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Teaching economics of monetary union with the IS-MP-PC model

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ABSTRACT

This paper explains how the three-equation *IS-MP-PC*-model can be adapted to discuss macroeconomic adjustment in a monetary union. It introduces a two-country version that is used to illustrate the difficulties of macroeconomic adjustment in the presence of asymmetric demand and financial shocks. The level of analysis does not go beyond the level of a course in introductory macroeconomics. The adaption can be used by instructors in euro area countries to bridge the gap between the standard model and the macroeconomic issues that these countries face or by any instructor who wishes to analyze shocks in regions sharing the same currency. It also allows instructors to debate current policy issues with their students and thus motivate them for the field.

1. Introduction

Undergraduate education in macroeconomics has gone through two developments in the past twenty years, both stemming from the need to better align macroeconomics teaching with what happens in the real world. The first development is the gradual, and as of yet incomplete, replacement of the *LM*-curve, one of the cornerstones of the workhorse *IS-LM*-model, by some version of a monetary policy rule (Romer, 2000; Taylor, 2000; Wren-Lewis, 2009). This shift has been brought about by the realization that the role of monetary aggregates in the practice of monetary policy-making is quite limited. Central banks do not target the money supply, which is at best reduced to one of many variables used to forecast inflation. Instead, central bank decision-making is better characterized by an interest rate rule. This view has found its way to many introductory macroeconomics textbooks, such as The CORE Team (2017), Jones (2020), Blanchard et al. (2021), Burda and Wyplosz (2022) and Stevenson and Wolfers (2023). A three-equation macroeconomic model, consisting of the *IS*-curve, an expectations-augmented Phillips curve (*PC*) and a monetary policy (*MP*) rule, has now become an established tool to explain short-run business cycle fluctuations to undergraduate students (Carlin and Soskice, 2009; Turner, 2006). At the post-introductory undergraduate level, teaching materials using the three-equation approach include Carlin and Soskice (2006), Carlin and Soskice (2014) and Davis and Gómez-Ramírez (2022). Well-known textbooks that maintain the *IS-LM*-approach nowadays discuss the importance of rule-based monetary policy for macroeconomic stabilisation (Krugman and Wells, 2020; Mankiw, 2021).

The second development took place a few years later, after the global financial crisis challenged macroeconomists to rethink how their models could explain, let alone predict, the Great Recession. Public dissatisfaction with the state of macro-modeling spilled over into economics education, where many students felt a disconnect between what they were taught and what was happening outside the classroom (Shiller, 2010). The survey by Gärtner et al. (2013) takes stock of the changes in the undergraduate macroeconomics curriculum that instructors have made following the crisis. The authors conclude that most courses feature the same models as before the crisis, but also that a host of topics related to financial markets and institutions have become more important. Examples are the role

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of the financial system in the economy, banks runs, systemic risk and unconventional monetary policy. This shift towards financial topics seems to be more prominent in the United States than in Europe (Gärtner et al., 2014). The inclusion of financial shocks in undergraduate macroeconomics has also worked its way to major textbooks (see e.g. Blanchard et al., 2021; Stevenson and Wolfers, 2023).

The changes made in introductory macroeconomics courses are usually related to topics that are relevant to student audiences on both sides of the Atlantic. As a result, less attention is being paid to macroeconomic issues that are specific to a monetary union and that came to the fore following the European sovereign debt crisis.[1] When introductory macroeconomics textbooks take a European perspective, this usually shows up in the use of European data and cases to illustrate the same models, not in the adaption of these models to the context of Europe's Economic and Monetary Union (EMU) (see e.g. Burda and Wyplosz, 2022; Blanchard et al., 2021). The prime textbook which covers macroeconomic issues relating to monetary union is De Grauwe (2022), but this is typically not used in introductory macroeconomics courses.

Economics students from euro area (EA) countries will thus be taught a macroeconomic model for a country that can conduct its own fiscal and monetary policy. The policy environment which they experience in the EA is, however, very different. This can make it challenging for them to understand and analyze macroeconomic events and policy debates that rage outside their classroom, such as those related to fiscal risk-sharing among countries and the limits of intervention by the European Central Bank (ECB). In a more positive vain, a stronger link between what students learn and what happens to the economy of their country could increase students' interest and motivation.

This paper explains how the three-equation *IS-MP-PC*-model can be adapted to discuss macroeconomic adjustment in a monetary union. It introduces a two-country version that will be used to illustrate the difficulties of macroeconomic adjustment in the presence of asymmetric shocks and the risk of fragmentation following financial shocks. The level of analysis is deliberately kept simple and mainly relies on diagrammatic devices. It does not go beyond the level of introductory macroeconomics. The adaption can be used by instructors in EA countries to close the gap between the one-country three-equation model and the macroeconomic issues that EA countries face. It allows instructors to debate current policy issues and thus motivate students for the field. An alternative use is as a supplement to De Grauwe (2022) in a specialized course on the economics of monetary union.

The organization of this paper is as follows. Section 2 briefly introduces the three-equation *IS-MP-PC* model. Section 3 extends the model to a two-country setting in an incomplete monetary union and discusses two sources of regional divergences. Section 4 discusses policy responses. Section 5 concludes.

