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FINANCIAL INTEGRATION AND CONSUMPTION COMOVEMENTS IN THE NORDIC COUNTRIES

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Abstract

The cross-country correlations between annual per capita consumption growth in the Nordic countries (Denmark, Finland, Norway and Sweden) during the period 1973-1996 are much lower than predicted by the basic theory of international financial integration. Capturing that the consumption behavior of parts of the population may be myopic and that some external consumption risks may be uninsured, this paper attempts to shed light on this observation. We find some evidence of myopic consumption behavior in Denmark, Finland and Sweden. Taking this into account, the financial markets of the Nordic economies seem to be well integrated. It proves hard to identify uninsured external consumption risks at the aggregate level.

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1. Introduction

During the last decades all OECD economies have deregulated their domestic capital and credit markets and abolished cross-border capital controls. Hence, the idea of one global financial market seems more realistic than ever before, at least among industrialized countries. We would therefore expect a potentially more efficient allocation of capital and improved opportunities to smooth consumption over time and across states of nature. This depends partly on whether capital is perfectly mobile internationally and partly on whether international trade in contingent assets takes place. If agents engage in contingent asset trade in a global financial market, they may diversify consumption risks that appear to be systematic at a domestic level but are idiosyncratic in a global setting. This implies that consumption growth should tend to be more synchronized across countries. In fact, the cross-country consumption correlations should be equal to unity under a set of restrictive but nevertheless standard assumptions, see for example Tesar (1995).

Turning to the rather large amount of recent consumption-based studies of international financial integration, we find that the consumption correlations have increased over time, but they are still far below unity.¹ In addition, French and Poterba (1991) and Tesar and Werner (1995) have documented a considerable bias towards domestic assets in the portfolios of investors in the industrialized countries. Since there are no longer any institutional constraints on cross-border capital movements in almost all parts of the OECD area, there is an apparent international risk-sharing puzzle.

Possible explanations to these findings include the incompleteness of markets for contingent assets (Obstfeld, 1994) and behavioral explanations in the sense that investors according to French and Poterba (1991) find investments abroad more risky because they are less familiar with foreign markets, institutions and firms. Other explanations may be transaction costs and the existence of non-traded goods, see Tesar (1993, 1995).² Further, the forward-looking consumption model underlying most of the international financial

¹ The literature on consumption-based studies of international financial integration includes Backus et al. (1992, 1993), Obstfeld (1994, 1995), Stockman and Tesar (1995) and Tesar (1995). Of course, this literature is closely related to the literature on savings-investment correlations stimulated by the well-known paper of Feldstein and Horioka (1980). Obstfeld (1995) and Obstfeld and Rogoff (2000) discuss the relationship between these literatures.

² Tesar and Werner (1995) and French and Poterba (1991) deem the effect of transaction costs as insignificant. The effect of non-traded goods is also controversial. Baxter et al. (1998) find that a home bias with respect to domestic traded-goods equities is never optimal. On the other hand, Lewis (1996) concludes that international risk sharing can not be rejected when non-separabilities between tradeables and non-tradeable leisure and goods are taken into account in countries facing no capital market restrictions.

integration literature may be criticized. Myopic consumption behavior caused, for example, by liquidity constraints, may explain part of the observed low consumption correlations (Bayoumi and MacDonald, 1995).

Adopting a model framework that captures the potential effects of uninsured consumption risks and domestic credit market imperfections, this paper investigates the degree of financial integration and consumption comovements in the four Nordic countries Denmark, Finland, Norway and Sweden.³ To our best knowledge a coherent study of consumption comovements in these countries has not yet been undertaken.⁴ We believe that this sample of countries may be of particular general interest. A common cultural background and very similar languages (Finland is an exception in the latter respect) imply that the Nordic countries are closely related. The political climate is also stable compared to most other regions. We therefore conjecture that the suggested effects of investors' non-familiarities with foreign markets, institutions and firms are minimized within the Nordic countries.

Further, the national income of the small, open Nordic economies is strongly exposed to external shocks. For example, the oil price drop in the winter of 1985-86 explains the main parts of the 25 % reduction in Norway's terms-of-trade in the period 1984-87, see Steigum (1993). Correspondingly, the crisis of the Finnish economy was to a large extent related to declining Soviet trade and the drop in the world market prices of paper and pulp products, see Honkapohja et al. (1993). This sensitivity of national income to external shocks implies that the Nordic economies have a strong incentive to engage in international asset trade and diversification. While international non-diversification and the domestic asset bias may be explained by small welfare gains which are dominated by even moderate transaction costs in large economies like the U.S. (see Tesar, 1995), this explanation seems less likely in the small Nordic economies.

