Economia Politica (2023) 40:781–794
https://doi.org/10.1007/s40888-023-00313-y

ORIGINAL PAPER

The Danish problem

Barry Eichengreen[1]

Received: 11 July 2023 / Accepted: 5 August 2023 / Published online: 24 August 2023

Abstract
Specialists in international finance have long been impressed by the fragility of currency pegs. Yet the National Bank of Denmark has been able to maintain the krone's peg to the euro since the euro came into existence in 1999, and the krone's peg to the Deutschmark and SDR for 17 years before that. This paper considers a series of hypotheses that may help to account for the exceptional nature of this case. None of these explanations is entirely satisfactory, but collectively they go some way toward explaining the Danish exception.

Keywords Exchange rates · Currency peg

JEL Classification F3 · F31

1 Introduction

For specialists in international finance, Denmark is a problem. Specialists in international finance have long been impressed by the fragility of pegged exchange rates. The resources that can be mobilized by financial market participants far exceed the reserves of central banks. Other policy priorities can come into conflict and ultimately trump the official commitment to maintaining the peg. These competing pressures are especially intense and difficult to reconcile in democratic polities. Such problems are apt to come to a head in periods of turbulence, which in recent years and decades have been coming fast and furious.

Yet against all odds, the National Bank of Denmark has been able to maintain the krone's peg to the euro continuously ever since the euro came into existence in 1999. (And the krone's peg to the Deutschmark and SDR for 17 years before that.)

An earlier version was presented as a keynote address at the Danish Nationalbank Conference on the 40th anniversary of the country's currency peg. I thank colleagues at the Bank for providing intervention data, Morten Spange for comments, and Qin Xie for exceptional research assistance.

✉ Barry Eichengreen
eichengr@econ.berkeley.edu

[1] University of California, Berkeley, Berkeley, CA, USA

For residents of Denmark, and not least to economists at the National Bank, this might seem like the natural state of affairs.

International experience suggests otherwise. Rather than natural, it is exceptional. So this exception is deserving of study. There has been considerable attention to currency crises, of which failed pegs are a significant subcategory, but less attention to successfully pegged exchange rates. In a sense, this paper addresses the same issues as the earlier literature on currency crises but from the opposite angle. If it turns out to be possible to identify the distinctive features of Denmark and Danish policies that have made for a durably pegged exchange rate, then the contrast with other countries and their policies may shed light on why pegged exchange rates in other times and places have been so fragile.

I will proceed by listing and evaluating a series of hypotheses that may help to explain the durability of the krone's peg.

2 Ample foreign exchange reserves

The National Bank has an extensive war chest of more than DK 550 billion (or around €65 billion). This is touted in the central bank's *Monetary Review*. "Denmarks Nationalbank holds a considerable foreign exchange reserve….Danmarks Nationalbank has not set a target for the size of the foreign exchange reserve. The only requirement is that it should be ample. An insufficient reserve would limit Danmarks Nationalbank's scope for intervention….Moreover, a small reserve could signal that Danmarks Nationalbank was not sufficiently poised to defend the krone in case of pressure. This could weaken credibility and could in itself fuel the risk of speculation against the krone."[1]

€65 billion sounds impressive. And in addition to this reserve, the National Bank has a €24 billion swap line with the ECB. But compare the Greenspan-Guidotti rule, which dictates that reserves should equal the sum of the current account deficit and short-term debt coming due in the next year. To be sure, Denmark runs a current account surplus, not a deficit, of about €30 billion. But short-term external debt is on the order of €235 billion. Some will say that the risk of a short-term debt runoff, requiring the central bank to intervene to support the exchange rate on this order of magnitude, is minimal in the Danish case given the borrowers' rock-solid creditworthiness – a creditworthiness that stabilizes short-term capital flows.[2] But this is just another way of saying that the explanation for the stability of the exchange rate lies elsewhere.

[1] Spange and Toftdahl (2014), p.54.

[2] Others will observe that short-term external debt was unusually high in 2021 because the government resorted to short-term external borrowing (issuing commercial paper) to fund exceptional spending during the COVID-19 pandemic.