2. The basic IS-MP-PC model

The version of the *IS-MP-PC* model that is used in this paper consists of the following three equations.[2] The *IS*-curve in equation (1) relates output (in log, denoted y) to the expected real interest rate (r) and a demand shock (ϵ_1):

$$y_t = \alpha_0 - \alpha_1 r_t + \epsilon_{1,t}, \qquad \alpha_1 > 0 \tag{1}$$

The expected real interest rate is defined as the difference between the nominal interest rate (i) and expected inflation (π^e). Equation (2) is a short-run Phillips Curve (*PC*). It relates inflation (π) to expected inflation, the output gap, defined as the difference between output and the potential level of output (in log, denoted y_P), and a temporary supply shock (ϵ_2):

$$\pi_t = \pi_t^e + \beta(y_t - y_{P,t}) + \epsilon_{2,t}, \qquad \beta > 0 \tag{2}$$

The model is completed with a single-mandate monetary policy (*MP*) reaction function, that assumes that the central bank targets inflation only. In equation (3), the monetary authorities set the policy rate in such a way that the real rate is increased whilst lagged inflation (π_{t-1}) remains above the target rate of inflation (π_T):

$$r_t = r_{t-1} + \gamma(\pi_{t-1} - \pi_T), \qquad \gamma > 0 \tag{3}$$

In Fig. 1, the three-equation model is illustrated with two diagrams placed one below the other. The top diagram plots the *IS*- and *MP*-curves in a *r*-*y* space. The lower diagram plots the *PC*-curve in a π -*y* space. A vertical long-run supply curve is plotted at y_P. Macroeconomic equilibrium is attained when output is at y_P and inflation expectations are anchored at the target inflation.

In a closed-economy setting in which a country conducts its own fiscal and monetary policies, Fig. 1 can be used to explain to students the familiar dynamics. A positive demand shock will shift the *IS*-curve to the right, raising output above y_P and inflation above π_T. The central bank then reacts by increasing the nominal policy rate in such a way that r rises, shifting the *MP*-curve up. By way of a range of potential transmission channels, this will reduce economic growth and dampen inflationary pressures, pushing y and π back to their starting positions. When inflation expectations are not fully anchored to π_T, the *PC*-curve will shift upward. In that case, the central bank will have to increase r beyond what is needed to close the output gap in order to reduce inflation expectations and force the *PC*-curve down. It can next reduce r to close the output gap.

As we will see, the stabilizing feature of monetary policy in the closed-economy setting of the three-equation model is compromised

[1] An exception is the increased attention to public debt dynamics, see Gärtner et al. (2013).

[2] In the literature, three-equation models may differ with respect to their lag structure, the expectations formation and, especially, the specification of the monetary policy rule. The current model is deliberately kept simple and for example excludes the output gap from the monetary policy rule.

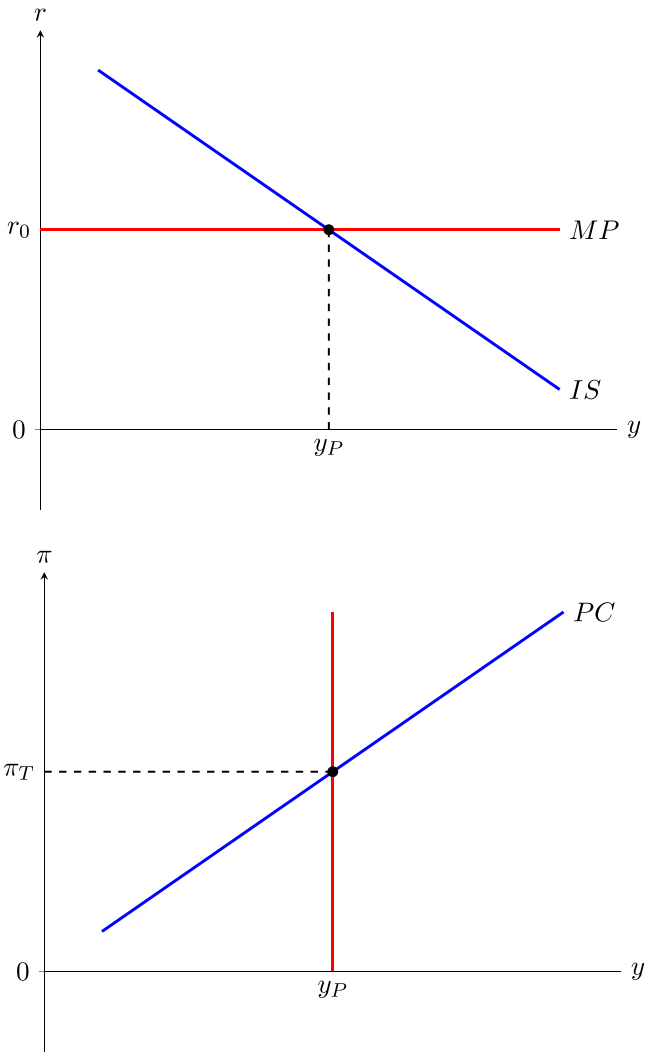

Fig. 1. The IS-MP-PC model.

in a monetary union.

