MACROECONOMICS IN THE TIME OF THE CORONA[1]

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ABSTRACT

For a developed market economies, the corona crisis is a new type of crisis, but this crisis has parallels to economies at other times, and to crises at other places. We discuss some mechanisms from the traditional macro literature, and from the literature on macroeconomics for developing countries, which contains economic mechanisms that overnight have also become more relevant to developed market economies. Phenomena such as bottlenecks, rationing, forced savings, production constrained by access to inputs, liquidity constraints, sector heterogeneity, and costs running despite production being shut down, are all permanent phenomena in developing countries. During the corona crisis, however, they have also emerged as key mechanisms in developed market economies. We discuss some of these well developed, but partially forgotten mechanisms, by extending simple textbook descriptions, and we provide some examples of how the effects of fiscal and monetary policy are modified in a time of crisis.

1. INTRODUCTION.

The ongoing corona-pandemic reveals a modern economy's vulnerability. No part of the economy escapes the macro economic consequences. Reduced production in one firm affects demand for other firms' products. Shortages in one sector lead to unemployment in other sectors.

It is not obvious how ordinary economic concepts and models dominating macroeconomics today are able to capture the situation. Is the crisis a negative supply shock or is it a negative demand shock? Or is it both? Standard supply shocks describe a situation where productivity declines or some goods become more expensive. The current situation is a very drastic variety of this: it is a story about some goods and services disappearing from the market, where some firms are not being able to produce. Actual productivity has dropped to zero once the production has shut down. *Bottlenecks* stifle parts of the economy.

[1] This paper is an extended and modified version of a paper (written in Norwegian) on the corona crisis discussing the impact on the Norwegian economy. We are grateful for comments from Lars-Erik Borge, Stein Ove Erikstad, Rune Jansen Hagen, Torfinn Harding, Kalle Moene, Øistein Røisland and Elin Strøm. The views and analysis are solely the responsibility of the authors. Ragnar Torvik is also affiliated with CAMP (Center for Applied Macroeconomics and Commodity Prices) at the BI Norwegian Business School.

At the same time as the products are gone, demand is also affected. When certain goods are not available, the realized demand for such goods is gone too. There is a suppressed need, but the item disappears from the budget constraint of consumers. Restricting the ability to spend money can lead to increased demand for other goods, but it can also lead to increased savings, that is, what previous literature refers to as *forced savings*.

2. MACROECONOMICS AT OTHER TIMES AND OTHER PLACES.

Bottlenecks and forced savings are not standard building blocks in describing a modern capitalist economy. However, they are classic and important topics in economies at other times and at other places. In his book *Economics of Shortage* (1980), the Hungarian economist János Kornai described both types of mechanisms in great detail. In his discussion of the problems of centrally planned economies, and in the article *The Measurement Of Shortage* (1976) he discusses in depth *shortage-forced saving*.

Shortages and rationing were also an important phenomenon in the war economies in the period 1940-45. Rationing of goods contributed to the high savings in the US during the war. The private savings helped fund the war effort, but they also proved important when peace came. At the end of the war, there was great concern in the United States about mass unemployment and downturns when the war industry shut down and when demobilized soldiers returned home. Later Nobel laureate Lawrence Klein was rather optimistic. His reasoning was that as soon as rationing ceased, consumption, which had previously been kept down, would skyrocket. His concept of this phenomenon was *pent-up demand.* Nobel laureate Trygve Haavelmo worked in Cowles Commission with Klein towards the end of the war and the discussions about such deferred consumption and forced savings certainly inspired Haavelmo in the lectures on price control and rationing he held in 1956. In Chapter 4 *Rationing and Savings* referenced by Johansen (1958, p. 21) he notes that (our translation from Norwegian), "We can say that the difference between the expenditure for the originally intended quantity and the cost of the rationed quantity can be denoted *forced savings* when your income is given."

Also in structuralist equilibrium models for developing countries, scarcity appears as an important explanatory mechanism. This is based on a long tradition that studies how scarcity of goods restricts production and investment. Michał Kalecki (1971) was concerned that scarcity of agricultural goods limited industrial expansion, while Hollis Chenery was concerned with how scarcity of export revenue limited imports of necessary inputs and investment goods, thereby hampering growth.[2] As the chief economist of the World Bank, Chenery in the 1970s used such reasoning as an argument for foreign aid. In structuralist equilibrium models, this problem is sometimes referred to as *import-compression.* In these models, prices are not able to balance supply and demand in all markets, and rationing has economy wide effects. An example is Davies, Rattsø and

[2] See, for example, Chenery and Bruno (1962).

Torvik (1994). In this description of Zimbabwe's economy *import compression* leads both to lower investment and lower production. In addition, rationing of consumption goods increases private savings.

Structuralist equilibrium models for developing countries also emphasize that monetary policy can have other and new effects during a crisis.[3] In crises, firms depend on access to credit, but such credit can dry up. Firms must finance part of the inputs with loans, and this affects costs. The firms have fixed costs that run, and higher production means that the cost per unit produced goes down. By influencing costs of inputs and capital, expansionary monetary policy does not only affect the economy by stimulating demand as is assumed in most present day macro models, but also has a direct effect on the supply side. The firms receive reduced expenses on their fixed capital but also on overdraft facilities and standing credit lines.

Disequilibrium models were also central to macroeconomics for capitalist economies. Here, models were developed where prices did not adjust to achieve equilibrium in the markets, often referred to as fixed-price models. These models may exhibit disequilibrium with rationing in some markets, for example in the labor market, while it can be equilibrium in others. Barro and Grossman (1976), Malinvaud (1976) and Bénassy (1982) delivered important contributions in this area of macroeconomics, which also is very relevant during the corona crisis.[4]

3. MACROECONOMICS IN OUR TIMES AND OUR PLACES.

We also find similar mechanisms from the literature above in recent macro-theory for developed market economies, albeit in models based on a somewhat different tradition. A dominant field of research is linked to so-called new-Keynesian models, where the agents are assumed to be more rational and forward-looking than in traditional Keynes models, but where there are nominal rigidities so that production is not always at its equilibrium level. Lately, these models have been modified to have some features that make them even more similar to the traditional Keynes models. For example, consumption not only depends on permanent income and real interest rates, but it is assumed imperfect credit markets so that some consumers are rationed and only consume current income. With this assumption, it follows directly that current income also plays a role in aggregate demand. See, for example, Kaplan, Moll and Violante (2018), and Debortoli and Galí (2018).