3 Sound fiscal and financial policies

Denmark's prudent fiscal and financial policies are another obvious place to look when seeking to understand the durability of the currency peg. Chronic budget deficits creating pressure for monetization and giving rise to current account deficits and loss of reserves (through the twin-deficits channel or, equivalently, by over-stimulating demand, fanning inflation and leading to real exchange rate overvaluation) are at the center of first-generation models of speculative attacks, as in Krugman (1979). Banking crises and related financial problems feature in both first- and second-generation models (see e.g. Obstfeld, 1996; Kaminsky & Reinhart, 1999).

Denmark has been relatively free of these problems. Budget deficits have been limited; the overall deficit was less than 3 percent of GDP even during the COVID crisis (average for calendar years 2020–2021). The country's Budget Law specifies that structural deficits cannot exceed ½ percent of potential GDP on an annual basis. The authorities maintain a medium-term objective of a zero structural balance, to which they currently anticipate returning by 2025. The ratio of gross debt to GDP is just slightly above 40 percent, which is low by advanced-country standards. Net debt to GDP, at around 15 percent, is more impressive still.

Interestingly, not everyone is equally positive in their evaluation of the fiscal stance. The Danish National Bank itself was critical of fiscal policy as excessively expansionary in the run-up to the 2008–9 financial crisis. The IMF (2021) is politely critical of the fiscal authorities for not displaying more flexibility in response to cyclical fluctuations.[3] One commonplace story of how some countries are able to forsake monetary autonomy and maintain a currency peg is through their compensatory use of fiscal policy as a stabilization tool. In other words, fiscal policy is used more actively for stabilization purposes because monetary policy is used less actively. This does not seem to be the case of Denmark, which uses fiscal policy less actively than the typical country. Again this highlights the question, not yet fully answered, of how Denmark is able to live with limited macroeconomic policy flexibility.

On the financial side, the banks are liquid and, to all appearances, well managed. It is important to recall that this has not always been the case: there were chronic banking problems between the mid-1980s and mid-1990s, for example, when more than 100 banks discontinued operations, fully half as a result of financial difficulties (Abildgren & Thomsen, 2011). Fortunately, the banks in question were virtually all relatively small.[4] A number of larger Danish banks then experienced difficulties during the Global Financial Crisis, which produced loan losses and interrupted access to wholesale funding. Many banks that were "discontinued" as a result of the crisis

[3] In contrast, the National Bank has acknowledged that the relief package implemented by the Danish government during the pandemic reduced the risk of the temporary lockdown resulting in a more prolonged economic downturn. However, it also emphasized the importance of support schemes being phased out in line with the reopening of society. Also see Spange (2022) for discussion of the implications of the peg for the conduct of fiscal policy.

[4] An exception was Varde Bank, bailed out in 1992–3.

had seen strong loan growth in the preceding period, relied extensively on wholesale funding, and had exposure to the property sector. In both 1985–96 and 2008–9, rescuing the banks required the government to inject public funds for recapitalization. Revealingly, both episodes of banking sector weakness were associated with pressure on the krone (Danmarks Nationalbank, 2009).

Thus, Denmark's experience confirms that banking stability is important for exchange rate stability. It serves as a reminder that banking stability cannot be taken for granted – and that an extended period of stability may itself contain the seeds of subsequent problems. The IMF warns of signs that banks had been relaxing credit standards before the pandemic, and that loan losses will increase as a result of the COVID-19 recession. One can now say the same of the fallout from Russia's invasion of Ukraine and the resulting rise in energy prices. For all these reasons, banking stability cannot be taken for granted.

4 Flexible labor markets

Conceivably, the existence of flexible labor market could limit the need for active use of monetary and fiscal policies to dampen business cycle fluctuations and limit increases in unemployment. The classic Mundell (1961) argument for monetary autonomy (made possible by a flexible exchange rate) is to offset asymmetric (country-specific) aggregate shocks that result in, inter alia, higher unemployment. If real wages adjust downward to restore the demand for labor or the jobless are otherwise able to find employment quickly, then this argument loses some of its force.

The elements of Denmark's "flexicurity" model are well known: these include permissive hiring and firing rules (which provide the flexibility), a generous social safety net (which provides the security), and an extensive system of active labor market policies (helping the structurally unemployed to adjust). Layoffs are virtually costless for employers. Unemployment benefits can be drawn for up to 2 years, at a replacement rate of up to 90 percent of earlier earnings for the lowest-paid workers, while the unemployed have available to them job-search services, education and training.