3. The IS-MP-PC model for a monetary union

In his seminal textbook on the economics of monetary union, De Grauwe (2022) uses the *AD-AS* framework to analyze the fragility of an incomplete monetary union. Incompleteness refers to the case where countries share a common currency, but lack a common fiscal policy. The exposition in De Grauwe (2022) includes diagrams in the traditional price-output space. For a number of reasons, I prefer the *IS-MP-PC* framework in the subsequent analysis. First, theoretical criticisms have been leveled against the *AD-AS* in macroeconomic analysis (Moseley, 2010). An example is that *AD-AS* relationships are between the price level and output, while in macroeconomics we are interested in the behaviour of inflation and output (Romer, 2000). This is also the reason that some textbooks prefer to apply the *AD-AS* framework in an inflation-output space (Jones, 2020). A second reason is that some educators question the *AD-AS* approach from a didactic perspective, finding it unnecessarily complicated, vague and not intuitive (Wolfers, 2022). Moreover, policymakers and media commentators do not describe their decisions and analyses in this language, making it hard for instructors to bridge the gap between the classroom and the real world.

The third, and for this paper the most important reason, is that the use of the *IS-MP-PC* model allows instructors to more clearly disentangle the various types of shocks which may hit a monetary union. While asymmetric demand shocks can be visualized by shifts in the *IS*-curves, financial shocks can be incorporated in the *MP*-curves, as we will see below. This allows us to model the effect of risk premia in a more explicit way. Finally, as the *IS-MP-PC* approach is making headway in undergraduate macroeconomics education, employing it to examine economic issues in a monetary union provides an application that is relevant for students in EA countries.

Within a monetary union, the centralization of monetary policy-making precludes deriving a *MP* reaction function for each region,

as the determinants of the nominal policy rate are union-wide variables. In the current model, the sole determinant is the deviation of union-wide inflation from the ECB's target in equation (3). When the central bank focuses on union-wide economic developments, a situation may arise in which regional economic conditions start to diverge. Using a stylized two-country model I graphically discuss two sources of destabilization within a monetary union. I first examine the standard case of asymmetric demand shocks and next use the *IS-MP-PC* model to analyze financial fragmentation risk.

3.1. Asymmetric demand shocks

If the EA would have a highly integrated economy and experience few asymmetric shocks to its economic stability, the unification of monetary policy would not pose a serious problem. Also, if the EA would have robust automatic adjustment mechanisms, asymmetric shocks could be easily absorbed. Concerns about whether all EA countries meet the economic conditions to make a success out of EMU are well-known. This issue has been studied extensively prior to the introduction of the euro in the context of the Optimal Currency Area (OCA) theory. De Grauwe (2022) provides a comprehensive analysis of the subject. The empirical literature provides ample evidence of the presence of asymmetric shocks. Bayoumi and Eichengreen (1992) show that idiosyncratic supply and demand shocks vary significantly more among European countries than among US regions, implying that a single monetary policy would create fewer complications in the US than in the EA. Subsequent studies have refined this finding (Campos and Macchiarelli, 2016; Furceri et al., 2022). Nevertheless, the conclusion of the earlier literature, which suggests that the EA is not an OCA, remains valid today. A recent example of economic asymmetry is the Covid-19 pandemic. Even though this shock hit all EA countries, there were sizable cross-country differences in economic performance. While the Northern EA countries did much better than the EA average, the more tourist-dependent Mediterranean countries suffered below-average growth.

In the case of asymmetric demand shocks, potential output will not be affected. In our two-country model, union-wide potential output (in €, Y_P) equals the sum of potential output in country A ($Y_{P,A}$) and country B ($Y_{P,B}$):

$$Y_P = Y_{P,A} + Y_{P,B} \tag{4}$$

Similarly, actual output (Y) equals the sum of output in country A (Y_A) and country B (Y_B):

$$Y = Y_A + Y_B \tag{5}$$

In our model, we assume that countries A and B are of equal size and that deviations between actual and potential output arise from equal but opposite asymmetric demand shocks:

