

Scotland as an optimal currency area

Binner, Jane M.; Chaudhry, Sajid M.; Mullineux, Andrew W.; Swofford, James L.

DOI:

[10.1111/sjpe.12181](https://doi.org/10.1111/sjpe.12181)

License:

Other (please specify with Rights Statement)

Document Version

Peer reviewed version

Citation for published version (Harvard):

Binner, JM, Chaudhry, SM, Mullineux, AW & Swofford, JL 2018, 'Scotland as an optimal currency area', *Scottish Journal of Political Economy*, vol. 65, no. 4, pp. 315-327. <https://doi.org/10.1111/sjpe.12181>

[Link to publication on Research at Birmingham portal](#)

Publisher Rights Statement:

This is the peer reviewed version of the following article: Binner, J. M., Chaudhry, S. M., Mullineux, A. W. and Swofford, J. L. (2018), Scotland as an optimal currency area. *Scott J Polit Econ*, 65: 315-327, which has been published in final form at: <https://doi.org/10.1111/sjpe.12181>. This article may be used for non-commercial purposes in accordance with Wiley Terms and Conditions for Self-Archiving.

General rights

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

Take down policy

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact UBIRA@lists.bham.ac.uk providing details and we will remove access to the work immediately and investigate.



Scotland as an Optimal Currency Area

Journal:	<i>Scottish Journal of Political Economy</i>
Manuscript ID	SJPE-Dec-16-116.R2
Wiley - Manuscript type:	Original Article
Date Submitted by the Author:	n/a
Complete List of Authors:	BINNER, Jane; University of Birmingham Swofford, James ; University of South Alabama Chaudhry, Sajid; University of Birmingham Mullineux, Andrew; University of Birmingham, Finance
JEL codes:	C14 - Semiparametric and Nonparametric Methods: General < C1 - Econometric and Statistical Methods and Methodology: General < C - Mathematical and Quantitative Methods, C43 - Index Numbers and Aggregation < C4 - Econometric and Statistical Methods: Special Topics < C - Mathematical and Quantitative Methods, C54 - Quantitative Policy Modeling < C5 - Econometric Modeling < C - Mathematical and Quantitative Methods, E50 - General < E5 - Monetary Policy, Central Banking, and the Supply of Money and Credit < E - Macroeconomics and Monetary Economics, F45 - Macroeconomic Issues of Monetary Unions < F4 - Macroeconomic Aspects of International Trade and Finance < F - International Economics
Keywords:	Scottish independence, Common Currency Areas, Microeconomic Foundations
Abstract:	The June 2016 UK referendum on continued EU membership where the people of Scotland voted to remain, while the rest of the UK voted to leave, once again makes the issue of whether Scotland is an optimal currency area very topical. In this paper we test the microeconomic foundations of a common currency area for Scotland, UK and the rest of the UK without Scotland. We find that the UK, Scotland and the UK without Scotland all meet the microeconomic criteria for a common currency area.

Scotland as an Optimal Currency Area

April 2018

Jane Binner
Department of Finance
Birmingham Business School
University of Birmingham
Birmingham
UK
Email j.m.binner@bham.ac.uk

Sajid Chaudhry
Department of Finance
Birmingham Business School
University of Birmingham
Birmingham
UK

Andrew Mullineux,
Department of Finance
Birmingham Business School
University of Birmingham
Birmingham
UK

James L. Swofford
Department of Economics and Finance
University of South Alabama
Mobile, AL 36688
USA

Abstract

The June 2016 UK referendum on continued EU membership where the people of Scotland voted to remain, while the rest of the UK voted to leave, once again makes the issue of whether Scotland is an optimal currency area very topical. England voted strongly to leave Europe whilst Scotland backed remain by 62% to 38%. The Scottish government published its draft bill on a second independence referendum in October 2016. The move does not mean another referendum will definitely be held, but this does raise the possibility that Scotland might choose independence and staying in the EU without the rest of the UK. If Scotland charts a course of independence from the rest of the UK, then they would likely either issue their own currency or join or form another currency area.

In this paper we test the microeconomic foundations of a common currency area for Scotland, UK and the rest of the UK without Scotland. We find that the UK, Scotland and the UK without Scotland all meet the microeconomic criteria for a common currency area. In contrast, banking data suggest that lending in Scotland is different from lending in the rest of the UK, adding some doubt to the issue of whether or not Scotland is a common currency area with the UK.