Finally, a variety of schemes are designed to limit long-term unemployment which is often especially hard for laid off workers to escape: these include wage subsidies for employers who hire the long-term unemployed and benefits for firms that send workers for training and hired unemployed persons as substitutes. Thus, firms are able to adjust employment, while individuals who are laid off receive generous support as a quid pro quo, and problems of long-term unemployment are avoided or at least minimized.

In good times this model is associated with rates of unemployment noticeably below EU averages.[5] But it doesn't prevent unemployment from rising significantly in bad times. In the Global Financial Crisis and then the Euro Crisis, it rose from low levels to 8 percent. This was one of the largest increases among OECD countries

[5] Though a significant problem of youth unemployment remains even in the good times.

in both absolute and relative terms (Bredgaard & Madsen, 2018). Thus, the question remains of why the Danish authorities don't feel more pressure to use monetary policy actively when unemployment rises.

5 Accommodating ECB policy and the predominance of buying attacks

The krone has been subject mainly to buying rather than selling attacks, given the accommodating stance of the ECB. The ECB's rock-bottom interest rates mean that capital has tended to flow toward Danish financial markets rather than away.

In defending the currency against selling attacks, central banks' intervention efforts are limited by finite stocks of foreign reserves.[6] But there is no such ceiling on intervention taken in response to buying attacks. With access to the printing press, central banks can purchase foreign assets without limit. There is no technical constraint, in other words, on increasing the money supply.

However, as Grilli (1986) was first to point out, there is a symmetry between buying and selling attacks. Just as there may be a lower limit on reserves below which the central bank is no longer able or willing to defend the currency against pressure to depreciate, there may be an upper limit on reserve accumulation beyond which the central bank is unwilling to defend the currency against pressure for it to appreciate. The central bank may fear that capital inflows and speculative purchases are inflationary, as in the case of the Bundesbank in the late 1960s and early 1970s (Gray, 2006). Or it may conclude that a large reserve portfolio has economic and political costs, as in the case of the Swiss National Bank's abandonment of its exchange rate "ceiling" in 2015 (Hui et al., 2016). The ability to defend against a buying attack may also have limits, in other words.

This Danish National Bank's ability to defend against a buying attack was put to the test in January–February 2015, after the Swiss National Bank (SNB) removed its cap on the euro/Swiss franc exchange rate and the ECB announced an expansion of its asset purchase program (signaling the advent of even more accommodating monetary conditions in the Euro Area). In particular, the SNB's abandonment of the exchange rate ceiling and decision to allow the Swiss franc to appreciate against the euro created expectations that the Danish National Bank might do likewise. In response, the National Bank was required to purchase three times as many foreign assets in the two months January–February 2015 as it had between mid-2011 and mid-2012, when foreign funds had flowed into Denmark in response to the debt crisis in Southern Europe.[7]

So why did the Danish National Bank react differently to capital inflows than the SNB? The SNB invoked unspecified "financial stability concerns" in support of its decision to abandon its peg. Amador et al. (2016) suggest that this refers to the risk

[6] Or by their limited appetite for holding policy rates at nose-bleed levels, as in Sweden in 1992.

[7] The central bank also cut its policy interest rates, but there was limited scope for such cuts given that rates were already very low.

of losses on foreign assets if and when the currency does appreciate – losses that will increase with the size of the central bank balance sheet and thus with the length of time that it continues to defend the peg against buying attacks.[8] In other words, it is better to abandon the peg earlier, and suffer smaller balance sheet losses, than to run the risk of larger balance sheet losses if the peg is abandoned later. Relatedly, it may have made a difference that the Swiss National Bank's balance sheet was larger relative to GDP (on the order of 80 percent, as opposed to 25 percent in Denmark), implying a risk of proportionately greater losses, other things equal, circa 2015.

