation of short run unemployment from its natural rate. Primarily due to the expected disinflation, the unemployment levels would be expected to increase. Empirical evidence of this is demonstrated by the “Sacrifice Ratio”, which estimates the percentage of a years GDP that would need to be forgone in order to reduce inflation by 1 percentage point (Mankiw 367). This relationship is further applied to unemployment by the use of “Okun’s Law” which theorizes that a 2 percentage point change in GDP translates to a 1 percentage point change in unemployment (Mankiw 35-37). Hence the disinflation would cause both unemployment and GDP to fall by their respective estimates over the cycle.

Policy Responses

So far, the assumption has been made that policy makers have not responded to the shocks presented by a natural disaster on an economy. Given the negative impacts on output (income), inflation, and employment levels, policy makers are expected to respond to these exogenous shocks using monetary and fiscal policy instruments in order to stabilize the economy. As it was stated earlier, the negative impacts on GDP are a result of policy makers taking no action to offset the shocks to the economy by natural disasters. Essentially, there are two main mechanisms at work in the IS-LM model as a result of the disaster: contractionary shifts in both the IS and LM curves. The contractionary shift in the IS curve can be offset in two ways:

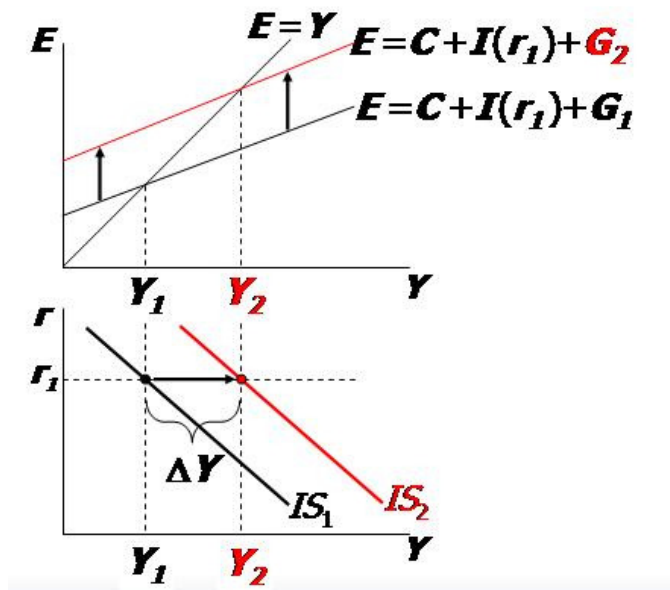


Figure 1.5 Source: Mankiw, N. Gregory. *Macroeconomics*. 5th ed. New York: Worth Publishers, 2005.

1. Increases in government spending: Figure 1.5 derives the IS schedule shift using the Keynesian Cross, expected overall spending (E) increases with an increase in government spending leading to higher output, at the same interest rate.
2. Decreases in the tax rate: Since consumption is a function of income and taxes, a decrease in the tax rate would intuitively drive by the consumption level as the population has a greater level of disposable income ($Y - T$). Therefore, the same apparatus in figure 1.5 can be used, this time holding government spending (G) constant and increasing consumption (C) such that expected overall spending increases.

Increases in government spending would likely be the first fiscal policy response in the form of aid and rescue efforts on the part of the state to help the victims and survivors of a natural disaster. This would result in the quickest way to shift the IS schedule to the right (increase the demand for goods and services). In the specific case of natural disasters and the human suffering therein, government spending on relief would be less subject to “Inside Lags”.

The term is used to denote the time taken between policy creation and implementation, since any increases in spending or reduction in taxes would need to be approved by congress (especially in democratic countries). Decreases in the tax rate would suffer quite a bit more from the inside lags because they would not get readily approved by the public officials as compared to increased expenditure. The fact remains, however, that decreases in the tax rate would prompt greater consumption and spending in the economy and can be used as an engine of stabilization.

By contrast, the contraction in the LM curve can be offset by monetary policy in a single way by the policy makers. Since increases in the money demand cause the market clearing interest rate in the money market to be higher, the LM curve shifts to the left. The policy makers, however, control the money supply. Hence, the money supply can be increased to meet the additional money demand. They would then increase the supply to bring the equilibrium interest rate down and thus cause a rightward shift in the LM curve to counter the shock. This would be subject to long “Outside Lags” since the economy will be slow to respond to the influx of money into the system. Over the long run, however, policy makers can use these instruments to put the economy “back on track”. Evidence of this outcome is given by a speech made by the U.S. treasury secretary John Snow on the third quarter GDP in 2005 following hurricane Katrina and Rita:

“I was pleased by today's strong GDP number, which indicates that the American economy is continuing to perform very well. In a quarter where the economy also had to absorb the shock of massive natural disasters, a 3.8% rate of growth is truly outstanding. For ten straight quarters, the American economy has grown at a healthy rate of 3.3 percent or more. There can be no doubt that the American economy is an adaptive and resilient marvel, and one that has benefited greatly

from good fiscal policies. The strong and steady GDP growth we've been experiencing is the result of lower tax rates, sound monetary policy set by the Federal Reserve, and the economy's underlying fundamentals. This growth bodes well for everything from job creation to Treasury receipts. There is little wonder why the American economy is the envy of the world.” - FDCH Regulatory Intelligence Database; 10/28/2005

This information is important because it shows the possibility of being able to implement policies to offset natural disasters such that the overall economy is not impacted to a large extent. Effectively, these unexpected shocks to the economy can be accounted for and brought under control in some circumstances. The final idea is that policy makers must make sound decisions about both fiscal and monetary policy in order to ensure the overall economic health of the nation.

Conclusion

Keeping humanitarian issues aside, the impacts of natural disasters have historically been devastating on economies that do not move to offset these effects. The economy of the U.S. and Japan are unique in that disaster recovery plans (albeit lacking) are set up to help offset such economic impacts. Furthermore, both economies are resilient to such shocks given the expectations of such shocks to take place. Developing countries often do not share the same luxury and cannot avoid the long term economic impacts. The impacts in question are specifically reductions in aggregate supply and demand, with lower levels of output (income), causing price deflations and higher levels of unemployment. The necessary instrument of macroeconomic stabilization (fiscal and monetary policy) need to respond to shocks and

contingency plans need to be implemented in order to keep the costs of natural disasters to a minimum.

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