The next section takes a first look at some striking observations of the consumption patterns in the Nordic countries. Section 3 presents our model framework, which extends a reference model of international financial integration in two directions. Firstly, we follow Obstfeld (1994) and derive the implications of uninsured consumption risks. Secondly, we consider the possibility that parts of the population in the different countries may face

³ An earlier version of this paper included Iceland as well. It turned out, however, that the consumption behavior of Iceland was highly myopic and completely unrelated to the consumption patterns in the other Nordic countries.

liquidity constraints. Following Campbell and Mankiw (1991) and Bayoumi and MacDonald (1995) this leads to a model specification that discriminates between the effects of domestic credit market imperfections and lack of international financial integration. Our empirical evidence from 1973-1996 is presented in section 4. It turns out that the financial markets of the Nordic economies are fairly well integrated. For Denmark, Finland and Sweden we also find some evidence of myopic consumer behavior. It proves hard to identify uninsured external variables. In the final section 5, we offer some concluding remarks.

2. A first look at consumption co-movements and variability in the Nordic region

As a point of departure, we consider the cross-country correlations in the data. Table 1 shows the correlation coefficients for changes in the logarithms of annual per capita private consumption for various combinations of regions and individual countries in our sample in the periods 1951-1972 (first row) and 1973-1996 (second row). The consumption data underlying the calculations here and in the rest of the paper are obtained from Penn World Table (version 5.6) and OECD's national accounts.⁵ Our calculations can be compared to Obstfeld's (1994) similar calculations for the G-7 countries in the periods 1951-1972 and 1973-1988.

While Obstfeld finds that the consumption correlations have increased from the first to the second period in almost all cases, the evidence in table 1 is more mixed. In many cases the consumption correlations between individual countries have in fact decreased to a very low level. If we look at the consumption correlations between each individual country and the rest of the OECD, we see that the correlations involving Denmark, Finland and Sweden have increased, while the correlation between Norway and the rest of the OECD has dropped significantly.⁶ Recalling the very large Norwegian

⁴ An analysis of the bilateral consumption comovements between Denmark and Norway is included in the study of Thøgersen (1997).

⁵ All data are measured in 1985 international prices. The Penn World Table (PWT) data used in this paper have been obtained from internet, <http://datacenter.epas.utoronto.ca:5680/pwt/pwt.html>. An early version of PWT is documented in Summers and Heston (1991). As highlighted by Summers and Heston, the PWT data facilitate international comparisons because all expenditure entries are denominated in a common set of prices in a common currency. Available PWT data does not cover the period after 1992, however. Consequently, we have extended our PWT data series to 1996 by using real growth rates calculated from the OECD national account data series.

⁶ Our definition of OECD includes all OECD members in 1990.

petroleum sector, a possible interpretation is that uninsured oil price risk accounts for parts of this low consumption correlation.

*** table 1 ***

It is also interesting to look at the variability of each country's per capita consumption growth relative to the variability of the consumption growth in the OECD for the two periods, see table 2. Through international diversification it is in principle possible for each Nordic country to reduce its consumption variability relative to the variability of the average consumption growth in the whole OECD area. Table 2 reveals, however, that only Finland has experienced a reduction in relative consumption variability. On the other hand, we observe that there is a significant increase in Norway's consumption variability. Compared to Obstfeld's calculations, this implies that Finland is in the same league as Germany and Japan. Norway, on the other hand, has experienced the same development in consumption variability as Canada, the exception among the G-7 countries.

*** table 2 ***

3. The framework

3.1 A reference model of international financial integration

Following Obstfeld (1994), we consider a reference model based on complete asset markets, perfect capital mobility and forward-looking consumption behavior. In the initial period 0 a representative infinitely-lived individual in country i , $i = 1, 2, \dots, N$ maximizes

$$(1) \quad U_0 = E \left[\sum_{t=0}^{\infty} (\beta_i)^t u(C_{i,t}, \theta_{i,t}) | s_0 \right],$$

where β_i is a time preference factor, $C_{i,t}$ is consumption of a single tradable consumption good, $\theta_{i,t}$ is a preference shock and the period utility function satisfies $u' > 0$ and $u'' < 0$. For each period there is a set of possible states of nature, and s_t is the realised state in period t . The probability that a given state is realized in period $t+1$ depends only on the value of s_t and possibly on time (i.e. a Markov structure). Hence, $E[\bullet | s_t]$ is expectation conditional on information observed up to period t . The maximization of (1) is subject to

feasibility constraints for each period and each state. National income in each country follows a stochastic process known by all individuals.

