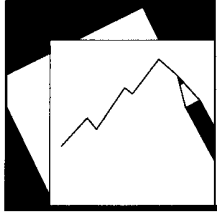


Spillovers to and from the Nordic Economies: A Macroeconometric Model Based Analysis



WP/13/225

IMF Working Paper

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**Spillovers to and from the Nordic Economies:
A Macroeconometric Model Based Analysis**

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November 2013

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Abstract

This paper analyzes the transmission of shocks and policies among and across the Nordic economies and the rest of the world. This spillover analysis is based on a pair of estimated structural macroeconometric models of the world economy, disaggregated into thirty five national economies. We find that the Nordic economies are heavily exposed to external macroeconomic and financial shocks, but have significant scope to mitigate their domestic macroeconomic impacts through coordinated policy responses, given their high degree of regional integration.

JEL Classification Numbers: F41; F42

Keywords: Spillover analysis; Trade linkages; Financial linkages; External risks; Policy coordination

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¹ The author gratefully acknowledges advice provided by Helge Berger, in addition to comments and suggestions received from seminar participants at the central banks of Denmark, Finland, Norway and Sweden.

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I. INTRODUCTION

The Nordic countries of Denmark, Finland, Norway and Sweden have small advanced economies that are tightly connected by trade and financial linkages, which extend globally. But these structural similarities are accompanied by important differences. The export bases of Denmark, Finland and Sweden are diversified, while that of Norway is concentrated in energy commodities. These countries also have different monetary policy and exchange rate regimes: Denmark and Finland respectively peg to and use the euro, while Norway and Sweden target inflation.

This paper analyzes spillovers to and from the Nordic economies within the context of these structural similarities and differences. This analysis is based on a complementary pair of estimated structural macroeconometric models of the world economy, disaggregated into thirty five national economies, documented in Vitek (2012, 2013). Within these frameworks, each economy is represented by interconnected real, external, monetary, fiscal, and financial sectors. Spillovers are transmitted across economies via trade, financial, and commodity price linkages. Financial linkages are both direct, through cross-border debt or equity portfolio holdings, and indirect via international comovement in asset risk premia. This spillover analysis was an input into IMF (2013), where it was integrated into a broader assessment of regional macroeconomic and financial developments and policies.

We find that the Nordic economies are heavily exposed to external macroeconomic and financial shocks, commensurate with their high trade and financial openness. Indeed, estimated historical decompositions of output growth primarily attribute their cyclical output growth dynamics to foreign macroeconomic and financial shocks. Furthermore, estimated impulse responses indicate that inward output spillovers to these economies are moderate from macroeconomic shocks in geographically close trading partners and large from financial shocks in systemic advanced economies. We also find evidence of regional comovement in asset risk premia not explained by global comovement, accounting for which significantly amplifies estimated inward output spillovers from financial shocks in other Nordic economies. Finally, simulated scenarios representing major risks to global macroeconomic and financial market stability can generate moderate domestic macroeconomic impacts. However, we find that the Nordic economies have significant scope to mitigate these macroeconomic impacts through coordinated policy responses, in particular synchronized fiscal stimulus measures, given their high degree of regional integration.

The organization of this paper is as follows. The next section documents trade and financial linkages, both among the Nordic economies and with the rest of the world. The estimation of inward and outward output spillovers from macroeconomic and financial shocks is the subject of section three. The implications of external risk scenarios for the Nordic economies are analyzed in section four, in particular an intensification of the Euro Area sovereign debt crisis, a disorderly fiscal consolidation in the United States, and a hard landing in selected emerging economies. The gains from policy coordination through regionally synchronized as

opposed to economy specific macroprudential, fiscal or structural measures are analyzed in section five. Finally, section six offers recommendations for further research.

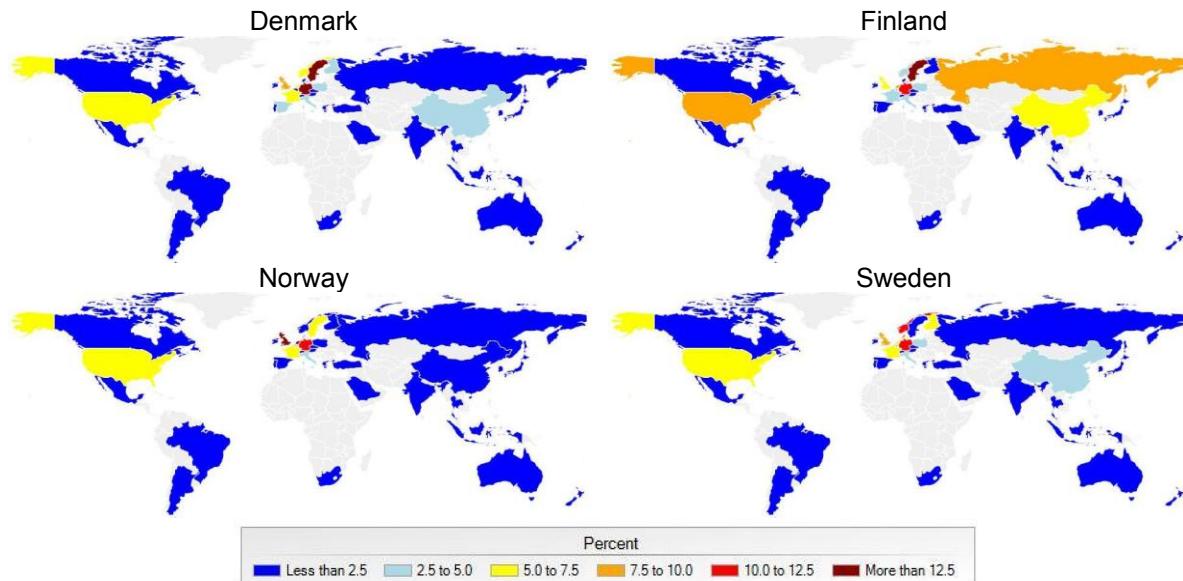
II. TRADE AND FINANCIAL LINKAGES

The Nordic economies are tightly connected by trade and financial linkages, both among each other and to the rest of the world. This section documents these linkages, distinguishing between direct financial linkages through cross-border portfolio holdings, and indirect financial linkages via international financial market contagion.²

A. Trade Linkages

The Nordic economies have high export openness, with ratios of exports to output of 50 percent for Denmark, 40 percent for Finland, 41 percent for Norway, and 50 percent for Sweden in 2010. These export exposures are concentrated among geographically close trading partners and systemic economies. Bilateral export shares are highest from Denmark to Germany at 19 percent, from Finland to Sweden at 13 percent, from Norway to the United Kingdom at 28 percent, and from Sweden to Germany at 12 percent.

Figure 1. Bilateral Export Shares, 2010

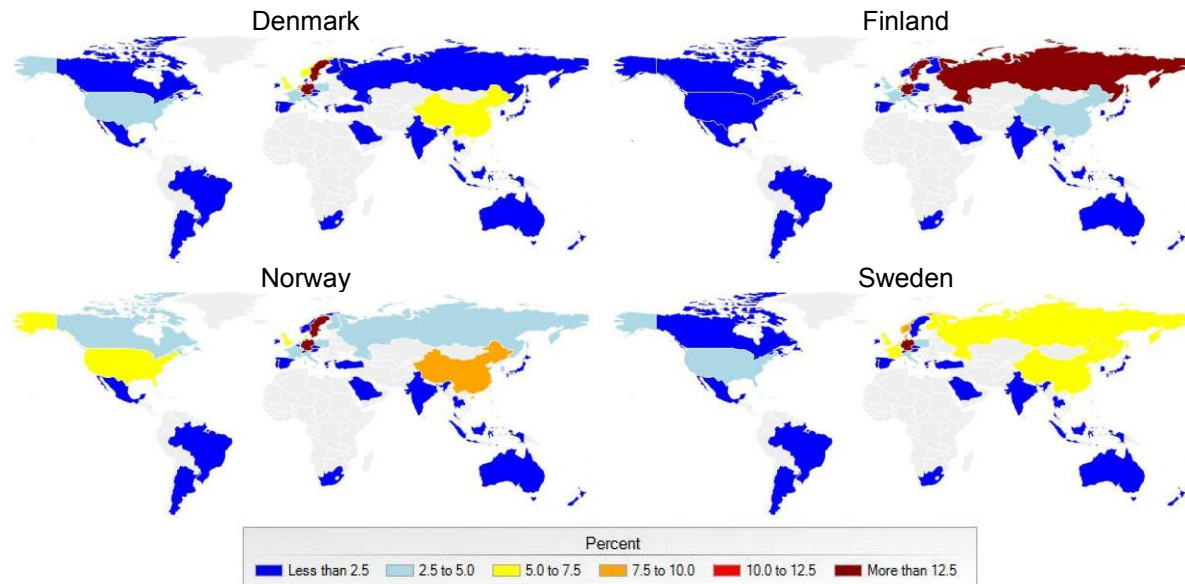


The Nordic economies also have high import openness, with ratios of imports to output of 45 percent for Denmark, 39 percent for Finland, 29 percent for Norway, and 43 percent for Sweden in 2010. These import dependencies are also concentrated among geographically

² Bilateral trade weights are derived from the DOTS database, while bilateral portfolio weights are derived from the CPIS, BIS and WDI databases.

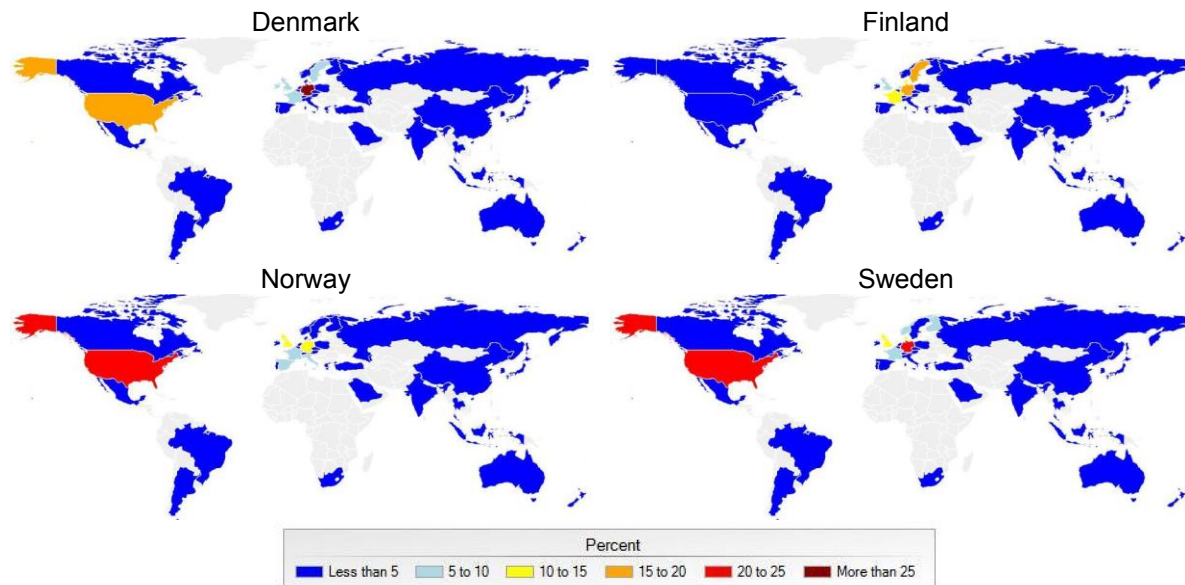
close trading partners and systemic economies. Bilateral import shares are highest to Denmark from Germany at 23 percent, to Finland from Russia at 19 percent, to Norway from Sweden at 16 percent, and to Sweden from Germany at 20 percent.

