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Pattern Bargaining as a Means to Coordinate Wages in the Nordic Countries

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Abstract

The various form of pattern bargaining with manufacturing, as representative of the tradables sector, deciding the norm for wage increases in the Nordic countries are reviewed. This form of bargaining has been consistent with strong international competitiveness and has widespread support among practitioners based on informal analysis. It is, however, hard to build a convincing case in more formal modelling for the idea that wage leadership for the tradables sector is particularly conducive to wage restraint. The conclusion is rather that it is norm setting in itself, irrespective of by whom it is done, that promotes wage moderation. In the future, when changing demograhics may motivate a reallocation of labour to welfare services, a rigid application of international competitiveness norms may imply an undesirable status-quo bias. More weight should probably be given to overall labour market conditions and more relative-wage flexibility allowed.

Keywords: Pattern bargaining, coordination of wage setting, the Scandinavian model, Stackelberg leadership, social norms, labour reallocation.

JEL codes: E24, J21, J51.

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1 Introduction

The Nordic countries are heavily dependent on trade. This explains why considerations of international competitiveness have always played an important role in wage setting. In the 1960s and early 1970s, this thinking was formalised in the *Scandinavian model of wage formation*. The basic idea was that price and productivity increases in the internationally competitive sector (henceforth *the tradables sector*) determines a room for wage increases to be followed also in the sector sheltered from international competition (henceforth the *nontradables sector*).[1]

When the model was formulated, wage bargaining in the Nordics involved the national peak organisations on both the employer and the trade union side. But over time, peak level bargaining has faded away and industry level bargaining has become dominant. This has not, however, meant the disappearance of coordinated wage setting. Instead, earlier centralised bargaining has been replaced by coordination through *pattern bargaining*, where manufacturing, as a representative of the tradables sector, concludes the first agreement, which determines a norm for wage increases for other sectors to follow. At the same time, the scope for local bargaining has widened.

There is a strong belief among practitioners that the pattern bargaining that has developed contributes to wage moderation and good macroeconomic performance. But there has also been critique, focusing on inflexible relative wages and that desirable labour reallocation could be impeded. This article reviews the arguments on the basis of existing research and discusses possible modifications of the system.

Section 2 describes bargaining coordination in the various Nordic countries. The Scandinavian model of wage formation is discussed in Section 3, whereas Section 4 surveys recent wage developments. Section 5 reviews the theoretical work on pattern bargaining. Risks that pattern setting could interfere with desirable relative wage flexibility and reallocation of labour are highlighted in Section 6. Section 7 summarises the analysis and draws conclusions regarding the desirable wage formation process in the future.

[1] The tradables sector comprises both export and import-competing industries. Traditionally, tradables have been associated with manufacturing and nontradables with services, but today also many services are traded. Unless stated otherwise, I do not include the public sector in the nontradables sector. Although the room (norm) for wage increases in effect also includes changes in costs for various employee benefits, I shall, for expositional convenience, refer to wages rather than wage costs except when I want to emphasise the distinction.

2 The Nordic systems for coordinating wage bargaining

Table 1 summarises the basic features of wage bargaining coordination in the Nordics. Although pattern setting by manufacturing takes place in all the four large Nordic countries, there is considerable variation in how this is done. The transitions from the earlier centralised systems were characterised by oscillations between them and the new systems. They are most firmly established in Denmark, Norway and Sweden, whereas the transition seems still to be in progress in Finland.

Table 1. Features of pattern bargaining in the Nordic countries

	Denmark	*Finland*	*Norway*	*Sweden*
Role of private-sector employer peak organisation	Concludes framework agreement before wage rounds on timetables and issues joint statements with the union counterpart on bargaining results. Approves industry level agreements. Assists in formulating mediation proposals.	Some coordination activities. Provides information on wage cost increases in various industry level agreements.	Formulates the norm under industry level bargaining after conclusion of the manufacturing agreement. Still sometimes a party to centralised agreements.	Approves industry level agreements.
Role of union peak organisations	Peak union organisation concludes framework agreement before wage rounds on timetables, issues joint statements with the employer counterpart on bargaining results and assists in formulating final mediation proposal.	Some coordination activities.	Private-sector employer peak organisation formulates the norm in understanding with peak organisation for blue-collar workers (*LO*). Still sometimes parties to centralised agreements.	Coordination of wage demands within peak organisation for blue-collar workers (*LO*).
Role of government and government institutions	Tripartite body provides wage statistics. Deliberations on public-sector wage structure in recent government commission comprising economic experts and representatives of labour market organisations.	Legal extension of collective agreements that are regarded as representative to all firms in an industry by a special board.	Tripartite bodies aimed at creating a common understanding of the economic situation. Consensus building in government commissions on the bargaining system. Occasional tripartite agreements.	None.

	Occasional tripartite agreements. Conflicts are sometimes ended with legislation on wage increases.		Conflicts are often ended with legislation on wage increases.	
Role of mediation institution	Mediation proposals in line with the manufacturing norm. Power to link all agreements in common vote on both sides of the labour market.	Mediation proposal normally in line with the manufacturing norm. The plans of the right-wing government in 2023–24 to legislate that mediation proposals cannot exceed the norm were watered down to a more general formulation on securing overarching objectives of society.	Mediation proposals normally in line with the manufacturing norm. Final mediation bid is usually followed if a conflict is terminated through legislation.	Mediators never exceed the manufacturing norm in their mediation proposals.
Scope of norm	Total wage increases.	Total wage increases.	Total wage increases.	Wage increases in industry level contracts, but not wage drift.
Public sector	Follows ex-ante norm. Ex-post adjustment if public-sector wage increases differ from private-sector ones.	Opposition from public-sector unions to norm setting by manufacturing.	Follows the norm.	Follows the norm. Principle inscribed into framework negotiation agreements.
Synchronisation of wage contracts in time	Mostly.	Mostly.	Yes.	In the private sector, but contract period are sometimes different in the public sector.
Local bargaining	Very important for actual wage increases, especially in the private sector.	Still less important than in the other Nordic countries but increasing importance.	Very important for actual private-sector wage increases.	Very important for white-collar workers, especially in the public sector, but small wage drift for blue-collar workers in the private sector.

2.1 Denmark[2]

Denmark was the frontrunner among the Nordic countries in moving to industry level bargaining with pattern setting by manufacturing. This happened after the earlier system of centralised wage bargaining between economy-wide peak organisations broke down in the 1970s and 1980s during a process when government policy focused on reducing (wage) inflation and restoring international cost competitiveness. This resulted in several tripartite incomes policy agreements between the peak organisations and the government in these years.

The incomes policy settlement, *Felleserklæringen* (the Common Declaration) in 1987, is seen as the starting point for the new form of coordination since it articulated the principle that the tradables (export) sector should determine the norm for wage increases in the whole economy, including the public sector, and that this norm should be based on international-competitiveness considerations. Coordination according to these principles developed gradually in the 1990s, and from 2000 it has been codified in recurring framework agreements between the peak organisations before the wage rounds.

The first wage agreement in a bargaining round is concluded between the Confederation of Danish Industry (*DI*), by far the largest employers' association in the Confederation of Danish Employers (*DA*), and a cartel of manufacturing trade unions (*CO-industri*) in the Danish Trade Union Confederation (*FH*). This agreement, which determines changes in minimum pay and other working conditions, establishes the norm for other private-sector agreements provided that it is approved by the *DA* executive committee (it typically is as *DI* holds half the votes there).[3] The committee does not allow subsequent settlements to exceed the norm.

The usual outcome is that settlements are not reached in some private-sector areas. Then mediation is compulsory. Mediators' proposals typically conform to the norm established in the manufacturing agreement. If mediation fails, the mediation institution (*Forligsinstitutionen*) formulates a final proposal in cooperation with *DA* and *FH* in line with the norm. The mediation institution then links all bargaining areas – both those which have reached agreements and those which have not – into a common decision process. Rejection on the union side requires a voting majority in a national ballot among *all* the unions' members. Otherwise, the mediation proposal

[2] The account is based on more detailed descriptions in Andersen et al. (2015), Ibsen (2016), Lønstrukturkomitéen (2023) and Holden IV-utvalget (2023).

[3] Minimum pay (*mindstebetalingssats)* is not a minimum wage in the usual sense, i.e., a wage applicable to inexperienced workers, but instead a common component of the total personal wage, which is determined in local bargaining and also depends on tasks, qualifications, individual performance etc. (Dahl et al., 2013; FAOS, 2023).

becomes binding in all bargaining areas – provided that it is approved also by a majority in the *DA* executive committee.

Public-sector bargaining usually takes place after private-sector agreements are concluded. There is a consensus that average wage increases should be the same in the various public-sector bargaining areas as in the private sector. A difficulty is, however, that *actual* wageswages in most of the private sector are determined locally. Hence, actual private-sector wage increases are not known when public-sector settlements are made. The latter, in contrast to private-sector agreements, usually contain provisions on actual wage increases: both central and local ones. There is a formalised system of ex-post regulation (*efterregulering*) of wages in the public sector. According to the 2024–26 collective agreements, if wages in a public-sector bargaining area have increased by less than in the private sector, 80% of the difference is added to the agreed increases; if wages have increased by more, 80% of the difference is deducted.

2.2 Sweden[4]

During the 1980s and 1990s, a gradual transition from economy-wide bargaining between peak organisations to industry-level bargaining occurred. There were then some elements of tripartite bargaining, but much less so than in the other Nordic countries. A crucial step was when the Swedish Employers' Federation (*SAF*), in 1990 decided to abandon central wage negotiations. Despite this, a government-appointed incomes policy commission managed to coordinate bargaining and achieve a strong deceleration of wage increases during the deep economic crisis in the early 1990s.

When uncoordinated industry level agreements for 1995–97 led to wage rises generally regarded as too high, the government in 1996 urged the labour market parties to reform the bargaining system. When peak organisations failed to do this, manufacturing trade unions proposed negotiations to their employer counterparts. This resulted in a framework agreement, the Industry Agreement (*Industriavtalet)*, in 1997, which – in revised form – still forms the basis for wage bargaining.[5]

[4] See Calmfors (2018), Calmfors et al. (2019), Andersen (2023), Holden IV-utvalget (2023) and Bender (2024) for more detailed accounts.

[5] The main signatories are on the union side *IF Metall* (blue-collar metal workers), *Unionen* (white-collar private-sector workers) and *Sveriges Ingenjörer* (Engineers of Sweden), and on the employer side *Teknikföretagen* (Technology Industries of Sweden) and *Industriarbetsgivarna* (Swedish Association of Industry Employers). *IF Metall* is the second largest union in the Swedish Confederation of Labour (*LO*) and *Unionen* the largest union in the Swedish Confederation of Professional Employees (*TCO)* and in Sweden.

The Industry Agreement emphasises the importance of maintaining the manufacturing sector's international competitiveness and stipulates that the signing parties shall work for the establishment of the wage increases in manufacturing as a norm for wage increases also elsewhere. In line with this, the manufacturing sector regularly concludes the first agreement in a bargaining round, and the wage increases in it constitutes a cost mark (*märke*) which is followed in subsequent agreements elsewhere.

The norm setting by manufacturing is upheld through several mechanisms. The strongest one is coordination within the Confederation of Swedish Enterprise (*Svenskt Näringsliv*), the peak organisation of private employers.[6] A special committee there oversees that no industry argreements exceed the norm. Wage demands are also usually explicitly coordinated within the Swedish Confederation of Trade Unions (*LO*), the peak organisation for blue-collar workers. There is also informal coordination among unions for private-sector white-collar employees.[7] In the public sector, there are framework negotiation agreements which acknowledge the norm-setting role of the tradables sector.

The National Mediation Office (*Medlingsinstitutet*) helps enforce the wage norm. According to the office's instruction, it should strive to uphold the existing consensus on the tradables sector's norm-setting role. Therefore, mediation proposals never comprise wage cost increases above the manufacturing norm.

A difference to especially Norway (see Section 2.3) is that Swedish norm setting refers to the wage increases in the industry agreements but does not incorporate additional local wage increases (wage drift). This may not have been considered necessary as drift has recently accounted for only a small part of wage increases (see e.g., Medlingsinstitutet, 2024). A practice has developed where the agreement in retailing sets a second norm, not in per cent but in *kronor*, for employees in lower-wage non-tradables (service) industries.

Public-sector white-collar workers tend to have *figureless* higher-level wage agreements, leaving the determination of all wage increases to the local level. But also for these groups, wage increases tend to be guided by the manufacturing norm, even though at times these agreements have allowed higher wage increases for groups of employees benefiting from labour shortages (Medlingsinstitutet, 2018; Calmfors et al., 2019). Also, Karlsson et al. (2014) found

[6] *Svenskt Näringsliv* replaced *SAF* as the peak organisation for private employers in 2001.
[7] Within *Unionen* (see footnote 4), which organises private-sector white-collar workers both inside and outside manufacturing, the coordination is "automatic", since the policy is only to conclude agreements following the manufacturing norm.

that the manufacturing norm was often followed also in private firms without collective agreements.

