

Bofinger, Peter

**Working Paper**

Teaching macroeconomics after the crisis

W.E.P. - Würzburg Economic Papers, No. 86

**Provided in Cooperation with:**

University of Würzburg, Department of Economics

*Suggested Citation:* Bofinger, Peter (2011) : Teaching macroeconomics after the crisis, W.E.P. - Würzburg Economic Papers, No. 86, University of Würzburg, Department of Economics, Würzburg

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# W. E. P.

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## Würzburg Economic Papers

No. 86

# Teaching Macroeconomics after the Crisis

Peter Bofinger<sup>(a)</sup>

<sup>(a)</sup>University of Würzburg, CEPR and German Council of Economic  
Experts

December 2011

Universität Würzburg  
Wirtschaftswissenschaftliche Fakultät  
Lehrstuhl VWL 1  
Sanderring 2, D-97070 Würzburg  
peter.bofinger@uni-wuerzburg.de

**Postal Address**

Peter Bofinger  
University of Würzburg, Department of Economics, 97070 Würzburg, Germany  
*Email:* [peter.bofinger@uni-wuerzburg.de](mailto:peter.bofinger@uni-wuerzburg.de)

# Teaching Macroeconomics after the Crisis

Peter Bofinger\*

Dezember 2011

## Abstract

It is often said that after the crisis economic textbooks have to be rewritten. However, as surveys show, almost all professors continue using the standard IS-LM/AS-AD model as the workhorse for undergraduate training. This paper shows that the IS-LM/AS-AD model is not only full of obvious inconsistencies, e.g. using two aggregate demand and two aggregate supply curves, it also presents the economy as an inherently stable system which is only destabilized by wage rigidities and policy shocks. Thus, it cannot explain involuntary unemployment and it pretends that deflation is a self-stabilizing mechanism if an economy is affected by a negative demand shock. This paper shows that it is relatively easy to reinterpret the basic model in a way that inconsistencies can be avoided and the inherent instability of macroeconomic processes which underlies the Keynesian paradigm can be demonstrated. It also allows a discussion of monetary policy in a more topical way than the traditional LM-curve.

**JEL-classification:** A10, A11, A22, E12

**Keywords:** Keynesian economics, AS/AD model, economic crisis, cyclical unemployment

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\*Peter Bofinger: University of Würzburg, Department of Economics, Chair of Money and International Affairs, Sanderring 2, 97070 Würzburg, Germany. Email: peter.bofinger@uni-wuerzburg.de, Phone: +49/931/31-82944

*“Unfortunately, it is these primitive models, rather than their sophisticated descendants, that often exert the most influence over the world of policy and practice. This is partly because these first principles endure long enough to find their way from academia into policymaking circles. As Keynes pointed out, the economists who most influence practical men of action are the defunct ones whose scribblings have had time to percolate from the seminar room to wider conversations. These basic models are also influential because of their simplicity. Faced with the “blooming, buzzing confusion” of the real world, policymakers often fall back on the highest-order principles and the broadest presumptions.”* (The Economist, 16 July 2009)

## **1. Macroeconomic teaching unaffected by the crisis**

After the economic and financial crisis it was often said that the economics textbooks would have to be rewritten. Most commentators suggested that the standard paradigm would have to be supplemented by a comprehensive analysis of the functioning of the financial system and the interplay with the real economy. While it is certainly true that the role and the working of banks as well as financial markets has been more or less disregarded not only in textbooks but also in the most elaborate dynamic stochastic general equilibrium (DSGE) models, this paper argues that the necessary revision of the macroeconomic paradigm has to be much more wide-ranging. Above all, it concerns the very core of the standard macroeconomic curriculum which presents a story about macroeconomic processes that is difficult to reconcile with the experience of the last five years. Axel Leijonhufvud (2011, p.1) puts it as follows:

*“The IS-LM model which originated as an attempt to formalize the verbal economics of Keynes, led after years of debate to the seemingly inescapable conclusion that unemployment had to be due to the downward inflexibility of money wages. This old neoclassical synthesis thus casts Keynesian economics as a stable system with a “friction”, rather than a theory of an economy harbouring dangerous instabilities.”*

By neglecting the inherent instability of the economy, the standard textbooks have contributed to the widespread belief among economists in the years preceding the crisis that major macroeconomic fluctuations were a problem of the past and that due to an intelligent macroeconomic management the world economy had entered the blissful state of the “*Great Moderation*”.

In the current situation, which is characterized by a strong increase in unemployment not only in the United States but also in Europe, the paradigm presented in standard textbooks suffers from the severe defect that cyclical unemployment is not presented in an analytical way. In fact, in almost all books the interplay between the goods market and the labor market is completely disregarded.

In spite of these obvious flaws of the IS/LM-AS/AD model it has been able to survive the crisis remarkably well. A recent survey by Gärtner et al. (2011) on “*Teaching Macroeconomics after the Crisis*” comes to the following result:

*“In intermediate macroeconomics, the lingua franca for discussing short-run issues appears to be the aggregate demand/aggregate supply model. The mandatory curriculum includes this almost universally, in 97% of all cases. (...) Interestingly, a smaller percentage teaches the very concepts that are typically thought to provide the underpinnings of the AD-AS model. Regarding aggregate demand, 94% cover the Keynesian cross and 92% teach the IS-LM model.”*

The survey also shows that the standard model has become even more popular after the crisis. Asked whether they intended to expand the coverage of a model or to add it to the curriculum, the percentage of the respondents for the AS/AD model was 17%, for the IS/LM model 18%.

This is a dangerous development as it leads to a divergence between the continuing instability of the global economy and a paradigm which presents an analysis of macroeconomic processes that seems not fundamentally different from the microeconomic partial analysis of the market for potatoes. The seemingly stability of the aggregate sphere is due to the following features of the macroeconomic paradigm:

- In many textbooks exogenous demand shocks are not discussed at all.
- Deflation is presented as a self-stabilizing mechanism which makes anticyclical policies redundant.
- The zero bound for the nominal interest rate is not mentioned.
- In many textbooks expansionary monetary policy is only presented as a destabilizing macroeconomic shock. As a consequence, a general trade-off between inflation and unemployment is postulated.
- Cyclical unemployment is only addressed in a very cursory way, but not discussed in an analytical way. Above all, the impact of disturbances on the goods market on the labor market is completely disregarded.

The disguised transformation of a basically Keynesian paradigm into a self-stabilizing framework is also related to severe logical inconsistencies and omissions of the model. Some of them were already identified in the debate of the 1990s which was triggered by articles by Barro (1994), Colander (1995) and Bhaduri et al. (1995). But this discussion had no major effects on the macroeconomic paradigm. Some of these inconsistencies and omissions are so obvious that it is almost surprising that they could survive for decades:

- The paradigmatic model presents two aggregate demand curves which are mutually inconsistent: the so-called expenditure curve in the income/expenditure model and the AD curve presented in the AS/AD model.
- The model has also two inconsistent supply curves: the 45°-line in the income/expenditure model and the AS curve presented in the AS/AD model.
- Monetary policy and fiscal policy are analyzed without macroeconomic loss functions.
- The LM curve presents a strategy of monetary targeting which is a relic of the monetarist era. In some textbooks it has been substituted by an incomplete Taylor rule which is only defined for the output level but not for deviations of the price level from a target level.

In addition to these flaws there is also the problem that the basic model is defined for the price level and not for the inflation rate. This was already criticized by Romer (2000) who

proposed to substitute the LM curve by a real interest rate line. His idea has led to the development of completely different models (Walsh, 2010; Bofinger et al., 2006), but it also did not affect the dominant role of the AS/AD model in undergraduate teaching.

Thus, this paper can definitively confirm the assessment made by Buiter (2009):

*“(T)he typical graduate macroeconomics and monetary economics training received at Anglo-American universities during the past 30 years or so, may have set back by decades serious investigations of aggregate economic behaviour and economic policy-relevant understanding.”*

In the following I will first discuss the inconsistencies in the three submodels, i.e., the income/expenditure model, the IS/LM model and the AS/AD model. I will show that it is relatively easy to reinterpret and to supplement the underlying macroeconomic relationships in a way that these inconsistencies can be removed. In addition, it will become possible to differentiate between a discretionary and a rule based monetary policy. I then compare the policy implications of this reinterpreted model with those of the dominant textbook model. In this reinterpretation the Keynesian features of the model reappear, above all the possibility of a short-term equilibrium on the goods market with unemployment on the labor market which cannot be reduced by lowering real wages. In addition, the scope for monetary policy is increased as in the case of demand shocks the trade-off between output and inflation disappears. Finally the problem of a zero lower bound for the interest rate can be addressed explicitly.

