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**Research Report**

## Worker flows and reallocation in COVID-19 exposed sectors in the Danish economy

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# DANMARKS NATIONALBANK

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## Worker flows and reallocation in COVID-19 exposed sectors in the Danish economy

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## Worker flows and reallocation in COVID-19 exposed sectors in the Danish economy

- When workers separate from firms, human capital can be lost. Episodes of large-scale worker separation and reallocation, such as the COVID-19 pandemic, can negatively affect aggregate productivity until human capital is rebuilt. The magnitude of this effect depends on the degree of firm and sector-specific human capital.
- This memo presents an empirical assessment of the relevance of this cost in Danish data across selected sectors. The method is based on an examination of past worker flows, where higher flows are indicative of less attachment between workers and firms, which is a sign of less firm/sector human capital accumulation.
- Workers in the 'Transport' sector on average have more sector-specific human capital relative to the 'Accommodation/Food' and 'Entertainment' sectors, implying that worker separations in transportation might be relatively more costly. The findings aim to contribute to the discussion about the costs and benefits of fiscal support packages targeted at firms.

By working in a given firm in a particular sector, workers accumulate specific firm and sector knowledge (on top of general human capital) and thus become more productive in their job. By definition, this human capital cannot be put to use in a different firm or sector. Therefore, **if a firm is forced to fire workers and then later replaces them with different workers, it is likely to be less productive** until the newly hired people catch up with the productivity of the previous workers. If the COVID-19 epidemic leads to the destruction of a large share of firm-worker matches and to the consequent loss of human capital, the recovery will be slowed down.

In this note, we use past flows of workers between firms and sectors to make conjectures about the human capital of workers across sectors. We present results for the '**Transportation**', '**Accommodation/Food**' and the '**Entertainment**' sectors. These sectors faced a particularly adverse situation as they were particularly hit by the social distancing measures. These sectors thus provide a natural benchmark for the impact of inefficient separations and reallocations on the wider economy.

## Introduction

The COVID-19 epidemic and the social distancing measures put into place by governments across the world have led to a drastic decrease in economic activity around the world. One aspect of this fall in economic activity is a fall in the demand for labour. If such a scenario materialises, it is likely that workers who lose their jobs in heavily affected sectors will relocate to less affected sectors.

In this memo, we examine human capital using past worker flows. Human capital of workers contributes to overall firm productivity (Abowd et al., 2005). Relocating workers across firms and sectors is likely to make some of this human capital obsolete. As the nature of work is different across sectors, it is likely that human capital is not evenly distributed across all sectors. We focus on three sectors which were hit particularly hard by the COVID-19 epidemic: **Accommodation/Food, Transportation** as well as **Entertainment**.

Why is human capital being destroyed when a worker separates from a firm? When working in a certain company or firm in a specific job, a worker becomes more productive in his/her tasks. Some of this human capital can be transferred to other jobs in the future (e.g. education or better work ethics). However, there are two types which are not transferable: sector-specific and firm-specific human capital.

Sector-specific human capital entails all the skills that one learns on the job that can be taken to a different firm operating in the same sector. As an example, consider an IT expert who becomes an expert in coding techniques on her job in firm A. After changing job to another firm B, which also develops software, all the coding techniques are still usable. However, if this person decides to change career and move to a job in a different sector, the sector-specific skills

will not be of use and the worker will not be as productive as in the previous job.

The second type of human capital that is even less transferable is firm-specific. The IT expert from the last example also developed institutional knowledge of the inner workings of firm A. While important for the job in firm A, this knowledge will not be useful in firm B. The empirical evidence on the returns to tenure suggests that the growth in productivity due to firm-specific knowledge is sizable. Kambourov and Manovskii (2009) document a significant growth in wages on the job: after five years on the job, workers' wages grow between 12 per cent and 20 percent.

It is a possibility that large-scale reallocation of human capital could be followed by a mass reduction in the work force if a large percentage of the firms and sectors affected were to close down due to bankruptcies and reduction in demand. The empirical evidence on this topic suggests that these events are very costly for the workers. In the US, Davis and Wachter (2011) find that workers who lose their job in a mass layoff event during a recession lose 2.8 years of income in present-value terms. Similarly for Germany, Heining et al. (2019) document a 15 per cent earnings loss over 15 years for workers who lose their job in a mass layoff during a recession.