Also relevant was the fact that the SNB had been under public pressure to minimize losses on its foreign assets. In 2014 it had been dragged into a highly charged political debate surrounding a referendum that would have required it to increase its gold reserve. This "gold initiative" would have required it to increase the share of its reserves held in gold to 20 percent, with the rationale that this would bullet-proof its balance sheet against losses. The goal was dear to the cantons, the states of the Swiss Confederation, which rely on transfers from the SNB (Eichengreen & Weder di Mauro, 2015). In the end, the referendum was voted down, but the debate put the SNB's balance sheet, and specifically the possibility of financial losses if the euro continued to depreciate against the U.S. dollar, squarely in the political crosshairs. The Danish National Bank faced no analogous obligation to the regions, and no analogous public pressure and criticism.

On the other hand, Denmark has obligations to its EU partners as a participant in the Exchange Rate Mechanism (ERM II) of the European Monetary System. Denmark holds its currency within ± 15 fluctuation bands against the euro, buying and selling euros to achieve this result.[9] Note, however, that the National Bank's policy is much stricter than required by the ERM II. So this obligation cannot be the entire story.

Finally, Denmark had maintained its peg for longer (more than 30 years as opposed to 4). Danish policy makers may have felt that they had more invested in its preservation. If the Danish National Bank and its public were more strongly committed to maintenance of the peg, then the perceived probability of abandoning it, and the likelihood of such losses, was less. Of course, this still begs the question of why commitment to the peg was stronger than in Switzerland. I return to this question below.

6 Effective foreign exchange market intervention

Sterilized intervention in the foreign exchange market by the Danish National Bank has been unusually effective in preventing the krone from straying from its central ERM 2 parity. Conclusions in the scholarly literature regarding the effectiveness of sterilized intervention (e.g. Bordo et al., 2012; Fratzscher et al., 2019; Sarno &

[8] Such losses will be uncomfortable for a central bank that is expected to return profits to the government and that relies on other branches of government for recapitalization in the event of losses.

[9] At the time of writing, Bulgaria is the other member state participating in the ERM II.

Taylor, 2001) are mixed. Bordo et al., to take a prominent example, find that the results of U.S. interventions in the foreign exchange market are no better than random. Yet Spange and Sorensen (2016), when analyzing daily Danish intervention for the period 2002–2016, find that intervention is successful in the sense of reversing the direction of the change in the exchange rate or slowing the rate of change of the exchange rate roughly 75 percent and 85 percent of the time, respectively. These success rates are virtually identical for interventions involving foreign exchange purchases and sales. They change only very slightly when dropping days when the central bank also changed its policy rate (when intervention was not sterilized) and when the analysis focuses on episodes where the central bank was "leaning against the wind" – when it was purchasing krone in response to the krone weakening or selling krone in response to the krone strengthening.

Sterilized intervention can be effective, the literature tells us, either when domestic and foreign assets are imperfect substitutes or when the central bank's market operations signal a future change in policy. In general, evidence for the portfolio balance channel, which relies on imperfect substitutability, is weak (Chiu, 2003). Danish government bonds may not be perfect substitutes for German bunds, but it is hard to argue that sterilized intervention in the market for krone is *more* effective than sterilized intervention in the market for other currencies because Danish bonds are *less* substitutable for bunds than other government bonds.

Thus, the effectiveness of sterilized intervention in the Danish context must rest on the signaling channel: interventions signal that the central bank is prepared to alter its policy interest rate if necessary to counter recent exchange rate movements. Spange and Sorensen show, again for the period 2002–2016, that a change in the policy interest rate spread (relative to the ECB rate) is three times as likely on a given day if the Danish National Bank intervened on the foreign exchange market on one of the preceding five days. I don't find it disconcerting that the Nationalbank follows such interventions with a policy rate increase only 15 percent of the time (that the signal is not frequently followed by the signaled response). This is what the target-zone literature (e.g. Krugman, 1991) would lead one to expect: that the credibility of the signal will induce market participants to alter their behavior in stabilizing fashion, thereby relieving the central bank of the need to act.

But again, the conclusion simply begs the question. There is nothing particularly special about the structure of Danish financial markets or the characteristics of Danish government bonds capable of accounting for the unusual effectiveness of sterilized intervention. Rather, intervention is effective because it sends a credible signal that the central bank will intervene to defend the peg. And that signal is credible because the central bank is credibly committed to defending that peg. But on what that credibility rests is not much clearer than when we started.

