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SCOTLAND'S LENDER OF LAST RESORT OPTIONS

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- Scotland's lender of last resort options depends on its choice of currency. If Scotland becomes independent, there is no question that it could use sterling. But this looks likely to be without the backing of the UK government and therefore without the Bank of England. Using sterling in these circumstances would constitute an informal currency union or 'dollarization'.

- An independent Scotland would require a financial border to create its own balance of payments. This would include cross border trade and capital flows to and from the rest of the world, including the rest of the UK. With dollarization, the balance of payments would become the key barometer of whether the Scotland's economy prospers or declines.

- Banking groups will also have to decide which side of the financial border to register. Where banks are registered (incorporated) matters for which government provides the deposit insurance, who regulates the banks, who is likely to receive emergency liquidity support and which taxpayers pay for any losses in the case of future failures.

- The Bank of England carries out regular sterling liquidity operations with banks from all over the world, and would surely do so for banks from an independent Scotland. But in times of financial distress, when liquidity insurance is most valuable, the Chancellor decides emergency sterling liquidity assistance, presumably in the rest of the UK's interests.

- The back-stop for lender of last resort is always the state (or the IMF). The Scottish government could, in theory, use foreign exchange and fiscal reserves to provide lender of last resort support to banks. But if the Scottish government accepts its 'fair share' of assets and liabilities, it would have small foreign exchange reserves and a high public debt burden.

- This paper looks at three possible solutions: creating a new Scottish Insurance Fund, negotiating a commercial lender of last resort line of credit with the Bank of England and whether the nascent European Banking Union could be a lender of last resort. We suspect that the only realistic option involves terms that would not be acceptable any government.

- Without a credible solution to the lender of last resort, the Prudential Regulatory Authority is likely to require systemically important banks using sterling to be domiciled in the UK. Shareholders, customers and rating agencies are also all likely to prefer systemically important banks to be located in the UK.

- Exports of financial services accounts for 15% of total Scottish exports (or almost 9% of GDP), and most of which go to the rest of the UK. The prospects for the financial sector matter for the balance of payments and for Scotland's prosperity. Finding a credible solution to the lender of last resort problem is important if Scotland ends up with dollarization. Part of the solution may require Scotland to have its own currency instead.

1.   INTRODUCTION

The debate over which currency an independent Scotland might use appears to have reached an impasse. The Scottish Government has stated that an independent Scotland would use sterling, and the UK Government (and the official opposition) has said unequivocally it would not participate in a formal currency union. Based on both positions, the most likely outcome seems to be that an independent Scotland would use sterling, but in an informal currency union. This is widely known as 'dollarization'.[1]

There has been little discussion about what dollarization might mean. The Fiscal Commission Working Group's (2013) Macroeconomic Framework has one paragraph on dollarization. It states that "this option would retain some benefits of a formal monetary union [but] there would also be some additional drawbacks. In this instance, the Scottish Government would have no input into the governance of the monetary framework and only limited ability to provide liquidity to the financial sector - this would depend on the resources and reserves of the country. The amount of currency available would depend almost entirely on the strength of the Scottish balance of payments position."[2] What is left unsaid is how limited the liquidity support would be, and what happens if more is required.

This paper considers what dollarization might mean in terms of providing lender of last resort support and assesses some alternative ways of providing liquidity insurance in an informal currency union. While the context is clearly Scottish independence, the issue of providing liquidity insurance is of wider interest. There is a clear need to re-think financial regulation. For example, liquidity requirements are now part of the global regulatory framework and central banks are revising how they provide liquidity insurance. The Winters Report (2012) into the adequacy of the Bank of England's liquidity framework raises some important questions which are also relevant beyond the Scottish context. Some of Winters's proposals are also touched on in this paper.

We do not consider a completely different model of banking, such as 'narrow' or mutual fund banking. Independence would present an opportunity for a complete re-think on what sort of institutions are appropriate, but such thinking is not part of the current debate and it is unclear whether such banks would survive in an open European banking market.[3] We also do not accept the other extreme, that the current reforms have solved the problem of instability. Instead, we take the direction of reform

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[1] Dollarization describes a currency arrangement rather than the currency being used. Some people use the term 'sterlingisation' but we prefer to stick to the more widely used term.

[2] Fiscal Commission Working Group, 2013, p.125.

[3] See for example, Armstrong, 2012.

proposals under the Basel Accords and the EU as our working assumption.[4] We consider a comment in the Winters Report (2012) as a reasonable assessment of the state of the banking industry: "banks continue to benefit from the market assumption that liquidity support will be forthcoming from central banks at times of extreme stress. Many informed observers go as far as to state that many banks' business models would be non-viable without such support."[5]

To frame the analysis, we make three assumptions. First, the Scottish Government has made it clear that an independent Scotland would seek to become a member of the European Union (EU) at the earliest opportunity. EU members are required to have a central bank (or monetary authority) and financial regulator, but treaties and protocols are less prescriptive about their functions and responsibilities. Second, the rest of the UK government maintains its position that it will not share the Bank of England (hence ruling out a formal currency union). Third, we focus on banks because the risks to financial stability are likely to be concentrated in the banking system.[6] However, during the recent financial crisis, central banks had to support specific capital markets and act as an agent to resolve non-bank financial institutions. Given the importance of non-bank intermediaries in Scotland the capacity to provide support more widely may be important.

The structure of this paper is as follows. Section 2 summarises what is meant by lender of last resort and its connection to national public finances. In section 3 we sketch-out a likely financial structure of an independent Scotland, including its available resources and reserves for liquidity insurance. Section 4 considers options for how an independent Scotland could provide liquidity insurance to its banking system. This includes the design of a Scottish Insurance Fund and third-party insurance arrangements. A conclusion follows with a technical annex showing the insurance issues with 'moral hazard' in multi-time period setting.

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[4] The core of the reforms is to 'bail-in' senior creditors. For bank specific shocks this is entirely plausible, but for a system wide shocks it is not clear that the centuries old problem is solved and this would not simply create more contagion and illiquidity.

[5] Winters, 2012, p.10.

[6] We take banks to mean all deposit taking institutions including building societies.

2.   THE ART OF LENDER OF LAST RESORT[7]

In this section we describe liquidity insurance provided to banks, commonly known as lender of last resort (LOLR). We describe how liquidity insurance is provided by the Bank of England, the role of the government as the back-stop, or underwriter, and touch on the political economy implications. Lender of last resort includes a whole palette, or gradation, of operations, from insuring against large day to day withdrawals to emergency liquidity assistance where doubts are raised about the solvency. Despite the neat distinctions attached to each operation, reality is not so straight forward: there is always some risk involved. For this reason, in this paper we bracket all liquidity insurance operations, including emergency liquidity assistance, under the rubric of LOLR.

The proposition that central banks could provide liquidity to the banking system during periods of panic was formalised by Thornton and later extended by Bagehot (1873) into the classic principles of LOLR.[8] As often happens in finance; theory followed from practice. In the banking panics of 1847 and 1857 the Banking Act (1844), which included limits on the amount of note issuance, was suspended when the Treasury allowed the Bank of England to supply emergency liquidity. Bagehot proposed that authorities should stand ready to lend freely to illiquid, but solvent, banks against assets which "in ordinary times is reckoned good security", and at a penalty rate. These principles have been contested ever since the day they were first presented.[9] They are also central to some of the issues which would face an independent Scotland.

First, by 'standing ready' this implies that the state is effectively providing liquidity insurance. Making it clear that liquidity would be available might allay an incipient crisis. Schwartz (1987) argues that real financial crises in the UK and US only materialised when the monetary authorities failed to demonstrate early enough their willingness to supply liquidity.[10] Yet the nature of banking is that there are differences in information between parties, such as between bank executives and depositors or even regulators, about the quality of the banks' assets. All insurance contracts when combined with asymmetries in information can lead to 'moral hazard' where the insured party takes on more risk simply because they are insured. The risks may be ex ante, such as riskier lending and capital structure

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[7] For Kindleberger, 1996, p.163 the timing of lender of last resort is an art, and, in his words, "that says nothing – and everything".

[8] Bagehot credited Ricardo with the lender of last resort principle.

[9] Some economists argue that lender of last resort causes bank instability and point to the period of so-called Free Scottish Banking as evidence. We prefer the more mainstream historical accounts including Bordo, 1989, Kindleberger, 1996 and Schwartz, 1897, who all argue it is preventative rather than destabilizing.

[10] Schwartz, 1987, p.280.

decisions, and ex post, perhaps delaying restructuring or raising new capital. The optimum solution is to regulate to limit the moral hazard rather than attempt to eradicate it fully.[11]

Second, while it is sensible to say that only 'solvent banks' should be assisted, reality is less convenient. If support is for solvent banks only, then the provider must be able to discern between banks which face legitimate liquidity problems (probably insolvent) from those facing illegitimate problems (possibly solvent).[12] In the midst of a crisis where markets are not functioning normally, accurately assessing the solvency of a particular bank is an extremely difficult judgement. Solvency can only be known with certainty after the fact. While ex ante it would make sense to rule out assistance, the consequences of a large bank failing (such as Lehman) may be so great as to justify support ex post. If the social benefits of maintaining financial stability are greater than the full costs of support, then the rational response is to provide assistance.

Third, the 'penalty rate' is designed to discourage banks from accessing official liquidity support ahead of market-based sources of finance. This is entirely reasonable for an 'internal drain' i.e. when resources shift from one institution to another in a form of, say, a 'flight to quality' owing to some bank specific problem. Yet in a systemic crisis or 'external drain' liquidity can be withdrawn from all banks at the same time and beyond their reasonable ability to control. In such circumstances a penalty rate would be unreasonable and may even make the situation worse.

These issues raise some of the challenges to providing fair liquidity insurance in an independent Scotland. To act promptly and control the risk of moral hazard the insurer must have immediate access to funds and also usually acts as the prudential regulator tom minimise the moral hazard. This depends on the financial strength of the Scottish state and whether cross border regulation can be coordinated effectively. The terms of liquidity insurance are necessarily case specific across the palette of operations. The design of an appropriate premium structure is difficult. Providing insurance may, in general encourage moral hazard, even if premiums are actuarially fair. But in banking, collecting fair premiums may not effectively manage risk for either the provider or the beneficiary. Each of these issues is important when thinking about the options for an independent Scotland, but also for liquidity insurance in general.

