THE PENSION SECTOR AS A FOREIGN EXCHANGE MARKET PARTICIPANT

Martin Dencker Raffnsøe, Financial Statistics,
and Jakob Roager Jensen and Anders Larsen,
Economics and Monetary Policy

INTRODUCTION AND SUMMARY

Danish pension wealth has grown substantially in recent years, and Danish pension companies' balance sheets now total approximately 175 per cent of GDP.[1] Half of the sector's balance sheet is placed in foreign assets. Consequently, pension companies' investment and risk hedging decisions have a considerable impact on the foreign exchange market.

As a result of the regulation of pension companies and the credibility of Denmark's fixed exchange rate policy, pension companies' level of hedging of foreign exchange risks tends to be considerably smaller in euro than in other currencies such as dollars.

During certain episodes in 2015 and 2016, the pension companies increased their hedging of exchange rate risks in euro in connection with turmoil in the European financial markets. A marked share of the stronger demand for kroner in early 2015 could be attributed to pension companies' increased hedging of positions in euro following Switzerland's abandonment of the minimum exchange rate of the Swiss franc against the euro.[2] Hedging of positions in euro also grew in connection with the UK referendum on EU membership in June 2016. Due to the size of the pension companies, even small changes in the hedge ratio impact the foreign exchange market.

The sector's liabilities have shifted from guaranteed products towards market rate products in recent years. In this way, the individual pension saver directly bears a larger share of the pension saving risk. Companies with large shares of market rate products tend to rely less on hedging of exchange rate risk. The hedge ratio is expected to fall in step with the gradual transition to market rate products. Hedging of the foreign exchange exposure varies greatly across pension companies.

Given the large and expanding net foreign assets, the Danes have an overall foreign exchange exposure. This also entails that, all else equal, the exchange rate of the krone appreciates if investors in foreign assets do not want the foreign exchange exposure. A substantial share of the exposure in euro is currently held by the private sector, including pension companies. If Danish pension companies and other Danish investors are not willing to take on the foreign exchange risk associated with larger net external assets, it falls upon Danmarks Nationalbank. It comes with the mandate for the fixed exchange rate policy against the euro. The key point for Danmarks Nationalbank is to maintain a stable exchange rate of the krone vis-à-vis the euro.

1 In this article, the insurance and pension sector is referred to as pension companies and the pension sector. The insurance and pension sector consists of life insurance companies, multi-employer occupational pension funds, non-life insurance companies and ATP.

2 See, inter alia, Danmarks Nationalbank, *Monetary Review*, 1st Quarter 2015, and *Monetary Review*, 2nd Quarter 2015.

THE PENSION SECTOR IN TRANSITION

The current account of Denmark's balance of payments has shown a surplus since 1990, following a long period of deficits. The surplus is attributable to a private sector savings surplus, which is channelled, inter alia, into contributions to labour market pensions.[3] This has generated a marked increase in Denmark' net foreign assets in recent years, cf. Chart 1 (left). The transition from a debtor to a creditor nation thus reflects considerable increase in gross savings in the economy over the last 30-35 years. Pension contributions have led to pension companies' net foreign assets exceeding Denmark's total net foreign assets. Part of the sector's investment is made via domestic investment funds which have invested abroad, meaning that the pension sector's net foreign assets are larger than the chart shows. Besides the pension sector, investment funds and Danmarks Nationalbank have positive net foreign assets, cf. Chart 1 (right). Investment funds and pension companies typically hold assets ultimately owned by households.

The size of the pension sector makes it a major participant in the Danish financial markets. Labour market pensions are expected to continue to mature towards 2040-50,[4] meaning that the sector's role in the financial markets is likely to increase further.