7 Broader institutional framework

Denmark, being a participant in the ERMII, and the European Central Bank having obligations under the ERMII, agreement, it could be that market participants anticipate stabilizing intervention by the ECB whenever the krone reaches the edge of

its ± 2.25 percent fluctuation band. The ECB's balance sheet is very large relative to the outstanding stock of krone. In the scenario where the krone weakens to the bottom of its bilateral band, the ECB would be selling euro for krone, and there will be essentially no limits to the extent of its intervention. This belief that the two central banks are jointly committed to maintaining the peg will then have stabilizing effects.

In fact, since the establishment of the ECB, the krone has never been close to the margins of its bilateral parity against the euro. The ECB does not appear to have intervened in the foreign exchange market for krone. ECB intervention is thus not relevant to the period starting in 1999 analyzed in the appendix to this paper. It can be argued that investors nonetheless retain the belief that if there did arise a serious threat to stability, then the ECB would intervene. However, neither the Danish National Bank nor the ECB has given prominence to this possibility. The potential existence of ECB support for the peg is not something that the Danish National Bank emphasizes in its communication.

Prior to the creation of the ECB, the krone did on occasion reach the margins of its bilateral fluctuation bands against other ERM currencies, and there were interventions by other central banks. There were no such interventions by other central banks in support of the krone after August 1993, when fluctuation bands were widened from ± 2.25 percent to ± 15 percent (Abildgren, 2010, Chapter 2). So the broader ERM framework could have been important for confidence in the krone peg in its first decade of existence. But even before 1993, interventions by foreign central banks such as the German Bundesbank were limited (as documented in Eichengreen & Naef, 2022). Invoking conditions detailed in a letter sent by then Bundesbank President Otmar Emminger when the EMS was created, the Bundesbank retained the option of opting out of these intervention obligations when it viewed them as in conflict with German monetary policy objectives. So it is hard to know how much weight to attach to those obligations.

A related point is that the krone peg is part of the broader institutional framework; it is viewed as integral to Denmark's relationship with the EU and the Single Market. Denmark competes with Ireland in markets for diary products, and with Germany in markets for machinery. A sharp depreciation of the krone that conferred an arbitrary competitive advantage on Danish exporters might be seen as inconsistent with those broader commitments. Knowledge of this fact may enhance investor confidence that necessary steps will be taken to maintain the peg.[10] Of course, this hypothesis begs the question of why a currency peg is a necessary concomitant of membership in the EU and the Single Market for Denmark but not others, such as Sweden for example.

8 History and longevity of the peg

The krone has been firmly pegged to the euro and before that to the Deutschmark and SDR for fully 4 decades. It could be that the expectations of market participants have been positively affected by this history. The longer the authorities have

[10] Here one might conceivably point to a role for history, as I do in the next subsection.

demonstrated their commitment to the peg – the longer that they have demonstrated their continued readiness to defend it in the face of challenges – the more confidence investors attach to their continuing to do so. Thus, both the longevity of the peg and, more recently, its maintenance in the face of the Global Financial Crisis, the Swiss National Bank's decision in 2015 to stop pegging the franc against the euro (which created chatter that the Danish National Bank would do likewise), and the COVID-19-related lockdowns and recession, may have futher enhanced the credibility of the peg.

A few studies have examined time dependence in the context of exits from pegged exchange rates. The most recent of these (Bizuneh, 2022) looks at a large sample of pegged exchange rates since 1970. Calculation of a nonparametric Kaplan–Meier hazard function shows that the hazard (likelihood of exit in this context) rises initially with time but then falls. After starting out positive, duration dependence eventually turns negative (the likelihood of exit begins to fall). An interpretation is that investors may be skeptical about recently established pegs, and that pressure on the peg initially tends to intensify as time proceeds. This could be for internal or external reasons and due either to economic or political factors. External liabilities could grow over time, increasing the scope for speculative attack. Or unemployment could persist, and the longer it persists the stronger will grow popular pressures for the authorities to address it instead of defending the peg – as in Eichengreen and Jeane (2000). After some point, however, markets become increasingly convinced of the authorities' commitment, and that level of conviction continues to rise with time. Or perhaps after some point the authorities grow so invested in the regime that they are less and less inclined to abandon it, regardless of the other economic problems with which they are confronted. Past performance then *does* become a guarantee of future returns.