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[11] This assumes that the first best of removing the information asymmetry is not feasible (as in banking).

[12] See Fisher, 1999, on this distinction.

2. A.   UK Lender of Last Resort Operations

The Bank of England uses its sterling balance sheet in order to meet its statutory objectives of monetary and financial stability on behalf of UK citizens.[13] As the Bank is the monopoly supplier of sterling liquidity it can provide liquidity insurance to individual banks and to the UK's financial system as a whole. The rationale for doing so is to reduce the cost of disruption to the payment services supplied by banks to the UK economy. The Bank can also alter the supply of reserves to accommodate unexpected shifts in the demand for sterling and thereby support an effective transmission of monetary policy. While the Bank has operational independence, this is constrained by relevant EU laws and the Chancellor has sole discretion when taxpayers' funds are at risk.

The Bank's operations for the carrying out monetary and financial stability policy are described in the Sterling Monetary Framework (SMF or the 'Red Book'). These have changed considerably since the depth of the financial crisis. The wider regulatory environment has also changed, in particular with the Prudential Regulation Authority (PRA), a subsidiary of the Bank, is now responsible for financial regulation. A Statutory Resolution Regime has also been created for the orderly wind-up of an insolvent bank incorporated in the UK.[14] Like many central banks, the Bank has two broad ways by which it can supply liquidity to banks or the financial system. The first utilises the SMF framework. The Bank controls this mechanism independent of government. The second is Emergency Liquidity Assistance (ELA) which requires the Chancellor to authorise whether and how to use public funds. Both channel are properly considered as LOLR operations but they vary with respect to risk and protocol.

The provision of liquidity within the SMF has been overhauled during and after the crisis. There are now three permanent facilities to provide liquidity insurance, summarised in Box 1. The Bank exchanges assets (collateral) for cash or gilts (a 'liquidity upgrade') and lend for a longer period of time ('maturity transformation').[15] It protects itself against its counterparty becoming insolvent by taking temporary delivery of high quality sterling collateral in excess of the liquidity supplied. In the event of the borrowing bank becoming insolvent, then the Bank of England will have a greater amount of collateral that it can then sell in the market and use the funds raised as repayment for the loan.[16] The Bank accepts three different levels of collateral from liquid and high-quality sovereign bonds, to lower quality

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[13] Bank of England, 2014, p.2.

[14] Quinn, 2012, p.10.

[15] The most innovative change is the introduction of a standard Discount Window.

[16] The Bank of England also provides finance through lines of credit and ad hoc programmes such as the Funding of Lending (FLS). Around £450bn of collateral has been posted for £280bn of drawable loans which implies a high haircut, given that the collateral is mostly packages of UK mortgages.

sovereigns and to less liquid securitisations and portfolios of loans. Lower quality collateral is accepted at a higher fee and higher haircut (the excess value of collateral exchanged for the liquid assets).[17]

Box 1: Bank of England's Lender of Last Resort Operations

STERLING MONETARY FRAMEWORK (SMF)		
Event	Facility	Term
Predictable/regular need for term collateral transformation	Indexed Long-Term Repo	• Monthly • Six-month term • Reserves lent • Auction price(s)
Firm-specific liquidity shock requiring liquidity in bespoke size and timing, with lagged disclosure	Discount Window Facility	• On demand • Rollable 30-day term • Usually gilts lent • Pre-specified prices
Actual or prospective market-wide stress meaning banks need cheap, plentiful cash at term	Extended Collateral Term Repo	• Triggered by the bank • Flexible term • Reserves lent • Auction price
EMERGENCY LIQUIDITY SUPPORT		
Outside of the Sterling Monetary Framework		

Source: Bank of England (2014) and NIESR.

According to the Bank of England there is a presumption that all banks which meet the Prudential Regulatory Authority's conditions to be authorised institutions would have access to the SMF published liquidity facilities.[18] An important distinction is whether an overseas bank operates in the UK through a separately capitalised subsidiary regulated by the host country regulator (the Bank) or through a branch which is regulated the home country regulator, see Box 2 for a discussion. In future, branches of Scottish banks could operate in the UK which would be regulated by the Scottish regulator and deposits covered by a Scottish deposit insurance scheme. By contrast, subsidiaries of Scottish banks would be incorporated in the UK, they would be separately capitalised, regulated by the PRA and depositors would be protected by UK deposit insurance.

Under EU law any bank incorporated in an EEA country is permitted to operate as a branch in another EEA country (such as the UK). This means there is no reason why banks domiciled in an independent

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[17] Where the shortage of liquidity is the firm's responsibility the fee is likely to be higher than when there is a general shortage of liquidity (and so may be beyond the control of an individual firm).

[18] Bank of England, 2014.

Scotland could not, in principle, access the published SMF facilities through branches or subsidiaries in London. The PRA has laid-out its approach to branch banking in the UK which includes the pre-condition of Home State Supervisor equivalence. Since a Scottish regulator is yet to be established and could be responsible for two of the largest banks in the world and operating in sterling markets, it is not clear that this condition would be met. Branches of foreign banks would not be included in a Statutory Resolution Regime for UK incorporated banks. This implies that even if the mechanisms work as intended, a branch which is deemed to be of systemic importance could present a risk to financial stability. Finally, as we show below, access to ELA is very rare to branches of foreign banks.

Box 2: Branches versus Subsidiaries

Foreign banks operating in London – or in any other market than their home market – can choose between operating as branches or subsidiaries. A branch is simply an office of the foreign bank operating in London. Capital typically flows freely between the branch and its foreign parent bank, and the branch typically maintains no separate capital of its own. It is regulated primarily by the regulator where the bank is incorporated (the 'home' regulator), although its 'host' regulator, in this case the PRA and FCA, may impose restrictions on the types of activities it may undertake and the services it may offer to UK based clients. A subsidiary is a separately registered bank incorporated in London, but which is wholly or partly owned by the foreign bank. Because it is registered in London, its primary regulators are the PRA and the FCA, and it must meet UK prudential requirements independently of its parent, although it may use the support of its parent to do so.

Branch structures may pose greater risks for financial stability. Capital can easily flow between branches and their parent meaning that financial shocks are easily transmitted across borders. On the other hand, branches may be more efficient than subsidiaries, leading to a tension between the preferences of supervisors and those of banking groups. Creating good relationships between 'home' and 'host' regulators is a particular focus of international banking regulations, such as the recently-revised Core Principles of Banking Supervision issued by the Basel Committee in 2013. This is because the effective resolution of cross-border banks, which requires the involvement of both 'home' and 'host' regulators, may be essential in preventing financial contagion from spreading across borders.

Source: Fiechter, et al. (2011).

2. B. Who back-stops liquidity insurance?

A prior question is why banks cannot manage their own affairs, either individually or collectively, and need liquidity insurance at all. In theory, banks create liquidity by financing opaque long term loans, such as our mortgages, with our savings which we prefer to have immediate access to. Banks are therefore exposed to liquidity risk if a critical mass of depositors wish to withdraw their funds. While banks manage their risks every day, and no doubt do better based on recent evidence, there are extreme (or tail) risks where it would simply be inefficient for each bank to hold enough reserves to

guard against.[19] JP Morgan's endeavours over a century ago highlights the issue. In response to the famous Knickerbocker Trust crisis in 1907, JP Morgan shored-up the banking system by persuading other bankers to join him in raising new capital to support the banking system and a systemic crisis was avoided. Twenty two years later on Black Thursday in 1929 a similar syndicate again headed by JP Morgan posted buy orders across the stock market to prevent the falling market becoming a crash. They failed and depression followed.

The moral of the story is if one or two banks fail because of idiosyncratic factors, such as malfeasance or an unexpected asset loss, then the risk can be easily diversified. The old-fashioned term for these events is an 'internal drain' where funds leave one bank for another but remain within the system. A weaker bank is often either absorbed by a stronger bank, or a coalition of banks, and the funds are to re-cycled once the issue is resolved.[20] But in practice, banking risks are often highly correlated (in good times and bad times).[21] This creates an 'external drains' when liquidity leaves the whole banking system rather than reallocated within it. When risks are highly correlated, effective diversification is not possible and claims are very large when they occur. McCarthy and Neuberger (2005a), shows that even in a world with many small risks just modest degrees of correlation are sufficient to create claims which are infrequent but extremely large.

Systemic banking crises end up becoming the liabilities of the state. This is not to suggest that we cannot do much more to prevent crises, only to recognise that governments are the risk managers of last resort. The government is invariably the only body which can absorb these losses. In severe crises the costs can be so large that they may take a generation to recover from.[22] This raises the key issue of government solvency in extreme events. If a government has its own currency then the banks can be made solvent by posting bank reserves at the central bank backed by bonds transferred from the government. This is a form of monetization which is possible as long as there is continued demand to hold the currency and not a fear that its real value will be eroded through inflation. Countries which do not have their own currency can have a banking crisis soon becoming a sovereign debt crisis, Ireland's recent financial

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[19] There is a debate amongst some economists around 'narrow banking' which might, in theory, prevent bank failures. Yet mutual funds may also be vulnerable to runs owing to differences in the liquidity of the assets they hold. The SEC has recently allowed money market mutual funds to suspend redemptions to avoid this occurrence.

[20] The misdiagnosis of an internal drain may explain the Lloyds merge with HBOS one month before Lehman failed.

[21] Some plausible reasons are that banks seek to internally diversify risk and thereby become 'large' and systemically important, banks use very similar risk management tools and face uniform regulations.

[22] According to Laevan and Valencia (2012) the average direct cost of crises between 1970 and 2011 is around 7% and the average increase in public sector debt associated with the crises is 24% of GDP.

history providing a salutary example. As we have often seen, governments which cannot underwrite its risks may need to fall back on supra-national agencies such as the IMF and EU.