Figure 2. Bilateral Import Shares, 2010

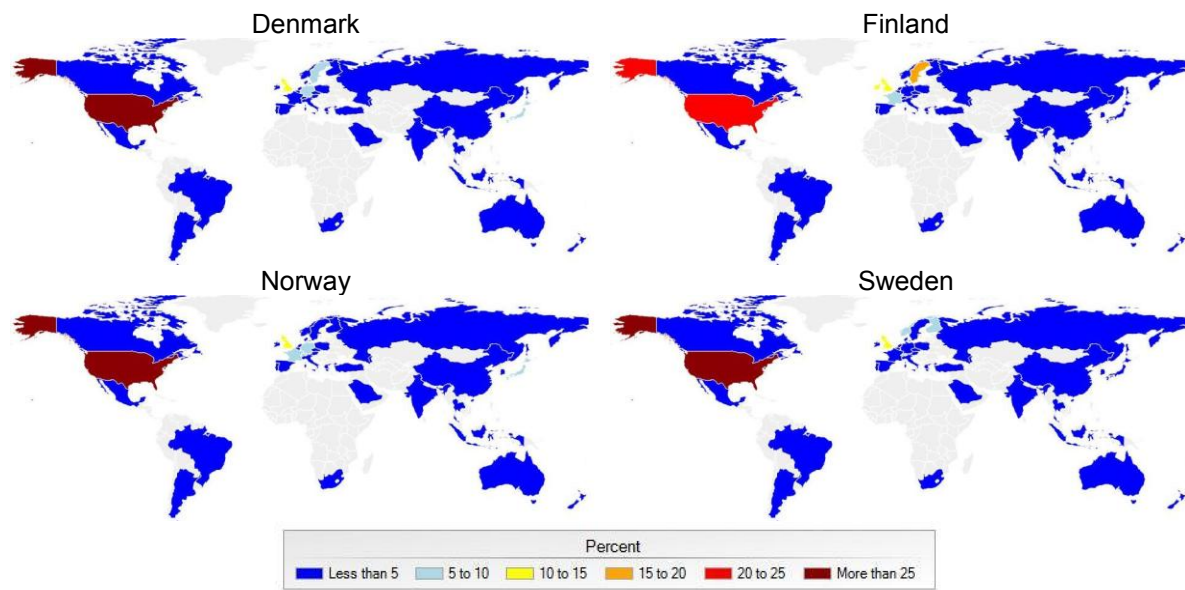


B. Direct Financial Linkages

The Nordic economies have high gross foreign debt assets, with ratios of external portfolio debt holdings to output of 59 percent for Denmark, 64 percent for Finland, 78 percent for Norway, and 35 percent for Sweden in 2010. These foreign debt exposures are concentrated among systemic advanced economies, and to a lesser extent geographically close trading partners. Bilateral external portfolio debt allocations are highest for Denmark in Germany at 28 percent, for Finland in Germany at 16 percent, for Norway in the United States at 23 percent, and for Sweden in the United States at 21 percent.

Figure 3. Bilateral External Portfolio Debt Allocations, 2010

The Nordic economies also have high gross foreign equity assets, with ratios of external portfolio equity holdings to output of 42 percent for Denmark, 54 percent for Finland, 97 percent for Norway, and 72 percent for Sweden in 2010. These foreign equity exposures are also concentrated among systemic advanced economies, and to a lesser extent geographically close trading partners. Bilateral external portfolio equity allocations are highest for Denmark in the United States at 37 percent, for Finland in the United States at 21 percent, for Norway in the United States at 30 percent, and for Sweden in the United States at 32 percent.

Figure 4. Bilateral External Portfolio Equity Allocations, 2010

C. Indirect Financial Linkages

We define international financial market contagion as cross-border comovement in asset risk premia or ex ante excess returns. To investigate the sensitivity of the Nordic economies to international financial market contagion, we conduct a factor analysis of ex post excess returns on their money, bond and stock markets.

Let $r_{i,t}$ denote the excess return on an asset for economy i at time t , expressed in terms of a common currency. Consider the following factor model expressing this excess return as a linear function of a global factor and a regional factor,

$$r_{i,t} = \beta_k^W \sum_{j=1}^N w_j^W r_{j,t} + \beta_l^R \sum_{j=1}^N w_j^R r_{j,t} + \varepsilon_{i,t}, \quad (1)$$

where $\varepsilon_{i,t} \sim \text{iid } \mathcal{N}(0, \sigma_i^2)$ and $\varepsilon_{j,t} \sim \text{iid } \mathcal{N}(0, \sigma_j^2)$ are independent for all $i \neq j$. The global factor is the excess return on the value weighted global portfolio for the asset class under consideration, while the regional factor is the excess return on the applicable value weighted regional portfolio.

We estimate this system of equations for the money, bond and stock markets by ordinary least squares, which is maximum likelihood under our distributional assumptions. The data set consists of annual observations on several financial market variables observed for thirty five economies over the sample period 2000 through 2012. We allow the factor loadings to vary across advanced economies, emerging economies with open capital accounts, and emerging economies with closed capital accounts, consistent with Vitek (2012, 2013). We include a regional factor only for the Nordic economies.

Table 1. Factor Model Estimation Results

	Money Market	Bond Market	Stock Market
Global factor			
Advanced economies	1.666***	1.181***	1.079***
Emerging economies, open	1.515***	1.842***	1.461***
Emerging economies, closed	0.255	0.513	1.003***
Regional factor			
Nordic economies	0.316*	0.280	0.293***
Observations	455	455	455

Note: Statistical significance at the 1 percent, 5 percent and 10 percent levels is indicated by ***, ** and *, respectively.

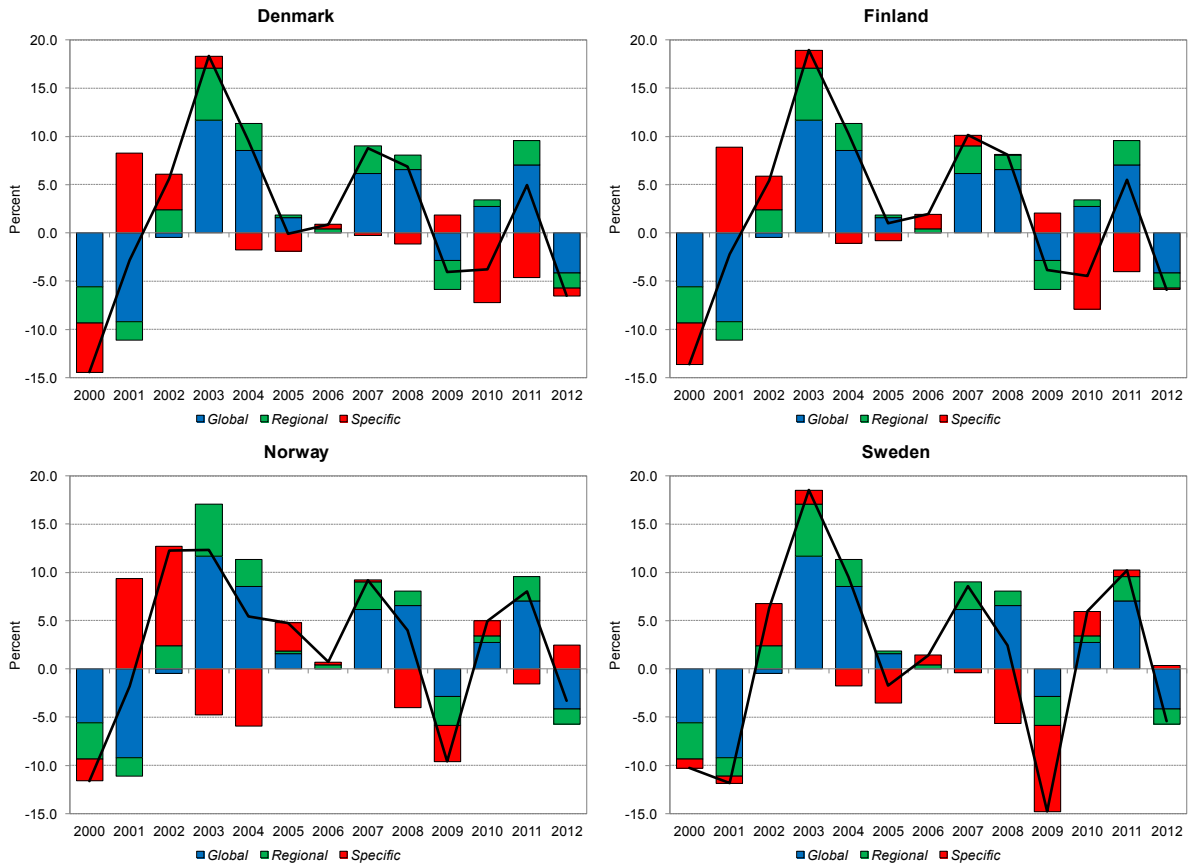
Variation in excess returns on the money, bond and stock markets of the Nordic economies is largely explained by variation in the corresponding global excess return, and to a lesser extent the regional excess return. Indeed, variation in the global factor is estimated to account for 61 percent of money market variation, 62 percent of bond market variation, and

69 percent of stock market variation, on average across the Nordic economies. In addition, variation in the regional factor accounts on average for 11 percent of money market variation, 9 percent of bond market variation, and 11 percent of stock market variation. This regional factor captures comovement in excess returns across the Nordic economies not explained by the global factor, and reflects their high trade and financial integration, including through cross-border bank balance sheet linkages. It follows that variation in the economy specific factor only accounts on average for 28 percent of money market variation, 29 percent of bond market variation, and 20 percent of stock market variation. These estimated variance contributions are similar across the Nordic economies.