Keywords: Scottish independence, Common Currency Areas, Microeconomic Foundations

Acknowledgements: The authors wish to acknowledge the helpful comments of two anonymous referees on an earlier version of this paper.

1. Introduction

The issue of whether or not Scotland is a common currency area first arose during the summer of 2014 when polls on the vote on Scottish independence showed the vote would likely be closer than expected. The Scottish independence from the United Kingdom referendum took place on 18 September 2014. The question, which voters answered with "Yes" or "No", was "Should Scotland be an independent country?" The "No" side won, with 2,001,926 (55.3%) voting against independence and 1,617,989 (44.7%) voting in favour. The turnout of 84.6% was the highest recorded for an election or referendum in the United Kingdom since the introduction of universal suffrage and the outcome seemingly putting this issue to bed for a while.

Then, in a referendum held on 23 June 2016, all 32 council areas in Scotland voted by a majority for the UK to remain a member of the EU. 62% of Scottish voters voted to remain a member of the EU, whilst 38% voted to leave. Overall 52% of voters in the UK voted to leave the EU, with 48% voting to remain. Majorities in England and Wales were in favour of leaving the EU. Since one of the arguments against Scottish independence was the uncertainty independence would mean for Scotland in the EU, the leave vote once again raised the issue of Scottish independence and whether the UK, Scotland and the rest of the UK without Scotland are common currency areas.

The Scottish government published its draft bill on a second independence referendum in October 2016 and in March 2017, the Scottish Parliament authorised the Scottish Government to request a transfer of powers from the UK Parliament to hold a referendum, but the UK Parliament and Government has not agreed to this request to date. This does not mean another referendum will definitely be held, but this does raise the possibility that Scotland might choose independence and staying in the EU without the rest of the UK. If Scotland charts a course of

independence from the rest of the UK, then they would likely either issue their own currency or join or form another currency area.

We take advantage of the fact that Scottish pound notes are not legal tender in England to investigate these issues.¹ Scottish banknotes are unusual, firstly because they are issued by retail banks, not central banks, and secondly, as they are technically not legal tender anywhere in the United Kingdom – not even in Scotland. As such, they are classified as promissory notes and legislation requires that the issuing banks hold a sum of Bank of England banknotes or gold equivalent to the total value of notes issued. This oddity of UK financial law allows us to test the issue of whether the UK or Scotland or the UK without Scotland are optimal currency areas. This issue is important in analyzing what the welfare gains would be when a country abandons its national currency and adopts the currency of a wider area. The economic costs and benefits of having one currency are widely known; see e.g. De Grauwe (2016). In brief, a common currency area provides several benefits to the people in the countries in the area and one such benefit is the complete elimination of transaction costs, because with a single currency there are no exchange rate conversions. Having a single currency also removes the risk of economic exposure because

¹ The legal tender issue is fairly complex in the UK as the Scottish pound sterling notes are not legal tender anywhere even in Scotland. Both Scottish and Northern Ireland banknotes are not "legal tender". Furthermore, Bank of England banknotes are only legal tender in England and Wales. Legal tender has, however, a very narrow technical meaning in relation to the settlement of debt. If a debtor pays in legal tender the exact amount he/she owes under the terms of a contract (and in accordance with its terms), or pays this amount into court, he/she has good defense in law if he/she is sued for non-payment of the debt.

In ordinary everyday transactions, the term "legal tender" in its purest sense need not govern a banknote's acceptability in transactions. The acceptability of a Scottish or Northern Ireland banknote as a means of payment is essentially a matter for agreement between the parties involved. If both parties are in agreement, Scottish and Northern Ireland banknotes can be used in England and Wales. Holders of genuine Scottish and Northern Ireland banknotes are provided with a level of protection similar to that provided to holders of Bank of England banknotes. This is because the issuing banks must back their banknote issue using a combination of Bank of England banknotes, UK coin and funds in an interest bearing bank account at the Bank of England.

there are no currency fluctuations. A further benefit to the formation of a common currency area is the price transparency associated with having a single currency. With price transparency consumers will be able to comparison shop easily because all goods in both countries are priced in the single currency. In addition, based on gravitational model results, Rose and Wincoop (2001) argue that national money seems empirically to act as a significant barrier to international trade. The Rose and Wincoop (2001) finding would mean that the gains from reduced transactions costs would be greater than those implied from merely looking at the current size of international trade among the members of a common currency area. Naturally this similarly implies the costs would be greater than those implied by current trade level if a common currency area were split up.