The paper also shows that the underlying dynamics of the reinterpreted model can easily be transplanted into a macroeconomic model which is defined for the inflation rate instead of the price level. This allows an adequate discussion of a Taylor rule and shows that negative demand shocks do not necessarily lead to deflation.

## **2. Flaws and logical inconsistencies of the standard model**

In the following I will present and reinterpret the main building blocks of the three models which together make up the standard macroeconomic textbook model:

- The income/expenditure model
- The IS/LM model
- The AS/AD model

### **2.1 From the income/expenditure model to an explicit aggregate demand/aggregate supply model**

In the standard textbook the income/expenditure model is presented graphically as an expenditure curve and a 45°-line. Equilibrium on the goods market is derived as the intersection of the two curves. This opaque presentation is a major reason for the inconsistencies in the whole textbook paradigm.

Astonishingly, only very few textbook authors come to the obvious approach that an **equilibrium on the goods market** requires a correspondence of planned aggregate supply with planned aggregate demand. From this basic insight one would try to derive explicitly an aggregate demand and an aggregate supply function.

In fact, the so-called **expenditure function** is nothing else but an **aggregate demand function** as it describes private consumption plans determined by aggregate income and private investment plans. While some authors explicitly speak of a demand function (astonishingly not of an aggregate demand function), many authors use the not clearly defined term “expenditure”.

In the same way, the **45°-line** is nothing else but an **aggregate supply function**. In line with Keynesian thinking this function describes aggregate supply which in the short-term is determined by aggregate demand. Thus, the 45°-line can be regarded as a **short-run aggregate supply curve (SRAS)**.

From this one could present the intersection of the 45°-line and aggregate demand as the locus where planned short-term aggregate supply equals planned aggregate demand.

$$Y^d = C(Y^s) + I \quad \text{Aggregate demand function}$$

$$Y^s = Y^d \quad \text{Aggregate short-run supply function}$$

After having discussed such a short-term equilibrium, one would immediately ask for the **long-run supply function (LRAS)**. It can be easily derived from a simple labor market model. The equilibrium on the labor market determines the natural level of employment ( $N_n$ ). Assuming that labor productivity is constant, one can choose the units of output so that one worker produces one unit of output (Blanchard et al., 2010, p. 155). Thus the production function becomes:

$$Y = N$$

The natural level of output ( $Y_n$ ), which is identical with the long-run aggregate supply is:

$$Y_n = N_n$$

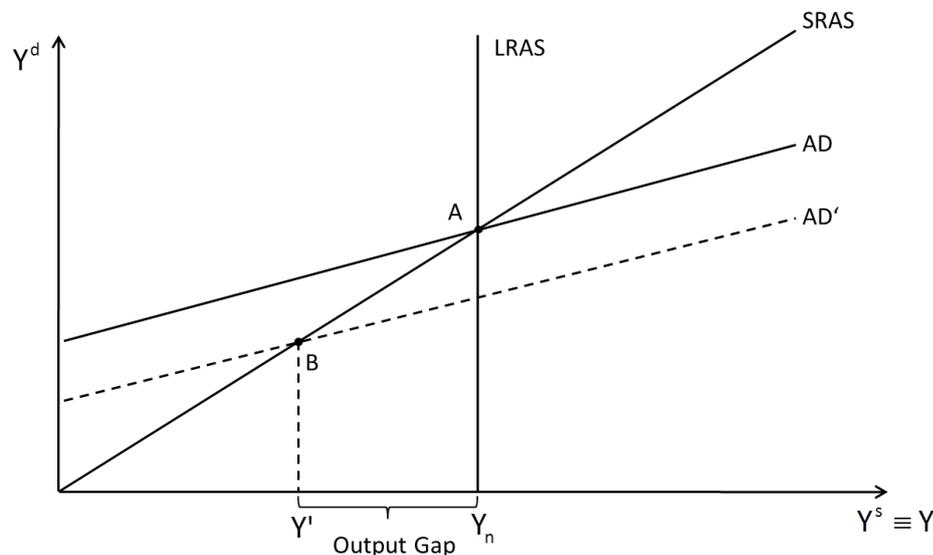
Thus, in the  $Y^d/Y^s$ -diagram, the long-run aggregate supply can be presented as a vertical line. With this simple model the intuition of Keynesian economics can be demonstrated in a very simple way (chart 1). If one assumes a negative demand shock, the AD curve shifts downwards from AD to AD'. The new short-term equilibrium on the goods market is point B. Thus, the shock has led to a negative output gap of  $Y_n - Y'$ .

This **demand-side determination of short-run supply** constitutes the essence of the Keynesian model, but it is difficult to identify in standard textbooks.<sup>1</sup> Together with the introduction of a full employment or natural output level it shows the student right from the start that a short-term equilibrium on the goods market is possible at the aggregate level while the production potential of an economy is not completely exhausted.

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<sup>1</sup> The notable exception is Richter et al. (1981).

Chart 1: Demand-Side Determination of Short-Run Supply



Given the simplicity of these basic relationships, it is surprising to see the clumsy and astonishingly different presentations of the income/expenditure model that are offered in **leading textbooks**.

E.g., Blanchard et al. (2010, p. 47) explain the 45°-line as follows:

*“recall that production and income are identically equal. Thus the relation between them is the 45° line, the line with a slope equal to 1.”*

The opaque term “*production*” can often be found in the context of the income/expenditure model although it would be more intuitive to speak of “planned supply”. And in fact, “planned supply” is identical with “planned income”. But by combining a mere national accounting identity between “value added” in the production process and the income which is created in this process to a demand curve, it would not be possible to derive a goods market equilibrium. In other words, aggregate supply has to be derived explicitly.

In Mankiw (2010, p. 291) a somewhat different explanation can be found:

*“The next piece of the Keynesian cross is the assumption that the economy is in equilibrium when actual expenditure equals planned expenditure. (...) The 45-degree line (...) plots the points where this condition holds. “*

In the context of an equilibrium analysis this approach - which can also be found in Begg et al. (2003, p.291) - is similarly astonishing. As the “*Keynesian cross*” intends to describe an equilibrium condition it can only be related to *planned* aggregates. Thus, it makes no sense to derive the equilibrium from a situation where a planned magnitude (ex ante) is identical with its realization (ex post).

Another strange presentation can be found in the textbook of Baumol and Blinder (2010, p. 180). In their view the income/expenditure model describes a “demand-side equilibrium”:

*“whenever production is above the equilibrium level, market forces will drive output down. And whenever production is below equilibrium, market forces will drive it up. In either case, deviations from demand-side equilibrium will gradually be eliminated.”*

But since equilibrium is defined by the correspondence of demand *and* supply plans what sense does it make to speak of demand side equilibrium? What the authors might seem to have in mind is the fact that the supply function is demand-side determined.

Even Colander (1995, p. 174) who is very critical with the AS/AD model fails to realize the true nature of the income/expenditure model when he states:

*“The Keynesian model is quite explicitly a model of expenditures and production.”*

Why does he not simply state that it is a model of planned aggregate demand and planned aggregate supply?

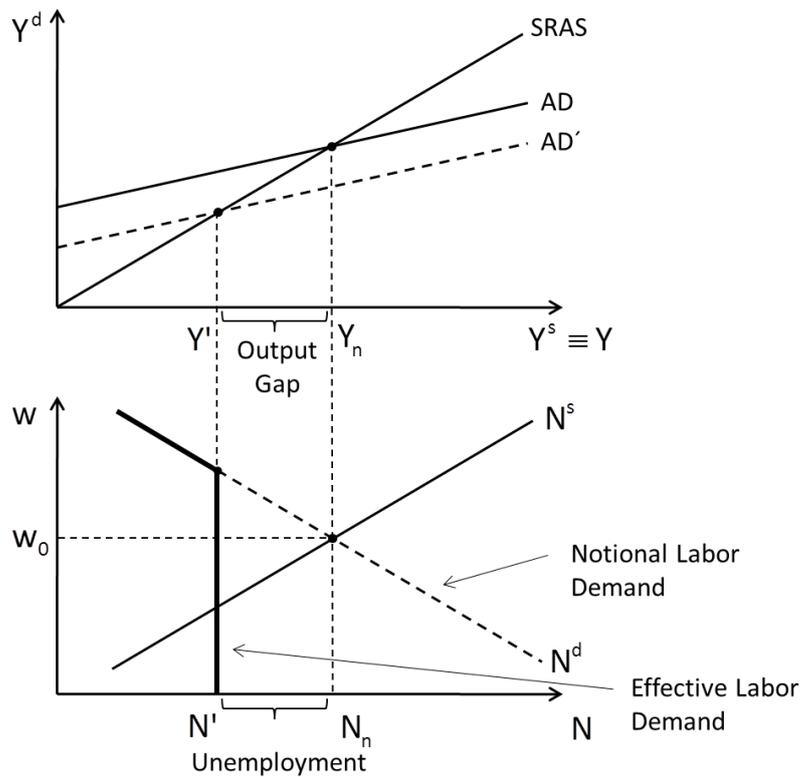
## 2.2 Keynesian implications of a goods market shock for the labor market

If one interprets the income/expenditure model as a model of the aggregate goods market, it seems straightforward to connect the aggregate goods market directly with the labor market. This link can be derived rather easily. By using the simple aggregate long-run supply function presented above, it can be shown graphically how a negative demand shock (AD shifts to AD') affects the labor market (chart 2). The reduction of output from  $Y_n$  to  $Y'$  is translated into a rationing of the firms' demand for labor. For the production of output  $Y'$  a quantity of employment  $N'$  is needed. Thus, the shock has caused **involuntary unemployment** in the magnitude of  $N_n - N'$ .

