Consumption and Capital Mobility in the Nordic Countries[*]

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Abstract

I use a consumption-based test to examine the importance of income constraints and the degree of capital mobility across the Nordic countries over the period 1968-96. In particular, I explore the effects of financial deregulation of the 1980s. The estimating equation is derived along the lines of Bayoumi and MacDonald (1995). The results indicate that Nordic financial markets are highly integrated, but that the consumption behavior of a significant part of the Nordic population is constrained by income. There is no evidence that financial deregulation altered the consumption behavior of households or increased the degree of capital mobility across countries.

Keywords: Consumer behavior, international capital mobility, financial deregulation
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1 Introduction

Up to the early 1980s, Nordic financial markets were strictly regulated and highly protected, as was the case in many other industrial countries. The 1980s, on the other hand, saw a worldwide move towards financial liberalization and global capital market integration. How did this affect the degree of capital mobility across the Nordic countries (Denmark, Finland, Norway, and Sweden)? In this paper, I follow the consumption-based approach to financial integration and international risk-sharing to address this question.

The Nordic countries provide an interesting case for the analysis of capital mobility.[1] This is not only because they are all small open economies who may have large efficiency gains to ripe from international asset trade and diversification, but also because they are closely related in terms of cultural backgrounds and languages. Differences in such factors are otherwise often suggested as reasons for why investors may be reluctant to hold foreign assets; French and Poterba (1991) and Tesar and Werner (1995) have shown that there is a significant home bias in portfolio allocations of investors for some of the major industrial countries, such as the United States and Japan. Furthermore, the process of financial deregulation in the Nordic countries had several features in common, although the timetables differed somewhat.[2]

[1] The only other study that involves all Nordic countries that I am aware of is due to Matsen and Thogersen (1996). Here, I am however using a different theoretical model, another estimating method, and longer time-series than they are.

[2] For an overview of financial deregulation in the Nordic countries, see Berg (1994).

The consumption-based literature on financial integration suggests that international capital mobility improves the opportunities of consumers to smooth consumption over time and across states of nature. The basic idea is that international asset trade allows residents in different countries to share the risks in their individual consumption profiles and thus insulate themselves against country-specific productivity shocks. One implication of this is that growth rates in aggregate consumption will be highly correlated across countries – even if growth rates in output are not.

However, in contrast to the common perception that capital has become highly mobile across countries in recent years, most empirical work find that cross-country correlations of consumption are significantly lower than what is warranted by full mobility of capital.[3] As proposed by Obstfeld (1994), this finding may be partly explained by the assertion that consumption comovements depend not only on the freedom of consumers to trade in international asset markets, but also on the completeness of those markets. That is, if people can trade away only part of their idiosyncratic consumption risk, the correlation between consumption growth rates across countries will be weakened. Another reason for why cross-country consumption correlations may be low, even if international capital markets are perfectly integrated, is the existence of non-traded goods and services. Tesar (1993) shows that, in the presence of non-traded goods, the optimal asset portfolio may be biased toward claims on domestic output, which in turn may result in low

[3] See, e.g., Backus, Kehoe and Kydland (1992), Bayoumi and MacDonald (1995), Obstfeld (1989, 1994, 1995), Stockman and Tesar (1995), and Tesar (1995), among others.

cross-country consumption correlations.

A third, more fundamental, explanation is offered by Bayoumi and MacDonald (1995), who point out that the forward looking consumption model underlying most consumption-based tests of financial integration may not be a good representation of aggregate consumption behavior. Their argument rests on the well-documented failure of the forward looking consumption model that consumption is more sensitive to changes in income than is warranted by the innovations in income.[4] In other words, excess sensitivity of consumption to income may be an additional reason for a low observed correlation of consumption across countries.

Consequently, Bayoumi and MacDonald suggest an alternative test for international capital mobility. This test is derived from the λ-model of Campbell and Mankiw (1989, 1990, 1991) and provides a method to differentiate between excess sensitivity to (local) income on the one hand, and lack of financial integration on the other, as reasons for consumption growth rates to differ across countries. This is also the approach I will follow here.