The costs of a common currency in an area include the loss of domestic monetary control and seigniorage for each country.^{2,3} The loss of a common currency area is the deepest question the government needs to address with respect to the stability of the financial system and levels of government debt, plus the loss of revenues from North Sea Oil for example. A monetary union presents huge constraints for an economy in terms of borrowing constraints, however, those in favour of independence might well feel independence is incomplete without domestic monetary independence. Trade-offs between exchange rate flexibility and monetary policy autonomy are the examined in detail in Fratzscher (2002).

² Infact, only 3 banks in Scotland may issue bank notes; the Bank of Scotland, the Royal Bank of Scotland and Clydesdale Bank. The Bank of England ("The Bank") has responsibility for regulating the treatment, holding and issuance of commercial banknotes in Scotland and Northern Ireland. The Bank derives its responsibilities and powers from Part 6 of the Banking Act 2009. The legislative framework is designed to ensure that holders of Scottish and Northern Ireland banknotes issued by the authorised banks receive a level of protection similar to holders of Bank of England banknotes.

³ Seigniorage will of course exist for the region as a whole. The cost is in deciding how much seigniorage to seek and how to divide it up among the countries.

Mundell (1963) and McKinnon (1963) developed the idea of the existence of an optimal or common currency areas and concentrate heavily on the macroeconomic criteria that affect the formation of such areas. More specifically, they consider mostly the political criteria that influence monetary policy. The direction of this thinking runs opposite to the idea that the determination of what actually constitutes money depends on the decisions of the people of a particular nation or nations. True to this line of thought, Swofford (2000) proposed microeconomic foundations for the existence of a common currency area, and subsequently used the tests for the existence of a common of a common currency area in North America in his later work, please see Swofford (2005).

We find that the UK, Scotland and the UK without Scotland meet the microeconomic criteria for a common currency area. We also find differences in the UK less Scotland and Scotland economies in its loan data.

The basis for these microeconomic foundations is that for a common currency area to exist, the people included in the area must treat money differently than other goods. These microeconomic foundations and revealed preference testing for the existence of a common currency area are reviewed in the following section of this paper.

2. Existence of and Testing for an Optimal Currency Area

If money is an elementary good, then economic agents treat other goods differently than they treat money. For example, if the Scottish people treat other goods differently than notes and coins and the people of the rest of the UK do not treat other goods differently than notes and coins, then the two areas do not form a common currency area. However, if the people of the two areas treat notes and coins and other goods in a similar manner, then the two countries can form a common currency area.

The microeconomic content of this definition of a common currency area requires that the common currency be an asset or assets in economic agents' optimizing function. If this common money is held by consumers for the liquidity services it provides, then it can be modeled in the consumer's utility function:

$$(1) \quad U = U(\mathbf{x}, m)$$

where U is a well-behaved utility function, \mathbf{x} is a vector of nonmonetary goods and assets, and m is cash that is the good that provides liquidity services.⁴

For currency to be money that is consistent with economic theory including neutrality, the other goods and assets held by the representative agent must be treated differently.⁵ This criterion means the other goods and assets are at least weakly separable from all other goods in the agent's preferences. Thus, if an elementary good like cash is to be the common money in an area, then the people in that area must treat all other goods and assets differently. This restricts $U(\cdot)$ to be at least weakly separable in all other goods and assets:

⁴ Feenstra (1986) shows that the liquidity costs and the utility of money approaches to modelling money demand are functionally equivalent.

⁵ Barnett (1980) originated the concept of an economic monetary aggregate.

$$(2) \quad U = U(V(\mathbf{x}), m).^6$$

When a weakly separable subutility function such as $V(\mathbf{x})$ exists, then the marginal rate of substitution between any two goods in $V(\mathbf{x})$ is independent of the level of money holding, m .⁷ Less formally, the weak separability criteria for aggregation is a way to identify money as whatever people in the hypothesized common currency area use as money. $V(\mathbf{x})$ will contain all other goods and assets the agent treats differently than money. If the common currency of an optimum currency area is thought of as using cash as money, then the weak separability restrictions in equation (2) must obtain. If this criterion is not met, then monetary policy in the hypothesized common currency area may be unstable due to the lack of a reliable relationship between money and other goods.