Box 3: National interests and LOLR

Former Bank of England Governor Mr King famously said that banks are global in life and national in death. In fact, they are also national in near death, as Emergency Liquidity Assistance tends to be decided on the basis of political interests. There is a long and fascinating history of the politics of cross border official transactions. This box summarises some of the politics of cross border support in the recent crisis.

The UK is one of the largest global centres in the world, but only UK banks received bi-lateral Emergency Liquidity Assistance from the UK government. Indeed, the UK government famously invoked its Terrorism Act against Iceland (a NATO member) to freeze the assets of Icelandic banks to prevent the funds being repatriated so that UK depositors of Icesave could be repaid. The Federal Reserve has published a list of transactions involving foreign and domestic banks under its LOLR operations. RBS and HBOS received $84.5bn and $18bn collateralised term loans respectively under the Term Auction Facility and Term Securities Lending Facility. These were open to US affiliates of major qualifying banks. According to the Federal Reserve website bi-lateral facilities were only available to a limited number of important US banks. RBS received $26bn of emergency liquidity from the Bank of England. The Federal Reserve also provided US dollar swaps to foreign central banks. This provided dollar liquidity, often to US institutions, in return for sovereign credit risk. Several countries were excluded although their names are redacted from the minutes. By the time the Eurozone crisis reached Cyprus European lawmakers decided to consider a discount on insured bank deposits only to relent when contagion appeared likely to affect other nations.

The Bank for International Settlements (2010) summarised cross-border resolutions stating that "national resolution authorities will seek, in most cases, to minimise the losses accruing to stakeholders in their specific jurisdiction to whom they are accountable."[23]

Whoever provides the back-stop for liquidity insurance tends to determine the rules. At the start of this section, it was noted that it was the Treasury's decision, and not the Bank of England, to suspend the gold rule and provide emergency liquidity in the nineteenth century. After the crises Parliament reviewed the Banking Act which had been suspended, but decided to maintain the ambiguity. Where cross border banking is involved, any assistance tends to be where it is a nations' own interest. If a nation does not have access to a central bank balance sheet or have the fiscal capacity to provide lender of last resort and must turn to the IMF or EU, then these loans generally come with tough conditions. Box 3 describes how some of the recent interventions were very much in the national interests of whoever underwrites the insurance contract. Goodhart and Schoenmaker remind us of that that Scottish saying, "he who pays the piper calls the tune".

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[23] BIS (2010) p14.

3. FINANCIAL CAPACITY FOR LIQUIDITY INSURANCE

This section considers what the financial capacity of an independent Scotland might be to provide liquidity insurance. We start by considering how the existing sterling monetary arrangements might change with independence. We find that one small legal change would have widespread consequences. Independence would necessarily create a financial border, where regional flows become international trade and capital flows. We assume that an independent Scotland joins the EU at the earliest opportunity. Scotland would be required to have a monetary authority (which we call the Scottish Monetary Authority or SMA for short) and a competent national financial regulator.[24] The EU Single Market Directive means that both Scottish and UK domestic banks are free to conduct business on the other side of the border through branches or subsidiaries (so-called 'passport' requirements).

3. A. Creating an informal currency union

If Scotland becomes independent the first question is what happens to Scottish notes. One of the historical legacies of the different banking systems in Scotland (and Northern Ireland) and England and Wales is that commercial banks issue distinct bank notes. Issuance has been regulated by the government since the Bank Notes (Scotland) Act (1845) which was repealed under the Banking Act (2009) which, in effect, make the value of Scottish notes the same as Bank of England notes (see Box 4). The Bank is responsible for ensuring that the issued notes are fully backed by ring-fenced and risk-free assets in the banks' reserve accounts. The Bank has the authority to issue fines to the commercial banks if they violate the regulations.[25] The Bank of England currently effectively acts as a currency board for Scottish notes by guaranteeing that they have full backing. The Bank has a similar arrangement with the Crown Dependencies (Jersey, Guernsey and the Isle of Man) which issue their own currencies which trade alongside Bank of England notes as legal tender. Crown Dependencies are not part of the UK, but they are also not sovereign states. The population of Jersey is only 2% of Scotland's population and so a substantively different case. Jersey's financial system is largely imported from other countries.[26]

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[24] The remit of the national central banks is open other than the collection of statistics. There is a precedent for a national monetary authority being part of the European System of Central Banks: the Maastricht Treaty included the Institut Monétaire Luxembourgeois until the Luxembourg Central Bank was created in 1998.

[25] See Banking Act, 2009, Part 6, 222.

[26] Jersey supports a substantial banking system which generates around half of the dependency's income. Bank deposits are more than £145bn of which around £53bn are denominated in Sterling. This is nearly 30 times the size of the Jersey economy. Strictly speaking, however, Jersey has no domestic banking system. Around 50 banks are currently licensed to take deposits in Jersey, but almost all are either branches or subsidiaries of overseas banks.

Box 4: Scottish and Northern Ireland Notes

Three commercial banks are permitted to issue Scottish banknotes (RBS, BOS and Clydesdale) along with four Northern Ireland commercial banks under the Banking Act (2009). Although they are not technically legal tender in England and Wales, they can be exchanged at the Bank of England, note holders have the same rights as Bank of England note holders and therefore they are accepted throughout the United Kingdom.

Following the Banking Act (2009) the Bank of England ensures that Scottish bank notes have the same level of protection as its own notes. At least 60% of the value of Scottish notes in issue should be backed by Bank of England notes (large denomination notes of £1mn called 'giants' and £100mn called 'titans') and UK coin, and the remainder can be held in accounts held by the issuing banks at the Bank of England. However, the right to issue is to the three existing banks and is non-transferable if any of them decided to stop for commercial reasons.

The commercial banks issue the notes because they gain some modest benefits. Seigniorage from issuing the notes (the interest on the remaining backing assets not held in note form) accrues to the Bank and is transferred to the UK government. Notes with the potential to enter circulation (authorised but not issued) are vault cash to the commercial banks for which they do not incur a cost of funding.[27] There is presumably some small benefit from advertising the commercial banks on the physical notes.[28]

As the rest of the UK Government has expressed no intention of creating a new formal currency union, some legal changes are necessary to define the new arrangement. There are several possibilities. First, the Scottish Government could ask the Bank of England to continue to act as its agent and ensure Scottish notes have full backing assets. This is similar to the Irish approach in 1928, but not the same as the Bank did not have statutory responsibility to enforce the backing rule. From a Scottish perspective, having the country from which one has just ended a three centuries of political union as the custodian of its financial system may sit awkwardly with the notion of independence. It is also unclear why this would be in the interests of the rest of the UK. The rest of the UK government would presumably wish to distance itself from any notion that it stands behind an independent Scotland. The clearest way to do this would be to issue primary legislation amending Part 6 of the Banking Act to remove the Treasury and Bank from managing the issuance of Scottish bank notes.

Second, an independent Scottish government could create its own currency board as a legally separate division of the Scottish Monetary Authority. The three commercial banks could be invited to transfer their backing assets to the SMA and the value of the notes would be guaranteed by its currency board. The commercial banks would continue to earn seigniorage. This would be the simplest solution, but the commercial banks may be less willing, particularly if they opt to re-domicile in the rest of the UK. An alternative solution is that the SMA could issue its own national notes in exchange for the existing

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[27] C Goodhart, 2013, p.144.

[28] Danske Bank took over Northern Bank in Northern Ireland and issues very visibly Danske branded bank notes.

commercial bank notes. The old notes could then be presented to the commercial banks in exchange for the backing assets which would then become the backing assets of the new SMA currency board. Under this scenario the Scottish Government would benefit from the full seigniorage and having a national currency would certainly resonate with the idea of an independent state.[29] However, it would also end three hundred years of commercial bank notes.

Third, the Scottish Government could simply rule that only Bank of England notes are the legal tender in Scotland. The three note issuing banks would simply exchange the Scottish notes for their backing assets in sterling and they would cease to exist after a certain time. Neither the Scottish government nor the note issuing commercial banks would receive seigniorage. Of course, the note issuing banks may choose to do this of their own volition or Scottish citizens may prefer the certainty of English pounds and Scottish notes eventually become obsolete. Under this scenario, Scotland would undeniably be using the UK pound sterling, but paradoxically at the cost of eliminating the clearly identifiable Scottish currency.

Option one is inconsistent the statements of Westminster politicians and would encourage the perception that the rest of the UK stands behind an independent Scotland (not to mention jarring with the idea of independence). Option two constitutes a currency board for Scottish notes. Scottish and Bank of England notes would circulate alongside each other and be freely convertible at the Scottish Monetary Authority. Both currencies would be called sterling, but in the same way that there is a US and Hong Kong dollar where the national prefix would be meaningful as the backing of the Scottish currency would be the independent Scottish state. The currency arrangement would be best described as 'partial dollarization' because bank deposits in Scotland would be mostly in UK sterling and a currency board would exist for mostly for cash transactions.[30] According to the Bank of England, there is approximately £4.6bn of Scottish notes (of which £4.1bn is outstanding). Assuming Scottish households and firms own a population share of UK retail deposits the Scottish domestic money supply would be around £122bn.[31] An independent Scotland's money supply would therefore be dominated by UK sterling. Option three is full dollarization which would bring to an end an identifiable Scottish currency.

There are important differences between 'partial' and full dollarization. First, there is the issue of who receives the seigniorage which has been mentioned within the options. Second, while there would be no

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[29] For example, the first act of the Irish Free State was the Coinage Act (1926) which replaced the portrait of the UK sovereign with the Irish harp.

[30] This is not unusual as even countries which are considered to be 'fully dollarized' such as Ecuador and Panama have their own coins.

[31] This is estimated from a population share of UK retail bank deposits plus Scottish bank notes.

intention to leave the currency board, having a separate currency makes it much easier to do so if circumstances change. Consistent with the White Paper, it would be easier to change currency regime if Scots choose to do so in future.[32] The ease of (re) introducing a separate Scottish currency cuts both ways. In periods of financial stress, fears of devaluation are more likely with a currency board compared to using another currency. For example, would a Greek devaluation have been more likely if the Drachma existed? Third, the more that contracts are conducted in a foreign currency such as UK sterling, any change in the currency arrangement this would lead to greater revaluation risk. Fourth, under a currency board the separate currency would require a separate payments systems (see section 3. C.).