Table 2. Estimated Variance Decompositions of Excess Returns, Percent

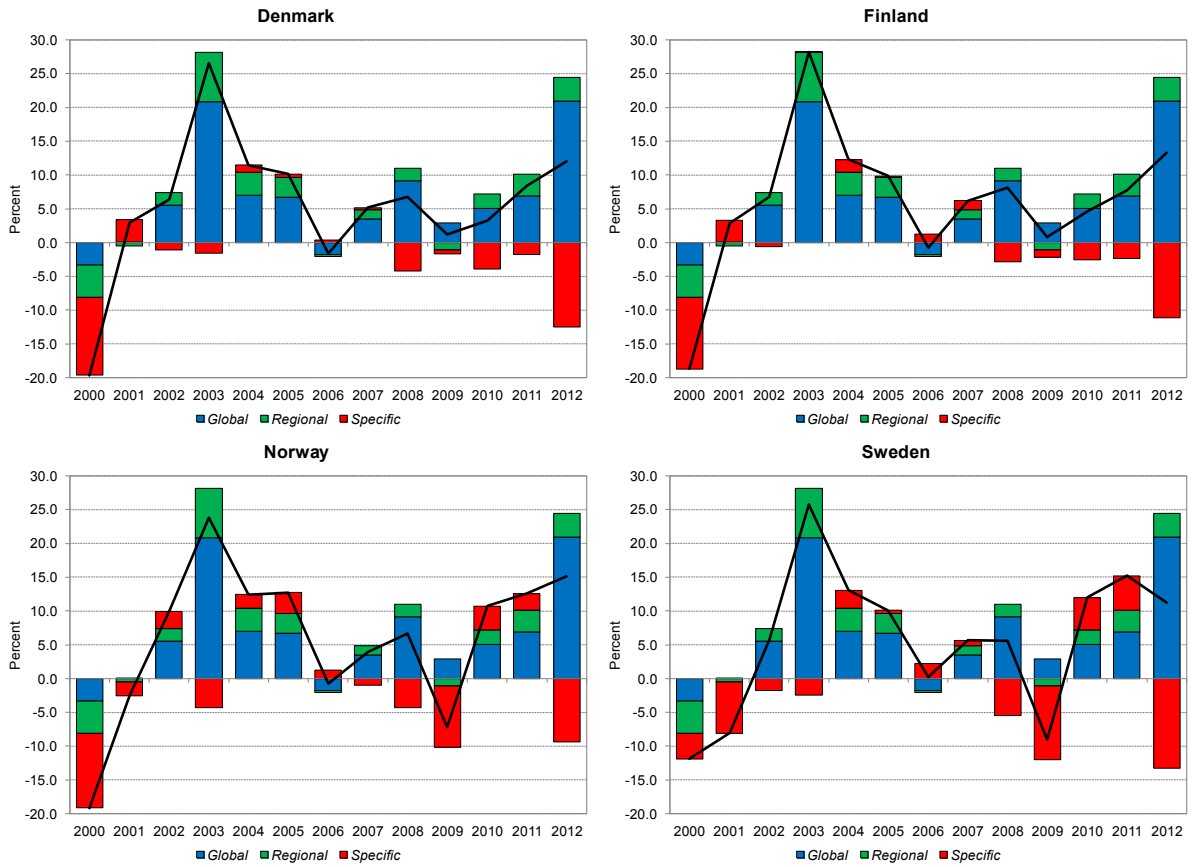
	Money Market			Bond Market			Stock Market		
	Global	Regional	Specific	Global	Regional	Specific	Global	Regional	Specific
Denmark	62	11	26	64	10	26	73	12	15
Finland	61	11	27	66	10	24	55	9	36
Norway	54	10	36	61	9	30	72	12	16
Sweden	66	12	22	57	9	35	75	12	13
Average	61	11	28	62	9	29	69	11	20

Figure 5. Estimated Factor Decompositions of Money Market Excess Returns



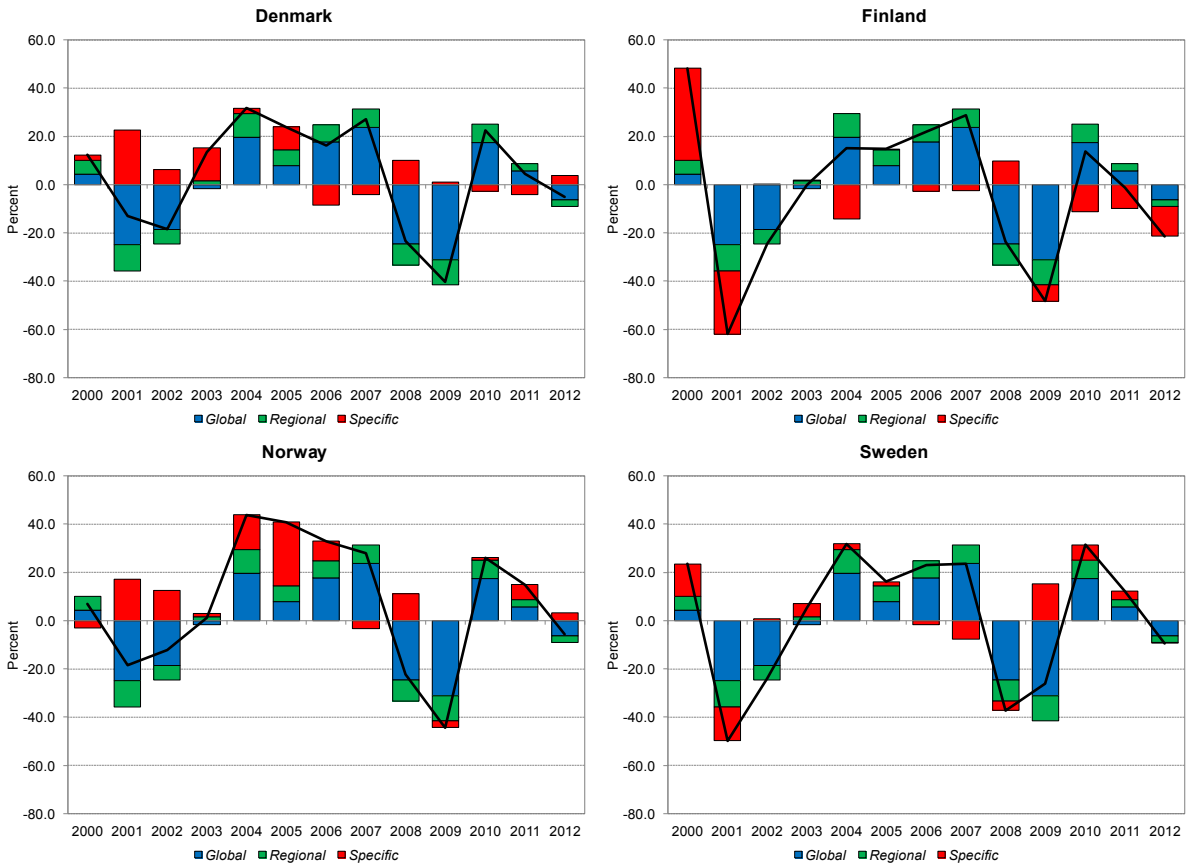
Note: The excess return on the money market is measured as $r_{i,t} = i_{i,t}^S - i_{i,t-1}^P - \Delta \ln \mathcal{E}_{i,i^*,t}$, where $i_{i,t}^S$ denotes the yield to maturity on a government bill, $i_{i,t}^P$ denotes the nominal policy interest rate, and $\mathcal{E}_{i,i^*,t}$ denotes the nominal bilateral exchange rate, defined as the domestic currency denominated price of one dollar.

Figure 6. Estimated Factor Decompositions of Bond Market Excess Returns



Note: The excess return on the bond market is measured as $r_{i,t} = i_{i,t-1}^L - (T-1)\Delta i_{i,t}^L - i_{i,t-1}^P - \Delta \ln \mathcal{E}_{i,i^*,t}$, where $i_{i,t}^L$ denotes the yield to maturity on a $T = 10$ period government bond, $i_{i,t}^P$ denotes the nominal policy interest rate, and $\mathcal{E}_{i,i^*,t}$ denotes the nominal bilateral exchange rate, defined as the domestic currency denominated price of one dollar.

Figure 7. Estimated Factor Decompositions of Stock Market Excess Returns



Note: The excess return on the stock market is measured as $r_{i,t} = \Delta \ln V_{i,t}^S - i_{i,t-1}^P - \Delta \ln \mathcal{E}_{i,t^*,t}$, where $V_{i,t}^S$ denotes the price of equity, $i_{i,t}^P$ denotes the nominal policy interest rate, and $\mathcal{E}_{i,t^*,t}$ denotes the nominal bilateral exchange rate, defined as the domestic currency denominated price of one dollar.