From the firms' perspective, the loss of human capital, both firm and sector-specific, is also costly: if a firm is forced to replace a number of workers (both due to temporarily low demand caused by the epidemic, but also due to standard worker fluctuation in normal times), the new workers will need time to accumulate firm and sector-specific human capital in order to reach the previous productivity levels.

The costs associated with human capital destruction could be mitigated if worker-firm relations are preserved. In past recessions,

several countries have implemented measures to support the continuation of worker-firm relationships during a downturn. Most of these policies subsidise wages in order to allow workers to work fewer hours trying to prevent a separation. Cahuc and Carcillo (2011) and Hijzen and Venn (2011) provide a cross-country overview. While the authors admit that the impact of these policies are difficult to measure, the general consensus is that such measures do save jobs during a recession, but little is known about their effect on expansions and institutional implementation matters. In the case of Germany, Balleer et al. (2016) find that such measures saved 1.29 pp of unemployment (466,000 jobs) during the Great Recession and that automatic, rule-based programmes are more efficient than discretionary ones.

While the goal of this memo is to examine and highlight the risks of human capital destruction resulting from worker reallocation, it does not claim that worker reallocation in general is necessarily detrimental to economic well-being nor that it should be stopped. In normal times, firm closures and workers moving from one firm to another is a healthy sign of dynamism that allows economic resources to be used in the most productive way. Economic policies that are introduced to save firms in recessions can slow down the subsequent recovery. The ultimate aim of this memo is to provide more information to policymakers regarding the balance between the benefits of preserving human capital and the risks to economic dynamics.

## Methodology and data

The central conjecture in this analysis is that human capital is valuable. This means that workers with more human capital are more productive and, *other things equal*, are more likely to earn higher wages. Because at least some part of human capital that workers

accumulate is linked to a specific firm and a specific sector, we expect workers who accumulate large amounts of firm or sector-specific human capital to be less likely to move to a different firm or sector.

To evaluate the amount of firm-specific human capital, we measure how attached workers are to their firms. To that end, we examine how long people stay in their jobs in a given firm. The longer workers stay with one firm, the more likely they are to have accumulated more human capital. Furthermore, getting recalled after a separation is another sign of firm-specific human capital.

In contrast, to measure sector-specific human capital we focus on the share of workers who switch to a different sector out of all workers who separate from their employer. We have also analysed how long people remain unemployed before they change sectors.

An economy where switching between firms and sectors is frequent would recover faster from the labour market disruptions and joblessness induced by the COVID-19 epidemic, because firm-specific human capital does not need to be rebuilt.

To assess the level of **firm-specific human capital** in a given sector, we focus on the average length of employment spells in firms that operate in the sector. The longer people are employed by one firm on average, the more human capital they are able to accumulate.

Next, we assess the level of **sector-specific human capital** by examining how frequently workers who separate from their employers move to a different sector. If workers switch sectors infrequently, we infer that they are relatively more valuable in the 'home' sector than in other sectors, which would be indicative of high levels of sector-specific human capital.

The main data source used is the '*Beskæftigelse for lønmodtagere*' dataset (BFL hereafter) provided by Statistics Denmark (DST hereafter). The sample starts in January 2008 and ends in September 2018. Details on the data can be found in the Appendix.

We analyse the following three sectors: **Accommodation/Food**, which covers hotels and restaurants. **Transportation**, which includes inter- and sub-urban rail, freight transport, water and air transport as well as postal and courier activities. Finally, the **Entertainment** sector includes theatres, concerts, libraries, museums as well as gambling, sport and amusement/recreation activities. These sectors were selected as they were hit particularly hard by the epidemic and the subsequent social distancing measures. Indeed, other sectors were also affected, but typically not in the same uniform way (the 'Trade' sector has a very strongly affected 'retail' component, but at least the anecdotal evidence suggests that the 'wholesale' businesses were affected much less). These three sectors thus provide a natural benchmark against which to compare all the other sectors of the economy.

## Sectoral overview

**The three selected sectors constitute only a small fraction of the economy** when measured by the number of workers, as depicted in Table 1. Among the three sectors, Transportation is the largest. Young people have less time to accumulate human capital. We therefore also differentiate by the age of the workers. We define **prime age** workers to be between 25 and 55 years old.