3. B.   Financial capacity in an informal currency union

Section 2. B. sought to explain that the real lender of last resort is always the state (or supra-national institutions). Therefore, an important question for an independent Scotland is the capacity of the government to provide liquidity insurance in an informal currency union. There are two sources of liquid state financial assets which could be used: foreign exchange reserves and fiscal reserves (or at least borrowing capacity). Each are considered in turn.

Currency boards and dollarization are both types of informal currency unions. While having important differences, they also have similarities. The value of the domestic currency is tied to the foreign (anchor) currency, which for dollarization is trivial as it is the same currency. This means that the monetary authority cannot create domestic currency beyond the extent to which the backing currency (sterling in this case) flows into the country. The system operates the same as the gold standard only with less room for flexibility.[33] Under a pure currency board a balance of payments surplus would show up as an increase in the backing currency and a subsequent increase in the domestic currency. With dollarization this would simply be an increase in sterling circulating in the domestic economy. Unlike countries which issue their own currency, countries with informal currency unions cannot freely create liquidity.

However, countries which operate currency boards rarely follow such a simple rules as a 'pure' currency board. They often accumulate surplus international reserves i.e. reserves which exceed the value of the domestic notes, by operating a 'modified' currency boards to create some scope for liquidity support.[34] Even countries which officially dollarize accumulate foreign reserves for the purposes of LOLR. Panama

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[32] The Scottish Government White Paper, 2013, p.111 makes it clear that it would be up to the Scottish people to choose a different currency arrangement in future.

[33] See Bordo and MacDonald, 2005.

[34] Reserves are accumulated during surplus periods by carrying out open market operations to withdraw liquidity.

has plans to develop a special fund for ELA purposes and El Salvador has created the capacity to offer very limited ELA support (IMF, 2013 and 2014a). Hong Kong has a very sophisticated LOLR and ELA framework. Given the enormous reserves which they have created from running fiscal surpluses almost continuously for three decades, the HKMA can supply up to HK$25bn to a single domestic bank before having to obtain authority from the Financial Secretary (IMF, 2014b). An absence of any LOLR may leave institutions perceived to be more fragile and therefore make depositors and investors flighty. Banks may choose to self-insure by holding more liquid assets to mitigate this perception and governments may also seek to provide some assurance even from limited LOLR.[35]

If Scotland becomes independent it would be reasonable to assume it would be entitled to a fair share of the UK's £68bn of foreign reserves meaning a population share of £5.7bn. These surplus reserves would barely cover 5% of estimated retail deposits. Clearly Scotland would need to accumulate more 'surplus' foreign reserves. This can only be achieved through generating balance of payments surpluses. While the Scottish government's economists have made great strides in producing experimental income and expenditure accounts we do not have full external or government accounts.[36] The data picture which follows is therefore inevitably incomplete and uses experimental data.

Our best estimate of a hypothetical current account balance for Scotland in 2010 is very roughly a zero balance (see Box 5 for an explanation).[37] As the chart shows, there is a very substantial difference in the trade balance depending on whether a geographic share of North Sea oil is included or not. The challenge for the future will be to replace the earnings as exports from oil and gas decline with non-oil exports. The income flows are likely to be a persistent deficit given the high proportion of ownership of Scottish firms by rest of the UK firms. Scottish output generated by firms owned by rest of UK firms was 23% of total output in 2009. By contrast, output in the rest of the UK generated by firms owned by Scottish firms was only 0.8% of UK output. Even adjusting for the different size, the rest of the UK the share of Scottish output generated by UK firms is three times greater. This suggests that income flows may be in deficit over the medium term. Much will depend on the income earnings associated with financial services firms in future.

[35] Gulde, et. al., 2004, found banks in dollarized economies generally more fragile.

[36] Belgium and Luxembourg went through a similar exercise in dividing one set of external and monetary accounts between 2000 and 2002 for EMU reporting purposes.

[37] The reliance on 2010 data is because was the latest ONS Foreign Direct Investment Survey available.

Box 5: Estimate of Scotland's Current Account Balance

According to the Scottish government's experimental data, over the past fifteen years Scotland has had an average annual trade of goods and services deficit of around 11.3% of GDP. This is almost all with respect to the rest of the UK as trade with the rest of the world has been basically in balance. If Scotland becomes independent then everything changes. The North Sea oil and gas fields are an asset which is being slowly depleted through extraction and the output is sold on world markets as an export. Assuming Scotland receives a 'geographic share' of the oil and gas fields then the export revenue would transform its trade balance. Based on the Scottish government's data, the previously large deficit would become an average surplus of around 2.7% of GDP over the last fifteen years (although more volatile).

Scotland's Goods and Services Trade Balance (as % of GDP)
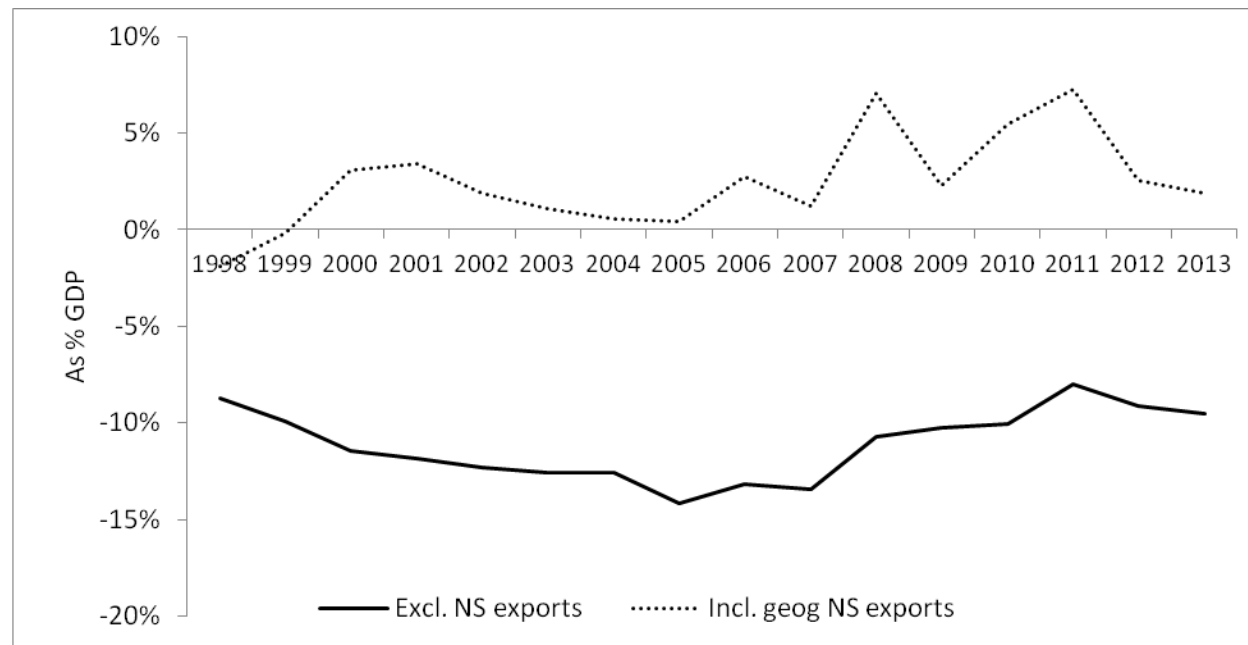
Source: Scottish National Accounts Project www.scotland.gov.uk/Topics/Statistics/Browse/Economy

Trade is of course only part of the current account balance. Net factor payments and transfers ought to be included which together would equal an estimate of the current account. The government economists have estimated factor payments for 2010. They estimate an outflow of factor income of £7.4bn of which £5.4bn was the remittance of profits and salaries from the North Sea. No estimate of transfers is provided, but for the UK overall this was a £5.1bn outflow, so a population share would be around £0.4bn. The Scottish government estimated a trade surplus in 2010 including oil and gas of £7.8bn or 5.5% of GDP. Given the data quality, a fair assessment is that the current account was roughly balanced once the geographic share of oil and gas is included. Two further caveats should be added. First, £5.4bn of the income outflow is associated with North Sea earnings. This is likely to decline over the medium term as the export revenue from the North Sea also declines. Second, the financial sector accounts for around one-third of gross income flows, although the estimates are significantly uncertain. The future size of Scotland's financial sector will be important for the balance of payments. In 2013 the trade balance including oil and gas would have been £2.8bn or 1.9% of GDP.

According to the Global Connections Survey exports of financial and insurance services were £11.2bn, or 15% of total exports and 9% of GDP in 2012. Without a substantial improvement in non-oil export performance it is difficult to see how the external accounts will be a source of foreign exchange reserves. In fact the risk is that without a back-stop for liquidity insurance this could have an important consequence of the balance of payments.

Another way to fund liquidity insurance is from fiscal reserves. Independence would effectively create a government balance sheet from a fair share of the assets and liabilities of the UK. Armstrong and Ebell (2014b) have described how the assets and liabilities could be divided. The best register of assets and liabilities is the Whole Government Accounts (WGA) which is the consolidated accounts of all audited UK public sector entities. A summary is presented in Table 1 below. The total asset figure of £1,268bn (mostly illiquid physical assets, such as infrastructure, and other assets such as licenses and equity investments) is quoted in the Scottish Government's White Paper as the 'net' assets to be shared if Scotland becomes independent.[38] As a consolidation of public sector entities, this includes the balance sheet of the Bank of England. The accounts exclude natural resources, in particular the remaining North Sea oil and gas.

Table 1: UK Whole Government Accounts 2011-12 (£bn)

Assets		Liabilities	
Physical assets	745	Net public service pensions	1,008
Other assets and equity investments	523	Government financing	966
Net liability	1,347	Other liabilities and provisions	641
Total	2,615	Total	2,615

Source: HM Treasury (2013).