Assuming that the representative individual in country i and country j have rational expectations and face identical asset prices, we obtain first-order conditions which can be written as

$$(2) \quad \frac{\beta_i u'[C_i(s_{t+1}), \theta_{i,t+1}]}{u'[C_i(s_t), \theta_{i,t}]} = \frac{\beta_j u'[C_j(s_{t+1}), \theta_{j,t+1}]}{u'[C_j(s_t), \theta_{j,t}]}.$$

Here $C_i(s_t)$ is the period t consumption per capita in country i provided that state s_t occurs. This condition means that for all states of nature the ex-post marginal rate of intertemporal substitution is equalized between country i and country j .

We assume an isoelastic period utility function,

$$(3) \quad u(C_{i,t}, \theta_{i,t}) = \frac{1}{1-\gamma} (C_{i,t})^{1-\gamma} \cdot \exp(\theta_{i,t}),$$

where γ is a common coefficient of constant relative risk aversion. Defining $t = 0$ as the initial period and normalizing θ_i so that $\theta_{i,0} = 0$, this specification implies that the following time-series model can be derived from (2):

$$(4) \quad \log C_{i,t} = a + \log C_{j,t} + \frac{t}{\gamma} \cdot \log\left(\frac{\beta_i}{\beta_j}\right) + \frac{1}{\gamma}(\theta_{i,t} - \theta_{j,t}).$$

Here $a = \log(C_{i,0}/C_{j,0})$ is a constant term. We see from (4) that equal time preference factors ($\beta_i = \beta_j$) and identical preference shock ($\theta_{i,t} = \theta_{j,t}$) imply equal ex-post comovements in $\log C_{i,t}$ and $\log C_{j,t}$. We will, however, take into account that country specific preference shocks and differences in the time preference rates break this complete ex-post synchronization of $\log C_{i,t}$ and $\log C_{j,t}$.

Since we consider financial integration in the Nordic region, equation (4) should hold for all combinations of the four countries. Consequently, we may define “country j ” as the aggregate of these countries minus country i . This procedure is common in the literature, and as explained in the appendix, it limits a potential endogenous regressor problem in the empirical application. The appendix also demonstrates that we, based on (4), may derive the following link between the change in the log of per capita consumption in country i and in the rest of the countries in the Nordic region:

$$(5) \quad \Delta \log C_{i,t} = b + \Delta \log C_{No-i,t} + \varepsilon_{i,t}.$$

Here $\Delta \log C_{i,t} \equiv \log C_{i,t} - \log C_{i,t-1}$, $b = \frac{1}{\gamma} [\log \beta_i - \log (\sum_j \beta_j)]$ is a constant, $C_{No-i,t}$ is the per capita consumption in the Nordic region except country i in period t and $\varepsilon_{i,t}$ is a stationary disturbance term which reflects preference shocks.

The representative individuals in each country smooth consumption over time and across future states of nature. As we see from (5), this leads to proportionality between per capita consumption growth in country i and in the rest of the Nordic region. The only effect of idiosyncratic income shocks is through their impact on the total Nordic consumption possibility set. In order to test these predictions, we may estimate the equations

$$(6) \quad \Delta \log C_{i,t} = b + \alpha_i \Delta \log C_{No-i,t} + \varepsilon_{i,t}, \quad \forall i.$$

The joint hypothesis of perfect financial integration and complete markets implies $\alpha_i = 1$. Correspondingly, we interpret α_i -values close to 0 as an indication of a low degree of financial integration.⁷

3.2 Incomplete asset markets

As discussed by Obstfeld (1994) among others, the international financial markets do not offer a complete set of insurance contracts. Accordingly, it seems relevant to consider a model where the asset markets may be incomplete in the sense that contracts can be made contingent on only a subset of the possible future states of nature. Obstfeld (1994) provides such an extension of the reference model, and he proves that "the date $t+1$ ex post marginal rate of intertemporal substitution difference between any two countries i and j ,

$$(7) \quad D_{i,j}(s_{t+1}, s_t) = \frac{\beta_i u'[C_i(s_{t+1}), \theta_{i,t+1}]}{u'[C_i(s_t), \theta_{i,t}]} - \frac{\beta_j u'[C_j(s_{t+1}), \theta_{j,t+1}]}{u'[C_j(s_t), \theta_{j,t}]},$$

is statistically uncorrelated with any random variable on which date $t+1$ contracts can be written, as well as any variable realized on date t or before."

