

Mark Carney: The economics of currency unions

Speech by Mr Mark Carney, Governor of the Bank of England, at a lunch hosted by the Scottish Council for Development & Industry, Edinburgh, 29 January 2014.

* * *

It is a pleasure to be in Scotland today and to have the opportunity to hear directly from businesses about the economy. The recovery that began in Scotland has now taken hold in the UK with the economy growing at its fastest rate since 2007.

Although a few quarters of above-trend growth driven by household spending represent a good start, they aren't sufficient. Even though employment is growing and unemployment has fallen – particularly so recently in Scotland – the recovery has some way to run before it would be appropriate to consider moving away from the emergency setting of monetary policy. The Monetary Policy Committee has noted that, when the time eventually comes to increase interest rates, any such move would be gradual. That should help to reassure businesses in Scotland and all around the UK that the path of interest rates will be consistent with achieving a sustained and balanced recovery in the face of the remaining headwinds stemming from the financial crisis.

Scotland is a land rich in history and ideas, and one to which I owe a great debt. Scots built the very foundations of my native land, Canada, whose first Prime Minister Sir John A. Macdonald was born in Glasgow. Scots have shaped the modern world through their contributions to culture and science. The pioneering work of Scottish economists from Adam Smith to Sir James Mirrlees has had great influence on my profession. Among them is David Hume, born just a short walk from here and a great friend and collaborator of Smith. While better known as a philosopher, Hume's essay "Of the balance of trade" set out the theory of how trade imbalances between nations sharing a currency (gold) would self-correct as inflows of money to surplus countries raised their prices and reduced their competitiveness.

As an empiricist, Hume would doubtless admit that recent euro area experience of persistent current account deficits leading not to self-correction but instead to crisis requires a more elaborate explanation. Fortunately economists have over the years obliged with substantial work on the economics of currency unions.

Given the recent focus here on the currency and the fundamental role of the Bank of England in maintaining monetary and financial stability across the United Kingdom, I want to draw on that body of economics today to review some of the most important issues with respect to monetary union.

I will stick rigidly to what Thomas Carlyle described as the dismal science. Any arrangement to retain sterling in an independent Scotland would need to be negotiated between the Westminster and Scottish Parliaments. The Bank of England would implement whatever monetary arrangements were put in place.

What follows is not an assessment of whether Scotland will be overall better or worse off under independence – that is a multi-faceted judgement for the Scottish people. It does not pass judgement on the relative merits of the different currency options for an independent Scotland, but instead draws attention to the key issues. This is a technocratic assessment of what makes an effective currency union between independent nations.

The costs and benefits of currency areas

Let me begin by outlining the basic rationale for sharing a currency.

Economist Robert Mundell first wrote about what determined an “optimum currency area”¹ Spurred by the breakdown of the Bretton Woods system and the move to floating exchange rates as well as by the formation of the European Monetary Union, others have elaborated and extended his work. We now have a fairly comprehensive sense of the costs and benefits of sharing a currency.

For Mundell, the main benefit was that it eliminates the transactions costs associated with using, and switching between, different currencies. The European Commission estimated the size of these direct benefits for Europe to be almost 0.5% of GDP every year.²

Sharing a currency can promote investment by reducing uncertainty about currency movements and giving businesses access to deeper, more liquid financial markets.³ It can also reduce borrowing costs for countries with a history of high inflation and currency devaluation. By tying themselves to the mast of the monetary policy of others they can import credibility. This is exactly what the UK and other European countries aimed to do in joining the Exchange Rate Mechanism.

Sharing a currency also helps promote integration. It does so by eliminating one of the barriers between markets, improving transparency of pricing and increasing competition. Sharing a currency can also help to increase the mobility of labour and capital, raise trade in goods and services, and improve the flow of technology and ideas.⁴ In these ways, members of a currency union can exploit more fully comparative advantage and ensure greater dynamic efficiency.

Set against these benefits are the potentially large costs of giving up an independent monetary policy tailored to the needs of the region and a flexible exchange rate that can help absorb shocks.

A flexible exchange rate acts as a valuable shock absorber when domestic wages and prices are sticky.⁵ For example, suppose demand for a country’s exports falls. All else equal, its output will fall, unemployment increase and current account deteriorate. With an independent currency, exchange rate depreciation can dampen these effects by improving competitiveness, and monetary policy can become more accommodative, supporting demand and employment. However, if the country were part of a currency area with its foreign market, its exchange rate would by definition not change, putting the full weight of adjustment on wages and unemployment – a significantly more protracted and painful process. In addition, the responsiveness of monetary policy to weak demand in that country would be diluted by the needs of the broader membership.

Being in a currency union can amplify fiscal stress, and increase both the risks and consequences of financial instability. In the situation just described, fiscal policy would ideally help smooth adjustment to the external shock. But its ability to do so could be limited by the budgetary impact of the falls in output, prices and wages. To maintain credibility, fiscal policy

¹ Mundell (1961).

² Commission of the European Communities (1990).

³ The elimination of currency risk within the area reduces uncertainty over future prices for firms and consumers, helping them to make better decisions about how much to produce, invest and consume. These benefits are hard to quantify, but probably important. It also avoids inefficiencies that can arise when the exchange rate fluctuates for non-fundamental reasons (Mundell 1973, Buiters 2000).

⁴ A substantial literature has sought to measure the impact of currency unions on trade flows, starting with Rose’s (2000) surprising estimate that they are associated with a tripling in trade flows. Subsequent work suggests smaller impacts. In relation to the Eurozone, a survey by Rose (2009) concludes that “EMU has raised trade inside the Eurozone by at least 8% and perhaps 23%”. De Grauwe and Mongelli (2005) survey the broader ways in which currency unions promote integration.