Other models, such as Ravenna and Walsh (2006), incorporate monetary policy mechanisms very similar to those studied in previous macro-

[3] See, for example, Taylor (1991) for an overview.

[4] It may be in order to include a critical note to some of the literature referred above. In both structural equilibrium models and fixed-price models, it can sometimes be difficult to see what role prices really play, as well as how the agents influence them. However, this literature shares this feature with much of the macro theory that dominates the profession today, where, for example, it is often exogenously assumed that only a fraction of firms can change prices at any given time.

literature for developing countries. In their model, the interest rate affects the marginal costs of the companies, and thus, like in the development literature, the interest rate acts not only through the demand side of the economy, but also through the supply side. Here, too, many of the effects that have been pointed out in the former macro-literature for developing countries applies.

Finally, there are examples of recent macro models that directly study the effects of the corona crisis, although none of these, as far as we have seen, point out that the mechanisms discussed are very similar to those previously studied in the macro-literature of developing countries. The paper that most closely resembles ours is Guerrieri, Lorenzoni, Straub and Werning (2020). They show that several of the results that we find in our simple model can also be valid in more recent types of macro models, as long as these are extended to allow for more than one sector.

In the following, we aim to discuss how some of the mechanisms from traditional macro literature, from development economics, and also from more recent macro literature, can impact the economy and economic policy in the time of the corona. We have chosen to do this by extending well-known model frameworks. This, hopefully, makes the analysis also available to students and to economists who do not have macroeconomics as their research field.

However, our choice of model framework comes at a cost. The literature referred to is much richer in mechanisms than the ones we address. And our presentation of the mechanisms, embedded in well-known frameworks, does not do justice to the literature. In addition, we look at economics and politics *during* the crisis. Mechanisms that are relevant in the longer term, i.e. after the crisis, may be different and are not addressed here. Particularly important are hysteresis effects. If the crisis continues deep and long, it can be very difficult to avoid having permanent effects in the form of lower production and higher unemployment. The steady state of an economy is not something that should be viewed as exogenous, as much of current macro theory implicitly assumes when focusing on fluctuations around a given steady state.

In order to discuss how the crisis affects demand and supply, we start out with the simplest Keynes model, and show how this can be modified by incorporating crisis mechanisms. We then use this modified model to discuss the impact of fiscal policy during the crisis. To discuss monetary policy, we use the AD-AS model, and show how this can be modified to capture the effects of monetary policy in a time of crisis.

4. A SIMPLEST POSSIBLE MACRO MODEL.

We start out with the model that all economists know, namely the most basic Keynes model. In this section we first show that this model, in its simplest form, is not suitable to analyze the effect of the corona pandemic. But at the same time we shall, in the next section, see that the model can be modified in a simple way so that it immediately becomes more relevant.

The model has two equations:

$$Y = C + I + G + NX. \quad 1)$$

Here is Y aggregate production, C is private consumption, I is private real investment, G is public purchases of goods and services, and NX is net exports. The public sector finances part of its spending by a tax rate t on production. Given a marginal propensity to consume denoted by c, consumer demand is

$$C = c(1 - t)Y. \quad 2)$$

The model can be solved by combining 1) with 2) yielding

$$Y = c(1 - t)Y + I + G + NX,$$

where the solution for Y is

$$Y = \frac{1}{1 - c(1 - t)}(I + G + NX), \quad 3)$$

where we in addition assume that employment L is in a fixed proportion to production:

$$L = aY. \quad 4)$$

Equation 3) can be used to see what happens to production, and thus employment, as a result of increased public purchases G, increased investment I, changed tax rates t, or changed propensity to consume c. Such analysis can be found in any textbook and thus we do not proceed to do it here. Rather, we ask another question: what happens when a sector is partially shut down in the economy?

In 3) production is determined by demand. It is also implicitly assumed that there is some available capacity, so if the only thing that happens is that some of the firms will close, the dismissed workers will immediately find work in some of the other firms. Production and employment are unchanged. Employment will possibly be kept down if the capacity limit in the existing firms is reached. In any case, the number of employees in each of the existing firms goes up, and possibly up to a capacity limit given by the available capital equipment.

Obviously, there has been no such transfer of labor in response to the corona crisis. To the contrary: to limit the spread of the virus governments decided that the supply from part of the economy needed to be restricted. However, it was not only the supply that disappeared, it was also the demand for these goods.

How can we change the model above to take this into account? One of the problems with the model, so far, is that it does not allow some

parts of the economy to be restricted from the supply side, while others may be limited from the demand side.[5]

5. A SIMPLE MODEL IN THE TIME OF THE CORONA.

Y in the model above is the total national product, i.e. *value added*, at fixed prices. That is, it is a sum of a number of components of value added, all measured in fixed prices (e.g. , air travel, cable TV magazine subscription, dwellings, cultural services, etc.). We are now changing the model to take into account that production of some of these goods may be restricted from the supply side, while others may be limited from the demand side. We let Y_1 denote the total production of goods that are affected by close down (full or partial), while Y_2 is the production in the sectors that are not directly affected by virus prevention measures.[6] In order to keep things simple we abstract from intermediate deliveries between sectors. This is innocuous as long as we assume that only final deliveries are affected.[7]

In the following, we refer to these parts as sector 1 and sector 2, even though these "sectors" does not have more in common than that one is directly affected and the other is not. We let *f* be the proportion of consumer demand that targets sector 1, while the proportion (1-*f*) targets sector 2. Moreover a parameter *q* captures the fraction of sector 1 that is currently quarantined and unable to deliver goods and services. [8] We also make a similar distinction between two categories of investment goods and two categories of public spending, and that exports and imports are also split between the two sectors. Relationship 3') is now divided into two, one for each sector

$$Y_1 = (1-q)fc(1-t)(Y_1 + Y_2) + I_1 + G_1 + NX_1, \quad 5')$$

[5] In other words, it is unreasonable, in particular under the corona crisis, to claim that the different sectors of the economy operate in a way so that they can be aggregated into one common sector. Variables that must be termed endogenous in some sectors are exogenous in others, and vice versa. Sen (1963) emphasized this as very important, and in particular in structuralist macroeconomics the issue of closure rules has since been key in emphasizing how macroeconomic mechanisms depend on the structural characteristics of the economy at hand.

