Aftershocks of Monetary Unification: Hysteresis with a Financial Twist

Tamim Bayoumi and Barry Eichengreen[1]

1. Introduction

Once upon a time, in the early 1990s, it was widely agreed that neither Europe nor the United States was an optimum currency area. Neither fully satisfied the conditions for operating a smoothly-functioning monetary union. Both experienced asymmetric shocks, aggregate supply and demand disturbances that differed across their constituent regions. This in turn constituted a case against a one-size-fits-all monetary policy in the absence of other instruments accommodating the need for different policy stances in regional economies affected by different economic conditions.

Moderating this concern was the finding that it was possible in both Europe and the U.S. to distinguish a regional core and regional periphery, and that the problem of asymmetric disturbances was less in the core. In Europe this strengthened the case for a relatively small monetary union centered on Germany, France and a handful of Northern European countries. It suggested that if Europe instead went ahead with a large monetary union including, inter alia, Portugal, Italy, Ireland, Greece and Spain, outcomes in the resulting monetary union could well be problematic.

We documented these points in Bayoumi and Eichengreen (1993). In addition, we showed there that the dispersion of shocks was larger in Europe than the United States, suggesting that monetary union, however configured, might not operate as smoothly in the European Union.

At the same time, the fact that much of the difference was on the demand side – the difference was most pronounced in the case of aggregate demand disturbances, in other words – raised the possibility that the lack of correlation in Europe was a figment of the monetary regime. While different candidate countries continued to run different monetary policies for the time being, this would change in the direction of greater symmetry with the establishment of monetary union.

In this paper we revisit these issues after the passage of 25 years.[2] As in our earlier work, we distinguish temporary and permanent disturbances to output, what are traditionally

---

[1] International Monetary Fund and University of California, Berkeley, respectively. Bayoumi's work was undertaken while he was affiliated with the Peterson Institute of International Economics. Eichengreen's was supported by the Clausen Center at the University of California, Berkeley. This views expressed herein are those of the authors, and should not be attributed to the IMF, its Executive Board, or management.

[2] See Bayoumi and Eichengreen (1993), circulated in 1992 as an NBER working paper. After we started work on this update, we discovered the closed related work of Campos and Machiarello (forthcoming). Their analysis is compatible with ours, although their emphasis and interpretation are different. Their sample starts earlier than ours, in 1989, and hence puts less weight on the recent financial super-cycle. They find relatively high correlations with Germany for Belgium, Ireland, and Portugal. They then argue that an over-identifying restriction that all supply shocks have the same impact on supply is rejected most decisively for Spain, Ireland, Portugal, and Greece, and hence that these countries continue to constitute a euro area periphery. Our own results, by contrast, do not impose the restriction that aggregate supply shocks should have the same long-run impact in all countries; rather, we allow

interpreted as disturbances to aggregate demand and supply.[3] Utilizing data from the transition to the euro (Stages I and II of the transition blueprint sketched in the Maastricht Treaty) and then from the monetary union itself, we examine whether the pattern of disturbances looks different than in the past. We consider whether warnings against a European monetary union based on this pattern, and warnings against a large monetary union in particular, are borne out by subsequent experience. We ask whether the United States, where the geography of production and employment has evolved over the last quarter century, looks more or less like a smoothly-functioning monetary union.

A number of findings emerge from this analysis. First, the United States continues to resemble an optimum currency area more closely than the Euro Area if the condition for optimality is the symmetry of supply and demand disturbances. This is not likely to surprise close observers of Europe's trials and tribulations.[4]

Second, while there remains a clear distinction between a Euro Area core and Euro Area periphery, as in the earlier period, the Euro Area core is now made up, surprisingly and in contrast the earlier period, of Germany together with none other than Portugal, Ireland, Italy, Spain and Greece.[5] Recall that the core is defined, for present purposes, as countries whose aggregate supply and demand shocks are relatively highly correlated with those in Germany. In contrast to the earlier period, we find that since the Maastricht Treaty shocks to aggregate demand and sometimes also to aggregate supply in the so-called GIIPS countries (the alphabetically listing of a more pejorative nickname) are now *more* highly with those in Germany, not less, compared to shocks to other Euro Area countries. This unlikely set of countries, which on other conventional criteria appears to be less integrated with Germany than do closer neighbors like Belgium and France, suggest that the shocks we have identified may reflect distortions in operation of the monetary union rather than the extent of underlying integration.

---

the magnitude of that impact to vary with the structure of each economy, as in our earlier work. We find little difference in the significance of the output effect of the aggregate supply shock from zero (a more sensible test in our view) for the so-called GIIPS (Portugal, Ireland, Italy, Greece and Spain) versus the rest of the Euro area. And in interpreting the results we place more weight on the impulse-response functions associated with the vector autoregressions specified and analyzed below, as opposed to the correlation of estimated disturbances across countries..

[3] Temporary disturbances to output are logically interpreted as aggregate demand disturbances in the presence of a vertical long-run supply curve, while permanent changes in output are interpretable as aggregate supply disturbances – as shifts in that vertical long-run supply curve. However, we will have reason to revisit this interpretation below.

[4] The extent of the difference, as we estimate it, depends however on the period considered, as documented in the appendix. The difference between Europe and the U.S. is less when we shorten the period from 1994-2014 to 1999-2014, reflecting the extent to which the more recent period is heavily dominated by the financial cycle, a demand disturbance that affects different European countries similarly. (Some will argue that Euro Area countries were also subject to more symmetric monetary shocks following the transition to monetary union, although we would argue that the convergence of monetary policies was already underway during Stage II of the transition to the euro, and we would caution that transmission mechanisms could continue to differ. We are not really able to distinguish these hypotheses.) The Euro Area also looks better, compared to the United States, when we include 2009 in the analysis, since this was a year of exceptionally large aggregate supply and demand disturbances affecting all advanced countries, (affecting them symmetrically, in other words). What conclusion is warranted on the basis of these findings depends on which years one views as predictive of experience going forward.

[5] Germany is a member of the core by construction (as explained in more detail below).

Third, there are striking changes in the response of prices to temporary and permanent shocks to output in the Euro Area. Temporary positive shocks to output in the U.S. raise prices permanently, consistent with the standard interpretation of them as shocks to aggregate demand. Similarly, permanent positive shocks to output in the U.S. reduce prices, consistent with interpreting them as shocks to aggregate supply.[6] These results resemble what we found for the U.S. in the earlier period. We also find the same basic pattern in other non-Euro Area countries.

For the Euro Area, in contrast, the price response is different. Prices now rise rather than falling in response to permanent shocks to output (what are otherwise interpretable as positive aggregate supply shocks). This pattern of price responses is not consistent with the standard aggregate-supply-aggregate demand model, in contrast to the situation in the U.S., in other non-Euro Area countries, and indeed in Europe itself prior to the advent of the euro.

