

**Drawing from the Region:
Early Labour-Market Adjustment to Novo Nordisk's Expansion
in Kalundborg**

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This thesis investigates the early labour-market response to the investment waves announced in 2021 and 2023 by Novo Nordisk, aimed at expanding its production capabilities in Kalundborg, Denmark. We use municipal-level register data on employment, commuting, unemployment, economic activity and migration from Danmarks Statistik, comparing conditions prior to the investment waves with labour-market developments observed thereafter. We document that workplace employment within Kalundborg rose sharply (+19.3%), largely met by in-commuters, with in-commuting growing by 44.2% over the observed period. Local resident employment similarly grew by 5.8%, while registered unemployment declined by 1.4 percentage points, indicating some degree of local absorption, though the magnitude of these changes was considerably smaller than that of commuting. The working-age population and net migration remained flat or slightly negative, suggesting limited residential relocation within the short timeframe of the analysis. The findings point to a dual adjustment, where the local labour-market tightened modestly whilst regional commuting functioned as the predominant adjustment channel, increasingly supplying labour to Kalundborg to meet the heightened demand. These results are consistent with short-run regional adjustment theory, suggesting that large and geographically concentrated investments can generate labour-demand shocks that are absorbed through the broader regional labour market, rather than through immediate in-migration or local resident employment alone.

Keywords: Labour-demand shock, regional adjustment, commuting, Kalundborg, Novo Nordisk

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1. Introduction

When a major firm expands its production capacity within a small municipality, the effects are rarely confined to the firm itself. The scale of investment relative to the local labour-market can generate a concentrated demand shock, with implications extending well beyond the municipal boundary. This chapter introduces Novo Nordisk's expansion in Kalundborg as precisely such a case, where two large investment waves, announced in 2021 and 2023, created a geographically concentrated increase in labour-demand relative to a small local labour supply. It establishes why the scale of the investment matters in relation to Kalundborg's labour-market, and frames the central question of the thesis: *whether the resulting increase in labour-demand was absorbed primarily through regional in-commuting, or through local resident employment growth and migration into Kalundborg.*

1.1 Background

Large firm investments can function as regional economic shocks when they are geographically concentrated and of sufficient scale. In small municipalities, even a moderate number of new permanent jobs, construction workers, or supplier linkages may be large relative to the local labour supply. The relevant question in such settings therefore extends beyond whether the firm expands, to how the surrounding regional labour-market absorbs the expansion.

In 2021 and 2023, Novo Nordisk announced two investment waves targeting its largest production site in Kalundborg, making it a particularly relevant case for regional economics, given the scale of the investment relative to the host municipality. The initial wave amounted to DKK 17 billion, with a second wave of DKK 42 billion following in 2023 (Novo Nordisk, 2021; Novo Nordisk, 2023). As detailed in Chapter 2, the total committed capital has since been revised, now standing at DKK 71.9 billion, representing an extraordinary concentration of investment relative to the size of a municipality of roughly 48,000 people. This case therefore provides a view into how an exceptionally large and geographically concentrated firm expansion is reflected in early labour-market adjustments.

1.2 Research Problem

Large firm investments tend to generate expectations beyond the firm itself, as they may increase local demand for labour and goods, stimulate construction activity, and generate demand for related services. In the long run, these investments may also contribute to broader processes of agglomeration, local multiplier effects, and regional development (Moretti, 2010; Greenstone et al., 2010). In the short run, however, local labour supply may be limited in small municipalities, and it is not self-evident that the resulting increase in labour demand can be fully absorbed by the local resident workforce alone. The research problem is

therefore not only whether adjustment following the shock occurs in Kalundborg, but rather how the increased labour demand is met.

This issue is particularly relevant in the case of Novo Nordisk's expansion in Kalundborg. The investment-waves announced in 2021 and 2023, represent a concentrated positive labour-demand shock within a municipality with a relatively limited local labour supply. Since the investments are recent and the new production facilities are not expected to be fully operational until 2027 and 2029 respectively, long-term effects such as migration or complete local employment adjustments are unlikely to be visible within the timeframe of this study. Instead, the more immediate question to address is how the local and regional labour markets have begun to absorb the shock in the short run.

