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What skills are employers looking for? Applying generative AI to Danish job postings[1]

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[1] This contribution was prepared for the workshop. The views expressed in this publication are those of the authors and do not necessarily represent the official views of the Committee, its members, or the BIS.

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What skills are employers looking for?
Applying generative AI to Danish job postings

4th IFC workshop on data science in central banking, February 18th 2025

Per Andersen & Erik Grenestam, Danmarks Nationalbank

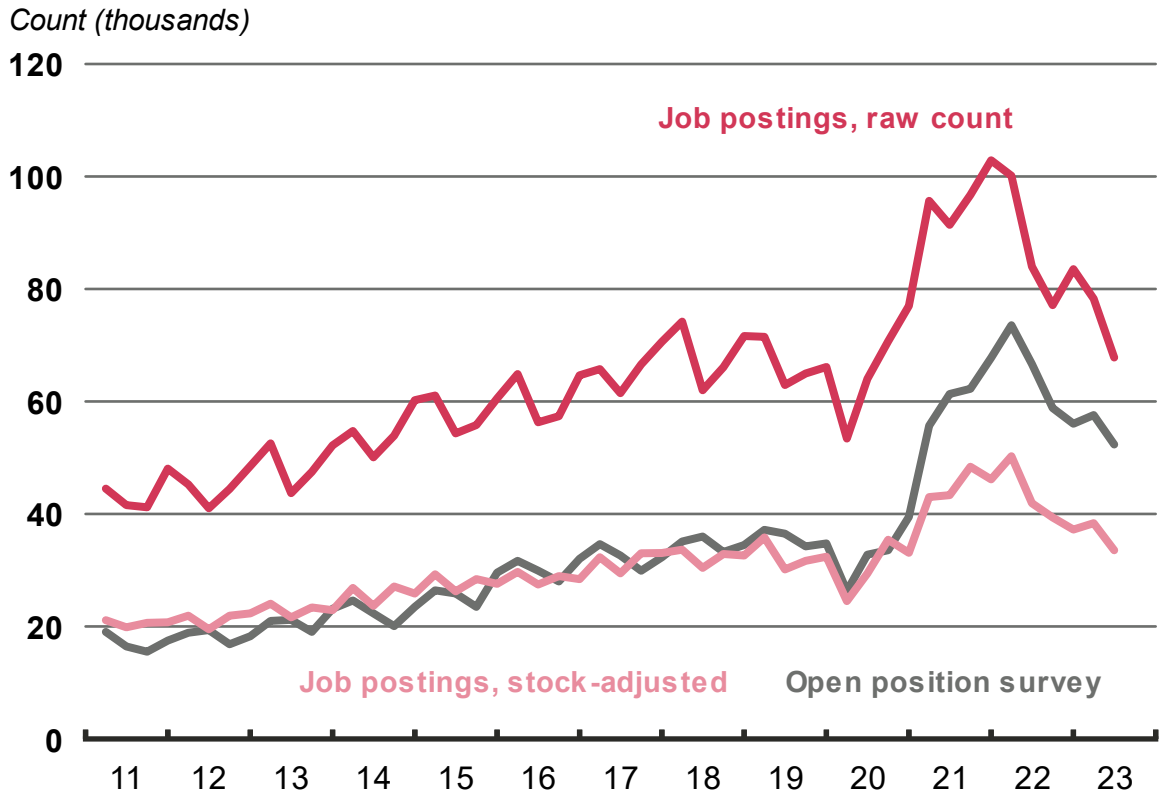
Our goal is to build a useful dataset describing skill demand in Denmark

~ 3.2 million job postings from *jobindex.dk* (2011-2023)