$$(Y_A - Y_{P,A}) = -(Y_B - Y_{P,B}) \tag{6}$$

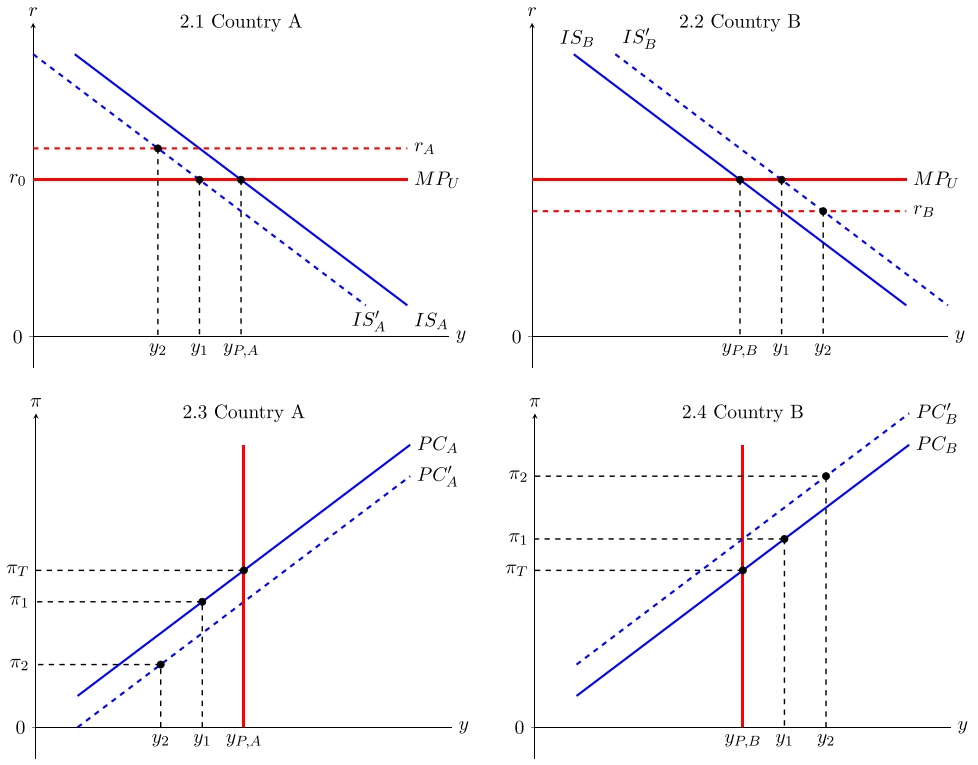

Fig. 2. Asymmetric demand shocks in the IS-MP-PC model.

In that case, the union-wide output gap remains zero and, cf. equation (2), union-wide inflation will not move. If union-wide inflation remains equal to the inflation target, the central bank will not change the nominal policy rate (cf. equation (3)). When a country experiences a stronger business cycle upswing than the rest of the union, its growth and inflation rates will be above-average. If this endures over time, regional inflation expectations may start to deviate from the union-wide target. Given a uniform nominal interest rate, the domestic real interest rate will then be lower than in the rest of the union. Lower real interest rates deter savings while encouraging consumption and investment. Thus, the real interest rate channel no longer dampens the business cycle but instead amplifies it. The reverse effect arises during an asymmetric downturn.

Figure 2 illustrates how regions may be destabilized in the standard case involving asymmetric demand shocks. The top graphs plot the *IS*- and *MP*-curves for countries A and B, which are hit by equal but opposite shocks. Country A (B) is hit by a negative (positive) demand shock. These shocks shift the *IS*-curves from IS_A and IS_B to respectively IS_A' and IS_B'. MP_U denotes the monetary policy reaction function at the level of the union. Absent changes in aggregate demand for the union as a whole, the central bank will not change its monetary policy stance. This implies that the MP_U-curve stays in place. The shifts in the *IS*-curves will lead to lower (higher) output in country A (B). The *PC*-curves in the lower panel of Fig. 2 next allow us to deduce the effect on inflation. In country A (B) inflation will decrease (increase), moving inflation from π^T to π_1.

Whether this will affect regional lending conditions now crucially depends on the formation of inflation expectations. The regional expected real interest rate can be written as follows:

$$r_{i,t} = i_t - \pi^e_{t,i}, \qquad i = \{A, B\} \tag{7}$$

Equation (8) specifies regional inflation expectations as a weighted average of anchored and adaptive expectations:

$$\pi^e_{t,i} = \omega\pi^T + (1-\omega)\pi_{t-1,i}, \qquad i = \{A, B\} \tag{8}$$

When ω equals one, inflation expectations are fully anchored to the inflation target ($\pi^e_{t,A} = \pi^e_{t,B} = \pi^T$). In this case, as long as the shocks to the *IS*-curves are not reversed, output and inflation will stay at y_1 and π_1. But this may not be a stable outcome. Absent a quick adjustment mechanism back to y_P, the deviation of regional inflation from the target may persist, which increases the risk that regional inflation expectations become unanchored. In the extreme case of fully adaptive expectations, ω equals zero and inflation expectations are equal to lagged regional inflation ($\pi^e_{t,i} = \pi_{t-1,i}$). When that happens, it will affect both the *PC*- and the *MP*-curves. According to equation (2), the PC_A (PC_B) will shift downwards (upwards) in Fig. 2 (parts 2.3 and 2.4). According to equation (7), r_A (r_B) will shift upwards (downwards) in Fig. 2 (parts 2.1 and 2.2). The spread between r_A and r_B which now develops leads to a divergence in real lending conditions for firms and households across regions, even though nominal interest rates remain the same across the union. This has the effect of amplifying the disinflationary downturn in country A and the inflationary upswing in country B. Output and inflation move from y_1 and π_1 to y_2 and π_2. In the absence of sufficiently strong countervailing forces or policy responses this process of macroeconomic destabilization may continue.

3.2. Financial shocks

Following the normalization of monetary policy in 2022 and the resulting increase in sovereign spreads between EA countries, the ECB decided to introduce the Transmission Protection Instrument (TPI). The TPI enables the ECB to control sovereign spreads, by buying up government bonds from countries whose interest rates have increased. Usually, these are countries in the periphery of the EA, implying that our two-country model can also be interpreted as a periphery-core model. The ECB is concerned that diverging yields on sovereign debt may hamper the transmission of monetary policy and increase the risk of fragmentation (ECB, 2022). The ECB's decision has invoked a lively policy debate (Bernoth et al., 2022; Feld et al., 2022). With a slight amendment of the *IS-MP-PC* model, the reasoning of the ECB can be explained to undergraduate students in macroeconomics.