The central uncertainty is whether the labour-demand shock has been absorbed mainly within Kalundborg or through the wider regional labour market. Labour-demand shocks can be absorbed through several channels, including commuting, local employment growth, and migration, but these mechanisms operate over different time horizons (Blanchard & Katz, 1992; Decressin & Fatás, 1995). Local resident employment and labour-force participation tend to adjust relatively quickly, whilst migration and residential relocation are generally slower responses that take longer to materialise (Kangasharju & Pekkala, 2001). Commuting is particularly relevant in this context because local labour-markets are not closed units, as workers are able to live in one municipality whilst responding to employment opportunities created in another (Monte et al., 2018; Bartik, 2024). Rather than treating the shock as a purely local employment question, it can therefore be understood as a regional labour-market question, where the demand created in Kalundborg may be met by workers from the wider regional labour-market.

The core empirical question with regard to Novo Nordisk's expansion in Kalundborg therefore becomes whether, and how, early labour-market adjustment is visible in the short run. The thesis focuses primarily on whether the early labour-demand shock was absorbed through increased regional in-commuting, whilst also assessing whether local resident employment or in-migration appear to have contributed to the adjustment. This distinction is important because the same increase in workplace employment can imply different forms of regional adjustment depending on whether the additional labour comes from local residents, commuters, or new residents. Without distinguishing between these channels, the early labour-market effects of Novo Nordisk's expansion may be misinterpreted as a purely local employment effect rather than as part of a wider regional adjustment process.

1.3 Aim and Scope

The aim of this thesis is not to estimate the full economic impact of Novo Nordisk's expansion, but to examine whether early labour-market changes are visible in municipal-level employment and commuting data from Danmarks Statistik. Specifically, we aim to assess how the shock was absorbed through commuting, local resident employment, unemployment,

and labour-force participation. The chosen time frame is 2014–2024, providing sufficiently long pre-investment trends whilst encompassing the most recently available years with consistent data availability. Given the recency of the investment waves, we do not attempt to establish direct causation. Instead, we provide descriptive evidence of whether employment and commuting patterns changed in ways consistent with early labour-market adjustment.

Through this study, we seek to answer: *To what extent did regional in-commuting, rather than local resident employment growth, absorb the early labour-demand shock associated with Novo Nordisk's expansion in Kalundborg?*

To answer this question, the thesis breaks the overall adjustment process into four observable dimensions: in-commuting, workplace versus resident employment, local resident labour-market adjustment, and residential adjustment:

Sub-question 1: *Did in-commuting into Kalundborg increase after the Novo Nordisk investment waves?*

Sub-question 2: *Did workplace employment in Kalundborg grow faster than resident employment, suggesting that labour-demand was not absorbed solely by local residents?*

Sub-question 3: *Is there evidence of local resident labour-market adjustment through higher employment, lower unemployment or increased labour-force participation?*

Sub-question 4: *Is there evidence of residential adjustment through population growth or net in-migration, or does migration appear limited in the short run?*

1.4 Outline

The remainder of this thesis is structured as follows: Chapter 2 adds contextual background on Kalundborg, Novo Nordisk's historical presence, and the recent investment waves. Chapter 3 provides the theoretical framework, grounding the analysis in existing literature on local labour-demand shocks, commuting as a short-run adjustment channel, and the regional adjustments expected to materialise in the long run. Chapter 4 describes the data sources, units of analysis, and key variables. Chapter 5 then outlines the methodological approach as well as the empirical strategy. Chapter 6 presents the empirical results and analysis, examining commuting, migration, and local resident labour-market indicators in sequence. The chapter additionally includes robustness and validation checks to corroborate the observations. Chapter 7 lastly concludes by summarizing our findings, discussing practical implications and future research, whilst addressing the research objectives set from the outset.

2 Context

Kalundborg, Denmark, is a small Danish municipality located in North-West Zealand, with a population of roughly 48000 people (Danmarks Statistik, 2026). Kalundborg is recognized for its industrial profile, including Kalundborg Refinery, Ørsted A/S, Novo Nordisk A/S, and more. Among these firms we focus on Novo Nordisk, a multinational pharmaceutical company which has a long-standing embeddedness in the municipality of Kalundborg.