The paper is organized as follows. In the next section, I derive the Bayoumi-MacDonald consumption model and discuss the implications of financial integration for aggregate consumption behavior. Using annual time series data from Denmark, Finland, Norway, and Sweden over the period 1963-96, I then examine the importance of income constraints and the degree of capital mobility across countries. In particular, I explore the effects of financial deregulation. The data and some estimation issues are discussed

[4] See Flavin (1981) and others.

in section 3, while the empirical results are presented in section 4. Section 5 summarizes and concludes.

2 The Model

Economic theory suggests that international capital mobility improves the opportunities of consumers to smooth consumption over time and across states of nature. The logic behind this is that free trade in international asset markets allows consumers in different countries to share the risk in their individual consumption profiles and thus insulate themselves against country-specific income shocks. One implication of this is that consumption paths in different countries will move together in proportion.

This can easily be illustrated using the log-linear version of Hall's (1978) life cycle-permanent income model. This model relies on the standard assumption of a rational and forward looking representative agent, with intertemporally additive preferences and a constant rate of time preferences. The period felicity function of the representative consumer is assumed to be isoelastic: $u(C_{it}) = C_{it}^{1-\gamma}(1-\gamma)^{-1}$, where C_{it} is real consumption and $1/\gamma = \sigma$ is the intertemporal rate of substitution. The set of Euler equations characterizing the optimal path of consumption for a country i, $i = 1, 2, \ldots n$, may then be closely approximated by

$$E_{t-1}\Delta c_{it} = \mu_i + \sigma E_{t-1} r_{it}; \tag{1}$$

where $\Delta c_{it} \equiv \ln C_{it} - \ln C_{it-1}$, r_{it} is the real interest rate between period $t-1$

and ε_t, μ_i is a constant that depends on the subjective rate of time preference and the variances and covariance of r and c,[5] and E_{t-1} is the mathematical expectation conditional on information available at $t-1$.

If equation (1) provides an appropriate representation of the consumption paths in different countries, the only reason for the paths to diverge ex ante is if there are cross-country differences in the μ_i's or in the expected real interest rates.[6] However, if countries are financially integrated, the expected real interest rates will be equal due to the opportunity of arbitrage, and so, for any two countries i and j, the consumption paths will move together in proportion:

$$\Delta c_{it} = \mu_{ij} + \Delta c_{jt} + \varepsilon_{ijt}, \tag{2}$$

where $\mu_{ij} = \mu_i - \mu_j$ and $\varepsilon_{ijt} = \varepsilon_{it} - \varepsilon_{jt}$ is the error term. Apparently, the only effect of idiosyncratic income shocks here is through their impact on the total consumption possibility set.

Equation (2) could be used to form a test of financial integration between any two countries i and j. The hypothesis that financial markets are perfectly integrated in countries i and j implies that a coefficient in front of Δc_{jt}, the consumption growth rate of country j, should be equal to one. A low observed value of the coefficient could therefore be interpreted as an indication of a low level of financial integration.[7]

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[5] $\mu_i = \sigma\rho + \omega_i^2/2\sigma$, where ρ is the subjective rate of time preference and $\omega_i^2 = Var_{t-1}(\Delta c_{it} - \sigma r_{it})$ is assumed to be constant. Note that if asset returns and consumption are jointly conditionally lognormal and homoskedastic, then as Hansen and Singleton (1983) showed, equation (1) holds exactly.

[6] Note that this implicitly assumes that individuals in different countries have identical preferences.

[7] This test is essentially a test of whether the optimality conditions characterizing the

However, as discussed in the introduction, there may be other reasons for observing a low correlation between consumption growth rates. In particular, as pointed out by Bayoumi and MacDonald (1995), the forward-looking consumption model underlying equation (2) may not be an appropriate characterization of the evolution of aggregate consumption; it is a common observation that consumption tends to be more sensitive to changes in current disposable income than is warranted by innovations in income.[8] The possibility that part of local consumption depends upon local income may thus be an additional reason for observing low correlation between consumption growth rates across countries.