III. SPILLOVERS FROM MACROECONOMIC AND FINANCIAL SHOCKS

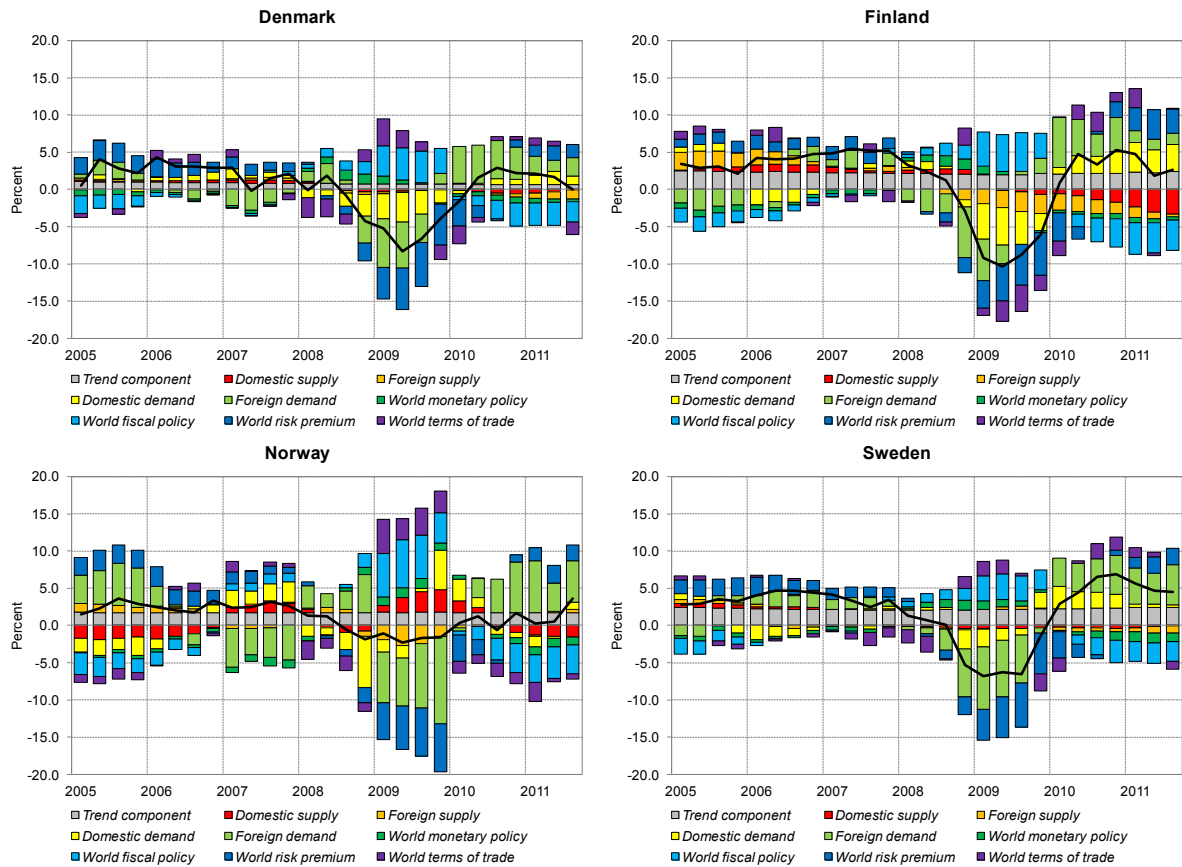
This section analyzes output spillovers to and from the Nordic economies caused by macroeconomic and financial shocks. This analysis is based on historical decompositions estimated with the structural macroeconometric model of the world economy documented in Vitek (2012). This model is not derived from microeconomic foundations, to enhance its empirical adequacy. It is also based on impulse responses estimated with the structural macroeconometric model of the world economy documented in Vitek (2013). This model is derived from microeconomic foundations, to enhance its theoretical coherence.

A. Business Cycle Accounting

Cyclical output growth dynamics in the Nordic economies have been primarily driven by foreign macroeconomic and financial shocks, reflecting their high trade and financial openness. Indeed, estimated historical decompositions of output growth primarily attribute the recessions they experienced during the global financial crisis to inward spillovers from

negative foreign demand and positive world risk premium shocks. Symmetrically, inward spillovers from positive foreign demand and negative world risk premium shocks were primary contributors to their recoveries.

Figure 8. Estimated Historical Decompositions of Output Growth



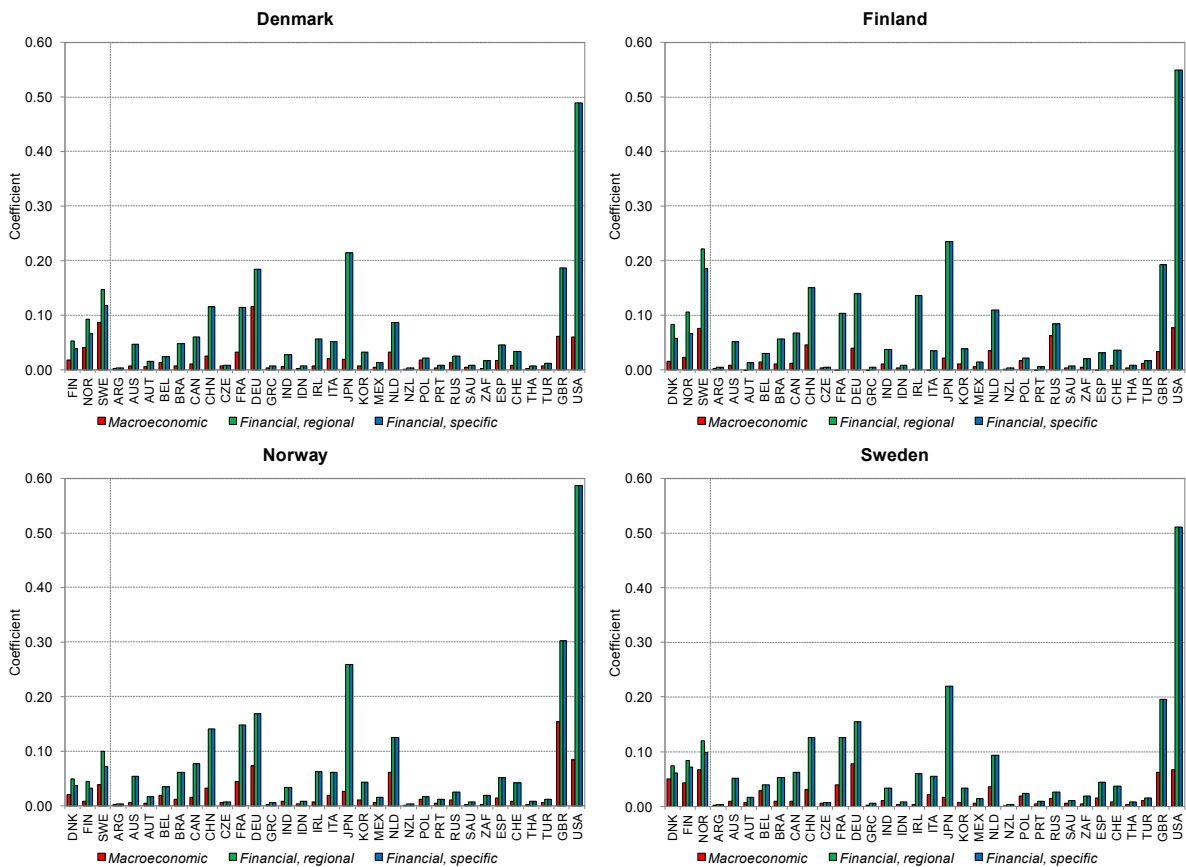
B. Output Spillovers

We analyze inward and outward output spillovers to and from the Nordic economies with output spillover coefficients. These output spillover coefficients measure the peak percent increase in output in the recipient economy in response to a set of macroeconomic or financial shocks in the source economy which induce a peak increase in domestic demand there of one percent. The macroeconomic shocks under consideration are composites of selected real, monetary policy and fiscal policy shocks, where applicable. The financial shocks under consideration are composites of credit risk premium, duration risk premium, and equity risk premium shocks. We distinguish between regional financial shocks which are globally and regionally correlated, versus specific financial shocks which are only globally correlated.

Inward Output Spillovers

Inward output spillovers to the Nordic economies are moderate from macroeconomic shocks in geographically close trading partners and large from financial shocks in systemic advanced economies. For macroeconomic shocks, estimated inward output spillover coefficients are highest to Denmark from Germany at 0.12, to Finland from the United States at 0.08, to Norway from the United Kingdom at 0.15, and to Sweden from Germany at 0.08. This primarily reflects high export exposures to these destination economies. For financial shocks, estimated inward output spillover coefficients are highest to all of the Nordic economies from the United States, ranging from 0.49 to 0.59. This primarily reflects high direct financial exposures through cross-border debt and equity portfolio asset holdings, together with high indirect financial exposures through international money, bond and stock market contagion. Estimated inward output spillover coefficients are relatively high among the Nordic economies themselves, particularly if they account for regional comovement across financial shocks in addition to global comovement, to an extent consistent with our factor model estimation results. Indeed, this regional comovement is estimated to amplify these inward output spillover coefficients by 33 percent, on average across the Nordic economies.

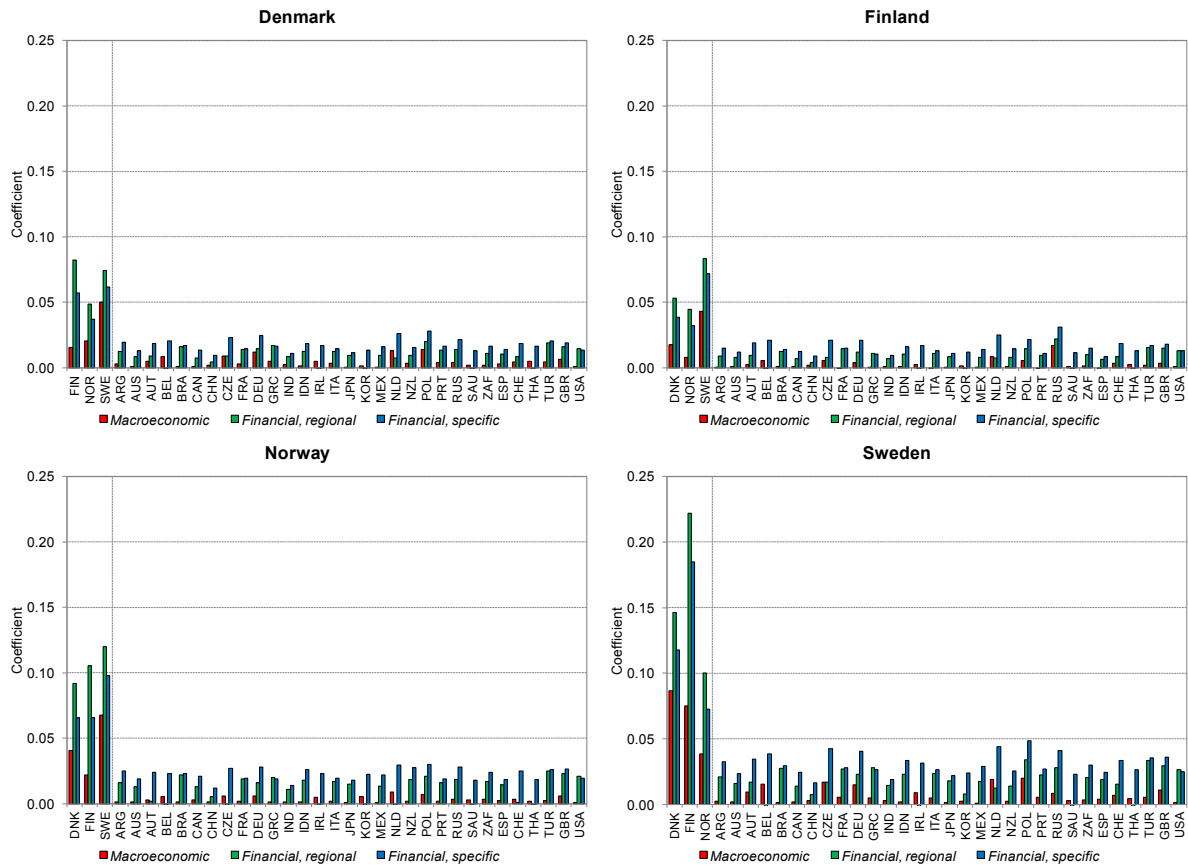
Figure 9. Estimated Inward Output Spillover Coefficients



Outward Output Spillovers

Outward output spillovers from macroeconomic and financial shocks in the Nordic economies are small to moderate, commensurate with their small size, and are concentrated among the Nordic economies themselves, reflecting their high trade and financial integration. For macroeconomic shocks, estimated outward output spillover coefficients are highest from Denmark to Sweden at 0.05, from Finland to Sweden at 0.04, from Norway to Sweden at 0.07, and from Sweden to Denmark at 0.09. This primarily reflects high import dependencies on these source economies. For financial shocks, estimated outward output spillover coefficients are highest from Denmark to Finland at 0.08, from Finland to Sweden at 0.08, from Norway to Sweden at 0.12, and from Sweden to Finland at 0.22. This amplification primarily occurs through international and regional contagion effects.