Indeed, there are large discrepancies among different age groups. Whilst the Accommodation/Food sector employs only 3 per cent of all the workers in the dataset, in the group below 25 years it is actually 10 per cent of all the workers. Similarly, Entertainment

employs only 1 per cent of workers over all, but 3 per cent in the youngest age group. This fact is important to interpret the findings presented later on.

**Sector size by number of workers**

Table 1

Sector	Worker share
Accommodation/Food	0.03
Transport	0.05
Entertainment	0.01

Note: The 'Worker share' column shows the share of workers working in a particular sector out of all workers.

Source: Statistics Denmark and own calculations.

Table 2 highlights the differences in workers' age structure further. In the aggregate, almost two thirds of the workforce belongs to the prime age group. However, this share is much smaller for the Accommodation/Food and Entertainment sectors, where young workers are disproportionately numerous. In contrast, the Transportation sector employs more than an average number of people above the age of 55.

**Age distribution of workers**

Table 2

	<25	25-55	>55
Accommodation /Food	0.51	0.41	0.08
Transport	0.14	0.58	0.28
Entertainment	0.38	0.46	0.16
Aggregate	0.16	0.63	0.20

Note: Each column shows what share of the workforce of a given sector (or aggregate) belongs to a particular age subgroup.

Source: Statistics Denmark and own calculations.

The age differences are important because younger workers are likely to be more adaptable. In contrast, workers who are closer

to the retirement age are more likely to struggle to find a new job as the new employer might be reluctant to invest in a long-term relationship with a person who is relatively close to retiring.

## Firm-specific human capital

From the firm's perspective, the stability of the workforce can be measured by the **worker turnover**, defined as

$$\text{turnover} = \frac{\text{new hires} + \text{separations}}{\text{number of workers}}$$

This measure is bounded between 0-2 with higher values indicating firms and workers being less attached to each other. The average rate of turnover across all firms and time in the sample is roughly 10 per cent, meaning that in steady state firms would let go and hire 5 per cent of their workforce every month, as indicated in Table 3.

<b>Worker turnover</b>		Table 3
Average worker turnover		
Accommodation /Food	0.22	
Transport	0.10	
Entertainment	0.19	
Aggregate	0.09	

Note: Average worker turnover on firm level  
Source: Statistics Denmark and own calculations.

Workers who are more attached to their employers are likely to have more firm-specific human capital. We focus on two metrics to assess the degree of attachment: the length of employment spells and the frequency of recalls (the share of workers going back to their

previous employer after an unemployment spell).

Two statistics measures are informative about the **length of employment spells**. The first measure is the share of **long-term workers** (see Table 4). This measure is defined as the number of workers who stayed with the same firm for the whole sample normalised by the number of all employed workers in the first period of the sample. The long run workers experience the longest employment spells that is technically possible given the length of the sample (192 months).

<b>Share of long-term workers</b>			Table 4
Sector	Share	(if prime age)	
Accommodation /Food	0.03	0.07	
Transport	0.14	0.20	
Entertainment	0.09	0.17	
Aggregate	0.16	0.22	

Note: Long-term workers are the workers who stayed employed for the longest period allowed in the data sample. The first data column shows the total population, whereas the second column limits the population to prime age workers (defined as 25-55 years).  
Source: Statistics Denmark and own calculations.

The Accommodation/Food and Entertainment sectors have a lower share of long-term workers. While the difference is more pronounced for the whole population, it is apparent also for the prime age subgroup defined as 25-55 years (in particular for the Accommodation/Food sector), so the difference is not driven only by the different age structure of the sectors.

The second measure is the average duration of a work relationship. This measure is computed only for those workers in the sample for whom



we observe both the start and end date of a work relationship.

Sector	Length of employment spell	(if prime age)
Accommodation /Food	9.0	11.5
Transport	18.6	25.8
Entertainment	9.7	14.1
Aggregate	17.5	23.7

Note: Average length of employment spell is computed only for those workers for whom we observe both the start and end date of the employment spell. For this reason, this measure provides a lower bound on the unconditional length of employment spell.

Source: Statistics Denmark and own calculations.

In line with the previous results, the employment spells in the Accommodation/Food and Entertainment sectors are shorter on average than in the economy as a whole. Similarly, the Transportation sector is also close to the economy average, confirming the results in Table 5.

The difference between the results for the whole population and the prime age group are relatively smaller in the sectors where people below 25 are relatively more numerous as people experience longer employment spells later on in their lives and careers.