[6] The closure can be caused both by direct infection control, as for hairdressers, and as an indirect consequence of the stopping of critical parts of the production chain, such as for goods dependent on air transport.

[7] To the extent intermediate deliveries are also affected downstream goods will also be among goods that are restricted in supply. Such interlinkages could be included but it complicates the graphical analysis.

[8] Note that this also captures the case where demand for some goods disappears due to behavioral responses such as demand disappearing because consumers do not want to expose themselves for contact with others.

$$Y_2 = (1-f)c(1-t)(Y_1 + Y_2) + I_2 + G_2 + NX_2, \quad 6')$$

where the first term on the right hand side of the equations represents consumer demand, and the rest of the variables are other demand components for the current sector.[9]

We now solve for the production in each sector, so that equations 5') and 6') can be written as

$$Y_1 = \frac{1}{1-(1-q)fc(1-t)}(f(1-q)c(1-t)Y_2 + I_1 + G_1 + NX_1), \quad 5)$$

$$Y_2 = \frac{1}{1-(1-f)c(1-t)}\big((1-f)c(1-t)Y_1 + I_2 + G_2 + NX_2\big). \quad 6)$$

These equations are drawn in Figure 1, as the solid curves marked, respectively, D_1 and D_2. When production in both sectors is determined by demand, there is an internal solution and the equilibrium Y_{01}, Y_{02} is where the two solid curves intersect, and overall production $Y = Y_1 + Y_2$ is

$$Y = \frac{1}{1-c(1-t)(1-qf)}(I_1 + I_2 + G_1 + G_2 + NX_1 + NX_2), \quad 7)$$

which, when $q=0$, is exactly as inferred in the one-sector description 3) above.

We can, based on 7), analyze effect of expansionary fiscal policy for total GDP and see that the increase in G increases Y with a multiplier $1/(1-c(1-t)(1-qf))$ irrespective of which sector G is initially directed to. In Figure 1 we have illustrated an increase in G_2 when $q=0$. The D_2 curve shifts up to the dashed curve marked D_2'. The size of the vertical shift is given by

$$\text{vertical shift} = \left(1 + \frac{(1-f)c(1-t)}{1-(1-f)c(1-t)}\right) dG_2.$$

[9] It is far from certain that these distributions are each proportional to f. Net exports are particularly interesting. Abroad holiday travel is an important import component of consumption. The net export of holidays is therefore large and negative. Such factors must be taken into account when total net exports are distributed between sector 1 and sector 2.