Our interpretation is in terms of hysteresis with a financial twist. Hysteresis is the idea that aggregate demand and aggregate supply shocks are endogenously linked (see e.g. Blanchard and Summers 1986). Demand shocks give rise endogenously to supply shocks as well as, conceivably, vice versa. Familiar variants of the hysteresis argument posit that negative aggregate-demand shocks create negative aggregate-supply shocks.[7] One such channel is for temporary unemployment to degrade the labor force through loss of experience and erosion of skills. Another is the possibility that temporary reductions in output cause firms to reduce investment, in turn lowering the capital stock and potential output.

The channels for hysteresis we emphasize in this paper, which we think of as especially relevant to the Euro Area through its first 15 years of existence, operate through financial markets rather than labor markets. In the Euro Area, positive shocks to aggregate supply produced a lending boom that fueled an increase in spending and aggregate demand. Positive supply shocks that increased the productivity of existing capital and labor increased margins and profitability and therefore raised asset prices. Higher asset prices encouraged additional bank lending both by increasing the adequacy of European bank capital (allowing banks to expand their lending) and by stimulating borrowing (which was used to finance additional investment, consistent with the now higher level of Tobin's q). More investment meant still more aggregate supply, causing output to continue rising over time. And more demand meant higher rather than lower prices.

Similarly, negative demand shocks that would normally that would normally be expected to reduce both output and prices had little visible output effect in the Euro Area because the short-run aggregate supply curve is relatively inelastic, reflecting real rigidities in product and labor markets. But the lower product prices associated with this negative shock to aggregate demand also reduce asset prices, causing the financial mechanism described in the previous paragraph to run in reverse. Lower asset prices discourage lending, depress borrowing, and cause demand to fall still further. The result of the negative demand shock is thus an exaggerated fall in output, and deflation, consistent with what Europe has experienced in recent years.

---

[6] Nothing in our methodology imposes the constraint that prices must rise in response to temporary shocks and fall in response to permanent ones; rather, this result serves as a check on our interpretation.

[7] And, symmetrically, that positive aggregate demand shocks give rise to positive aggregate supply shocks. This last idea is one rationale for running what is referred to as a "high-pressure economy" (that is, as subjecting the economy to a positive aggregate demand shock).

Note that this interpretation emphasizing hysteresis operating via the financial sector also suggests an explanation for why disturbances to Germany became more highly correlated with disturbances to the GIIPS compared to disturbances to other Euro Area countries. When Germany experienced a positive aggregate supply shock, in the form of the Hartz II reforms adopted shortly after the advent of the euro, not only did the country's own growth accelerate but large amounts of bank finance flowed from Germany and other Northern European countries toward the GIIPS, which were an attractive destination for now more abundant bank finance, as a result of their heretofore high interest rates. Thus, Germany and the GIIPS experienced correlated aggregate supply and aggregate demand shocks in the first post-Euro decade. When the global financial crisis hit and banks in Germany and elsewhere retrenched, the same process then operated in reverse. This financial distortion appears to be what is driving some of our otherwise counter-intuitive results.

For this explanation to be consistent with the observed contrast between the U.S. and the Euro Area in recent years, there must be reasons to think that the bank-lending response, the mechanism through which positive supply shocks endogenously generate positive demand shocks, operated more powerfully in the Euro Area than the U.S. or, for that matter, thatn in Europe itself in the earlier (pre-euro) period. To explain the greater elasticity of bank lending in the Euro Area than the United States, we point to lesser reliance of European bank regulators on simple leverage ratios, and to their greater reliance on banks' own internal models, which are inherently procyclical. To explain the greater elasticity of bank lending in post-euro than pre-euro Europe, we point to the intensification of bank competition with completion of the Single Market, the elimination of exchange risk courtesy of the euro, and the temptation of national regulators to favor their national champions through the adoption of light-touch regulation.

An implication of this analysis is that the Euro Area needs vigorous, coordinated regulation of its banking and financial systems by a single supervisor (that monetary union without banking union will not work). This perhaps encourages a somewhat optimistic conclusion (for the optimistically minded), since the Euro Area may in fact moving toward banking union. But another implication is that the Euro Area will remain prone to financial booms and busts, and therefore to destabilizing shocks, so long as regulators continue to rely on banks' internal models. To the extent they do, this leads one to a rather more pessimistic conclusion.

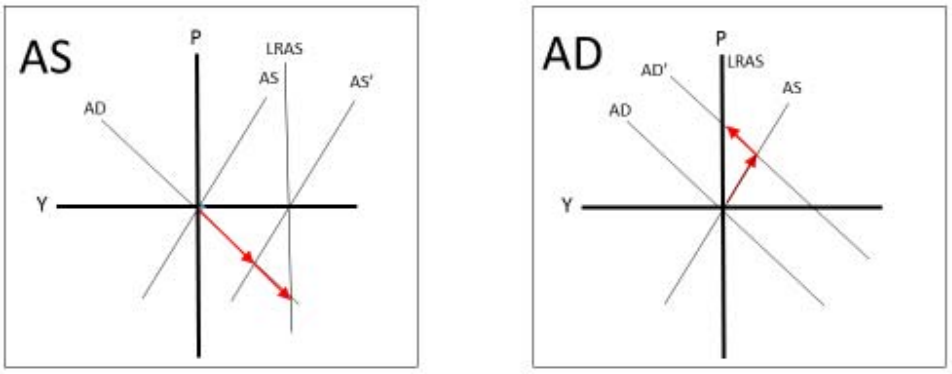
2. **Estimation Results**

We follow the same procedures as in our earlier work, collecting data on real GDP and the GDP deflator through 2014 for the eleven initial members of European Monetary Union as well as ten additional advanced countries, and Gross State Product and the associated deflator for the eight Bureau of Economic Analysis U.S. regions.[8] Growth and inflation are measured using the first difference of the logarithm of real GDP and the GDP deflator, respectively. Since the VARs are estimated using two lags, the estimation period is 1990-2014, or 25 years of data. This is the same length as the time period for the earlier work, which covered 1963-1988.

[8] The eleven Euro area members are Germany, France, Italy, Spain, the Netherlands, Belgium, Austria, Ireland, Portugal, Greece, and Finland, as well as the Euro area as a whole. The 8 US regions are the Mideast, New England, Southeast, Southwest, Great Lakes, Plains, Rocky Mountains, and the Far West. The additional advanced countries are the United States, Japan, the United Kingdom, Canada, Sweden, Switzerland, Australia, New Zealand, Denmark, and Norway.

We used a Blanchard-Quah decomposition to differentiate between two types of shocks, those that have permanent effects on both output and prices, which we will refer (for now) to as aggregate supply shocks, and those that have only a temporary effect on output but a permanent effect on prices, which we will call aggregate demand shocks (more on this assignment below). The logic for this interpretation is the canonical aggregate-demand-aggregate-supply model shown in Figure 1.