The liabilities are for the state, but they are also someone's asset. For example, issued government bonds (in government financing) are a liability of the government but an asset of the owner. The net liabilities of £1,347bn is the sum of the government's liabilities after taking account of its assets and known future obligations and is conceptually the most coherent measure of the UK's obligations. It does not include provisions for contingent liabilities such as deposit insurance or state pensions.

There are three official and widely used measures of debt: WGA net liabilities; public sector net debt; and gross or Maastricht defined debt, which is commonly used overseas. The two clear ways to divide

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[38] Scottish Government, 2013a, pp 30, 341 and 554. 'Net' refers to net of depreciation.

the debt are by population or affordability. Assuming the debt is divided on a population basis and based on OBR (2014) projections, an independent Scotland would inherit a debt burden of 77%, 73% or 86% of GDP respectively for each of the three measures. The key point is that whichever measure is negotiated, an independent Scotland would have little fiscal capacity to back-stop liquidity insurance. To create the capacity would require running fiscal surpluses for many years and even decades.[39] Analysts project that the fiscal deficit including oil and gas might be substantial at the time of independence. For example, Moody's predict the fiscal deficit will be 7.1% of GDP in 2016 including revenues from North Sea oil exports.[40] Such deficits require even more borrowing instead of paying down the debt.

Countries are required to re-finance their outstanding debt as it matures. Here they face judgement for their actions. In periods of financial stress a government may be forced to support its financial system, particularly if illiquidity transforms into insolvency due to a lack of timely action. The direct and indirect costs of a banking crisis can turn public accounts from prudent to seemingly imprudent almost overnight. The increase in indebtedness lead to rising credit risk premiums which raised the cost of re-financing debt and thereby lead to a further erosion of the public accounts. Countries without (timely) access to a central bank balance sheet face the prospect of being caught in destructive cycle with no way of breaking the link.[41] Investors are no longer enticed by higher yields but rather worry about preserving the capital on their existing portfolio of assets. In the end, capital markets become effectively closed until the supra-national authorities such as the IMF takes on the role of international lender of last resort.

Recent cases in Europe are not a special case. Rather they are further evidence of Schwartz's observation noted in section 2 about the importance of timely lender of last resort actions.[42] Countries which adopt an informal currency union are particularly vulnerable unless they accumulate reserves to self-insure. Those which survive crises have high reserves or at least low debt. History has not been kind to those with high debt burdens. This is exactly the feed-back loop that the EU is trying to resolve through its European Banking Union discussed in the following section.

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[39] This is the approach of Hong Kong which has amassed fiscal reserves of 35% of GDP and foreign exchange reserves of more than $300bn.

[40] See Moody's 2004.

[41] See Armstrong and Ebell (2013) for a fuller explanation of this feedback mechanism.

[42] Schwartz, 1987, p.20.

3. C.   Access to payments systems

Whether financial institutions in an independent Scotland have access to liquidity insurance depends in part whether they are part of the sterling settlement system. RBS and HBOS had access to Federal Reserve liquidity facilities because, in part, because its affiliates were primary dealers. The sterling payment system is simply a set of accounts which link financial institutions together so that funds are easily transferred between people and businesses. For example, in sterling we use BACS for transfer funds between bank accounts, LINK for cash machine transactions, CHAPS for high-value payments (like buying a house) and CREST for settling securities payments.[43] Settlement is made by transferring sterling funds between the reserve accounts of settlement banks at the Bank of England.[44] There are 19 settlement banks, of which 9 are headquartered outside of the UK. All three note issuing Scottish banks are settlement banks. There is no reason, in general, why banks in an independent Scotland would not have access to lender of last resort activity published in the Sterling Monetary Framework.

More interesting for our purposes would be the cost of providing these operations and the decision to provide emergency lending. Section 4 describes how an independent Scotland's large banking system in an informal currency union might have a negative externality on the rest of the UK and why this might be reflected in the pricing of liquidity operations. Between late 2008 and early 2009 the Bank extended £61.5bn in ELA: £25.4bn to HBOS and £29.4bn and a further $25bn to RBS. The first point to note is that ELA in sterling and dollars was provided by the Bank of England. Second, the collateral was portfolios of mortgages and loans of unsure quality which would have been very difficult to manage. Third, all funds were repaid by January 2009 (plus a fee of 2%), but arguably this is only because HBOS and RBS were part-nationalised by the UK government in October and December 2008.[45] The Chancellor has the sole authority to decided whether and when to use UK taxpayers' money for liquidity assistance. Any decision to do so would surely be taken strictly in the UK's national interests.

We expect that RBS and Lloyds would take a commercial approach about where to have their registered offices and headquarters. First, banks are rated on a standalone basis together with the strength of the fiscal back-stop of the country in which they are incorporated in. The lower expected credit rating of an independent Scotland suggests the risk is toward higher funding costs which would be passed on to

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[43] CHAPS is by far the biggest in value terms (£254bn per day versus £17.4bn in BACS) but BACS is by far the biggest in terms of number of transactions (22.8mn per day versus 0.1mn in CHAPS). Bank of England (2012).

[44] Settlements are through the Real Time Gross Settlement system and the Bank of England.

[45] According to Plenderleith, 2012, ELA should only be extended to institutions which pose a systemic threat and are in some sense fundamentally solvent. Plenderleith may be stretching the point when he stresses that ELA was consistent with the LOLR principles laid down by Bagehot.

borrowers.[46] This may raise competitiveness concerns. Second, the banks will need to assess whether customers north and south of the border would prefer deposit insurance ultimately back-stopped by the UK or Scottish governments. Third, the costs and challenges of dealing with two sets of regulators would be likely to be significant. Fourth, the Prudential Regulatory Authority is likely to require an systemically important bank carrying out its business is sterling to be based in the UK. This would be necessary to protect the integrity of the sterling payments system. Finally, the UK government owns an 82% and 24.9% stakes in RBS and Lloyds respectively. The regulatory and commercial interests both suggests that at least the two government part-owned banks would re-domicile into the rest of the UK. The banks could open branches or subsidiaries or even divest their Scottish operations. Other UK banks would be free to compete on a branch or subsidiary basis.

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[46] Moody's indicate that an independent Scotland would be rated at least two notches below the UK's rating.

4.   THE PROVISION OF LOLR FACILITIES

In this section we consider possible options for an independent Scotland to provide liquidity insurance in an informal currency union. We draw on the description of LOLR in section 2 and the economic structure of an independent Scotland in section 3. Of course, an independent Scotland operating with full or partial dollarization would not be the first country to face this issue. We start by drawing some lessons from other countries. There are two main options for an independent Scotland: self-insurance or arranging liquidity insurance with a third party. In the case of self-insurance, Scotland could create a specialised Scottish Insurance Fund to hold assets in anticipation of a crisis at the same time as significantly reducing public sector debt. In the case of third-party insurance, Scotland could seek an arrangement with the Bank of England or join the European Banking Union. Each of these options involves a trade-off between the intensity of regulation, the fairness of insurance premiums and the incentives for moral hazard. This is discussed in the text with a formal presentation in the Annex.

4. A.   Liquidity insurance in informal currency unions

Countries with informal currency unions face the challenge of how to provide effective liquidity insurance to their banking sector. Table 2 provides a summary of a diverse range of policy options that have been used internationally. Only two examples of 'dollarized' countries are included, which reflects the relative scarcity of the regime outside of city states and in some notable cases of instability.[47] While the two large dollarized countries have been able to maintain their currency regimes, this has come at some cost. Both countries have been regular clients of the IMF and have defaulted / rescheduled their debt obligations. For these countries the lender of last resort is de facto the multilateral organisations or even foreign creditors.

Currency board countries have had a slightly more encouraging record. Many countries have maintained their exchange rate links during periods of financial distress but at very different costs. Hong Kong operates a successful currency board with a large financial system. It has survived two major financial crises by self-insuring by accumulating large fiscal and foreign exchange reserves by running fiscal surpluses almost every year.[48] These reserves enables the monetary authority to operate an extensive LOLR facility. Where funds have been used, including to famously intervene in the stock market in 1998,

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[47] Wealthy city states which are dollarized include Monaco, Vatican and Lichtenstein and notable cases of instability are former USSR countries.

[48] For example, Hong Kong's foreign exchange reserves are 130% of its GDP whereas an independent Scotland's reserves would be less than 5% of its GDP.

this has been with fiscal reserves rather than surplus foreign exchange reserves.[49] The key lesson is that self-insurance on a large scale can be very effective in creating space for effective liquidity insurance. This requires sustained fiscal surpluses over decades.

At the other extreme, Argentina was forced to abandon its statutory currency board in 2002, default on foreign debts and re-introduce the peso. After surviving the 1995 Mexican financial crisis many reforms including arranging a liquidity insurance line of credit specifically for times of banking stress. The idea was that Argentina had an option to swap (a repo or temporary transfer) government bonds for cash. Similar contingent credit lines have operated in Indonesia and Mexico and on each occasion the outcome has been difficult for all parties. The authorities were concerned that exercising the option would trigger a loss of confidence, the amount involved was too small and the foreign banks sought to hedge their likely exposure by selling Argentinian bonds which exacerbated the situation. A deeply unpopular austerity programme was introduced which increased credit risk further leading to capital flight and eventual economic collapse. The key lesson is that a pre-arranged cross border liquidity insurance may not be effective if there is no additional net funding.

Two examples of European countries which operated currency boards are Latvia and Bulgaria (in a recent crisis still to be resolved). Latvia has an international financial system where about two thirds of deposits are in local branches of foreign banks (mainly Scandinavian banks). Although the Latvian public sector was extremely fiscally prudent, inappropriately low interest rates led to high private-sector borrowing. When international capital inflows reversed the fall in asset prices caused difficulties for local banks. Latvia arranged a foreign credit line, guaranteed by the government, equal to 40% of GDP from the IMF, EU and Swedish Central Bank. The government introduced strong austerity measures which led to a fall in output of almost 20%. A lessons from Latvia are that relying on an international banks alone does not remove risk and international agencies impose tough conditions when called on for funding.