Fragmentation risk is usually defined as the risk that nominal interest rates on EA countries' sovereign debt start to diverge too much (Claeys et al., 2022). A broader definition would also look at any divergences in the real borrowing costs of firms and households. The latter definition is more relevant from a macroeconomic perspective, as the real cost-of-borrowing rate is what matters for private spending and is the relevant rate in the *IS*-curve. It is also the rate which should matter to the ECB, which sets monetary policy to influence financing conditions in the private sector. If monetary policy normalization would have the effect that mortgage rates or corporate lending rates rise more sharply in highly indebted EA countries, monetary policy would no longer have the same effect across the union. This would compromise the singleness of monetary policy and be a source of concern for the ECB. Even worse, financial fragmentation may set in motion a process of economic destabilization, as we will see below.

Part of the reasoning behind the ECB's introduction of the TPI is the possibility that risk premia due to "unwarranted disorderly market dynamics", disconnected from macroeconomic fundamentals, may destabilize the union (ECB, 2022). Following Stevenson and Wolfers (2023), I introduce financial shocks to the *IS-MP-PC*-model by adding a region-specific risk premium ρ_i to the *MP*-curve:

$$r_{i,t} = i_t - \pi^e_{t,i} + \rho_{i,t}, \qquad i = \{A, B\} \tag{9}$$

In contrast to Stevenson and Wolfers (2023), Blanchard et al. (2021) model financial shocks as shifts of the *IS*-curve, while reserving *r* for the real risk-free policy rate. I prefer the approach in Stevenson and Wolfers (2023) for three reasons. First, in the context of EMU, both the nominal policy rate *i* and the TPI, which will be used to compress risk premia, are policy instruments of the ECB, making it natural to combine them in the *MP*-function. Second, from a didactic perspective it may work better to graphically disentangle demand shocks (causing shifts in the *IS*-curve) from financial shocks (causing shifts in the *MP*-curve). Finally, the real cost-of-borrowing rate

including risk premium is the relevant rate for spending decisions. It may therefore be preferable to have this variable on the vertical axis of the *IS*-curve.

Conform equation (9), cross-regional fragmentation in borrowing conditions may now result from divergences in both inflation expectations and risk premia. In Fig. 3, we can see the impact of disorderly market dynamics causing capital flows from country A to B. An example is the rebalancing of portfolios by Northern financial institutions from peripheral governments bonds to safer Northern bonds during the sovereign debt crisis. As investors sell (buy) government bonds of country A (B), the resulting bond market fragmentation may spill over into a broader fragmentation in the cost-of-borrowing of firms and households. When country A is perceived as risky, it will experience a positive risk premium ρ_A, while country B may benefit from a safe-haven effect (negative ρ_B). This results in a spread between r_A and r_B in Fig. 3 (parts 3.1 and 3.2). The increase (decrease) in r in country A (B) reduces (increases) output in country A (B), resulting in disinflationary (inflationary) pressures along the *PC*-curves. If unaddressed, this could lead to a de-anchoring of inflation expectations, exacerbating the fragmentation. The dynamics would then follow a similar trajectory as in Fig. 2, with shifts in r_i and the *PC*-curves due to changing inflation expectations (not shown in Fig. 3). Additionally, the decrease in output in country A could heighten financial market anxiety and further increase its risk premium, leading to a self-fulfilling destabilizing effect of fragmentation. An obvious question to discuss with students is if and how this process of destabilization can be halted. I will turn to solutions in subsections 3.3 and 4.2–4.4.

3.3. Extensions

Figs 2 and 3 provide a stylized view of the macroeconomic dynamics in a monetary union, which can be extended along the following lines. Most of the extensions have the effect of exacerbating the destabilizing dynamics. Firstly, asymmetric shocks and financial market disorder can interact. A negative demand shock may trigger an increase in the risk premium, leading to further destabilization. This is illustrated in Fig. 4, which shows how an initial decrease (increase) in IS_A (IS_B), moving the economy from (π^T, $y_{P,i}$) to (π_1, y_1), is aggravated by an increase (decrease) in r_A (r_B), moving the economy even further away from equilibrium to (π_2, y_2). In Fig. 4, inflation expectations remain anchored. In case of adaptive expectations, the regional economices would be further destabilized, along the lines of Fig. 2.

Secondly, the state of the public finances also plays a role. A high public debt ratio may cause countries to fall into a debt trap due to a combination of low economic growth and high interest rates, making the debt-GDP ratio unsustainable. In this context, a possible alternative interpretation of the two-country model is as high-debt/low-debt model.

Thirdly, divergences in real borrowing rates can result in wealth effects with macroeconomic implications. In a booming regional