Figure 1. US Adjustment AS/AD



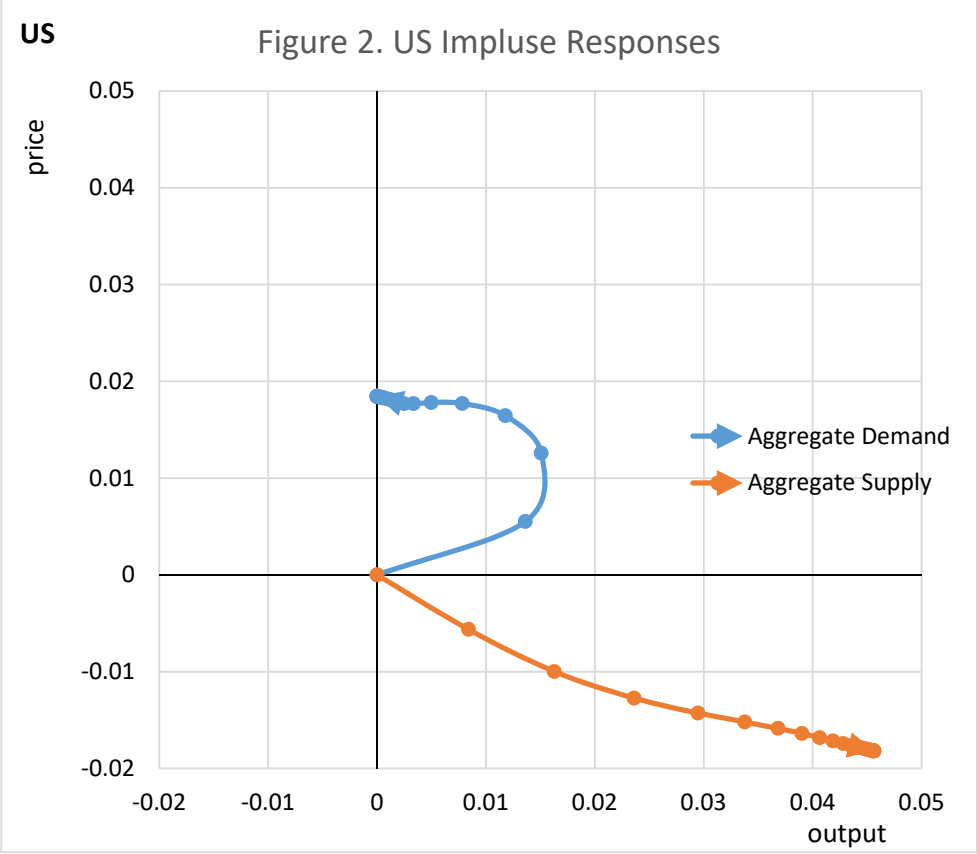
The left hand panel labeled AS shows the response to an increase in aggregate supply. Initially, output rises and prices fall as the supply shock traces out the downward sloping aggregate demand curve. Over time the aggregate supply curve rotates so as to become vertical at the new higher level of potential output, and the initial path is further extended along the aggregate demand curve. The final outcome is permanently higher output, and permanently lower prices.

The right hand panel marked AD shows the path following an aggregate demand shock. In this case the initial impact is to raise both output and prices, as the shock traces out the upward-sloping aggregate supply curve. But as the short-run aggregate supply curve becomes vertical in the long run at the initial level of output, output falls back to its initial value, even as prices continue to rise, and these dynamics trace out the aggregate demand curve. Thus, an aggregate supply shock should produce a gradual rise in output and fall in prices, while an aggregate demand shock should initially produce a rise in output and prices, followed by a gradual reversion of output to initial levels, but a continuing rise in prices.

The estimation procedure only requires (effectively, enforces) that there is one permanent and one temporary shock to output. In particular, it does not require that prices rise in the second case and fall in the first. Whether or not these implications follow are purely dependent on the data. The estimation results and associated impulse responses can therefore be used to check whether patterns in the data are consistent with the interpretation suggested by the textbook

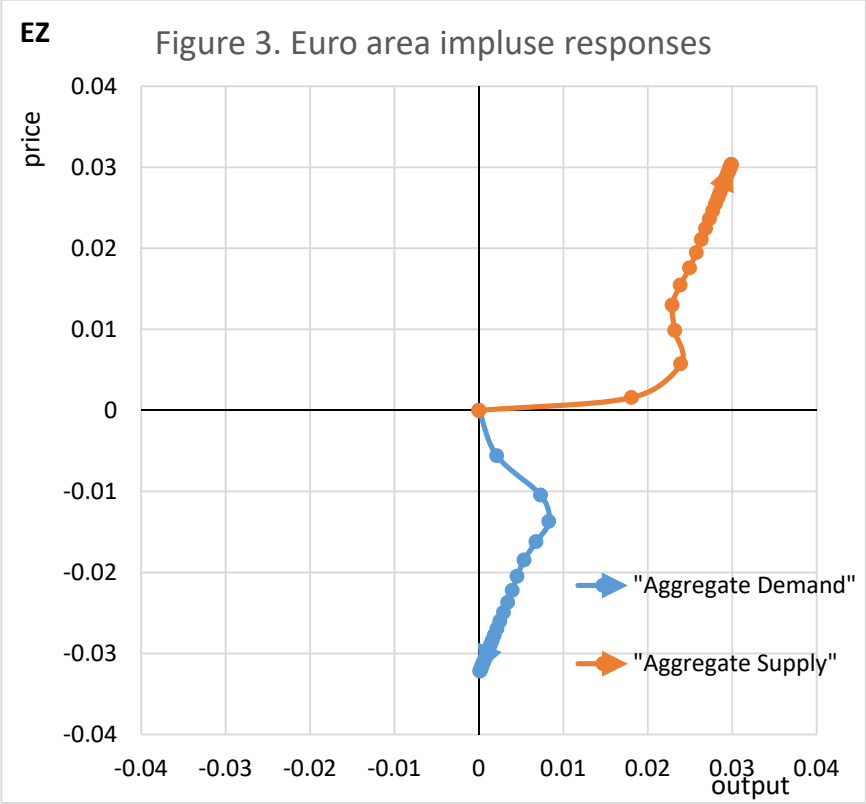
aggregate-supply-aggregate-demand model. In our earlier paper, the data and impulse responses in both Europe and the United States were consistent with these textbook predictions. Prices fell in response to permanent shocks but rose in response to temporary ones. The estimated impulses indicated relatively large negative aggregate supply shocks in the 1970, around the time of the first and second OPEC oil shocks. These findings encouraged us to interpret the two underlying shocks in terms of aggregate demand and again supply.

The results for the United States for the recent period again conform to this basic pattern. Figure 2 shows the impulse response functions associated with our estimated equations, in price-output space, for the United States as a whole. The aggregate supply curve traces out a downward sloping aggregate demand curve with a slope about 30 degrees below the vertical. The aggregate demand shock, depicted in blue, traces out a short-run aggregate demand curve with a slope of 30-45 degrees, followed by a return to the initial level of output along a path that has a similar slope to that traced out by the aggregate supply shock (shown in orange, directly below). Results for individual U.S. regions (not shown for the sake of brevity) show the same basic patterns, with some intuitive differences.[9]



[9] For example, the mineral-rich Southwest and Rocky Mountain regions both have relatively flat aggregate supply curves, as one would expect.