Bulgaria introduced a currency board in 1997 following a banking crisis. Around 70% of deposits are held in branches or subsidiaries of international banks. Possible criminal activity and poor supervision led to a run on two Bulgarian-owned banks in June 2014. In response, the Government, which has been fiscally prudent, was to create a USD2.3bn line of credit to the banking system, financed partly out of reserves and partly by normal borrowing. It is too soon to tell whether this form of self-insurance will succeed. Both Latvia and Bulgaria could access foreign credit lines because of their prudent fiscal management.

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[49] See Caprio et al (1996).

Table 2: Examples of liquidity insurance in informal currency unions

Country and crisis date	Informal currency union	Liquidity insurance arrangement	Prior fiscal prudence	International banking system	Economic outcome	Ultimate LOLR
Panama, 1988	Fully dollarized, 1904 - today	No special arrangements	No, consistent fiscal deficits	Yes, regional financial centre	Economic collapse: Fall in GDP of 16%	IMF and default
Ecuador, 1999	Partial dollarized, 76% of deposits	Loans / international credit line for banks	No, large fiscal deficits	No, but access to international markets	Recession: Fall in GDP of 7%	IMF and default
Hong Kong, 1997	Currency board, 1983 - today	Self-insurance	Large internal / external surplus	Yes, no limitations	Recession: Fall in GDP of 6%	Successful
Argentina, 2002	Currency board, 1991-02	Prior international credit line for banks	Large internal / external deficits	Yes, liberalisation after 1994-95 crisis	Economic collapse: Fall in GDP of 18%	IMF and default
Latvia, 2009	Currency board, 1992-13	Limited ELA capacity	Yes, negligible public debt	Yes, large Scandinavian ownership	Economic collapse: Fall in GDP of 22%	IMF / EU / Sweden
Bulgaria, 2014	Currency board, 1997-today	Limited ELA capacity	Yes, low level of public debt	Yes, but crisis confined to domestic banks	No data yet	Govt credit line

Source: IMF publications and press reports for ongoing Bulgaria crisis.

4. B.   Scottish self-insurance

Most countries do not and perhaps cannot self-insure by accumulating ring-fenced assets in advance on the same scale of Hong Kong. Certainly an independent Scotland would be in a very different position. Moreover, Chang and Velasco (2000) argue that building up a central fund of assets is, in fact, inefficient because banks will not internalise the cost of holding the insurance fund leading to inefficient investment decisions.[50] One way around this may be to create a bank insurance fund and charge banks a premium in exchange for access to LOLR operations in a way that causes them to internalise the cost of holding the assets. While an independent Scotland has no fiscal capacity to create a public fund, it could begin to create a fund from premiums charged to financial institutions.

An insurance fund would have good reasons to want to collect premiums that are 'fair' in some sense. In any insurance system where the action of the agent (the insured bank) cannot be fully observed, there is a potential for moral hazard. In banking, given the asymmetries of information, this is likely to be large. Further, while premiums ought to change over time to reflect changes in the underlying risks, there is a tension between collecting premiums which are 'fair' and ensuring that premiums are 'smooth'. A totally fair premium would be small when a bank is safe, but large when the bank is risky, or during a crisis, where the probability of failure was high. When banks enter into a stressed period, just trying to collect these premiums may end up causing the very failure the insurance fund is designed to prevent. This is more like 'anti-insurance'[51]

To be collectible and not run the risk of causing a failure, insurance premiums should be smoother over time. This implies a higher than fair premium when banks are healthy and lower than fair when banks are weak. But this comes at a price: since changes in premiums will not fully reflect changes in underlying risks, the insurance will give especially weak banks an incentive to take risks, otherwise known as moral hazard.[52] Banks would then have an incentive to alter their lending policies, change how they fund themselves or engage in more risky proprietary trading to maximise the value – to them – of the insurance, resulting in a greater level of risk. Collecting premiums which in some way reflect the risk

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[50] By internalise the cost we mean that the opportunity cost of the fund is not a cost to the bank and it is invariant to the amount of risk being taken by banks.

[51] These issues are discussed in the context of pension insurance by McCarthy and Neuberger (2010).

[52] The appendix presents a theoretical model which shows that, in the presence of moral hazard, fully socially-optimal premium schedules may actually be less smooth than actuarially fair ones, because insurance providers will want to discourage moral hazard by changing premiums more than changes in the underlying risk warrants. Even fully actuarially-fair premium schedules encourage moral hazard, not to mention the smooth premium schedules which are actually collectible in practice.

of the insured bank can therefore never be a full substitute for effective bank regulation: the insurance fund will still need to rely on regulating banks to protect its balance sheet.

The premium structure would also need to be robust to arbitrage across different parts of the banking system or between different liquidity insurance providers. This is likely to be a problem if Scottish banks can simultaneously access limited liquidity insurance from the Bank of England through the SMF via their branches or subsidiaries in London and a Scottish Insurance Fund. One way to ensure robustness would be to allow the insurance fund to accept only collateral refused by the Bank of England, and to mirror the charging structure of the Bank of England precisely for similar collateral, but with a surcharge added to discourage use.

While an insurance fund could be useful for helping smaller banks, it would be unlikely to survive a crisis involving large banks without some form of public support. This is because it will almost certainly not be able to build up the large amounts of capital required to survive a crisis, particularly if the banking sector is very large relative to GDP. Reserves that are large enough to survive a major crisis will look increasingly wasteful as the last crisis recedes in memory. Many will argue that the reserves are excessive, and that premiums make banking services expensive or uncompetitive. Even if the stated intention of the fund were to protect the Scottish banking system against a significant crisis, a likely outcome is that the fund would be run down before the next crisis approached.

One way to prevent a loss of public support for the Fund is to combine it with similar funds to provide some diversification. For instance, Scotland could combine its bank insurance fund with its proposed oil stabilisation fund and a "Future Fund" designed to protect the economy from the consequences of ageing. Allowing the single fund to be used for a variety of purposes would have two important consequences. First, it would allow the fund to benefit from some degree of diversification. However, when it rains it tends to pour, and the fund would not be able to cope with a sharp fall in the oil price and a banking crisis at the same time. Second, it may be easier to justify a single fund held for many purposes to the public than many different funds, each held for a single purpose. The funds could be held on the government balance sheet, similar to Hong Kong, to encourage the Government to run a prudent fiscal policy and reduce its debt. Some desirable basic design features of the insurance fund would be:

- some form of *ex ante* premium to build up capital and increase financial resilience, with at least a token amount of allowance for risk in the premium to cause banks to internalise the cost of providing the insurance in their capital structure and investment decisions;

- a very strong relationship between the insurance fund and the Scottish banking regulator to control moral hazard. The very visible public funds at risk may incentivise regulators to scrutinise banks more thoroughly;

- a strong political commitment over decades to raise the fund to a meaningful level and then keeping the fund funded. The priority will be fiscal surpluses to accumulate a substantive fund over other public programmes;

- a strong dependence on the structure and pricing of the SMF facilities provided by the Bank to prevent arbitrage (such as only accepting collateral refused by the Bank of England and should charge absolutely higher rates for similar loans).

Given the size of the banking sector in Scotland and the national debt it is likely to inherit, it would take decades to accumulate enough savings for a credible insurance fund. Without access to a central bank Scotland would remain exposed to tail risks of another crisis without a lender of last resort and therefore vulnerable. It is also unclear why banks with a presence both sides of the border would choose to remain in Scotland as they could fund themselves more cheaply in the rest of the UK and provide branch banking into Scotland. The public knowledge that Scotland was not able to provide full protection to its banks could also lead to greater instability for those banks if they remained domiciled in Scotland.

4. C. Third party insurance

Besides self-insurance, Scotland could try and share the risks of its financial system with third parties. This might be by arranging some form of liquidity insurance with a third party in advance in exchange for a fair premium. There are no examples of this – international assistance always seems to involve a government guarantee from the borrowing country, which is best thought of as self-insurance, financed by borrowing. The contingent credit lines of Argentina and others offer salutary lessons of how good ideas on paper fail in practice. Yet there are two third parties which, in the world of realpolitik, may have an interest in finding a solution if Scotland votes for independence: the rest of the UK and EU.

(i) The rest of the UK / Bank of England

Scottish banks will impose an externality on the rest of the UK's banking system. This may arise from three sources: the high degree of integration between Scottish and rest of the UK banking systems, with possibly higher risk of contagion; the limited ability of a Scottish government to stand behind its own banks due to its debt burden and use of sterling; and the moral obligation the UK may feel towards its

neighbour if Scotland gets into difficulties. Rather than wait for the externality to be obvious after the event, the rest of the UK might reasonably seek compensation in advance for the externality costs.[53]

Given that Scotland is likely to be predominantly dollarized, a key issue when considering the role of the Bank of England is the collateral that it will be willing to accept when granting Scottish banks access to the SMF. One way for the Bank to recover the costs of these externalities would be for it to charge banks posting 'Scottish' collateral (such as sterling-denominated Scottish government debt or securities constructed from loans to Scottish firms or households) in SMF facilities an extra premium in respect of these additional externality costs. The premium could be expressed as an additional spread on any loan against which 'Scottish' collateral is posted, or an additional haircut could be imposed on the collateral. Although this may look controversial, the spreads and haircuts would compensate the Bank and the UK for the externality costs imposed them by the Scottish banking system's use of sterling as its currency. The Bank of England would not commit to providing any support to Scottish banks beyond the usual SMF facilities. Emergency liquidity assistance could be judged on a case-by-case basis.

It would also be invulnerable to arbitrage, since any bank posting 'Scottish' collateral would need to pay the haircut, regardless of where it was domiciled. A significant involvement in Scottish bank regulation by the Bank of England would not be required, as loans to Scottish banks would be fully collateralised and there would be no commitment to provide additional support. But it may still be necessary for the Bank of England to have some involvement in Scottish bank regulation, for instance to prevent the Scottish regulator from loosening other regulations to 'undo' the effects of the surcharges and haircuts.

