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(Mis)matching in the post-pandemic Danish labour market

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Abstract

Since the beginning of the covid-19 pandemic, matching in the Danish labour market seems to have been dampened: Fewer workers are being hired than the number of unemployed job seekers and open vacancies would lead to believe. Furthermore, employers report a stark increase in failed recruiting efforts since mid-2021.

In this memo, I discuss one potential explanation: mismatch in the labour market between vacancies and job seekers. I build two indicators of mismatch in the Danish labour market that can be used to study such developments since 2008. Both measures indicate that mismatch increased a lot during the 2008 Great Recession. In subsequent years, mismatch recovered only partly. The increase in mismatch during the pandemic was noticeable, but much less than during the Great Recession. There is no clear evidence that mismatch significantly dampened the Danish recovery in late 2021, or contributed to the employers' reported hiring difficulties in that period.

As in many other European countries, the Danish labour market witnessed some volatility throughout the covid-19 pandemic. Prior to the pandemic, the unemployment rate and reported hiring conditions had remained stable for the previous five years, cf. chart 1. At the onset of the pandemic, the unemployment rate increased immediately, whereas employers reported somewhat easier hiring conditions.[1] From the summer 2020, both indicators started to slowly bounce back, reaching previous levels by the 2nd quarter of 2021. Both indicators subsequently moved to levels not seen since the financial crisis.

Hiring conditions regressed by Q2 2021   Chart 1
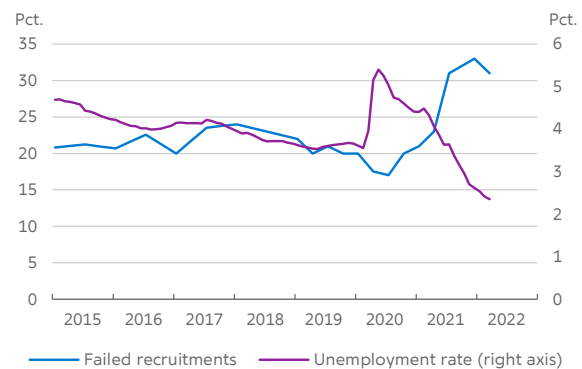
Note: Last observation is March 2022. Failed recruitments are based on failed recruitment attempts in the previous six months.

Source: National Labour Market Authority (Arbejdsmarkedsstyrelsen) and Statistics Denmark.

One reason for these reported hiring difficulties is the lack of labour supplied, as measured here by the unemployment rate. However, I show that in 2021 fewer matches were being formed in the Danish labour market, even when taking the number of workers that seek employment into consideration.

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[1] Note that chart 1 measures failed recruitments as an average over the previous six months, which is why it the easing in the hiring conditions is somewhat delayed.

I then discuss one prominent reason that may dampen matching: mismatch. Mismatch typically occurs when firms seek for specific characteristics that the job seekers do not possess. For example, firms in the IT sector may be looking to hire workers, while unemployed workers are seeking to be employed in construction. In that case, we may face a situation where many individuals seek to work, and many firms attempt to hire, but only few matches are being formed between the two.

I discuss two measures of mismatch. First, I reproduce the indicator suggested by Şahin, Song, Topa and Violante (2014), which builds on differences in labour market tightness across industries. It indicates low mismatch when the labour market is equally tight across all industries, and higher mismatch the larger the dispersion of market tightness is across industries.

The second indicator is based on Darougheh (2020). Here, the assumption is that a worker's relevant labour market is best described by their occupation, and that they would prefer to change industry in order to remain in that occupation. If this is true, then occupations that are employable in only very few industries are strongly dependent on these industries. Other things being equal, workers in these occupations would be more at the risk of being mismatched if they become unemployed. I then build an empirical measure using the concentration of employment of workers in each occupation across industries. This measure indicates high mismatch if unemployed workers were previously employed in an occupation that is not employable in many industries, for example electricians that mostly work in construction. When most of the unemployed were previously employed in broad occupations – for example, clerks that work in many industries – this measure instead indicates low mismatch.

Both mismatch measures indicate a stark rise in mismatch during the 2008 Great Recession, and a somewhat weak recovery thereafter. The measures suggest small increases in mismatch during the covid-19 pandemic, but do not fully agree in that

period. However, both indicate that mismatch did not significantly contribute to the reported hiring difficulties.