In the case of the Euro Area, however, the results are less intuitive (Figure 3). They do not obviously conform to the predictions of the standard textbook model. One shock raises output and lowers prices, but this is the "aggregate demand" shock with only a temporary impact on output. The other shock, which raises output permanently, produces almost no change in prices initially, followed by a gradual increase in prices over time. Looking at the individual results for the 11 long-term members of the Euro Area (where Luxembourg is aggregated with Belgium, and Greece is included despite only joining in 2001), eight of the countries in question, including Germany, display this same pattern, with the exceptions, France, Belgium, and Finland, conforming to the traditional pattern, as in our earlier paper and as in the United States. The ten other advanced economies for which we have comparable data and estimates also conform to the traditional U.S. pattern, with the sole exception of Japan. It would appear, then, that these unconventional responses are essentially a Euro Area phenomenon.[10]



The responses in Figure 3 are not easily explained using the standard aggregate-demand-aggregate-supply framework. To make sense of the "aggregate demand" shock would require a downward sloping aggregate supply curve and an upward sloping aggregate demand function—the opposite of what the textbook model assumes. Even then it would be hard to rationalize an

[10] And to the extent that they are also a Japanese phenomenon, that may telling us something about their interpretation (more on this below).

aggregate supply shock that had little impact on prices initially but a large impact subsequently. That said, these patterns cannot be dismissed as a figment of the data, given that they obtain for a substantial number of Euro Area countries.

Our interpretation of the phenomenon is "hysteresis with a financial twist." At its most basic, the hysteresis argument is that aggregate demand and supply shocks are linked (see e.g. Blanchard, Cerutti, and Summers, 2015). Familiar variants of the hysteresis argument see aggregate-demand shocks as creating a long-term aggregate-supply response. One such channel allows temporary unemployment to degrade the labor force (through loss of experience and erosion of skills). Another is the possibility that temporary reductions in output cause firms to reduce investment, in turn reducing the capital stock and potential output.

An alternative is that the aggregate supply shock comes first, and that this then leads to changes in aggregate demand in anticipation of its future impact. This possibility has not been much discussed in the literature, although it cannot be ruled out a priori.

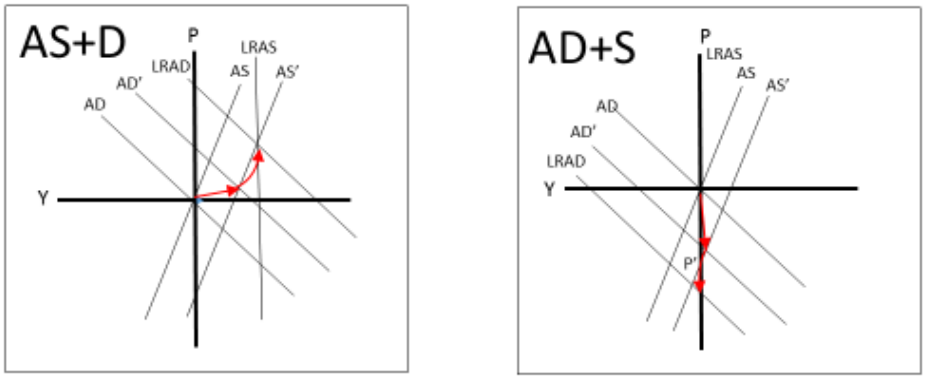
Our explanation synthesizes these two views. In a world where the supply of credit by the financial sector is extremely responsive to asset prices, anticipations of positive aggregate-supply shocks will become self-fulfilling (they will create their own demand). Expected increases in supply will generate a loosening of financial conditions (a "credit boom") through a financial accelerator (a la Bernanke, Gertler, and Gilchrist, 1999), that in turn produces an increase in spending. Much of the increase in spending goes into investment and results in additional hiring, thereby increasing aggregate supply at least in the short-term. Asset prices rise because the same factors of production produce more output in the short run following the positive supply shock (productivity and profitability both rise, other things equal). Lending responds because financial institutions using internal risk models interpret higher asset prices as a reduction in risk, requiring them to hold thinner risk buffers and allowing them to lend more (more on this below).

The dynamics are depicted in Figure 4. Consider a shock that is anticipated to raise aggregate supply, shifting the AS curve rightward to AS' and therefore also affecting aggregate demand. This is the shock in the left-hand panel labeled AS+D. Since the financial system responds to the higher asset prices associated with this positive shock, credit becomes more abundant, spending rises, and aggregate demand shifts rightward, to AD'. Because the financial accelerator moves aggregate demand and aggregate supply curves together, in the same direction, the normal downward pressure on prices from an aggregate supply shock is offset. That impact on prices may be offset more or less than completely; in the figure we depict the case where it is offset more than completely. Over time, the impact on financial conditions continues stimulate higher lending. This effects persists after the initial shock; as a result, aggregate demand continues to rise, shifting AD further to the right, ultimately to LRAD, even as aggregate supply rotates to become vertical at its higher long-run level LRAS. The result is a steady upward spiral in prices accompanying the permanent increase in output.

Observers of Europe since 2008 may prefer to run this experiment in reverse. A negative shock to aggregate supply due to, say, disruptions to the financial system leads initially to a

decline in output and also a decline in credit, spending, demand and prices. The observed decline in output is associated with deflation, in other words. Over time, as output falls further, that deflation continues to deepen.[11] This interpretation can also help us understand why the impact on output and prices is larger in the GIIPS than center, including Germany (as documented in the Appendix), insofar as the negative shock associated with the disruption to financial system is greater in the Southern European countries.

Figure 4: Euro Area Adjustment: Financial Hysteresis



Why might this hysteresis only have affected the Euro Area and not also the United States? One answer is that the Euro Area banking system was much more sensitive to changes in asset prices. For most of this period, Euro Area banks operated under Basel capital rules, applying risk weights to all or many of their assets. In addition, the major universal banks were permitted to use their own internal risk models when gauging the adequacy of the capital they held against those risk-weighted assets, and the banks in question were overseen by national supervisors. Intense regulatory competition within the Single Market, which was effectively completed for financial services in this period, provided supervisors incentives to support their banking systems through regulatory means that ended up increasing the elasticity of credit supply. Insofar as Europe was overbanked, banks for their part had an incentive to aggressively expand lending in boom periods in the effort to survive. Large Euro area banks used the flexibility afforded by pro-cyclical Basel capital rules and their national supervisors to increase lending aggressively when asset prices rose. Higher asset prices signaled additional lending opportunities (as indicated by Tobin's q). They reduced required capital holdings (in other

[11] Note that in this example we have added a second channel through which the negative supply shock can depress demand, spending, prices and output: along with the negative impact on credit supply of lower asset prices, impairment of the financial system further reduces credit supply. There is no incompatibility between the two channels. Their coexistence reinforces our point.

words, they allowed additional lending and assets to be piled atop existing bank capital) insofar as they were associated higher credit ratings and lower risk weights. Since addition lending led to further increases in asset prices, this process was self-reinforcing. It generated powerful and long-lasting financial accelerator effect.