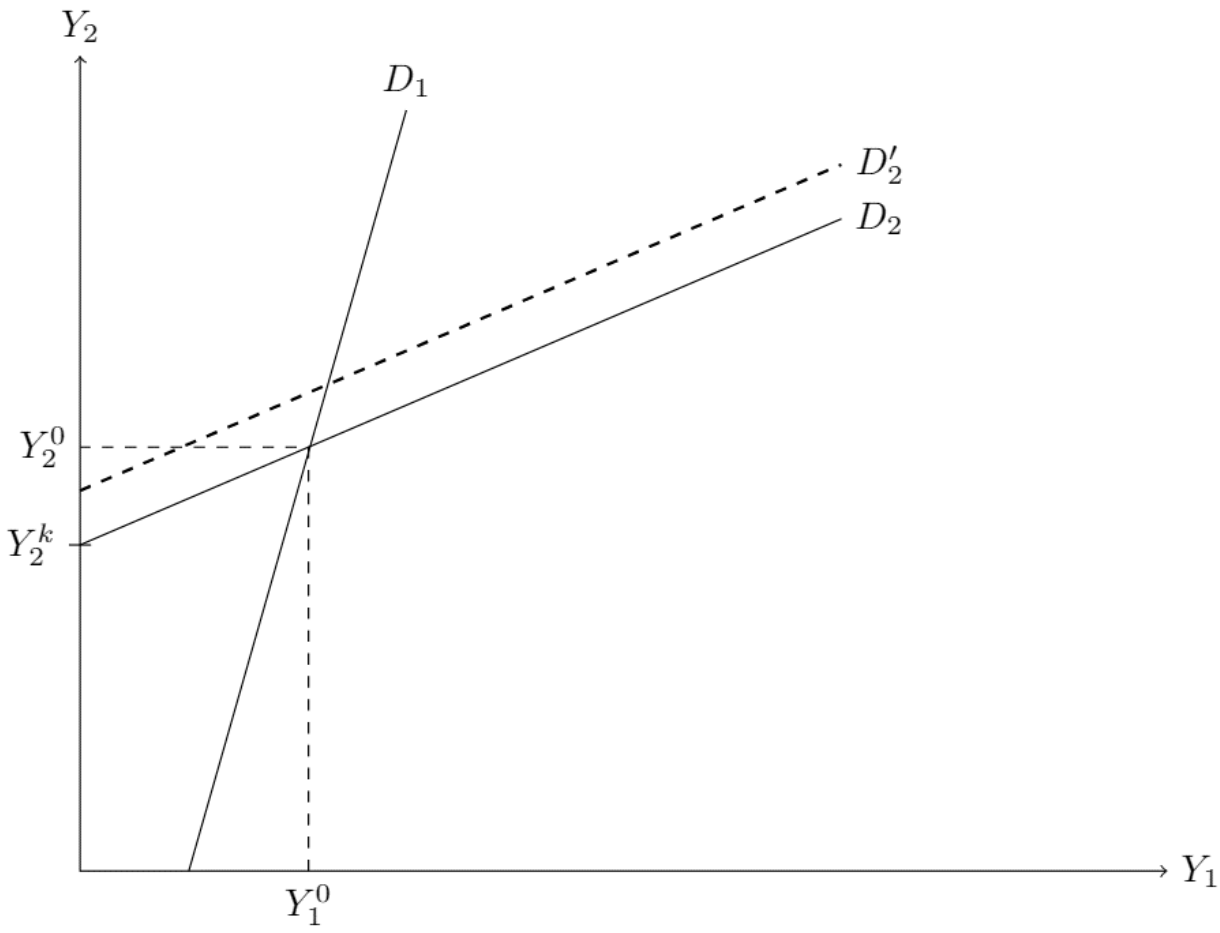

FIGURE 1: Two-sector equilibrium with demand determined production

This shift captures the impact that income in sector 2 has for the demand for sector 2.[10] When q=0 the final equilibrium is where the D_2' curve crosses the D_1 curve and the total effect on Y_2 exceeds the vertical shift:

$$dY_2 = \left(1 + \frac{(1-f)c(1-t)}{1-c(1-t)}\right) dG_2,$$

This is due to the interaction via sector 1. In the new equilibrium, production in sector 1 has also gone up. There are indirect effects driving up production in both sectors. The reason is that the two sectors are in a complementary relationship with each other where income in one sector provides demand for the other. It is this total effect the multiplier in 3) captures. One sector is dependent on consumer demand from the other, and vice versa. This feature has links to another classic in development economics, namely Rosenstein-Rodan's *big push mechanism*. In the descriptions by

[10] As we shall return to below, this is also the overall effect when there is no positive interaction with sector 1.

Rosenstein-Rodan (1943) and Nurkse (1953), the different sectors depend on each other's demand for workers to cover fixed costs.[11]

The quantitative effects in the model change when we look at a situation where production in sector 1 is limited from the supply side. When we take into account that the economy consists of many goods, and if we allow groups of goods such as air travel and cultural services to be eliminated from the supply, this will affect consumption. We leave *c* and *f* unchanged in Equations 5) and 6) and then implicitly follow Kornaí's idea of "forced saving", assuming that consumption of the goods that have become unavailable will cease if there are no good alternatives, hence *(1-q)* will drop. Potentially all the way down to zero.

Then equation 3) no longer gives an answer to what total production is. As we have defined sector 1, Y_1 is pushed down when the lights in the sector is gradually switched off. Lights being shut off in one sector result in production in the other sector being affected as well. We now denote variables after the corona pandemic has occurred with top-script k. As illustrated in Figure 1, if $q=1$, production in sector 2 is now determined where D_2 crosses the axis. As seen, the drop in aggregate income exceeds the drop in income due to the closing of sector 1, since production in sector 2 has also fallen. Guerrieri, Lorenzoni, Straub and Werning (2020) define a supply shock that decreases aggregate production by more than the shock itself a "Keynesian supply shock". Of course, in development economics such a result is rather standard, for instance that with a drought aggregate production drops by more than the fall in agricultural output.

In general, for intermediate values of *q,* the equilibrium values in both sectors are lower than what they are without corona. This is illustrated in Figure 2. Here there is a partial closing of sector 1, depicted as the leftward shift to the dotted demand curve. Y_2 gets less responsive to the income in sector 1, Y_1. Moreover, it shifts inwards as parts of G and I that used to come from sector 1 can no longer be delivered. As D_1 shifts inwards Y_1 drops and due to the complementarity also Y_1 drops.

Production in sector 2 falls when sector 1 is gradually turned off, and this result is based on the interdependence between sectors. In the model we are looking at here the demand from the other part of the economy is important. The reason is that own employees in a firm are not interested in just buying goods from their own firm. Similarly, those who earn their income in Sector 2 are not interested in moving all their consumption to Sector 2. Then they rather save.[12]

[11] A microfounded formulation of the theory of big push is given by Murphy, Schleifer and Vishny (1989). The findings of Guerrieri, Lorenzoni, Straub and Werning (2020) on the interdependence of sectors are also the result of a similar mechanism, although these authors do not refer to any of the previous literature in the field.

[12] It is straight forward to analyze what happens in the model if the scarcity of goods from one sector leads to increased consumer demand for goods from the other, as Haavelmo does in his 1956 lecture (Johansen 1958). This can be analyzed by letting a share of demand directed at the sector

