

James Swofford, Lena Birkelöf, John Filer

University of South Alabama, United States of America (Swofford)

Umeå University, Sweden (Birkelöf)

Arizona State University, United States of America (Filer)

A Smaller Step: Tests of Microeconomic Foundation of a Scandinavian Common Currency Area

Abstract:

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. A smaller step would be a Scandinavian common currency area. In this paper we present estimates of transactions costs savings associated with such a common currency and results from revealed preference tests of microeconomic foundations of an Scandinavian common currency area. Our results can be viewed as broadly favorable toward the formation of an Scandinavian common currency area.

JEL Classification: F33, C14.

1 Introduction

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 to far. A smaller step that might be more inline with the preferences of voters in this area is a Scandinavian common currency area composed of Denmark, Iceland, Norway and Sweden.¹

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.² The four countries are geographically relatively close to each other and have a relatively large volume of trade between each other.³

¹ 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.

² 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.

³ 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.

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.

While many of these benefits from forming a common currency area are difficult to measure, we can estimate the transactions costs savings that the people of the Scandinavian countries would realize from adoption of a common currency. The Bank for International Settlements (2007) conducts a triennial survey of world central banks with respect to turnover in foreign exchange markets. Turnover is a measure of the volume of foreign exchange trading in a specified market, and is defined as the absolute gross value of all new deals entered into during the year and is measured in terms of the nominal amount of the contracts completed in the market.⁴ Direct cross-country transactions are counted as single transactions, and not double counted.

In Table 1 we present total annual foreign exchange turnover among Denmark, Iceland, Norway and Sweden for 2007 in US dollars. Foreign exchange trading between the Scandinavian currencies averaged US\$ \$8.35 billion per day, and was “steady” over the year.⁵ A lower bound of potential cost savings from a Scandinavian common currency area in US dollars was \$23 billion in 2007.

We can bound the present value of future transactions cost savings for a Scandinavian common currency area. We find the present value of these cost savings is between \$353.8 billion and \$515.5 billion.⁶

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 an intermediate step before joining the euro bloc, 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.⁷

⁴ No distinction is made between sales and purchases (i.e., a purchase of 7 million Icelandic kronur and a sale of 12 million Icelandic kronur against Danish kroner amounts to gross turnover of 19 million Icelandic kronur.)

⁵ Bank for International Settlements, (2001), pp. 13, 65. “Steady” is the BIS description of the Icelandic, Norwegian and Swedish foreign exchange market over the year, as contrasted with the BIS description of increasing for the Danish foreign exchange market.

⁶ The current forecast LIBOR rate over the coming year averages at least 2 percent. The current forecast 30-year U.S. bond rate averages around 5 percent. Transactions costs were discounted over a 30 year period using these two rates to bound the present value.

⁷ 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.

Table 1: Denmark, Iceland, Norway, and Sweden Cross-Border Foreign Exchange Turnover and Transactions Costs for 2007⁸ (Millions of U.S. Dollars)

Country Pairs	Daily Total Turnover	Annual Transactions Costs
Danish Krone/Swedish Krona	\$3,891,660,000	\$10,725,410,000
Danish Krone/Norwegian Krone	\$2,669,640,000	\$7,357,530,000
Danish Krone/Icelandic Kronur	\$543,100,000	\$1,496,780,000
Swedish Krona/Norwegian Krone	\$547,220,000	\$1,508,140,000
Swedish Krona/Icelandic Kronur	\$301,140,000	\$829,940,000
Norwegian Krone/Icelandic Kronur	\$399,550,000	\$1,101,160,000
Total	\$8,352,310,000	\$23,018,960,000

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. True to this line of thought, Swofford (2000) proposed microeconomic foundations for the existence of a common currency area and tested the Euro area for consistency.⁹ 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.

⁸ Daily average spot, outright forward and foreign exchange swap transactions, adjusted for local and cross-border inter-dealer double-counting. Because two currencies are involved in each transaction, the actual total turnover comes to twice the total reported turnover.

Daily average total net turnover (all currencies) in U.S. dollars: Denmark: \$86,062,000,000; Sweden: \$42,150,000,000; Norway: \$31,919,000,000; Iceland: \$7,399,000,000.