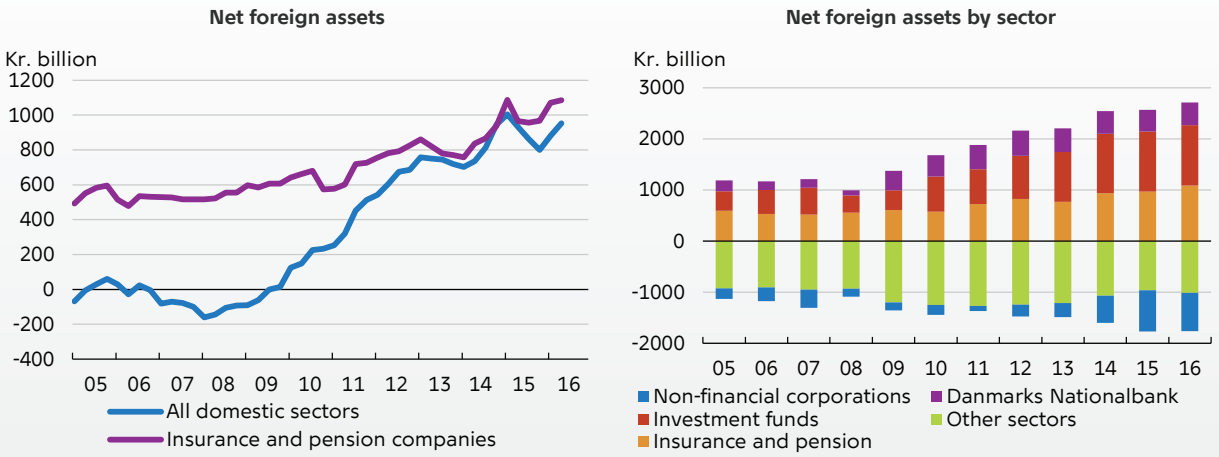
FROM AVERAGE TO MARKET RATE PRODUCTS

Against the backdrop of growing pension savings, the sector is changing in several respects. The sector's liabilities are changing, as the sector is undergoing a transition from guaranteed products to market rate products.[5] The shift towards market rate products implies a changing asset composition. Moreover, higher pension savings generate a growing need to place funds abroad.

The transition to market rate products entails a lower degree of guaranteed return for pension savers. The size of the return is directly dependent on the return earned by the pension company. This means that the risk of pension savings is borne to a higher degree borne directly by the individual pension saver, while the risk of average rate products is to a higher degree shared collectively

Net foreign assets by sector

Chart 1



Note: Left: The pension sector's holdings of foreign assets via Danish investment funds are excluded. Right: For 2016, the holdings for the 2nd quarter are shown. The pension sector's holdings of foreign assets via Danish investment funds are excluded.
Source: Danmarks Nationalbank.

3 See, inter alia, Autrup, Kramp, Pedersen and Spange, 2015

4 See, inter alia, Autrup, Kramp, Pedersen and Spange, 2015.

5 See Danmarks Nationalbank, *Financial stability*, 2nd Half 2016.

between pension savers.[6] Another implication of the transition to market rate products is a closer match between the value of assets and the liabilities associated with market rate products. This gives pension companies offering market rate products more degrees of freedom in their investment choices.[7] Market rate products accounted for 5 per cent of the companies' insurance liabilities in 2005, but 37 per cent in 2015.[8] The absolute level of liabilities associated with average rate products has not declined for the sector overall, however.

The pension companies' total assets amount to around kr. 3,500 billion, and slightly more than half is placed in Denmark, primarily in government and mortgage bonds. The remainder, around kr. 1,700 billion, is invested in assets abroad, approximately 85 per cent in euro or dollar assets, cf. Chart 2. The pension sector's holdings of dollar assets have grown in recent years, now accounting for a larger share of the sector's balance sheet than euro assets. Especially foreign equities have risen substantially during this period. In terms of total global market value, US equities considerably exceed European equities. A shift towards foreign equities would thus mean a shift towards dollar assets.