Figure 10. Estimated Outward Output Spillover Coefficients



IV. EXTERNAL RISK SCENARIOS

This section analyzes spillovers to the Nordic economies under scenarios representing major risks to global macroeconomic and financial market stability that were under consideration in 2012Q4. The external risk scenarios that were considered were an intensification of the Euro Area sovereign debt crisis, a disorderly fiscal consolidation in the United States, and a hard

landing in selected emerging economies. While the realization of these downside risks has been avoided, these scenarios illustrate potential transmission channels. They are simulated with the structural macroeconomic model of the world economy documented in Vitek (2012). Under all of these scenarios, we assume that monetary policy responses are constrained by the zero lower bound on the nominal policy interest rate through 2015Q2 in Denmark, the Euro Area, Japan, Switzerland, the United Kingdom, and the United States.

A. Intensification of the Euro Area Sovereign Debt Crisis

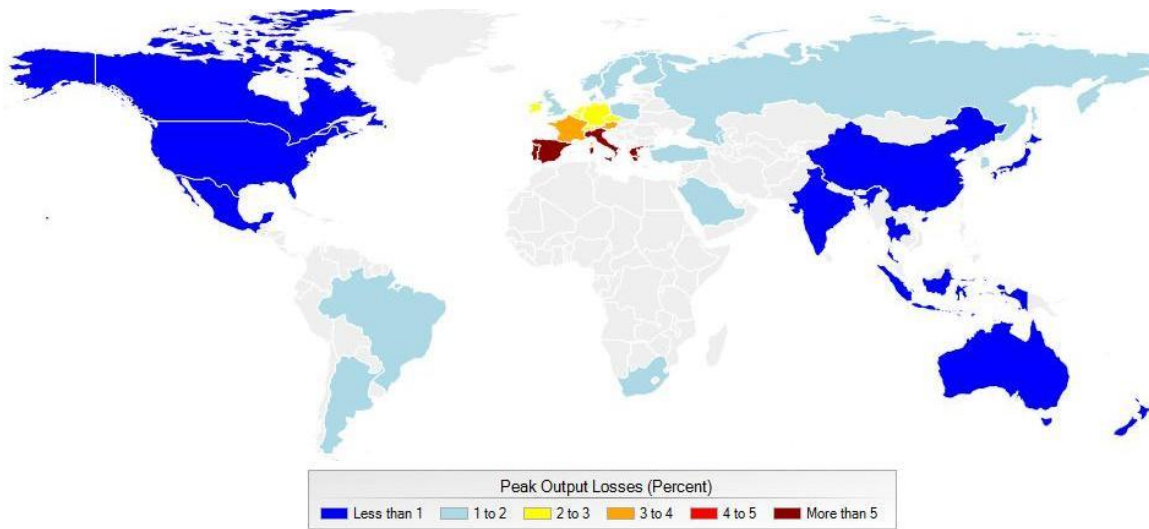
This scenario represents an intensification of the Euro Area sovereign debt crisis with the escalation of financial stress in 2013Q1, which induces balance sheet deleveraging by banks and fiscal consolidation by governments. Within the Euro Area, these effects are differentiated across a high beta group (Greece, Ireland, Italy, Portugal, Spain), a medium beta group (Austria, Belgium, France), and a low beta group (Finland, Germany, Netherlands). Outside of the Euro Area but within Europe, we also identify a low beta group (Denmark, Switzerland). We represent the intensification of stress in the money, bond and stock markets of the high beta group within the Euro Area with positive credit risk premium shocks which raise short term nominal market interest rates by 150 basis points, positive duration risk premium shocks which raise long term nominal market interest rates by 300 basis points, and positive equity risk premium shocks which reduce equity prices by 40 percent. These risk premium shocks are correlated internationally to account for contagion effects, with the calibration of beta coefficients informed by event study estimation results. We account for balance sheet deleveraging by banks with negative private domestic demand shocks which reduce domestic demand by 1.5 percent in the high beta group within the Euro Area, and by 0.5 percent in the rest of the Euro Area, as well as in the low beta group outside of the Euro Area but within Europe, informed by deleveraging simulation results.³ We assume fiscal consolidation reactions by governments which raise the ratio of the primary fiscal balance to nominal output by 2.0 percentage points in the high beta group within the Euro Area, and by 1.0 percentage point in the medium beta group within the Euro Area. Expenditure measures represented by negative fiscal expenditure shocks account for 50 percent of these fiscal consolidations, while revenue measures represented by positive fiscal revenue shocks account for the remainder. We assume that all of these shocks are temporary but persistent, following first order autoregressive processes having coefficients of 0.85.

³ This bank balance sheet deleveraging analysis is presented in IMF (2012).

Table 3. Assumed Financial Market Impacts

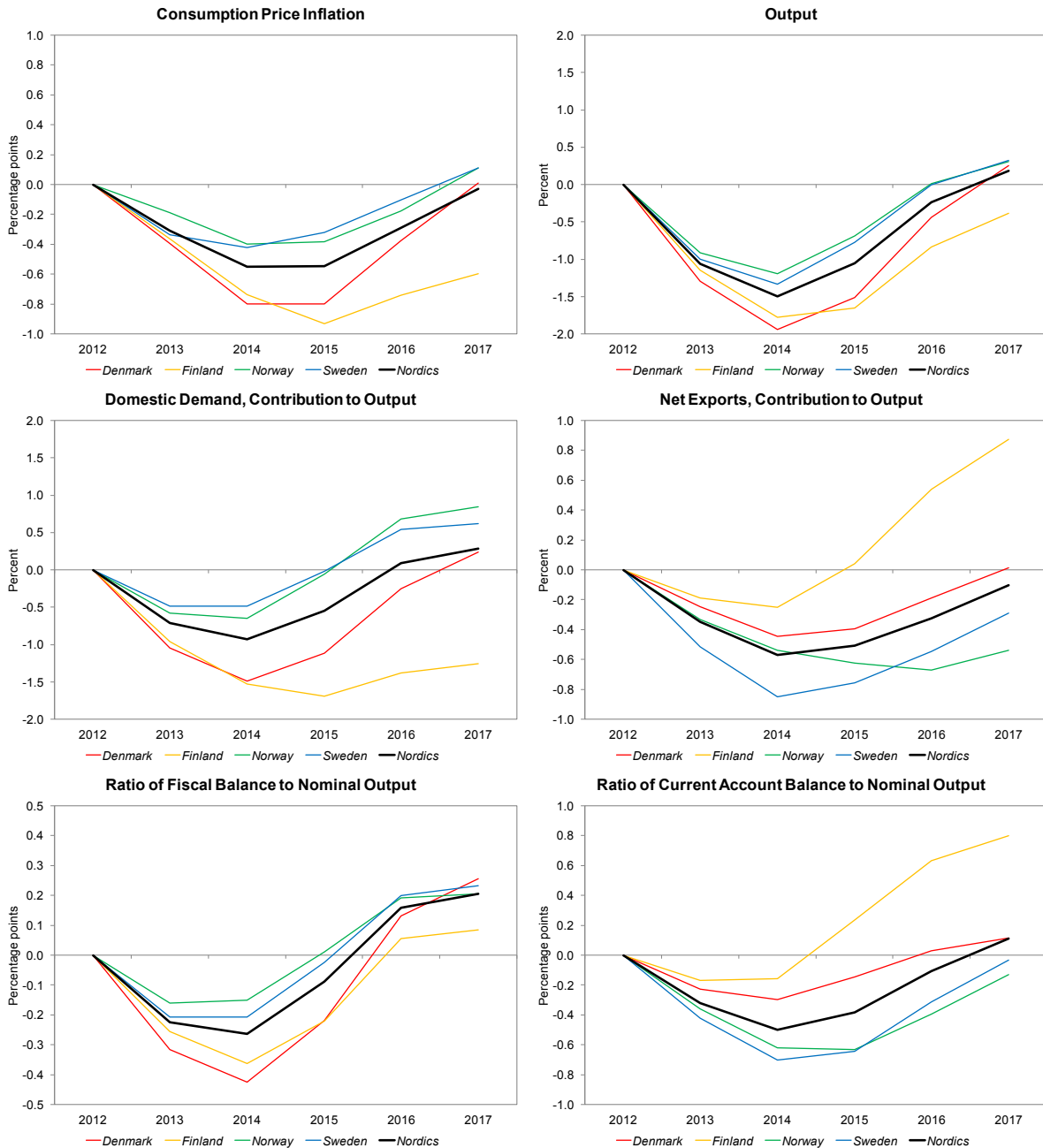
	Money Market (Basis Points)	Bond Market (Basis Points)	Stock Market (Percent)
Euro Area			
High Beta (GRC, IRL, ITA, PRT, ESP)	150	300	-40
Medium Beta (AUT, BEL, FRA)	0	0	-40
Low Beta (FIN, DEU, NLD)	-30	-60	-40
Other Advanced Economies			
High Beta (AUS, CAN, JPN, NZL, NOR, SWE)	-10	-20	-15
Medium Beta (GBR, USA)	-15	-30	-15
Low Beta (DNK, CHE)	-30	-60	-40
Emerging Economies			
High Beta (BRA, CZE, KOR, MEX, POL, ZAF, TUR)	35	70	-20
Medium Beta (ARG, IDN, RUS, THA)	25	50	-15
Low Beta (CHN, IND, SAU)	20	40	-10

Under this scenario, severe output losses in the Euro Area, concentrated in the high beta group and to a lesser extent the medium beta group, are accompanied by mild to moderate output losses in the rest of the world, concentrated in the rest of Europe. Simulated peak output losses within the Euro Area range from 2.9 to 7.5 percent in the high beta group, to 2.9 to 3.6 percent in the medium beta group, to 1.8 to 2.7 percent in the low beta group. Outside of the Euro Area, simulated peak output losses range from 0.3 to 2.6 percent in other advanced economies, and from 0.7 to 2.3 percent in emerging economies. Aggregating these simulated peak output losses, which all occur during 2014, implies a peak world output loss of 1.6 percent. The associated peak decline in the price of energy commodities is 7.1 percent, while that for the price of nonenergy commodities is 3.5 percent.