In order to discriminate between excess sensitivity of consumption to income and lack of financial integration as reasons for consumption to deviate from its optimal path, Bayoumi and MacDonald suggest that the estimating equation should be derived from the λ-model of Campbell and Mankiw (1989, 1990, 1991). This model supposes that part of the population consumes all of its disposable income, instead of obeying the life cycle-permanent income consumption function. A frequently cited reason for such a behavior is that consumers may lack access to capital markets and therefore are liquidity constrained. Another reason is that they simply adopt some rule-of thumb decision rule.

Either way, the λ-model divides aggregate consumption into a fraction received by current income consumers and another fraction received by per-

consumption behavior in an intertemporal model of financially integrated economies hold empirically or not. It was first proposed by Obstfeld (1989).

[8] See Flavin (1981), among others.

manent income consumers. Generalized to the log-linear case, the λ-model reads

$$E_{t-1}\Delta c_{it} = \lambda_i E_{t-1}\Delta y_{it} + (1-\lambda_i)(\mu_i + \sigma E_{t-1} r_{it}); \tag{3}$$

where y_{it} is the log of disposable income in country i.[9]

Equation (3) can now be used instead of equation (1) to derive a two-country model corresponding to the one in (2). As before, this is based on the premise that international capital market integration equalizes expected real interest rates across countries. Thus, under the hypothesis that capital markets are perfectly integrated, the model is derived for any two countries i and j by equating their expected real interest rates as given by (3).[10] Solving for Δc_{it} and removing the mathematical expectations operator yields

$$\Delta c_{it} = \mu_{ij} + \lambda_i \Delta y_{it} + \frac{1-\lambda_i}{1-\lambda_j}\Delta c_{jt} - \lambda_j \frac{1-\lambda_i}{1-\lambda_j}\Delta y_{jt} + \varepsilon_{ijt}; \tag{4}$$

where $\mu_{ij} = (1-\lambda_i)\left(\mu_i - \mu_j\right)$ and $\varepsilon_{ijt} = \varepsilon_{it} - \varepsilon_{jt}$ is the error term. Note that ε_{ijt} may be correlated with the right-hand side variables, but is uncorrelated with any lagged variable.

Equation (4) is the basic estimating equation of Bayoumi and MacDonald (1995). It shows that if countries are financially integrated and some individuals have a myopic consumption behavior, the consumption growth rate in a country i will be related not only to the growth rate in foreign consumption, but also to the growth rates in domestic and foreign income.

[9] Note that in the log-linear model the coefficient λ cannot be precisely interpreted as the fraction of current income consumers, unless of course one is willing to approximate the log of an average by an average of the logs (Campbell and Mankiw (1991)).

[10] $\sigma E_{t-1} r_{it} = (E_{t-1}\Delta c_{it} - (1-\lambda_i)\mu_i - \lambda_i E_{t-1}\Delta y_{it})/(1-\lambda_i)$.

To see how the model can be used to test for financial integration between two countries, as well as for the importance of current income consumers, consider the unrestricted regression model

$$\Delta c_{it} = \alpha_i + \beta_1 \Delta y_{it} + \beta_2 \Delta c_{jt} + \beta_3 \Delta y_{jt} + \varepsilon_{ijt}. \qquad (5)$$

Here the coefficients on income can be used to test the importance of current income consumers. Estimates of β_1 that are positive and significantly different from zero indicate that part of the home population is current income consumers. Likewise, estimates of β_3 that are negative and significantly different from zero indicate that part of the population in the foreign country is current income consumers.

Controlling for excess sensitivity of consumption to income, the coefficient on foreign consumption can be used to test for capital mobility across the two countries. Estimates of β_2 that are positive and significantly different from zero indicate that financial markets are integrated. Moreover, if $\lambda_i = \lambda_j$ and financial markets are perfectly integrated, then β_2 should be equal to one. Finally, equation (4) puts one additional restriction on the coefficients in (5), namely that they should sum to one. Since (4) is derived under the hypothesis that capital markets are perfectly integrated across countries, this restriction may viewed as an additional test of financial integration.