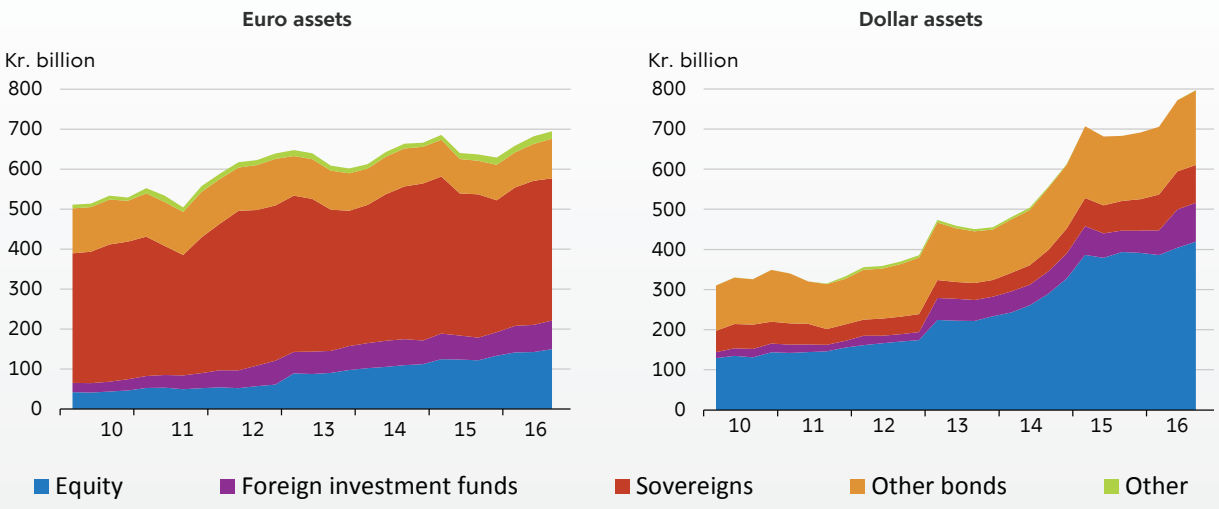
PENSION COMPANIES' PURCHASES AND SALES OF ASSETS ABROAD AND THE IMPACT ON THE FOREIGN EXCHANGE MARKET

HOW DO PURCHASES AND SALES OF ASSETS AFFECT THE FOREIGN EXCHANGE MARKET?

Pension companies' purchases and sales of foreign financial assets contribute to changes in the

Development in asset composition by currency

Chart 2



Note: The pension sector's indirect holdings of assets in euro and dollars via Danish investment funds are included. Holdings of assets via foreign investment funds cannot be broken down. These holdings have been stated under the listing currency of the foreign investment funds. The "Other" category consists mainly of Danish mortgage bonds issued in currencies other than kroner. The "Equities" category consists of shares and other equity investments. The values have been calculated on the basis of securities portfolios, and derivatives and lending and deposits are not included. Data break at the turn of the year 2012-13. The most recent observation is from the end of the 3rd quarter of 2016.

Source: Danmarks Nationalbank.

6 See, inter alia, Danish Financial Supervisory Authority, 2016, and *Financial stability*, 2nd Half 2016.

7 See also *Financial stability*, 2nd Half 2016.

8 Non-life insurance companies are not included. ATP's provisions, totalling kr. 705 billion at end-2015, are not included either. See *Financial stability*, 2nd Half 2016.

exchange rate of the krone. The ultimate effect on the exchange rate of a purchase of a foreign asset depends on how the purchase is funded and how the associated exchange rate risk is hedged.

There are several different funding methods. As a main rule, the purchase of a foreign asset requires foreign currency. If the purchase of the foreign asset is funded by borrowing or selling kroner, the result is a sale of kroner against foreign currency. This weakens the krone. If, instead, the purchase of the foreign asset is funded by borrowing or selling another currency, two currencies are traded against each other with no effect on the krone. The key question is thus whether the purchase is funded by kroner or another currency. This also applies to sales of foreign assets. If the sale is funded by the purchase of a krone asset, the result is a sale of foreign currency against kroner, which will strengthen the krone. If, instead, the sale funds the purchase of another foreign asset, it has no effect on the krone.