From a set of areas that meet the microeconomic conditions for a common currency, the optimal currency area is the one that is the broadest. The broadest of the areas that meet the conditions is optimal in the sense that it eliminates the most transactions costs.

If more than one person is in a hypothesized optimum currency area, then (1) or (2) is restricted further by the conditions for aggregating over agents. The restrictions for aggregation over agents are more stringent than those for aggregation over goods. As Deaton and Muellbauer (1980) point out, aggregation over agents requires that the preferences of each agent be at least quasi-homothetic. Thus, quasi-homothetic representations of $U(\cdot)$ and $V(\cdot)$ are required for

⁶ This is a slightly different structure than that suggested in Swofford (2000) since if money is a single good rather than an aggregate, then the only way to see if money is treated differently is to see if all other goods are weakly separable from money. Data limitation make us maintain money as a single elementary good in this case.

⁷ See Deaton and Muellbauer (1980) concerning aggregation over goods.

aggregation over agents.⁸ Still the quasi-homothetic restrictions are very stringent and often are finessed by assuming a representative agent as will be done in this study.⁹

A common currency area still requires a political decision by the people within the hypothesized area. Thus the existence of a well-behaved utility function with an at least weakly separable sub-utility function can be viewed as a sufficient condition for the existence of a common money within an area. Even if the Scottish people can form a common currency, by choosing to go alone as a common currency they will be increasing transactions costs for all commercial interaction with the rest of the UK. Thus the necessary political consensus to form a common currency area may not develop.

Revealed preference tests are used to test for the existence of UK, Scottish, UK without Scotland common currency areas. The advantages of revealed preference tests are that they do not require the assumption of a particular functional form, and they can be used with limited data observations as is the case with the separate series on Scottish pound sterling notes. However, revealed preference tests do not include random behavior. A detailed discussion of these nonparametric tests is presented in Varian (1982 and 1983).

Let $p^i = (p^i_1, p^i_k)$ be the i^{th} observations for the prices of some k goods and assets and $x^i = (x^i_1, \dots, x^i_k)$ denotes the corresponding quantities of the k goods and assets. Varian (1982) developed the generalized axiom of revealed preference, henceforth GARP. GARP can be stated:

$$\text{If } x^i R x^j \text{ then } p^j x^i \leq p^j x^j \text{ for all } i, j = 1, \dots, n.$$

If the data satisfy GARP there exists a nonsatiated, continuous, monotonic, concave utility function that rationalizes the data.¹⁰

⁸ Quasi-homothetic preferences imply that each agent's Engle curves are linear. While quasi-homothetic Engle curves are linear, they need not pass through the origin as is the case for homothetic preferences.

⁹ The assumption of a representative agent is necessary unless micro or panel data exist.

Varian's (1985) implementation of revealed preference tests becomes a three part test.

Part 1: Test if the goods in the hypothesized utility function are consistent with GARP.

Part 2: Test whether the data in the hypothesized sub utility function are consistent with GARP.

Part 3: Test a sufficient, but not necessary, condition for weak separability that is whether the data with the goods in the hypothesized sub utility function replaced by an aggregate good calculated using the Afriat inequalities are consistent with GARP.

Hereafter, the sufficient condition for weakly separable utility, Part 3, will be referred to as the Afriat sufficient condition.

Consistency with GARP, and the Afriat sufficient test for a well-behaved utility function at least weakly separable in all other goods from money collectively are a sufficient condition for the existence of a common money. If these conditions hold, then a common money exists in an area whether or not the people in the area politically decide to use a common currency. The data set used for these revealed preference tests is discussed in the next section. Our approach is based solely upon tests of the revealed preferences of representative agents' utility for holding and using component assets of the money supply as described here above. Hence, our approach is very different from alternative methodologies which examine macroeconomic conditions of an optimum currency area based upon a structural framework of the New Keynesian model of currency unions; see for example Gal'1 and Monacelli (2008). The latter authors use models of currency unions to demonstrate that regions (provinces) that have no predictability of inflation at medium term horizons are not operating differently in this respect than they would be under their

¹⁰ Thus, a violation of GARP happens when for some $x^i R x^j$, the condition $x^j S x^i$ is true or a violation of GARP happens if x^i is shown to be revealed preferred to x^j but x^j is directly revealed preferred to x^i .