This framework does not only allow to explain involuntary unemployment, it provides at the same time an important policy implication: As long as there exists a negative output gap at the aggregate goods market, which leads to a rationing on the labor market, a **reduction of the real wage ( $w$ )** cannot increase employment. While there is still the standard demand function for labor that is determined by the marginal productivity of labor and the real wage, the demand shock sets an upper limit for the demand for labor ( $N'$ ) irrespectively of the real wage. If firms know that their maximum demand is  $Y'$  they will not hire more workers than required for the production of this output level. This rationing leads to two different demand curves for labor:

- A **notional demand for labor** that applies if there are no demand constraints on the goods market.
- An **effective demand for labor** that is identical with notional demand up to  $N'$ . Beyond  $N'$  it becomes vertical which implies that even with a lower real wage firms are not willing to hire more workers.

Chart 2: Involuntary Unemployment



Barro and Grossman (1971, p. 82) regard this interrelationship between the goods and the labor market as an essential insight of Keynesian economics:

*“Keynesian theory proposes as a general case a system of markets which are not always cleared. Keynes was, tacitly concerned with the general theoretical problem of the intermarket relationship in such a system. The failure of a market to clear implies that, for at least some individuals, actual quantities transacted diverge from the quantities which they supply or demand.”*

As Barro and Grossman (1976, p. 44) show, this framework can also be used to derive minimum-wage unemployment as an alternative explanation of unemployment. For this purpose a minimum real wage ( $w_{\min}$ ) above  $w_0$  must be introduced which leads to an excess supply of labor.

Thus, it is analytically rather easy to present cyclical unemployment in an introductory macroeconomics course. This stands in contrast to the practice of the voluminous leading textbooks which state the importance of unemployment,<sup>2</sup> but which make no effort to discuss the implications of business cycles for the labor market.<sup>3</sup>

<sup>2</sup> E.g., Abel and Bernanke (2005, p. 6): *“Along with growth and business cycles, the problem of unemployment is a third major issue in macroeconomics.”*

<sup>3</sup> Begg et al. (2003, p. 388) are one of the few exceptions. However, they derive *“demand-deficient unemployment”* from a shift in the labor demand curve, not by differentiating between a notional and an effective demand for labor. Thus, in their model a reduction of the real wage is able to restore equilibrium which is not possible in a framework where the labor market is rationed by the goods market.

Because of the insufficient treatment of aggregate supply in the income/expenditure model the main message of Keynesian economics gets lost from the beginning.

*“In the General Theory, Keynes proposed a theory in which flexible money wages would not restore the economy to full equilibrium and very flexible wages would produce financial catastrophe.”* (Leijonhufvud, 2011, p. 1)

### 3. From the IS/LM model to the DS/IR model

The reinterpretation of the income/expenditure model has no major implications on the derivation of the **IS curve**. In all textbooks this curve is explicitly presented as the locus of goods market equilibria for different interest rates. But for teaching purposes it would be more intuitive to label it as a DS curve (demand equals supply) instead as an IS (investment equals saving curve) which, of course, is also a correct interpretation.

A very comprehensive reform agenda is required for the **LM curve**. The standard explanation that it represents equilibrium on the money market is rather unfortunate as students might think that this is the money market from which they hear in the media. However, while the former is a market for short-term interbank lending, the latter is a market for the demand and the supply of the money stock M1 which represents the interactions between banks and non-bank customers.

In addition the LM curve is derived for the monetary policy strategy of **monetary targeting**. This strategy had become popular in the late 1970s, but only few central banks did practice it for a longer period of time and in a consequent way.<sup>4</sup> Today, monetary theory and policy are characterized by strategies of interest rate targeting. Therefore, for a refurbishment of the whole model it seems more convenient to substitute the LM curve by an **interest rate line (IR curve)**. This has also been suggested by Blanchard et al. (2010, p. 87) who have argued that the LM relation can be presented as *“an interest rate rule”*. However, they leave it open how such a rule might be defined and which concrete interest rate rules are chosen by a central bank:

*“Which LM relation should you use? It depends on the question at hand.”* (Blanchard et al., 2010, p. 88)

For a very simple introduction in macroeconomic theory the interest rate policy of a central bank could be presented as a horizontal IR line. This would be equivalent with a **discretionary interest rate policy** where the central bank sets the interest rate in a way to maintain a goods market equilibrium that is identical with the full employment output ( $Y_n$ ). Such a simplified presentation would be much more in line with the actual practice of central banks. In addition, its rationale can be explained much easier than the intricacies of the LM curve, above all with its speculative demand for money. As an additional advantage of this simple approach an AD curve in the P/Y-diagram would be no longer needed as there is no longer a given relationship between variations of the price level and the interest rate. For a more

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<sup>4</sup> The Deutsche Bundesbank who proclaimed to follow this strategy in the period from 1975 to 1998 missed its self-proclaimed and very broad targets every second year.

sophisticated exposition the horizontal interest rate line would be combined with a macroeconomic loss function that has to be presented in the P/Y-diagram.

Alternatively the IR curve could be designed for a rule-based interest rate policy which is defined by the output gap and a price level gap, i.e., a deviation of the price level from a target level of the central bank. Such a **Taylor rule for the price level** can be formulated as follows:<sup>5</sup>

$$i = i_0 + \alpha(P - P^*) + \beta(Y - Y_n)$$

Thus, the nominal interest rate is determined as a neutral nominal rate ( $i_0$ ) plus  $\alpha$  times the price level gap plus  $\beta$  times the output gap. Of course, it would be more convenient to discuss the Taylor rule in the framework of a macroeconomic model which focuses on the inflation rate and not on the price level (see Bofinger et al., 2006).

In several textbooks a reinterpretation of the LM curve as a Taylor rule can be found. However, in Begg et al. (2003, p. 341) it is presented as a Taylor rule which is only formulated for output and thus does not take into account changes in the price level.<sup>6</sup> This is due to the fact that the authors present a second Taylor rule for inflation in a  $\pi/Y$ -diagram (figure 25-1) which is unrelated to their exposition of the IS/LM model only a few pages before.

The same approach can be found in Burda and Wyplosz (2009, p. 253). Although they define a Taylor rule for inflation and the output gap, they fail to realize that changes in the inflation rate must shift the Taylor line in the  $i/Y$ -diagram. Therefore, their analysis in figure 10.13 is also incomplete as it does not include the feedback effects of a lower inflation rate on the Taylor interest rate.

In the same way as the monetary targeting rule in the traditional presentation of the LM curve, a Taylor rule leads to an upward-sloping IR line in the  $i/Y$ -diagram. In the case of the LM curve this is due to the fact that an increase in real output requires additional transaction balances. They can be only made available by higher interest rates which induce investors to reduce speculative money holdings. In the case of a Taylor rule, the positive slope of the IR curve is related to the fact that with a higher output (a lower negative or higher positive output gap) the central bank increases the interest rate to prevent inflationary tendencies.

#### 4. The many flaws of the AS/AD model

After getting off track from its very beginning the exposition of macroeconomics becomes even more flawed in the AS/AD model. As already mentioned this submodel tries to add an additional supply and an additional demand curve to the system.

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<sup>5</sup> As the price level gap and the output gap in this Taylor rule are defined as absolute deviations, the weight parameters  $\alpha$  and  $\beta$  are normalized with  $P^*$  and  $Y_n$ .

<sup>6</sup> This approach can also be found in Arnold (2006).