In the case of the reference model, the complete markets assumption implies $D_{i,j}(s_{t+1}, s_t) = 0$. Hence, equation (2) applies. When the markets are incomplete, $D_{i,j}(s_{t+1}, s_t)$ is, however, correlated with some period $t+1$ variables which reflect uninsured shocks. As carefully demonstrated by Obstfeld, this leads to the following simple modification of (5):

$$(8) \quad \Delta \log C_{i,t} = b + \Delta \log C_{No-i,t} + \eta_{i,t} + \varepsilon_{i,t}.$$

⁷ If the hypothesis $\alpha_i = 0$ can not be rejected, this indicates no financial integration. A rejection of the $\alpha_i = 0$ hypothesis does not, however, exclude the possibility of no financial integration since common shocks (for example global technology shocks) may imply $\alpha_i > 0$ even if there is no integration of financial markets.

Here $\eta_{i,t}$ is a function of noninsurable risks facing the representative consumer in country i in period t . We observe that the model still predicts proportional movements in per capita consumption growth in the different Nordic countries after we have controlled for uninsured variables and preference shocks.

In order to test for Nordic financial integration, we may then estimate

$$(9) \quad \Delta \log C_{i,t} = b + \alpha_i \Delta \log C_{No-i,t} + \boldsymbol{\pi}_i \Delta \log \mathbf{X}_{i,t} + \varepsilon_{i,t}, \quad \forall i,$$

where $\mathbf{X}_{i,t}$ is a vector of variables which reflects the uninsured risks (i.e. $\eta_{i,t}$). If \mathbf{X}_i is correctly specified, financial market integration implies $\alpha_i = 1$ and $\boldsymbol{\pi}_i$ -coefficients which are significantly different from 0.

3.3 Myopic consumer behavior

So far we have relied on forward-looking consumption behavior and perfect domestic credit markets. This may be criticized since available empirical evidence indicates that the consumption behavior of a significant share of the population in many OECD countries has been myopic during the period we analyze (1973-1996), see for example Campbell and Mankiw (1991). As a final modification of the model framework, we will therefore include the consumption set-up of Campbell and Mankiw which assumes that a proportion λ_i of aggregate consumption is associated with myopic current income consumers and a proportion $1 - \lambda_i$ with forward-looking consumers. Basically, this means that we combine the reference model above with Campbell and Mankiw's model along similar lines as in Bayoumi and MacDonald (1995). We may interpret the current income consumers as consumers who face liquidity constraints in an imperfect domestic credit market.

The consumption of the current income consumers is given by $\lambda_i Y_{i,t}$ where $Y_{i,t}$ is real disposable income. This implies that

$$(10) \quad \log C_{i,t} = \lambda_i \log Y_{i,t} + (1 - \lambda_i) \log C_{i,t}^{FL} \quad \forall i,$$

where $\log C_{i,t}^{FL}$ is the consumption of the forward-looking consumers. As before we want to consider each individual country i versus the rest of the Nordic countries. Hence, we follow the procedure outlined in the appendix and substitute equation (A-2) (in the appendix) for $\log C_{i,t}^{FL}$ in (10). We may then derive the following estimation equation:

$$(11) \quad \Delta \log C_{i,t} = b + \lambda_i \Delta \log Y_{i,t} + \omega_i \Delta \log C_{No-i,t} - \phi_i \Delta \log Y_{No-i,t} + \varepsilon_{i,t} \quad \forall i.$$

Here $\omega_i = \frac{1-\lambda_i}{1-\lambda_{No-i}}$ and $\phi_i = \lambda_{No-i} \cdot \omega_i$. Estimates of λ_i which are significantly larger than 0, indicate that parts of the population is characterized by myopic consumption behavior, possibly caused by liquidity constraints. Furthermore, ω_i -coefficients significantly larger than 0 indicate financial integration between the Nordic countries after we have controlled for myopic behavior in parts of the population. We observe that $\lambda_{No-i} = \lambda_j$ implies $\omega_i = 1$ if the financial markets are completely integrated in the region.

4. Estimation issues and empirical evidence

4.1 The reference model

Turning to our empirical analyses, we first consider the estimation of (6), i.e. the reference model which includes preference shocks but disregards uninsured risks and domestic credit market imperfections. Table 3 reports the results.

As mentioned above and explained further in the appendix, there is a potential endogenous regressor problem in the reference model. This can be mitigated, however, by using the aggregate consumption growth for the whole region minus country i as the regressor (see the appendix for details). The LM test for cross-country correlation in the error terms, which is reported in table 3, implies that the hypothesis of uncorrelated error terms is rejected at the 5 per cent level. Accordingly, we choose to estimate the reference model using Zellner's seemingly unrelated regression (SUR) estimation. The Durbin-Watson (DW) tests (see table 3) indicate a first-order autocorrelation problem for the Danish equation. Employing a Cochrane-Orcutt procedure changes the results very little, however. Consequently, we report only the SUR results.