Another feasible way that the Bank of England could provide support to the Scottish banking system would be for it to collect premiums from Scottish banks, based on the size and some measure of the riskiness of their balance sheets, in exchange for providing liquidity during a crisis on defined terms. Winters (2012) raised such a possibility by selling 'liquidity options'. Even assuming that terms could be defined and agreed upon in advance (given the experience during the crisis, terms that seemed appropriate in advance may need to be revisited during a crisis) and that banking risks could be accurately quantified (again based on recent experience, there seems to be little evidence they can) charging risk-based premiums would not protect the Bank of England fully from moral hazard, and would not build up sufficient capital to protect its balance sheet in a crisis, as shown previously and in the appendix. Premium structures that are smooth enough to be collectible in practice and to build up

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[53] The UK made a £3.2bn loan to Ireland on the basis of "a friend in need" although others may suggest there was more self-interest. Sweden provided financing to Latvia in their 2008 banking crisis to protect its own banks from contagion. Its banks also honoured their obligations to Latvia and took a large share of the losses of that crisis.

sufficient capital, could expose the Bank to quite severe risks of moral hazard. For this reason, it seems unlikely that the Bank of England would agree to this arrangement unless:

- purchase of the insurance by Scottish banks were made mandatory to give the Bank greater flexibility over premium structures and avoid adverse selection. If Scottish banks could choose whether to purchase coverage or not, they would be more likely to choose coverage when they are riskier in ways not observable by the Bank;

- Bank of England was strongly involved in the regulation and supervision of Scottish banks, for instance by making the Bank of England the de facto regulator and supervisor of Scottish banks. (If the Scottish banking regulator simply shadowed the Bank of England, this may still introduce risks the Bank of England may well regard as unacceptable, given the amount of discretion involved in regulation and the skewed incentives facing the Scottish regulator);

- Bank of England could take appropriate action to reduce the risks to which it was exposed, for instance by withdrawing cover or otherwise compelling covered banks to take specified actions. This would mean that Scotland would not be able to count on receiving the insurance it had paid for, and

- there is some form of protection provided to the Bank by the Scottish government. For instance, the Scottish government could agree to indemnify the Bank against the costs of rescue above a specified threshold. The challenge here would be how to make the cross-border indemnity binding in all states.

The advantage of this approach is that it gives the UK Treasury some reward for taking on risks it might have to assume regardless: if a systemically important Scottish bank were to fail, and could not be rescued by the Scottish Government, the risk of contagion might cause the UK to step in even if there is no explicit obligation to do so, as was the case in Latvia, where the Swedish Central Bank intervened.

Clear challenges with such an arrangement remain. Firstly, if insurance were made mandatory to avoid moral hazard and the Bank of England were the only provider, it is unclear how Scotland would ensure that premiums were structured fairly and they were not systematically over-charged. Second, the decision to rescue a troubled bank involves a trade-off between the costs of doing so and the perceived costs of not doing so The Bank of England's interests will not be aligned with the interests of Scottish citizens, and it may be less likely to rescue a Scottish bank as a consequence, particularly if such a bank posed few risks for the rest of the UK. The greater the discretion offered to the Bank of England, the more significant this problem becomes. Third, and most important, it is not clear that placing UK funds at risk by providing potentially open-ended obligations to the banks of another country could be made

consistent with the mandate of the Bank of England. In fact, there seem to be no examples of countries that have passed banking risks onto a third party country in this way.

(ii) European Banking Union

A fundamental difficulty facing Scotland in providing liquidity insurance, besides its high level of debt and its inability to create central bank reserves if it chooses to use sterling, is the low degree of diversification of banking risk. Increasing the degree of diversification – by sharing risks across countries – could reduce the amount of capital all countries need to hold in respect of these risks. A possible solution for Scotland is joining the nascent European Banking Union (EBU). The EBU aims to de-link national solvency and banking risk by diversifying across member states and to ensure that failed banks are resolved without recourse to public funds. Although proposals are still being developed, the banking union consists of three pillars: a single banking supervisory mechanism (SSM), and a single resolution mechanism (SRM), including a single resolution fund (SRF) and a single deposit guarantee scheme.[54] Countries are not required to be members of the Eurozone to join.

From November 2014, the European Central Bank (ECB) will be the official supervisor of all 6000 banks in the euro area under the framework of the Single Supervisory Mechanism. It will supervise around 130 systemic banks directly, while its powers will be delegated to national supervisors in respect of smaller banks. If Scotland wished to join the EBU, it would therefore surrender supervision of its major banks – if indeed these retain their Scottish domicile – to the ECB. While there may be some advantages to ECB supervision, the change of supervisor from the Bank of England might encourage the large Scottish banks to move their domicile to the UK. Since the UK has made clear that it will remain outside of the EBU, this raises the prospect of a single currency and two sets of regulators and regulations. The potential for regulatory arbitrage would be considerable.

The single resolution fund will cover the costs of resolving failed banks, but it will be operated as a single fund for all 18 Eurozone members and for those countries who are not members of the Eurozone but who wish to join the EBU. It will be pre-funded by premiums paid by banks. Premiums will comprise a flat portion and a risk-adjusted portion. The institutional arrangements for the single resolution mechanism are complex, involving a single resolution board, national resolution authorities in 18 (or more) countries, the European Commission and Council, and the European Central Bank as the single

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[54] See http://ec.europa.eu/internal_market/finances/banking-union/index_en.htm for current details.

banking supervisor. Decisions about Scottish banks would be ultimately taken by the ECB and Scotland would not be a member of the Governing Council if it remains outside of the Eurozone.[55]

It is unclear how Scotland's entry to the EBU would assist in providing liquidity insurance to the banking sector. Granted that once a bank has failed at to be resolved then the costs are diversified across other member states. However, the point of liquidity insurance is that it is provide before that stage and the ECB is not the provider of emergency liquidity assistance across the Eurozone. All the member countries of the EBU have national central banks that provide liquidity insurance to banks in their countries, and that can either create reserves in their own currency (e.g. Denmark) or have lines of credit with the ECB through the TARGET2 system if they use the Euro.[56] Countries cannot have access to both sources of liquidity, which would open up clear arbitrage opportunities. If Scotland succeeds in joining the EBU while continuing to use the pound, it will have neither the ability to create sterling reserves, nor a mechanism to provide liquidity insurance to its banks.

This is important, because besides the single resolution fund, it appears at this stage that there will be no sharing of the burden of rescuing banks or providing liquidity insurance to cover banks between countries within the EBU. The resolution fund is for banks which are undergoing resolution. Scotland will therefore depend on its own arrangements for providing LOLR cover to its banks, and will only be able to rely on the Single Resolution Fund once its banks have failed. This may create resistance from other countries against allowing Scotland to join the EBU, unless Scottish banks are made to pay higher premiums to reflect the lower level of support provided them by their Government. There would be both pros and cons to an independent Scotland joining the EBU, but as its currently configured this would not provide access to sterling or reduce its debt burden and so not resolve the issue of LOLR.

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[55] HM Treasury, 2013 p31.
[56] See Bordo (2014) on the TARGET2 payment system. Note that countries in ERM II are not permitted to run deficits through the TARGET2 mechanism. They remain to rely on their own arrangements for liquidity insurance.

5.   CONCLUSIONS

The main conclusion of this paper is that if Scotland chooses dollarization as its Plan B (because the UK Government refuses to enter into a formal currency union) it would have little scope to offer lender of last resort facilities to its banking sector. While Scottish banks could continue to have access to the Bank of England's liquidity operations under the Sterling Monetary Framework, it is doubtful that a UK Chancellor would be expected to provide emergency liquidity assistance to a non-UK institution.

The rare examples of countries with informal currency unions (typically a currency boards) and large and successful financial sectors have very strong government finances. Put simply, the strength of financial system reflects the strength of the government that stands behind it. These countries effectively self-insure their own banking industry by choosing to maintain high levels of fiscal and foreign reserves. This option would not be available to an independent Scotland for many years because it would inherit a high debt burden. An alternative way of providing lender of last resort would need to be found.

We review two potential third-party providers of lender of last resort. First, because the rest of the UK would be affected by any financial problem in Scotland it may be willing to explore how the Bank of England could provide a commercial line of credit. We reviewed what this might involve, but consider that the conditions to make this an effective and fair contract (mandatory, discretionary and the full right to regulate) would simply be too burdensome for any independent country. There are perhaps good reasons why cross border lender of last resort facilities in informal currency unions are rare and have tended to fail anyway. Second, the European Banking Union would offer some attractive features for independent Scotland. In particular, there would the possibility of diversifying some of the risk of losses from a bank failure. However, the EBU does not provide net liquidity to countries outside of the Eurozone and so cannot resolve the lender of last resort issue.

The lack of lender of last resort would have important consequences for Scotland's financial sector. Banks in the rest of the UK are may supply banking services through branch operations so that they benefit from UK deposit insurance and regulation. This matters because of the size of financial sector exports in Scotland's balance of payments. Exports of financial services are by far Scotland's most successful export sector (mostly to the rest of the UK). Given the large non-oil deficit in traded goods and services and the gradual decline in oil and gas over the years, this would put greater emphasis on creating and supporting export industries rather than seeing them migrate. Part of the solution to Scotland's lender of last resort problem may be to have its own currency and a functioning central bank.

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7.   ANNEX

This appendix using a mathematical model to explore the tension between premium 'fairness' and 'smoothness' in multi-time period model of insurance contracts where there are hidden actions (moral hazard). The model shows that even when premiums are actuarially fair in all periods, insurance will cause the insured party to exert less than the socially-optimal level of care, increasing the expected losses. To restore the socially optimal level of effort, the insurance provider will need to design premium schedules which are less smooth than actuarially fair – lower than the fair premium in low-risk states and higher than the fair premium in high-risk states.

This model shows that even if central banks collect premiums from banks in each period that are exactly equal to the expected cost of losses, banks will still have an incentive to run more risk than they would if they were not insured. This is the famous 'moral hazard' problem, caused ultimately by the reluctance of central bankers and others to allow especially large banks to fail because of their crucial importance in providing a financial infrastructure in modern economies.