2.3 Norway[8]

The principle that international-competitiveness considerations should guide wage developments was articulated in the so-called Aukrust (Scandinavian) model of wage formation (see Section 3) already in the 1960s and has since formed the basis for wage bargaining. From the 1970s to the end of the 1990s, this thinking exerted its influence via economy-wide bargaining between peak organisations, often with participation by the government in comprehensive incomes policy settlements.

Elements of incomes policy have been less frequent after the turn of the millennium. Instead, wage bargaining has become more structured along lines designed to strengthen the influence of the tradables sector on wage setting. This has to a large extent been achieved through consensus building between labour market organisations in a series of government commissions (headed by and named after professor Steinar Holden).[9]

So called head agreements (*hovedoppgjør)*, on both wages and other issues, are for two years. Bargaining is either at industry or peak level, although the former dominates. Then the first agreements are concluded in manufacturing between, on one hand, the Federation of Norwegian Industries (*Norsk Industri*), the largest member organisation in the private-sector peak organisation for employers, *NHO*, and, on the other hand, two trade unions, *Fellesforbundet* (the second largest member organisation in the peak organisation for mainly blue-collar workers, *LO*) and *Parat* (the largest member organisation in the peak organisation for white-collar workers, *YS*, the Confederation of Professional Unions). Alternatively, the first head agreements are concluded between *NHO* and *LO* and between *NHO* and *YS.* Such agreements – on wages only – are regularly concluded for the second year of a head agreement (*mellomoppgjør*).

After the first agreements for the frontrunner (*frontfaget,* which may thus refer either to manufacturing or most of the private sector), *NHO* "in common understanding" with *LO*, decides on the scope (*rammen*) for wage increases in manufacturing. This norm is typically followed in subsequent bargaining in the rest of the economy. The norm is a forecast for actual

[8] The account is based on Andersen et al. (2015), Müller et al. (2019), Andersen (2023) and Holden IV-utvalget (2023).
[9] The commissions published their reports in 2000, 2003, 2013 and 2023.

wage increases in manufacturing based on the frontrunner agreement and expected outcomes of subsequent local bargaining. Despite that a major part of actual wage increases in manufacturing is determined at the local level, the forecast has usually been quite accurate (Holden IV-utvalget 2023). One reason for this is that *NHO* exerts strong pressure on firms to stick to the norm.

In case of mediation, the National Mediator (*Riksmekleren*) normally adheres to the norm set in the frontrunner agreement. The same applies for the National Wages Board (*Rikslønnsnemnda*) if an industrial conflict is ended through legislated compulsory arbitration.

2.4 Finland[10]

In Finland, bargaining between economy-wide peak organisations stayed on longer than in the other Nordic countries. It was usually conducted as tripartite bargaining involving also the government, often offering tax cuts or social reforms in exchange for wage restraint. Such centralised incomes policy agreements were common in the 1968–2006 period, although they were occasionally replaced by industry level agreements.

In 2007, the Confederation of Finnish Industries (*EK*), the peak organisation for private employers, decided no longer to take part in centralised bargaining. The next two bargaining rounds were at the industry level. A combination of high wage increases and economic crises (the global financial crisis and a home-grown crisis associated with the collapse of Nokia, falling trade with Russia and stagnating demand for forest and steel products), however, triggered new centralised incomes policy agreements in 2011–16 with the aim of improving international cost competitiveness. At the same time, the leading employer associations in the export sector (technology, forest and chemical industries) campaigned for a transition to industry level pattern bargaining where this sector would set the norm for economy-wide increases, with Denmark and Sweden seen as role models.[11]

A change in this direction occurred in 2016, after the EK had revised its statutes so that it could no longer negotiate binding agreements for member organisations. Subsequently, bargaining has occurred at the industry level with the technology industry as pattern setter. But the system has not yet stabilised. The forest industry has turned to firm level bargaining from 2021 after the Finnish Forest Industries Federation (*FFIF*) abandoned industry level bargaining. The Technology Industries of Finland (*TT*) allows member firms to choose between firm level and

[10] See Müller et al. (2019), Jonker-Hoffrén (2019), Kauhanen (2024) and Kuuskoski (2024) for more details.
[11] Somewhat illogically, the proposal has sometimes been labelled the Finnish model (*Suomen malli)*.

industry level agreements, but – except for IT services – so many member firms have opted for the latter variant that it became binding for all firms in the industry through legislated extension provisions.[12]

Public-sector unions have opposed the idea that they should follow a norm set by the export sector. For the 2023–27 period, municipal-sector unions after a labour market conflict and mediation negotiated a wage programme that will give them wage increases in excess of the general ones in the economy by as much as five percentage points (JHL 2022).

The right-wing government that took office in 2023 has been pursuing an agenda to strengthen the export sector's norm setting. The aim has been to achieve this through negotiations between the parties in the labour market. In addition, the government planned legislation according to which mediation proposals from the National Conciliator's Office (*Valtakunnansovittelijan toimisto*) or a conciliation board could not exceed "the general level of wage increase" (Arbets- och näringsministeriet, 2024). In the final law passed, this was watered down to a formulation that "the mediator, in order to secure the overarching goal of society shall act so that wage formation works in the best possible way and that the functioning of the labour market is not endangered".[13]

2.5 Summing-up

Pattern bargaining at the industry level with manufacturing concluding its agreements first and this way determining the norm for wage increases, is firmly established in Denmark, Norway and Sweden since the end of the 1990s. This system is less established in Finland, where trade unions in the public sector oppose such norm setting. In all the countries, support from the national peak organisations, in particular on the employer side, is important for adherence to the norm.

The role of government for pattern bargaining differs between the countries. In all of them, governments have played some role in initiating the systems either through threats of more government intervention (Sweden and more recently Finland) or through consensus building (Denmark and Norway). Sweden stands out with a clear principle that wage bargaining is the

[12] If the Board for the Ratification of Validity of Collective Agreements considers an agreement "representative" for an industry, usually meaning that it covers at least half the workforce, it becomes universally applicable to all firms there.

[13] Though not inscribed into the law, the government's proposal to the parliament also stated that the mediator "shall guide the parties in the labour conflict to find solutions that are well designed with respect to Finland's competitiveness and a well-functioning wage formation" (Regeringens proposition RP 146/2024).

sole responsibility of the labour market parties and that this rules out government involvement.[14] The other extreme is Norway where cooperation in tripartite institutions, like the Contact Committee (*Kontaktutvalget*) and the Technical Computation Committee (*TBU*), is aimed at building a common understanding of the economic situation before a wage round (Holden IV-utvalget 2023). Proposals on developing the system of pattern bargaining have also been formulated by government commissions, consisting of economic experts and representatives of the labour market organisations. In both Denmark and Norway, tripartite bargaining involving the government happens occasionally.

The moves to pattern setting by the tradables sector in the Nordics have coincided with an increasing role for local bargaining, on both the size of wage increases in individual workplaces and the distribution among employees. In Denmark and Norway, such *organised decentralisation* has gone the furthest in the private sector (where the bulk of wage increases are determined locally, especially for white-collar employees). In Sweden, this development has been much more pervasive for public-sector white-collar employees than private-sector ones. Finland has experimented with hardship clauses, allowing temporary wage cuts in firms in distress, provided that industry level organisations give their approval (Müller, 2018; Jonker-Hoffrén, 2019).

3 The Scandinavian model of wage formation

The idea that the tradables sector should determine wage increases in the whole economy has been embodied in, what is usually referred to as, the Scandinavian model of wage formation. It was first developed in Norway where it grew out of work at Statistics Norway (*Statistisk sentralbyrå)* in the early 1960s. The model was formulated in two reports from a government commission providing the basis for incomes policy settlements (Utredningsutvalget for inntektsoppgjørene, 1966, 1967). Somewhat later, similar ideas were formulated by the chief economists in the peak labour market organisations in Sweden (Edgren et al., 1973).[15] The model has both a positive and a normative side.

[14] Political involvement in bargaining between labour market parties is unusual in Sweden. A rare exception is the reform of employment protection and the simultaneous introduction of a career transition support system for employees in 2022, which was based on intertwined negotiations between political parties and between labour market organisations (Regeringens proposition 2021/22:176).

[15] The reference is to the English version. The Swedish version was published in 1970. It is usually referred to as the EFO model after the initial letters of the authors' surnames.

3.1 The positive interpretation

The original thinking behind the Scandinavian model is laid out in Aukrust (1977).[16] The starting point were three stylised facts: (i) the profit share in the tradables sector fluctuated strongly around a stable mean; (ii) the profit share in the nontradables sector varied much less (around a decreasing trend – taken to depend on falling self-employment); and (iii) wage increases are the same in the two sectors. Several conclusions were drawn from this:

First, there exists a main course (*hovedkurs*) for wage increases in the tradables sector defined by the *room* for them, i.e., the sum of price increase (determined in the world market and thus exogenous to a small economy like Norway at the time with a fixed exchange rate) and productivity increase, resulting in a constant wage, and thus also profit, share in the long term. Wages can deviate from the main course in the short and medium term but this triggers mechanisms that bring them back again. Aukrust (1977) lists three such mechanisms: variations in the profit share (i) affect both union wage demands and employer resistance in collective bargaining; (ii) give rise to variations in labour demand that influence wage drift; and (iii) are associated with changes in the trade balance which may trigger changes in government demand policy.

Second, changes in unit labour costs are shifted on to prices in the nontradables sector, implying that the profit share is more or less constant there. *Third,* wage developments in the nontradables sector follow those in the tradables sector because the two sectors compete for labour and unions look at each other's wage gains changes.

Early research on the Scandinavian model, like Calmfors (1977, 1979), tried to integrate it with Phillips curve analysis by postulating that wage increases in the tradables sector depend on labour market slack (unemployment) and expected price increases for tradables – not CPI increases.

A more satisfactory way of modelling Aukrust's original thinking arose with the development of cointegration theory in econometrics. The idea is then that, although variables such as wages, prices and productivity are non-stationary, i.e., follow stochastic trends, there exist a stationary combination of them. According to the technical jargon, the variables are cointegrated. This means that there exists a long-run relationship between the wage and the value added per unit of labour in the tradables sector which the economy strives towards. Models of this type are

[16] Odd Aukrust was director of research at Statistics Norway 1953–84 and chair of the government commission for the incomes policy settlements in 1966 and 1967.

labelled error correction models. The assumption is that the larger the "error", i.e., the difference between the actual wage and the wage given by the long-run relationship, the faster is the adjustment to it.

Several studies have found support for such an error-correction interpretation of wage formation in Norwegian manufacturing and some also in the other Nordic countries.[17] Two recent contributions are Gjelsvik et al. (2020) and Dalnoki (2020), who also find that wages in the nontradables and public sectors follow those in manufacturing in an error-correction fashion.[18]

3.2 The normative interpretation

There is a small step from the idea that deviations of wages from a main course trigger mechanisms which bring them in line with it again to a normative prescription that the labour market parties *should* try to set wages so that they follow this course. If an upward (downward) deviation from the room for wage increases causes unemployment (labour shortages) that lower (raise) wages again, there is a welfare gain from avoiding these fluctuations in economic activity by adhering to the main course in the first place (e.g., Facken inom industrin, 2015; Holden IV-utvalget, 2023). Wage increases in line with the main course are often also seen as motivated in order to ensure a size of the tradables (export) sector allowing desired imports to be financed (e.g., Aukrust, 1977; Holden IV-utvalget 2023). In addition, it has been argued that if wages in the nontradables and public sectors follow those in the tradables sector, all sectors are assured of labour supply and conflicts over relative wage changes mitigated (e.g., Andersen, 2023; Holden IV-utvalget, 2023; Lønstrukturkomitéen, 2023).

Since productivity growth varies much over the business cycle, wage increases would be very volatile if they adjust to *actual* productivity growth in the short term. Therefore, it has become customary instead to base the Scandinavian-model wage norm on assessments of *potential* productivity growth, which is then taken as exogenous. This is, however, potentially problematic, as higher wage increases tend to raise productivity growth by increasing the capital-

[17] Early studies for Norway include Nymoen (1989, 1991), Langørgen (1993) and Johansen (1995). Calmfors & Nymoen (1990), Bårdsen et al. (2005) and Forslund et al. (2008) are early examples of studies of all Nordic countries.