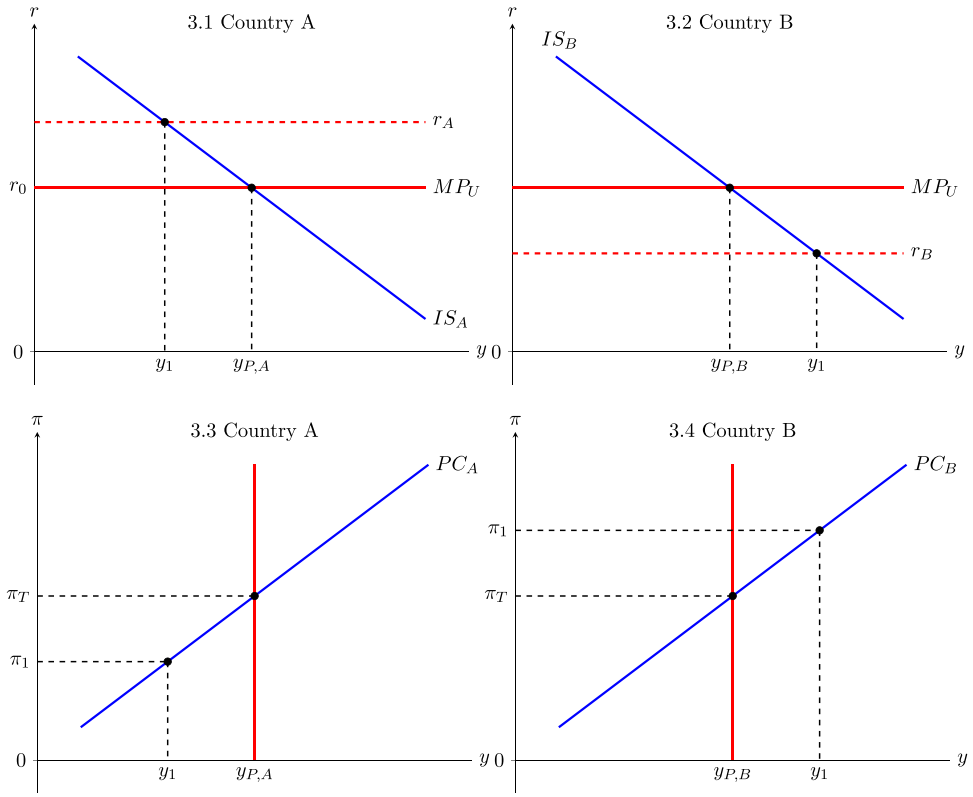

Fig. 3. Financial shocks in the IS-MP-PC model.

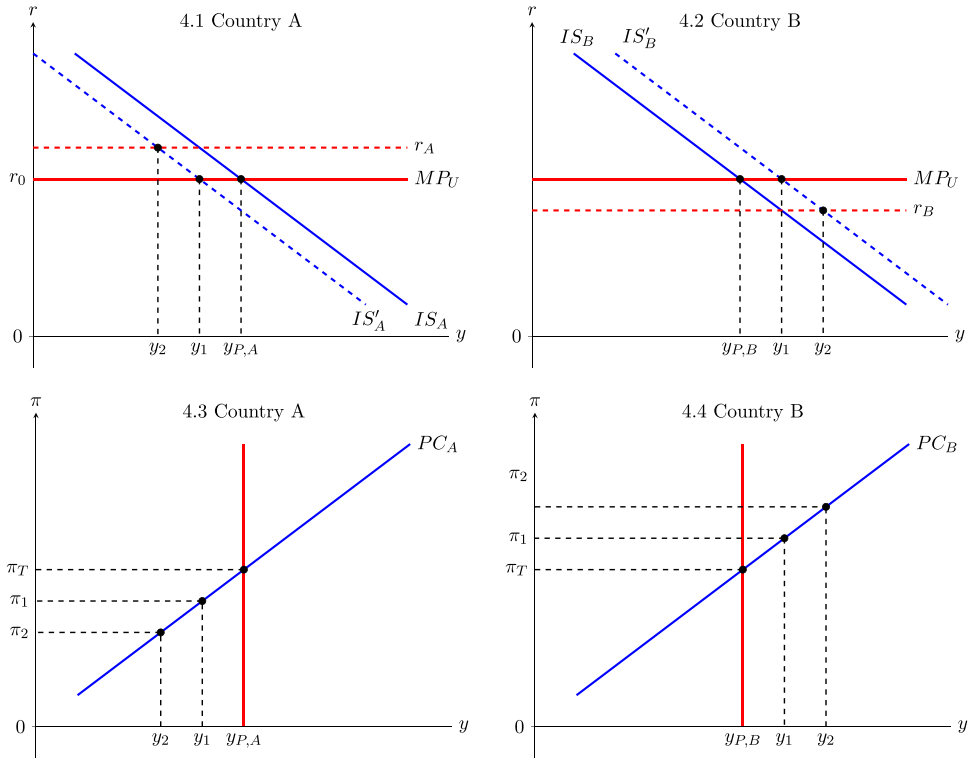

Fig. 4. Interaction between asymmetric demand and financial shocks in the IS-MP-PC model.

economy with low real interest rates, housing prices may increase, stimulating consumption through balance sheet effects and amplifying the effect on output. The reverse may happen in a stagnating economy. Limited labor mobility in Europe reduces arbitrage between national housing markets. Divergences in regional housing wealth are therefore likely to occur within Europe, as we have seen prior to the sovereign debt crisis. Fourthly, the EA is characterized by a strong correlation between sovereign and banking risk. During the global financial crisis, governments rescued banks to maintain financial stability, which had a negative effect on their public finances. Conversely, deteriorating public finances can increase banking risk through banks' exposure to sovereign bonds and by limiting governments' ability to bail out banks. This is the so-called "doom loop" (Brunnermeier et al., 2016). Any increase in risk premia on sovereign debt may then also affect the stability of a country's banking system and its capacity to support the private sector.

Finally, I discuss a stabilizing effect. Even though nominal exchange rate adjustments are no longer feasible within a monetary union, the real exchange rate channel remains intact. The competitive position of a depressed (booming) region will improve (deteriorate), not via changes in the nominal exchange rate but via a change in the price ratio. Changes in competitiveness arising from this process of internal devaluation will be reflected in next exports, shifting the *IS*-curve in country A (B) back to the right (left). Absent a swift adjustment through the nominal exchange rate, the speed with which the real exchange rate changes will be slow (Arnold and Kool, 2004). This has also been demonstrated during the sovereign debt crisis.