own optimal monetary (and fiscal) policies. That is, there are no consequences in terms of monetary policy for their participation in the currency union. Notably, these conditions do allow for differences in conditional mean inflation rates across provinces that would arise with the different productivity growth rates across provinces, which is consistent with observed provincial inflation rates. This alternative approach, therefore, is to test the regional inflation target conditions to assess each region's performance within the currency union. This Gal'ı and Monacelli (2008) method is adopted by Chaban and G. M. Voss (2016) to demonstrate that for regions within a currency union the path of regional inflation will differ from national inflation depending upon the asymmetries of the underlying economic disturbances and or whether regional fiscal policies are appropriately set. Should asymmetries be not be too significant and fiscal policies set appropriately then regional inflation should satisfy a simple forecast target condition; that is, regional inflation differences should not be predictable at medium term horizons. Hence, this alternative approach, which, as stated above, tests the regional inflation target conditions to assess each region's performance within the currency union, is very different from our approach which is to perform a test of whether or not an optimum currency area exists using nonparametric GARP tests of the microeconomic foundations of common currency areas. We now move to our choice of data, the presentation of our results and we offer conclusions and suggestions for future research.

3. Data

The data used in this paper for the UK and Scotland are from the Office of National Statistics, the NOMIS – Official UK Labour Market Statistics and the Bank of England Interactive Database. These data are quarterly observations on consumption and monetary asset from 2009Q4 through 2016Q4. The starting point of our sample is the 2009Q4 because the data on

‘Notes and Coins’ for Scotland are available from 2009Q4, leaving us only with 29 data points.

As discussed above an advantage of revealed preference tests is that they can be used with limited data observations. Also perhaps, the recent period preferences of agents are more representative of their choices now when compared to their historical preferences.

We obtain all the non-monetary data (Gross Value Added (GVA), Consumer Price Index (CPI), Labour Hours Worked and Population) for the UK and for Scotland from the Office of National Statistics except GVA for Scotland that we obtain from the Scottish National Accounts Project (SNAP) and Labour Hours Worked for Scotland, Wage Rate for the UK and Scotland, which we gather from NOMIS – Official UK Labour Market Statistics. We obtain the monetary data, which are Notes and Coins and the benchmark interest rate, for the UK and for Scotland from the Bank of England Interactive Database¹¹. We use real GVA for the UK, for Scotland and for the UK without Scotland as our real goods sector data. We assume CPIH^{12, 13} for Scotland is the same as that in the UK because no separate price index is computed for Scotland. We use the CPIH to convert the consumption and money series into real terms. We use the working population having an age of 16 plus to convert the consumption, leisure and money series into real per capita terms.

Following Barnett (1980) that the appropriate price for each financial asset is its user cost, we define the nominal user cost of the monetary assets as a discounted interest rate differential, $(R-r)/(1+R)$, where R is the benchmark rate and r is the rate of return on the

¹¹ available at <http://www.bankofengland.co.uk/boeapps/iadb/>

¹² CPIH is a new measure of consumer price inflation including a measure of owner occupiers’ housing costs (OOH).

¹³ We took nominal annual data from the ONS GVA data source for Scotland, Table 3 in current prices and created annual averages for all our other data in Section 3 above and ran the revealed preference tests on the resulting seven observations, 2010 through 2016. We ran the tests for both Scotland and the UK less Scotland. The results are as expected. GVA and leisure meet the necessary and the Afriat sufficient conditions for weakly separable utility maximization for both the data on Scotland and the data on the UK less Scotland. Thus this additional Scottish source for GVA did not change our results.

monetary asset. Since the monetary asset used in our study is only Notes and Coins, r is equal to zero. Following the Bank of England's 'Envelope Approach', we use the rate of M4 component that pays the highest interest rate as our benchmark rate (Hancock, 2005).

Finally, in order to check business sector behavior is the same as that of the overall consumer behavior in Scotland and the rest of Great Britain, we collect data on value of loan balances advanced to the Small and Medium Enterprises (SMEs) from the British Bankers Association.¹⁴ These data are quarterly observation from 2011Q3 to 2016Q4. Furthermore, we also check consumer borrowing behavior and collect data on value of mortgage and personal loans outstanding advanced to the households from the UK Finance Statistics.¹⁵ The data are the most recently available quarterly observations from 2013Q2 to 2016Q4.