The Beveridge curve

Traditionally, the Beveridge curve has been used to assess the functioning of labour markets. For a given matching rate, it implies a relationship between the number of vacant jobs and unemployed workers in an economy. It suggests that in times when vacancies are high, the number of unemployed workers must be low, and vice versa: If vacancies and jobseekers both were numerous, they should match with each other, bringing down the numbers of both. Therefore, when we do see an outward shift of the Beveridge curve – a rise in both unemployed workers and vacancies – it suggests that something has been impairing the matching process in the labour market.

Danish Beveridge curve is shifting outwards   Chart 2

Vacancies in per cent of labour force

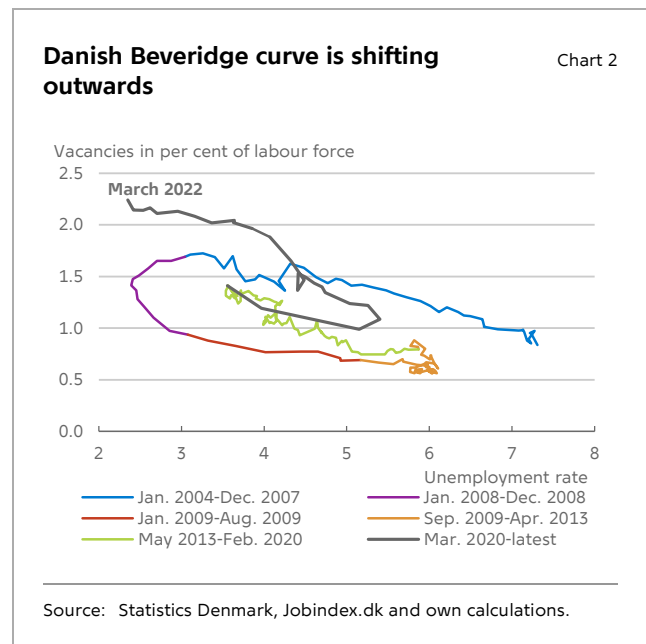Source: Statistics Denmark, Jobindex.dk and own calculations.

Chart 1 displays the Beveridge curve for the Danish economy. As we can see, there has been an outward shift of the Beveridge curve from September 2009 during the financial crisis: In that period, matching was impaired, and we observe a higher number of unemployed jobseekers for roughly the same number of vacancies. Since 2013, the Beveridge curve has remained stable on its new outer position. At the onset of the pandemic, the Beveridge curve

slowly shifted outwards, and since the summer of 2021 it has reached its furthest outward position to date: The number of new matches currently generated for a given number of vacancies and jobseekers has not been this low for the past decade[2].

The Beveridge curve can indicate that labour markets are not functioning properly, but it will not identify the underlying cause, nor whether it is detrimental for welfare. Consider a situation in which demand for labour increases and workers consequently raise their reservation wage. This could lead to fewer matches, but an increase in the average income – the welfare level would not necessarily fall in this situation.

An increase in the workers' reservation wages might have played a role during the pandemic, but certainly not during the 2008 financial crisis, when many workers were struggling to find a job. A candidate explanation is that mismatch in the labour markets played a role in the aftermath of the Great Financial Crisis. This could also be the case in the aftermath of the pandemic.

Mismatch in the labour market

To understand the concept of mismatch, consider that labour markets are markets with differentiated jobs and workers: During the hiring process, both the employer and the employee try to assess the quality of their potential match. Employers might find it difficult to hire if the available workers lack specific qualifications or characteristics. Similarly, workers might have certain expectations regarding their new job that not every employer might fulfil.

The phenomenon in which one or both sides of the labour market have requirements towards their respective counterparty that render the matching process between workers and employers difficult are referred to as mismatch. Recent literature considers

geography, industry and occupation as the most relevant aspects of mismatch. For instance, the 2008 Great Recession rendered many construction workers unemployed, and new jobs were available in non-construction sectors, among others IT. If IT firms prefer to hire workers with experience in the IT sector, or construction workers are reluctant to accept jobs in the IT sector that render their job experience less valuable, this will lead to mismatch: Fewer matches are generated for a given amount of labour supply and labour demand. In consequence, total unemployment in the economy is higher than it otherwise would be – a phenomenon referred to by Sahin et al (2014) as 'mismatch unemployment'.

To be precise, Sahin et al (2014) consider a benchmark economy in which all frictions across labour markets are removed: Workers can move freely across industries and occupations. They then compute the unemployment rate in this counterfactual economy. Mismatch unemployment is then computed as the deviation between the actual unemployment rate and the counterfactual unemployment rate. They further provide a mismatch index that is tightly linked to their mismatch unemployment. This index can be computed using the distribution of unemployed workers and vacancies across industries.[3] The basic version of this mismatch index computes the alignment of jobseekers and vacancies across industries: The more aligned workers and vacancies are across industries, the lower the index. When workers and vacancies are less aligned – for example when many workers search for jobs in construction, but vacancies are posted in IT – the mismatch index rises.