[18] In addition, it is well documented that wage increases over time in the Nordics have been similar across sectors (e.g., Brubakk & Hagelund, 2022; Holden IV-utvalget, 2023, Lønstrukturkomitéen, 2023; Ejrnæs & Würtz, 2024; Medlingsinstitutet, 2024).

labour ratio in production.[19] This endogeneity problem of productivity growth is seldom discussed when the Scandinavian model is used as a wage norm.

Another problem concerns the exchange rate system. The Scandinavian model was developed for a fixed exchange rate, which all the Nordic countries earlier tried to maintain (although there were devaluations from time to time). Then, anticipated foreign price increases for tradables served as a good predictor of domestic-currency price increases for these goods. This no longer holds with a flexible exchange rate. A norm aiming at a constant wage share in the tradables sector must then also take exchange rate changes into account. As flexible exchange rates are difficult to predict, this implies much larger uncertainty regarding the room for wage increases than under a fixed exchange rate.

This uncertainty can be addressed in different ways. One is to base the assessment of the room for wage increases on a calculation of an equilibrium exchange rate and a projected path to it. But such computations are uncertain and there can be substantial long-term deviations from calculated equilibrium values, as shown by the large and persistent depreciations of the Norwegian and Swedish currencies in 2013–24. An alternative is to assume a random walk for the exchange rate, implying that the current exchange rate is also the most likely future outcome. A third possibility is to calculate the exchange rate compatible with the inflation target and use that for predicting domestic-currency price changes for tradables. Appendix A shows that this, under Scandinavian-model assumptions, gives a room for wage increases equal to the sum of the inflation target and average productivity growth in the economy, so the latter could be a way of formulating the Scandinavian wage norm under inflation targeting. However, because of the erratic behaviour of exchange rates, large differences between the rate required to reach the inflation target and the actual rate are likely to emerge. Hence, large swings in the wage share in the tradables sector can arise under a flexible exchange rate.

Another perspective on a Scandinavian-model wage norm concerns the risk for wage-price spirals. Kolsrud & Nymoen (2023) analyse in a stylised model whether, after a series of shocks, there is a return to stable price and wage growth. It is found that, for a large range of unemployment levels, there is indeed such a return if wage increases depend not only on unemployment and past consumer price increases (a version of the Phillips curve) but also (negatively) on the wage share in the tradables sector. The latter relationship is taken as a

[19] Indeed, with a Cobb-Douglas production function, which implies a constant wage share, any wage change will equal the sum of price and productivity changes.

reflection of wage setters acting in line with a Scandinavian-model norm by trying to gradually adjust wages to the main course. With low unemployment, stability is attained at a high wage share, with high unemployment at a low wage share. If wage changes are determined in a pure Phillips curve fashion, such stability is obtained only at a specific rate of unemployment (the NAIRU).

Bjørnstad (2023) argues that, under inflation targeting, wage formation according to the Scandinavian model by itself eliminates the risk that a bout of foreign inflation could trigger a domestic wage-price spiral, because when wages have adjusted to the higher prices of tradables, no further wage responses to the higher CPI level induced by subsequent increases in prices of nontradables will occur. Hence, in his view such a foreign inflation shock would not require any interest hikes to stem additional domestic wage and price increases.

Bjørnstad's reasoning has been criticised by Røisland (2023a) for implicitly assuming a fixed exchange rate.[20] According to the latter, holding the interest rate constant in the above case would result in an exchange rate depreciation, causing further wage increases in the tradables sector to counteract a fall in the wage share. To stop such a wage-exchange rate spiral, the central bank must raise the interest rate sufficiently. The rise required is lower if wages are linked not only to the price of tradables but also to the CPI. This is because the interest rate increase then not only strengthens the exchange rate and thus limits the price increase for tradables, but also, by decreasing aggregate demand, reduces the rise in the non-tradables price, with an additional dampening effect on the CPI. The latter effect is absent when only the price of tradables affects wages. In contrast, Røisland (2023b) shows that stopping a wage-price spiral in the case of a domestic inflation shock requires a smaller interest rate increase, the more the wage depends on the price of tradables as opposed to the CPI.

3.3 The Scandinavian model and international capital mobility

The normative prescription that wage cost developments in the tradables sector should follow the room given by price and productivity increases there is sometimes motivated by *relative-profitability* concerns vis-à-vis other countries.[21] With free capital mobility, the return to capital in the domestic tradables sector must be the same as abroad if capital is not to be reallocated.

[20] A similar criticism could be directed against the Nymoen-Kolsrud (2023) analysis, as it assumes a random walk for the exchange rate.
[21] E.g., Holden IV-utvalget (2023), Section 3.3. See also Calmfors et al. (2019).

With a lower (higher) return, capital is exported (imported) and the tradables sector shrinks (expands).

A constant wage share implies a constant gross profit share. The latter means a constant net return to capital if the capital-output ratio and the depreciation rate of capital are also constant.[22] Thus, a constant wage share can be taken as an indication of a constant net return to capital. But the relative return to capital vis-à-vis the rest of the world is unchanged only if the foreign return to capital is unchanged. Using changes in wage shares as proxies for changes in the return to capital, the (approximate) condition for an unchanged relative return to capital is:

$$\Delta s_T^H \approx \Delta w_T^H - \Delta p_T^H - \Delta q_T^H = \Delta w_T^F - \Delta p_T^F - \Delta q_T^F \approx \Delta s_T^F, \qquad (1)$$

where Δs is the percentage change in the wage share, Δw the percentage change in the wage, Δp the percentage change in the product price, and Δq the percentage change in productivity. Subscript *T* denotes the tradables sector and superscripts *H* and *F* home and foreign country, respectively.[23] The equation states that the percentage change in the home and in the foreign wage share in the tradables sector should be (approximately) equal. As the percentage change in the wage share (approximately) equals the difference between the percentage wage change and the sum of percentage price and productivity changes, this difference must be the same at home and abroad.

Equation (1) can be rewritten:

$$\Delta w_T^H \approx \Delta p_T^H + \Delta q_T^H + \Delta s_{T.}^F \qquad (2)$$

Equation (2) is a modified Scandinavian-model room for the wage increase, according to which it should (approximately) equal the sum of domestic price and productivity increases in the tradables sector augmented by the change in the wage share in the foreign tradables sector. Thus, to obtain a benchmark for the wage increase that maintains a constant *relative* rate of return vis-à-vis the rest of the world, the "traditional" room for wage increases according to the Scandinavian model should be adjusted for the change in the wage share abroad.

Alternatively, equation (2) can be written:

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[22] Let R be the net rate of return to capital, π gross profits, K the capital stock, D depreciation and Y output, all measured in real terms. Then $R = (\pi - D)/K = (\pi/Y) \times (Y/K) - (D/K)$. Hence, if the capital-output ratio, K/Y, and the depreciation rate, D/Y, are given, a constant gross profit share, π/Y, implies a constant net rate of return to capital, R.

[23] If w_T^i is the wage, L_T^i hours worked, p_T^i the product price, Y_T^i output, $q_T^i = Y_T^i/L_T^i$ labour productivity, all in the tradables sector, and $i = H, F$, the wage share is $s_T^i = w_T^i L_T^i / p_T^i Y_T^i = w_T^i / p_T^i q_T^i$. Then equation (1) follows.

$$\Delta w_T^H \approx \Delta w_T^F + (\Delta p_T^H + \Delta q_T^H) - (\Delta p_T^F + \Delta q_T^F) \quad (3)$$

or

$$\Delta w_T^H - \Delta q_T^H \approx (\Delta w_T^F - \Delta q_T^F) + (\Delta p_T^H - \Delta p_T^F). \quad (4)$$

According to equation (3), the constant-relative-return benchmark for the wage increase would thus be the foreign wage increase plus the difference between the domestic and the foreign rooms for wage increases, $(\Delta p_T^H + \Delta q_T^H) - (\Delta p_T^F + \Delta q_T^F)$. If these rooms are equal, the benchmark is that wage changes should be the same. Alternatively, the benchmark can be expressed as equation (4), which states that the change in the domestic unit labour cost should (approximately) equal the sum of the change in the foreign unit labour cost and the difference in price changes.[24] If price increases are the same, the condition simplifies to changes in unit labour costs being the same.[25]

4 Recent wage and wage cost developments in the Nordics

This section shows various measures of wage and wage cost developments in manufacturing (as a proxy for the tradables sector) in the Nordic countries.

4.1 Nominal wage cost and real wage changes

Figure 1a shows annual nominal wage cost changes in manufacturing in the Nordic countries and in the euro area in 2001–23. Among the Nordic countries, average increases were the highest in Norway, 4.1%, and the lowest in Finland and Denmark, 2.7% and 2.8% respectively, with Sweden, 3.1%, in between. The high wage cost increases in Norway occurred mainly in the first decade of the millennium. Denmark exhibits the most stable growth in wage costs, whereas it has been most volatile in Finland. There, high increases in 2007–09 were followed by a fall in 2010. The years 2016–17 were also characterised by much wage restraint. In all countries, wage cost increases were lower in the decade preceding the 2020 pandemic than in 2001–10. There were only modest rises in wage cost increases in 2022–23 despite high consumer price increases.

[24] The unit labour cost is defined as $w_T^i L_T^i / Y_T^i = w_T^i / q_T^i$. It follows that $\Delta w_T^i - \Delta q_T^i$ is the (approximate) percentage unit labour cost change.

[25] It does not matter for the comparison of changes in wage shares whether or not wage and price variables are measured in national currencies or in common currency.

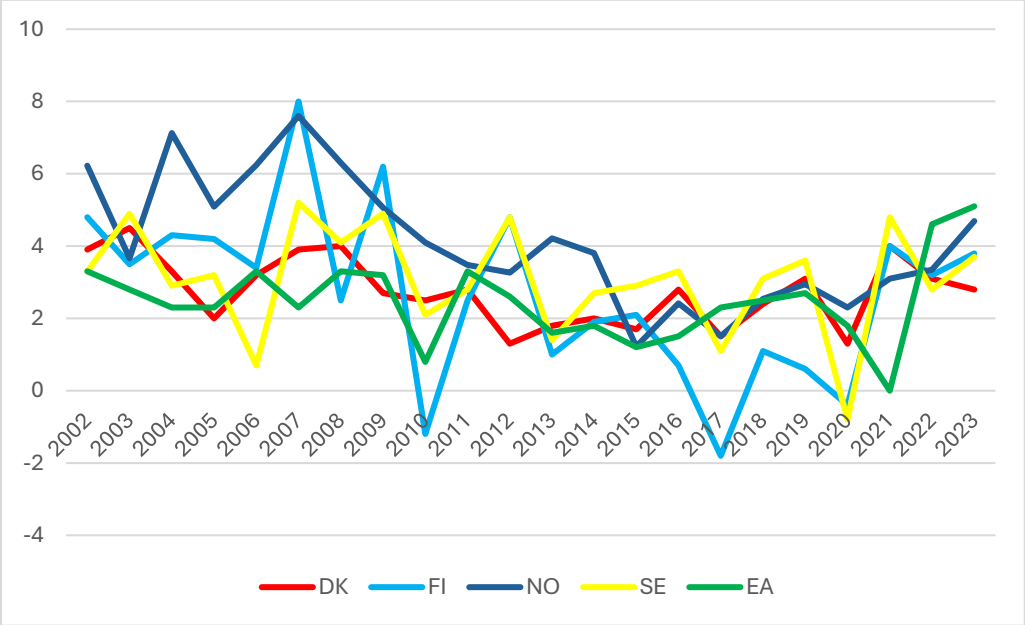
Figure 1b shows changes in the real consumption wage (the nominal wage deflated by the CPI) in manufacturing. Since nominal wage increases stayed far below the high inflation in 2022–23, all the Nordic countries then exhibited substantial real wage falls. They were the largest in Denmark and Sweden.

4.2 Wage shares

Figures 2a and 2b show that in Finland, Norway and Sweden no major long-term changes in the wage shares of value added in manufacturing occurred between 2000 and 2021. This is in line with the Scandinavian model. However, in Finland, there was a substantial increase in the share in 2008–12 followed by a strong decline. Denmark deviates from the picture of a stable long-term wage share with a steady decline from 2010.[26] The diagrams also show a more or less stable wage share in the euro area in the 2000–21 period. In 2021–23, the wage share fell in Denmark, Norway and Sweden as in the euro area, but the falls were larger in the three Nordic economies.