Besides the asset funding method, the impact on the foreign exchange market also depends on the hedging of the exchange rate risk. Pension companies normally rely on forward contracts when hedging foreign exchange exposure. A pension company's purchase of a foreign asset will generally not influence the exchange rate of the krone if the foreign exchange exposure is hedged, cf. Box 1.

Purchases and sales of assets by pension companies are driven by several factors. For instance, more favourable growth prospects in a given country may prompt long-term investors to buy assets from that country, cf. IMF, 2011. Other drivers of pension companies' purchases and sales of assets are capital requirements and risk management. Losses in the financial markets weaken pension companies' ability to take on risk in relation to the solvency requirements. During the financial crisis in 2008-09, the Danish pension sector increased the volume of German euro-denominated bonds, which are regarded as secure and liquid. This also happened during the sovereign debt crisis in 2012 in the euro area. Under the assumption of low hedging of euro exposures and funding in Danish kroner, this contributed to weakening the krone.

Example of forward hedging of exchange rate risk from the purchase of a foreign asset Box 1

When a Danish pension company buys a US bond, the first step is to buy dollars against kroner in the foreign exchange market (spot) to pay for the bond. This will weaken the exchange rate of the krone. However, the pension company wishes to hedge the exchange rate risk. Accordingly, the company concludes a forward contract, typically with a bank, on the purchase of kroner against dollars at a fixed exchange rate. This enables the pension company to buy kroner against dollars at an agreed price at an agreed time.

In general, the bank will not undertake the risk associated with the forward contract and will hedge the exchange rate and interest rate risks involved in the forward contract. The bank can do so by selling dollars and buying kroner immediately (spot). This means that the bank will already have the amount in kroner to pass on to the domestic investor on the expiry of the forward contract. The original sale of kroner by the pension company is thus offset by a corresponding krone purchase by the bank. The net effect of the purchase of the foreign asset in the krone market is therefore basically zero.

1. See also "The Danish krone under pressure in January-February 2015", Danmarks Nationalbank, *Monetary Review*, 1st Quarter 2015, and "Monetary policy in Denmark", Danmarks Nationalbank, 2009, for more detailed examples of the use of forward contracts.

VARIATION IN HEDGING BEHAVIOUR ACROSS COMPANIES

HEDGING BY PENSION COMPANIES

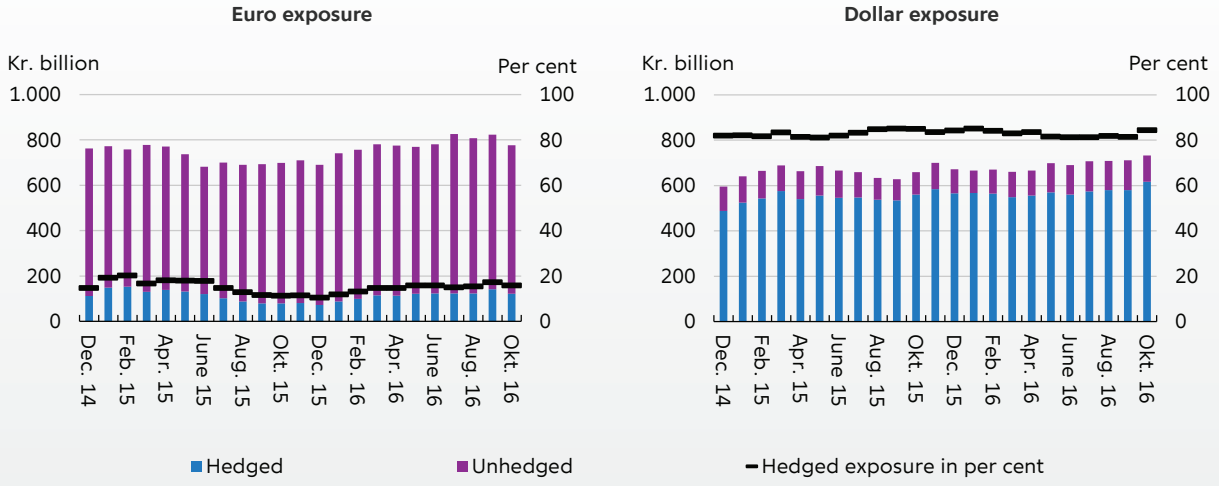
Pension companies' hedging of exchange rate risks may potentially have a great impact on the foreign exchange market. In January 2015, the sector's total hedging of euro rose by five percentage points in the course of one month, following Switzerland's abandonment of the minimum exchange rate of the Swiss franc against the euro. This led to increased demand for kroner. Pension companies' behaviour thus contributed to the pressure on the krone in the first months of 2015, despite the small increase in hedging in percentage points, cf. Chart 3.[9]