Danish mismatch index

We compute the mismatch index for the Danish economy by combining three different datasets with different advantages. We observe the industry of each worker in the administrative wage payment

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[2] A non-economic reason for shifts in the Beveridge curve could be changes in the share of vacancies that are covered by our data. An increase in coverage would appear like an increase in the number of vacancies, without any fundamental change in their number, or the resulting number of formed matches. This would therefore appear as

an outward shift of the Beveridge curve. The coverage increased in the years prior to the Great Recession, but I am not aware of any change in the coverage of the jobindex.dk that might explain this outward shift since 2020.

[3] Box 1 provides details on the computation of the mismatch index.

records (BFL). This data is available with delay, but we can assume that workers' industries are a persistent characteristic without too much loss of accuracy. We combine this information with Danish social security records, which inform us whether a worker has been receiving unemployment benefits. These records are available at high frequency, and we can combine these two datasets to compute the sectoral allocation of workers in recent months. Finally, we use data on vacancies from the largest Danish job advertisement portal, jobindex.dk. Jobindex uses different categories, not all of which can be mapped back to the sectoral data.

The recent developments in the mismatch index are displayed in chart 3. The index is bound between zero and one, but does not have a cardinal meaning. We can use it, however, to track relative changes in mismatch. As shown, mismatch in the Danish labour markets increased during the 2008 financial crisis and subsided afterwards. The increase is similar to the United States, where mismatch, however, completely recovered by the end of the financial crisis.[4] There was a second smaller peak in 2013, and since then the mismatch has been on a steady decline. The mismatch did not change noticeably at the onset of the pandemic. Yet, since the recovery of labour markets in spring 2021, the mismatch has been on a steady decline.

Mismatch increased more during the Great Recession than the pandemic — Chart 3

Mismatch index

Note: The mismatch index is computed according to box 1 and then seasonally adjusted.
Source: Statistics Denmark, Jobindex.dk and own calculations.

Broad and specialised workers

Another approach to study mismatch is through the qualifications of the workers. In the previous example, we have assumed that each worker is specialised in their respective industry and is not willing to change sectors. This is, however, not true: The majority of Danish job-to-job transitions include a change of industry.[5] A large body of research has also shown that the benefits of staying in one's occupation are larger than the benefits of staying in one's industry.[6]

Consequently, we will now assume that a worker's labour market is aptly represented by their occupation: They are willing to move across industries, but not willing to move across occupations. We then characterise each occupation by its 'broadness' following Darougheh (2022). Broader occupations are those that are employable in many industries, for example engineers. At the other end of the spectrum, we have occupations that are highly specialised on a few industries, such as electricians specialised in construction. A shock to the construction sector would affect electricians more than construction engineers, since the former have fewer outside options and are more dependent on

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[4] See Sahin et al (2014).
[5] Cf. Bess, Grenestam, Hviid and Rozsypal (2022), Chart 8.

[6] See, for example, Kambourov and Manovskii (2009).

their current sector: These specialised occupations are more at the risk of being mismatched across sectors. In general, when many of the unemployed job seekers come from more specialised occupations, we expect the risk of mismatch in the labour market to be higher.

Danish broadness index

We combine register data to compute a broadness-based mismatch measure for the Danish economy. The detailed steps are listed in box 1. In short, we compute for each occupation the distribution of workers across sectors. We compute the dispersion of that distribution as one minus its Herfindahl index: Occupations with all workers in a single industry will have a Herfindahl concentration index of one and a broadness of zero. Occupations with all workers spread across many industries will have a concentration close to zero and a broadness of one.

In a second step, we attach to each worker the broadness of their most recent occupation. We then compute the average broadness of the unemployed.

The broadness index increases when the average broadness of the unemployed increases. We can see that the broadness index fell a lot during the 2008 financial crisis: More specialised workers were among the unemployed during that period, cf. chart 5. This supports the hypothesis that mismatch in the labour market was an important driver of the unemployment in that period and is in line with the outward shift of the Beveridge curve and the rise of the mismatch index in that period. Since then, broadness has slowly been recovering.