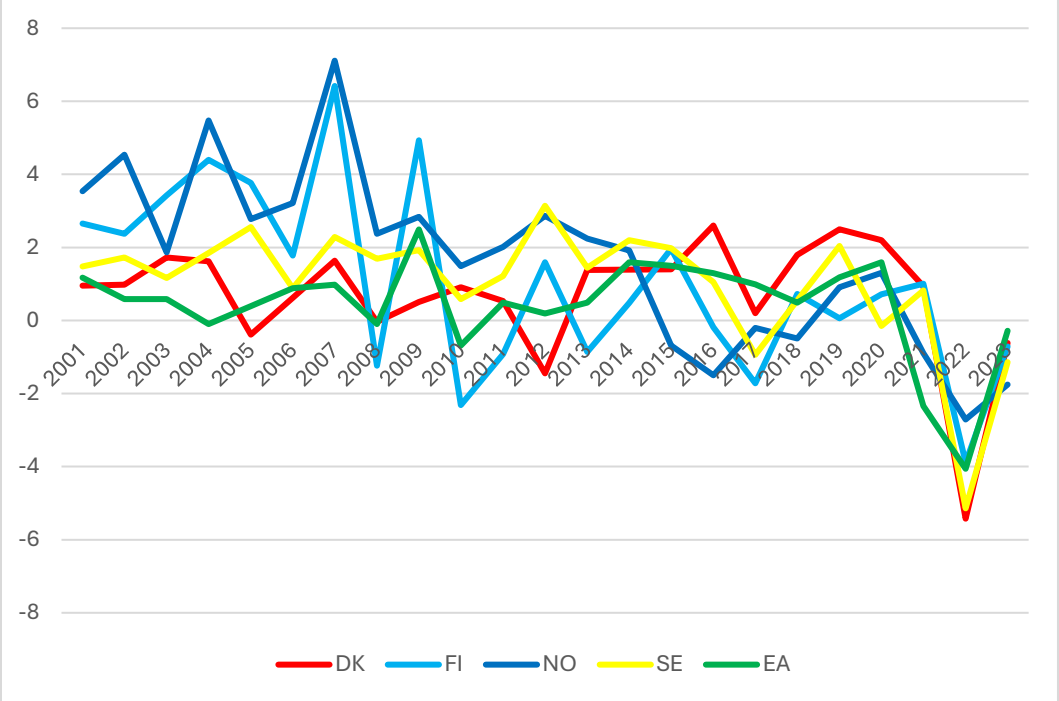
[26] Structural shifts appear to be an important factor behind the trendwise fall in the wage share in Denmark: the relative importance of a small number of very large firms with low wage shares has increased at the same time as wage shares have fallen there. These firms have had large and increasing revenues from *merchanting and processing* (foreign sales of goods that are produced or purchased abroad and thus never cross the Danish border). See e.g., De Økonomiske Råd Formandskabet (2024).

Figure 1a. Annual nominal hourly wage cost change in manufacturing in the Nordic countries and the euro area, per cent



Sources: Eurostat (all countries except Norway), Statistics Norway (Norway).

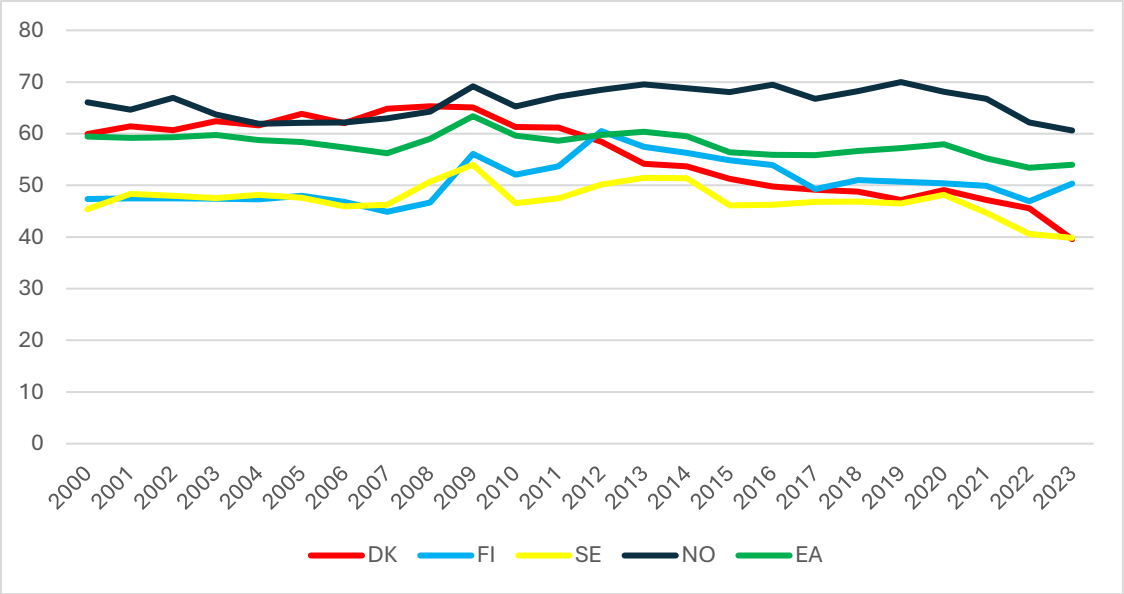
Figure 1b. Annual hourly real wage change in manufacturing in the Nordic countries and the euro area, per cent



Note: Nominal wages have been deflated by the HICP (Harmonised Index of Consumer Prices).

Sources: Eurostat and national statistical offices.

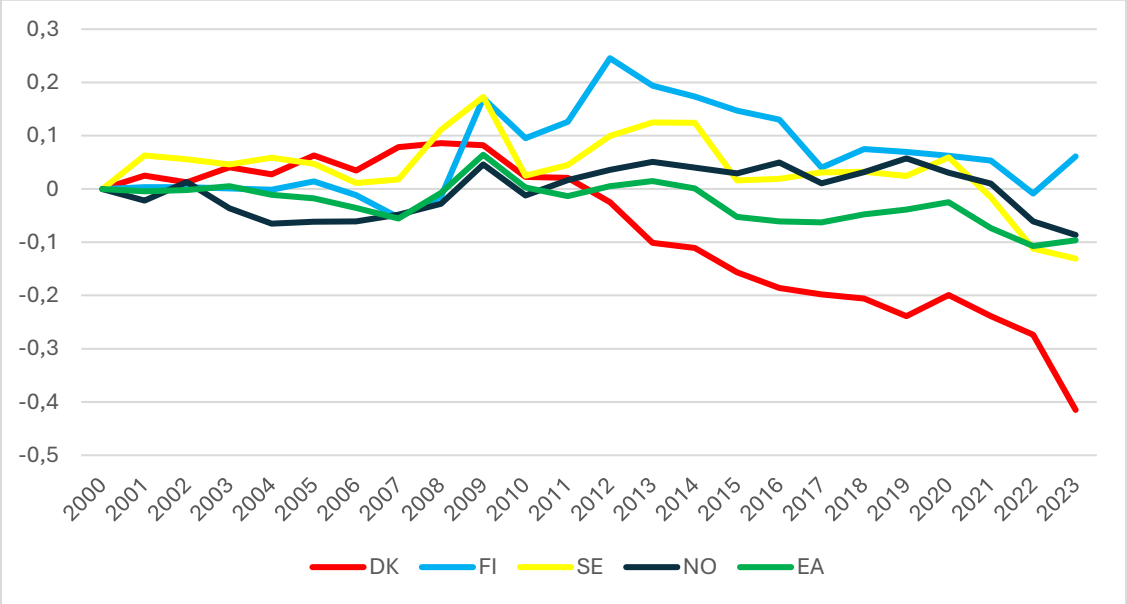
Figure 2a. Wage share in manufacturing in the Nordic countries and the euro area, per cent of value added



Note: The wage share is the compensation of employees (wages, salaries, and employers' social contributions) divided by value added.

Source: OCED.

Figure 2b. Wage share in manufacturing in the Nordic countries and the euro area, index



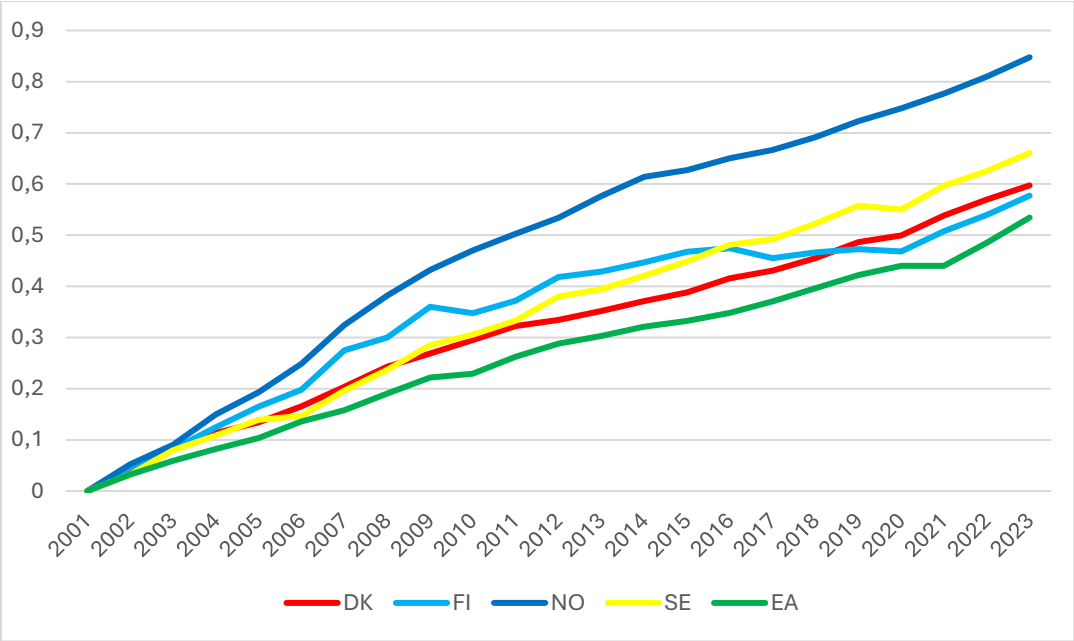
Note: The index is set to 1 in 2000. The diagram shows the log of the index. Hence, the value is 0 in 2000 and the slopes of the curves approximate relative changes. See also Figure 2a.

Source: Own calculations based on OECD data.

4.3 Wage cost levels

Figures 3a and 3b show the cumulative development in 2000–23 of nominal wage costs in national currency and in euros, respectively. Although wage costs rose much more in Norway and Sweden than in the euro area in national currencies, they increased somewhat less in common currency. The difference is due to the large depreciations of the two countries' currencies since 2013. Wage costs in euros increased more in Denmark and Finland than in both Norway and Sweden as well as in the euro area.

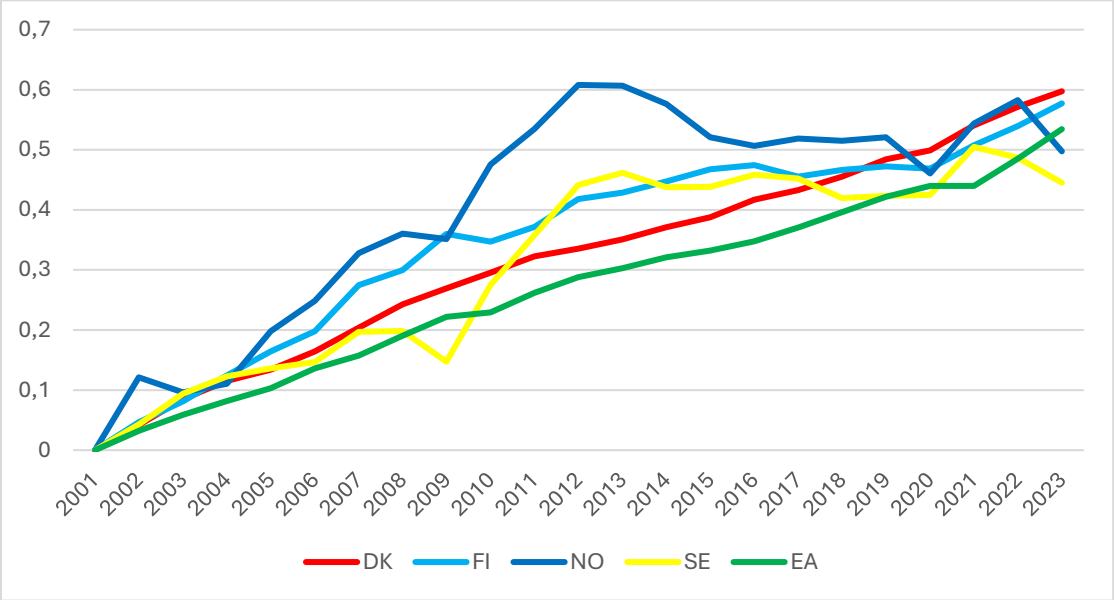
Figure 3a. Nominal hourly wage cost in national currency in manufacturing in the Nordic countries and the euro area, index



Note: See Figure 2b.