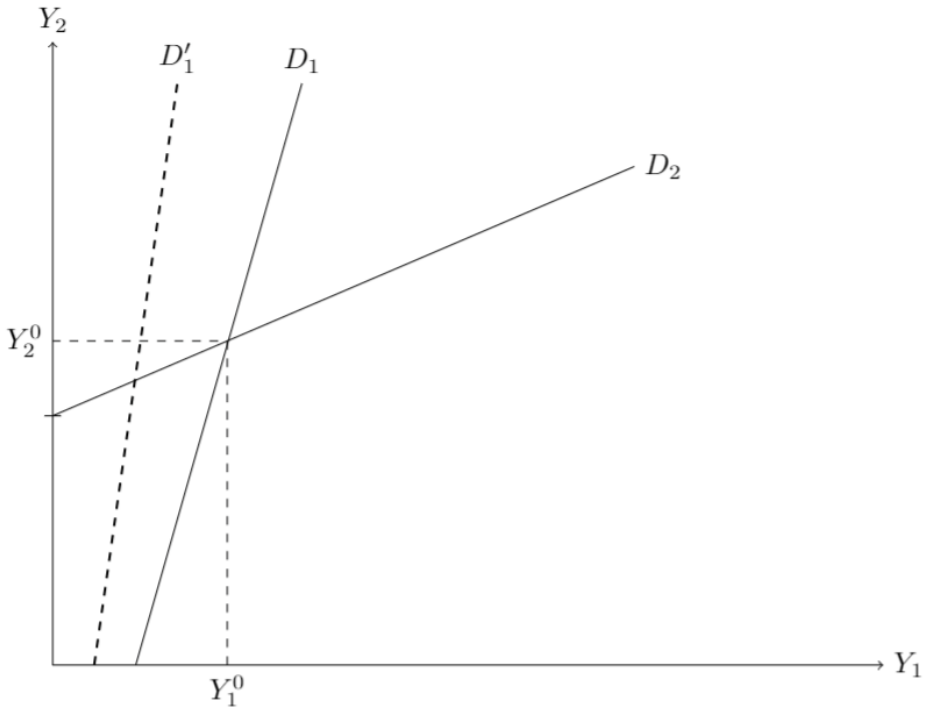

FIGURE 2 Partial corona-quarantine of sector 2

Unemployment in our model is higher than the closing down of one sector should imply in isolation. If we assume full employment at the start, and for simplicity we assume that the other demand components have the same proportion *f(1-q)* and *(1-f)* towards the two sectors as the private consumer has, it can be shown that unemployment by corona shutdown U_k, is given by

$$U^k = \frac{1}{1-(1-fq)c(1-t)} fq. \quad 7)$$

f is now the general demand fraction directed towards sector 1. *f* is therefore also sector 1's share of the economy. The drop in production as the sector closes down is then given *fq* and the immediate increase in unemployment is given by *fq*. The multiplier in the expression is an unemployment multiplier which is always greater than unity. The increase in unemployment thus comprises the direct effect in sector 1 given by *fq*, multiplied by the unemployment multiplier.

Equation 7) can be used to investigate the effects on the economy as the shutdown becomes more and more extensive. The immediate crisis management determines how *qf* increases or decreases during crisis. A gradual increase in qf may occur as critical cross-deliveries

closing down shift over as demand against the sector that is still open. However, unless the two goods are perfect substitutes savings go up and nothing qualitative change in our analysis. See also Guerrieri, Lorenzoni, Straub and Werning (2020), where substitution within and between periods is central to the results. Such results are also well covered in Tobin (1952), and in Haavelmo in Johansen (1958).

between the sectors, such as maintenance and spare parts, disappear, implying that larger parts of the economy can no longer supply goods. The parameter *qf* can then be interpreted as the sum of the sectors that are directly ordered to shut down and the sectors where the supply of goods is aborted for other reasons. Over time, more and more firms will be affected and *qf* will rise. A gradual opening of all sectors will have the opposite effect, causing q*f* to fall over time. Equation 7), under our simplifying assumptions, gives the relation between the proportion of the economy that is exogenously shut down and the endogenous unemployment consequence thereof.

So far, we have focused on the shutdown and impact on income and demand. Investments can also be expected to be hit hard. The reason is that investments are complex activities where each project requires input from *both sectors.* If there is such a strong complementarity, we get the classic problems of developing countries, where investment will be paralyzed by certain essential goods or components not available. Often, the restriction is linked to the investor 's access to currency. When there is such a strong complementarity between the elements, the shutting down of sector 1 may completely end all investment demand directed to sector 2. The reason is that the ability to invest is gone while the desire to invest is reduced. This represents a demand shock that hits the remaining activity in sector 2 hard. It comes at the top of the mechanisms via consumer demand and multipliers and provides a further need for public countermeasures.

5.1 WHAT CAN BE ACHIEVED WITH FISCAL POLICY?

The new economic situation has, as we have seen, reduced production through lower supply in one sector and through lower demand for the other sector. As a reference, we can consider the case where the economy was in equilibrium before the outbreak of the corona, with full utilization of capital and labor in both sectors. This means that a policy aimed at compensating for the loss of demand with increased demand directed at sector 2, so that we again get full employment in the economy as a whole, cannot succeed. Employment can only increase in sector 2, and it can only be increased as long as there is idle production capacity in the sector. I.e. sector 2 can only be brought back to the pre-crisis level.[13]

This situation again has clear parallels to studies of developing economies. Expansive fiscal policy does not raise agricultural production when it is determined by the weather. It does not bring up production in manufacturing when it is restricted by access to imported inputs, or, as in our case, when production is halted for infectious disease protection.

[13] Strictly speaking this sentence is only valid in the case without substitution between labor and capital in sector 2. During the corona crisis, in the short run, it seems like a reasonable assumption as it in a simple way captures the feature that it is difficult for sector 2 to absorb all labor being vacant in sector 1.

5.1.1 DEMAND STIMULUS IN THE TIME OF THE CORONA.

In order to save notation and simplify the discussion we look at the case where q=1 and where Y_1 is suppressed all the way to zero. The results we derive can easily be extended to intermediate extents of quarantine.

When sector 1 is closed down entirely, this sector will no longer be part of the economic loop. As we saw above, stimulus of sector 2 will appear stronger when the effects via sector 1 are active. When sector 1 is closed down, the vertical shift we saw in Y_2 following an increase in G_2 will be the total effect on the economy. If sector 2 starts at full capacity of its capital equipment the most expansive effect one can hope for, with demand stimulus, is to eliminate the decline in production due to a lower demand from sector 1. By setting Y_1=0 in equation 6) we see that demand towards sector 2 drops by $(1-f)c(1-t)\ Y_{01}$. If this drop in demand can be replaced by alternative demand, then production in sector 2 will be the same as before the corona crisis. This is the highest level of production that can be achieved by demand stimulus. If we denote this demand increase by D_k, then we get

$$D^k = (1-f)c(1-t)Y_1^0. \quad 8)$$

This term is equivalent to consumer demand towards sector 2 from those previously earning their income in sector 1. A demand stimulus to compensate for the loss of this demand can be designed in several ways. First, suppose that a lump-sum transfer is given to consumers, which we designate by S_k. Since only a fraction, given by $(1-f)c(1-t)$, of this transfer provides demand for sector 2 we have that

$$S^k = Y_1^0. \quad 9)$$

Should increased demand be achieved with such a grant, it is required that the amount is equal to the entire production decline in sector 1. Some of this amount is, however, recovered via public sector tax income tS_k, so the net outlay is $(1-t)S_k$.