U.S. commercial banks, by contrast, were required to comply with a U.S.-specific "simple leverage ratio" that limited the extent to which they could respond to higher asset prices. The leverage ratio was imposed in the wake of the Saving & Loan crisis of the early 1980s. It was part the "prompt corrective action" process aimed to enforce timely and hence less costly interventions in failing financial institutions. Specifically, it required commercial banks to hold at least 5 cents of capital for every dollar of assets. Since this U.S.-specific overlay to the Basel capital-adequacy rules used total assets rather than risk-weighted assets. it short-circuited the flexibility in Basel risk-weights that was used (and abused) in Euro area. Hence, the U.S. regulatory system limited the operation of the self-reinforcing financial accelerator-process evident in the Euro area, where higher asset prices led to more lending which in turn led to even higher asset prices.

Banks elsewhere were also under Basel rules but with stronger supervision, smaller investment banking operations, and fewer competitive incentives to expand lending, all of which reduced the financial accelerator. An interesting intermediate case is the United Kingdom, where banks had many of the same incentives as in the Euro Area banks but a significant share of the commercial banking system had close links with the more conservative Hong Kong banking model. And, indeed, the UK represents an intermediate result insofar as the initial downward pressure on prices after an aggregate supply shock is gradually reversed as prices come back to the initial level suggesting some role for an expansion in aggregate demand through the financial system. It is also possible to understand the otherwise peculiar results for Japan in this light, insofar as the Japanese economy operated under the influence of highly procyclical bank lending – a crisis in the banking system, and in bank lending, that was associated with a persistent growth crisis starting in the early 1990s.

If aggregate supply and aggregate demand shocks are linked to one another via the financial system, what then is the interpretation of the "aggregate demand" shock that only has a temporary impact on output shown in the AD+S panel in Figure 4? We interpret it as a reduction in aggregate demand that has little or no effect on asset prices and therefore on bank lending on impact. Since the financial system is the main mechanism in this set-up through which increases in aggregate demand affect real economic activity, most of the impact of the reduction in aggregate demand in this case feeds through to lower product prices rather than output. This is consistent with the observed impulse-response for Europe in Figure 3. It is the result of an aggregate demand shock when the short-run aggregate supply curve is relatively inelastic, as we have drawn it in Figure 4. (Compare Figure 1 above for the United States.) A relatively inelastic short-run aggregate supply curve is conventionally understood as reflecting the prevalence of real rigidities (Romer 2011). A substantial literature concludes that these rigidities are more prevalent in Europe than in the United States (see e.g. Bauer, Bonin, Goette and Sunde 2007 and Babecky, Du Caju, Kosma, Lawless, Messina and Room 2010 for reviews).

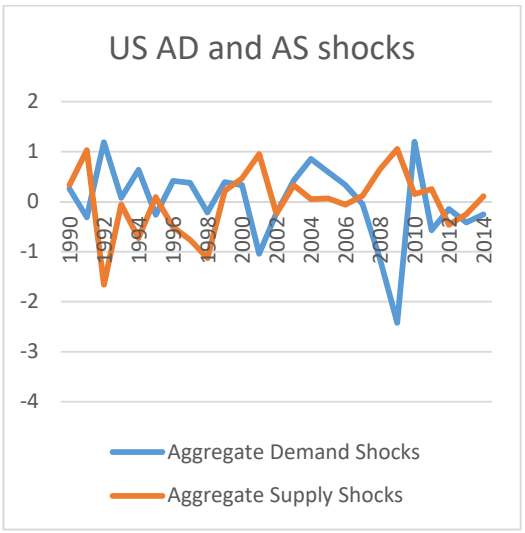
In Figure 3, output rises rather than falling in the short run. This indicates that the negative aggregate demand shock is being accompanied by a downward (outward) shift in the short-run aggregate supply curve. In Europe, reductions in aggregate demand that were not linked to the financial cycle, such as moves to fiscal austerity, were accompanied by lower wages and prices that improved competitiveness within the currency union. As lower costs widened margins on exports, firms were able to expand production even if the resulting increase in costs offset some of the downward pressure on prices. Since there is no increase in long-term potential output in this scenario, the result can be interpreted as a reduction in the price level P' around which the short run aggregate supply curve AS' rotates.

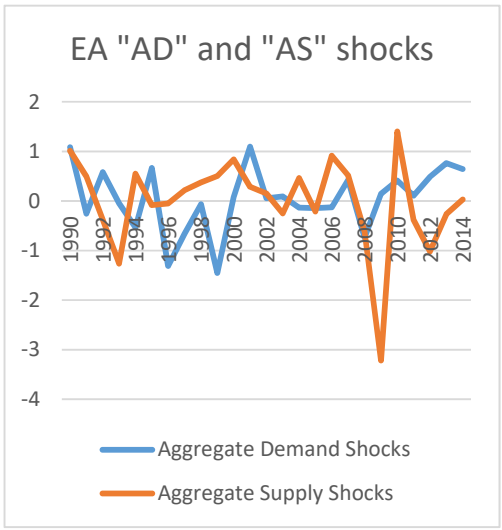
In the case we have drawn, designed to correspond to the kind of impulse-response shown in Figure 3, the positive competitiveness effect outweighs the negative demand effect in the short run. This is not necessarily the case, however. We could have as easily shown the case where the negative demand shock dominates in the short run, leading to a fall in output rather than a rise. Over time, real rigidities bring about a continuing fall in aggregate demand to LRAD. This leads to lower prices even as the aggregate supply curve becomes vertical and output reverts to its initial level.

This perspective enables us to interpret the shocks observed over time in the Euro Area and the United States, as shown in the two panels of Figure 5. The 2008/9 crisis in the United States is identified as a negative aggregate demand shock—a temporary shock that lowered output and prices but was reversed over time. This negative demand shock follows a series of positive demand shocks in 2004-06, which are plausibly associated with the country's housing bubble. In the Euro Area, in contrast, the 2008/9 crisis is identified as an aggregate supply disturbance that, after being partially offset in 2010 by fiscal support, persists into 2011 and 2012 as it produces self-reinforcing aggregate demand effects.

The pattern of shocks around the transition to the euro is also intuitive. There was a run of negative (i.e., deflationary) aggregate demand shocks in the run-up to monetary union in 1996 through 1999, as countries engaged in fiscal consolidation in the effort to meet the "convergence criteria" for entry into the monetary union. The ERM crises of the early 1990s appear as negative aggregate supply shocks, which were followed by a set of largely positive supply shocks from 1997 to 2008 as EMU became what appeared to be, at the time, a well-functioning reality.

Figure 5. US and Euro Area Aggregate Demand and Supply Shocks Over Time





3. Correlation Results

We now compare the correlation of shocks across U.S. regions and Euro Area members. Doing so requires selecting a pair of anchor regions, which following our earlier paper we take to be the Mideast (the mid-Eastern Seaboard) in the United States and Germany in the Euro Area. For the results reported here we make two adjustments to the sample. First, we start the calculations using shocks from 1994 rather than 1990. Although the Maastricht Treaty was negotiated in 1991 and signed in 1992, this was followed by the crises in the Exchange Rate System (EMS) in 1992 (when the UK and Italy were forced to leave the system) and 1993 (when France was almost forced to do likewise, before there was a face-saving expansion of the bands of the Exchange Rate Mechanism from 2¼ percent to 15 percent around the central parity).