Sources: Own calculations based on Eurostat (all countries except Norway) and Statistics Norway (Norway).

Figure 3b. Nominal hourly wage cost in euros in manufacturing in the Nordic countries and the euro area, index



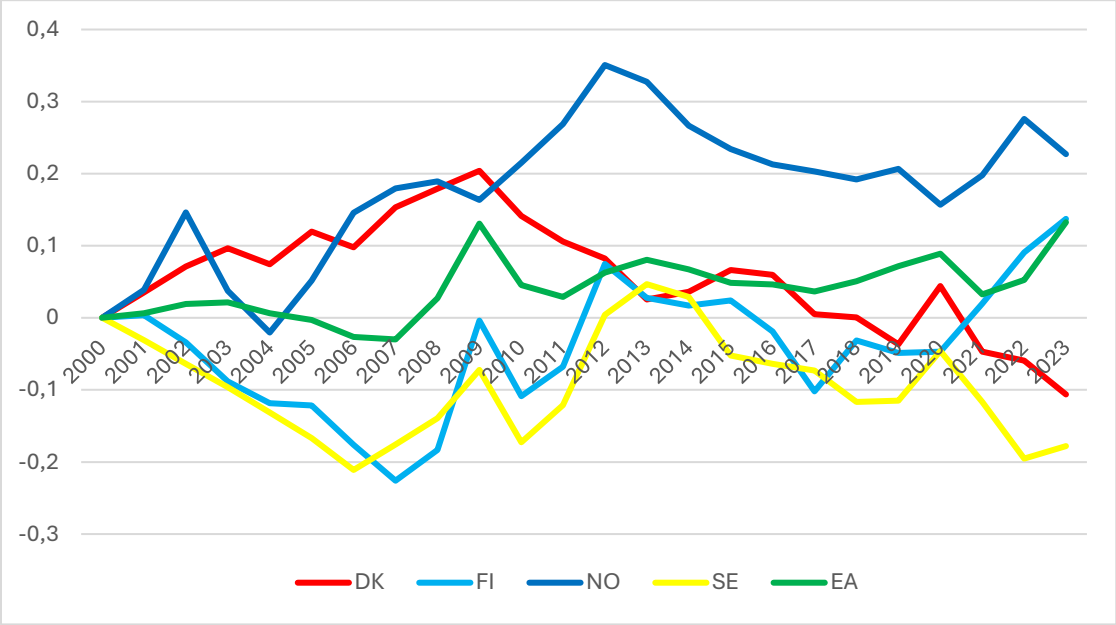
Note: See Figure 2b.

Sources: Own calculations based on Eurostat, Statistics Norway and ECB.

4.4 Unit labour cost levels

According to Figure 4a, the unit labour cost in manufacturing in national currency fell over the 2000–23 period in Sweden and Denmark, reflecting strong productivity growth. The Finnish unit labour cost increased in line with that in the euro area, whereas Norwegian costs rose more. Measured in euros, the fall in the Swedish unit labour cost is even more pronounced, and the Norwegian cost also decreased.

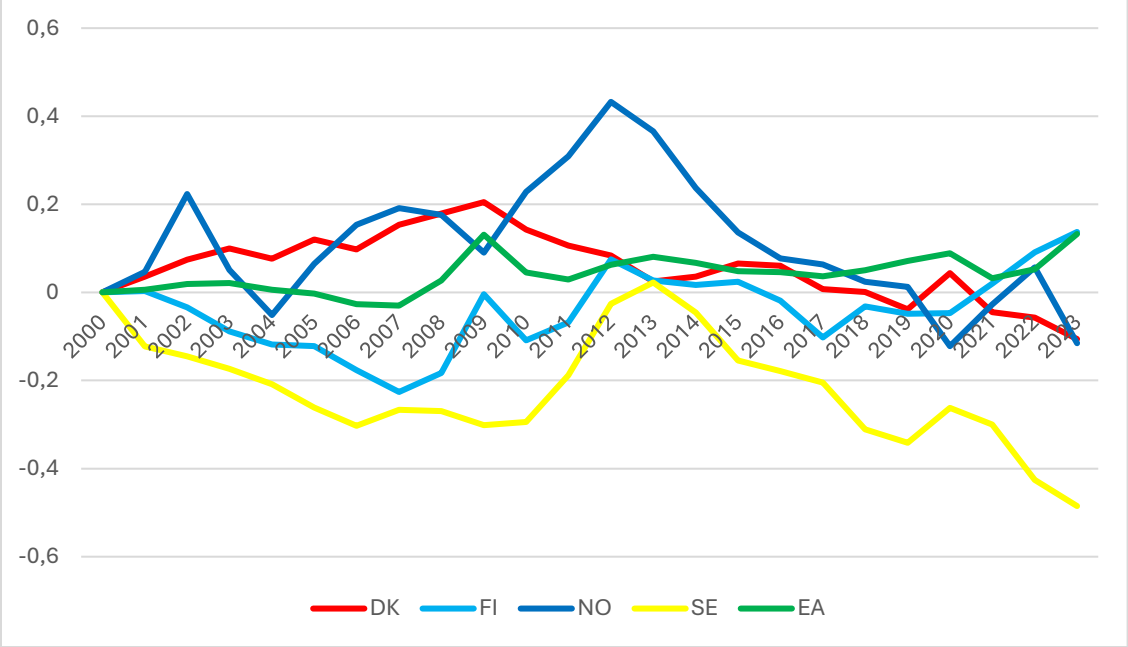
Figure 4a. Unit labour cost in national currency in manufacturing in the Nordic countries and the euro area, index



Note: See Figure 2b.

Source: Own calculations based on Eurostat.

Figure 4b. Unit labour cost in euros in manufacturing in the Nordic countries and the euro area, index



Note: See Figure 2b.

Source: Own calculations based on Eurostat and ECB.

4.5 Overall picture

The above diagrams show wage cost developments in line with unchanged, or even improved, international competitiveness over the last two and a half decades in the Nordic countries. There have been only limited fluctuations in the manufacturing wage share in Norway and Sweden. Finland exhibits more variability, with a large increase in 2008–12 followed by an approximately equally large decrease. The developments in those three countries thus conform to the Scandinavian model. In Denmark, there has, however, been a trendwise decline in the wage share in manufacturing. In all four Nordic countries, wage costs did not keep up with price and productivity increases during the recent inflation period, reflecting substantial wage moderation resulting in large real wage declines. They were the largest in Denmark and Sweden.

Over the whole 2000–23 period, manufacturing wage costs in national currency rose faster in all the Nordic countries than in the euro area, and especially so in Norway. But when measured in common currency, wage costs in Sweden, and also in Norway, fell relative to those in the euro area. This is a consequence of the large depreciations of the Swedish and Norwegian currencies. In terms of unit labour costs in common currency, there has been a huge fall relative to the euro area for Sweden, but also substantial falls for Denmark and Norway, depending partly on favourable productivity developments relative to the euro area.[27]

The large trade surpluses since the turn of the millennium in Denmark, Norway and Sweden is another indication of strong international competitiveness, although the situation is, of course special in Norway due to the large petroleum exports (see Table 2). Finland differs with small trade deficits in recent years.

Table 2. Trade balance as a share of GDP in the Nordic countries, per cent

	2000–09	*2010–19*	*2020–23*
Denmark	4.8	6.1	7.5
Finland	5.7	-0.6	-0.7
Sweden	6.1	3.7	3.9
Norway	15.1	7.3	15.3

Sources: Eurostat, Statistics Denmark and Statistics Norway.

[27] In the Swedish discussion, a “European norm”, according to which domestic wage costs should increase at the same pace as wage costs in Europe, has sometimes been advocated (Edingruppen, 1995, was the original proposal). It has not always been clear whether the comparison should be made in national currencies or in common currency and whether the norm applies to wage costs or unit labour costs (see Gottfries, 2018, for a critique).

5 Pattern bargaining and wage restraint

Below, both informal and formal analyses of the argument that pattern setting by the tradables sector promotes wage moderation are reviewed (see e.g., Holden IV-utvalget 2023; Lønstrukturkomitéen, 2023; Kuuskoski, 2024; Medlingsinstitutet, 2024 for various expositions of this argument).

5.1 Informal reasoning

The traditional argument for why wage leadership of the tradables sector is conducive to wage restraint is that this sector is the one hurt the most by excessive wage increases (Aukrust, 1977). The reasoning was developed for a fixed exchange rate. Since foreign competition makes it difficult to shift wage increases on to prices in the tradables sector, it has a strong incentive for wage moderation as there would otherwise be large adverse effects on profits and employment. In contrast, the negative consequences for profits and employment of large wage rises are much smaller in the nontradables sector because prices there can be raised. Such price rises are likely to have strong adverse effects on the tradables sector, both directly by driving up its input prices and indirectly if employees there press for high wage increases in order to compensate themselves for the CPI increases.

The reasoning loses some of its strength when it comes to earlier Nordic wage determination in the 1960s, 1970s and 1980s since the fixed exchange rates in Finland, Norway and Sweden then were not really fixed: instead, there were repeated devaluations to restore international cost competitiveness after periods of high wage increases. If such exchange rate accommodation was anticipated, the wage restraint logic above did not apply except to the extent that there were long lags between, on one hand, the devaluations and, on the other hand, the profit and employment deteriorations. The argument is stronger with the Danish credible exchange rate peg since 1979 and the Finnish eurozone membership since 1999.

How does the reasoning above translate to inflation targeting? It has been argued that there is then a *double* incentive for wage restraint in the tradables sector (e.g., Konjunkturinstitutet, 2012; Facken inom industrin, 2015; Holden IV-utvalget, 2023). The reason is that when high wage rises drive up price increases for nontradables, and thus also CPI inflation, the central bank raises the interest rate to defend the inflation target. This causes the currency to appreciate. The consequence is additional profit and employment reductions in the tradables sector compared to the fixed-exchange rate case.

One could, however, argue that under inflation targeting, the nontradables sector, too, has strong incentives for wage moderation (Calmfors, 2008). The reason is that demand for its products, and thus profits and employment in the sector, are negatively affected by interest rate rises aimed at counteracting deviations from the inflation target. This channel may be more certain than the exchange rate channel for the tradables sector discussed in the previous paragraph.[28] Because a higher price level in itself tends to weaken the currency, one cannot be assured that the combination of higher inflation and interest rate hikes to counter it causes the exchange rate to appreciate rather than depreciate.[29]

5.2 Formal analysis

Informal reasoning cannot capture more complex interactions between sectors. For example, since wages in the tradables sector affect output and income there, demand for nontradables, and thus their prices are influenced, which in turn has consequences for the purchasing power of wages and profits in the tradables sector. Also, wage rises in the nontradables sector, by affecting prices there, increase production costs in the tradables sector to the extent that it uses nontradables as inputs, which lowers output of tradables and thus has repercussions for the demand for nontradables.

In game-theoretical terms, one can conceive of three ways of analysing pattern bargaining:[30] (i) as a *cooperative solution* where weight is given to the welfare effects of wage increases in each part of the economy on other parts; (ii) as a *Stackelberg game*, where the parties in the leader sector try to maximise their own welfare, taking into account that followers will do the same; and (iii) as a game where parties in the leader sector try to maximise their own welfare under the constraint that followers are bound by a *social norm* making them choose the same wage (increases) as the leader.

Pattern bargaining as centralisation in disguise

Earlier centralised bargaining between peak labour organisations can be seen as a way of internalising *externalities* of wage setting, i.e., of caring about how wage changes in one area affect other areas. Bargainers in peak organisations are then assumed to try to maximise welfare functions which assign weights to all the members whom they represent. Several negative

[28] Gottfries (2010), however, argues that the negative demand effects of higher interest rates may take time to materialise and that demand for nontradables is likely stimulated in the short run by higher real wage increases.
[29] According to standard interest rate parity theory, an interest hike causes the currency to appreciate relative to the expected future exchange rate. But because inflation raises the price level, the expected future exchange rate likely depreciates.
[30] Vartiainen (2010) makes similar distinctions.

externalities of high wages in an individual part of the economy have been identified (see e.g., Calmfors, 1993) This explains why centralised bargaining likely produces wage restraint.

Calmfors & Driffill (1988) focused on consumer price externalities: a wage rise in one industry pushes up prices there, which reduces the purchasing power of incomes elsewhere. There are also fiscal externalities. A wage increase in one area, reducing output and employment there, could decrease the tax base to the detriment of other areas. If such a wage increase causes higher costs for unemployment benefits, these are mainly paid for by the rest of the economy. There are also unemployment (hiring) externalities because higher unemployment in one part of the economy makes it harder for unemployed workers elsewhere to find jobs.[31] Another unemployment externality arises if wage increases in one area raises inflation and this induces the central bank to adopt a more contractionary monetary policy (e.g., Soskice & Iversen 2000).[32] Also, there could be envy effects: workers in one sector could perceive their utility to fall if their relative wage decreases due to another group´s wage increase.