Source: Turnover rate: (Denmark, Norway, and Sweden) Bank for International Settlements, *Triennial Central Bank Survey, December 2007*. (Iceland) Central Bank of Iceland, *Interbank Market for Foreign Exchange, September 4, 2008*. Transactions costs: See Appendix.

⁹ Other potential common currencies tested include North America, Swofford (2005), Australia and New Zealand, Swofford, Birkelöf and Filer (2007) and East Asia, Swofford (2008).

2 Existence of an Optimum 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.¹⁰ 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.¹¹ 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.¹²

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:

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

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.¹³

If more than one asset is held as money, then a common currency area must have a common economic monetary aggregate.¹⁴ 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 $U(\cdot)$ to be at least weakly separable in the monetary assets:

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

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

¹⁰ 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.

¹¹ Machlup (1977) pointed out that a common currency area is not the same thing as a fixed exchange rate regime unless the exchange rate were fixed at a ratio of one to one.

¹² 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.

¹³ Feenstra (1986) shows that the liquidity costs and the utility of money approaches to modeling money demand are functionally equivalent.

¹⁴ Barnett (1980) originated the concept of an economic monetary aggregate.

of any good in $\mathbf{x}$.¹⁵ Less formally, the weak separability criteria for aggregation is a way to identify money as whatever people in the hypothesized optimum 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 an optimum 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 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 aggregation over agents.¹⁶ Still the quasi-homothetic restrictions are very stringent and often times are finessed by assuming a representative agent.¹⁷

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 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.

3 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 $\mathbf{p}^i = (p_1^i, p_k^i)$ be the i th observations for the prices of some k goods and assets and $\mathbf{x}^i = (x_1^i, \dots, x_k^i)$ 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:

$$\text{If } x_i R x_j \text{ then } p_j x_j \leq p_i x_i \text{ for all } i, j = 1, \dots, n.$$

If the data satisfy GARP there exists a nonsatiated, continuous, monotonic, concave utility function that rationalizes the data.¹⁸

¹⁵ See Deaton and Muellbauer (1980) concerning aggregation over goods.

¹⁶ Quasi-homothetic preferences imply that each agent's Engel curves are linear. While quasi-homothetic Engel curves are linear, they need not pass through the origin as is the case for homothetic preferences.

¹⁷ The assumption of a representative agent is necessary unless micro or panel data exist.

¹⁸ 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 .

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.*
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.

4 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.¹⁹

¹⁹ 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.

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.²⁰ 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-yea 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 microeconomic criteria for the existence of a common currency area are presented in the following section.

5 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:

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

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 an optimum currency area.

As presented in Table 2, 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.

Table 2: Reveal Preference Test Results²¹

Area	Utility Function	Subutility Function	
	GARP	Necessary	Afriat Sufficient
Denmark	Y	N(2)	-

²⁰ The population series used is 99z.

²¹ 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.

Iceland	Y	Y	Y
Norway	Y	Y	Y
Sweden	Y	Y	Y
Scandinavia	Y	Y	Y

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.²²

6 Summary and Conclusions

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.
- Bank for International Settlement (2007), "*Triennial Central Bank Survey*," Basel, Switzerland: Bank for International Settlement.
- 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.

²² Clearly seigniorage could be allocated by population in the countries, but such an agreement would need to be reached.

- 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.
- Swofford, James L.. (2005) "Tests of Microeconomic Foundations of a North American Common Currency Area." *Canadian Journal of Economics*, Vol. 38, No. 2, pp. 420-429.
- Swofford, James L. (2000). "Microeconomic Foundations of an Optimal Currency Area," *Review of Financial Economics*, 9, 121-128.
- James L. Swofford, Lena Birkelöf and John E. Filer. (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.
- Swofford, James L. and Gerald A. Whitney. (1986). "Flexible Functional Forms an 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
- Varian, Hal R. (1983). "Nonparametric Tests of Consumer Behavior," *Review of Economic Studies*, 50, 99-110.
- Varian, Hal R. (1985). "Nonparametric Demand Analysis," software program.