

2018 WEA ON LINE CONFERENCE

MONETARY POLICY AFTER THE GLOBAL CRISIS

How Important Are Economic (Divisia) Monetary Aggregates for Economic Policy?

(in honour of William A. Barnett)

15th February to 15th March, 2018

Title of the paper

Economic monetary aggregates and common currency areas: The case of Scandinavia

Author

James L. Swofford

Abstract

Barnett (1980) described how to identify and construct monetary aggregate consistent with economic theory. Swofford (2000) extended Barnett's work to the subject of common currency areas.

When the euro bloc was formed, among the European Union members not to join were Denmark and Sweden. These two countries did not join the euro bloc after "no" votes in referendums in each country. Perhaps the people of these countries felt the euro bloc was too large a step.

In this paper results are presented from revealed preference tests of microeconomic foundations of a Scandinavian common currency area. These results can be viewed as broadly favorable toward the formation of a Scandinavian common currency area.

Author Affiliation and Email

University of South Alabama, USA, jswoffor@southalabama.edu

Economic Monetary Aggregates and Common Currency Areas: The Case of Scandinavia*

January 2018

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

*The empirical results in this paper are previously published in Swofford et al. (2013). The author would like to thank various referees for useful comments on this paper. The usual *caveat* remains.

Abstract

Barnett (1980) described how to identify and construct monetary aggregate consistent with economic theory. Swofford (2000) extended Barnett's work to the subject of common currency areas.

When the euro bloc was formed, among the European Union members not to join were Denmark and Sweden. These two countries did not join the euro bloc after "no" votes in referendums in each country. Perhaps the people of these countries felt the euro bloc was too large a step.

In this paper results are presented from revealed preference tests of microeconomic foundations of a Scandinavian common currency area. These results can be viewed as broadly favorable toward the formation of a Scandinavian common currency area.

JEL Classifications: F33, C14

\

I. Introduction

Barnett (1980) introduced the concept of an economic monetary aggregate. Such an aggregate must contain monetary goods that are at least weakly separable from other goods and must be constructed using a reputable index number. Barnett suggested using the Tornqvist discrete time approximation of the continuous Divisia index.¹ This index is one from the class of superlative index numbers.

Swofford (2000) illustrated the breadth and depth of Barnett's (1980) contribution to financial economics by extending Barnett's ideas to the subject of common currency areas.² Swofford (2000) pointed out that Barnett's weak separability criterion of a group of monetary assets as a necessary condition for the existence of an economic monetary aggregate implies a similar criterion for the existence of a common currency in any sized area.

When the euro bloc was formed in 2002, Denmark and Sweden were among the European Union members who did not join the euro bloc. Denmark and Sweden did not join after voters in each country voted against joining the euro bloc in separate referendums. While a new referendum is pending in Denmark, perhaps what the voters of these countries were telling their leaders is that they considered the euro a step too far. A smaller step that might be more in line with the preferences of voters in this area is a Scandinavian common currency area composed of Denmark, Iceland, Norway and Sweden.³

¹ This led to these aggregates being called Divisia aggregates despite the index number being only half of Barnett's criteria for the economic monetary aggregates.

² This shows the depth and breadth of one of Barnett's contributions. Barnett has also made contributions in other areas including modeling and estimating demand systems, index number theory, complex macroeconomic modeling among others.

³ There are various definitions of Scandinavia including some that include the parts of Finland populated by ethnically Swedish people. For this paper we are defining Scandinavia to include Denmark, Iceland, Norway and Sweden.

There are several reasons to suspect that Scandinavia might form a common currency area. The four countries have strong trading relationships with each other. Each country already uses a similarly named decimal based currency.⁴ The four countries are geographically relatively close to each other and have a relatively large volume of trade between each other.⁵

The formation of a common or optimal currency area provides several benefits to the people of the prospective countries. One 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 there are no currency fluctuations. Another benefit to the formation of a common currency area is the characteristic of 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 will be 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. This 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 potential members of a common currency area.

Costs of forming a common currency area also come from several sources. One cost is the transition cost from changing from domestic currencies to a common currency. If a Scandinavian common currency is viewed as a intermediate step before joining the euro bloc,

⁴ The Danish currency is called the kroner, in Iceland the currency is known as the kronur, in Norway the currency is called the kroner and the Swedish the currency is the kronor.