Pension companies' decisions on hedging of foreign exchange risk are shaped by two factors: One is the decision on the overall risk profile of a pension company laid down by its board of directors;

9 The reporting population accounts for more than 90 per cent of the sector in terms of asset size.

Pension sector exposure in euro and dollars

Chart 3



Note: No other currencies than euro and dollars have been included.
Source: Danmarks Nationalbank and own calculations.

the other is the market-related decisions made within the overall risk profile. Key contributors to the decision on the overall risk profile are typically regulatory requirements, the long-term strategic development and protection of the company's equity, while the market-related decisions tend to be more tactical with a shorter time horizon.

The regulatory framework and the capital requirements for pension companies influence their hedging behaviour. The current regulation is based on the EU Solvency II Directive adopted in 2009.[10] After gradual implementation, with the introduction of the standardised approach to the calculation of capital requirements in the 1st quarter of 2014, the Solvency II rules were fully implemented by the beginning of 2016. Under these rules, pension companies must have enough capital to be able to meet a risk-based capital requirement[11]. This implies that pension companies are subject to a capital requirement related to the type of the unhedged foreign exchange exposure. The direct capital requirement is 0.39 per cent of unhedged exposures in euro and 25 per cent of unhedged exposures in other currencies. This gives pension companies an incentive to hedge their foreign exchange exposures in other currencies to euro or Danish kroner. Pension companies are also subject to other requirements, such as regular assessment of own risk and solvency and that the companies' investment strategies must reflect the benefits and risk profile offered to the customers (the prudent person principle).[12]

The capital requirements, together with the credibility of Denmark's fixed exchange rate policy, have induced the pension companies to have considerably higher unhedged exposures to the euro than to the dollar. The price of hedging euro exposure also influences the decision to hedge euro. Moreover, the dispersion of foreign exchange hedging is obviously considerably more pronounced in euro than in dollars. Although the average hedging of euro exposures is low, some pension companies have opted for hedging of virtually their entire euro exposure, cf. Chart 4. Consequently, hedging of foreign exchange exposures varies considerably across companies.[13] This is attributable to factors such as regulation and differences in the composition of liabilities.

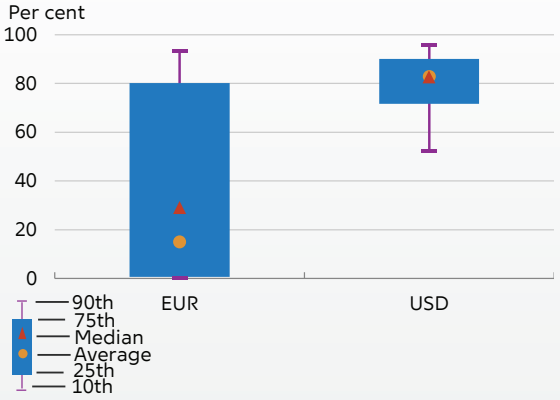
10 https://www.finanstilsynet.dk/Lovgivning/Solvens/Forsikringsomraadet.