*** table 3 ***

We can reject the hypothesis that $\alpha_i = 1$ in the case of Sweden only. Further, the α_i -coefficients are significantly larger than 0 for all countries. These results indicate that the private consumption patterns of Denmark, Finland and Norway are consistent with full financial integration. In addition, the consumption pattern of Sweden also indicates a

significant degree of synchronization with the rest of the region. We must admit, however, that the estimates are not very precise.

Compared to Obstfeld's (1994) results for the G-7 countries, which are obtained from a similar model specification, our results at this stage indicate that the degree of financial integration within the Nordic area is approximately at the same level as between the G-7 countries. Recalling the low consumption correlations reported in section 2, this implies that we (as well as Obstfeld) must attribute an important role to preference shocks.⁸

4.2 Uninsured risks

As discussed in the introduction, the national income of each of the Nordic economies seems to be vulnerable to fluctuations in a small number of international commodity prices and interest rates abroad. Despite our results in table 3, which suggest a rather high degree of financial integration and risk sharing, we therefore use the regression equation (9) in order to investigate whether shocks in various external variables may reflect idiosyncratic consumption risks. Potentially important variables in this respect include the German interest rate and the prices for paper and pulp products as well as oil.

The German interest rate may reflect idiosyncratic risks to the extent that, for example, the tendency to peg the currency to the German mark differs among the Nordic countries. The commodity prices may capture idiosyncratic risks through the relatively large size of the paper and pulp industry in Finland and the petroleum sector in Norway. It turns out, however, that available price indexes for paper and pulp products do not enter significantly into the regression equation (9) for any country. Hence, we consider only the effects of oil prices and German interest rates in the following. In both cases there are evidence of error terms correlation across equation, and consequently we continue to apply SUR estimation.

Table 4 reports the results from the estimation of (9) when we include the change in the log of the real oil price ($\Delta \log OILP_t$) as a possibly uninsured variable.⁹

⁸ The inclusion of unexplained preference shocks in the utility function is standard in the literature on consumption based studies of international financial integration. In addition to Obstfeld (1994), see Ubide (1994), Stockman and Tesar (1995) and Canova and Ravn (1996). As discussed by Obstfeld (1995), such preference shocks are fully plausible. Still, a more elaborate modeling of these shocks is necessary in order to evaluate whether their important role in the present literature is reasonable. This is a natural topic for future research.

⁹ We obtained our real oil price data series from Green et al. (1993) and the IMF's "International Financial Statistics".

*** table 4 ***

We observe that oil price changes have a significant impact on the private consumption patterns in Denmark only. In this case there is a negative relation between oil price changes and consumption growth which means that Denmark has not traded their idiosyncratic oil price risk to the other Nordic countries. (This conclusion is not affected by estimating the Danish equation alone, even if we correct for the autocorrelation that table 4 reveals for Denmark.) The negative relation probably indicates that the existence of large Danish petroleum resources was not recognized during most of the period 1973-96. Surprisingly, the results indicate that the Norwegian private consumption growth has not been significantly affected by oil price changes.¹⁰ This is puzzling when we take the considerable size of the Norwegian petroleum sector and the high oil price volatility during the last decades into account, see for example Thøgersen (1995). From table 4 we also see that both the magnitudes and the significance of the α_i -coefficients are almost similar to the reference case (compare table 3).

Table 5 reports our results of testing the impact of changes in the German long-term interest rates (GI_t).¹¹

*** table 5 ***

Once again our results indicate that Denmark has not traded all its idiosyncratic consumption risk to the other Nordic countries. We see that the German interest rate has a significant negative effect on the Danish private consumption growth. This probably reflects that the Danish capital market has been closely connected to the German capital market during most of the period 1973-96. Increases in German interest rates have therefore rapidly spilled over to Danish interest rates and depressed Danish consumption. The significant positive effect of German interest rates on the Swedish consumption growth is harder to explain.

¹⁰ To some extent this result contrasts with the results in Thøgersen (1997), which indicate that oil price fluctuations contribute to the explanations of low consumption correlations between Norway and respectively Denmark and Germany.

¹¹ The German interest rate data series (yield on long term German T-bonds) is collected from the EcoWin database and the IMF's "International Financial Statistics".

While Danish consumption seems to be exposed to fluctuations in both oil prices and German interest rates, it proves hard to identify uninsured private consumption risks at the aggregate level in the other Nordic countries. This may, of course, imply a rather high degree of risk sharing between the countries in the region. Still, we conjecture that our results to some extent also reflect that tax-transfer policies in the Nordic countries share consumption risks over time and between generations in a way which weakens the immediate responses in private consumption to external shocks.