⁵ These countries have other interaction. As suggested above, Denmark and Sweden belong to the EU while Iceland and Norway do not. Also Denmark, Iceland and Norway belong to NATO while Sweden does not.

then the transition costs associated with this intermediate step are avoidable. A second cost is the loss of domestic monetary control and seigniorage for each country.⁶

Following Mundell (1963) and McKinnon (1963), previous discussion on the existence of an optimal or common currency area concentrates heavily on the macroeconomic foundations 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. Barnett (1980) is in the spirit that what is money is whatever people uses as money. True to this line of thought in common currency areas, Swofford (2000) proposed microeconomic foundations for the existence of a common currency area and tested the Euro area for consistency.⁷ The basis for these microeconomic foundations is that for a common currency area to exist, the people included in the area must use the same assets as money.

II. Existence of a Common Currency

As Swofford (2000) discussed, a common currency area is any area in which the economic agents treat the same asset or group of assets as providing monetary services.⁸ For example, if the people of Sweden use currency as money and the people of Denmark use currency and checkable deposits or some additional assets as money, then the two countries do not form a common currency area. However, if the people of the two countries use only currency and checkable deposits as money, then the two countries can form a common currency area.⁹

⁶ 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.

⁷ Other potential common currencies tested include North America, Swofford (2005), Australia and New Zealand, Swofford, Birkelöf and Filer (2007) and East Asia, Swofford (2008).

⁸ The research by Patterson (1991) on the United Kingdom and the papers by Swofford and Whitney (1986 and 1990) on the United States suggest that money is likely composed of more assets than just currency.

⁹ Machlup (1977) pointed out that a common currency area is not the same thing as a

Even if the people of Scandinavia use currency and checkable deposits as money and can form a common currency area, but the criteria of Mundell (1961) and McKinnon (1963) are not met, then the gains from forming a common currency area may not be large enough to offset the costs. In such case a political consensus to form a common currency area may not develop.¹⁰

Consistent with Barnett's (1980) definition of an economic monetary aggregate in a single country, 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:

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

where U is a well-behaved utility function, \mathbf{x} is a vector of nonmonetary goods and assets, and \mathbf{m} is a vector of the asset or assets that provide liquidity services.¹¹

If more than one asset is held as money, then a common currency area must have a common economic monetary aggregate. For an economic monetary aggregate to exist, the assets combined into the aggregate must be at least weakly separable from all other items in the objective function. In monetary economics this criteria means that a monetary aggregate can be formed including only those financial assets that are at least weakly separable from all other goods in the agent's preferences. Thus, if a common money of more than one asset is to exist it must be composed of assets at least weakly separable from all other goods. This restricts $U(\)$ to be at least weakly separable in the monetary assets:

fixed exchange rate regime unless the exchange rate were fixed at a ratio of one to one.

¹⁰ Of course as discussed above, Rose and Wincoop (2001) have found national currencies act as significant barriers to trade and the gains from forming a common currency area are greater than that indicated from the current level of trade between countries.

¹¹ Feenstra (1986) shows that the liquidity costs and the utility of money approaches to modeling money demand are functionally equivalent.

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

When a weakly separable subutility function such as $V(\mathbf{m})$ exists, then the marginal rate of substitution between any two monetary goods in $V(\mathbf{m})$ is independent of the level of consumption of any good in \mathbf{x} .¹² Less formally, the weak separability criteria for aggregation is a way to identify money as whatever people in the hypothesized common currency area treat as money. $V(\mathbf{m})$ will contain currency and all other assets the agent treats in a similar manner. If the common currency of a common currency area is thought of as including both currency and other near monies, 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 monetary target.

If more than one person is in a hypothesized common 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 aggregation over agents.¹³ Still the quasi-homothetic restrictions are very stringent and often times are finessed by assuming a representative agent.¹⁴

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 subutility function containing money and other monetary assets can be viewed as a

¹² See Deaton and Muellbauer (1980) concerning aggregation over goods.

¹³ 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.

¹⁴ The assumption of a representative agent is necessary unless micro or panel data exist.

sufficient condition for the existence of a common money within an area. Approaches for testing for the existence of such a common currency area are discussed next.