Figure 11. Simulated Peak Output Losses

Inward output spillovers to the Nordic economies are moderate under this scenario, with simulated peak output losses ranging from 1.2 to 1.9 percent. These output spillovers are primarily transmitted via trade and indirect financial linkages. Trade spillovers arising from reductions in export demand are reflected in lower contributions from net exports to output, and vary primarily with export exposure to the high beta group and to a lesser extent the medium beta group within the Euro Area. They are less persistent for Finland, reflecting its high export exposures to China and Russia, where the zero lower bound constraint on monetary policy does not bind. Financial spillovers are reflected in lower contributions from domestic demand to output, and vary widely across the Nordic economies. Financial spillovers to Denmark and Finland are relatively high, reflecting the assumed balance sheet deleveraging by banks, as well as some tightening in financial conditions induced by losses on internationally diversified equity portfolios, in spite of declines in nominal market interest rates associated with safe haven capital inflows. They are also relatively persistent, reflecting the zero lower bound constraint on monetary policy. Financial spillovers to Norway and Sweden are lower, arising from tightening in financial conditions induced by losses on internationally diversified equity portfolios due primarily to contagion effects, again in spite of declines in nominal market interest rates associated with safe haven capital inflows.

Figure 12. Simulation Results for the Nordic Economies, Deviation From Baseline



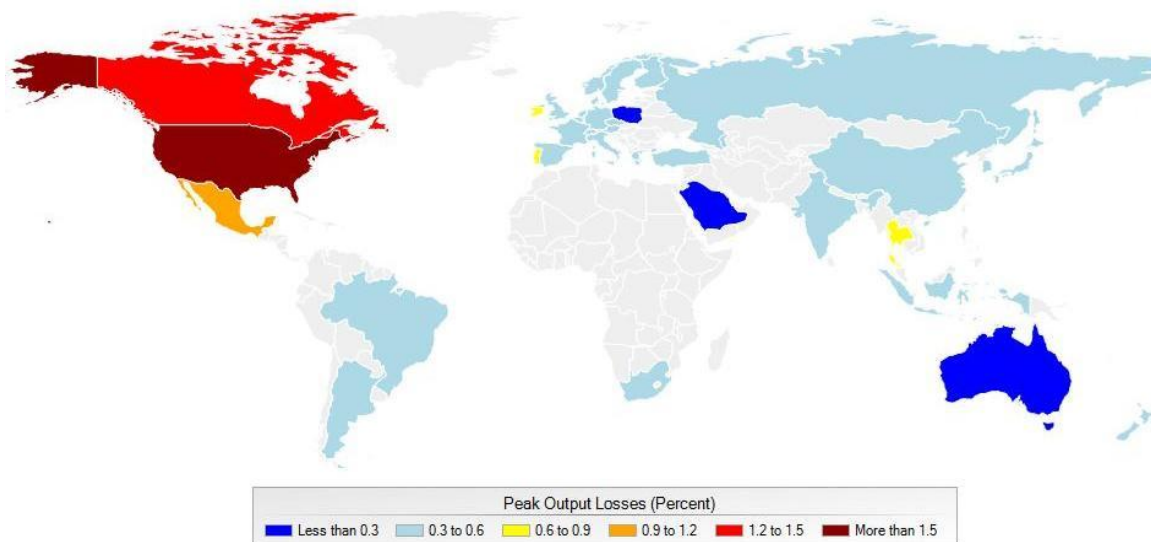
B. Disorderly Fiscal Consolidation in the United States

This scenario represents a political stalemate in the United States which triggers a disorderly fiscal consolidation and reduces financial market confidence. It combines a large temporary fiscal consolidation with a small permanent fiscal consolidation and a temporary but persistent tightening in financial conditions. In particular, we assume that the primary fiscal balance ratio rises by 3.10 percentage points above baseline in 2013Q1, falls to 0.80 percentage points above baseline during the remainder of 2013, rises to 1.00 percentage

points above baseline during 2014, and stabilizes at 1.25 percentage points above baseline thereafter. We represent expenditure measures with an unanticipated sequence of fiscal expenditure shocks, and revenue measures with an unanticipated sequence of fiscal revenue shocks. Expenditure measures account for 23 percent of the fiscal consolidation in 2013Q1, for 50 percent during the remainder of 2013, for 50 percent during 2014, and for 60 percent thereafter. In addition, we assume that concerns over the effectiveness of the political process in the United States manifest through a sustained deterioration in financial market confidence, which we represent with a positive equity risk premium shock which reduces equity prices by 10 percent. We assume that this equity risk premium shock is temporary but persistent, following a first order autoregressive process having a coefficient of 0.85. We also assume that this equity risk premium shock is correlated internationally, to account for contagion effects.

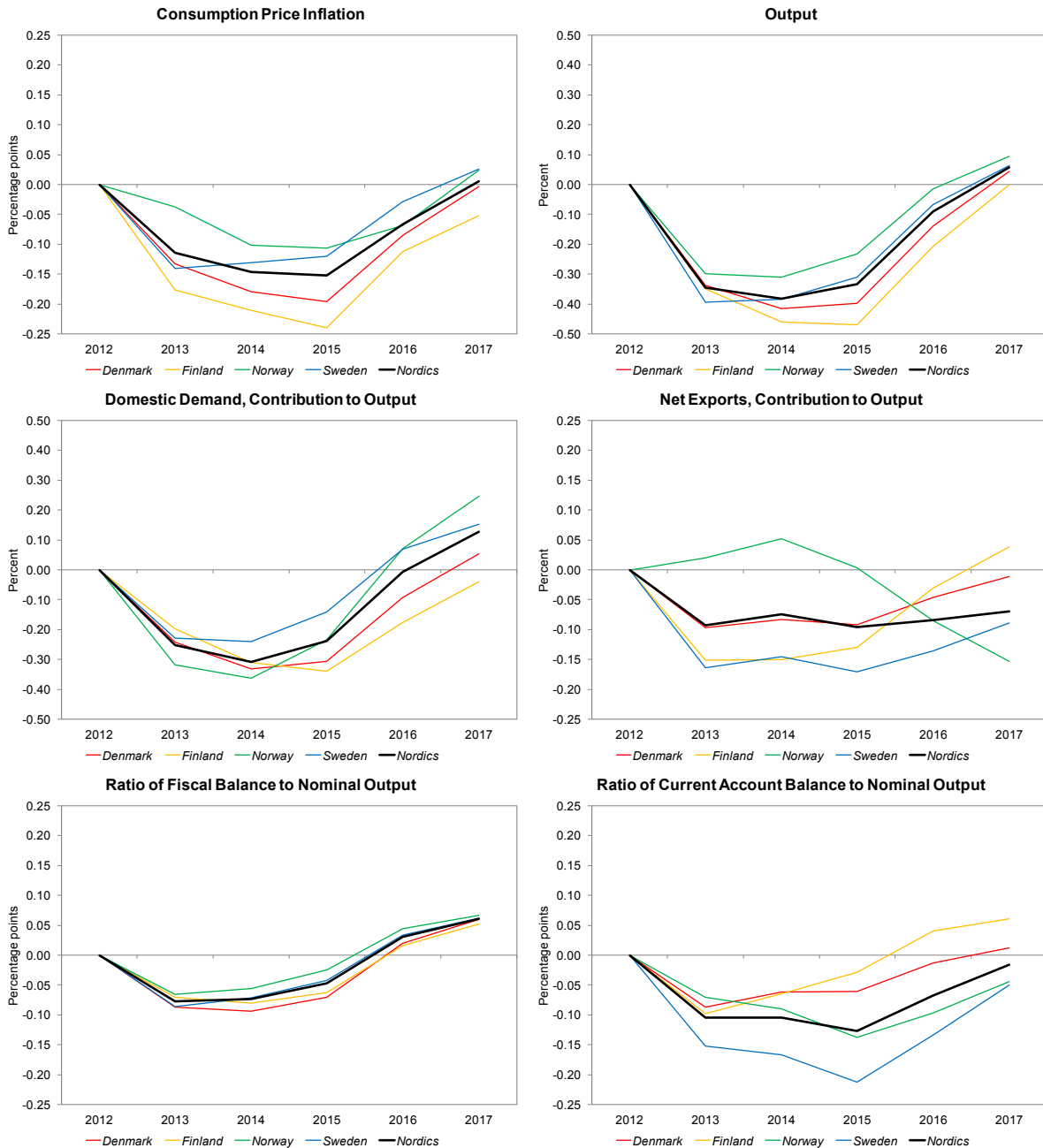
Under this scenario, moderate output losses in the United States are associated with mild to moderate output losses in the rest of the world, concentrated in the rest of North America. In 2013, a simulated output loss of 2.4 percent in the United States, implying a fiscal multiplier of 1.7, is associated with simulated output losses of 1.3 percent in Canada and 1.1 percent in Mexico. In the rest of the world, simulated peak output losses range from 0.2 to 0.7 percent in other advanced economies, and from 0.2 to 0.7 percent in other emerging economies. Aggregating these simulated peak output losses implies a peak world output loss of 0.9 percent. The associated peak decline in the price of energy commodities is 6.5 percent, while that for the price of nonenergy commodities is 3.9 percent.

Figure 13. Simulated Peak Output Losses



Inward output spillovers to the Nordic economies are mild under this scenario, with simulated peak output losses ranging from 0.3 to 0.5 percent. These output spillovers are primarily transmitted via trade and indirect financial linkages, with the exception of Norway where commodity price linkages dominate trade linkages as a conduit. Trade spillovers

arising from reductions in export demand are reflected in lower contributions from net exports to output, and vary primarily with export exposure to the United States. In Norway, the current account balance ratio declines in spite of little or no change in the contribution from net exports to output, reflecting a deterioration in the terms of trade associated with the fall in the price of energy commodities. Financial spillovers arising from tightening in financial conditions induced by losses on internationally diversified equity portfolios are reflected in lower contributions from domestic demand to output, and are similar across the Nordic economies. These equity portfolio losses are due primarily to contagion effects, given the depth of the stock market in the United States.