4.3 Myopic consumption behavior

As indicated by table 3 above, estimation of our reference model indicates a high degree of financial integration within the Nordic area. The results in table 3 may, however, be explained by other economic mechanism than forward-looking consumption behavior and a high degree of financial integration. The results may simply be the consequences of myopic consumption behavior and common income shock in economies which are not highly financially integrated. Based on the regression equation (11), we therefore investigate simultaneously the relevance of the forward-looking consumption model and the degree of financial integration.

Equation (11) was estimated by the Generalized Methods of Moments (GMM) procedure for the 1973-1996 period. Bayoumi and MacDonald (1995) discuss why GMM is appropriate in these models. The main argument is that the disturbances to domestic income contain information about permanent income and may be correlated with consumption. An instrumental variable technique, such as GMM, should therefore be applied. In addition, GMM is robust to heteroscedasticity and autocorrelation, and it provides a direct test of orthogonality of the errors to the instruments.

As instruments, we use the second lag of the level of real consumption per capita and real disposable income per capita for both the home country and the rest of the region.¹² We have also experimented with lagged growth rates of consumption and disposable income as instruments. Based on the Wu-Hausman test for evaluation of instruments (see e.g. Johnston and DiNardo, 1997, pp. 348-342), it followed that the level

¹² We use the second lag because both the inclusion of nondurables in the consumption measure and the time averaging of consumption data can induce a correlation between the error term and the first lag of consumption (see Campbell and Mankiw, 1989).

variables generally performed better. Thus, we only report the parameter estimates where the level variables are used as instruments. These results are given in table 6.¹³

*** table 6 ***

The last row in table 6 reports a Sargan test of whether the errors in equation (11) are orthogonal to the instruments. The reported values all imply that we can not reject the orthogonality hypothesis. This indicates that the model in equation (11) can be regarded as a valid description of the data.

All coefficients on domestic disposable income (λ_i) have the expected positive sign. The λ -coefficient is significant at the 5 per cent level for Finland only. In the Swedish case the λ -coefficient is significant at the 10 per cent level. The ω -coefficient is significant at the 5 per cent level for Denmark and Norway, and at the 10 per cent level for Finland and Sweden. None of the coefficients on external income (ϕ_i) are significantly different from 0 at the 5 per cent level.

Comparing our results to earlier studies, we first consider the λ -estimates and note that Bayoumi and MacDonald (1995), based on the sample period 1973-1992, report an approximately similar estimate for Finland as that presented in table 6. For Denmark, Bayoumi and MacDonald present an estimate that is highly significant and larger than our estimate. One possible interpretation is that the fraction of rule-of-thumb consumers has been reduced over time in Denmark. Turning to Sweden, our λ -estimate is approximately similar to the estimate provided by Campbell and Mankiw (1991) for the period 1972:2-1988:1 (see table 2 of that paper) and also very close to the series of λ -estimates presented by Agell and Berg (1996). Finally, for Norway Boug et al. (1995) report insignificant λ -estimates for the period 1984:3-1994:4.

Bayoumi and MacDonald also estimate coefficients corresponding to our ω_r -coefficients. For Denmark, they report negative estimates both with respect to their broad sample of selected OECD economies and with respect to other EU-countries (members in 1991). Our results (table 6) suggest, however, that Denmark over the 1973-1996 period was financially well integrated with their Nordic neighbors once rule-of-thumb

¹³ For Finland, Norway and Sweden, we collected the data for per capita real private disposable income from the OECD national accounts. The full series is not available for Denmark. Consequently, we used real GDP as a proxy for Danish disposable income.

consumption behavior is taken into account. For Finland, Bayoumi and MacDonald's coefficient on external consumption is positive, but insignificant. Because our coefficient on external (Nordic-) consumption is significant at the 10 per cent level, this suggests that Finland's capital market is well integrated with the other Nordic countries, but not with the other OECD nations. We suspect that Finland's close economic ties to particularly Sweden might be responsible for this result (recall that Sweden is captured by our sample but not by Bayoumi and MacDonald's). We also recall the high consumption growth correlation between Finland and Sweden in table 1.

The overall impression from table 6 is that once myopic consumer behavior is taken into account, the financial markets of the Nordic economies seem to be highly integrated. We can throw additional light on this issue by looking at similar regressions for the period 1951-72. Table 7 reports the estimation results from this period.

It turned out to be very hard to identify good instrument from our set of available candidates for 1951-72 (the same set as for the 1973-96 period). In all our attempts, the Wu-Hausman test was very far from rejecting that an endogeneity of Y_i had no effect on the consistency of the estimates. This indicates that OLS is more efficient than GMM in this case.¹⁴ Consequently, we chose to employ a regular OLS procedure in this case. Because data on disposable income are not available for the 1951-72 period, we rely on real GDP per capita as a proxy.