III. Testing for the Existence of a Common Currency Area

Revealed preference tests are used to test for the existence of an Scandinavian common currency area. The revealed preference tests do not require the assumption of a particular functional form, and they can be used with limited data observations. 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:

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

If the data satisfy GARP there exists a nonsatiated, continuous, monotonic, concave utility function that rationalizes the data.¹⁵

Further if the data are partitioned into two sets of goods and associated prices (p^i, x^i) , (r^i, m^i) , $i = 1, \dots, n$, then a utility function is weakly separable if a subutility function $V(\mathbf{m})$ and a macro-utility function strictly increasing in V such that $U(\mathbf{x}, \mathbf{m}) = U(\mathbf{x}, V(\mathbf{m}))$ can be found. In this vein Varian (1983) showed,

The following conditions are equivalent:

1. *There exists a weakly separable nonsatiated continuous, concave, monotonic utility function that rationalizes the observed data.*

¹⁵ 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 .

2. *There exist utility indices U^i, V^i and marginal utility indices $\lambda^i > 0, \mu^i > 0, i = 1, \dots, n$ that satisfy the following Afriat inequalities:*

$$U^i \leq U^j + \lambda^i p^j (x^i - x^j) + \lambda^j / \mu^j (V^i - V^j)$$

$$V^i \leq V^j + \mu^j r^j (m^i - m^j), \text{ for } i, j = 1, \dots, n.$$
3. *The data $(r^i - m^i)$, and $(p^i, 1/\mu^i, x^i, V^i)$ satisfy GARP for some choice of (u^i, V^i) that satisfies the Afriat inequalities.*

To meet condition (3) the entire data set and any hypothesized weakly separable subgroup must satisfy GARP. Thus, consistency with GARP is a necessary condition for weak separability.

The sufficient conditions checked for in this paper are that the data satisfy GARP when the subutility function is calculated using the Afriat inequalities. That is, using the observed prices and quantities, the Afriat inequalities in (2) above are solved for utility levels, U^i and V^i , and marginal utilities, λ^i and μ^j , and used to construct an aggregate good for those in the hypothesized subutility function. This aggregate good is then included in the hypothesized overall utility function which is tested for consistency with GARP. If the data set including the aggregate good for the subutility function is consistent with GARP, then the original data are consistent with a well-behaved utility function weakly separable in the assets in the hypothesized subutility function. Hereafter, these sufficient conditions for weakly separable utility will be referred to as the Afriat sufficient conditions.

The necessary test, consistency with GARP, and the Afriat sufficient test for a well-behaved utility function at least weakly separable in monetary assets collectively are a sufficient condition for the existence of a common monetary aggregate. If these conditions hold, then a common monetary aggregate exists in an area whether or not the people in the area politically decide to adopt a common currency. The data set used for these revealed preference tests is discussed in the next section.

IV. Data

The data used for this paper are from the International Monetary Fund (2007). These data are annual and quarterly observations for the period 1995 to 2006. From this source annual data were gathered for Denmark, Iceland, Norway and Sweden. The series of data taken for these four countries include population, private consumption (C), the consumer price index (P), money (M), quasi-money (Q), the deposit rate (r), a benchmark interest rate (R), the lending rate, r , and the dollar exchange rate.¹⁶

The money series consist of currency and demand deposits. The quasi-money series is made up of savings and time deposits. The consumer price index is used as the price of a unit of consumption in each country. To convert the consumption, money, and quasi-money series into real terms the consumer price index and population series were used.¹⁷ To construct data series on areas broader than one country, the exchange rate is used to convert each series to United States dollars.

The appropriate price for each category of financial assets is its user cost (Barnett, 1980). The user cost is a discounted interest rate differential, $(R-r)/(1+R)$. The differential is the opportunity cost of holding a particular asset rather than the bench mark asset and the bench mark asset is further used for discounting the differential back to the beginning of the period when the choice to hold assets is made.