Figure 14. Simulation Results for the Nordic Economies, Deviation from Baseline

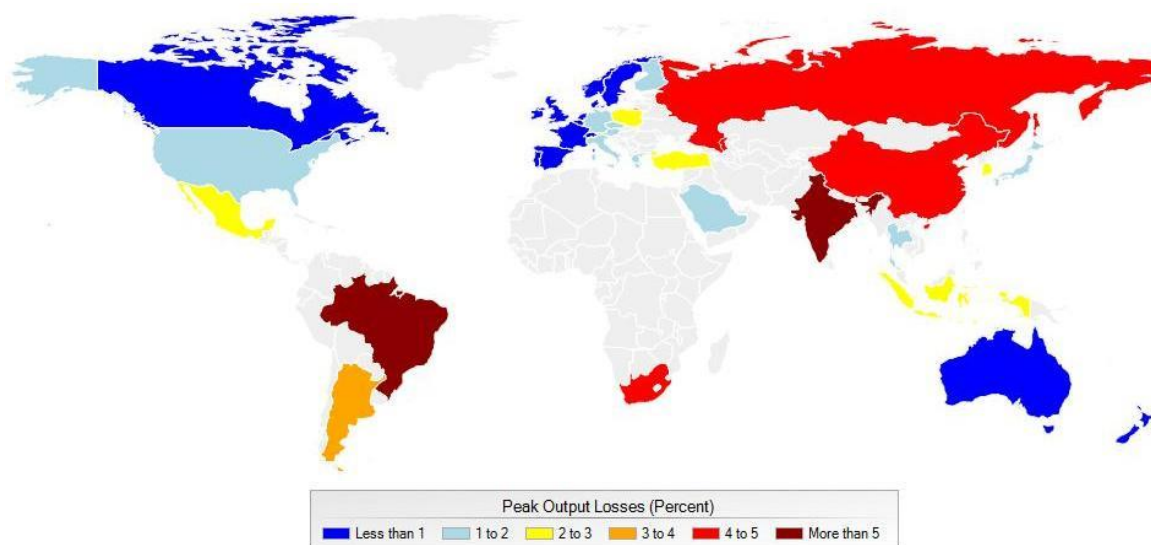
C. Hard Landing in Selected Emerging Economies

This scenario represents a hard landing in Brazil, China, India, Russia and South Africa with a collapse in investment demand in 2013Q1, combined with capital outflows which tighten financial conditions in all emerging economies. We generate a collapse in investment demand with negative private domestic demand shocks which reduce the investment demand component of domestic demand by 12.5 percent. We assume that these effects are temporary but persistent, following first order autoregressive processes having coefficients of 0.85. The

tightening of financial conditions is differentiated across emerging economies with open capital accounts (Brazil, Russia, South Africa) versus closed capital accounts (China, India). In emerging economies with open capital accounts, we generate stress in the money, bond and stock markets with positive credit risk premium shocks which raise short term nominal market interest rates by 250 basis points, positive duration risk premium shocks which raise long term nominal market interest rates by 500 basis points, and positive equity risk premium shocks which reduce equity prices by 50 percent. In contrast, we subject emerging economies with closed capital accounts to positive credit risk premium shocks which raise short term nominal market interest rates by 125 basis points, positive duration risk premium shocks which raise long term nominal market interest rates by 250 basis points, and positive equity risk premium shocks which reduce equity prices by 50 percent. We assume that all of these risk premium shocks are temporary but persistent, following first order autoregressive processes having coefficients of 0.85. We also assume that these risk premium shocks are correlated internationally to account for contagion effects, with beta coefficients of 0.50 for other emerging economies.

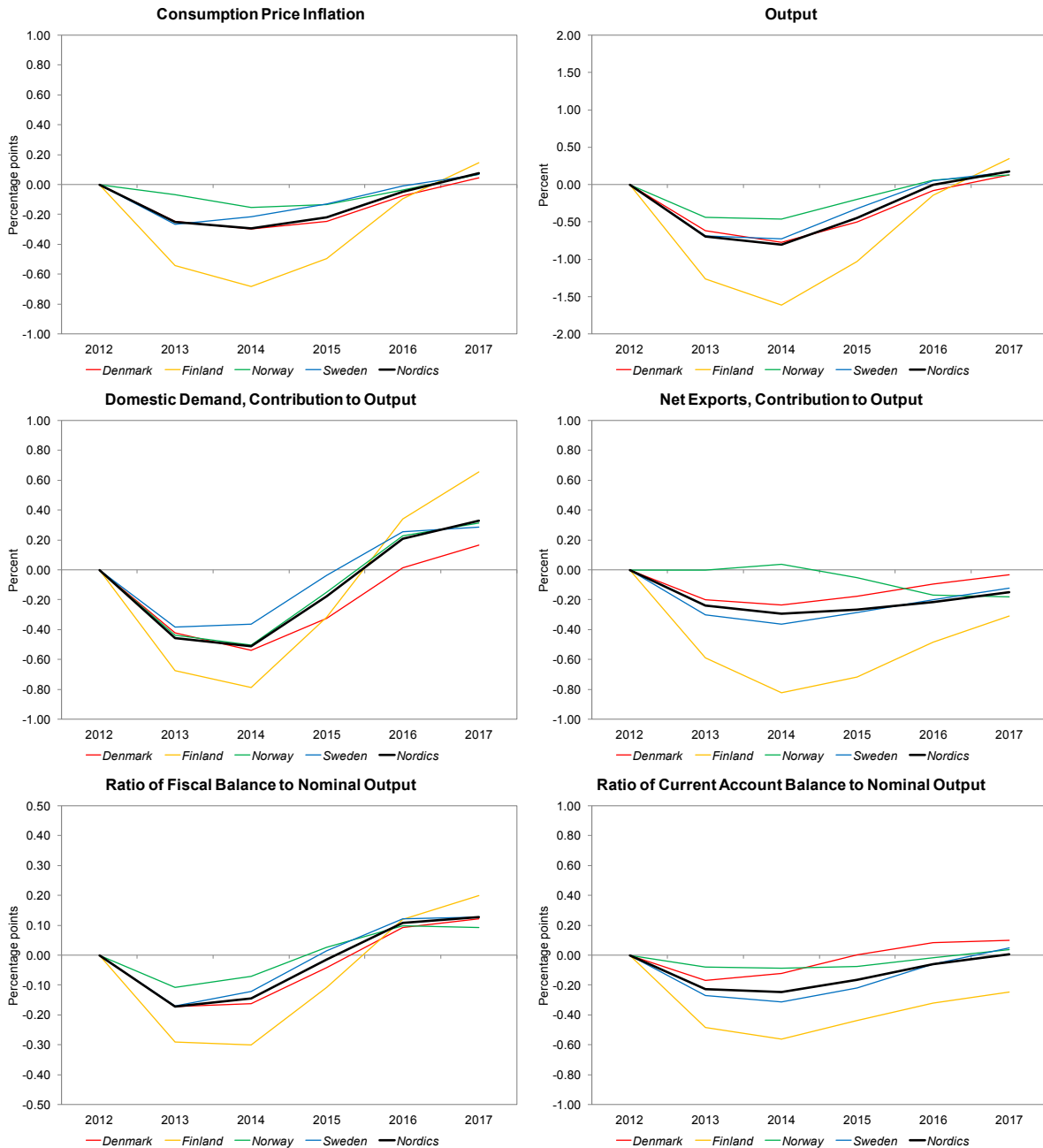
Under this scenario, severe output losses in these emerging economies, concentrated among those with high investment intensities and low trade openness, are accompanied by mild to moderate output losses in advanced economies and other emerging economies, concentrated among those with high trade and financial exposures. Simulated peak output losses in the emerging economies under consideration range from 4.5 to 5.8 percent. Simulated peak output losses in advanced economies range from 0.4 to 1.6 percent, while those in other emerging economies range from 1.4 to 3.8 percent. Aggregating these simulated peak output losses, which generally occur during 2014, implies a peak world output loss of 1.8 percent. The associated peak decline in the price of energy commodities is 9.9 percent, while that for the price of nonenergy commodities is 4.8 percent.

Figure 15. Simulated Peak Output Losses



Inward output spillovers to the Nordic economies are mild to moderate under this scenario, with simulated peak output losses ranging from 0.5 to 1.6 percent. These output spillovers are primarily transmitted via trade and financial linkages, with the exception of Norway where commodity price linkages dominate trade linkages as a conduit. Trade spillovers arising from reductions in export demand are reflected in lower contributions from net exports to output, and vary primarily with export exposure to the emerging economies under consideration. The reduction in the contribution from net exports to output is particularly high for Finland, reflecting its high export exposures to China and Russia. Financial spillovers arising from tightening in financial conditions are reflected in lower contributions from domestic demand to output, and are similar across the Nordic economies. This tightening in financial conditions is transmitted via cross-border equity exposures and contagion effects.

Figure 16. Simulation Results for the Nordic Economies, Deviation From Baseline



V. GAINS FROM POLICY COORDINATION

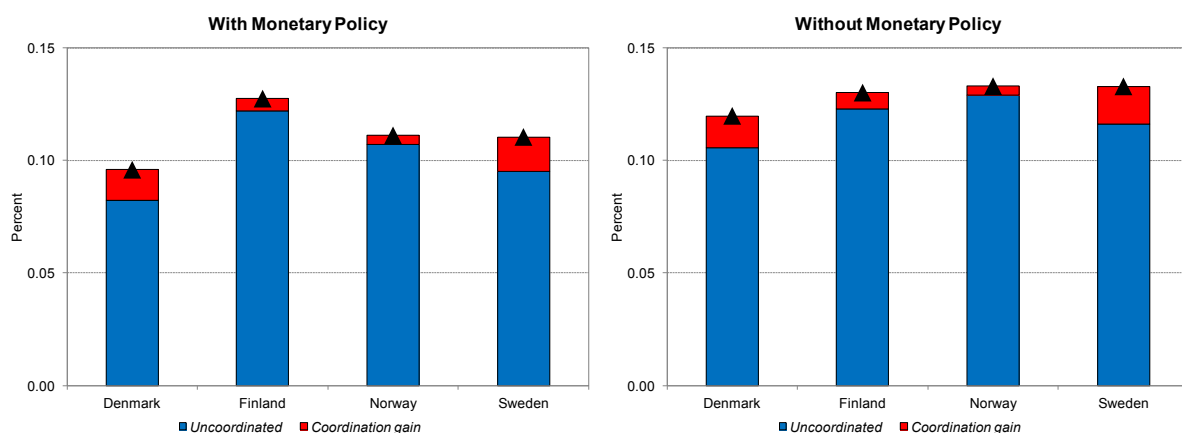
This section analyzes spillovers among the Nordic economies under coordinated versus uncoordinated macroprudential, fiscal, and structural policy scenarios. In particular, it estimates the output gains from regionally synchronized as opposed to economy specific policy measures, which could be warranted by a regionally synchronized cyclical contraction caused by a large external shock. The macroprudential policy scenarios consider a reduction

in the discretionary countercyclical capital buffer, with and without conventional monetary policy responses. The fiscal policy scenarios consider expenditure and revenue based stimulus measures, with and without conventional monetary policy responses. The structural reform scenarios consider productivity and competitiveness enhancing measures. These scenarios are simulated with the structural macroeconometric model of the world economy documented in Vitek (2013).