⁵ If wages and prices can adjust instantaneously then the adjustment to shocks can happen costlessly via movements in prices and wages, so there is no cost to losing exchange rate flexibility.

may even become pro-cyclical, with the resulting austerity exacerbating the initial fall in demand. In the extreme, adverse fiscal dynamics could call into question a country's membership of the union, creating the possibility of self-fulfilling "runs" on bank and sovereign debt absent central bank support.⁶ Such adverse feedback loops turned recessions into depressions in several European countries in recent years.

What makes a successful currency union?

The success of a currency area hinges on whether its features mitigate the costs of losing the flexibility that comes from an independent monetary policy. These features generally promote the alignment of economic cycles, and the maintenance of price and financial stability within the union.

The most obvious feature is the degree of similarity amongst members. Similar economies won't suffer from a "one size fits all" monetary policy.⁷ Surprisingly, a review of major currency areas suggests that similarity is neither necessary nor sufficient for success. For example, the industrial structures of the core and periphery of the euro area are more similar than those of the constituents of Canada or the US (table 1). Yet few would argue that the euro area is the most effective currency union of the three. Conversely, the Canadian monetary union works well despite having substantially larger industrial variation than even the US.⁸

The similarity of the industrial structure of Scotland and the rest of the UK depends on how offshore oil is allocated. With oil split on a per capita basis Scotland and the rest of the UK look about as similar as the core and periphery of the euro area; but with oil split on a geographic basis they look about as diverse as the United States (table 1). Despite any differences, the close integration of the Scottish and rest of UK economies has helped ensure that their economic performance has been very similar over a long period – output growth is highly correlated (chart 1).⁹

So theory notwithstanding, being similar doesn't necessarily help and being different doesn't necessarily hinder. This suggests we should look elsewhere for the ingredients of a successful union: to the mobility of labour, capital and goods; to institutional structures promoting financial stability; and to institutions that mutualise risks and pool fiscal resources.

An economic union with free movement of labour, capital and goods

The "five tests" formulated by the UK Government to analyse the merits of joining the euro in 2003 were crafted in large part around the degree of integration of the UK and the euro area.¹⁰ That is because greater openness and integration within a currency union not only enhances

⁶ These dynamics were in operation in the recent euro area crisis, until the announcement of the ECB's Outright Monetary Transactions.

⁷ Members are similar when they experience similar shocks and respond to the same shock in similar ways. That reduces the likelihood of a shock affecting one part of the currency union, and hence reduces the need for the exchange rate to adjust. Kenen (1969) argued that more diversified economies were better candidates to join currency unions because industry-specific shocks were less likely to have macroeconomic effects, reducing the need for exchange rate adjustment.

⁸ See Carney (2013).

⁹ Moreover unit labour costs in Scotland and the UK as a whole have moved closely together (chart 2), whereas large relative movements in the Eurozone imply divergences in competitiveness (chart 3).

¹⁰ The five tests focused on the degree of convergence between the UK and the rest of Europe, the degree of flexibility to adjust without moves in the exchange rate, and on whether joining would promote investment, financial services, and growth, stability and employment (HM Treasury 2003).

the benefits of a shared currency but can also mitigate the cost of losing exchange rate flexibility.¹¹

Mundell originally argued that currency areas should coincide with regions which had high internal factor mobility.¹² The idea was that by moving from areas where demand has fallen to those where it has risen, workers help moderate changes in wages and unemployment.¹³

There are clear practical impediments to labour mobility within the euro area including language and culture. As a consequence, it has the lowest cross-border mobility of the five currency unions in table 2.¹⁴ This has contributed to the need for painful internal devaluation for some countries in the euro area to restore competitiveness.

Given that more than 700,000 Scots live in the rest of the United Kingdom and over 500,000 from the rest of the UK live in Scotland, one would be tempted to assume that labour mobility between the two is high.¹⁵ In fact gross migration flows between Scotland and the rest of the UK are lower than in the constituent parts of some other currency areas (table 2).

That probably in part reflects the fact that economic conditions in Scotland and the rest of the UK have been very similar, such that the incentive for migration is relatively limited. It is reasonable to think that the similarities between Scotland and the rest of the UK mean that there is the potential for higher labour mobility should that become necessary. Given differences in industrial structure, this would put a premium on ensuring barriers to mobility are not allowed to develop if monetary arrangements were to change.

It is not just an integrated labour market that helps adjustment within a currency union. Openness to trade and free movement of goods also assists in diluting the effect of shocks by spreading them across the union. If one part of the union imports a large share of what it consumes from other parts, changes in demand will be quickly transmitted. This helps to align economic cycles and makes a common monetary policy more appropriate.^{16, 17}

¹¹ The classic early contribution on this point was made by McKinnon (1963), who argued that the more open the economy, the more flexible would be domestic prices and wages so that movements in the exchange rate would have little impact on competitiveness, and would be less effective as a stabiliser. In that case moving to a fixed exchange rate would be less costly.

¹² Mundell (1961).

¹³ Some, including Bean (1992), have expressed scepticism that factors of production could in fact move over a shorter timescale than that over which prices and wages adjust.

¹⁴ This is consistent with evidence that labour moves less in Europe in response to regional shocks than is the case in the US – see Blanchard and Katz (1992) for the US, and Decressin and Fatas (1995) who apply the same methodology to Europe. The latter find that participation reacts by more to a labour demand shock, and migration by less in Europe than the US.

¹⁵ Office for National Statistics, 2011 Census.