Generative AI

Panel of granular **skill mentions** using an established **skill taxonomy**

Our job postings data cover most of the open positions in Denmark



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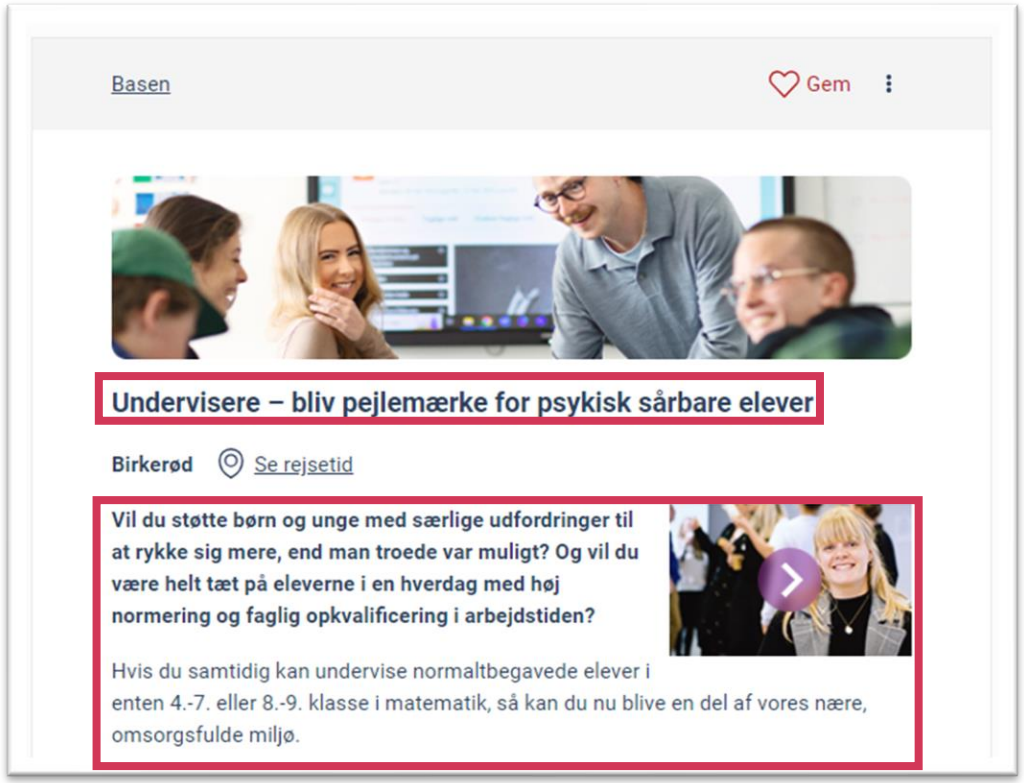
Why should we care about skills?

- Labor economics has seen a paradigm shift from a static view of labor to a task- and skill-based approach (Autor, 2013).
- Skill-biased technological change shifts the demand for specific skills (Acemoglu & Restrepo, 2018; Autor, 2019).
- Evidence of a rising premium for non-cognitive (”soft”) skills (Edin et al., 2017)

→ **Data on skill demand could be critical for understanding labor market trends**

We extract a list of required skills, competencies, and knowledge using OpenAI's GPT 4o-mini



You are given a job posting written in Danish. Your tasks are:

1) *Extract all the required skills, competencies, and knowledge.*
2) *Identify the job title as accurately as possible.*

You must perform both tasks with equal care and thoroughness. Focus first on identifying and listing all relevant skills and competencies in detail. Then, identify the job title. Translate your findings into English. Do not include any information about the employer.

{job posting text}

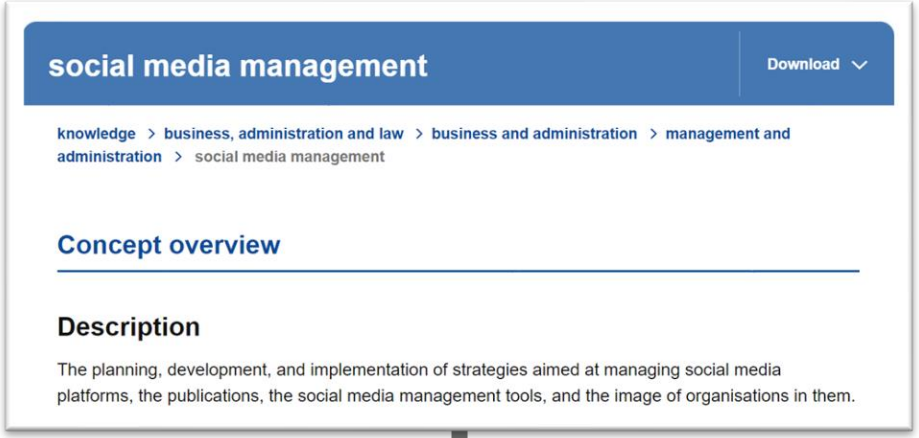
Matching the GPT response to ESCO enables us to create a structured dataset of skills

Example response from GPT 4o-mini

Skill	Job title
planning and coordinating content	Social Media Specialist
performance reporting and analysis	
influencer management	
trend spotting	
interest in social media	
aesthetic sense	
experience with trends	
fluency in English (written and spoken)	
strategic thinking	
creative thinking	
content creation for social media	

For structure, we match each skill to it's closest ESCO skill

ESCO (*European Skills, Competences, Qualifications and Occupations*) is a classification system maintained by the European Commission. ESCO lists about 14.000 skills that are "relevant to the European labor market".