A possible hypothesis is that pattern setting by the tradables sector internalises wage externalities in a similar way as bargaining between peak organisations. Pattern bargaining would then work as *centralisation in disguise* where bargaining has been delegated to the tradables sector (manufacturing). It thus bargains on behalf also of all other sectors, which follow the wage increases negotiated by it. One could conceive of the bargaining stance of the parties in the tradables sector as having been determined through informal negotiations with the other parties on the same side of the labour market in the rest of the economy, giving more or less the same results as formal decision-making within peak organisations. Alternatively, the tradables sector unions and employers' associations could be taken to behave *as if* there had been such negotiations because they realise that the delegation of bargaining to them is conditional on their acting in the interest of *all* unions and *all* employers' associations, respectively.

[31] Krusell & Rudanko (2016) is a recent paper stressing such hiring externalities. A positive demand externality arises if a wage increase in one part of the economy causes higher demand in another part because the goods produced are substitutes. Calmfors & Driffill (1988) argue that this is the case for different firms in the same industry. Hence, industry level bargaining may imply higher wages than firm level bargaining (the Calmfors-Driffill hump shape hypothesis).

[32] This externality is internalised by centralised bargaining in an economy with an own currency, as the central bank there responds to domestic inflation. In contrast, such internalisation occurs to a very small extent in an economy participating in a monetary union, because monetary policy is then pursued by a common central bank which reacts to union-wide inflation.

It makes sense to analyse bargaining as a *repeated game*. It is well-known that a cooperative solution may then be upheld if an individual participant's short-run gain from defecting from this equilibrium is outweighed by the long-run loss if the consequence is a breakdown of future cooperation. This requires the effective discount factor, the factor by which future outcomes are discounted, to exceed some critical level, so that sufficient weight is given to them. Holden & Raaum (1991) provide such an analysis of bargaining cooperation.[33]

It is an implicit assumption in many analyses that pattern bargaining and centralised bargaining achieve similar internalisation of externalities.[34] Empirical studies often classify both bargaining systems in the same category, which is found to be conducive to low unemployment, interpreted as evidence of wage restraint. An exception is OECD (2018), which distinguishes between "predominantly centralised and coordinated bargaining systems" and "organised decentralised and coordinated systems", the former corresponding to peak level bargaining and the latter to pattern setting by the tradables sector, but still finds that both systems promote high employment.[35]

An obvious problem with the interpretation of pattern bargaining as centralisation in disguise is that the transition from formal centralisation is left unexplained. Why did moves from the earlier system to today's one occur if they deliver similar outcomes?

Stackelberg solutions

Another interpretation of pattern bargaining is as a Stackelberg game. Then, bargainers in the sector concluding the first agreement (the leader) are not concerned with welfare in other sectors (followers) per se. Instead, the agents in the leader sector try to maximise their welfare, but when doing so, the effect of the own wage decision on follower wages and the subsequent repercussions on the own sector are considered.

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[33] In their analysis, if the bargaining power of industry unions is sufficiently strong, they may prefer a cooperative solution with lower wages than would be the outcome of uncoordinated industry level bargaining (which is also in the interest of employers). If some union defects from this cooperative equilibrium, future cooperation breaks down (and is replaced by uncoordinated industry level bargaining). A cooperative equilibrium is reestablished with an exogenously given probability in each period. Under certain conditions, the cooperative solution mimics the outcome with a centralised monopoly union deciding wages unilaterally.

[34] Holden IV-utvalget (2023) is one example. Another is Bhuller et al. (2022) who seem implicitly to assume that pattern bargaining implies internalisation of externalities. Barth et al. (2023) find that increased import competition from China caused decreases in manufacturing employment in European countries with low wage coordination but not in countries with pattern setting by the tradables sector. This is explained by more wage restraint in the non-tradables sector in the latter countries, holding down input prices of the tradables sector, because of internalisation of this externality.

[35] According to the OECD's terminology, the degree of centralisation refers to the level of bargaining in each part of the economy but may imply different degrees of coordination with other parts.

Calmfors & Seim (2013) analyse such games between a tradables and a nontradables sector. The model is neoclassical with output and employment in each sector depending negatively on the real product wage (the ratio between the wage and the product price) there. In each sector, an employers' association bargains with a union. The former tries to maximise real profits (nominal profits deflated by the CPI), the latter a utility function which depends positively on the real consumption wage (the nominal wage deflated by the CPI) and employment. Stackelberg equilibria with either the tradables or the nontradables sector as leader are compared with uncoordinated wage setting (a Nash equilibrium), where the two sectors determine their wages simultaneously, taking the wage in the other sector as given.

With membership in a *monetary union* (or a credible exchange rate peg), Calmfors & Seim find leadership for the tradables sector to imply a *higher* real consumption wage there and *lower* aggregate employment than uncoordinated bargaining. The explanation has to do with the perceived trade-off in the tradables sector between, on one hand, the gain in the real consumption wage for employees and, on the other hand, the losses in terms of employment and real profits from a nominal wage increase. The accompanying fall in output of tradables, and hence in incomes in that sector, reduces demand for nontradables and therefore their price as well as the CPI. This reinforces the gain in the real consumption wage in the tradables sector (and tends also to raise the purchasing power of nominal profits there). The effect is boosted with wage leadership for the tradables sector because wage setters there then realise that the fall in demand for nontradables induces a decrease in the nontradables sector wage, which will cause a further fall in the price of nontradables and thus in the CPI. This gives a stronger incentive to choose a high wage in the tradables sector when it acts as Stackelberg leader than when bargaining is uncoordinated. In contrast, leadership for the nontradables sector promotes wage restraint. Then, the real consumption wage in the nontradables sector is lower, and aggregate employment higher, than with uncoordinated bargaining and thus also than with tradables sector leadership. These results are thus the exact opposite to the conclusions from informal analysis..

Under *inflation targeting*, Calmfors & Seim assume that the central bank pursues monetary policy so that the exchange rate adjusts in such a way that the target is met. Then, wage leadership for any of the sectors and uncoordinated bargaining produce identical outcomes. This is because the real consumption wage in each sector turns out to be a constant mark-up on the (exogenous) income as unemployed. Hence, the nominal wage in a sector changes (equiproportionally) only when the CPI changes. But if the central bank holds the CPI fixed,

this shuts down the effect of a wage change in one sector on the wage in the other sector. Thus, the wage in the other sector is taken as exogenous also under wage leadership and the optimisation problem becomes the same as under uncoordinated bargaining.

Vartiainen (2010) analyses a similar model as Calmfors & Seim, although the assumption is that wages are set by unions and not through bargaining. In his analysis, under *inflation targeting*, pattern setting by *any* of the sectors gives lower wages and higher employment than uncoordinated bargaining if tradables and nontradables are not easily substitutable for each other.[36]

Juvonen (2023) uses a dynamic stochastic general equilibrium (DSGE) model with New Keynesian features, i.e,. with slow adjustment of nominal prices. A tradables sector produces only export goods. Exporters are not price takers, as in the Calmfors-Seim and Vartiainen models, but monopolistically competitive firms with sales depending on the relative price vis-á-vis foreign competitors. Consumption comprises import goods, with a price given from abroad, and nontradables. The latter are also used as inputs in the production of tradables. A union in each sector sets the wage by maximising the expected lifetime utility of a representative member with per-period utility depending positively on consumption and leisure.[37]

Juvonen's analysis is restricted to the monetary-union case. Like Calmfors & Seim (2013), he finds that pattern setting by the tradables sector gives a higher wage in that sector and lower aggregate employment than uncoordinated wage setting. Unlike in Calmfors & Seim, leadership for the nontradables sector results in a higher wage there and lower aggregate employment than in the uncoordinated equilibrium. But leadership for the tradables sector is associated with more aggressive wage setting and lower international competitiveness (higher export prices) than leadership for the nontradables sector, as in Calmfors and Seim's analysis.

Pattern bargaining as a social norm

A third approach is to assume that the agents in the leader sector set the wage there by maximising their own welfare, knowing that a social norm will make followers choose the same wage (increases). Vartiainen (2010) shows that such behaviour on the part of the follower, under *inflation targeting*, restrains the leader's choice of wage strongly, more so than in the

[36] The condition is an elasticity of substitution smaller than unity. Calmfors & Seim instead assume an elasticity of substitution equal to unity, i.e., a Cobb-Douglas utility function, resulting in constant expenditure shares for the two goods.

[37] Like in most DSGE models, changes in employment take the form of changes in a representative worker's amount of work, not in the number of employed persons.

Stackelberg case. In the model, a fixed relative wage implies a fixed relative price between the sectors.[38] Hence, if the CPI is held constant by the central bank, the increase in the real product wage, and hence the fall in employment, in the leader sector caused by an increase in the nominal wage there is not mitigated by an increase in the product price.[39] The mimicking of the leader´s wage increases by the follower disciplines the leader as she realises that high wage increases on her part induces the same behaviour by the follower with an adverse effect on her own welfare. The restraining forces are the same irrespective of whether the tradables or the nontradables sector is leader.

Juvonen (2023) draws similar conclusions regarding the social-norm case as Vartiainen but for *monetary-union membership*. It is demonstrated that pattern setting with mimicking of the leader's wage gives a lower tradables sector wage, a lower export price, higher aggregate employment and higher aggregate welfare than both uncoordinated bargaining and leadership in an ordinary Stackelberg game where both unions maximise their welfare functions. Again, it does not matter which sector is leader and which is follower.

In addition to treating long-run equilibria, Juvonen also analyses adjustment to shocks. Then, pattern setting by the tradables sector in the social-norm case leads to higher welfare for workers there than uncoordinated wage setting, but this effect is dominated by lower welfare for workers in the non-tradables sector (which is the larger one)[40], so that aggregate welfare falls. The reason is that the wage in the nontradables sector is less aligned to the situation there if it must follow the tradables sector wage, which prevents desirable sector-specific adjustment.

When referring to a social norm in order to motivate why followers choose the same wage (increases) as the leader, one would like to explain why such a norm was established in the first place and why it is followed. There must be such a large utility cost for the follower of deviating that she chooses not to maximise her "ordinary" utility function (excluding this cost). It could be loss of reputation because of shaming or punishment of the deviating unions or employers' associations as well as their officials in other arenas than wage bargaining.[41] Alternatively, one

[38] This follows from market clearing for nontradables and the assumption that all income is spent.
[39] Let P_T be the price of tradables, P_N the price of nontradables, P the CPI, and c and k constants. If $P_N/P_T = k$ and $P = P(P_N, P_T) = c$, it follows that both P_N and P_T must stay constant since then $P = P(P_N, P_T) = P(kP_T, P_T) = P(P_N, P_N/k) = c$.
[40] This is in line with various assessments. For example, Sagelvmo et al. (2023) report that the tradables sector according to their classification accounts for only 30% of GDP and 14% of employment in Norway.
[41] Calmfors (2021) reports conversations with seasoned Swedish wage bargainers (in nontradables and public sectors) falling into tears when describing how they were bullied by their peers in the tradables sector when trying to deviate from the wage norm set by the latter.

might view also the social-norm equilibrium as the outcome of a repeated game (see Section 5.1), where defection by a sector causes a breakdown of this form of coordination. A possible hypothesis is that the norm of equal wages (wage increases) is chosen because it is easy both to understand and to monitor.[42]

Calmfors & Seim (2013) analyse why it may be in the interest of a follower to choose the same wage as the leader in an ordinary Stackelberg game without referring to an "exogenous" social norm as above. The explanation builds on: (i) comparison thinking, i.e., that the utility of employees in the follower sector depends not only on the purchasing power of their wages but also on the wage relative to employees in the leader sector; and (ii) loss aversion, according to which a larger weight is attached to losses relative to a reference norm than to gains (Kahneman and Tversky, 1979). The utility of an employee in the follower sector is assumed to depend on only the real consumption wage if it is above that in the leader sector but on both the real consumption wage and the ratio between the own wage and that in the leader sector if the own wage is lower.

With this formulation, it is in many cases optimal for the follower to choose the same wage as the leader; following the leader's wage then functions as an "endogenous" social norm.[43] Such equilibria involve lower wages in the leader sector and higher aggregate employment than other equilibria in both the inflation targeting and monetary-union cases. The logic is again that the knowledge that the follower will mimic the wage of the leader restrains the latter. The mimicking equilibria tend to arise when the leader sector is smaller than the follower sector, irrespective of which sector leads. But as the tradables sector in the Nordic countries is much smaller than the nontradables sector, the Calmfors-Seim results here could be interpreted as supporting the idea that pattern setting by the tradables sector produces favourable macroeconomic outcomes.