If demand stimulus is instead achieved through increased government purchases of goods and services towards sector 2, the required increase in G_2 is given by

$$dG_2^k = (1-f)c(1-t)Y_1^0 < (1-t)S^k. \quad 10)$$

Behind this is a well known result, as well as a corona specific mechanism. The well-known result, established by Haavelmo (1945), is that public purchases has a stronger impact on demand than transfers to the private sector. The reason is that the entire public purchase contributes to increased demand, while only a share c of net cash support $(1-t)S_k$ contributes to increased demand. The corona-specific mechanism is that this difference in the effectiveness of the two policy instruments in influencing demand is *reinforced* during the corona crisis. The intuition for this is that more than usual of a transfer is saved because some goods are not possible to buy. This effect is represented by the term $(1-f)$. The relative difference in the efficiency of public demand directly to sector 2, compared to a general tax cut, is thus that public purchases are $1/[(1-f)c]$ times as efficient. This ratio was in Haavelmo (1945) $1/c$. In a numerical

example where c = 0.7 and f = 0.3 then the Haavelmo-result is twice as strong in corona times compared to in normal times. The larger the part of the economy that is hit by the shutdown, the less efficient is tax cuts relative to public purchases of goods and services in affecting total production.

The analysis above does not, however, take into account that the behavior of the individuals directly affected by the shutdown may be different compared to those not affected by the shutdown. The income of the unemployed is lower than the income of those still in employment. It is reasonable to expect that the consumption propensity of those affected is higher than that of those who are not affected (as in Taylor 1991). Targeted transfers to those affected can then provide both more efficient demand stimulus and a more equitable distribution of the burden of closure than a general tax cut would provide. If the propensity to consume sector 2 goods from those affected is not $(1-f)c$, but rather is 1, then targeted transfers are as effective as public purchases of goods and services in influencing demand. Thus a variant of Haavelmo's result is that general taxes that fund targeted transfer to those affected by the shutdown will be expansionary without weakening the government budget.

5.1.2 SUPPLY POLICY IN THE TIME OF THE CORONA.

The main component of supply policy in the corona crisis is a deliberate strangling of supply of certain sectors. The best one can hope for is to avoid the unintended consequences, and to make it possible for viable firms to start up again when the measures are over. The policy must therefore concentrate on fixing bottlenecks that are unwanted, but not relieving the bottlenecks that are actually wanted. One must therefore contribute with financing and liquidity so that the firms survive. In addition to giving intravenously support to companies that are closed, the supply policy must be adapted specifically to the industries that suffer from lack of inputs, lack of liquidity, or low demand . Many firms have fixed costs that run and that cannot be covered when the turnover is reduced. This can be remedied with direct support or loans, but also with monetary policy instruments.

6. A SIMPLE MODEL OF MONETARY POLICY IN THE CORONA CRISIS.

The usual view of monetary policy is that expansionary monetary policy increases both the activity level and prices. Here too, development economics offers alternative perspectives that are relevant during the corona crisis. Taylor (1981, 1991) points out that when the production is held back by liquidity, or when firms must use loans to finance inputs, monetary policy can act in ways different from what is normally assumed: expansionary monetary policy can, at the same time, provide higher activity and *lower* prices.

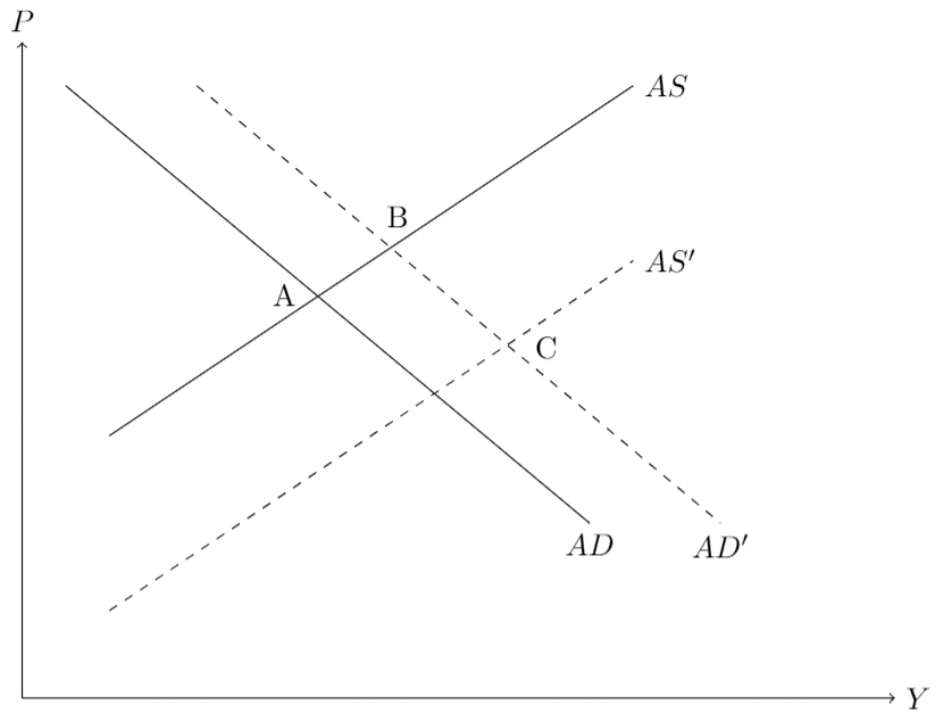

FIGURE 3: AD-AS with interest expenses on the cost side

Most monetary policy theories assume that the effect of an expansionary monetary policy is to increase demand (through various channels such as the direct demand effect of lower interest rates, and the indirect effect through a depreciation of the exchange rate). The increased demand (possibly along with depreciation of the currency) will push prices up.

We illustrate this in Figure 3, which shows an economy where demand is decreasing and supply is increasing in the aggregate price level. The initial equilibrium is at point A. Monetary policy works expansively by moving the demand curve to the dashed curve, and in the new equilibrium at point B, the activity level and the price level are higher.