*** table 7 ***

Table 7 shows significant λ_i -coefficients for all countries. In addition we observe that none of the ω_i -coefficients are significant at the 5 per cent level. Comparing tables 6 and 7, we safely conclude that the gradual reforms in domestic and global financial markets after 1970 have led to both increased consumption smoothing over time as well as increased real integration of financial markets in the Nordic region.

¹⁴ We did run GMM for 1951-72, using the same instruments as in table 6. This exercise gives a significantly positive λ for Finland, while all other parameters are insignificant and extremely imprecise.

5. Final remarks

This paper has analyzed the degree of financial integration in the Nordic countries based on their per capita private consumption patterns. The removal of formal restrictions on cross border capital flows during the last decades has led to a high degree of financial integration between financial *centers* in different countries. Our consumption based analysis sheds light on a more fundamental issue, however. The question is to what extent the liberalization of cross border capital flows as well as domestic credit markets has real implications for per capita consumption movements.

Our analysis indicates that the financial markets of the Nordic economies were well integrated over the 1973-96 period. For Denmark, Finland, and Sweden we have also found some evidence of myopic consumption behavior, in accordance with earlier research. This may be interpreted as the consequences of liquidity constraints in imperfect domestic credit markets. Finally, our analysis indicates that it is hard to identify uninsured external consumption risks.

We have seen that both the degree of financial integration and the degree of forward-looking consumption behavior have increased in the Nordic region when we compare the period 1951-1972 with the period 1973-1996. It is tempting to ask whether we should have chosen a shorter recent period, e.g. after 1985, since we know that the financial markets were deregulated over a considerable time span and several restrictions in some of the Nordic countries prevailed into the early 1980s. In order to investigate whether a shorter time period may lead to stronger support to financial integration and forward-looking consumption behavior, we have experimented with varying sample periods in the different regressions. Our impression is that a shorter recent sample period does not alter our qualitative conclusions in any way.

Appendix

This appendix - which closely follows Obstfeld (1995) - briefly derives the relationship between equation (4) and equation (5) in the main text. If (4) is estimated directly for different combination of countries, it may cause econometric difficulties. A high realization of $\theta_{j,t}$ raises the marginal utility of country j 's consumption in period t . Thus, country j 's consumption in (4) is likely to be positively correlated with $\theta_{j,t}$. This creates a potential endogenous-regressor problem. In order to reduce this problem, we define $n_{i,t}$ as country i 's share of the total Nordic population and $C_{No,t}$ as Nordic consumption per capita. This means that

$$(A-1) \quad C_{No,t} \equiv \sum_{j=1}^5 n_{j,t} C_{j,t}.$$

Using (A-1), we rewrite equation (4) in the main text as

$$(A-2) \quad \log C_{i,t} = \log C_{No,t} + \log C_{i,0} + \frac{t}{\gamma} \cdot \log \beta_i + \left\{ \frac{\theta_{i,t}}{\gamma} - \log \left[\sum_j (\beta_j)^{\frac{t}{\gamma}} \cdot \exp\left(\frac{\theta_{j,t}}{\gamma}\right) \cdot n_{j,t} \cdot C_{j,0} \right] \right\}.$$

Compared to the error term $\frac{1}{\gamma}(\theta_{i,t} - \theta_{j,t})$ in equation (4), it is more plausible that the composite error in the brackets in (A-2) is uncorrelated with $\ln C_{No,t}$. This implies that the endogenous-regressor problem has been reduced. Differencing (A-2) yields equation (5) in the text when we remove country i from the aggregate consumption variable. If country i is not removed from the aggregate, we would probably face another endogenous-regressor problem since positive realizations of $\theta_{i,t}$ in many cases would be correlated with $C_{No,t}$ (particularly if country i is large).

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Table 1. Correlation coefficients for changes in the logarithms of annual per capita private consumption growth in 1951-1972 (first row) and 1973-1996 (second row).

Country (region) <i>i</i> :	Nordic Region	Denmark	Finland	Norway	Sweden
OECD – except country <i>i</i>	0.34	0.05	0.28	0.45	0.35
Nordic Region - except country <i>i</i>	0.55	0.42	0.42	0.16	0.45
Denmark		0.53	0.30	0.61	0.56
Finland		0.52	0.48	0.18	0.45
Norway			0.21	0.40	0.56
Sweden			0.35	0.54	0.25
				0.42	0.22
				-0.03	0.60
					0.52
					0.02

Table 2. Standard deviation of each individual country's private annual consumption growth (logs) relative to standard deviation of private annual consumption growth in OECD (logs) in 1951-1972 and 1973-1996.