11 The capital requirement can be calculated using a standardised approach or an IRB, Internal Ratings Based, approach approved by the Danish Financial Supervisory Authority.

12 See "Markedsudviklingen i 2015 for livsforsikringsselskaber og tværgående pensionskasser" (Market developments for life-assurance companies and multi-employer occupational pension funds in 2015 – in Danish only), Danish Financial Supervisory Authority.

13 See also Larsen, 2015.

Cross-sector variation in hedging behaviour Chart 4



Note: The chart shows the pension companies' average dispersion in foreign exchange hedge ratios from December 2014 to October 2016. If the hedging of assets exceeds their value, the result is regarded as additional exposure. The average is weighted in relation to the companies' exposure.
Source: Danmarks Nationalbank and own calculations.

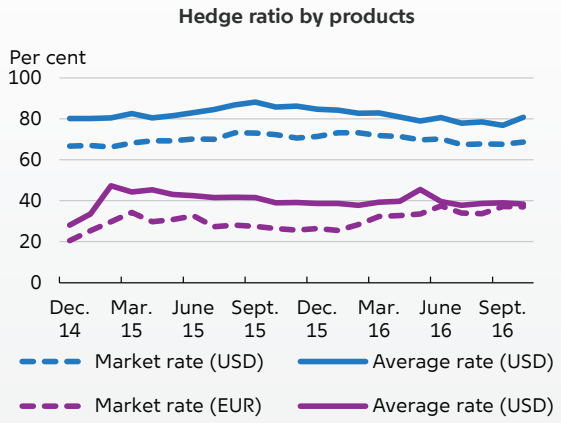
Pension companies tend to hedge dollar exposures to a greater extent than euro exposures. This means that purchases of dollar assets generally have a smaller impact on the exchange rate than purchases of euro assets, assuming that the hedge ratio is unchanged. The difference in foreign exchange hedging also means that a change from dollar to euro assets implies sales of kroner and vice versa. As the foreign assets of the sector grow, the percentage value adjustments of the foreign portfolio become more important to the exchange rate of the krone. Companies opting for a constant hedge ratio need to hedge larger amounts for this purpose. This is normally achieved by means of forward contracts, implying sales of dollars and purchases of kroner.

Given the large and expanding net foreign assets, the Danes have an overall foreign exchange exposure. This also entails that, all else equal, the exchange rate of the krone appreciates if investors in foreign assets do not want the foreign exchange exposure. A substantial share of the exposure in euro is currently held by the private sector, including pension companies. If Danish pension companies and other Danish investors are not willing to take on the foreign exchange risk associated with larger net external assets, it falls upon Danmarks Nationalbank. It comes with the mandate for the fixed exchange rate policy against the euro. The key point for Danmarks Nationalbank is to maintain a stable exchange rate of the krone vis-à-vis the euro.

THE COMPOSITION OF LIABILITIES INFLUENCES FOREIGN EXCHANGE HEDGING

The shift towards market rate products implies a change in the companies' hedging of exchange rate risks, due to a lower foreign exchange hedge ratio for companies with a larger share of market rate products, cf. Chart 5.[14] Consequently, the composition of liabilities influences the companies' hedging behaviour. This applies especially to foreign exchange hedging of dollars. For dollar hedging, there are substantial differences between market rate and average rate products. One reason is that risks associated with market rate products affect pension companies' total capital less than risks associated with average rate products. For market rate products, the exchange rate risk is directly borne by the individual customer. This enables pension companies to assume greater

Foreign exchange hedging depends on the liabilities composition Chart 5



Note: The charts have been calculated by weighting pension companies' foreign exchange hedge ratio by the market rate and average rate shares of liabilities. Total liabilities have been calculated as provisions for life insurance, collective bonus potential and unit-linked contracts. Liabilities have been projected flat from a quarterly to a monthly basis.
Source: Danmarks Nationalbank and own calculations.

14 Non-life insurance companies are not included.

exchange rate risks if this reflects the customers' risk appetite, cf. the prudent person principle. The gradual transition to market rate products is thus expected to reduce pension companies' desire to hedge the exchange rate risk.