6.1 MONETARY POLICY IN THE TIME OF THE CORONA.

In development economics, at least two additional perspectives that are relevant to the corona crisis are emphasized. These can be illustrated by how they affect Figure 3.[14] The first is insight is that monetary policy not only shifts the demand curve, but also shifts the supply curve. One example is that expansionary monetary policy makes it cheaper for firms to finance inputs with credit. This insight have also later been promoted by others than

[14] Note, however, that the literature referenced here is much richer in mechanisms than the ones we address. This implies that our simple presentation does not do justice to this previous literature. See, for example, Taylor (1981, 1983, 1991) and Taylor and O`Connell (1985). Also, see Krugman and Taylor (1978) for possible effects in that a depreciation of the exchange rate may be contractionary, a topic we do not address here.

development economists. For example, Christiano and Eichenbaum (1992) cite James Tobin, who in the Wall Street Journal in 1991 states that

> *Experience and common sense tells us that. . . ordering materials and hiring workers . . . would look like a better deal if the prime rate is 6% instead of 8%*

Monetary policy may also, by affecting the amount of liquidity in the market, enable firms that would otherwise not have had access to the credit market to obtain loans, and these firms may thus maintain their supply.

Due to such effects an expansionary monetary policy shifts the supply curve outward and downward. In Figure 2 this is illustrated with the new dashed supply curve, and equilibrium after an expansive monetary policy arrives at point C. The change in the supply curve contributes (in isolation) to lower prices. The net effect is that prices rise less, or even fall, with expansionary monetary policy.

The other perspective that is emphasized, and which is relevant to monetary policy, is that the supply curve in some situations can be downward sloping. The reason for this is the absence of factors that usually give rise to an upward sloping supply curve, and the presence of factors that give a downward sloping supply curve.

During the crisis, unemployment is high which implies excess labor supply. A higher level of activity will then have a negligible effect on wage pressure, so that an important channel for the supply curve "usually" being upward sloping is absent. At the same time, many firms during a crisis will depend on expensive liquidity. Higher turnover means that access to liquidity improves, and costs fall when companies have to finance less of their activity with expensive borrowing. In addition, the price of liquidity falls as production and sales increase, because the firms are then regarded as safer borrowers. One effect that also pulls in the direction of a falling supply curve is that companies will have high fixed costs. Higher production then causes unit costs to be lower the more that is produced, and lower unit costs may, in turn, result in lower prices.

This is illustrated in Figure 4, where the supply curve is depicted as downward sloping when there is a crisis, i.e. when production is low , but where it is upward sloping in normal times, i.e. when production is high. In times of crisis, the figure assumes that the supply curve is still flatter than the demand curve, implying that supply cuts demand from below.[15] In normal times, the equilibrium is given at the intersection of the supply curve with the fully drawn demand curve AD_1 to the right in the figure. In times of crisis, the equilibrium is given by the intersection of the supply curve and the fully drawn demand curve AD_2 to the left in the figure.

[15] Otherwise, under normal conditions, the equilibrium at which the two curves intersect will be unstable.

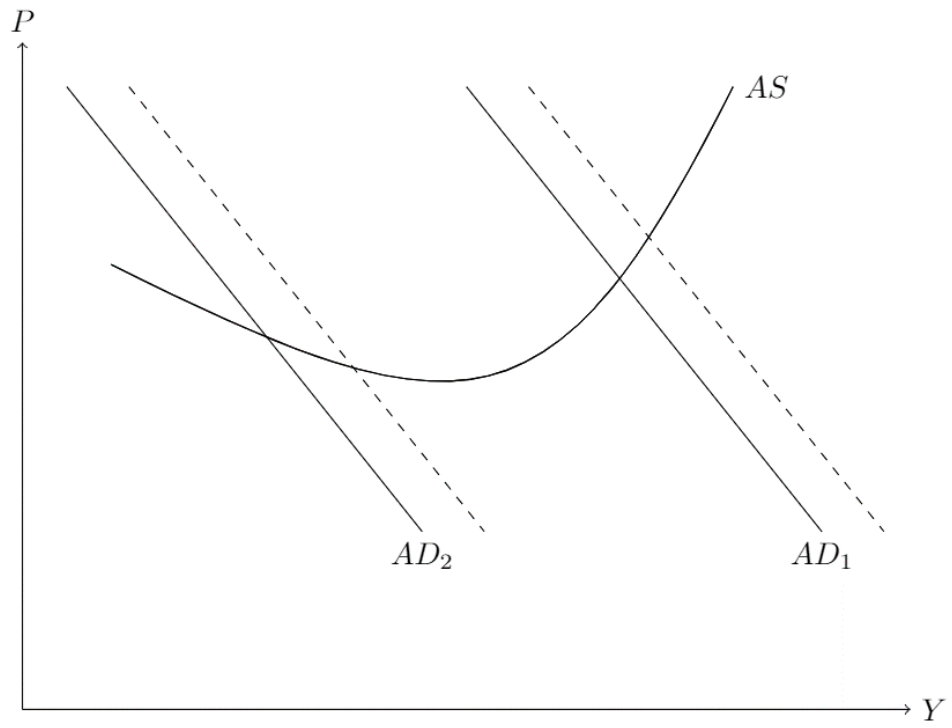

FIGURE 4: AD-AS when the borrowing terms improve in good times

Now suppose that expansionary monetary policy contributes to shifting the demand curve to the right, i.e. from the solid lines to the dashed lines in Figure 4. We note that while monetary policy entails higher production and prices in normal times, it does not do so in times of crisis. Expansive monetary policy also shifts the demand curve to the right in times of crisis, but this shift contributes to higher activity and *lower* prices.