	Denmark	Finland	Norway	Sweden	Nordic Region
1951-1972	2.45	3.68	1.64	1.36	1.49
1973-1996	2.61	2.62	2.42	1.88	1.69

Memo: Standard deviation of OECD private annual consumption growth is 1.10% in 1951-1972 and 1.11% in 1973-1996.

Table 3. Reference model - SUR estimation of equation (6), 1973-1996.

Country <i>i</i> :	Denmark	Finland	Norway	Sweden
α_i	0.84	1.54	0.75	0.52*
	(0.21)	(0.39)	(0.33)	(0.14)
R^2	0.27	0.23	0.03	0.20
LM het. test	0.71	1.95	0.10	0.52
DW	0.94	1.55	1.41	1.42

LM test for contemporaneous correlation across equations = 19.60

Note: Standard errors of coefficients are shown in parentheses. **Boldface** entries indicate coefficients that are significantly larger than 0 at the 5% level. Asterisks indicate coefficients that are significantly different from 1 at the 5% level.

Table 4. Oil price risk - SUR estimation of equation (9), 1973-1996, $\Delta \log OILP_t$ as a possibly uninsured variable.

Country i :	Denmark	Finland	Norway	Sweden
α_i	0.75 (0.17)	1.54 (0.40)	0.78 (0.34)	0.57* (0.14)
π_i^{oilp}	-0.03 (0.01)	0.00 (0.02)	0.01 (0.02)	0.01 (0.01)
R^2 adjusted	0.48	0.20	-0.01	0.20
LM het. test	0.17	1.78	0.06	0.71
DW	0.86	1.53	1.39	1.54

LM test for contemporaneous correlation across equations = 21.98

Note: Standard errors of coefficients are shown in parentheses. **Boldface** entries indicate coefficients that are significantly larger than 0 at the 5% level. Asterisks indicate α_i -coefficients that are significantly different from 1 at the 5% level.

Table 5. German interest rate risk - SUR estimation of equation (9), 1973-1996, ΔGI_t as a possibly uninsured variable.

Country i :	Denmark	Finland	Norway	Sweden
α_i	0.81 (0.19)	1.65 (0.39)	0.73 (0.32)	0.58* (0.14)
π_i^{gi}	-0.88 (0.34)	0.65 (0.64)	-0.94 (0.60)	0.66 (0.30)
R^2 adjusted	0.40	0.21	0.07	0.28
LM het. test	0.48	2.86	0.42	0.81
DW	1.47	1.78	1.61	1.55

LM test for contemporaneous correlation across equations = 22.72

Note: Standard errors of coefficients are shown in parentheses. **Boldface** entries indicate coefficients that are significantly larger than 0 at the 5% level. Asterisks indicate α_i -coefficients that are significantly different from 1 at the 5% level.

Table 6. GMM estimation of equation (11), 1973-96.

Country i :	Denmark	Finland	Norway	Sweden
λ_i	0.39 [#] (0.23)	0.89 (0.22)	0.79 (0.71)	0.37 [#] (0.21)
ω_i	0.82 (0.36)	0.87 (0.50)	1.18 (0.45)	0.49 [#] (0.29)
ϕ_i	0.58 (0.41)	-1.11 [#] (0.62)	-0.47 (0.32)	0.45 (0.62)
Overidentif. restrictions (Sargan)	0.05	0.05	1.91	1.40

Note: Standard errors (robust to heteroscedasticity and 1 order autocorrelation) are shown in parentheses. **Boldface** (#) entries indicates coefficients that are significantly larger than 0 at the 5% (10%) level. The instruments were the second lags of (per capita) domestic and external consumption, and domestic and external disposable income. Critical value of the Sargan test at the 5% level is 3.84 from $\chi_{(1)}$.

Table 7. OLS estimation of equation (11), 1951-72.

Country i :	Denmark	Finland	Norway	Sweden
λ_i	0.47 (0.14)	0.79 (0.16)	0.50 (0.22)	0.52 (0.17)
ω_i	-0.11 (0.40)	0.68 (0.74)	0.47 (0.37)	0.28 (0.20)
ϕ_i	0.61 (0.41)	-0.01 (0.66)	-0.03 (0.31)	-0.27 (0.21)
Adjusted R^2	0.51	0.64	0.35	0.44
LM het. test	1.71	0.06	0.22	1.25
DW	2.39	1.87	2.12	2.07

LM test for contemporaneous correlation across equations = 12.51

Note: Standard errors of coefficients are shown in parentheses. **Boldface** entries indicate coefficients that are significantly larger than 0 at the 5% level.