¹⁶ Frankel and Rose (1998) found that countries with closer trade links tend to have more tightly correlated business cycles. Since joining a currency area promotes trade integration, it also is also likely to help align international business cycles. That means one of the key optimum currency area criteria is endogenous to the decision to join. Rose's (2009) more recent meta-analysis also finds a significant effect of trade on the synchronisation of business cycles.

De Grauwe (2000) provides a discussion of how closer integration may affect the likelihood that countries experience asymmetric shocks. On the one hand closer trade links could result in greater specialisation, leaving currency union members more prone to asymmetric shocks. On the other, it could result in more intra-industry trade, increasing the likelihood that countries will experience similar shocks, and thereby helping to align business cycles.

¹⁷ A high degree of openness also means that the adjustment required to boost net exports is somewhat lower. A much weaker adjustment in prices and wages is necessary to raise net exports by a given share of GDP if both exports and imports are a large share of GDP than if they are a small share, Krugman (1992). However Adrian and Gros (2004) observe that open economies are correspondingly more vulnerable to external shocks.

Scotland and the rest of the UK are highly integrated. 70% of Scottish exports are destined for, and 74% of imports into Scotland come from, the rest of the UK (table 3). A word of caution applies here. There is a body of evidence that national borders can influence trade flows, even between otherwise highly integrated economies.¹⁸ The high degree of integration between Scotland and the rest of the UK may in part depend on their being part of the same sovereign nation.

Mobility of capital can also promote necessary adjustment to shocks. Moreover, if capital in one part of a union is owned by those in other parts, the effect of a given shock is diluted across the union. Simply put, risks and rewards are shared. Similarly, the ability to borrow from other parts of the currency union in deep and liquid cross-union credit markets or integrated banking systems allows one part of a union to smooth out temporary falls in incomes.¹⁹

However, free movement of capital can be a mixed blessing. If the funds provided by one part of a union to another can be withdrawn easily, these outflows can – if the right structures are not in place – undermine financial and economic stability of all members.

This brings me to the second feature of a successful currency union – banking union.

Banking union

Effective currency unions need a wide range of institutions to support an integrated and efficient financial sector. These are often referred to as a “banking union” and include:

- Common supervisory standards,
- Access to central bank liquidity and lender of last resort facilities,
- Common resolution mechanisms, and
- A credible deposit guarantee scheme.

Without a banking union, cross-border capital flows can be restricted, the effectiveness of monetary policy impaired and, in the extreme, the viability of the union itself undermined.

It is as difficult to separate the institutions that support banking union from national fiscal arrangements as it is to separate the creditworthiness of banks and sovereigns. Let me explain.

In recent years, doubts about the resilience of major financial institutions have created expectations of sovereign support. The scale of these potential liabilities can in turn generate doubts about public finances undermining the resilience of both banks and sovereigns.

When such concerns emerge, the consequences can be dramatic. The banking systems of peripheral European countries experienced outflows of between 10% and 85% of total deposits from elsewhere in the euro area in the three years following June 2010 (chart 4). Bank funding spreads in those countries ballooned by 5 percentage points from the beginning of 2010 to the

¹⁸ Borders seem to matter. Trade between countries tends to be much more limited than trade within countries, as shown for Canada and the US by McCallum (1995). There is also evidence for a border effect for financial integration – there is more risk sharing through financial markets within countries than between countries (see e.g. Crucini 1999). Rose and van Wincoop (2001) assess to what extent national currencies are a barrier to trade, and find that trade barriers associated with national borders are halved when countries join a currency union.

¹⁹ Mundell (1973). Asdrubali et al (1996) estimate that for the US risk-sharing in private markets is quantitatively important in stabilising output at the state level.

middle of 2012 (chart 5). Bank lending to the real economy collapsed and credit conditions tightened massively (see charts 6–7).^{20, 21}

Clearly something must be done.

It is in the interests of all countries to sever the link between banks and sovereigns by ending too big to fail. Governments must put in place regimes that impose losses on bank management, shareholders and creditors rather than taxpayers. That is exactly what is established by the UK's recent Banking Reform Act, and the recently agreed European Bank Resolution and Recovery Directive. The Bank of England is at the forefront of efforts to establish the common global requirement that is needed to finish the job.

While ending too big to fail should mean that taxpayers no longer have to bail out banks, it will not fully break the bank-sovereign loop, for three reasons.

First, banks hold substantial amounts of their national government's debt in order to manage liquidity, meet collateral obligations and hedge exposures – European banks hold more than €1trn of home country sovereign debt amounting to 5% of total assets.

Second, confidence in deposit guarantee schemes relies on a national backstop.²² The European process illustrates the difficulty of building the institutional arrangements for a common insurance scheme across sovereign states. This is unsurprising since mutualised deposit guarantee schemes imply a pooling of risk and loss of sovereignty. All member states must be persuaded that they won't simply be left with the bill for the mistakes of others.

Third, a currency union requires a common fiscal backstop for its central bank. Central banks must be able to act as Lender of Last Resort, both to financial institutions that are solvent but experiencing an unwarranted loss of confidence and to provide bridging finance to institutions that are being recapitalised using new resolution regimes. Under the current governance arrangements in the UK, these operations require an indemnity from, and the approval of, the Chancellor, because they would put substantial public funds at risk.

The existing banking union between Scotland and the rest of the United Kingdom has proved durable and efficient. Its foundations include a single prudential supervisor maintaining consistent standards of resilience, a single deposit guarantee scheme backed by the central government, and a common central bank, able to act as Lender of Last Resort across the union, and also backed by the central government. These arrangements help ensure that Scotland can sustain a banking system whose collective balance sheet is substantially larger than its GDP.