Pre-trained embedding model

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We use an LLM to choose the best ESCO matches for each extracted skill-title pair

- The embedding model reduces the scope of the classification problem from ~14.000 down to 5-10 labels.
- However, the closest match is not always the best…

Skill	Job title	ESCO title	Rank
perform statistical analysis using SAS	biostatistician	mathematics and statistics	1
		apply statistical analysis techniques	2
		SAS language	3
		statistical analysis system software	4
		statistical modeling techniques	5
		statistics	6
		data analytics	7

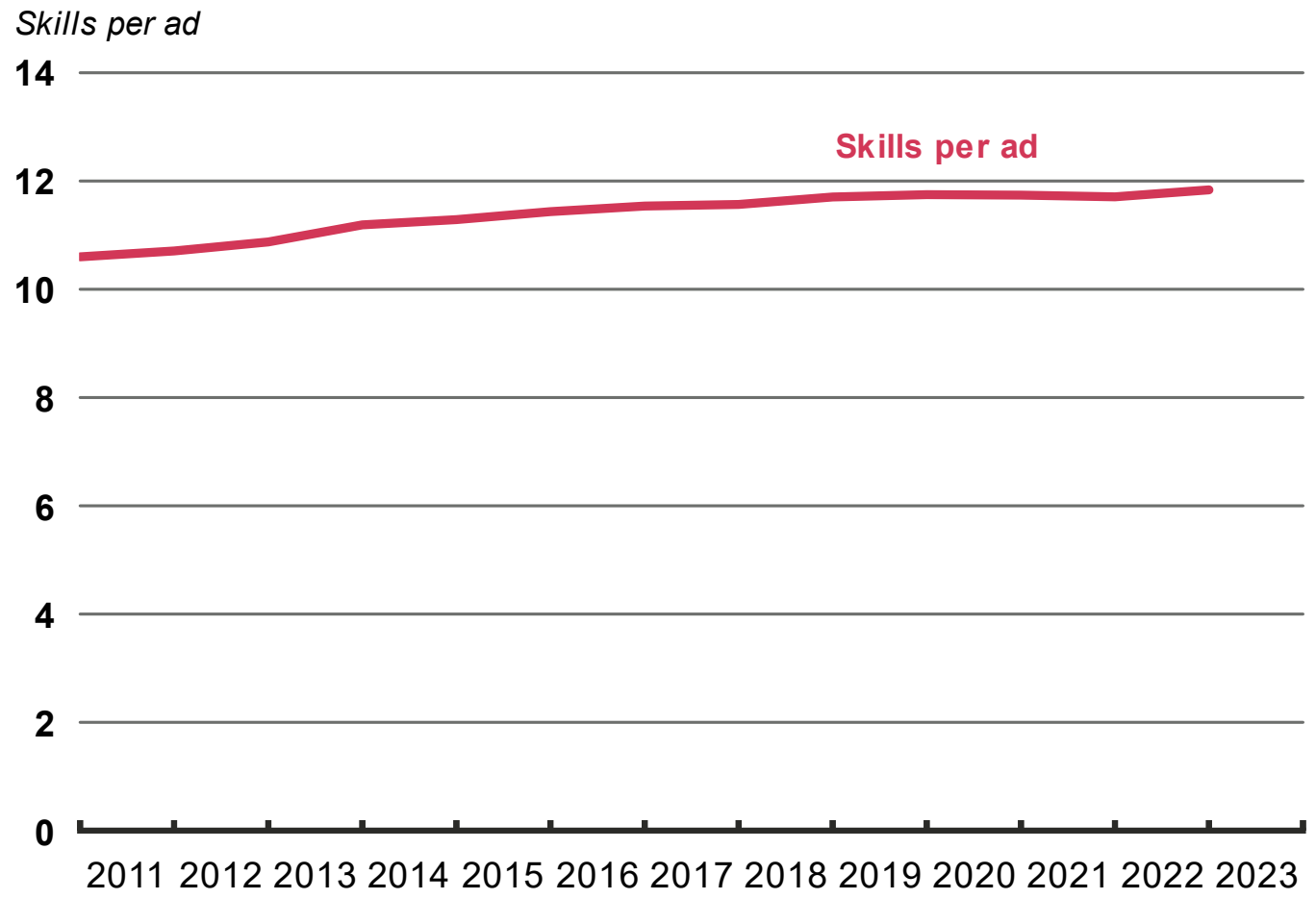
Prompt for reranking labels

The skill *'perform statistical analysis using SAS'* is required for the job *'biostatistician'*. Which of the following options is the best match for this skill?