According to Bizuneh's estiamates, the hazard turns negative after 18 years, which in Denmark's case coincides with the beginning of the krone peg to the euro. It is not clear how literally we should take this estimate of the turning point, although it is plausible that the peg gained increasing credibility in the late 1990s after surviving the turbulence surrounding the ERM crisis of 1992–3.

And even if we agree that the long history of the peg and the demonstrated commitment of the Danish authorities now matter for the durability and stability of the regime, this begs the question of from what the credibility of that commitment derives. Danish authorities tell us that adoption of the peg required an embrace of sound and stable policies – maintaining the peg required the country to put the era of fiscal deficits and inflationary policies behind it – and that this embrace of sound and stable policies launched the country onto a trajectory of successful economic growth and increasing prosperity. But one can point to a long list of other countries that adopted a currency peg as a forcing device meant to require the adoption of sound and stable policies, where those policies were not adopted in the end, and the peg collapsed. This interpretation thus requires something more if we are to understand why Denmark is different. One might point to the country's electoral system, which incentivizes political parties to moderate their programs, and its tradition of political moderation and cooperation as allowing consistent policies to be sustained over time. But is this answer enough?

9 Conclusion

An old joke about economics is that it involves showing that what works in practice also works in theory. The Danish currency peg is a case in point. Many of the factors to which observers point – the Danish Nationalbank's ample foreign reserves, sound and stable fiscal and financial policies, flexible labor markets – help one to understand why Denmark has been more successful than other countries in maintaining its currency peg. But they provide, at best, an incomplete explanation. Reserves, while ample, are not an iron-clad defense against speculative attacks. Fiscal policies may be strong, but they are not a perfect substitute for the absence of monetary autonomy. Financial policies are sound, but they have not prevented the development of financial problems. Labor markets are relatively flexible, but such flexibility does not prevent unemployment from rising in recessions, something that in other countries creates irresistible pressure for the central bank to act. These factors limit the number of occasions on which the central bank's resolve is tested. But they do not prevent it from being tested.

Ultimately, the success with which Denmark has maintained its peg rests on the credibility of the commitment to do so. Observers can point to the long history of the peg's successful defense, but this again begs the question: why has it succeeded for so long? Is it Denmark's commitment to its EU partners and a desire to avoid being seen as a currency manipulator? Then what about Sweden? Is it that success breeds success, just as failure breeds failure? Self-fulfilling expectations are an answer, but they are not an entirely satisfying answer.

Appendix

In this appendix, I update the analysis of the effectiveness of Danish Nationalbank intervention in the foreign exchange market as pioneered by Spange and Sorensen (2016). Whereas these authors considered interventions in the period 2002–2015, here I consider the period from January 1, 1999, when the euro (to which the kroner is currency pegged) came into existence through February 26, 2021 (omitting only the latest year at the time my data request was made). Intervention data were supplemented by daily exchange rate data from Haver and policy interest rates from the websites of the Danish Natonalbank and European Central Bank. Those policy interest rates move closely together, as would be expected in the case of a credible peg, with a few notable if brief exceptions. (See the accompanying Fig. 1.)

An intervention event is defined as a string of days in which interventions in the same direction take place, separated by at least two consecutive days when no intervention takes place. As in Spange and Sorensen (2016), one day without intervention is not taken to end an intervention episode or event. Thus, intervention on a Monday and a Wednesday but not on the other three days of the week