However, in banking even actuarially fair premiums may not be collectible in practice, because the expected losses differ so hugely between strong and weak states and collecting a fair premium from a weak bank could end up driving it into insolvency rather than provide insurance to it. Collecting lower premiums from a risky bank results in a premium schedule which increases less than expected losses increase as a bank's financial condition weakens – called a 'smoother' premium schedule. Smoother premium schedules have an even greater risk of encouraging moral hazard than actuarially fair premium schedules, especially for weaker banks, where market-based incentives start to weaken. The implication is that central banks cannot rely on fair premiums to protect society against the higher losses caused by moral hazard. Instead, they must still regulate banks to ensure that the risks they run are optimal.

A model of premium smoothness in multi-time period insurance with moral hazard

In multi-time period insurance contracts, the issue often arises of how 'smooth' a premium ought to be over time. That is how much the premium changes as the risk characteristics of the insured entity changes. Examples of multi-time period insurance contracts might be whole-life life insurance, medical insurance, pension default insurance or liquidity insurance for banks. For instance, whole-life insurers often charge a level premium, despite the fact that the probability of death rises exponentially with age. And medical insurance is often not re-rated as evidence of ill-health accumulates.

To illustrate the economic trade-offs, we presents a two-period model. The insured party (an individual buying life, medical or auto insurance; a pension fund buying default insurance; a bank buying liquidity insurance) has risk characteristics which can change in the second period relative to the first period. To keep matters simple, only two levels of risk are possible in the second period: high risk and low risk. In the first period, the risk is intermediate, between these two states. It is assumed that the risk characteristics of the individual can be observed by the insurer. In all periods, the amount of the loss is fixed at 1, but the probability of the loss changes. In the first period the probability is p_M, and in the second period, it is either p_H or p_L depending on the state, with $p_H > p_M > p_L$. The insurance policy

charges a premium in the first period which is independent of risk, π_M, and a risk-dependent premium in the second period, conditional on the observed risk state of the individual and written as a vector (π_L, π_H), written as $\{\pi_M; (\pi_L, \pi_H)\}$. Note that an insurance policy which was actuarially fair in each state would charge premiums equal to $\{p_M; (p_L, p_H)\}$ under the assumptions of the model.

In the first period, the insured can undertake costly action to alter the probability that it will end up high risk or low risk in the second period. This action cannot be observed by the insurance company. This creates a moral hazard problem. For simplicity, the endowment of the insured is assumed to be *X* per period, which is fully consumed at the end of each period and renewed at the beginning of the next, so self-insurance through private saving and borrowing is not possible.

Further, it is initially assumed that the individual enters into a binding two-period contract in the first period, so reneging from the contract after observing the second-period risk state is assumed not to be possible. The consequences of relaxing this assumption will be explored in a subsequent section. For now, it is also assumed that this contract is assumed to be for full insurance only, although this assumption is shown to be an outcome of the model, as will be demonstrated. Interest rates and the subjective discount rate of the insured party are assumed to be identical to zero for simplicity. Given that the contract is for full insurance, the insured party will have the following objective function, which depends on the premium schedule:

$$OF(\{\pi_M; (\pi_L, \pi_H)\}) = \max_\lambda u(X - \pi_M - \lambda) + E(u(X - \tilde{\pi}_1)).$$

In the second period, there is a probability $f(\lambda)$ that the individual will end up in the low-risk state *L*, in which case the premium charged will be π_L, and a corresponding probability $1 - f(\lambda)$ that the individual will end up in the high-risk state *H*, in which case the appropriate premium will be π_H. $f(\lambda)$ is assumed to be (weakly) increasing in λ, at a (weakly) decreasing rate, reflecting the fact that greater costly effort will reduce the probability of a high-risk state occurring, but that the marginal effect of extra effort on outcomes falls with increased effort. $f(\lambda)$ quantifies the severity of the potential moral hazard problem: for instance, $f'(\lambda) = 0$ then the actions of the individual do not influence the probability of changing state in the next period and there is no moral hazard. Large positive values of $f'(\lambda)$ signify that large changes to probabilities can be made relatively cheaply, providing significant potential for moral hazard. The laws of probability require that $0 £ f(/) £ 1$.

The expectation is taken over both the uncertainty regarding which risky state the insured will occupy in the second period and the outcomes of the risk states. However, because the individual is assumed to be fully insured in all states, the only risk is with respect to the state the individual is in and the premium that is consequently charged. The individual's objective function therefore reduces to:

$$\max_\lambda u(X - \pi_M - \lambda) + f(\lambda)[u(X - \pi_L) - u(X - \pi_H)] + u(X - \pi_H)$$

The first order condition can be calculated as:

$$u'(X - \pi_M - \lambda) = f'(\lambda) g(\pi_L, \pi_H),$$

where $g(\pi_L, \pi_H)$ is the difference in the second-period utility between low and high-premium states.

From this first-order condition, two conclusions can already be deduced. If the insurance company decides not to differentiate between risk states in the second period, so $\pi_L = \pi_H$, or if $f'(\lambda) = 0$, so no actions by the individual at time 0 can alter the probabilities of the different outcomes in period 1 (so moral hazard is not possible), then it is optimal for the individual to exert no effort in controlling risk in period 0. The more sensitive risk state is to effort, or the greater the difference in premiums payable in the different states, the more effort the individual optimally exerts. This analysis therefore demonstrates that one of the techniques that insurers can use to control moral hazard in multi-period insurance contracts is risk-dependent changes in premiums. The most obvious example is bonus-malus systems in automobile insurance.

Further, we note that the first-best socially optimal level of effort exerted by the insured to reduce the risk (this is the amount of effort the individual would exert if he bore all the social costs of the risk) is given by the solution to the following equation, which is the first-order condition of the individual's objective function solved without insurance:

$$u'(X - \pi_M - \lambda) = f'(\lambda)[u(X) - u(X - 1)][p_H - p_L].$$

Whether the individual exerts the socially-optimal level of effort or not under the insurance policy thus depends on the relative magnitude of the terms $g(\pi_L, \pi_H)$ and $[u(X) - u(X - 1)][p_H - p_L]$. Note that for an actuarially fair premium schedule in all states and a risk-averse insured, the second term is always less than the first, implying that the individual always exerts less than the socially-optimal level of effort when they are fully insured. This is the social cost of moral hazard in the model: although the insured always pays actuarially-fair premiums, the risk taken on will be higher than if they did not purchase insurance. The obvious implication of this is that one way of getting the insured to exert a social-optimal level of effort would be to *increase* the dispersion in the premium beyond what is actuarially fair, increasing $g(\pi_L, \pi_H)$ – in other words to charge less than the actuarially-fair premium in low-risk states and more than the actuarially fair premium in high risk states. Bonus-malus systems may be one example of this approach.

The next part of the problem relates to how the insurance company chooses the premium schedule $\{\pi_M; (\pi_L, \pi_H)\}$. It is standard in this literature to ignore expenses and profit and assume a zero-profit constraint, so the expected cost of claims is set equal to the expected value of premiums over the life of the contract as follows:

$$p_H(1 - f(\lambda)) + p_L f(\lambda) + p_M = \pi_M + (1 - f(\lambda))\pi_H + f(\lambda)\pi_L.$$

Further, an incentive compatibility constraint is required to ensure that the individual would optimally choose to purchase the insurance. However, in this example, since the individual is assumed to be risk averse ($u''(.) < 0$), and the insurance is actuarially fair over the life of the contract by design, the individual will optimally choose full insurance in line with the fundamental theorem of insurance economics, and the incentive compatibility constraint is redundant. (Note that this makes the assumption that neither the insurer nor the individual can renege in the second period).

The insurer therefore chooses to:

$$\max_{\{\pi_M;(\pi_L,\pi_H)\}} OF(\{\pi_M;(\pi_L,\pi_H)\}) \;\; s.t. \;\; p_H(1-f(\lambda)) + p_L f(\lambda) + p_M = \pi_M + (1-f(\lambda))\pi_H + f(\lambda)\pi_L.$$

Although a full solution is beyond the scope of this paper, it can be seen that the optimal premium schedule is a trade-off between the ease of moral hazard (and the consequent additional cost to the insured party) and the utility benefits to the insured of a smooth premium. If the propensity for moral hazard is low (i.e. $f'(\lambda)$ is small), or the insured has a high level of risk aversion, then smoother premiums which are not actuarially fair in every state will be preferred to premiums which fully reflect risk in each and every period. If the propensity for moral hazard is high, or the insured is not too risk averse, then the additional insurance costs caused by moral hazard will mean that a greater degree of variation in premium is tolerated by the insured party. In certain circumstances, the degree of variation in the optimal premium schedule could even exceed what is actuarially fair, even though the contract as a whole is constrained to be actuarially fair.

Note that we have made some strong assumptions: long-term insurance contracts are assumed to be enforceable and the premium in the second period is assumed to be collectible regardless of the probability of loss.

If long-term insurance contracts are not enforceable, then competition between insurers constrains the optimum premium schedule: in the 'low'-risk state in the second period, the premium under all schedules must be less than or equal to the probability of loss, and the 'high'-risk premium must be less than or equal to the premium in the 'high' risk state. This then implies that any under-collection in the second period 'high'-risk state caused by premium smoothing must be compensated for by a higher first-period premium: individuals must over-pay in the first period to avoid a large jump in premiums in the second period if the high-risk state occurs. This implies that in competitive insurance markets without enforceable long-term contracts, there is still room for smoothing premiums: insureds might willingly choose to over-pay in the first period in order to reduce the premium in the second period should the high-risk state occur – effectively, they are purchasing insurance against large future changes in premiums. A common example of this is long-term life insurance, where consumers willingly over-pay when they are young in order to secure lower premiums when they are older. The excess premiums paid by the young function as a bond, binding the insured to the insurer and preventing lapses in high-risk states in the next period. A similar result might obtain in cases where, for some other reason, the full premium cannot be collected in the high-risk state in the second period.