The discussion has thus far been held in terms of a test between two countries. It may however be convenient to reformulate the model in terms of one particular country versus "the rest of the world". This approach has commonly been used in the literature and is also the one adopted by Bayoumi and MacDonald. In my case, being concerned with capital mobility in the Nordic countries, it amounts to replacing country j with an aggregate measure of "the rest of the Nordic countries" (excluding country i). Besides limiting the number of regressions to be run in the empirical analysis, this procedure may also reduce the size of the error term in equation (5) since ε_{ijt} is replaced by an average.

3 Data and Econometric Issues

To estimate my model, I use annual time series data from Denmark, Finland, Norway, and Sweden. The data are taken from four separate sources, described in the Appendix; though, in principle, they are all national accounts data. The reason I am using annual data is that forward looking consumption models, such as the one I use, are likely to be sensitive to seasonality of higher frequency data, as well as to the method of seasonal adjustment.[11] The longest time series that could be constructed for all countries covers the period 1968-96.

While the consumption of nondurable goods and services can simply be equated with consumer expenditure, the consumption of durable goods is more difficult to measure. What one really needs is a measure of the service flow that durable consumption goods render to the consumer during a certain period of time. Unfortunately, the ways of computing imputed service

[11] See, e.g., the discussion in Assarsson (1991) about seasonality in Swedish aggregate consumption data on a quarterly form.

flows are still associated with a certain degree of arbitrariness. Therefore, in the empirical analysis I follow the majority of the consumption literature by looking only at the consumption of nondurable goods and services. I thus implicitly assume that the utility function is separable between nondurable and durable goods, so that equation (5) can be estimated for nondurable consumption alone. Nondurable consumption is then measured as households' expenditures on nondurable goods and services.

The appropriate measure for income is also under some debate. However, if the presence of current income consumers is to be interpreted as evidence of liquidity constraints, it seems natural to use some measure of nonproperty income. As argued by Carroll, Fuhrer and Wilcox (1994), such a measure would better represent the income actually received by liquidity constrained consumers because it excludes any income generated by capital assets. Consequently, for the purposes of this paper, I identify current income with households' nonproperty disposable income, which in turn I define as households' disposable income less capital income and operating surplus for unincorporated businesses and real estate; or as households' labor income plus government transfer payments less taxes on labor income and transfers.

The measures of nondurable consumption and nonproperty disposable income are both expressed in fixed prices and per capita terms before their growth rates are calculated. Nondurable consumption is deflated using the price deflator for non-durable consumption, and nonproperty disposable income is deflated using the price deflator for total consumption. Further, the aggregate measures representing growth rates in consumption and income in the rest of the Nordic region are calculated as weighted sums of, respectively, the consumption and income growth rates in the different countries (excluding one country at a time), where the weights are the shares of the countries' populations out of total Nordic population.

Before I turn to the empirical results, there are some econometric issues that need to be discussed. First, the error term ε_{ijt} in (5) may be correlated with the right-hand side variables. This implies that the model cannot be consistently estimated by least squares, but that an instrumental variable method has to be employed. For this purpose, I use the same instruments as Bayoumi and MacDonald (1995), namely lagged values of domestic and foreign growth in real per capita consumption and income, as well as the ratios of income to consumption.[12]

Second, while the theoretical model can be applied to observations on the instantaneous flow of consumption and income measured at two points in time, it does not correctly characterize the behavior of time averages of these variables. Time averaging in available data may in fact induce a first-order moving average process into the disturbances.[13] This may also happen if there is durability in the measure of nondurable consumption, something which is likely since this measure generally includes items such as clothing and footwear. The presence of an MA(1) process in the disturbances is important not only for the choice of estimator, but also for the timing of the

[12] For a discussion of the choice of instruments, see Bayoumi and MacDonald (1995) and references therein.

[13] This is the well-know result of Working (1960), which also is thoroughly discussed in Hall (1988).

instruments. Specifically, it implies that the instruments must be lagged at least two periods to be uncorrelated with the error term and hence valid as instruments.

Finally, the use of aggregate measures to represent the rest of the Nordic region implies that the disturbances, by construction, will include factors that are common to all countries. Considerable efficiency may hence be gained from estimating the equations of different countries jointly. To deal with this and the other issues discussed, I will carry out a series of preliminary diagnostic tests. The final choice of estimator and the timing of instruments will then be made accordingly.