#### 4.1 From the AD curve to a policy reaction function or a monetary policy rule line

When it comes to the **AD curve** most authors do not seem to be bothered deriving an aggregate *demand* curve from an IS curve (together with the LM curve) which they have presented to their students one or two weeks ago as a goods market equilibrium relationship. While Colander (1995, p. 175) proposes to speak of an “*aggregate equilibrium curve*”, it seems more appropriate to speak of a **monetary policy rule line (MP curve)**. As the discussion of the IR curve has shown, for a completely discretionary policy an AD curve cannot be derived. It requires either that monetary policy is guided by a policy rule or by a macroeconomic loss function. A downward sloping MP curve can be derived for both policy rules:

- The MP curve for the **constant money stock rule** is derived from the effects of the price level on the real money stock. That is, a higher price level reduces the real money stock which leads to higher interest rates and reduces output.

-The MP curve for a **Taylor rule** is derived from the effects of the price level on the Taylor interest rate. That is, a higher price level increases the Taylor interest rate which also reduces output.

Alternatively for the case of a discretionary monetary policy the P/Y-space can be used for the presentation of a central bank’s **loss function**. Within a P/Y-framework the loss function has to be defined as follows:<sup>7</sup>

$$L = (P-P^*)^2 + \lambda(Y-Y_n)^2$$

Where L is the macroeconomic loss, P\* is the price level target of the central bank. The factor  $\lambda$  is used to determine the relative weight of the two targets. For  $\lambda = 1$  the loss function can be depicted as loss circles in the P/Y- diagram with  $(P^*|Y_n)$  as its center. The optimal interest rate is a horizontal line in the i/Y-diagram.

#### 4.2 From the aggregate supply curve to a Phillips curve for the price level

The problem of using two inconsistent supply curves within one theoretical framework can be easily removed if one decides to label the AS curve as a **Phillips curve for the price level**. In fact several authors explicitly argue that the AS curve can be interpreted in this way. E.g., Mankiw (2010, p. 389) states that “*the Phillips curve equation and the aggregate supply curve represent essentially the same macroeconomic ideas*”.

In fact, some pages earlier Mankiw (2010) derives the AS curve from the sticky-price model in a way that the price level is determined by the expected price level and the output gap:<sup>8</sup>

“*Hence, the overall price level depends on the expected price level and on the output gap.*” (Mankiw, 2010, p. 382)

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<sup>7</sup> Here the assumption is made that Y and P are Index values normalized to the same base  $P^*=Y_n=100$ . This assures that the price level gap and the output gap are in the same dimension.

<sup>8</sup> This is the way Taylor (1979) has derived the Phillips curve.

However, after having explained the Phillips curve convincingly, Mankiw (2010, p. 383) completely reverses the causality:

*“The sticky-price model says that the deviation of output from the natural level is positively associated with the deviation of the price level from the expected price level.”*

With the reinterpretation of the AS curve as a Phillips curve for the price level, students would no longer be tortured by this and other **unconvincing ad-hoc explanations** of how a higher price level leads to a higher supply of goods. They are all flawed by the analytical problem that an increase of the price *level* provides - in contrast to an increase of a relative price – no obvious reason to increase the supply of a firm.

A positively sloped aggregate supply curve requires that the increase of the price level is associated with a change in **relative prices**. This approach can be found in Abel and Bernanke (2005, p. 379) as well as in Mankiw’s economics and macroeconomics textbook. They use the **imperfect information model** (or misperceptions model) which rests on the assumption that suppliers *“sometimes confuse changes in the overall level of prices with changes in relative prices”* (Mankiw, 2010, p. 383). In other words, the model assumes that a relevant number of firms misinterpret an increase in the aggregate price level as an increase of their individual relative price. This explanation is not very plausible in a world where the actual inflation rate is presented prominently with a time lag of no more than one month in all media and where data on inflation rates is easily accessible in the internet.

Another approach is presented by Mankiw and Taylor (2010, p. 708) as **“sticky wage theory”**. It assumes that due to sticky nominal wages changes in the price level have a direct effect on the real wage. Thus a rising price level reduces real wages which makes it more attractive for a firm to hire additional workers for producing a larger quantity of goods and services. This solution rests essentially on **“money illusion”** on the side of the workers, because otherwise they would not be willing to increase their supply of labor. At the same time, it requires the absence of money illusion on the side of the firms because otherwise they would not hire additional workers. Again, these are not very plausible assumptions.

As a third option Mankiw and Taylor (2010, p.709) offer a **“sticky price theory”**. It assumes an increase in the money supply which is supposed to increase the overall price level. While some firms increase their prices immediately others keep their prices constant due to *“menu costs”*. As prices of the lagging firms are too low, their sales increase which induces them to increase production and employment. Again, this is not very intuitive. If firms are unable to increase their prices in an environment with an overall increase of prices and costs, they would wait until they can adjust their prices before they increase production and employment. Otherwise, the increase in output would have a negative effect on their profitability.

Blanchard et al. (2010, pp. 151-156) derive the AS curve from a **wage-setting** and a **price setting equation**. As the authors show the price-setting curve is identical with a horizontal demand curve for labor, the wage setting curve is identical with a traditional labor supply curve. In such a framework it is very difficult to explain a short-term aggregate supply in an intuitive way. While Blanchard et al. (2010) have great difficulties presenting a consistent explanation, the correct story of their model would read as follows: As the price level goes

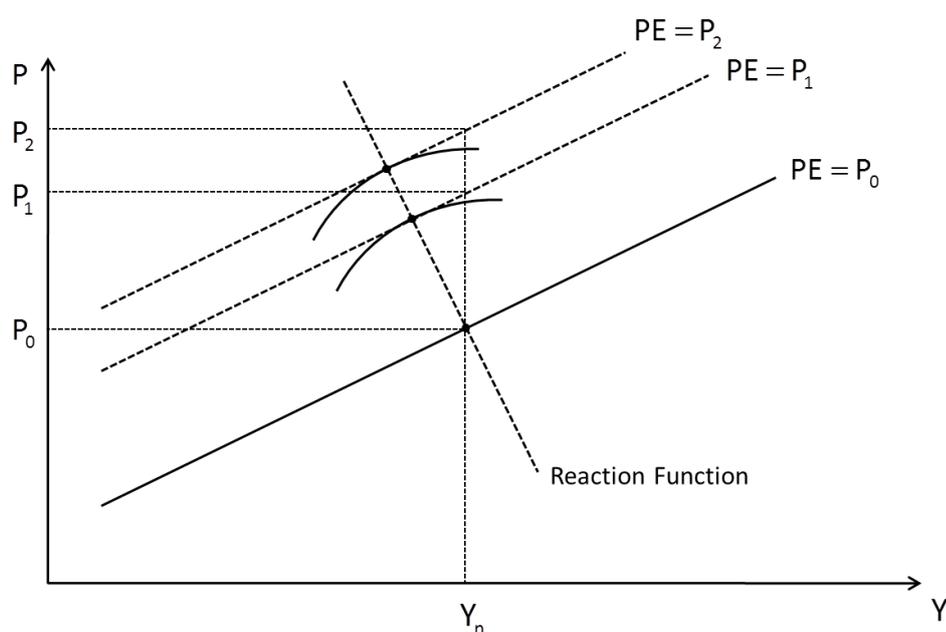
up, firms immediately increase nominal wages, as the model assumes a constant mark-up, even in the short-term. Workers receive higher wages, but they do not realize that the price level has increased, thus because of money illusion they are willing to work more. Although the real wage has remained constant firms, which have a completely elastic demand for labor, are willing to employ more workers and to increase their output.

#### 4.3 The AD curve as a policy reaction function

In the reinterpreted model a more sophisticated presentation of a discretionary monetary policy can be derived using the macroeconomic loss function and the Phillips curve. As already mentioned, for  $\lambda=1$  the loss function can graphically be represented by a loss circle. For a given Phillips curve the policy optimum for central banks is derived where the Phillips curve is a tangent to a loss circle. As each Phillips curve is determined for a certain expectation for the price level, one can derive the policy optimum for each price level expectation.

Combining these optimal points leads to the **policy reaction function** of the central bank. As it is also downward-sloping, it looks similar to the familiar AD curve (chart 3).

Chart 3: Reaction Function of the Central Bank



### 5. The reinterpreted model in action

The mechanisms of the reinterpreted macroeconomic framework can be demonstrated graphically for the case of a demand and a supply shock.