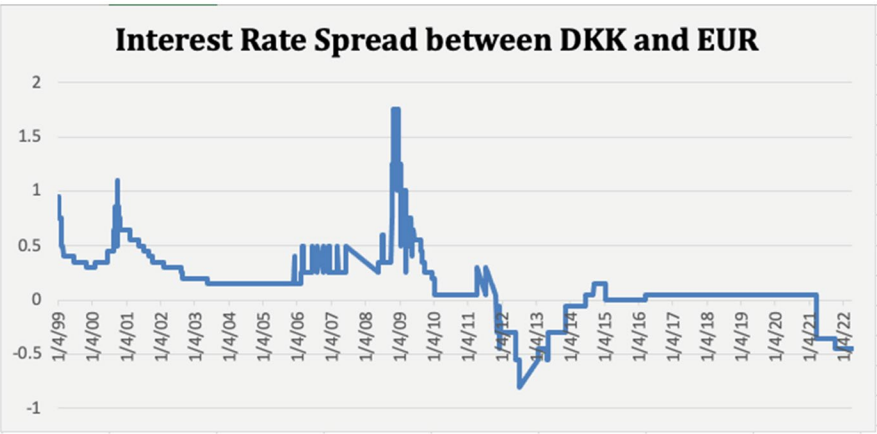

Fig. 1 Policy Interest Rate Spread

is said to constitute a three-day long intervention event. We have 225 intervention events as opposed to Spange and Sorensen's 162. Slightly fewer than half of these events last just one day, roughly the same proportion in the shorter data set of these earlier authors. The longest intervention, lasting 28 days, remains that in the autumn of 2015. Interestingly, the majority but not all of these episodes are "leaning against the wind" interventions, when the central bank purchased kroner following a period of depreciation or sold it following a period of appreciation. Why, in more than a few cases, the central bank leaned into the wind is not obvious.

We again consider two alternative success criteria. The "direction criterion" requires the exchange rate to move in the intended direction following an intervention (to depreciate following sales of kroner by the central bank, to appreciate following purchases). The "stabilization criterion" allows the exchange rate to continue moving in the same direction as prior to the intervention, only by less. Thus, direction successes are a subset of stabilization successes. The pre-intervention window is defined as the last two days prior to the start of the intervention event, while the post-event window includes the two days immediately following the end of the event.

As Fig. 2 shows, success rates so defined are high – even higher than in Spange and Sorensen's shorter sample. Most of the additional data and interventions come from the recent period, suggesting that the frequency of success has been even higher recently. When only interventions leaning against the wind are considered, there are some small differences: the share of foreign exchange purchases meeting the stabilization criterion goes down, while the share of foreign exchange sales meeting it goes up, for example (Table 1).

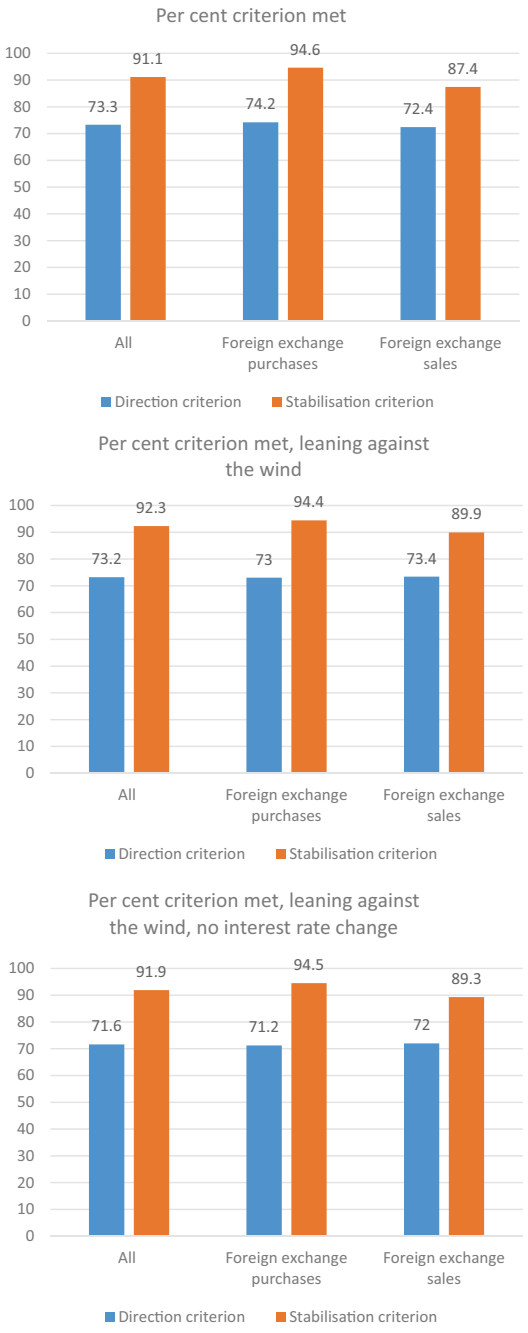

Fig. 2 Effect of intervention events

Table 1 Interventions by Danish National Bank, 1999–2021

Average size of intervention[a]	EUR 362.1 million
Average size of intervention[a], purchases of kroner	EUR 322.3 million
Average size of intervention[a], sales of kroner	EUR 399.5 million
Largest intervention on a single day	EUR 4767 million
Number of intervention events	225
Average duration, event	3.0 days
Number of events of only one day duration	102
Longest event	28 days

Source: Denmark's National bank

[a]Daily values on days of intervention

References

Abildgren, K. (2010). *Monetary history of Denmark, 1990–2005. Volume 6*. Danmarks Nationalbank.