4. Results

The data described above on per capita value added, leisure and cash were checked for consistency with the microeconomic criteria for the existence of common currency using Varian's (1985) three-step revealed preference test for weak separability that was discussed previously. Consistent with the modeling above, the specification check was:

$$(3) \quad U = U(V(C, L) M).$$

where C is real gross value added per capita, L is hours of leisure per capita and M is real cash or notes and coins per capita. That is the data for a representative agent in the UK, Scotland, and the UK without Scotland, were checked for consistency with the microeconomic foundations of an optimum currency area with an elementary good as money.

¹⁴ The British Bankers Association does not report data on loans outstanding to Small and Medium Enterprises in Northern Ireland.

¹⁵ Similar to the SME data, the household debt data is also not available for Northern Ireland.

The data for the UK, Scotland and the UK without Scotland, presented in Table 1, each individually meet the necessary and sufficient microeconomic conditions for the existence of a common currency area. That is, each of these areas meet the necessary conditions and the Afriat sufficient condition outlined above

These results offer a bit of something for every side of this debate. The result on the UK means it meets the microeconomic conditions for a common currency area and the UK remaining a common currency area would present no economic problems. The results on the UK without Scotland means this area meets the microeconomic conditions for a common currency area and the rest of the UK would not encounter instability as a common currency area were Scotland to go its separate way. The results on Scotland mean it could form its own common currency area, if the Scottish people are willing to pay the transition costs and operational costs associated with changing to their own currency. Experiences from countries that have unilaterally adopted a foreign currency suggest that an independent Scottish state could either have no central bank, (e.g. Panama) or have a central bank with limited powers and responsibilities (e.g. Montenegro), and this would not be a currency issuing bank. Either choice could potentially conflict with the institutional requirements for EU membership. Please see the HM Government policy document (2013) for a detailed discussion on monetary policy in Scotland.

[TABLE 1 ABOUT HERE]

A weakness of our approach is that we are not able to get separate data on various possible near monies for Scotland and the rest of the UK without Scotland. So we looked at some bank lending to SME and to Households data for Scotland and the GB without Scotland to test whether lending in Scotland and the rest of the GB are statistically different from each other.

The descriptive statistics are given in Table 2. Panel A shows the SME lending in the rGB and in Scotland from 2011Q3 to 2016Q4. The mean SME lending in the rGB is £82,043.61 million and in Scotland it is £6,446.07 million. This makes 92.7% of the total SME lending in the rGB and 7.3% in Scotland. This is also shown in pie chart in the left hand side of Figure 1. The median lending is very close to mean lending showing there is no extraordinary lending in any period. Panel B shows household lending in the rGB and in Scotland from 2013Q2 to 2016Q4. The mean household lending in the rGB is £864,793.70 million (making 92.8% of the total) and in Scotland it is £67,064.05 million (making 7.2% of the total). This is illustrated in the pie chart on the right hand side of Figure 1. Similar to SME lending, the median household lending is very close to the mean lending showing there is no extraordinary lending in any period.

[FIGURE 1 AND TABLE 2 ABOUT HERE]

To test whether lending in Scotland and the rest of the GB are statistically different from each other, we ran Wilcoxon/Mann-Whitney tests. These tests have the null hypothesis of the equality of medians. Wilcoxon/Mann-Whitney test is a non-parametric test and robust for small sample sizes and compares two populations to see if they are significantly different from each other. The test strongly rejects the null hypothesis that the samples have the same median and we conclude that both business (Table 3) and household loans (Table 4) are different in Scotland compared to the rest of the UK. This result, suggesting differences in the economies, means that the UK including Scotland is not a common currency area.

[TABLE 3 AND 4 ABOUT HERE]

Thus, overall, the data on value added, leisure and money indicate that the UK, Scotland and the UK without Scotland form common currency areas. That the data are consistent with

Scotland and the UK minus Scotland as common currency areas does not overcome various macroeconomic and political issues that might arise within the individual countries. In addition to the added transactions costs a Scottish currency would impose on the Scottish people and the rest of the UK, the Scottish would face transactions costs including, as above, the possibility of setting up a central bank and other Scottish governmental agencies. Still, the will of the Scottish people remains a necessary condition for Scotland adopting its own currency or adopting another non-UK common currency.

Finally, it is worthwhile mentioning that there is a distinction between a monetary union and the fiscal policies that are subsequently required in a monetary union. The role of fiscal policies within a monetary union; a discussion on how independent national fiscal policies can be; and a detailed debate on whether or not a monetary union increases or reduces fiscal discipline, including any rules that may be used to restrict national fiscal policies, may be found in de Grauwe (2016, chapter 10).