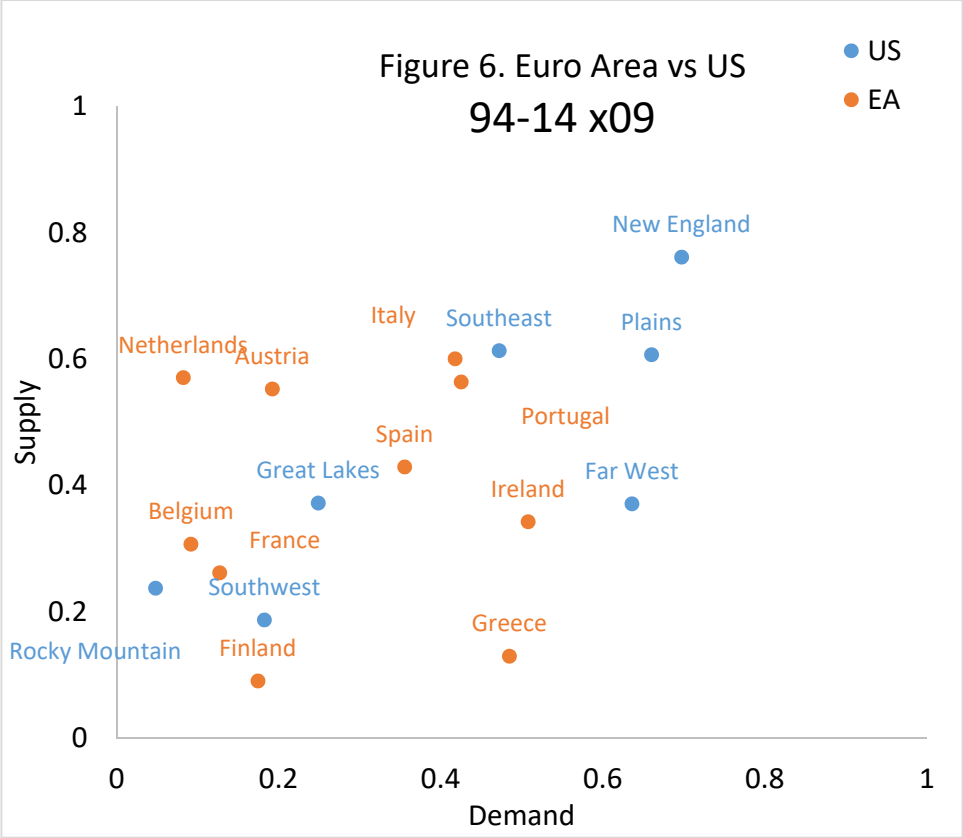
The EMS crises matter because they cast doubt over the whole future of the single currency, especially once Denmark rejected the Maastricht Treaty in a referendum and France barely accepted it in another. It seems reasonable, therefore, to conclude that the "real" start of the run-up to EMU, when a consensus existed that the monetary union would actually come into being, was in 1994, which is logically therefore also the breakpoint after which one should expect to observe different financial-market behavior..

Second, we exclude 2009 from the analysis, since in both the U.S. and the Euro Area (as in other advanced economies) this year is characterized by an exceptionally large and highly correlated (across countries) global shock.[12] Including this observation would bias the results strongly toward finding highly correlated shocks everywhere. Little information is added, in other words, by including a shock where all regions experienced very similar shocks (although we will return to the implications of the ubiquitous nature of the 2009 crisis below).

[12] When we include it, 2009 is characterized as both a negative aggregate demand and negative aggregate supply shock

Figure 6 shows the resulting correlations with the respective anchor regions, where aggregate supply shocks are on the vertical axis and aggregate demand shocks are on the horizontal. The United States shows an inner/outer structure similar to the one we identified in our analysis of the earlier period. Four regions are located relatively close to the top-right hand corner of the figure, which means that both shocks are highly correlated with those in the Mideast: the regions in question are New England and the Southeast, which are contiguous to the anchor region, and the Plains and the Far West, which are not. The "periphery," as we term it, is comprised of the Rocky Mountains and Southwest, which depended relatively heavily on mineral extraction, and the Great Lakes, which is specialized in manufacturing.

The main change from our earlier results is that the Southeast and the Great Lakes have switched positions, with the Southeast joining the inner core and the Great Lakes joining the periphery. This likely reflects changes in the U.S. currency union. The Southeast plausibly became more integrated with the core as it shed low-value-added manufacturing in favor of services and motor vehicle production. By contrast, globalization and the loss of manufacturing left the Great Lakes less tightly linked to the U.S. anchor region, more so to the extent that the manufactures that were left were traded increasingly on global rather than domestic markets.



The Euro area displays less well defined subgroups. Still, it is possible to distinguish one countries with relatively correlated "aggregate demand" and "aggregate supply" shocks; these constitute was came to be known as the Euro Area periphery during the crisis (Italy, Portugal, Spain, and Ireland and Greece, although Greece only shows a relative high correlation of "aggregate demand" shocks). Of the remaining countries, the Netherlands and Austria exhibit high correlations of "aggregate supply" shocks with those in Germany, while France, Belgium, and Finland do not – they are clearly in the outer circle. This inverts one of the findings of our earlier study, in which the inner circle could be interpreted as a Euro Area core (the Netherlands, France, and Belgium—Austria was not included in the analysis) and the outer circle comprised Italy, Spain, Ireland, Portugal, and Greece.

We interpret these results are being consistent with a Euro area "financial super-cycle" that linked Germany and the periphery, described already above. One element of this involved optimism about the future for the periphery that raised asset prices, increased lending and spending, and sucked in exports from Germany (the lower correlations for Greece reflect the fact it was still a relatively closed economy in this period). Improved prospects in Germany, reflecting the Hartz II reforms and a competitive Euro Area exchange rate, raised asset prices; much of the resulting lending and spending affected the GIIPS, whose economic prospects consequently came to be seen as brighter. The resulting financial accelerator then fed on itself in a self-reinforcing cycle. This amplification of the financial cycle in the outlying countries is also consistent with their much larger observed output and prices responses to an "aggregate supply" shock.[13] The results also suggest similar, but less potent, process affected the two economies otherwise linked to Germany, namely the Netherlands and Austria. Finally, shocks to the three economies least associated with this financial super-cycle, France, Belgium, and distant Finland, were least correlated with those in Germany.

The differing role of aggregate supply shocks in the Euro Area from the rest of the world can also be seen in the changes in their coherence over time. Table 1 shows the percentage of the variance of the underlying aggregate demand and aggregate supply shocks explained by the first principle component in the first half of the sample (1990-2001) and the second half (2002-2014 less 2009). In the Euro area, the coherence of the supply socks jumps after 2002, rising from explaining 48 to 60 percent of the total variance, while this share falls both for U.S. regions and for the other non-Euro Area advanced economies for which we have data.