4. Policy applications

This section shows how the two-country version of the *IS-MP-PC*-model discussed in section 3 can be used to discuss policy issues with undergraduate students. I start with the policy decision to join a monetary union. The next subsections discuss possible policy responses, both at the national and the union level, to the destabilizing forces described in sections 3.1 and 3.2.

4.1. Joining a monetary union

The potential for macroeconomic destabilization described above should motivate aspiring members of a monetary union to look before they leap. This is well-recognized in the OCA-literature, which has identified four criteria which may determine whether countries should join a monetary union (Frankel and Rose, 1998). The relevance of these criteria can be explained to students using the *IS-MP-PC*-model. The first criterion relates to the similarity of shocks. According to Fig. 2, when asymmetric *IS*-shocks are less prevalent, regional divergences in y and π are less likely to occur and the lack of regional monetary policy will be felt less. The second criterion relates to labor mobility as an adjustment mechanism to asymmetric shocks. This works through the supply curves, as visualized in Fig. 5. Permanent reallocation of workers from depressed to booming regions would decrease (increase) $y_{P,A}$ ($y_{P,B}$) in the

depressed (booming) region. This shifts both the long-run aggregate supply curves and the *PC*-curves, reducing the disinflationary (inflationary) pressures in region A (B). As a result, the regional differences in inflation are eliminated. The third criterion relates to fiscal transfers. If regional demand shocks are compensated by cross-regional fiscal transfers, spending is stabilized and the movements in the *IS*-curves are reduced. Finally, greater trade linkages between members of the union would allow for a better functioning of the real exchange rate channel discussed above.

4.2. National policy responses

According to the Treaty of Maastricht, fiscal policy in the EA is first and foremost a national responsibility. National governments therefore should try to prevent fragmentation risk in government bond markets by maintaining investor confidence with sound fiscal policies. In the absence of fiscal risk-sharing among EA members, there is a risk that national policymakers may be forced to react to asymmetric demand or financial shocks with an immediate contractionary fiscal policy response. In terms of the analysis in section 3, such a response would shift the *IS*-curve of country A even more to the left, leading to further macroeconomic destabilization. The contractionary effect of austerity on output in country A will also do little to dispel anxiety in the financial markets, and be probably ineffective in reducing the risk premium on sovereign debt. This would plea against the use of short-term austerity measures in reaction to asymmetric shocks. Since the establishment of the European Stability Mechanism (ESM), which can provide EA countries that experience severe funding problems with financial support, the need for sudden sizable spending cuts in reaction to asymmetric shocks has decreased.

Regarding the interconnectedness between sovereign and banking risk discussed in section 3.3, an appropriate national policy response is to sever the ties between domestic banks and their governments. Although the European banking union has endeavored to accomplish this objective, it remains unfinished (Howarth and Quaglia, 2014). Banks are still permitted to have unlimited exposure to their governments' sovereign debt. Consequently, any apprehensions about the creditworthiness of the government can potentially destabilize banks and impair their capacity to extend credit to the private sector (Brunnermeier et al., 2016). To mitigate this spill-over effect, limits could be placed on the amount of domestic government debt that banks can retain on their balance sheets.

4.3. Fiscal integration

The incompleteness of EMU can be regarded as an economic flaw, which could be addressed through political action. A straightforward solution to bond market fragmentation is to move towards fiscal union. The most radical form of fiscal union involves merging national budgets into a single budget and combining national government debts into union debt. The *IS-MP-PC*-model in