The prevalence of market rate products may also imply a different asset composition with a potential impact on the hedging behaviour. Market rate portfolios allow riskier assets, e.g. equities, while average rate portfolios may require a stable and secure return, which can be achieved to a greater extent by investing in government and mortgage bonds. The foreign exchange risk will typically be hedged to a higher degree on bonds than on equities.

Companies with large shares of average rate products had higher hedge ratios in the period from December 2014 to October 2016. After January 2016, the spread has narrowed for hedging of euro, which may be attributed to uncertainty in connection with the UK referendum on EU membership in June 2016.

HOW GREAT IS THE PENSION SECTOR'S INFLUENCE ON THE FOREIGN EXCHANGE MARKET?

The pension sector's purchases and sales of kroner have substantial influence on the foreign exchange market. The exchange rate of the krone may potentially be affected by pension companies' investments in various assets, portfolio restructuring and hedging decisions. For instance, if pension companies increase their hedging of euro assets by one percentage point, the demand for kroner will, all else equal, rise by approximately kr. 8 billion on average.

The effect of pension companies' purchases and sales of foreign exchange can be estimated by applying the study "Effects of Danmarks Nationalbank's interventions in the foreign exchange market" in this Monetary Review, cf. Box 2.[15] Throughout the period, pension companies' purchases of kroner have had a significant impact on the change in the exchange rate of the krone against the euro, cf. Table 1.

Changes in the krone rate explained by sector transactions Table 1

Dependent variable: Change in krone rate (per cent)	Full period	2007-2009	2015-2016
Net purchases from:			
- Insurance and pension	-0.0047***	-0.0063***	-0.0073***
- Other domestic customers	-0.0052***	-0.0061***	-0.0072***
- Domestic banks	-0.0024***	-0.0045***	-0.0002
- Non-residents	-0.0038***	-0.0047***	-0.0081***
Interventions	-0.0055***	-0.0071***	-0.0076***
Constant	Yes	Yes	Yes
Observations	2974	746	452

Note: One asterisk, two asterisks and three asterisks denote the significance of the estimate of 10, 5 and 1 per cent, respectively. Newey-West standard error has been used. The interventions of the preceding 5 days have been used as instrument for interventions. The full estimation period is from 1 December 2004 to 24 October 2016.
Source: Danmarks Nationalbank and own calculations.

15 See the description of data and methodology in Box 4 in "Effects of Danmarks Nationalbank's interventions in the foreign exchange market" in this Monetary Review.

According to the analysis, the krone strengthens if the demand for kroner from pension companies rises. Purchase of kr. 1 billion against euro causes the krone to strengthen by 0.0047 per cent. Viewed over the entire period, this means that krone purchases by pension companies for kr. 10 billion have strengthened the krone rate by kr. 0.35 per 100 euro. This implies that even a small increase in the hedge ratio of euro exposures has a marked impact on the krone rate. Pension companies' demand for kroner rose in January and February 2015. Of the sector's total purchases of kroner of around kr. 130 billion in January and February, approximately kr. 40 billion can be attributed to increased hedging of the euro exposure.[16] So, viewed in isolation, the more pronounced hedging strengthened the krone by kr. 1.40 per 100 euro.

The effect per krone traded is in line with the effect of krone purchases by other domestic sectors. In the periods around the financial crisis in 2007-09 and the pressure on the krone in 2015, the effect of domestic sectors' purchases of kroner is estimated to have been stronger than in the whole period, including for the insurance and pension sector. Moreover, foreign purchases of kroner had a stronger effect in the period around the pressure on the krone in 2015.

An indication of the importance of pension companies to the foreign exchange market is that the pension sector is the only sector whose purchases/sales of euro against kroner are statistically significant in a probability model for whether Danmarks Nationalbank will intervene or not. Pension companies' total purchases or sales of kr. 1 billion in the foreign exchange market increase the probability that Danmarks Nationalbank will need to intervene by 7-14 per cent, cf. Table 2. This indicates that pension companies' behaviour has impacted Danmarks Nationalbank's intervention viewed over the period as a whole.