Summary of theoretical results

If tradables sector pattern setting works as centralised bargaining in disguise, there is a strong theoretical case for wage-restraining effects. However, it is not clear why the parties in the

[42] But to the best of my knowledge, a repeated game of this type has not been analysed formally.

[43] Then the marginal utility of the wage in the follower sector is larger when the wage is immediately below than immediately above that in the leader sector. In technical terms, the Stackelberg equilibria are corner solutions where the marginal utility of the follower's wage is not zero as in a standard interior solution but positive immediately below the same wage as the leader's and negative immediately above. Similar assumptions about relative-wage concerns and loss aversion have been used by e.g., Bhaskar (1990) and Driscoll & Holden (2004) to show that wages in uncoordinated equilibria may equal the expected wage level in the economy.

labour market have dismantled one institutional structure and replaced it with another if the same bargaining outcomes are achieved. This is a strong argument for viewing pattern bargaining as a system distinct from centralised bargaining.

Table 2 summarises the main findings in the small theoretical literature on wage leadership reviewed above. Assumptions of wage leadership in models without any relative-wage concerns and where the parties in the leader sector try to maximise their utility under the constraint that the parties in the follower sector do the same (Stackelberg equilibria) give conclusions that are very much at odds with informal reasoning. Under such conditions, one cannot show that wage leadership for the tradables sector is conducive to wage restraint and high employment. Instead, in several cases macroeconomic outcomes are less favourable than under uncoordinated bargaining. At the same time, some of the mechanisms behind these results, although logically consistent within the model frameworks, are counterintuitive and may reflect so complex interactions that practitioners are not likely to see through them.[44]

The most plausible models are those where the other sector follows the wage set by the leader either because of adherence to an "exogenous" social norm or because the combination of relative-wage concerns and loss aversion produces an "endogenous" social norm. Such behaviour seems most consistent with what we actually observe. But a striking result in the "exogenous" social-norm models is that it does not matter what sector is pattern setter; it is the existence of pattern bargaining per se that is crucial for wage moderation. In the relative-wage concerns/loss aversion case, pattern setting by the smaller sector is conducive to wage restraint. In the real world, this means the tradables sector, but this conclusion has nothing to do with international competition as in informal reasoning.

[44] For example, the mechanism under monetary-union membership in the Calmfors-Seim model that a higher wage in the tradables sector via a lower output there, a lower demand for nontradables, a lower wage in that sector, a lower price for its product, a lower CPI, and thus a larger purchasing power of incomes in the tradables sector (see Section 5.1) would seem insufficiently salient for it to be taken into account by wage setters. Such a negative effect of a higher wage in one sector on the wage in another also conflicts with the common notion that wage rises in one part of the economy tends to induce wage rises elsewhere.

Table 2. Theoretical model results on the effects of pattern bargaining

	Calmfors & Seim (2013)	*Vartiainen (2010)*	*Juvonen (2023)*
Model	Neoclassical.	Neoclassical.	New Keynesian.
Monetary union			
Stackelberg leadership for tradables sector	Higher tradables sector wage and lower aggregate employment than with uncoordinated bargaining.		Higher tradables sector wage and lower aggregate employment than with uncoordinated bargaining.
Stackelberg leadership for non-tradables sector	Lower non-tradables sector wage and higher aggregate employment than with uncoordinated bargaining.		Higher nontradables sector wage and lower aggregate employment than with uncoordinated bargaining, but more wage restraint and higher aggregate employment than with Stackelberg leadership for the tradables sector.
Social-norm leadership for any of the sectors			Lower tradables sector wage, higher aggregate employment and higher welfare than with uncordinated bargaining and Stackelberg leadership.
Social-norm leadership for the smaller sector	Lower wage in the leader sector and higher aggregate employment than in other equilibria.		
Inflation targeting			
Stackelberg leadership for any of the sectors	Same wages and aggregate employment as with uncoordinated bargaining.	Lower wages and higher aggregate employment than with uncoordinated bargaining if goods are not easily substitutable.	
Social-norm leadership for any of the sectors		Lower wages and higher aggregate employment than with uncoordinated bargaining and with Stackelberg leadership.	.
Social-norm leadership for the smaller sector	Lower wage in the leader sector and higher aggregate employment than in other equilibria.		

There is thus a strong dissonance between the conclusions from theoretical modelling and from informal reasoning. It cannot be ruled out that important aspects are missing in the theoretical models. One such factor could be a stronger bargaining position of employers in the tradables than in the non-tradables sector, because of the option to relocate production to foreign sites in the former. On the basis of anecdotical evidence one might also hypothesise that perceptions of

the effects of high wage increases could differ between unions in the tradables and in the nontradables sector. The former may be more neoclassical in their outlook (with a greater focus on cost aspects) and the latter more Keynesian (with more focus on positive demand effects of higher wages). Pattern setting by the tradables sector (manufacturing) is also likely to have greater *legitimacy* because of higher rates of organisation among both employees and employers as well as higher coverage of collective agreements. Given the established role of the tradables (manufacturing) sector to be responsible for pattern setting, it would likely take time to build up a similar *operational capacity* in the nontradables (service) sector.

6 The size of the tradables sector and labour reallocation

Section 5 discussed whether wage leadership for the tradables sector promotes wage restraint and employment. Another common argument for why international-competitiveness concerns should determine wage increases is that this is required for maintaining an appropriate size of the tradables sector (e.g, Aukrust, 1977; Holden IV-utvalget, 2023). Consistent wage increases in excess of price and productivity increases in the tradables sector would obviously cause an untenable continuous shrinking of the sector. However, there might be good reasons for changes in the size of the tradables sector from one *level* to another depending on structural shifts in the economic environment. Then, rigid pattern setting might be welfare-decreasing.

An important challenge in all Nordic countries is ageing populations. Fiscal sustainability analyses have identified this as a threat to the long-run viability of public finances, but potentially problematic labour market implications have also been pointed out (e.g., Konjunkturinstitutet, 2020; Holden IV-utvalget, 2023; Andersen, 2024). Labour requirements in especially the health and care sector will likely rise strongly at the same time as aggregate labour supply is stagnating. This may require reallocation of labour from tradables to welfare services production provided by both the public sector and the (private) nontradables sector. A question is how such a development squares with pattern setting by the tradables sector.

Appendix B features a stylised model of the impact of changing demographics on the allocation of labour under different assumptions on wage formation. The basic assumption is that an older population implies two fundamental structural changes: (i) lower savings and higher domestic aggregate demand – synonymous with a weakening of the trade balance – which in turn increases demand for labour in the non-tradables and public sectors; and (ii) a shift in the composition of domestic aggregate demand from tradables to nontradables and government-

provided services, which also raise labour demand in the latter sectors.[45] At the same time, the relative price of nontradables rises (in addition to the increase following from differential potential productivity growth in the two sectors). These changes may follow from both private-household and collective-government decisions.

The natural market reaction to these changes would be a rise in the real product wage, i.e, the wage relative to the product price, in the tradables sector, so that labour is freed there and moved to the nontradables sector (where the real product wage falls) and the public sector, which both are willing to pay more than before. The tradables sector shrinks and the other sectors expand. This would be a desirable reallocation of resources because the composition of the population has changed.

Pattern setting by the tradables sector, with the wage set to hold the size of the sector, unchanged would prevent reallocation of labour. Market forces would not be allowed to operate. Instead, a situation of excess labour demand in the nontradables and public sectors would arise. Pattern setting by the tradables sector would not allow the other sectors to bid up the wage so that they can recruit the labour they demand.

The analysis points to a possible conflict between, on one hand, socially efficient resource allocation and, on the other hand, high employment and output. It might be the case that labour shortages in the nontradables and public sectors arising from the pattern setting by the tradable sector helps draw more labour into employment. This could be because discouraged workers find it worthwhile to look for jobs, because employers in the nontradables and public sectors lower their qualification demands and provide the appropriate training of recruits, because the government expands regular school education or because more labour migration is stimulated.

An important question is whether, and if so to what extent, a reallocation of labour requires relative-wage changes. Holden IV-utvalget (2023) argues that this does not need to be the case and shows that there is no relationship between wage and employment growth in various industries in Norway over the periods 1970–2000 and 2000–22. In contrast, long-term fiscal-sustainability analyses in Sweden have included scenarios where a projected increase in the

[45] A weakening of the trade balance is most plausible for Denmark, Norway and Sweden, which currently all run large surpluses (see Section 4.5). It may not happen in Finland, where the consequence would be larger trade (and government budget) deficits., which policy makers might want to prevent by raising taxes or reducing government transfers. But on the other hand, as the old-age dependency ratio is projected to rise much more in this country (Calmfors 2020), the composition effect may be stronger.

share of employment in welfare services are associated with substantial relative-wage increases there.[46]

Labour supply to various sectors is, of course, more elastic with respect to relative wages in the long run, when labour market entrants can choose their education, than in the short and medium run when already employed workers with given education and experience would have to move. It seems safe to conclude at least that relative-wage changes would facilitate labour reallocation to welfare services. Hence, if wage leadership by the tradables sector rules out such relative-wage changes, this could serve as an impediment to efficient labour reallocation from the tradables sector to welfare services in the public and non-tradables sector. The severity of this problem will, however, depend on to what extent labour can be reallocated *within* the latter sectors.

7 Conclusions and suggestions

Pattern bargaining, with manufacturing as a representative of the tradables sector deciding a norm for wage increases also in the rest of the economy, has become the dominant form of wage bargaining in Denmark, Norway and Sweden since the end of the 1990s. At the same time, a process of organised decentralisation involving a larger role for local bargaining has taken place. Changes have come later to Finland, although moves in the direction of similar pattern bargaining and more importance for the local level have occurred recently.

The pattern setting by the manufacturing sector has been guided by international competitiveness concerns. Especially in Norway and Sweden, they have been embodied in the Scandinavian model of wage formation, according to which wage increases should follow a room given by the sum of price and productivity increases in the tradables sector. Although developed for a fixed-exchange rate situation, the Scandinavian model has continued to be a benchmark also in the more challenging environment of flexible exchange rates in Norway and Sweden, which make it more difficult to predict price developments for tradables.

Wage developments from the early 2000s have been in line with the Scandinavian model in Finland, Norway and Sweden. The two latter countries have exhibited rather small variations in the wage share in manufacturing except for the falls in 2021–23, which were associated with unexpectedly high international inflation and large exchange rate depreciations , whereas there

[46] E.g., Långtidsutredningen (2019) and Konjunkturinstitutet (2020).

was a substantial increase in Finland in 2008–12 followed by a decline of a similar magnitude. In Denmark, there has been a trendwise decline of the wage share in manufacturing. In all four Nordic countries, pattern bargaining delivered moderate wage increases during the high-inflation period of 2022–23. This helped prevent the development of price-wage spirals.

Also, the large trade balance surpluses in Denmark, Norway and Sweden can be taken as indications that wage formation in these countries have been consistent with strong international competitiveness. In contrast, the trade balance in Finland has recently shown small deficits.

There is a strong consensus among practitioners in all the Nordic countries on the merits of pattern setting by the tradables (manufacturing) sector. Therefore, it is noteworthy that theoretical research has not been able to build a convincing case that wage leadership by the tradables sector is especially conducive to wage moderation. The few existing analyses rather suggest that that it is pattern bargaining per se – not that the pattern setter is the tradables sector – that is important. The mechanism is that the knowledge that other bargaining areas will mimic the wage increases by the pattern setter, with repercussions on herself, exerts a moderating influence on wage determination. [47]

Wage formation guided by international competitiveness concerns tends to preserve the status quo. This could come into conflict with demands for labour reallocation. Ageing populations in all the Nordic countries will imply a stagnating labour supply at the same time as labour requirements in welfare services will rise. This could make it desirable to reallocate labour from the tradables to the public and nontradables sectors. Wage increases guided by the ability to pay of the tradables sector may counteract the desirable adjustment.

The above considerations could motivate more flexible norm setting. This may apply to both the determination of the norm to be followed in most bargaining areas and how binding this norm should be, i.e., the degree of relative-wage flexibility.

In a situation with demand shifting from tradables to nontradables and government-provided services, thus raising the relative price of nontradables (in addition to the rise following from differential productivity growth) as discussed in Section 6 and Appendix B, it might be appropriate to base the norm for wage increases not only on price (and productivity) increases in the tradables sector but to factor in to some extent price developments for nontradables as

[47] An additional consideration might, however, concern labour conflicts. Pattern bargaining by the manufacturing sector seems to be viewed as associated with low conflict risks. Labour conflicts are relatively few in this sector (see e.g, Holden IV-utvalget, 2023).

well. This may be particularly relevant under the monetary regimes in Norway and Sweden, where the inflation target serves as a nominal anchor, preventing price-level-raising interactions between wage increases and price increases for nontradables. Such an approach for the wage norm was earlier followed by the National Institute of Economic Research (*Konjunkturinstitutet*) in Sweden, which has a government remit to publish an annual report on wage formation. The institute calculated a benchmark for wage increases by adding the anticipated rise in potential productivity in the *whole* business sector and the increase in the value-added price there assessed to be compatible with the inflation target (see, e.g., Konjunkturinstitutet, 2016).