The euro area has shown the dangers of not having such arrangements, as well as the difficulties of the necessary pooling of sovereignty to build them. An independent Scotland would need to consider carefully how to develop arrangements with the continuing United Kingdom that are both consistent with its sovereignty and sufficient to maintain financial stability.

²⁰ That in turn contributed to the divergence in output growth between core and periphery (chart 8). In the UK the share of mortgage lending in Scotland has been essentially flat through the crisis period (chart 9), suggesting that there has been little if any divergence in credit conditions between the UK and Scotland.

²¹ This downward spiral of confidence can be most acute in countries with large banking sectors relative to their economies – Iceland, Ireland and Cyprus all had banking sectors exceeding 600% of GDP in 2007 (table 4). In the extreme, doubts about the sustainability of a nation's membership of the currency union can only be relieved by massive external support.

²² In theory these could be pre-funded. For small countries with large, concentrated banking systems, pre-funded schemes are unlikely to be realistic in the short-term. Protected Scottish retail bank deposits are over 100% of GDP, compared to around 50% for the rest of the UK. New European rules mandate deposit guarantee funds to be built up only slowly over a decade and even then only to less than one per cent of insured deposits.

Fiscal arrangements

While banking union requires common fiscal backing, there are two broader justifications for shared fiscal arrangements within a currency area.

The first is that deeper fiscal integration between members can play an important role in smoothing shocks that affect only part of the currency area.²³

It is no coincidence that effective currency unions tend to have centralised fiscal authorities whose spending is a sizeable share of GDP – averaging over a quarter of GDP for advanced countries outside the euro area (table 5). That offers scope for a significant degree of stabilisation, much of it happening automatically as slowing growth in one part of the union causes tax revenues there to fall and welfare spending to increase. Those automatic fiscal stabilisers are important within the UK – it is estimated that for every £1 that output falls the reduction in taxes and increases in transfers are together worth about 50 pence.²⁴

What matters for individuals is the extent to which this risk sharing insulates their disposable income from shocks. In the UK there is evidence that around a fifth of variation in regional personal income relative to the national average is stabilised by central government transfers. That is probably an important factor in accounting for the close harmonisation of economic performance within the UK. The degree of stabilisation in France and the US is similar, with a slightly lower figure for Canada.²⁵

Fiscal stabilisation is particularly important in a currency union because it helps mitigate the loss of exchange rate flexibility. But being in a currency union can amplify fiscal stress for individual nations, limiting their ability to perform this valuable role just when it is most needed. So it makes sense to share fiscal risks across the whole currency area. A localised shock is less likely to stretch the fiscal position in a larger more diversified currency area, especially if it shifts demand between different parts of the area. That makes a given shock to Nova Scotia less severe than the equivalent to Portugal.

The second justification for shared fiscal arrangements is that problems in one country are very likely to spill over to others. For example, the threat of default by one country may trigger a generalised crisis, particularly if the liabilities of the crisis country are held by the banking system of the broader currency area. It will be in the interests of other countries in the union to bail out a country in crisis, and that reduces the incentives for countries to run their finances prudently in the first place. At a minimum, this “moral hazard” problem suggests the need for tight fiscal rules, to enforce prudent behaviour for all in the union, although credible sanctions for breaking those rules are hard to develop.²⁶

There is an obvious tension between using robust fiscal rules to solve this problem, and allowing national fiscal policy to act as a shock absorber. This reinforces the need for fiscal risk sharing between nations.

As the Presidents of the European Council, European Commission, Eurogroup and European Central Bank argued in their report, European monetary union, which has so far relied on fiscal rules, will not be complete until it builds mechanisms to share fiscal sovereignty.²⁷ Possible

²³ Kenen (1969).

²⁴ This refers to a fall in output relative to potential output. See Chamberlin et al (2013).

²⁵ These estimates are reported in Melitz and Zumer (2002).

²⁶ The Delors Committee (1989) report, which provided the foundation for monetary union in Europe, recognised that market discipline would not be sufficient to ensure that participating countries followed sound fiscal policies, and that fiscal constraints would therefore be required. Beetsma and Uhlig (1999) provide a formal motivation for the resulting stability and growth pact as a device to internalise the costs of inflation that might otherwise result from imprudent fiscal policies. See also Chari and Kehoe (2007). Recent experience demonstrates that over-indebtedness can also have costly spillovers through financial crises.

²⁷ See Barroso et al (2012).

options range from a transfer union to a pooled employment insurance mechanism. Whatever is ultimately chosen, the degree of fiscal risk sharing will likely have to be significant.

Similarly, in a monetary union between an independent Scotland and the rest of the UK the two Parliaments would have to agree on whether fiscal rules were sufficient or whether similar risk-sharing mechanisms were necessary.

Conclusion

The Scottish government has stated that in the event of independence it would seek to retain sterling as part of a formal currency union. All aspects of any such arrangement would be a matter for the Scottish and UK Parliaments. If such deliberations ever were to happen, they would need to consider carefully what the economics of currency unions suggest are the necessary foundations for a durable union, particularly given the clear risks if these foundations are not in place.

Those risks have been demonstrated clearly in the euro area over recent years, with sovereign debt crises, financial fragmentation and large divergences in economic performance. The euro area is now beginning to rectify its institutional shortcomings, but further, very significant steps must be taken to expand the sharing of risks and pooling of fiscal resources. In short, a durable, successful currency union requires some ceding of national sovereignty.

It is likely that similar institutional arrangements would be necessary to support a monetary union between an independent Scotland and the rest of the UK.

I suspect you have reached your limits of endurance of the dismal science, so you'll be relieved to know that economics can take us no further. Decisions that cede sovereignty and limit autonomy are rightly choices for elected governments and involve considerations beyond mere economics. For those considerations, others are better placed to comment.