5. Conclusions

A Scottish national currency that might result due to the Scottish people voting for the EU whilst the rest of the UK voted against EU membership would impose added transactions costs on people on both side of the border with England. Such a common currency area would add an additional national currency that as Rose and Wincoop (2001) showed might act as an implicit barrier to trade.

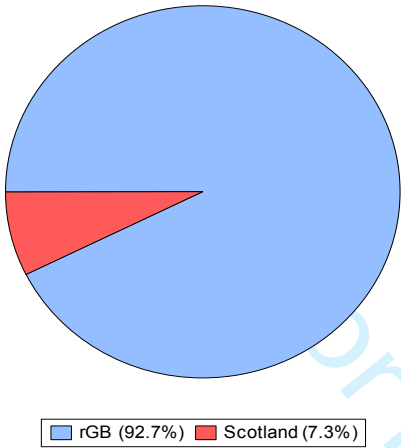
We have found that data on gross value added per capita, leisure per capita and notes and coins per capita show the UK, Scotland and the UK without Scotland meets the microeconomic conditions for a common currency area. Finally, banking data suggest that lending in Scotland is different from lending in the rest of the UK, adding some doubt to the issue of whether or not

Scotland is a common currency area with the UK. With respect to Euro area monetary aggregates, further research might be profitably be directed towards exploring more sophisticated aggregation procedures, such as those suggested by Barnett and Su (forthcoming) or towards incorporating risk bearing assets into the money measures.

For Review Only

Figure 1

Mean share of rGB and Scotland SME lending



Mean share of rGB and Scotland household lending

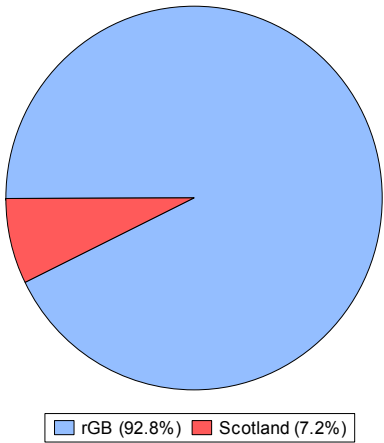


Table 1

Revealed Preference Test Results

<i>Area</i>	<i>Utility Function</i>	<i>Subutility Function</i>	
	<i>GARP</i>	<i>Necessary</i>	<i>Afriat Sufficient</i>
UK	Y	Y	Y
Scotland	Y	Y	Y
UK without Scotland	Y	Y	Y

Note Y implies the condition is met and N means a condition is not met. The reader is reminded that the Afriat sufficient condition is not necessary and that other sufficient conditions might hold.

Table 2

Descriptive Statistics

Panel A: SME Lending (Amount in million £)

	Mean	Median	Maximum	Minimum	Std. Dev.
rGB	82,043.61	82,112.17	85,113.65	78,730.74	1,659.71
Scotland	6,446.07	6,474.52	8,117.28	5,767.73	520.73

Panel B: Household Lending (Amount in million £)

	Mean	Median	Maximum	Minimum	Std. Dev.
rGB	864,793.70	864,875.10	904,583.20	827,600.30	27,069.65
Scotland	67,064.05	67,115.47	69,527.89	64,840.41	1,459.81

Table 3

Test for Equality of Medians Between Business Lending Series in Scotland and England

<i>Method</i>	<i>df</i>	<i>Value</i>	<i>Probability</i>
Wilcox/Mann Whitney		5.67	0.000
Wilcox/Man Whitney (tie adjusted)		5.67	0.000
Median Chi-square	1	44.00	0.000
Adjusted Median Chi-square	1	40.09	0.000
Kruskel-Wallis	1	32.27	0.000
Kruskel-Wallis (tie-adjusted)	1	32.27	0.000
van der Waerden	1	28.59	0.000

Note the sample is from 2011Q3 to 2016Q4 or 22 observations.

Table 4

Test for Equality of Medians Between Household Lending Series in Scotland and England

<i>Method</i>	<i>df</i>	<i>Value</i>	<i>Probability</i>
Wilcox/Mann Whitney		4.65	0.000
Wilcox/Man Whitney (tie adjusted)		4.65	0.000
Median Chi-square	1	30.00	0.000
Adjusted Median Chi-square	1	26.13	0.000
Kruskel-Wallis	1	21.77	0.000
Kruskel-Wallis (tie-adjusted)	1	21.77	0.000
van der Waerden	1	19.49	0.000

Note the sample is from 2013Q2 to 2016Q4 or 15 observations.