4 Results

In contrast to what theory suggests, preliminary estimates of the model in (5) indicate that the residuals are serially uncorrelated. On the other hand, they do appear to be contemporaneously correlated across countries. To carry out the diagnostic tests, the model was first estimated for each country separately, using the generalized instrumental variable/ two-stage least squares estimator. In each case, the set of instruments included a constant and the second lags of domestic and foreign growth in real income and consumption, as well as the ratios of consumption to income. This should yield, if not efficient, so unbiased and consistent parameter estimates, even in the presence of an $MA(1)$ in the error term.

The diagnostic tests are presented in Table 1.[14] In the first and second rows of the table, there are two different tests for first-order serial correlation. Q-stat is the Ljung-Box test statistic, asymptotically distributed as chi-squared with one degree of freedom under the null hypothesis of no serial correlation up to the first order. t-ratio is a modified LM procedure consisting of a simple t-test of the significance of the lagged residual in the Gauss-Newton regression.[15] Under the null of no first-order serial correlation, the coefficient on the lagged residual should be zero, and t-ratio is asymptotically distributed as standard normal.

The calculated values of Q-stat and t-ratio are all associated with high p-values, meaning that they are all less than their critical values at the 5 percent significance level. The hypothesis of no first-order serial correlation can therefore not be rejected for any of the countries.

The last row of Table 1 reports the Breusch-Pagan LM statistic λ_{LM} for seemingly unrelated regressions. Under the null that the errors are contemporaneously uncorrelated across countries, λ_{LM} is asymptotically distributed as chi-squared with six degrees of freedom.[16] The value of λ_{LM} obtained here is 15.04. This is well above the 5 percent critical value of 12.6, so the hypothesis that the errors are uncorrelated across countries can be rejected.

[14] All estimates presented here and later are obtained using E-Views 3.1.

[15] The Gauss-Newton regression is an artificial regression corresponding to the underlying regression model. For a thorough discussion of the Gauss-Newton regression and its applications, see Davidson and MacKinnon (1993), chapter 6. It should be noted that the modified LM procedure in E-Views follows Wooldridge (1990) and differs somewhat in its specification of the artificial regression from the one described by Davidson and MacKinnon. I have calculated the test statistics using both methods, but since they gave rise to the same conclusions, I present only the ones from E-Views.

[16] See Greene (1993), p. 492.

Table 1: Tests for serial correlation and seemingly unrelated regressions

2SLS using instruments lagged two periods, 1970-96				
	Denmark	Finland	Norway	Sweden
Q-stat: $\chi^2[1]$	1.042	0.001	1.391	0.952
	[0.307]	[0.973]	[0.238]	[0.329]
t-ratio	0.952	0.030	1.20	-0.887
	[0.352]	[0.977]	[0.242]	[0.385]
λ_{LM} : $\chi^2[6]$		15.04		
		[0.020]		

Notes: i) The instruments include a constant and the second lags of domestic and foreign growth rates in real consumption, real income, and the ratios of consumption to income. ii) Q-stat is the Ljung-Box test statistic for first-order serial correlation, t-value is the ordinary t-statistic for the lagged error term in the artificial regression, and λ_{LM} is the Breusch-Pagan LM test statistic for seemingly unrelated regressions. iii) p-values are given in square brackets.

In short, the results indicate that the residuals are serially uncorrelated, but contemporaneously correlated across countries.[17] This suggests that the instruments need only to be lagged once to be orthogonal to the residuals and hence admissible as instruments. It also suggests that the efficient estimator is three-stage least squares (3SLS), which is the two-stage least squares version of the seemingly unrelated regression (SUR) method.

Table 2 presents the parameter estimates and associated standard errors from a 3SLS regressions using instruments lagged one period. Along with these estimates, I also report the Sargan test of the overidentifying restrictions. Under the joint hypothesis that the instruments are orthogonal to the residuals and the model is correctly specified, the Sargan statistic is asymptotically distributed with three degrees of freedom (the number of overiden-

[17] This conclusion was confirmed when the test procedure was repeated on the residuals from a 2SLS regression in which the instruments were lagged only one period.