#### 5.1 Mechanics of a demand shock

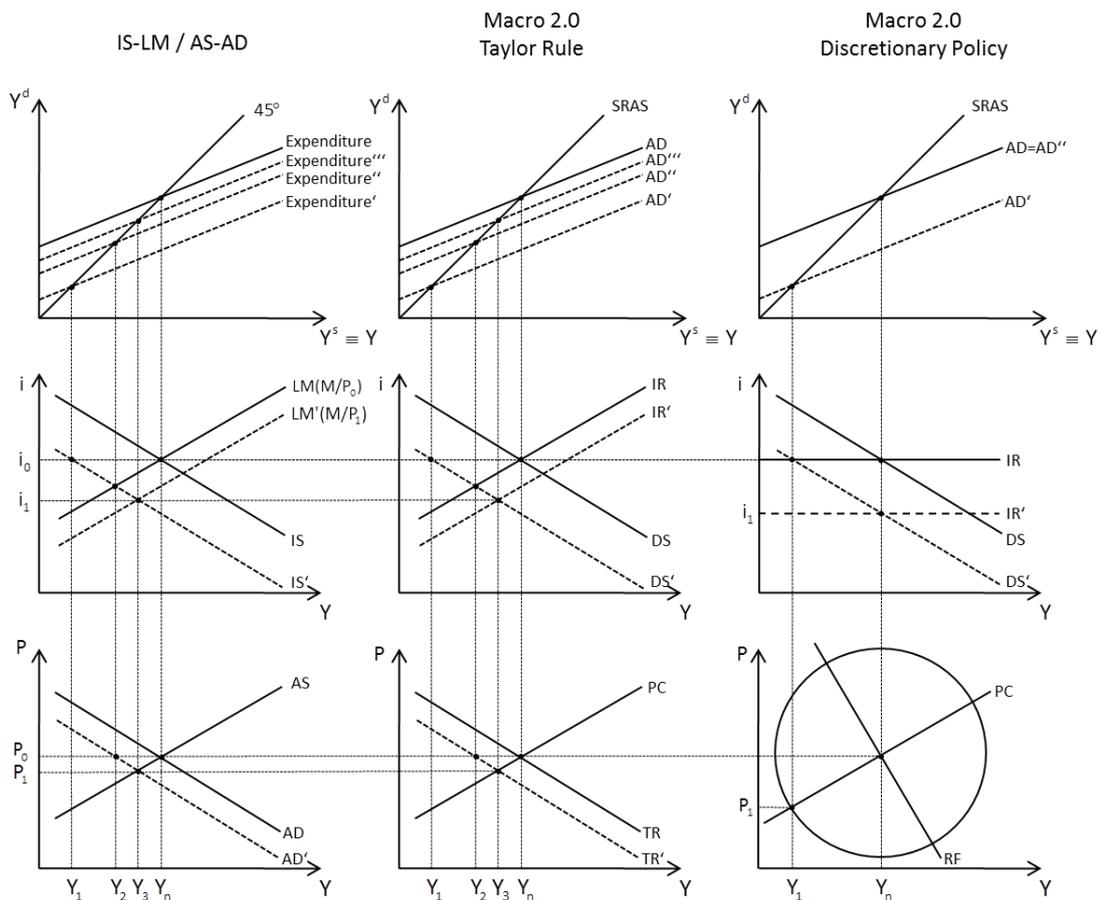
A **negative demand shock** shifts the AD curve in the  $Y^d/Y^s$ -diagram downwards. The new intersection with the short-term aggregate supply curve leads to an equilibrium output level

$Y_1$  that is lower than the natural output  $Y_n$ . As a result of the negative output gap, involuntary unemployment emerges (chart 4).

In the  $i/Y$ -diagram the shock is represented as a downward-shift of the DS curve. The repercussions on output and the price level depend on the strategy of the central bank.

In the case of a **discretionary monetary policy** with a horizontal interest rate line the initial negative effect on output is not compensated automatically. From the Phillips curve one can see that the decline in output from  $Y_n$  to  $Y_1$  is accompanied by a fall in the price level from  $P_0$  to  $P_1$ . If the central bank uses a loss function, it realizes that the combination  $(P_1|Y_1)$  of output and price level is associated with a high macroeconomic loss. In order to get back to its bliss point  $(P_0|Y_n)$  it reduces the interest rate from  $i_0$  to  $i_1$ . The interest line shifts downwards and intersects with the IS curve at the output level  $Y_n$ . As the output shock has been completely compensated, the price level returns to its initial value ( $P_0$ ). In the  $Y^d/Y^s$ -diagram the AD curve is shifted to its original position ( $AD''$ ).

Chart 4: Mechanics of a Demand Shock



If monetary policy is determined by a **policy rule**, the mechanics become much more difficult. But they are exactly identical for the Taylor rule and the constant money stock rule, only the labels for the curves are different.

In the  $i/Y$ -diagram the initial effect of the demand shock is now already partially compensated by a decline in the interest rate. With monetary targeting this is due to the

reduced transactions demand for money. With a Taylor rule a lower output level requires an interest rate reduction. In both cases the lower interest rate leads to an output level  $Y_2$  that is higher than  $Y_1$  but still below  $Y_n$ . In the  $P/Y$ -diagram the shift of the IS curve is translated into a downward shift of the TR curve and the AD curve respectively. The intersection of the new TR/AD curve with the Phillips/AS curve determines the definitive equilibrium. The output level  $Y_3$  is lower than  $Y_n$ , but higher than  $Y_1$  (due to the interest rate response in  $i/Y$ -diagram) and higher than  $Y_2$  (due to the fall in the price level that in both rule-based frameworks generates an additional interest rate reduction). In order to derive the output level  $Y_3$  in the  $i/Y$ -diagram, the IR curve/LM curve has to shift downwards to  $IR'/LM'$ . In the case of the constant money stock rule this is related to the higher real money stock which is generated by the fall in the price level from  $P_0$  to  $P_1$ . In the case of the Taylor rule, the lower price level also leads to a lower interest rate.

The comparison of discretionary monetary policy (guided by a loss function) and a rule-based monetary policy shows that the latter is much more difficult to analyze graphically. The presentation could be simplified somewhat in both cases if the  $Y^d/Y^s$ -diagram is not explicitly discussed. Nevertheless, for an introductory course the discretionary policy seems much more appropriate. For sake of simplicity it can also be presented without the loss function.

The reinterpretation of the basic macroeconomic model leads to the important result that a discretionary monetary policy is able to fully compensate a demand shock, while under a rule-based monetary policy the compensation is only partial. This can be explained with the fact that in the former monetary policy is able to react to the shock directly, while under a rule based regime it only reacts to the effects of the realizations of the shock on the price level and the output level. Another important result is that in the case of a demand shock there is no trade-off between output and price level stabilization. Thus, one of Mankiw's and Taylor's (2010) "*Ten Principles of Economics*":

*"Society faces a short-run tradeoff between inflation and unemployment"*

Which they present already on page 14 of their economics textbook is not generally true. It only applies to supply shocks, but not to demand shocks.

## 5.2 Mechanics of a supply shock

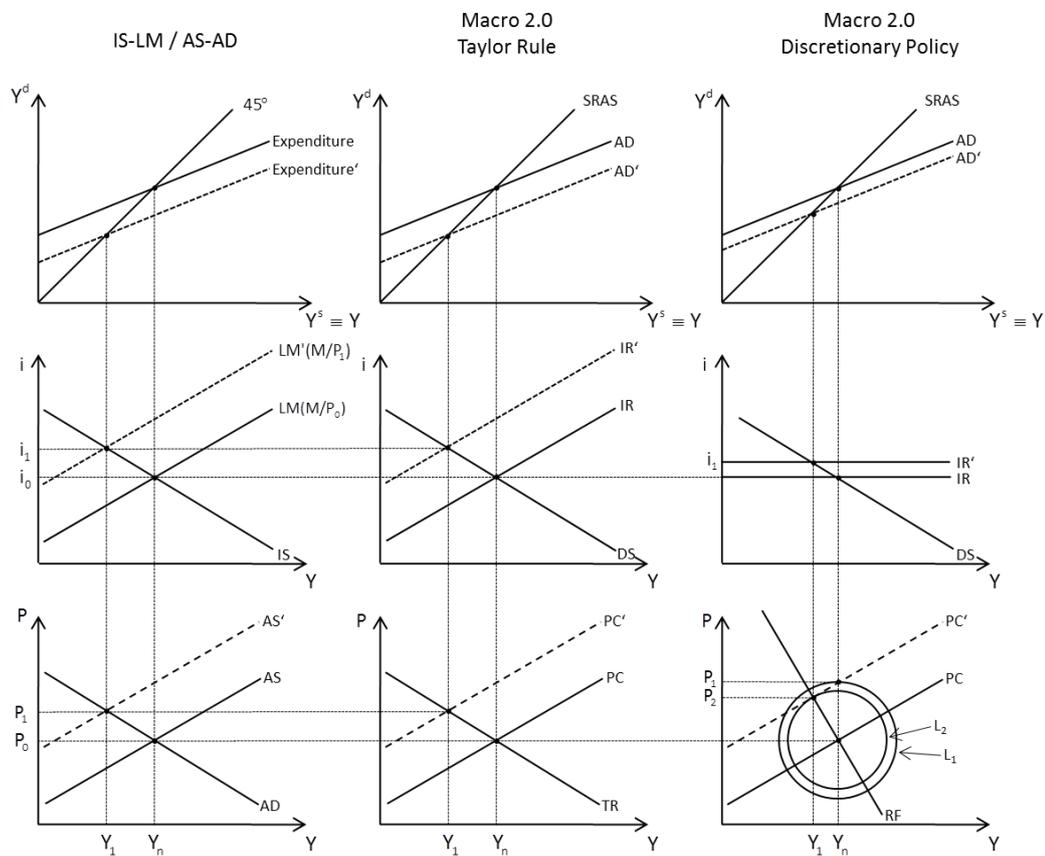
The graphical analysis of a supply shock is somewhat less complicated. In all three variants it can be represented by an upward shift of the Phillips curve from  $PC$  to  $PC'$  (chart 5).