These data were converted into five twelve-year annual time-series. These time-series are for each individual country both quarterly and annually as well as for Scandinavia aggregated. The aggregates are a weighted average of the data for each country that comprises the respective area. The results from checking these data for consistency with the

¹⁶ These are series 96f, 64, 34, 35, 60P, 60L and ae. For the first five years the series on M and Q for Sweden the values were approximately calculated from other series. For a very few other missing values, data from closely related series were taken.

¹⁷ The population series used is 99z.

microeconomic criteria for the existence of a common currency area are presented in the following section.

V. Results

The data described in section IV above 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 described in section III. Consistent with the modeling in section II above, the specification check was:

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

That is the data for a representative agent in each individual Scandinavian country, Denmark, Iceland, Sweden and Norway and the Scandinavian area were checked for consistency with the microeconomic foundations of a common currency area.

As presented in Table 1, for the Icelandic, Norwegian and Swedish individual annual data sets both the necessary and the Afriat sufficient conditions obtain. The Danish data do not meet these microeconomic foundations due to two small violations of GARP for the monetary sub-utility function. Collectively the aggregate representative Scandinavian data meet the necessary and Afriat sufficient conditions. This suggests that people in Scandinavia treat currency, demand deposits and quasi-money in a similar way in their preferences. Thus, these annual results are consistent with a common currency for Scandinavia.

Thus, overall, the data indicate that the Scandinavian countries Denmark, Iceland, Norway and Sweden might form a common currency area. That the data are consistent with a common currency area does not overcome various macroeconomic and political issues that might arise within the individual countries. For example seigniorage and control of central banking

institutions would need to be allocated between the two countries in such a common currency area.¹⁸

Table 1

Reveal Preference Test Results

<i>Area</i>	<i>Utility Function</i>		<i>Subutility Function</i>	
	<i>GARP</i>	<i>Necessary</i>	<i>Afriat Sufficient</i>	
Denmark	Y	N(2)	-	
Iceland	Y	Y	Y	
Norway	Y	Y	Y	
Sweden	Y	Y	Y	
Scandinavia	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.

IV. Summary and Conclusions

Barnett (1980) described how to identify and construct monetary aggregate consistent with economic theory. Swofford (2000) extended Barnett's work to the idea of common currency areas showing the depth and breadth of Barnett's 1980 contribution to financial economics.

¹⁸ Clearly seigniorage could be allocated by population in the countries, but such an agreement would need to be reached.

A hypothesized Scandinavian common currency area would result in substantial transactions costs savings. Such a common currency area would remove national currencies that might act as implicit barriers to trade.

We also have found that annual data for Iceland, Norway, and Sweden are consistent with the necessary and sufficient conditions for the microeconomic foundations of a common currency area. The data on Denmark had only two violations of one condition. Further we found that data for the Scandinavian countries together are consistent with the necessary conditions and sufficient conditions for a common currency area. These results can broadly be taken as supportive of a Scandinavian common currency area.

References

- Afriat, Sydney N. (1967). "The Construction of Utility Functions from Expenditure Data." *International Economic Review* 8, 66-77.
- Barnett, William, A. (1980). "Economic Monetary Aggregate: An Applications of Index Number and Aggregation Theory," *Journal of Econometrics* 14, 11-48
- Central Bank of Iceland (2008) *Interbank Market for Foreign Exchange*.
- 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.
- International Monetary Fund, (2007). *International Financial Statistics: Yearbook*. Washington, D.C.: International Monetary Fund.
- 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. (2008) Tests of Microeconomic Foundations of Asian Common Currency," *Journal of Asian Economics*, , vol. 19, issue 3, pages 254-258.
- _____. (2005) "Tests of Microeconomic Foundations of a North American Common Currency Area." *Canadian Journal of Economics*, Vol. 38, No. 2, pp. 420-429.
- _____. (2000). "Microeconomic Foundations of an Optimal Currency Area," *Review of Financial Economics*, 9, 121-128.
- Swofford, J., Birkelöf, L., and Filer, J. (2013). A Smaller Step: Tests of Microeconomic Foundation of a Scandinavian Common Currency Area. *International Journal of Economic Sciences*, II(2), 135–143.
- _____. (2007) "Tests of Microeconomic Foundations of a Australia/New Zealand Common Currency Area," in *Functional Structure Inference* Apostolos Serletis and William A. Barnett editors, Elsevier VB.
- 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.