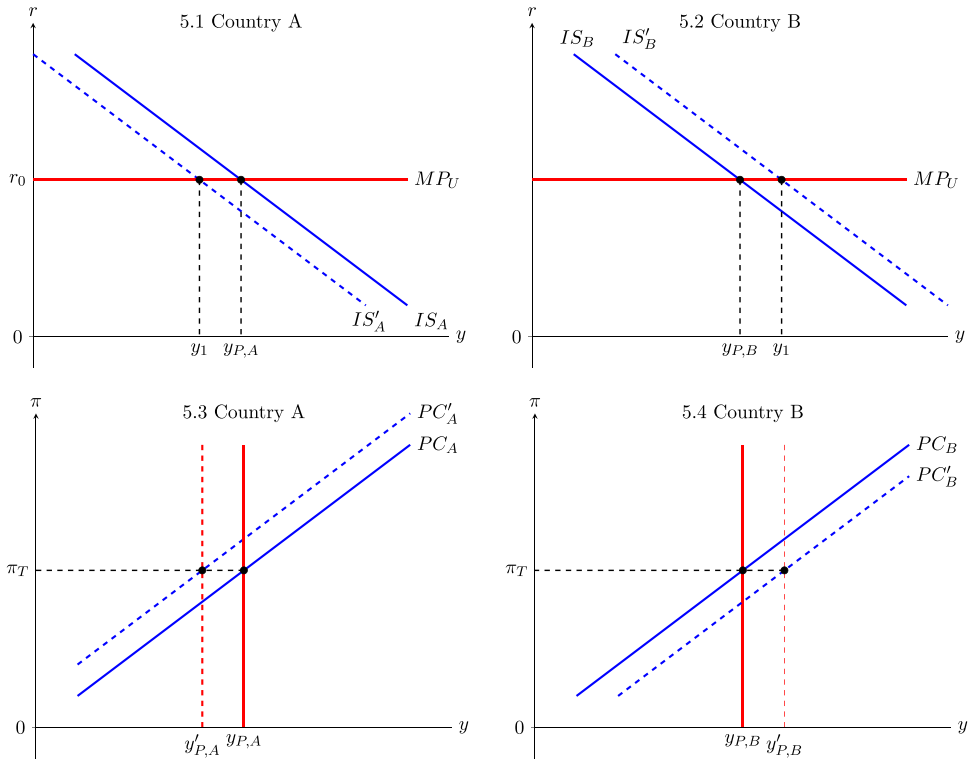

Fig. 5. Labor mobility as an adjustment mechanism.

section 3 can be used to discuss two positive effects of fiscal union (De Grauwe, 2022). Firstly, by facilitating income transfers, fiscal union would create an insurance mechanism to offset the impact of asymmetric shocks. Graphically, this enables the *IS*-curve in country A (B) in Fig. 2 to to shift back to the right (left) after an asymmetric demand shock. Secondly, by consolidating national debts and establishing joint liability, a fiscal union provides a mechanism that would shield individual member states from liquidity crises and default risk. This would eradicate the risk premia in Fig. 3. Implementing fiscal union raises concerns about moral hazard and would require further progress towards political unification, for which there is currently little public support. In the absence of complete fiscal union, EA countries can utilize the funding opportunities provided since the onset of the sovereign debt crisis, such as the ESM and more recently the Next Generation EU funds, to alleviate the impact of asymmetric shocks and maintain investor confidence.

4.4. ECB policy

Fragmentation risk in government bond markets is an inherent characteristic of Europe's incomplete monetary union. Whether the ECB has a role in mitigating this risk is controversial (Feld et al., 2022; Bernoth et al., 2022). The ECB's TPI aims to reduce fragmentation risk through intervention in the bond markets. By purchasing assets issued by weaker EA countries, risk premia can be reduced. In terms of Fig. 3, r_A and r_B will be aligned with MP_U. Critics argue that this type of spread control can be considered as fiscal support, which is outside the scope of the ECB's mandate (Feld et al., 2022).

To address this criticism, the ECB has taken pains to argue that the use of the TPI is consistent with its mandate, framing its argument in monetary and financial terms. This applies to both the objective of the TPI, which is to safeguard the uniform transmission of monetary policy, and to the two conditions under which the TPI can be activated (ECB, 2022). First, to refute the notion that the TPI constitutes fiscal support, the ECB must assess whether countries are pursuing "sound and sustainable fiscal and macroeconomic policies". Second, the TPI can only be activated to counter "unwarranted, disorderly market dynamics".

Advocates of spread reduction by the ECB contend that market interest rates do not always reflect underlying fundamentals (De Grauwe and Ji, 2013). As outlined in section 3.2, in theory this could lead to a "bad equilibrium", where unfounded market pessimism about a EA country drives up interest rates to a level where the debt-GDP ratio takes an unsustainable path. The country then faces the stark choice between harsh austerity measures or default. Both choices justify the markets' pessimism, which in this way has become self-fulfilling (De Grauwe and Ji, 2013). In this view, the unpredictable nature of market sentiment is regarded as the source of economic instability, which may justify intervention by the ECB to stabilize the monetary union. In discussing this policy response with students, interesting questions are whether disorderly market dynamics unconnected to fundamentals are an important feature of the EA financial markets and whether the ECB can do better than the financial markets in assessing sovereign risk and determining the appropriate size of risk premia.

5. Conclusions

In the past two decades, the economics profession has made sizable efforts to better align undergraduate teaching in macroeconomics with real world practice. The first development has been a gradual shift from the *IS-LM* model to a three-equation *IS-MP-PC*-model, reflecting the limited role of the money supply in the practice of monetary policy-making today. The second development, taking place after the global financial crisis, has been to incorporate topics relating to financial markets and institutions in macroeconomics courses.

Issues relating to the macroeconomics of monetary union are, however, rarely discussed in introductory macroeconomics courses. They are also missing from textbooks in undergraduate macroeconomics. As most textbooks are, at least initially, targeted at the US market, this is understandable. However, since the introduction of the euro, the EA has grown to a currency union in which more than 300 million Europeans share a common currency and have experienced the sovereign debt crisis. Among them are many economics students. They are now taught a standard macroeconomic model which differs substantially from the policy environment in which they live and which for them is of limited use to understand macroeconomic events and policy issues in their country.

This paper shows how the three-equation *IS-MP-PC*-model can be easily adapted to discuss macroeconomic adjustment in a monetary union. It introduces a two-country version that illustrates the difficulties of macroeconomic adjustment in the presence of asymmetric demand or financial shocks. The level of analysis does not go beyond the level of introductory macroeconomics. The model can be used by instructors in EA countries to close the gap between the macroeconomics that EA students learn from their textbooks and the macroeconomic issues that their countries face. Policy applications are added to allow instructors to discuss current policy issues with their students and thus motivate them for the field. Future work could focus on the pedagogy of using this model in the classroom to increase student engagement.

Credit author statement

This is a single-author paper.

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