In contrast, the opposite pattern is apparent for aggregate demand shocks. This suggests that in the Euro Area the financial cycle and (mistaken) forward-looking expectations about supply-side improvements melded aggregate demand and supply shocks in a manner that did not happen elsewhere.

Finally, the global nature of the 2009 crisis is underscored by the universal increase in the proportion of variance explained by the first principal component, something that displays no particular geographic pattern.[14]

[13] This is less true of Italy than Greece, Ireland, Portugal, and Spain.
[14] These results are available on request.

Table 1. Proportion of Variance Explained by the First Principal Component

	EMU	US regions	Other Advanced
Aggregate Demand			
1990-2001	0.31	0.32	0.38
2002-2014 less 09	0.27	0.53	0.50
Difference	-0.04	0.21	0.11
Aggregate Supply			
1990-2001	0.48	0.74	0.43
2002-2014 less 09	0.60	0.44	0.34
Difference	0.12	-0.30	-0.09

Source: see text.

4. Conclusion

A standard approach, since the early 1990s, to analyzing the suitability of a collection of economies for joining together in a monetary union is to estimate the correlation among them of disturbances to output – temporary and permanent shocks, or aggregate demand and aggregate supply disturbances in the conventional interpretation – using a bivariate vector autoregression of inflation and GDP growth with structural restrictions imposed. Updating those earlier results with 25 years of additional data is a way of determining whether Europe remains further than the United States from satisfying the symmetric-disturbances criterion for an optimum currency area. It enables us to ask whether it is still possible, as earlier, to distinguish a Euro Area core and periphery. And it speaks to the question of whether there is support for the endogeneity of the optimum currency area criteria, i.e. that Europe has come closer to satisfying the asymmetric-disturbances condition following creation of the single currency.

Utilizing this approach, we find that correlation of shocks across regional and national economies is still higher in the U.S. than the Euro Area, suggesting that Europe remains further from satisfying the symmetric-disturbances criterion for an optimum currency area. This finding resonates with the observation that Europe has experienced considerable teething pains in its first decade and a half of monetary union. It provides only limited support for the variant of the "endogeneity of the optimal currency criteria" story in which it is asserted that the asymmetric-disturbances problem will solve itself.

We also find evidence, as before, of the existence of a Euro Area core and Euro Area periphery – a first group of countries where disturbances are highly correlated with those in the anchor country, Germany, and a second set where they are less highly correlated. But whereas in the earlier period the Euro Area core was made up a subset of Northern European countries –

namely France, Benelux and Denmark – it now appears, surprisingly, to be made up of the crisis countries Portugal, Ireland, Italy, Greece and Spain. To reiterate, it is the crisis countries whose disturbances are most highly correlated with Germany's in the recent period.

Our interpretation of this last finding is in terms of the financial cycle. During the years Germany was growing strongly (after the Hartz II reforms at the turn of the century), asset prices soared, supporting an increase in banking-system leverage and encouraging a surge of lending to the so-called GIIPS. When the global financial crisis hit, asset prices collapsed and banks in Germany and other "core countries" retrenched, causing the same process to shift into reverse. Thus, the increased correlation of shocks between the German anchor region and the GIIPS should not be seen as an indication that Europe has moved closer to satisfying the criteria for an optimum currency area, but rather as evidence that the Euro Area continues to display important structural weaknesses, notably a highly procyclical and destabilizing banking and financial sector.

Whereas earlier work pointed to textbook-style aggregate-supply and aggregate-demand responses (permanently higher output and permanently lower prices in response to supply shocks, temporarily higher output and permanently higher prices in response to demand shocks), the impulse-responses for the recent period look different. Prices rise rather than falling in response to permanent ("supply") shocks. We interpret this in terms of a hysteresis effect, where positive supply shocks raise profitability and asset prices, setting off an investment boom that so stimulates demand as to offset the normal downward pressure on prices from a positive supply shock. One can equally well imagine the same mechanism operating in reverse in the wake of a negative supply shock, due for example to disruptions to the operation of the financial system like those experienced starting in 2008.

The implication is that stabilizing the Euro Area will require more vigorous, coordinated regulation of the European banking and financial system than in the past. Europe is now moving in this direction with the creation of a Single Supervisor and a common resolution mechanism. The question is whether it is moving fast and far enough. That Single Supervisor has yet to be battle tested. The feasibility of the common resolution mechanism is open to question. The banking union still lacks a common deposit insurance scheme with a fully funded financial backstop. Most troubling in our view is the fact that regulators continue to rely on the banks' own internal models for judging capital adequacy. We worry that, so long as they do, the Euro Area will remain prone to lending booms and busts with undesirable financial consequences.

References

Babecky, Jan, Philip Du Caju, Theodora Kosma, Martina Lawless, Julian Messina and Tairi Room (2010), "Downward Nominal and Real Wage Rigidity: Survey Evidence from European Firms," *Scandinavian Journal of Economics* 112, pp.884-910.

Bauer, Thomas, Holger Bonin, Lorenz Goette and Uwe Sunde (2007), "Real and Nominal Wage Rigidities and the Rate of Inflation: Evidence from West German Micro Data," *Economic Journal* 117, pp.508-529.

Bayoumi, Tamim and Barry Eichengreen (1993), "Shocking Aspects of European Monetary Unificaton," in Francisco Torres and Francesco Giavazzi eds, *Adjustment and Growth in the European Monetary Union*, Cambridge: Cambridge University Press, pp.193-229.

Bernanke, Ben S., Mark Gertler, and Simon Gilchrist (1999) "The Financial Accelerator in a Quantitative Business Cycle Framework," in *Handbook of Macroeconomics Volume 1C*, editors John B. Taylor and Michael Woodford, North Holland, pp. 1341-1393.

Blanchard, Olivier, Eugenio Cerutti and Lawrence Summers (2015), "Inflation and Activity: Two Explorations and their Implications for Monetary Policy," IMF Working Paper 15/230 (November).