Broad occupations are employable in many sectors   Chart 5

Electrical and electronic trades workers (broadness: 0.637)

Industry	
Construction	
Trade	
Operational services	
Furniture	
Machines	
Consulting	
Food products etc.	
Eletrical equipment	
Public administration	

Science and engineering professionals (broadness: 0.894)

Industry	
Consulting	
Trade	
Machines	
Medical	
Research	
Construction	
Electronics	
Public administration	
Information technology	

Note: We plot for both exemplary occupations the employment shares in the top 9 industries.
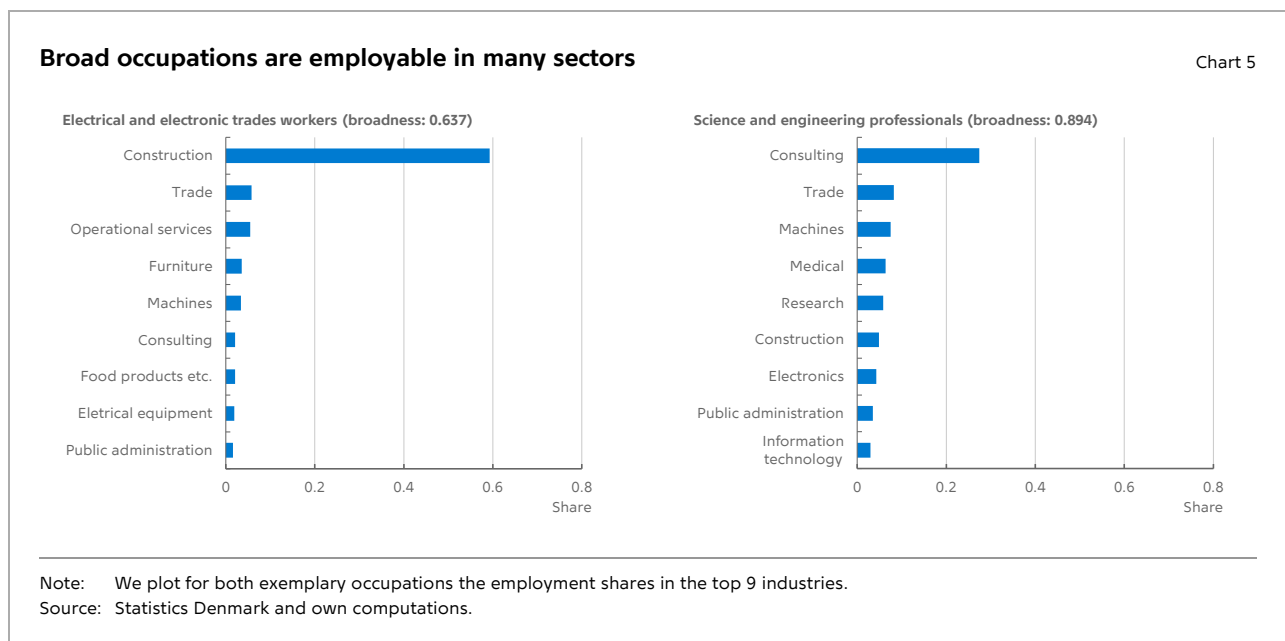Source: Statistics Denmark and own computations.

Chart 5 plots the employment shares of the two exemplary previously mentioned occupations. Indeed, the electricians are mostly employed in the construction sector and thereby much more specialised than the engineers, who are employed across a multitude of industries.

Broadness of unemployed fell slightly during the pandemic

Chart 4

Broadness of unemployed

Note: The broadness index is computed according to box 1 and subsequently seasonally adjusted.

Source: Statistics Denmark and own calculations.

During the pandemic, we observe two strong dips in the broadness index. These dips are likely caused by short-run changes in the composition of the pool of the unemployed – for example a quick increase in unemployed restaurant workers specialised in the restaurant sector. Denmark witnessed two economic lockdowns throughout the pandemic, and the timing roughly agrees with the falls. For the past two years, broadness has on average decreased to some extent. Yet, these changes are small compared to the change in broadness during the 2009 financial crisis.

Conclusion

In this memo, we have studied two measures of mismatch in the Danish labour markets. Both indices come with their strengths and weaknesses. The mismatch index is in theory closely linked to the Beveridge curve. However, it needs data on both vacancies and unemployment for each industry. This mapping was not successful for some industries, which are therefore not covered by the mismatch index. The broadness index adds value here since it does not require data on vacancies. It however requires additional assumptions, most importantly

that experienced workers mostly move across industries rather than occupations.

Differences between the indicators can be due to several factors. First, some vacancies could not be assigned to any sector and therefore are not used in the mismatch index.[7] Second, the assumption underlying the broadness index is that a worker's labour market is better described by their occupation than by their industry. This assumption may be incorrect for some occupation-industry combinations.[8] Third, the mismatch index is based on market tightness, while the broadness index is based on unemployment rates.