Pension companies' purchases of kroner increase the probability of intervention by Danmarks Nationalbank Table 2

Dependent variable: Intervention or not	Probit model	Logit model
Net purchases from:		
- Insurance and pension	0.07***	0.14***
- Other domestic customers	0.01	0.03
- Domestic banks	-0.03	-0.05
- Non-residents	-0.00	-0.00
Lagged interventions	Yes	Yes
Constant	-1.19***	-2.05***
Observations	2975	2975

Note: One asterisk, two asterisks and three asterisks denote the significance of the estimate of 10, 5 and 1 per cent, respectively. The full estimation period is from 1 December 2004 to 24 October 2016.
Source: Danmarks Nationalbank and own calculations.

Estimation of the effect of the pension sector's krone purchases on the krone rate Box 2

The largest Danish banks' purchases and sales of foreign exchange as reported to Danmarks Nationalbank can be broken down by the pension sector and other domestic sectors. The estimation in the article "Effects of Danmarks Nationalbank's interventions in the foreign exchange market" in this Monetary Review is elaborated on, focusing on the effect of various sectors on the exchange rate of the krone. This is done by estimating the following relationship by means of instrument variables:

$$\Delta Krone\ rate_t = \beta_0 + \beta_1 I\&P_{Net\ purchases} + \beta_2 Intervention_t + \gamma' X_t + \varepsilon_t$$

Where $\Delta Krone\ rate$ is the relative change in the krone rate in kroner per euro, $I\&P_{net\ purchases}$ denotes the pension sector's net purchases of kroner in billion kroner, Intervention denotes Danmarks Nationalbank's interventions in billion kroner, X_t is a vector of control variables consisting of purchases of foreign exchange by other domestic sectors. Since interventions cannot be regarded as an exogenous variable, the interventions of the preceding 5 days are used as the instrument for interventions today. Table 1 shows the results of the regressions.

16 See Danmarks Nationalbank, *Monetary Review*, 2nd Quarter 2015.

LITERATURE

Autrup, Søren Lejsgaard, Paul Lassenius Kramp, Erik Haller Pedersen and Morten Spange, Balance of payments, net foreign assets and foreign exchange reserve, Danmarks Nationalbank, *Monetary Review*, 4th Quarter 2015.

Danmarks Nationalbank, *Monetary Review*, 1st Quarter 2015.

Danmarks Nationalbank, *Monetary Review*, 2nd Quarter 2015.

Danmarks Nationalbank, The Danish krone under pressure in January-February 2015, *Monetary Review*, 1st Quarter 2015.

Danmarks Nationalbank, *Monetary policy in Denmark*, 2009.

Danish Financial Supervisory Authority, Markedsudviklingen i 2015 for livsforsikringsselskaber og tværgående pensionskasser (Market developments for life-assurance companies and multi-employer occupational pension funds in 2015 – in Danish only).

Danish Financial Supervisory Authority, Strategy 2020 – Justified confidence – Well-functioning financial markets, 2016.

Evans, Martin D.D. and Richard K. Lyons, Order Flow and Exchange Rate Dynamics, Journal of Political Economy, Vol. 110, No. 1 (February 2002), pp. 170-180.

Hansen, Jakob Lage and Peter Ejler Storgaard, Capital flows and the exchange rate of the krone, Danmarks Nationalbank, *Monetary Review*, 2nd Quarter 2005.

IMF, Long-term investors and their asset allocation: where are they now? Global Financial Stability Report, Chapter 2, September 2011.

Larsen, Henrik Olejasz, Kronepres og pensionskasserne (Krone under pressure and pension funds – in Danish only), Finans/Invest, March 2015.

Danmarks Nationalbank, *Financial stability*, 2nd Half 2016.