Table 2: Results from the unrestricted model

Three-stage least squares, 1960-96	Denmark	Finland	Norway	Sweden
α	0.0079	0.0001	0.0100	0.0018
	(0.0047)	(0.0063)	(0.0083)	(0.0046)
β_1	-0.0062	0.5031*	0.0988	0.3601*
	(0.1745)	(0.1145)	(0.2741)	(0.1499)
β_2	1.1387	1.2140	1.6098	0.5545
	(0.6377)	(0.6359)	(0.9371)	(0.5606)
β_3	-0.4159	-0.3080	-0.8072	-0.2277
	(0.3404)	(0.4659)	(0.7626)	(0.4549)
Sargan: $\chi^2(3)$	5.95	1.66	6.90	2.72
P-value	[0.1141]	[0.6459]	[0.0752]	[0.4368]
Wald: $\chi^2(1)$	0.65	0.63	0.03	0.88
P-value	[0.4219]	[0.4259]	[0.8526]	[0.3478]
W_2: $\chi^2(12)$		17.89		
P-value		0.12		

Notes: i) The instruments include a constant and the first lags of domestic and foreign growth rates in consumption, income, and the ratios of consumption to income. ii) Standard errors are in parentheses. iii) * indicate estimates significantly different from zero at the 5% level. iv) Sargan is the Sargan test of the overidentifying restrictions, W_1 is a Wald test of the hypothesis that the beta-coefficients sum to one, and W_2 is a Wald test of the hypothesis of equal parameter vectors across countries. v) p-values are given in square brackets.

tifying restrictions). The overall result from the Sargan tests indicates that the instruments are valid and the specification appropriate.

Although most parameter estimates in Table 2 have the expected signs, very few of them are significantly different from zero: at the 5 percent significance level, only the coefficients on domestic income for Finland and Sweden are significantly different from zero. While this may suggest that capital markets are poorly integrated across the Nordic countries, the other test for capital market integration – the one that the coefficients on domestic income, foreign consumption, and foreign income should sum to one – fails to be rejected. The Wald statistics W_1 for testing this restriction are all smaller than the 5 percent critical value given by the chi-squared table with one degree of freedom. Given the contradicting results, one should be careful to draw any strong conclusions from Table 2.[18]

One might of course suspect that the number of observations used for estimation is too small to assure efficiency. One way to increase efficiency is to pool the country-specific regressions. This approach would however put strong restrictions on the model, since it requires the parameter vectors of the different countries to be equal. Nonetheless, the restrictions can be tested for using a simple Wald test. The W_2 reported in the table is the Wald statistic for the hypothesis of equal-parameter vectors in all four equations. W_2 is here 17.89 with 12 degrees of freedom. This is obviously less than the 5 percent critical value of the chi-squared distribution (p-value 0.12), so the hypothesis of parameter homogeneity fails to be rejected. Consequently, my next step is to estimate the model under the restriction that the coefficient vectors are equal across countries.

Imposing the restriction of equal parameter vectors on the model in (4) implies that the unrestricted regression equation (5) is replaced by

$$\Delta c_{it} = \alpha + \beta_1 \Delta y_{it} + \beta_2 \Delta c_{jt} - \beta_1 \Delta y_{jt} + \varepsilon_{ijt}; \qquad (6)$$

[18] Similar results were obtained when the model was estimated by 2SLS.

Table 3: Results from the restricted model

Three-stage least squares, 1960-96			
	α	β_1	β_2
The Nordic countries	0.0019	0.3935*	0.9975*#
	(0.0019)	(0.0659)	(0.1456)

Notes: i) The set of instruments include a constant and the first lags of domestic and foreign growth rates in real consumption, real income, and the ratios of consumption to income. ii) Standard errors are in parentheses. iii) * indicate that estimates are significantly different from zero at the 5% level. iv) # indicate that estimates are not significantly different from one at the 5% level.

where β_1 measures the excess sensitivity of consumption to local income, and β_2 the level of correlation between home and foreign consumption. Note from (4) that, under the null hypothesis of perfect capital market integration, β_2 should now be equal to one. This follows directly from the restriction of equal parameter vectors, since it implies that $\lambda_i = \lambda_j$ (i.e., the share of current income consumers is equal across countries).