References

- Adrian, T., and D. Gros (2004), “The degree of openness and the cost of fixing exchange rate”, *Economics Letters*, Vol. 83, Issue 1, Apr, pp 141–146.
- Asdrubali, P., B. Sorensen and O. Yosha (1996), “Channels of Interstate Risk Sharing: United States 1963-1990”, *Quarterly Journal of Economics*, CXI, Nov: pp 1081–1110.
- Barroso, J., M. Draghi, J-C. Juncker and H. Van Rompuy (2012), “Towards a genuine economic and monetary union”, available at http://www.consilium.europa.eu/uedocs/cms_Data/docs/pressdata/en/ec/134069.pdf.
- Bean, C. (1992), “Economic and Monetary Union in Europe”, *The Journal of Economic Perspectives*, Vol. 6, No. 4 (Autumn), pp 31–52.
- Beetsma, R. and H. Uhlig (1999), “An Analysis of the Stability and Growth Pact”, *The Economic Journal*, Vol. 109, No. 458 (Oct.), pp 546–571.
- Blanchard, O. and L. Katz (1992), “Regional Evolutions”, *Brookings Papers on Economic Activity*, 1: 1–77.
- Buiter, W. (2000), “Optimal currency areas: why does the exchange rate regime matter? (with an application to UK membership in EMU)”. *CEP Discussion Paper* 462.
- Carney, M. (2013), “Canada Works”, remarks at Board of Trade of Metropolitan Montreal, available at <http://www.bankofcanada.ca/wp-content/uploads/2013/05/remarks-210513.pdf>.
- Chamberlin, G., Dhami, P., Farrington, S., Helgadottir, T. and Robins, J. (2012), “Cyclically adjusting the public finances”, *Office for Budget Responsibility Working Paper* No. 3, <http://budgetresponsibility.org.uk/pubs/Working-paper-No3.pdf>.
- Chari, V., and P. Kehoe (2007), “On the need for fiscal constraints in a monetary union”, *Journal of Monetary Economics*, Vol. 54, Issue 8, Nov. 2007, pp. 2399–2408
- Commission of the European Communities (1990), “One market, one money: an evaluation of the potential benefits and costs of forming an economic and monetary union”, *European Economy*, No. 44, Oct.
- Crucini, M. (1999), “On International and National Dimensions of Risk Sharing”, *Review of Economics and Statistics*, LXXXI, 1, Feb., pp. 73–84.
- Decressin, J. and A. Fatas (1995), “Regional Labour Market Dynamics in Europe”, *European Economic Review*, Vol. 39: pp. 1627–1655
- De Grauwe, P. (2000), “The Economics of Monetary Union”, 4th ed., Oxford University Press, Oxford.
- De Grauwe, P. and F. Mongelli (2005), “[Endogeneities of Optimum Currency Areas: What Brings Countries Sharing a Single Currency Closer Together?](#)”, *ECB Working Paper* No.468, Apr.
- Delors Committee: Committee for the Study of Economic and Monetary Union (1989), “Report on Economic and Monetary Union in the European Community”, Luxembourg: Office for Official Publications of the European Communities.
- Frankel, J. (2008), “The Estimated Effects of the Euro on Trade: Why Are They Below Historical Effects of Monetary Unions Among Smaller Countries?”, *NBER working paper* 14542.
- Frankel, J. and Rose, A. (1998), “The Endogeneity of Optimum Currency Areas Criteria”, *The Economic Journal*, Vol. 108, Jul, pp. 1009–1025.
- [Frankel, J. and Rose, A. \(2002\)](#), “An Estimate of the Effect of Common Currencies on Trade and Income”, *Quarterly Journal of Economics*, 117, pp. 437–466.

HM Treasury (2003), "UK membership of the single currency – an assessment of the five economic tests", CM 5776, London, HMSO, Jun.

Kenen, P (1969), "The Theory of Optimum Currency Areas: An Eclectic View," in Robert Mundell and Alexander Swoboda (eds), *Monetary Problems of the International Economy*, Chicago: University of Chicago Press, pp.41–60.

Krugman, Paul R. (1992) "Policy Problems of a Monetary Union", pp. 185 – 203 in Krugman, Paul R. (1992) *Currencies and Crises* (Cambridge Ma, and London: MIT Press).

Melitz, J. and Zumer, F. (2002). "Regional Redistribution and Stabilization by the Center in Canada, France, the UK and the US: A Reassessment and New Tests". *Journal of Public Economic*, 86, pp. 263–286.

McCallum, J. (1995), "National borders matter: Canada-US regional trade patterns", *The American Economic Review*, 85 (3), 615–623.

McKinnon, R., (1963), "Optimum currency areas", *American Economic Review*, Vol. 53, Sep, pp. 717–25.

McKinnon, R., (2004), "Optimum Currency Areas and Key Currencies: Mundell I vs. Mundell II", *Journal of Common Market Studies*, Vol. 42. Number 4. pp. 689–715.

Mundell, R. (1961), "A theory of optimum currency areas", *American Economic Review*, Vol. 51, Sep.

Mundell, R. (1973), "Uncommon Arguments for Common Currencies", in Johnson, H.G. and Swoboda, A.K. (eds).

Persson, T. and G. Tabellini (1996), "Federal Fiscal Constitutions: Risk Sharing and Moral Hazard", *Econometrica* 64(3): pp. 623–646.

Rose, A. (2000), "One money, one market: estimating the effect of common currencies on trade", *Economic Policy*, Vol. 15, April, pp. 7–45.