**Workers in Accommodation/Food and Entertainment seem to be less attached to their firms compared to the rest of the economy**, as documented both in terms of long-term workers and length of employment spells.

Finally, even if a firm and worker separate, they might stay somewhat attached. A **recall** is a situation when a worker separates from a firm, stays unemployed at least for one month and then is rehired by the same firm. Firms having a

preference for their past workers suggest that these workers may have some firm-specific human capital that other workers do not have.

Using this measure of worker-firm attachment, Table 6 shows that **Accommodation/Food has lower-than-average firm-specific human capital.**

Sector	Share of recalls	(if prime age)
Accommodation /Food	0.12	0.12
Transport	0.17	0.13
Entertainment	0.21	0.15
Aggregate	0.17	0.15

Note: The share is computed as the number of separated workers whose next job was at the same firm (after experiencing at least one month without a job) over the total number of separations.

Source: Statistics Denmark and own calculations.

In terms of recalls, the three sectors and the aggregate economy become more similar after restricting the sample to the prime age workers.

Roughly half of all recalls happen very quickly, with the workers spending less than a full quarter unemployed. This suggests that **firm-specific human capital depreciates significantly after spending more than a couple of months outside of the firm.**

## Sector-specific human capital

To assess the importance of sector-specific human capital, we focus on workers who separate from their employer and find the next job in a different sector. The share of these workers, labelled **sector switchers**, is reported in Table 7. Workers in Entertainment and in Accommodation/Food switch sector more often compared to the average across all sectors. In



contrast, **workers in Transportation tend to switch less often.**

Sector	Share of switchers	(if prime age)
Accommodation /Food	0.61	0.57
Transport	0.54	0.50
Entertainment	0.65	0.67
Aggregate	0.56	0.55

Note: The share of switchers is computed as the number of all workers who separate from their employer and switches to a different sector in their next job relative to the total number of separations.  
Source: Statistics Denmark and own calculations.

These differences are present both in the population as a whole and in the prime age subgroup.

Another way to assess the importance of sector-specific human capital is to look at how long workers search before they switch sector. Workers with more sector-specific human capital are likely to search for a job in the original sector for longer before moving to a different sector (perhaps until their sector-specific human capital depreciates). In general, workers spend less time being unemployed when searching in their original sector.

Table 8 shows that **in the Transportation sector, the longer unemployment spells for the workers who switch sector once again point to the presence of high sector-specific human capital.** Interestingly, workers who switch from the Entertainment sector do so after very short unemployment spells, suggesting that in this sector there is a lot of less attached workers, perhaps students who do not see this job as their ultimate career.

Sector	Switchers		Stayers	
	Length of U spell	(if prime age)	Length of U spell	(if prime age)
Accommodation /Food	3.7	3.8	2.8	2.8
Transport	6.7	4.1	3.7	2.8
Entertainment	3.2	3.1	4.2	3.4
Aggregate	4.1	3.6	4.0	3.2

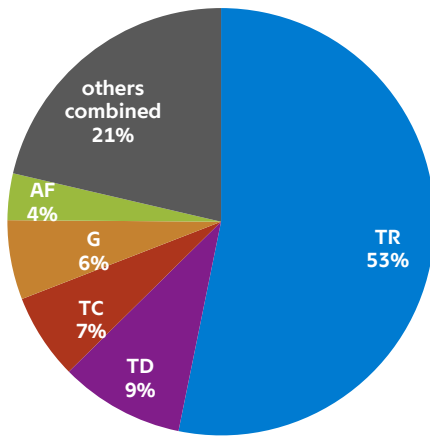
Note: Average number of months before finding a new job. The first two columns report this number for workers who ultimately switch sectors, the last two columns for workers who stay in the same sector.  
Source: Statistics Denmark and own calculations.

Chart 1 shows the five most frequent destination sectors after separation. The most common sector is the starting sector. However, the figure also shows that there are significant flows of workers between Entertainment and Accommodation/Food. This could be worrisome as both sectors are severely exposed to the coronavirus shock; these workers may have to look for employment opportunities in different sectors than the ones which historically have represented an inflow destination.