Denmark witnessed a dramatic shift in the Beveridge curve throughout 2020 and 2021. Both measures indicate that there was no strong increase in mismatch during the pandemic. Similar findings have been reported for other OECD countries.[9]

This leaves a number of other explanations of the observed outward shift of the Beveridge curve to be studied in the future. Most prominently, workers' preferences and outside options could have changed, rendering them less willing to accept jobs in their previous labour market for a given wage. Further analysis and data – for example on worker's job search behaviour and their reservation wages – are necessary to test this hypothesis and find a definitive explanation for the recent outward shift of the Beveridge curve.

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[7] For details on the construction of the mismatch index, see box 1.
[8] Sullivan (2009) shows that while occupational-specific human capital is *on average* more important than industry-specific human capital, the opposite is true for some occupations, for example managers.
[9] Duval, Ji, Li, Oikonomou, Pizzinelli, Shibata, Sozzi and Tavares (2022) report that mismatch increased significantly at the onset of the

pandemic relative to the 4th quarter of 2019 in several advanced economies, including the United States, the United Kingdom and Spain. Unfortunately, they do not provide a longer time series, rendering it difficult to compare this increase to historical patterns. They however estimate that the increased mismatch did not decrease employment significantly in most of the studied countries.

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Computation of mismatch and broadness indices Box 1

We compute both the mismatch index and the broadness index by combining the Danish administrative records 'BFL' and 'DREAM'. The former contains the universe of Danish wage payments since 2008 and contains information on both the occupation and the industry of any given employment. The latter contains information on social security payments and allows us to identify workers receiving unemployment benefits.

These two datasets are great complements: BFL is rich in information, but available only with long delay. DREAM is scarce in information, but available with very short delay. For both indices, we use the BFL to compute characteristics of a worker that are less likely to change, for example their typical occupation or industry. We then compute their unemployment status – a less permanent characteristic that we have at the weekly frequency until October 2021 – using DREAM.

Mismatch index

To compute the mismatch index along the industry dimension, we need the number of vacancies and unemployed job seekers for each industry. We use data on vacancies from Jobindex.dk and unemployment numbers by industry from our combination of BFL and DREAM. Jobindex.dk uses a classification that combines both industries and occupations: We build a mapping of this classification to the combination of BFL-DREAM. This is not a unique mapping: Several industry groups have to be aggregated on both sides. For some industries, there is no counterpart, but we manage to map the majority of industry groups to each other. Two per cent of workers and 10 per cent of vacancies are lost in the process and not covered by the index. Most notably, vacancies that are classified as 'Design', 'Management', 'Security' and 'Students' could not be matched to an industry in the BFL data.

We then compute the mismatch index following Sahin et al (2014):

$$M = 1 - \sum_{i=1}^{I} \left(\frac{v_{i,t}}{v_t}\right)^{\alpha} \left(\frac{u_{i,t}}{u_t}\right)^{1-\alpha},$$

where i is an index for industries. The first bracketed term computes the vacancies of a given sector i as a share of all vacancies in that month t. The second term computes the corresponding expression for the unemployment rate. The parameter α captures the elasticity of the number of job matches created to the number of vacancies in the economy. Intuitively, this indicator computes a dispersion-like moment of the distribution of the vacancy-to-unemployed ratio across the different industries, and weights vacancies and unemployed by their relative impact on matching. The indicator signals a high amount of mismatch when this dispersion is high.

Broadness index

We compute the broadness of each occupation as one minus the concentration of workers of that occupation across industries:

$$b_o = 1 - \left(\sum_{i=1}^{I} \frac{e_{i,o}}{e_o}\right)^2$$

, where $e_{i,o}$ denotes the number of workers in industry i and occupation o. The bracketed fraction thus computes the Herfindahl index of concentration of workers in a given occupation across industries.
We assume that the broadness of a given occupation is constant, and hence use this occupation-specific broadness also after the end of our BFL sample. The occupational coding of the BFL changed in the year 2010, and so we compute the broadness of each occupation separately for the periods before and after 2010.

In a second step, we compute the average broadness of the unemployed by identifying a worker's occupation in the BFL, and their unemployment rate in DREAM. We then compute the broadness index as

$$B_t = \sum_{o=1}^{O} \frac{u_{o,t}}{u_t} b_o$$

, where $u_{o,t}$ denotes the number of unemployed workers in a given month and occupation. This broadness index does not change with the unemployment rate, but only with the composition of unemployed workers with respect to the broadness of their occupations.

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