Rose, A. and van Wincoop, E. (2001), "National money as a barrier to international trade: The real case for currency union", *American Economic Review* 91(2), pp.386–390.

Rose, A., (2009), "Is EMU becoming an optimum currency area? The evidence on trade and business cycle synchronization", *mimeo*.

TABLE AND CHART ANNEX⁽ⁱ⁾

Table 1: Similarity of industrial structures

	EA (Core vs VEAPs) ^(a)	EA (17 countries) ^(b)	rUK and Scotland ^(c)	rUK and Scotland (oil on geographic basis) ^(d)	Canada (13 provinces and territories)	US (50 states + DC)
Energy	0.1	1.0	1.8	10.0	11.5	3.1
Construction	0.6	1.3	0.1	0.7	1.3	0.6
Manufacturing	1.3	6.1	0.7	0.5	4.8	4.5
Finance and insurance	0.3	2.5	0.8	1.4	2.2	3.2
Other	0.3	5.6	1.5	7.4	8.5	5.2
Sum	2.6	16.4	4.7	20.1	28.3	16.6

Sources: Bank calculations; Statistics Canada; US Bureau of Economic Analysis; Eurostat; ONS Regional Gross Value Added. rUK and Scotland data are for 2011; Euro Area (EA), US and Canada data are for 2012. Industrial classifications in the US and Canada are NAICS, in the UK SIC, and in the Euro Area they are NACE Rev2. These were consolidated into the five broader industrial classifications to ensure consistency.

Notes: The table shows absolute differences between output industry shares in each region and the monetary union as a whole, which are then averaged for each industry in each monetary union. The sum of each column is the Krugman Specialisation Index (multiplied by a factor of 100) and is a measure of dispersion of industrial structure. A value of 0 indicates all regions within a monetary union have an identical industrial structure. The higher the index, the more diverse the industrial structure across regions. A more detailed description of different indexation measures of specialisation can be found in Appendix B of [EMU and business sectors](#) (HM Treasury).

(a) Based on data for Vulnerable Euro Area Periphery economies (VEAPS) (Ireland, Portugal, Spain, Greece, Italy) and core (all other EA countries).

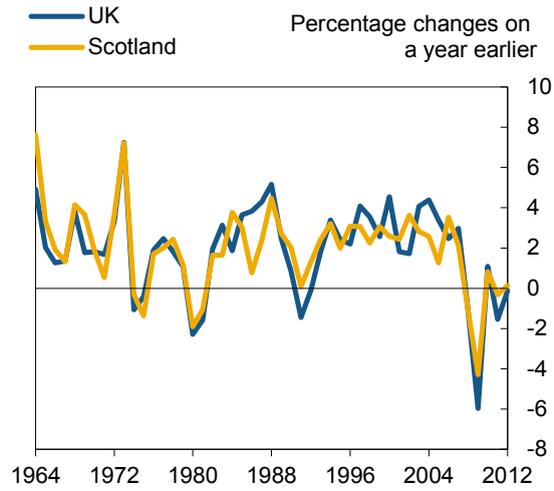
(b) Based on data for 17 Euro Area (EA) countries (all EA countries excluding Malta).

(c) Estimates for rUK and Scotland exclude the 'extra-regio' contribution from North Sea mining & extraction.

(d) The contribution from 'extra-regio' mining & extraction is allocated on a 'geographical' basis. This assumes that around 90% is allocated to Scotland and 10% to the rest of the UK. This is in line with estimates proposed by Professor Kemp and used by the Scottish Government. Used here for illustrative purposes.

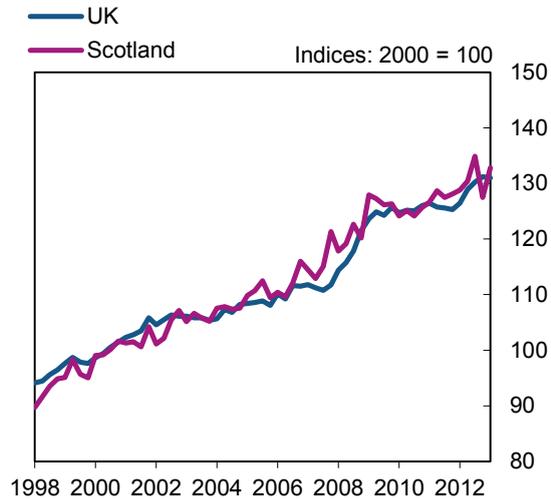
(i) Throughout this annex the abbreviation 'rUK' refers to the UK excluding Scotland.

Chart 1: UK and Scottish onshore GDP per capita



Source: Bank calculations; Scottish Government GDP statistical bulletin (2010Q1 and 2013Q3); ONS UK real GVA ex oil and gas extraction (KLS2 & UIZY); ONS mid-year population estimates; General Register Office Scotland; OECD.

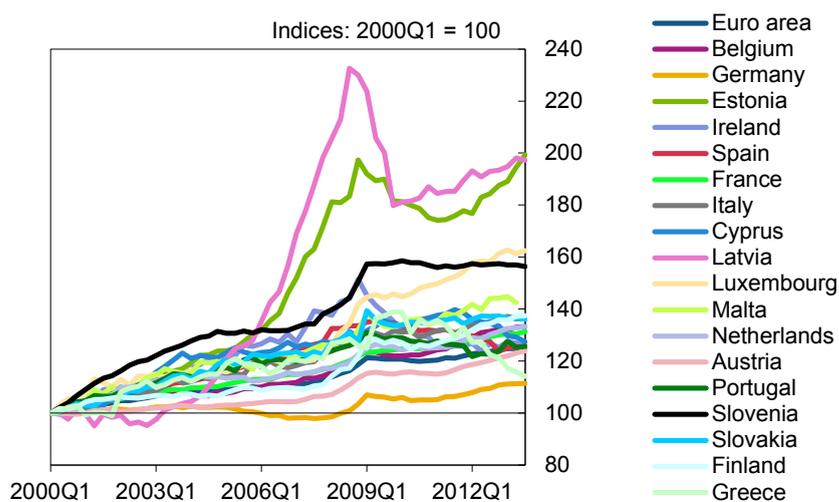
Chart 2: Unit wage costs in the UK and Scotland



Sources: Bank calculations; ONS Gross weekly earnings by region (EARN05); ONS real GDP (ABMI); Scottish Government GDP statistical bulletin 2013Q3; Labour Force Survey. Gross weekly earnings seasonally adjusted in-house.