In the case of a **discretionary monetary policy** the interest rate would initially remain constant. As the output level remains also unchanged, the shift of the Phillips curve leads to an increase of the price level from  $P_0$  to  $P_1$ . From its loss function the central bank realizes that the combination  $(P_1|Y_n)$  is associated with a loss circle  $L_1$ . By moving along the Phillips curve and substituting some output loss against a reduction of the price level it is possible to reach a lower macroeconomic loss. The optimum is reached if the Phillips curve becomes a tangent to the loss circle ( $L_2$ ). In order to reach the combination  $(P_2|Y_1)$  the central bank has

to increase the interest rate from  $i_0$  to  $i_1$ . Thus, the interest rate line shifts upwards. In the  $Y^d/Y^s$ -diagram the AD curve shifts downwards as the higher interest reduces investment.

In both variants of a rule based monetary policy the intersection of the TR line/AD curve with the new Phillips curve determines the final equilibrium  $(P_1|Y_1)$ . As in the case of the discretionary monetary policy the two policy rules have the effect to distribute the negative impact of the supply shock on output and on the price level. The  $i/Y$ -diagram is in principle not necessary for the discussion of supply shocks. In this diagram the IR line/LM curve shifts upwards as the increase of the price level induces a higher Taylor interest rate or, in the case of monetary targeting, reduces the real money stock.

Chart 5: Mechanics of a Supply Shock



An important policy implication of this presentation is the existence of a trade-off between output and price level stabilization when the economy is affected by a supply shock. In addition, one can see that even a discretionary monetary policy is not able to reach the bliss point  $(P_0|Y_n)$ .

## 6. Policy implications

As already mentioned, Leijonhufvud (2011, p.1) criticizes the IS/LM model for casting Keynesian economics as a stable system with a "friction", rather than a theory of an economy

harbouring dangerous instabilities. This also applies to the presentation of the AS/AD model in leading textbooks. They do not only often fail to introduce demand shocks originating from the private sector, they also do not hesitate to present deflation as a mechanism that is able to lead an economy out of goods market equilibrium with unemployment.

### 6.1 The stable world of standard textbooks

The most serious flaw of the mainstream textbook introduction is the complete neglect of cyclical unemployment as a consequence of a negative demand shock. Thus, a reader of leading textbooks who tries to understand macroeconomic processes would be unable to explain the strong increase of unemployment in the United States following the crisis in 2007/2008. But the problem is even more severe, as demand shocks that are caused by instabilities in the private sector are not in the focus of many standard textbooks.

This applies for instance to the textbook of Blanchard et al. (2010) where the reader can only find a discussion of shifts of the AD curve that are due to an expansionary monetary or a restrictive fiscal policy. In other words, the authors create the impression that while the system is stable by itself there is always a risk that it is destabilized by politicians. That an economy might be affected by a demand shock, e.g., a bursting real estate bubble and/or a financial crisis, is beyond the scope of Blanchard's macroeconomic textbook.

The same applies to Mankiw's macroeconomics textbook where a negative aggregate demand shock is also only presented in the form of a decrease in the money supply. Mankiw (2010, p. 276) discusses this shock for the case of a vertical aggregate supply curve. The student gets the comforting message:

*"As prices fall, the economy gradually recovers from the recession."*

Based on the mechanics of the AS/AD model, Mankiw (2010, p. 276) concludes:

*"Thus, a shift in aggregate demand affects output in the short-run, but this effect dissipates over time as firms readjust their prices".*

In other words, in the situation of a negative demand shock there is no need for anticyclical fiscal or monetary policies. Deflation will bring the economy back to full employment.

The same message is presented even more explicitly in Mankiw's and Taylor's economics textbook. Here, the demand shock is at least attributed to *"a wave of pessimism in the economy"* (Mankiw and Taylor, 2010, p. 713). The policy implications are stated as clearly as possible:

*"Even without action by policy makers, the recession will remedy itself over a period of time. (...) Even though the wave of pessimism has reduced aggregate demand, the price level has fallen sufficiently (...) to offset the shift in aggregate demand."* (Mankiw and Taylor, 2010, p.714).

Mankiw and Taylor (2010, p. 700) try to elaborate the **positive effects of deflation** in more detail:

- **Wealth effect:** *“a decrease in the price level makes consumers wealthier.”* While it is true that deflation has a positive effect on the currency holdings of consumers, for all other financial assets (including bank deposits) the positive wealth effect of creditors is balanced by the negative wealth effect on debtors. For an economy like the United States with a negative financial wealth vis-à-vis the rest of the world, the overall effect (even including positive wealth effects for currency) would be negative. As Irving Fisher (1933) has mentioned, the fall in the price level after a period of very strong credit demand can even lead to a “debt deflation”.
- **Interest rate effect:** *“a lower price level reduces the interest rate, encourages greater spending on investment goods.”* As Mankiw and Taylor do not differentiate between the real and the nominal interest rate and as they ignore the zero lower bound for the interest rate, they also miss the very likely outcome that deflation increases the real interest rate and at the same time the real debt of the firms which discourages investment.
- **Exchange rate effect:** *“when a fall in the European price level causes European interest rates to fall, the real value of the euro falls, and this depreciation stimulates European net exports.”* Here, Mankiw and Taylor argue that a deflation will lead to real appreciation. This is incompatible with the purchasing power parity theory, which they summarize only some pages earlier as follows: *“countries with relatively high inflation should have depreciating currencies, and countries with relatively low inflation should have appreciating currencies.”* (Mankiw and Taylor, 2010, p. 663).

## 6.2 The unstable world of the reinterpreted framework

With the reinterpretations of the basic model that are suggested in this paper the inherent instability of the economic system becomes quite obvious.

The presentation of the 45°-line in the income/expenditure model as a short-term aggregate supply curve gives an explicit account of the Keynesian logic according to which **demand determines supply**, at least in the short-term. Together with the discussion of the long-run supply curve and a presentation of the labor market, one can show that an economy can be trapped in goods market equilibrium that is associated with cyclical unemployment. In addition, the rationing of the labor market by the goods market has the effect that a decline in real wages does not lead to an increase of employment.

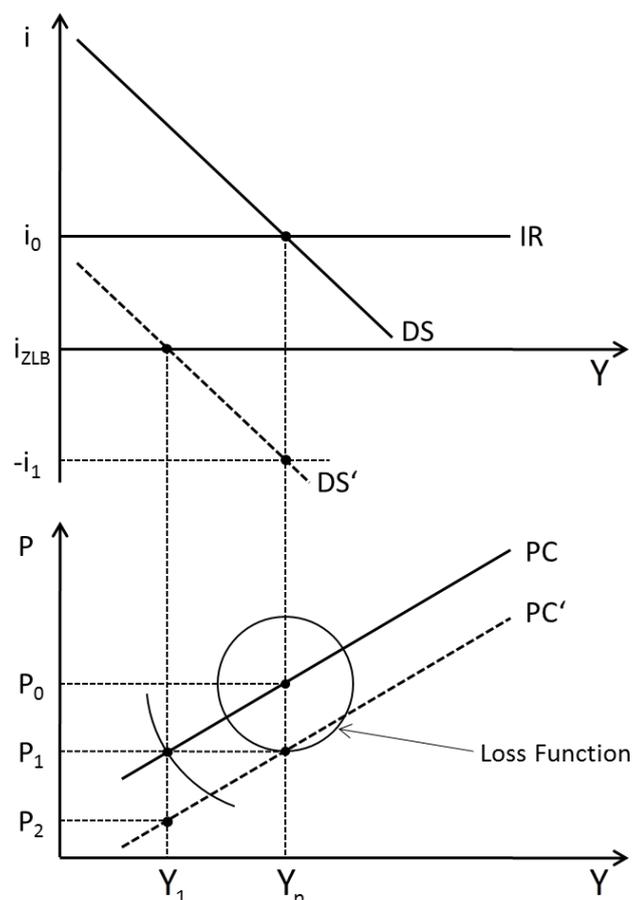
If one combines this shock with a **discretionary monetary policy**, one can show that with an unchanged nominal interest rate no automatic return to the full employment output is possible. With a deflationary development the constant nominal interest rate would even lead to a higher real interest rate. Thus, an explicit reaction of the central bank is required in order to stabilize the economy.