Abildgren, K., & Thomsen, J. (2011). A tale of two danish banking crises. *Monetary Review, 50*, 121–142.

Amador, M., Bianchi, J., Bocola, M., & Perri, F. (2016). Reverse speculative attacks. *Journal of Economic Dynamics and Control, 72*, 125–137.

Bizuneh, M. (2022). Are we floating yet? Duration of fixed exchange rate regimes. *Eastern Economic Review, 48*, 63–89.

Bordo, M., Humpage, O., & Schwartz, A. (2012). The Federal Reserve as an Informed Foreign Exchange Trader, 1973–1995. *International Journal of Central Banking, 8*, 127–159.

Bredgaard, T., & Madsen, P. (2018). Farewell flexicurity? Danish flexicurity and the crisis. *Transfer, 24*, 375–386.

Chiu, P. (2003). *Transparency versus constructive ambiguity in foreign exchange intervention*. BIS Working Paper no. 14.

Eichengreen, B. & Weder di Mauro, B. (2015). Central Banks and the Bottom Line. *Project Syndicate* (12 February) https://www.project-syndicate.org/commentary/central-bank-balance-sheet-losses-by-barry-eichengreen-and-beatrice-weder-di-mauro-2015-02

Eichengreen, B., & Jeanne, O. (2000). Currency crisis and unemployment: Sterling in 1931. In P. Krugman (Ed.), *Currency crises* (pp. 7–46). University of Chicago Press.

Eichengreen, B., & Naef, A. (2022). Imported or home grown: The 1992–3 EMS crisis. *Journal of International Economics, 138*, 103654.

Fratzscher, M., Gloede, O., Menkhoff, L., Sarno, L., & Stohr, T. (2019). When is foreign exchange intervention effective? Evidence from 33 countries. *American Economic Journal: Macroeconomics, 11*, 132–156.

Gray, W. (2006). "Number one in Europe": The startling emergence of the Deutsch Mark, 1968–1969. *Central European History, 39*, 56–78.

Grilli, V. (1986). Buying and selling attacks on fixed exchange rate systems. *Journal of International Economics, 20*, 143–156.
Hui, C., Lo, C., & Fong, T. (2016). Swiss Franc's one-sided target zone during 2011–2015. *International Review of Economics and Finance, 44*, 54–67.
International Monetary Fund. (2021). *Article IV consultation: Denmark*. IMF.
Kaminsky, G., & Reinhart, C. (1999). The twin crises: The causes of banking and balance-of-payments problems. *American Economic Review, 89*, 473–500.
Krugman, P. (1979). A model of balance of payments crises. *Journal of Money, Credit and Banking, 11*, 311–325.
Krugman, P. (1991). Target zones and exchange rate dynamics. *Quarterly Journal of Economics, 106*, 669–682.
Mundell, R. (1961). A theory of optimum currency areas. *American Economic Review, 51*, 657–665.
DanmarksNationalbank. (2009). *Monetary policy in Denmark* (3rd ed.). Danmarks Nationalbank.
Obstfeld, M. (1996). Models of currency crises with self-fulfilling features. *European Economic Review, 40*, 1037–1047.
Sarno, L., & Taylor, M. (2001). Official intervention in the foreign exchange market: Is it effective and if so, how does it work? *Journal of Economic Literature, 39*, 839–868.
Spange, M. (2022). Monetary and fiscal policy in Denmark. Analysis no.12 (27 October).
Spange, M., & Sorensen, J. (2016). *Effects of Danmarks Nationalbank's interventions in the foreign exchange market* (pp. 61–73). Danmarks Nationalbank Monetary Review. fourth quarter.
Spange, M., & Wagner Toftdahl, M. (2014). *Fixed exchange rate policy in Denmark* (pp. 49–60). Danmarks Nationalbank Monetary Review. first quarter.