Notes: Unit wage costs calculated as gross weekly earnings divided by real output per worker for the UK and Scotland.

Chart 3: Unit labour costs in the Euro area^(a)



Sources: DataStream, Eurostat and Bank Calculations.

Notes: Greek data seasonally adjusted by Bank of England.

Table 2: Labour mobility estimates, 2010

Regions	Annual gross migration flows/population, %
US: between 50 states	2.4
Australia: between 8 states/territories	1.5
Canada: between 10 provinces/territories	1.0
Scotland/rUK	0.6
EU27: between 27 countries	0.3

Sources: OECD; Bank calculations using General Register Office Scotland Migration Statistics and ONS mid-year population estimates. All data are for 2010.

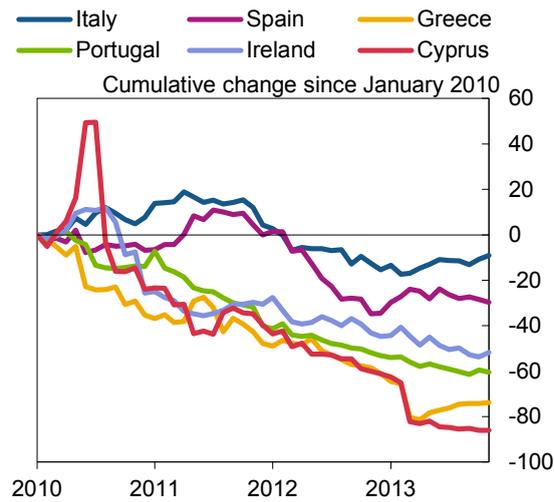
Notes: Population mobility estimates are shown for the UK, Australia, Canada and the United States and labour force mobility for the EU.

Table 3: Nominal export and import shares in 2013

Export Shares	2013 Q1 & Q2
rUK (to Scotland)	14%
Scotland (to rUK)	70%
Import Shares	
rUK (from Scotland)	8%
Scotland (from rUK)	74%

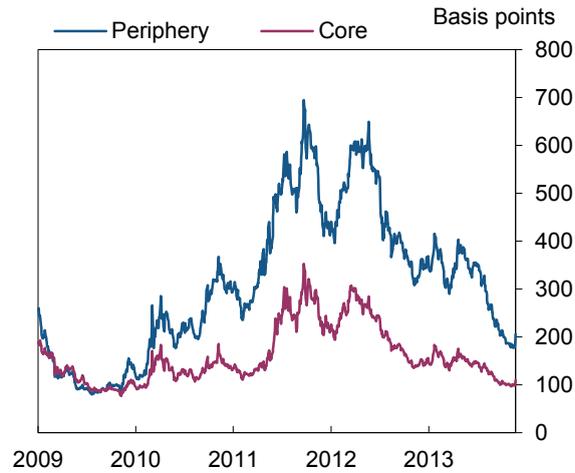
Sources: Bank calculations; ONS Quarterly National Accounts (2013Q3); Quarterly National Accounts Scotland (2013Q2)

Chart 4: Cumulative change in MFI deposits from other euro-area countries (all sectors)



Sources: ECB and Bank calculations.

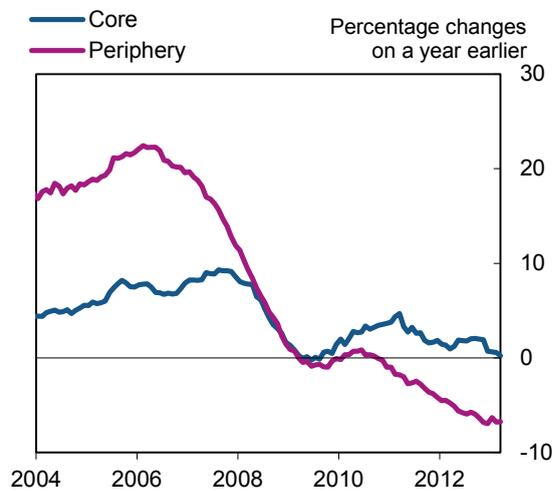
Chart 5: Cost of default protection for euro area core and periphery banking systems



Sources: Markit Group Limited, SNL Financial, Thomson Reuters Datastream and Bank calculations.

Notes: Asset-weighted five-year senior CDS premia for major banks in each country. 'Periphery' covers Greece, Ireland, Italy, Portugal and Spain. 'Core' covers Austria, Belgium, France, Germany and the Netherlands.