What, then, is the implication for monetary policy during the corona crisis? Usually, there is thought to be a trade-off in monetary policy: an expansionary monetary policy increases the level of activity, but this must be weighed against the fact that it also increases prices. In the model above this trade-off is weaker, or it is nonexistent. In normal times, the effect of monetary policy on activity level is dampened by rising prices. In times of crisis , the impact of monetary policy can be amplified by falling prices. Thus, in a crisis, monetary policy seems strong at the same time as the argument that prices are rising is weak or absent. This implies that there are stronger arguments than in a "normal" recession for an expansionary monetary policy. According to this view, monetary policy should therefore be used for everything it is worth. The view that monetary policy is the first-line defense in stabilization policy has relevance also in a time of crisis. The problem is, naturally, that the corona crisis has brought many economies into a situation where monetary policy alone does not have enough power to achieve the desired effect, and thus fiscal policy might be needed in addition to the monetary policy response.

7. CONCLUDING REMARKS.

In the analyzes above, where there is full employment and capacity utilization *before the* crisis occurs, it is impossible for the policy to ensure balance in the economy *when the* crisis occurs. No matter how powerful the sum of fiscal and monetary policies, this cannot offset the decline in activity levels and the rise in unemployment. The reason is that part of the economy is directly restricted from the supply side by political decisions motivated by limiting the spread of the virus. The best one can achieve, as regards stabilization policy, is to correct for the *indirect* demand and supply effects.

In a time of crisis, it may make sense for economists to supplement the model types they usually work with. For developed market economies, it may be much to learn from economies in crisis at other times, and at other places. Both historical analyzes of non-market economies, and analyzes that study economic mechanisms in developing countries, contain well-developed insights for analyzing the crisis we are in, as well how economic policy may work during such a crisis. It is easy to become too preoccupied with the most recent advances in economic models, and to get too caught up in the present consensus. That is the nature of research, and so it must possibly be. But the nature of research should also be to look back, and to look for established insights that have proven relevant in similar crisis situations. We should recognize that analyzes that the economics mainstream profession do not usually see as relevant can bring lessons into a new, and for the mainstream economic profession, unfamiliar time.

REFERENCES.

Barro, Robert J., and Herchel I. Grossman (1976). *Money, Employment and Inflation*, Cambridge: Cambridge University Press.

Bénassy, Jean-Pascal (1982), *The Economics of Market Disequilibrium*. New York: Academic Press.

Chenery, Hollis B., and Michael Bruno (1962). *Development Alternatives in an Open Economy: The Case of Israel.* The Economic Journal 72, 79-103.

Cristiano, Lawrence J., and Martin Eichenbaum (1992). *Liquidity Effects and the Monetary Transmission Mechanism*. American Economic Review 82, 346-353.

Debortoli, Davide, and Jordi Galí (2018). *Monetary Policy with Hetrogenous Agents: Insights from TANK models*. Upublisert Working Paper, Barcelona: CREi.

Davies, Rob, Jørn Rattsø, and Ragnar Torvik (1994). *The Macroeconomics of Zimbabwe in the 1980s: A CGE-model Analysis*. Journal of African Economies, 3(2), 153-198.

Guerrieri, Veronica, Guido Lorenzoni, Ludwig Straub and Ivan Werning (2020). *Macroeconomic Implications of COVID-19. Can Negative Supply*

Shocks Cause Demand Shortages? Upublisert Working Paper, Cambridge: MIT.

Haavelmo, Trygve (1945). *Multiplier effects of a balanced budget.* Econometrica, 311-318.

Johansen, Tore (1958). *Fra teorien om rasjonering og prisregulering.* Utarbeidet på grunnlag av notater fra professor Haavelmo's forelesninger våren 1956. Memorandum 12.12.1958. (Translation: *From the theory of rationing and price regulation.* Developed on the background of notes from professor Haavelmo's lectures in the spring of 1956).

Kalecki, Michał (1971). *Selected Essays on the Dynamics of the Capitalist Economy.* Cambridge: Cambridge University Press.

Kaplan, Greg, Benjamin Moll, and Giovanni L. Violante (2018). *Monetary Policy According to HANK*. American Economic Review 108, 697-743.

Klein, Lawrence (1964). *The Keynesian Revolution Revisited*. The Economic Studies Quarterly XV (November 1964), 1-24.

Kornai, János (1980). *Economics of Shortage*, Amsterdam: North Holland Press.

Kornai, János (1976). *The Measurement of Shortage.* Acta Oeconomica, Vol. 16, No. 3-4, 321-344.

Krugman, Paul, and Lance Taylor (1978). *Contractionary Effects of Devaluation.* Journal of International Economics 8, 445-456.

Malinvaud, Edmond (1977). *The Theory of Unemployment Reconsidered*, Oxford: Blackwell.

Murphy, Kevin M., Andrei Schleifer and Robert W. Vishny (1989). Industralization and the Big Push. Journal of Political Economy 97, 1003-1026.

Nurkse, Ragnar (1952). *Some International Aspects of the Problem of Economic Development*. American Economic Review 42, 571-583.

Rosenstein-Rodan, Paul N. (1943). *Problems of Industrialisation of Eastern and South-Eastern Europe*. The Economic Journal 53, 202-211.

Sen, Amartya K. (1963). *Neo-classical and Neo-Keynesian Theories of Distribution*. Economic Record 39, 54-64.

Ravenna, Federico, and Carl E. Walsh (2006). *Optimal Monetary Policy with the Cost Channel*. Journal of Monetary Economics 53, 199-216.

Taylor, Lance (1981) *IS/LM in the Tropics: Diagrammatics of the New Structuralist Macro Critique*. I William R. Cline og Sidney Weintraub, *Economic Stabilization in Developing Countries*, Washington D.C.: The Brookings Institution.

Taylor, Lance (1983). *Structuralist Macroeconomics*, New York: Basic Books.

Taylor, Lance (1991). *Income Distribution, Inflation, and Growth: Lectures on Structuralist Macroeconomic Theory*, Cambridge: MIT Press.

Taylor, Lance, and Stephen O`Connell (1985). *A Minsky Crisis.* Quarterly Journal of Economics, 100, 871-885.

Tobin, James. (1952) *A Survey of the Theory of Rationing*. Econometrica 20, 521-553.