The results for the restricted model are presented in Table 3. The parameter estimates are here associated with much smaller standard errors than before. The coefficient on incomes β_1 is about 0.39 and significantly different from zero. This suggests that a substantial part of the Nordic population fails to take full advantage of domestic capital markets and is well in line with other estimates obtained for the Nordic countries.[19] Furthermore, the coefficient on foreign consumption β_2 is 0.9975. This is significantly different from zero, but not significantly different from one, which is the null of perfect capital market integration. This is a very strong result and it suggests that

[19] λ has for instance been estimated to 0.33 ± 0.10 for Sweden (Ågell and Berg (1996)), and 0.60 ± 0.24 and 0.56 ± 0.25 for Norway (Boug, Mork and Tjemsland (1995)).

Nordic capital markets are highly integrated.

I have so far assumed that the parameters of the model are constant over time. This assumption is not very plausible, however. Up to the early 1980s, the financial systems in the Nordic countries were strictly regulated and highly protected. The 1980s, on the other hand, saw a widespread tendency towards financial market liberalization and global capital market integration. For this reason, one would expect that capital mobility has increased over time. Likewise, if excess sensitivity of consumption to current income is due to liquidity constraints, one would expect that the degree of excess sensitivity is closely linked to the extent of financial market regulations. It would therefore be interesting to relax the assumption of constant parameters and investigate the potential effects of financial deregulation.

Nordic financial deregulation was a gradual process, however, involving a series of reforms. Even if one could argue that the Nordic reforms had several features in common, the timetables differ somewhat across countries.[20] This can be seen in Table 4, which lists some of the more important measures of financial deregulation. For this reason, it is difficult to decide upon an appropriate sample split that could represent before and after deregulation. Nevertheless, I have experimented with various time periods and dummy variable tests, but I did not find anything that would support the hypothesis of a shift in the estimates of β_1 and β_2.

One could also adopt a more visual approach by estimating the model

[20] For a more detailed overview of financial deregulation in the Nordic countries, see Berg (1994).

Table 4: Financial deregulation in the Nordic countries

	Denmark	Finland	Norway	Sweden
Deregulation of bank lending rates	1979	1986	1985	1985
Abolishment of bank lending ceiling	1980, replaced by a system of overall guidelines which lasted until 1985	Credit guidelines discontinued in 1987	1984	1985
Removal of exchange controls	Completed in 1988	Completed in 1991	Completed in 1990	Completed in 1989

Source: Söderström Tson (1993), Berg (1994), and Boug et al. (1995)

recursively. Figure 1 and 2 plot the point estimates of β_1 and β_2 plus/minus two standard deviations from 1980 and onwards. If deregulation brought the behavior of Nordic households closer in line with the forward looking hypothesis, one would expect to see a downward jump in the point estimates of β_1 and an upward jump in the point estimates of β_2 as observations from the mid 1980s and early 1990s are added to the regression.

However, as was the case with the dummy variable tests, there is nothing in Figure 1 that indicates that the excess sensitivity of consumption to current income decreased in the 1980s. Instead, the point estimates of β_1 remain stable throughout this period and do in fact increase after 1992. Figure 2, on the other hand, does show an upward shift in the point estimates of β_2 in the