Novo Nordisk's presence in Kalundborg is not new. The company was formed in 1989 through the merger of Nordisk Insulinlaboratorium and Novo Terapeutisk Laboratorium, two Danish firms with roots in insulin and diabetes care, dating back to the early 1920s (Novo Nordisk, n.d.). However, Novo's connection to Kalundborg predates this merger. In 1969, Novo established an insulin production facility in Kalundborg, initiating a long-standing industrial presence in the region. Because of their ties to Kalundborg, predating the investments, the recent investment waves represent an expansion of existing operations rather than a new firm entering the market.



Figure 2.1 - Novo Nordisk Expansion Timeline

Source: Novo Nordisk, 2021; Novo Nordisk, 2023; Novo Nordisk A/S, 2026, p. 10

As noted, the pre-existing facilities are being expanded through two major investment waves announced in 2021 and 2023, amounting to DKK 17 billion and DKK 42 billion respectively. (Novo Nordisk, 2021; Novo Nordisk, 2023). The capital injections are targeted at upgrading existing infrastructure and constructing additional facilities, specifically increasing manufacturing capacity for Active Pharmaceutical Ingredients (API), alongside the assembly and packaging of both current and future oral and injectable medicines. Prior to the 2021 wave, Novo Nordisk Kalundborg employed approximately 3,000 people (Novo Nordisk, 2020). The 2021 expansion is expected to create 400 permanent jobs, while the 2023 wave is projected to increase that count by another 800, with an anticipated need of

approximately 3,000 external workers during the intensive construction phase (Novo Nordisk, 2021; Novo Nordisk, 2023).

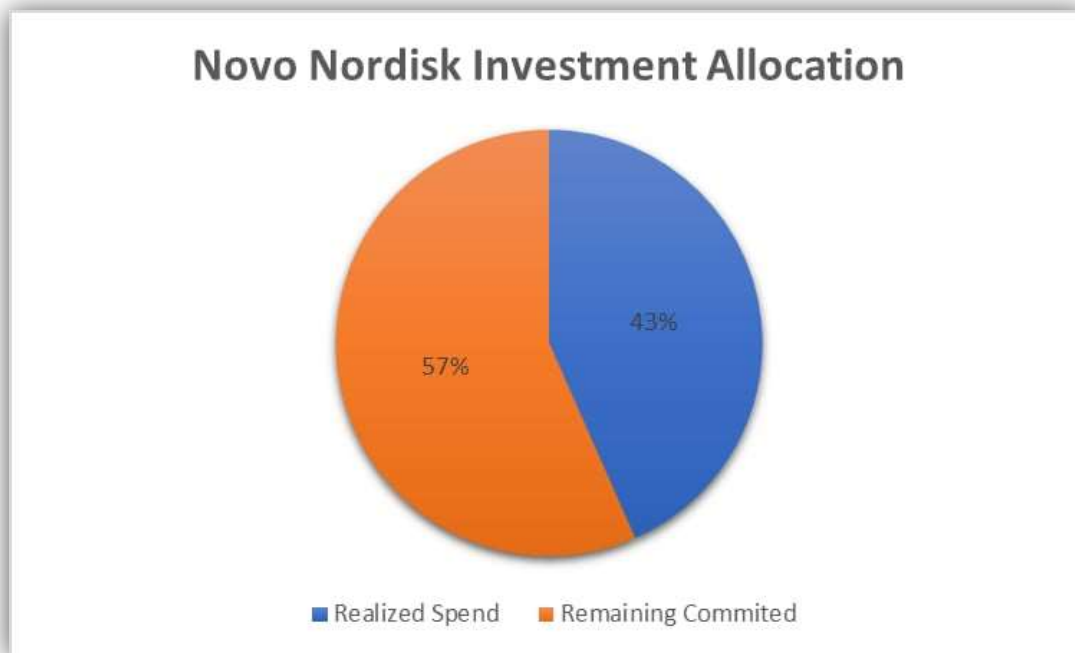


Figure 2.2 - Novo Nordisk Investment Commitment in Kalundborg

Source: Novo Nordisk A/S (2026, p. 10); Novo Nordisk (2021); Novo Nordisk (2023).