A. Macprudential Policy

To estimate the potential gains from macroprudential policy coordination across the Nordic economies, we simulate coordinated and uncoordinated macroprudential loosening scenarios, with and without accounting for monetary policy responses. In particular, we consider a reduction in the discretionary countercyclical capital buffer of 1.0 percentage point during the first year. Following MAG (2010), we implement this bank capital adequacy ratio requirement decrease with a 25 basis point reduction in the spread between the short term nominal market interest rate and the nominal policy interest rate, generated with an unanticipated sequence of credit risk premium shocks. We assume that this reduction in this interest rate spread is temporary but persistent, following a first order autoregressive process having a coefficient of 0.5.

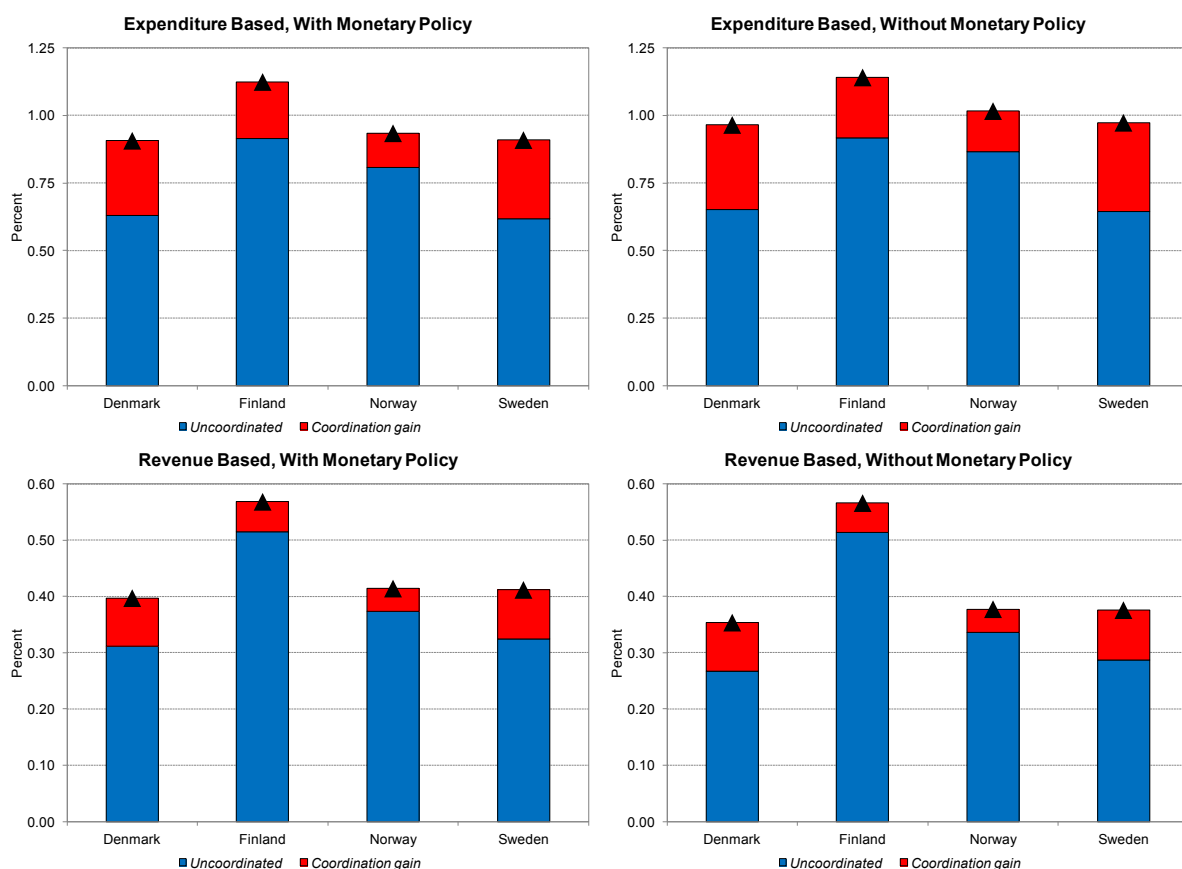
We estimate small to moderate short run output gains from macroprudential policy coordination, reflecting their transmission primarily via the effects of domestic demand shifts on trade flows among the Nordic economies. Accounting for monetary policy responses, macroprudential policy coordination raises the one year output gain from 0.10 to 0.11, on average across the Nordic economies. Abstracting from monetary policy responses, macroprudential policy coordination raises this output gain from 0.12 to 0.13. These coordination gains are highest for Denmark and Sweden, reflecting their regionally concentrated export exposures, and are lowest for Norway, given its high energy commodity export intensity. They are mitigated by coordination induced reductions in currency depreciation in real effective terms.

Figure 17. Simulated Short Run Output Gains From Macroprudential Loosening

B. Fiscal Policy

To estimate the potential gains from fiscal policy coordination across the Nordic economies, we simulate coordinated and uncoordinated fiscal stimulus scenarios, with and without accounting for monetary policy responses. In particular, we consider expenditure and revenue based measures which reduce the primary fiscal balance ratio by 1.0 percentage point during the first year, represented by unanticipated sequences of fiscal expenditure and revenue shocks, respectively. We assume that these reductions in the primary fiscal balance ratio are temporary but persistent, following first order autoregressive processes having coefficients of 0.5.

We estimate small to moderate short run output gains from fiscal policy coordination, reflecting their transmission primarily via the effects of domestic demand shifts on trade flows among the Nordic economies. Accounting for monetary policy responses, fiscal policy coordination raises the one year fiscal expenditure multiplier from 0.74 to 0.97, and the one year fiscal revenue multiplier from 0.38 to 0.45, on average across the Nordic economies. Abstracting from monetary policy responses, fiscal policy coordination raises this fiscal expenditure multiplier from 0.77 to 1.02, and this fiscal revenue multiplier from 0.35 to 0.42. These coordination gains are highest for Denmark and Sweden, reflecting their regionally concentrated export exposures, and are lowest for Norway, given its high energy commodity export intensity.

Figure 18. Simulated Short Run Output Gains From Fiscal Stimulus

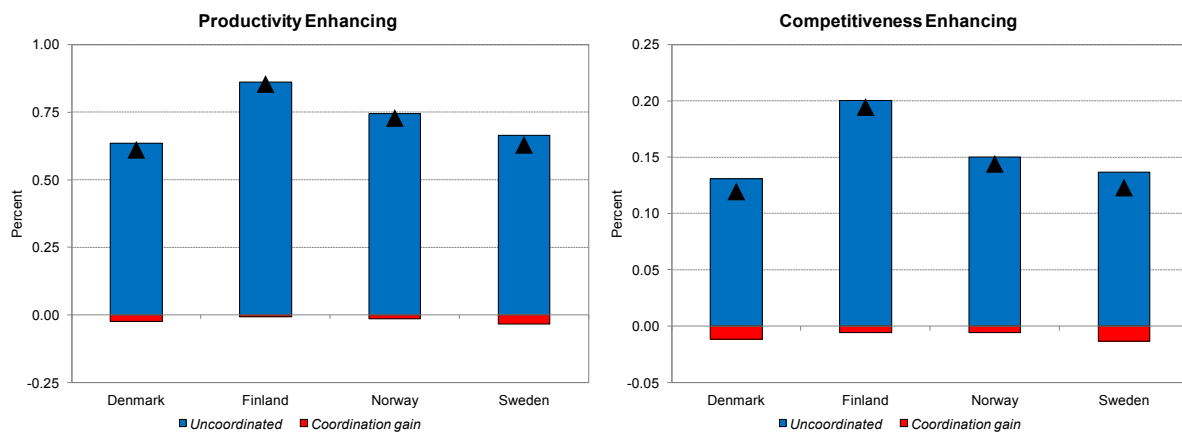
C. Structural Policy

To estimate the potential gains from structural policy coordination across the Nordic economies, we simulate coordinated and uncoordinated structural reform scenarios. In particular, we consider productivity enhancing measures which raise the marginal product of labor by approximately 1.0 percent, represented by a permanent productivity shock. We also consider competitiveness enhancing measures which reduce the output price markup by approximately 1.0 percentage point, represented by a permanent output price markup shock.

We estimate small medium run output effects from structural policy coordination, reflecting their transmission primarily via the offsetting effects of domestic demand shifts versus terms of trade shifts on trade flows among the Nordic economies. In general, productivity and competitiveness enhancing structural reforms raise output more than domestic demand in source economies, implying an increase in net exports facilitated by a deterioration in the terms of trade. It follows that net exports tend to decline in recipient economies with high export exposures, implying output losses. But these negative output spillovers are small relative to the output and domestic demand gains realized by source economies, particularly for productivity enhancing measures, which induce less terms of trade driven expenditure switching than competitiveness enhancing measures. Indeed, policy coordination reduces

output gains from structural reforms by only 3 percent after five years for productivity enhancing measures, and by 6 percent for competitiveness enhancing measures, on average across the Nordic economies.

Figure 19. Simulated Medium Run Output Gains From Structural Reforms



VI. CONCLUSION

This paper analyzes the transmission of shocks and policies among and across the Nordic economies and the rest of the world. This analysis is based on estimated structural macroeconomic models of the world economy in which spillovers are transmitted via trade, financial, and commodity price linkages. Indeed, these models account for both direct financial linkages through cross-border debt or equity portfolio holdings, and indirect financial linkages via international comovement in asset risk premia, which in turn capture omitted cross-border balance sheet linkages in a reduced form manner. Nevertheless, the Nordic economies are tightly connected by cross-border bank balance sheet linkages, which extend globally. The development of a structural macroeconomic model of the world economy which articulates these linkages, and its application to the analysis of spillovers to and from the Nordic economies, remains an objective for future research.

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