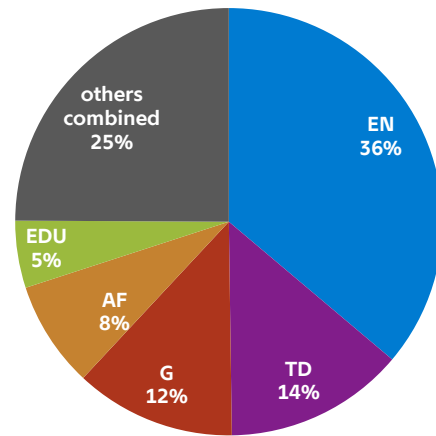
Destination sectors for separated workers

Chart 1

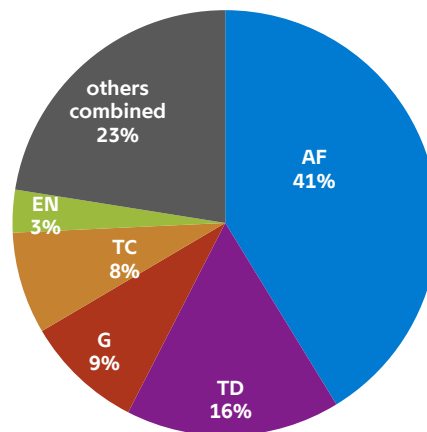
Transport



Entertainment



Accommodation/Food



Note: The destination sector is the sector of new job regardless of the length of the unemployment spell. The pie charts report raw flow shares. Despite Accommodation/Food and Entertainment being such small sectors (as described in Table 1), they appear in each other's top 5 destinations, suggesting that these two sectors share some workers. Abbreviations: AF – Accommodation and Food, EN – Entertainment, TR – Transportation, G-Government and public sector, EDU – Education, TC – Travel, Cleaning and other miscellaneous services, TD – Trade.

Source: Statistics Denmark and own calculations.

To summarize, **Transportation sector workers seem to have important sector-specific human capital** as they switch to other sectors less often and only after longer unemployment spells. This

indicates that reallocating these workers will be difficult and replacing them will be costly in terms of regaining pre-epidemic productivity levels.

In contrast, workers in **Entertainment** switch a lot and after very short unemployment spells. This finding is consistent with **low sector-specific human capital**, suggesting that these workers will have an easier time finding jobs elsewhere.

## Conclusion

The social distancing measures imposed by governments across the world to fight the pandemic are likely to lead to some short-term unemployment, particularly in sectors like Transportation, Accommodation/Food and Entertainment. During their tenure, workers accumulate both firm and sector-specific knowledge that increases their productivity within the same firm and the same sector, but which is not useful elsewhere.

**Large worker reallocations can thus be detrimental for aggregate productivity and slow down the recovery if a large amount of human capital gets destroyed or lost.** To assess the importance of sector-specific human capital, we focus on worker flows between firms and between sectors.

**The historical evidence on worker flows suggest that reallocating workers from the Transportation sector may take longer and reduce aggregate productivity to a larger extent than reallocating workers from the Accommodation/Food and Entertainment sectors. The reason is that workers in Transportation accumulate relatively more sector-specific human capital.**

Workers in Accommodation/Food and Entertainment appear to accumulate firm-specific human capital to a smaller extent and reallocate relatively easily during normal times. At least some part of this result is driven by the fact that workers in these sectors are relatively younger.

## Appendix

**Data:** The main data source used is the 'Beskæftigelse for lønmodtagere' dataset (BFL) provided by DST. This dataset consists of monthly pairs of worker-firm data from January 2008 to September 2018. Using the firm identifier from BFL, we obtain the sectoral information 'Generel firmastatistik' (FIRM) register. FIRM is an annual dataset that covers the period until 2017. Where possible, we make an assumption that firms do not switch from the sectors they operate in, so the data from 2018 BFL can be used.

In order to be able to track workers across employers, we only keep the work relation with the largest number of hours in the given month and we disregard all employee-employer matches that report working less than 10 hours a month. The resulting dataset contains roughly 2.5 million employee-employer matches a month.

The sectors<sup>1</sup> analysed in this note are defined using the following sector codes:

- Accommodation/Food 55.00.0-56.00.0
- Transportation 49.00.1-53.00.0
- Entertainment 90.00.0-93.00.2

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<sup>1</sup> Danish Industrial Classification and Standard Industrial Groupings is available at <https://www.dst.dk/pubfile/22257/appendix>

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