Modeling monetary policy in this way would also make it possible to show the limitations of a central bank's interest rate policy in the case of a severe demand shock. As it is well known, the leeway for interest rate policy is limited asymmetrically by the **zero bound of nominal**

**interest rates.** As chart 6 shows, after a very strong negative demand shock a return to the full employment equilibrium would require a negative interest rate of  $-i_1$ . Thus, the maximum stabilization that is possible is reached at the intersection of the IS curve with the lower bound, i.e., the x-axis. The output level  $Y_1$  leads to a reduction of the price level from  $P_0$  to  $P_1$ . The macroeconomic loss function shows that this situation is associated with a high loss for the society. This loss becomes even bigger, when due to the decline of the price level price expectations are revised downwards so that the Phillips curve shifts downwards. Thus, in contrast to the standard textbook presentation deflation has no positive effect on output.

For the situation of a severe demand shock where monetary policy reaches the zero lower bound one can also derive the additional **need for an anticyclical fiscal policy** to shift the demand curve back into its old position. In fact this is exactly what has happened as a policy response to the recent economic and financial crisis in most countries. While central banks reduced their policy rates to zero, fiscal policy followed a pronounced expansionary policy.

Chart 6: Severe Demand Shock and the Zero Lower Bound (Discretionary Policy)

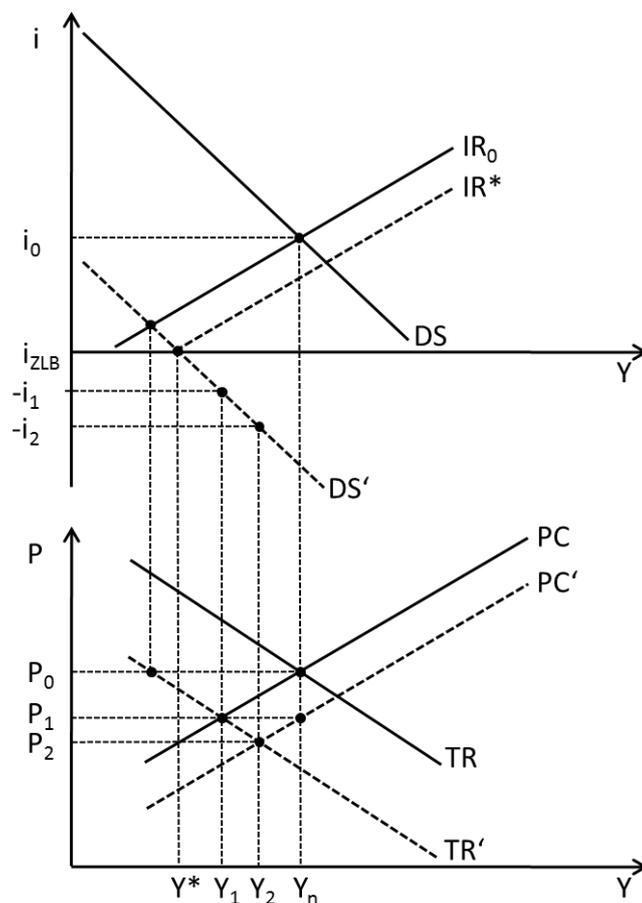


A relatively similar result is obtained if monetary policy is represented by a **Taylor rule** (chart 7). While the negative demand shock is partially compensated by a decline in the interest rate, the effect is not strong enough to bring the economy back to equilibrium with full employment. With this rule deflation would still have a stabilizing effect: a downward revision of price expectations would lead to a downward shift of the Phillips curve so that the

price level declines. In the Taylor rule this would lead to a further reduction of the interest rate which increases output. While this problematic feature of a macroeconomic model can only be fully avoided if it is based on inflation and not on the price level, the stabilizing effects would again be limited by the zero bound of interest rates.

As chart 7 shows the equilibrium output  $Y_1$  cannot be realized as it would require a negative interest rate of  $-i_1$ . Thus, the maximum stabilization is again reached at the zero lower bound with an output level  $Y^*$ . Also in this case a downward revision of price expectations, which shifts the Phillips curve downwards so that it could intersect with the TR curve in  $Y_n$ , provides no solution as such an equilibrium would require an even more negative interest rate ( $-i_2$ ).

Chart 7: Severe Demand Shock and the Zero Lower Bound (Taylor Rule)



Of course, the same result would apply for the world of the LM curve, i.e., a **constant money stock rule**. Here the severe demand shock would lead to an excess supply at the money market at the zero lower bound. Thus, the self-stabilizing effects of a deflation that are presented by Mankiw (2010, p. 276; 2010, p. 713) can materialize only as long as the zero bound is not reached. Figure 33.9 in his economics textbook is in principle identical with lower panel of chart 7. However, as it does not address the required interest rate response, he overlooks that the return of output to its natural level is prevented by the zero bound.

### 6.3 Two completely different views of macroeconomic policy

As the standard macroeconomics textbook presents the economy as a basically self-stabilizing system without cyclical unemployment, it is not surprising that it leaves little room for an anticyclical fiscal or monetary policy. As already mentioned it even goes so far to present monetary policy as an autonomous source for macroeconomic instability. This is mainly due to the fact that monetary policy is discussed without introducing a loss function that determines a central bank's policy making. This approach is not only incompatible with more advanced macroeconomic models, it also leads to a completely flawed assessment of economic policy.

Like many others Blanchard et al. (2010) discuss an expansionary monetary policy for a situation where the economy is in full equilibrium (Blanchard, 2010 pp. 169). But in such a situation a central bank that is guided by a macroeconomic loss function would never become active. Thus, it is not surprising that while there are positive short-term effects on output and the price level, in the medium-term monetary policy has only increased the price level. So the student might ask himself why a central bank might engage in such useless exercises. This would be similar to a textbook for medicine which presents the effects of antibiotics only for the use of completely healthy patients. It would necessarily come to the conclusion that the therapy, while having temporary negative effects, is of no use in the long-run. The intuition for an expansionary monetary policy would become completely different, if the presentation would start with a negative demand shock that drives the economy away from equilibrium and shows then that an expansionary monetary policy is able to bring the economy back to this equilibrium.

For **fiscal policy**, Blanchard (2010, p. 172) uses the same approach but with a different sign. He demonstrates the effects of a deficit reduction which is equivalent to a downward shift of the aggregate demand curve. Due to the decline in the price level the negative effects of this shock are perfectly compensated in the medium-term. In other words, the textbook suggests that the fear that a deficit reduction could lead to a recession and unemployment is misplaced. Again deflation increases the real money stock sufficiently enough so that in the end full employment can be maintained. The message again is clear: it is always possible to reduce government deficits without the risk of ending up with unemployment.<sup>9</sup>

In sum, after the standard presentation of the AS/AD model a student must necessarily come to the conclusion that the macroeconomic sphere is in principle ruled by the same self-equilibrating forces as the microeconomic sphere. This is already suggested graphically, as the AS/AD model looks like an aggregate version of a micro model, e.g., for a market for potatoes. Therefore, any interference of the government or the central bank must have the same destabilizing effects on the economy as government interventions on markets for individual goods (e.g., minimum prices, tariffs or subsidies).

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<sup>9</sup> Blanchard (2010) mentions the need to accompany the restrictive fiscal policy with an increase in the money supply. But his presentation rests on a constant nominal money supply and an increasing real money supply due to the falling price level.

## 7. A macroeconomic model based on the inflation rate

Finally one can ask the fundamental question whether - in addition to the reinterpretations suggested so far - it would not be more convenient to transform the IS/LM model into a framework that allows the incorporation of the inflation rate instead of the price level. This approach has been adopted by a new class of macroeconomic models that are all based on the pioneering article by Romer (2000). The basic idea is to replace the LM curve by an interest rate curve. In contrast to the approach presented so far, the Romer model is designed for the real interest rate.