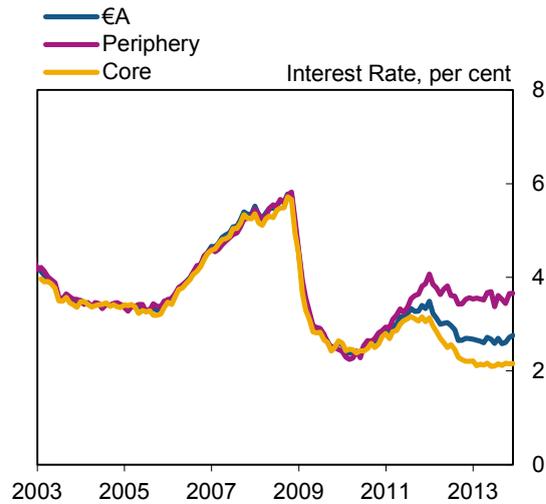
Chart 6: Real economy lending growth – core/periphery divergence



Sources: ECB and Bank calculations.

Notes: Periphery includes Greece, Ireland, Portugal and Spain. Core includes Austria, Finland, France, Germany, Luxemburg and the Netherlands. Lending to non-MFIs excluding general government (adjusted for sales and securitisation). Weighted using 2012 GDP weights.

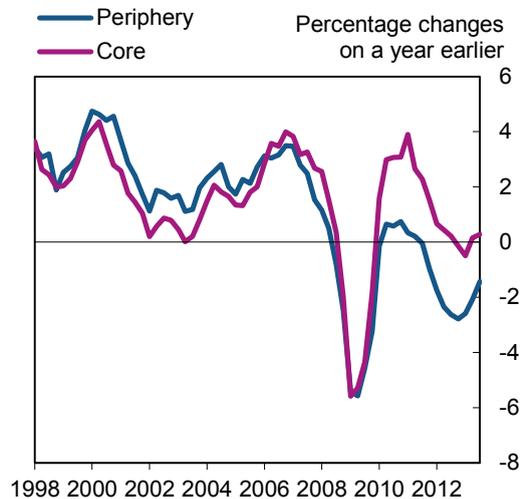
Chart 7: Euro area non-financial corporations loan rates – core/periphery divergence



Sources: ECB and Bank calculations.

Notes: Average interest rate on new lending to NFCs (excluding revolving loans and overdrafts, convenience and extended credit card debt). Core: Austria, Belgium, Germany, Finland, France and Netherlands. Periphery: Italy, Portugal, Spain and Ireland. Weighted using shares in 2012 nominal GDP.

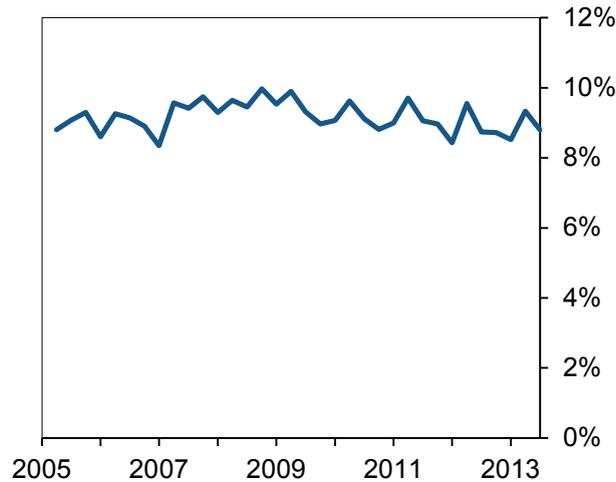
Chart 8: Euro area core/periphery output growth



Sources: Eurostat and Bank calculations.

Notes: Based on data for Vulnerable Euro Area Periphery economies (VEAPS) (Ireland, Portugal, Spain, Greece, Italy) and core (all other EA countries excluding Malta). Data up to 2013Q3.

Chart 9: Scottish mortgage loans as a share of the UK total



Source CML.

Note: Number of Scottish regulated mortgage loans as a share of the UK total.

Table 4: Banking sector size as multiple of GDP^(a)

2012	
Scotland	12.5
rUK	4.3
2007	
Ireland	7.1
Iceland ^(b)	7.4
Cyprus	6.6
Spain	3.2
UK ^(c)	5.1
US ^(d)	1.2

Sources: Bank of England, ECB, Central Bank of Iceland, Datastream, Federal Reserve and Bank of England calculations.

(a) Banking assets of euro area countries are recorded in the country where the parent entity is domiciled and includes all EU assets. Assets reflect gross derivative positions.

(b) Iceland data reflects net derivative positions and includes resident banks' domestic and foreign assets.

(c) 2012 UK data taken from the HMT's 'Scotland analysis: Financial services and banking', for methodology see https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/206166/banking_assets_vs_gdp_explanation.pdf. 2007 UK data use the same methodology.

(d) US data is based on US GAAP accounting principles. 2007 US data is break-adjusted by Bank of England staff to include assets of several large bank holding companies (BHCs) that became BHCs in 2009, and so were previously excluded from the data.

Table 5: General and central government expenditure as % GDP

	General government expenditure, % of GDP ^{(a)(b)}	Central government expenditure, % of GDP ^{(a)(b)}
Australia	36	26
Austria	53	27
Belgium	53	30
Canada	44	17
Czech Republic	44	30
Denmark	58	42
Estonia	40	30
Finland	56	28
France	57	24
Germany	48	16
Greece	51	40
Hungary	50	33
Iceland	52	40
Ireland	65	58
Israel	45	39
Italy	50	29
Japan	41	18
Korea	30	20
Luxembourg	44	31
Mexico	23	19
Netherlands	51	31
Norway	45	36
Poland	45	27
Portugal	51	39
Slovak Republic	40	23
Slovenia	49	31
Spain	46	19
Sweden	52	30
Switzerland	34	11
Turkey	40	29
United Kingdom	50	46
United States	43	26

Source: OECD

Notes: Table shows ratios of nominal government expenditure to nominal GDP for 2010.