1) mathematics and statistics
2) apply statistical analysis techniques
3) SAS language
4) statistical analysis system software
5) statistical modeling techniques
6) statistics
7) data analytics
8) none of the above

24 million prompts later…

- We've extracted 36.3 million skills mentioned across 3.2 million job ads.
- In 2023, we identify 11.8 skills per ad, up from 10.5 in 2011.
- Total cost of tokens: **~$800**



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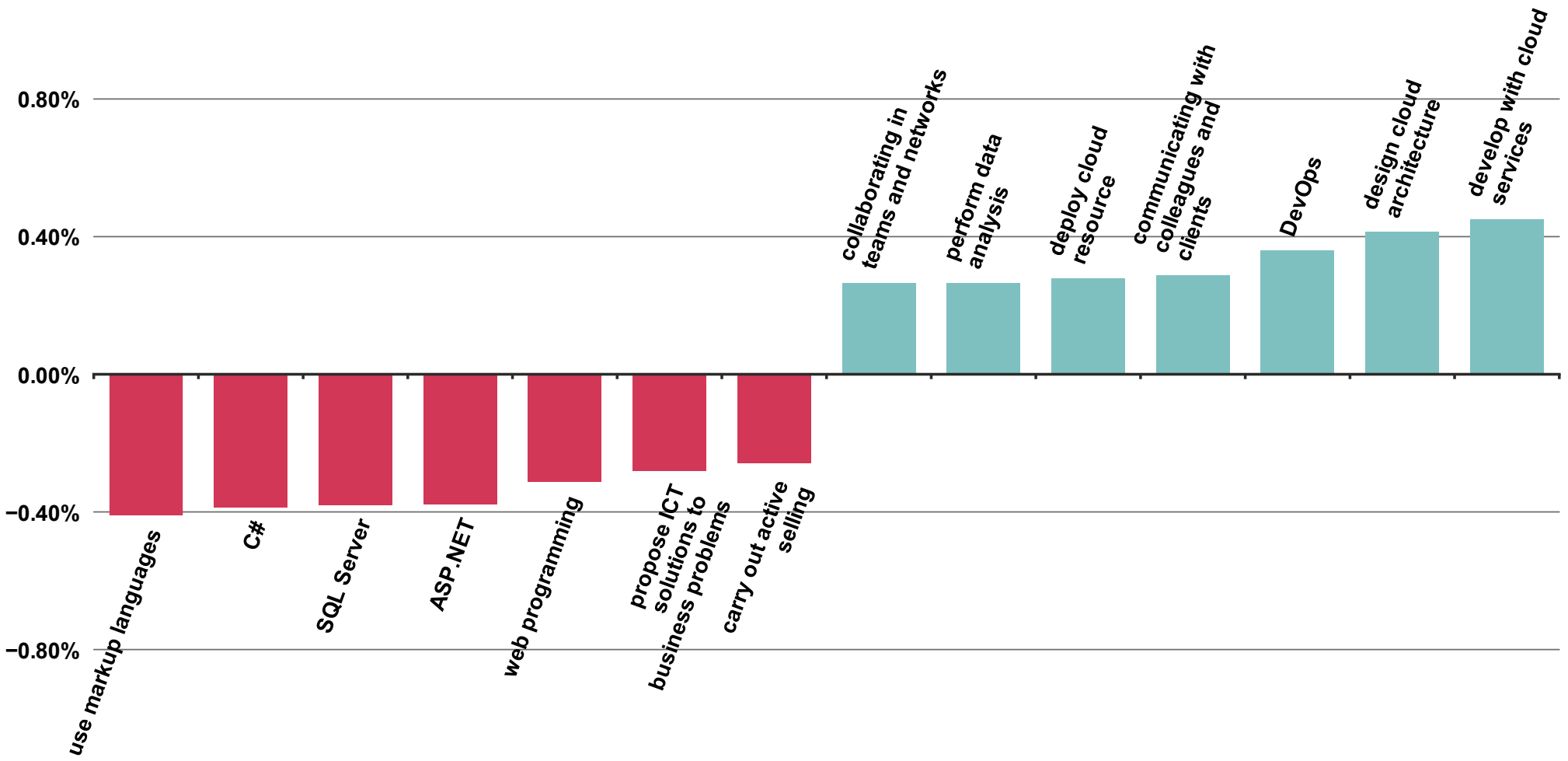
Case: Skill trends in the information sector reflect programming languages falling out of favor and the rise of the cloud

Skill share, percentage point change, 2011-2023



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