References

- Afriat, Sydney N. (1967). "The Construction of Utility Functions from Expenditure Data." *International Economic Review* 8, 66-77.
- Barnett, W. A., (1980) "Economic Monetary Aggregate: An Applications of Index Number and Aggregation Theory," *Journal of Econometrics* 14, 11-48. Reprinted in: Barnett, W.A., Serletis, A., 2000. (Eds.), *The Theory of Monetary Aggregation*. North Holland, Amsterdam, pp. 11-48.
- Barnett, W.A., and Su. L., (forthcoming) "Risk Adjustment of the Credit-Card Augmented Divisia Monetary Aggregates," in Giovanni De Bartolomeo, Daniela Federici, and Enrico Saltari (eds.), *Macroeconomic Advances in Honor of Clifford Wymer*, special issue of *Macroeconomic Dynamics*, .
- Binner, J.M., Chen, SH., Mullineux AW., and Swofford, J. (2011) "Do the ASEAN countries form a common currency area?" *Journal of International Money and Finance*, 30, 1429-1435.
- Chaban M. and Voss G.M., "Is Canada an optimal currency area? An inflation targeting perspective" *Canadian Journal of Economics*, 49:2, 738 -771.
- De Grauwe, P., (2016). *Economics of Monetary Union* Oxford University Press, 11th edition. ISBN: 9780198739876
- Deaton, Angus and John Muellbauer, (1980). *Economics of Consumer Behavior*, Cambridge: Cambridge University Press.
- Feenstra, Robert C., (1986). "Functional Equivalence between Liquidity Costs and the Utility of Money," *Journal of Monetary Economics*, 17:2, 271-91.

Fratzscher M., (2002), "The Euro bloc, the Dollar bloc and the Yen Bloc: How Much Monetary Policy Independence can Exchange Rate Flexibility Buy in an Interdependent World" *European Central Bank Working Paper Series* No 14, June 2002.

Gal'ı J. and Monacelli T., (2008) "Optimal monetary and fiscal policy in a currency union" *Journal of International Economics* 76, 116–32.

Hancock, M., (2005)., "Divisia Money". *Bank of England Quarterly Bulletin*, 45:1, 39-46.

HM Government., (2013)., "Scotland Analysis, Currency and Monetary Policy" available at www.gov.uk/scotlandanalysis, ISBN: 9780101859424 Printed in the UK by The Stationery Office Limited on behalf of the Controller of Her Majesty's Stationery Office.

McKinnon, Ronald I., (1963). Optimum Currency Areas", *American Economic Review*, Vol 53, pp. 717-724.

Mundell, Robert A., (1961). "A Theory of Optimum Currency Areas," *American Economic Review*, 51, 657-665.

Patterson, K. D., (1991). "A Non-parametric Analysis of Personal Sector Decisions on Consumption, Liquid Assets and Leisure," *The Economic Journal*, 101:408, 1103-1116.

Rose, Andrew K. and Eric van Wincoop, (2001). "National Money as a Barrier to International Trade: The Real Case for Currency Union," *American Economic Review*, 91:2, 386-390.

Swofford, James L. (2000), "Microeconomic foundations of an optimal currency area", *Review of Financial Economics*, 9,:2, 121 – 128.

Swofford James L., (2005), "Tests of Microeconomic Foundations of a North American Common Currency Area" *The Canadian Journal of Economics / Revue Canadienne d'Economique* Vol. 38, No. 2 (May, 2005), pp. 420-429.

Swofford, James L. and Gerald A. Whitney. (1988). "Comparisons of Nonparametric Tests of Weak Separability for Annual and Quarterly Data on Consumption, Leisure and Money," *Journal of Business and Economic Statistics*, 6, 241-246.

_____. (1986). "Flexible Functional Forms and the Utility Approach to the Demand for Money: A Nonparametric Analysis," *Journal of Money, Credit, and Banking*, 18:3, 383-389.

Varian, Hal R. (1982). "The Nonparametric Approach to Demand Analysis," *Econometrica*, 50, 945-973

_____, (1983). "Nonparametric Tests of Consumer Behavior," *Review of Economic Studies*, 50, 99-110.

_____, (1985). "Nonparametric Demand Analysis," software program