Analyzing a **discretionary monetary policy** under such a macroeconomic framework the loss function for the central bank becomes:<sup>10</sup>

$$L = (\pi - \pi^*)^2 + \lambda(Y - Y_n)^2$$

With  $\pi^*$  as the central bank's inflation target. For  $\lambda = 1$  the loss function can be depicted as loss circles in the  $\pi/Y$ -diagram with  $(\pi^*, Y_n)$  as its center.

Accordingly the horizontal interest rate line of the central bank becomes a real interest rate line.

For a **rule-based monetary policy** only the Taylor rule can be used, as monetary targeting can only be addressed for changes in the price level but not for changes in the interest rate. Within this framework the Taylor rule can be applied in its original form:

$$i = r_0 + \pi + \alpha(\pi - \pi^*) + \beta(Y - Y_n)$$

which is equivalent to

$$r = r_0 + \alpha(\pi - \pi^*) + \beta(Y - Y_n)$$

Finally the **AS curve** has to be reformulated as a standard Phillips curve for the inflation rate.

In spite of these modifications the mechanics of the curves in response to demand and supply shocks remain identical as in the case of the reinterpreted macroeconomic framework for the price level. Thus for the three versions of a rule-based monetary policy, a demand shock leads to the same shifts in the relevant curves

- for the standard IS/LM-AS/AD model and
- for a Taylor rule in the price-level variant as well as in the inflation variant of the reinterpreted macroeconomic framework.

The starting point is a negative demand shock which shifts the IS curve downwards. As chart 8 shows, the shift of the IS curve leads to an identical downward shift of

- the traditional AD curve in the P/Y-diagram
- the TR curve in the P/Y-diagram (Taylor rule for the price level)
- the TR curve in the  $\pi/Y$ -diagram (Taylor rule for inflation)

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<sup>10</sup> Note that  $\lambda$  is normalized with  $Y_n$  to keep the dimensions in the loss function consistent.

The new equilibrium  $(P_1|Y_1)$  respectively  $(\pi_1|Y_1)$  is reached with the intersection of the AS curve (P/Y-diagram), the Phillips curve for the price level (P/Y-diagram) and the Phillips curve for inflation ( $\pi$ /Y-diagram).

The decline of the price level/inflation rate leads in the  $i$ /Y-diagram to a downward shift of

- the LM curve due to the higher real money stock
- the Taylor line for the price level due to the lower price level

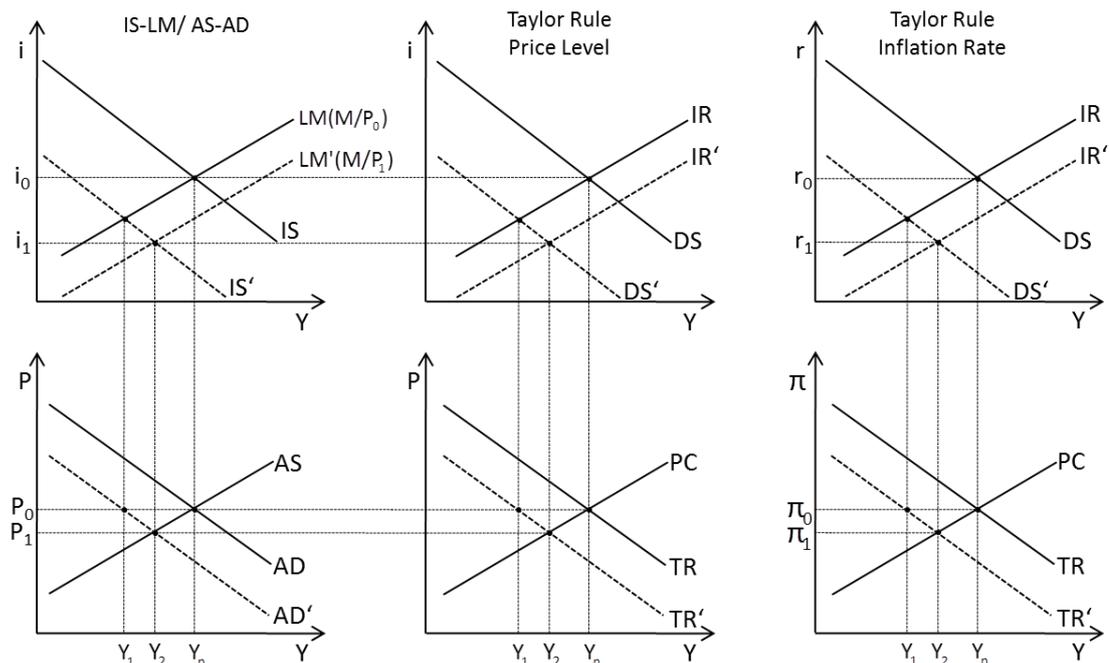
and in the  $r$ /Y-diagram to a downward shift of the Taylor line for inflation.

A detailed presentation of this model can be found in Bofinger et al. (2006).

This type of macromodel has several advantages compared with a model that focuses on the price level:

- Demand shocks lead to a decline in the inflation rate and not to an outright deflation. This is much more compatible with the reality of the post-war era with many recessions in the OECD countries but, with the exception of Japan, no case of a deflation.
- For investment decisions the real and not the nominal interest rate matters. Using the nominal interest rate can lead to flawed results in the case of a deflation. In the standard models the nominal interest rate remains constant or even declines in a situation with a deflation.
- A Taylor rule can only be presented correctly in a model with a focus on the interest rate.

## Chart 8: Demand Shock in Different Macromodels



## 8. Is pedagogy necessarily dirty?

In his profound criticism of the AS/AD model Colander (1995) proposes several ways of dealing with the problems of the AS/AD model. As a practical approach he considers a “*Pedagogy is Dirty Solution*”:

*“It views the AS/AD model as a rough and dirty policy model and holds that what we should be doing in the principles course is simplifying the essence of the macro policy problem to something that is understandable. The standard AS/AD analysis does that. (...) If, in our teaching, we focus on analytical distinctions that only macro specialists understand or care about, students will get all involved in these distinctions and will not learn the important policy lessons of the model.”*(Colander, 1995, pp.178/179)

But does the IS/LM-AS/AD model really present the essence of macroeconomics? If one takes the lessons from the recent crisis serious, a macroeconomic model should be able to demonstrate that a negative demand shock can lead to a negative output gap with involuntary unemployment and that an expansionary fiscal and monetary policy are required to restore full employment. In addition, a student should learn that in the case of a very strong decline in aggregate demand, the zero bound of nominal interest rates requires an additional stimulation by fiscal policy. Thus, the main message of a macro model should be that there exists a fundamental difference between the adjustment processes to exogenous shocks at the micro- and at the macroeconomic level.

In other words it is not only the inconsistencies of the standard model but also the completely flawed policy lessons that a student will draw from introductory courses that are based on most of standard textbooks.

As alternative, Colander (1995) proposes a “*banishment solution*” with two polar cases. In the “*micro only*” view one would simply do away with aggregate demand and supply analysis. In the “*return to the 60s*” view one would give up the AS/AD submodel and focus on the old fashioned income/expenditure-IS/LM submodels.

In a world where macroeconomic problems are dominating the headlines of newspapers the “*micro only*” view is certainly not a very good idea. In fact, it can only be found in the textbook of Barro (2008). However, taking into account that in most textbooks the AS/AD model is leading the student in a completely wrong direction one is tempted to ask whether the world would not be better off without the insights derived from most macroeconomics courses.

Of course, a “*return to the 60s*” is also not a good solution. However, as this paper shows the canonical income/expenditure-IS/LM model can be easily reinterpreted to provide a comprehensive description for the interplay between exogenous shocks, the goods market and the labor market. Instead of adding an additional aggregate supply and aggregate demand function in a P/Y-diagram it can be supplemented by a policy rule curve or a reaction function which looks similar as the AD curve and a Phillips curve which is identical with the AS curve. This allows in a rather simple way to overcome the serious inconsistencies that were identified by Colander (1995) and others.

## 9. Summary

The financial and economic crisis has seriously impaired the reputation of the economic science in the general public. As macroeconomics classes are attended by many students who are not studying economics this is one of the rare occasions where our science reaches a broader audience. Therefore, the paradigm should of course avoid obvious inconsistencies and it should also tell a convincing story about the economy. This paper argues that the IS/LM-AS/AD model as it is presented in leading textbooks is not only full of inconsistencies and implausible ad-hoc explanations but in the end it also leads to the impression of a fully self-stabilizing economic system which is only suffering from rigid wages and destabilizing policy interventions.

The good news is that the whole apparatus can be easily re-interpreted so that the inconsistencies can be removed and that at the same time the inherent instability and the need for policy interventions become obvious.

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