Such broader norm-setting considerations could in principle be made by the manufacturing sector itself based on a consensus among both unions and employers' associations that the sector should have such a mandate. Alternatively, the bargaining area acting as pattern setter could be extended to include also areas encompassing non-tradables (for example, a large area such as retailing).[48]

Reallocations of labour could also be facilitated if norm setting allowed greater relative-wage flexibility. In the Swedish discussion, Calmfors (2018) and Calmfors et al. (2019) proposed that the bargaining parties should adopt a principle that deviations from the norm – upwards or downwards – should be allowed in the case of large imbalances between labour supply and demand in individual bargaining areas. The establishment of an independent advisory expert council, which on request from a union or an employers' association, could express a – non-binding – opinion on this was also proposed. Mediation institutions might take such an opinion into account, allowing them more flexibility to deviate from the norm than today.

Labour shortage problems in welfare services also raise questions about the government's role. On one hand, the government has a responsibility to provide welfare services to citizens, which may require the use of wage instruments to secure a sufficient labour supply. On the other hand, government interventions into wage bargaining could destabilise pattern setting and increase the risk that bargaining becomes uncoordinated, with excessive wage increases as a result. This danger would be particularly great if government interventions are dominated by political short-termism.

[48] Both these approaches have been proposed in Sweden by Arbetsmarknadsekonomiska rådet (2017), Calmfors (2018) and Calmfors et al. (2019). In Norway, a widening of the pattern-setting bargaining area (*frontfaget*) by including also other *tradables* industries, was discussed, but not proposed, in Holden III-utvalget (2013) and Holden IV-utvalget (2023).

A recent example of government intervention is a tripartite agreement in Denmark in 2023 where the government provided local governments with an extra budget appropriation (of around 0.25% of GDP) to be used mainly for wage increases in excess of the ordinary collective-agreement rises in 2024–26 with the aim of making work in welfare services more attractive (Regeringen 2023). The intervention was presented as a one-off measure, but whether or not this will be the case remains to be seen.[49] The risk that such government interventions are inconsistent with responsible pattern bargaining is probably limited if they are based on a broad consensus among the labour market parties. The threat against overall wage moderation is likely much larger with wage rises in excess of the norm that are obtained after labour market conflicts, which was the case for municipal employees in Finland in 2022 (see Section 2.4).

To sum up: pattern setting by the manufacturing sector in Denmark, Norway and Sweden over the last decades has, by coordinating wage increases across the economy, contributed to international cost competitiveness, holding inflation in check and promoting high employment. Changing demographics may, however, entail great challenges, as a rigid interpretation of competitiveness norms could imply a status-quo bias, counteracting shifts in relative sector sizes. Norm setting by the tradables sector and an unchanged size for it are not ends in themselves but have been useful intermediate targets in the past. In the future, a more flexible approach may be warranted in order to allow desirable labour reallocation between sectors.

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[49] In Sweden, this did not happen when the government in 2013 and 2016 made special budget appropriations in order to raise teacher salaries (Grönqvist et al., 2023), but a reason could be that the target group was relatively small.

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Appendix A. The Scandinavian-model wage norm under inflation targeting

The Scandinavian model of wage formation can be summarised by the following five equations:

$$\Delta w_T^H = \Delta p_T^H + \Delta q_T^H \quad \text{(A.1)}$$

$$\Delta p_T^H = \Delta p_T^F + \Delta v \quad \text{(A.2)}$$

$$\Delta w_N^H = \Delta w_T^H \quad \text{(A.3)}$$

$$\Delta p_N^H = \Delta w_N^H - \Delta q_N^H \quad \text{(A.4)}$$

$$\Delta p^H = \alpha \Delta p_T^H + (1-\alpha)\Delta p_N^H, \quad \text{(A.5)}$$

where Δw_T^H is the percentage change in the tradables sector wage, Δp_T^H the percentage change in the domestic-currency price of tradables, Δq_T^H the percentage change in the tradables sector productivity, Δp_T^F the percentage change in the foreign-currency price of tradables, Δv the percentage exchange rate depreciation, Δw_N^H the percentage change in the non-tradables sector wage, Δp_N^H the percentage change in the price of nontradables, Δq_N^H the percentage change in the nontradables sector productivity, $\Delta p^H$the percentage change in the CPI, α the weight of tradables in the CPI, and $(1-\alpha)$ the weight of nontradables in the CPI.

Combining the five equations gives:

$$\Delta p^H = \Delta p_T^F + \Delta v + (1-\alpha)(\Delta q_T^H - \Delta q_N^H).$$

Hence, to reach an inflation target Δp_{Target}^H, there has to be an exchange rate depreciation of:

$$\Delta v = \Delta p_{Target}^H - \Delta p_T^F - (1-\alpha)(\Delta q_T^H - \Delta q_N^H). \qquad \text{(A.6)}$$

Inserting equations (A,2) and (A.6) into equation (A.1), one obtains:

$$\Delta w_T^H = \Delta p_{Target}^H + \alpha \Delta q_T^H + (1-\alpha)\Delta q_N^H. \qquad \text{(A.7)}$$

Thus, if the exchange rate adjusts so that the inflation target is met (and the price- and wage-setting assumptions of the Scandinavian model hold), wage increases equal to the sum of the inflation target and average productivity growth in the economy imply that the norm of wage increases given by the sum of price and productivity increases in the tradables sector is followed.[50]

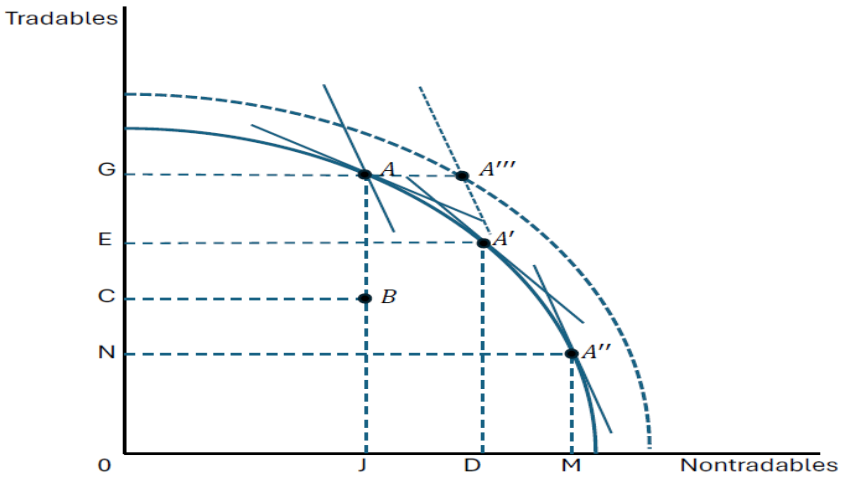
Appendix B. A stylised model of the effects of ageing

The model builds on Calmfors et al. (2019), who adapted an analysis by Rose et al. (2007). The population consists of three overlapping generations: children, workers and pensioners. Workers accumulate savings which finance consumption after retirement. There is a tradables and a nontradables sector. No distinction is made between the private nontradables sector and the public sector. Care for the elderly is provided through purchases of nontradables irrespective of whether financing is private or public. Labour is homogeneous and can move between the sectors. Labour demand and output in each sector depends on the real product wage there.

[50] Equation (A.7) has to be modified if price increases differ between domestically produced and imported tradables (see e.g., Holden III-utvalget, 2013, vedlegg 1). Other modifications have to be done if there is not full pass-through of exchange rate changes on to the domestic-currency price of tradables or if the price increase of nontradables deviate form the increase in the unit labour cost (the difference between the wage and the productivity increase).

Figure 5 illustrates the likely consequences of changing demographics. It is first assumed that the wage is determined so that demand for labour equates (a fixed) supply. The axes show output and consumption of the two goods. The curve is a *production possibility frontier*, giving the combinations of tradables and nontradables that can be produced.

Figure 5 Changing demographics and sector sizes



Initially production is at *A*. Output of tradables is *OG* and of nontradables *OJ*. The slope of the line that is tangent to the frontier at *A* measures the initial relative price between the goods. The steeper the slope, the higher the relative price of nontradables. The tangency between the production possibility curve and the price line implies both profit maximisation by firms and a socially efficient labour allocation.[51] Initial consumption is at *B*. Consumption of nontradables equals production *OJ*. But consumption of tradables *OC* is smaller than production *OG*. The difference *AB* equals net exports, i.e., positive financial saving – corresponding to the current situation in Denmark, Norway and Sweden.

When the number of pensioners rises, total saving in the economy falls and consumption demand rises. The consequences are easiest to illustrate in the case with a fixed exchange rate. Then the price of tradables is unchanged as it is determined abroad. But the price of non-

[51] If P_T is the price of tradables, P_N the price of nontradables, MP_T the marginal product of labour in the tradables sector, MP_N the marginal product of labour in the nontradables sector and W the wage, profit maximisation implies $P_T \times MP_T = W = P_N \times MP_N$. As the value of the marginal product is the same in both sectors, the value of production cannot be increased by labour reallocation. Hence, the allocation is efficient. The equality also says that $P_N/P_T = MP_T/MP_N$. P_N/P_T is the slope of the price line and MP_T/MP_N the slope of the production possibility frontier. Thus, the tangency point between the price line and the production possibility frontier represents both profit maximisation and social efficiency.

tradables rises. The price line becomes steeper. Production moves to *A'*. Output of nontradables rises to *OD* and output of tradables falls to *OE.* If the fall in saving is so large that the trade surplus disappears, *A'* also shows consumption. In addition, the composition of consumption tilts towards nontradables, as more is spent on them with more pensioners.[52] This raises the price of non-tradables further, steepening the price line even more. Production and consumption therefore move all the way to *A"*.[53]

The demographic change thus causes output of nontradables to increase at the expense of output of tradables. The adjustment takes place because the nontradables sector bids up the wage when its product price rises. Hence, labour is reallocated to the nontradables sector. This is socially efficient as the demographic change has increased consumers' relative evaluation of nontradables.

What happens if instead of clearing the labour market, the wage is linked to the price of tradables because of pattern setting by the tradables sector? Then, when the (relative) price of nontradables rises, the wage cannot respond to the increase in labour demand from the nontradables sector. Consequently, no labour reallocation occurs. Production remains at *A* and there is excess demand for labour in the nontradables sector (this is captured by the price line cutting the production possibility frontier instead of being a tangent to it). Pattern bargaining is then socially inefficient as the marginal value of tradables output is smaller than the marginal value of non-tradables output.[54] This situation could be avoided, i.e. the point *A"* be attained, if the wage is instead linked to a price index with appropriate weights for tradables and non-tradables prices.[55] This would imply a deviation from norm setting by the tradables sector.

In the stylised model above, labour supply (equilibrium employment) is fixed. It may be realistic to assume that in a situation with labour shortages in the nontradables sector due to the wage norm, more labour is drawn into the effective labour force. If so, the production possibility

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[52] The decrease in saving and the composition shift in product demand are the combined effect of individual and government decisions.

[53] With inflation targeting, the central bank does not allow a rise in the relative price of non-tradables to increase the general price level (more than is consistent with the target). Hence, monetary policy induces an exchange rate appreciation. This lowers both the domestic-currency price of tradables and the price of non-tradables relative to the fixed-exchange rate case, but does not otherwise change the analysis. The same increase in P_N/P_T causes the same increase in the real product wage W_T/P_T in the tradables sector and the same decrease in the real product wage W_N/P_N in the non-tradables sector as under a fixed exchange rate.

[54] If $P_N/P_T = MP_T/MP_N$ in *A*, an increase in P_N/P_T implies that $P_N/P_T > MP_T/MP_N$ if the economy stays there. This is inefficient as then $P_N \times MP_N > P_T \times MP_T$, which implies that the total value of production would be larger if labour was reallocated.

[55] Calmfors & Viotti (1982) and Arbetsmarknadsekonomiska rådet (2017) show that a change in the relative price would result in unchanged total labour demand, and thus unchanged total employment, if the weights are the sectors' shares in total employment weighted by their labour demand elasticities.

frontier is shifted outwards, so that production could move to a point *A'''*. This suggests a possible conflict between goals of high output (employment) and efficient sectoral allocation of labour.