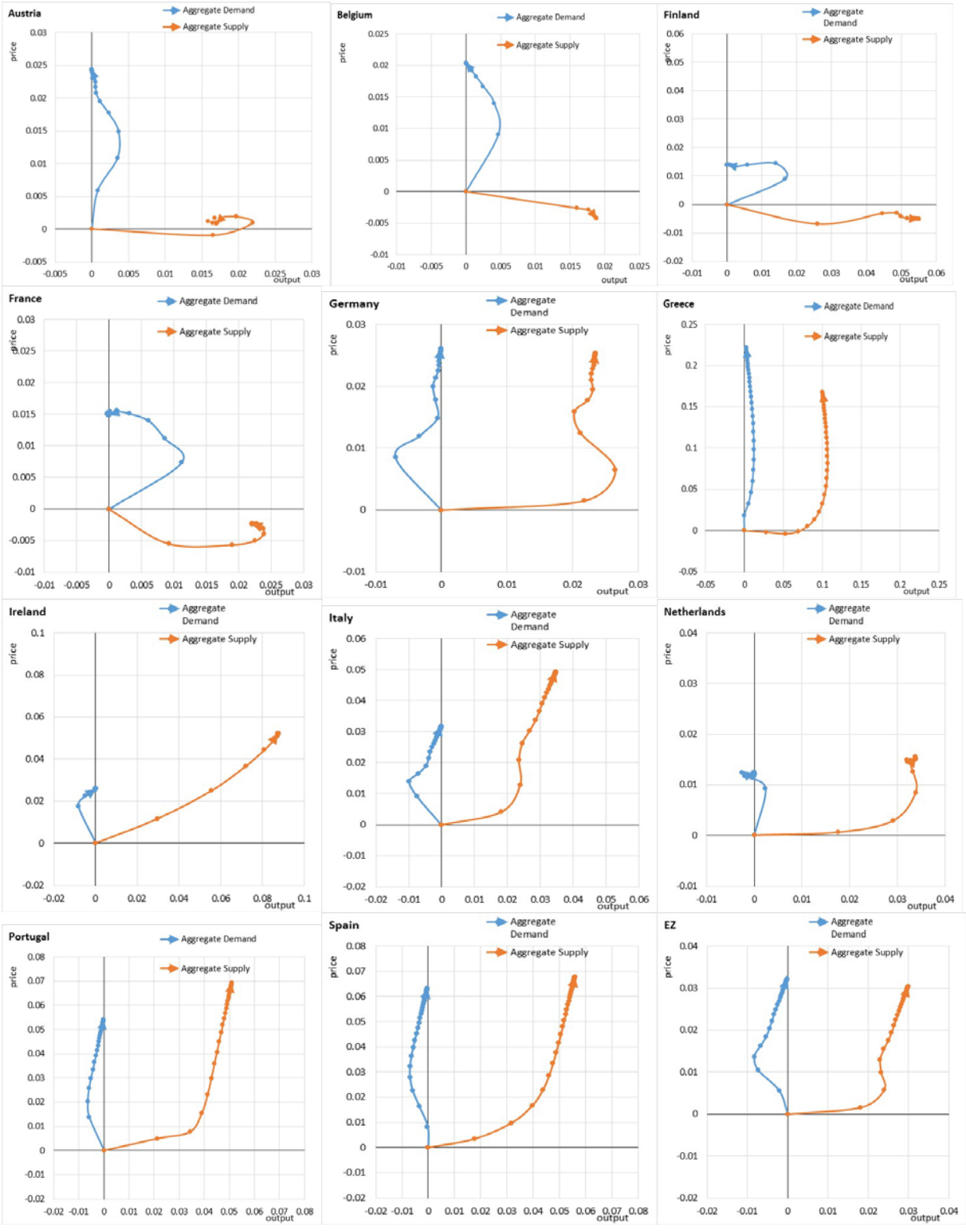
Blanchard, Olivier and Lawrence Summers (1986), "Hysteresis and the European Unemployment Problem," *NBER Macroeconomics Annual* 1, pp.15-90.

Campos, Nauro and Corrado Machiarelli (2016), "Core and Periphery in the European Monetary Union: Bayoumi and Eichengreen 25 Years Later," *Economics Letters* (forthcoming).

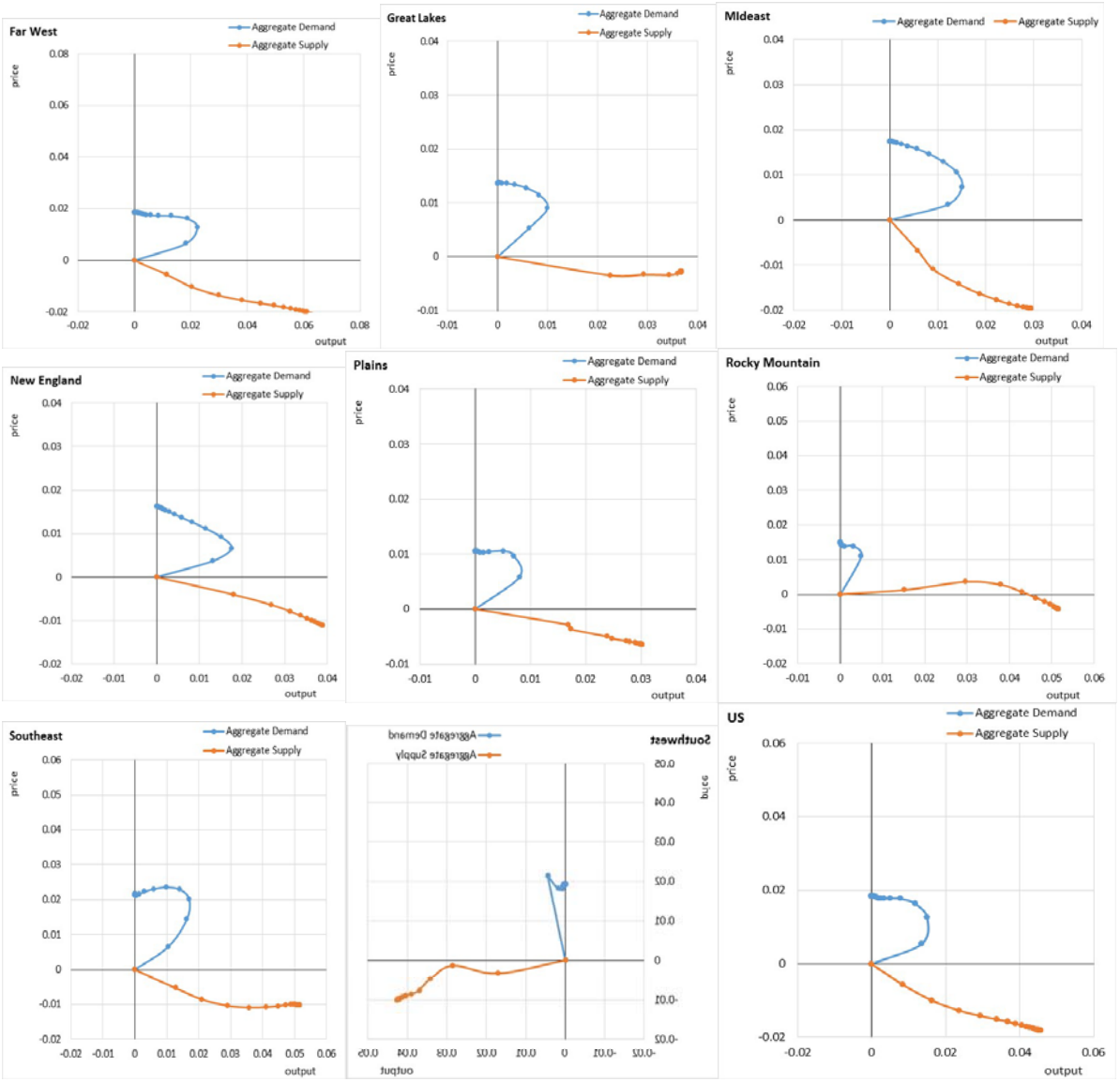
Romer, David (2011), *Advanced Macroeconomics*, New York: McGraw-Hill.

Appendix: IRFs for the Euro area, US Regions, and other Advanced Countries

Euro area countries and Euro area



United States Regions and United States



Other Advanced