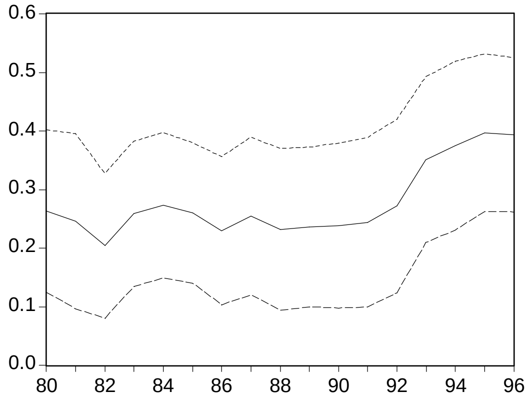

Figure 1: Recursive estimates of $\beta_1 \pm 2$ standard deviations: 1980-96

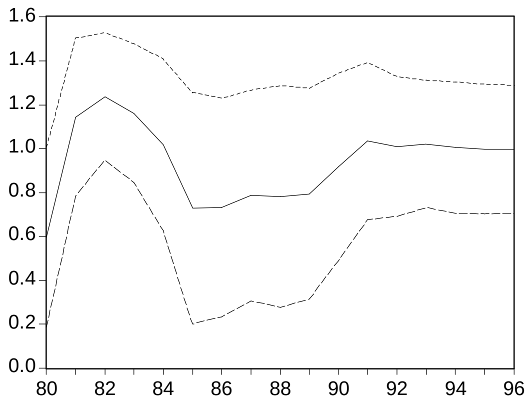

Figure 2: Recursive estimates of $\beta_2 \pm 2$ standard deviations: 1980-96

early 1990s. As this coincides in time with the completion of deregulation of exchange controls, it may speak in favor for the hypothesis that financial deregulation helped to increase capital mobility in the 1990s. I am however reluctant to make to much out of it since there is also a peculiar hump shaped pattern in the estimates of β_2 in the early 1980s that fits very badly into the explanation. Moreover, the change in β_2 does not appear to be statistically significant.

Repeating the recursive estimation on the unrestricted model (5) does not change the picture; not for any country do the point estimates of β_1 and β_2 show evidence of decreasing excess sensitivity of consumption to local income or increasing capital mobility. I am thus left with the conclusion that financial deregulation in the Nordic countries did little to alter the consumption behavior of households.[21] The high level of capital mobility found across the Nordic countries appears to have been present throughout the sample period and cannot be attributed to the removal of exchange controls. Likewise, a significant part of the Nordic population was current-income consumers before deregulation and remained so after deregulation.

[21] Agell and Berg (1996) reach the same conclusion with respect to current income consumers and financial deregulation in Sweden. For Norway, on the other hand, I note that Boug et al. (1995) has found that the consumer behavior changed dramatically in response to deregulation. Their result was obtained using quarterly data over the period 1968:2-1994:4.

5 Conclusions

This paper has examined the importance of income constraints and the degree of capital mobility across the Nordic countries. In particular, the effects of deregulation of cross border capital flows and domestic credit markets in the 1980s have been explored. The empirical analysis was performed using annual data from Denmark, Finland, Norway, and Sweden on households' nondurable consumption and nonproperty income over the period 1968-1996. The analysis was based on a test of the optimality of consumption paths across countries. In order to differentiate between excess sensitivity to (local) income on the one hand, and lack of financial integration on the other, as reasons for consumption to deviate from its optimal path, the estimating equation was derived along the lines of Bayoumi and MacDonald (1995) from the λ-model of Campbell and Mankiw (1989).

The results indicate a significant part of the Nordic population is characterized by a myopic consumption behavior. This may be interpreted as an indication of liquidity constraints in imperfect domestic capital markets and is well in line with previous evidence. Taking excess sensitivity of consumption to income into account, consumption growth rates in the Nordic countries move together in a synchronized manner. This suggests that financial markets are highly integrated across the countries. There is however no evidence that financial deregulation altered the consumption behavior of households or changed the degree of capital mobility across countries. Apparently there had been ways to circumvent exchange controls in the 1980s.

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A Appendix

The data used in the empirical study were kindly provided by Lennart Berg, Department of Economics, Uppsala University; Övind Eitrheim, Bank of Norway; John Smidt, Det Ökonomiske Råd, Denmark; and Kari Takala, Bank of Finland. The data for Denmark are from the database of the o¢ cial Danish macroeconomic model ADAM. The Finish date are from BoF5, the macroeconomic model of Bank of Finland. The Norwegian data are from the RIMINI database of the Bank of Norway, and the data for Sweden are from Agell and Berg (1996), who extracted them from the National Accounts of Statistics Sweden. For a full documentation of ADAM, see Arbejdsnotat nr 23, 1988, Denmarks Statistik, and Boldsen Hansen and Smidt (1992). For a full documentation of BoF5, see Kortelainen, Männistö, Tujala and Willman (1998).