Whilst the investment waves were announced in 2021 and 2023, the actual deployment of capital remains ongoing, noting a substantial discrepancy between pledged capital and realized spend. As of December 2025, realized spend amounted to DKK 31.2 billion, representing 43.4% of the total committed investment of DKK 71.9 billion, as illustrated in Figure 2.2. This total is considerably higher than the initially committed DKK 59 billion, reflecting upward revisions disclosed in Novo Nordisk's Form 20-F: the 2021 wave pledge rose from DKK 17 billion to DKK 22.3 billion, an absolute increase of DKK 5.3 billion or 31.2%, while the 2023 wave commitment increased from DKK 42 billion to DKK 49.6 billion, an absolute increase of DKK 7.6 billion or 18.1%. Combined, this brings the total pledged capital allocation to DKK 71.9 billion (Novo Nordisk A/S, 2026).

To contextualise the scale of this investment relative to Kalundborg, the total committed DKK 71.9 billion is approximately eighteen times the municipality's total annual expenditure of DKK 3.9 billion in 2023 (Danmarks Statistik, 2023). This highlights that the investment represents an extraordinary concentration of capital relative to the size of the local economy, and reinforces why even the early adjustment phase warrants close examination.

This means that the majority of the investment, approximately 56.6%, is yet to be spent. The associated construction activity, hiring, and general expansions are still actively unfolding as increasing amounts of the committed capital is translated into realized spend. Furthermore,

the expanded facilities are not anticipated to be fully operational until 2029, meaning that the labour-market adjustments assessed throughout this thesis capture only the early phases of a much larger and longer process. The findings should therefore be understood as early evidence of adjustment, rather than a definitive picture of how the entire regional labour market will ultimately respond to the shock.

3 Theory

This chapter presents the theoretical and previous research used to analyze Novo Nordisk's investment waves in Kalundborg as a local labour-market shock. It first defines local labour-demand shocks and explains why the expansion is treated as a positive labour-demand shock, and its relevance as a geographically concentrated increase in workplace labour-demand (localized demand shock). Then, it turns to *commuting* as the central short-term labour-market adjustment mechanism. Finally, long-term adjustment mechanisms such as agglomeration, supplier linkages and local multipliers, are discussed but these are treated as background to the empirical focus of the study.

3.1 The Novo Nordisk Expansion as a Labour-Demand Shock

We identify the Novo Nordisk expansion in Kalundborg as a positive labour-market demand shock. This follows the framework of Blanchard and Katz (1992), who treat “*regional employment innovations*” as labour-demand shocks when such innovations are driven by increases in labour-demand rather than changes in local labour supply. The Novo Nordisk expansion, however, does not strictly qualify as an *employment innovation* according to the definition used by Blanchard and Katz (1992), where such an innovation is an unexpected movement in regional employment (Blanchard & Katz, 1992, p 24). The investment waves were publicly announced and therefore partly anticipated, but their reasoning still helps conceptualize the expansion as a positive local labour-demand shock, as such a shock can be interpreted as employment changes driven by firms' increasing demand for labour. In the case of Novo Nordisk's investment waves, we interpret the expansion in this way because it stems from increased production needs following rising global demand for its pharmaceutical products, rather than from changes originating in Kalundborg's labour supply (Pharmaceutical Technology, 2024).

We emphasize that this does not imply that the investments are treated as exogenous events in a strict causal sense. We do not employ a quasi-experimental design, and therefore do not rely on exogeneity as an identification assumption. Firm investments are inherently influenced by factors such as labour availability, supply-chain dependencies, and existing production assets (Jacobsen, 2008). The specific strategic considerations and internal decision-making processes driving Novo Nordisk's expansion fall outside the scope of this study.

We instead frame the labour-demand shock descriptively. This allows us to study how an externally driven, large, localised and geographically concentrated expansion is reflected in

early labour-market adjustments, and which mechanisms appear to absorb the shock. This framing allows us to analyze the expansion as a major increase in labour-demand, while still acknowledging that the location of the investment is tied to Novo Nordisk's pre-existing assets. Although not central to the analysis, it is also likely that local industrial conditions play a role in making such investments viable.

3.2 Adjustment Mechanisms and the Role of Commuting

Our reading on adjustment mechanisms in the labour-market, and within regional economics more broadly, implies that adjustment to a shock can occur through several channels, including *unemployment*, *labour-force participation*, *migration*, *wages*, *housing prices*, and *commuting* (Blanchard and Katz, 1992; Bound and Holzer, 2000; Kangasharju and Pekkala, 2001; Monte, Redding and Rossi-Hansberg, 2018; Moretti, 2011). Blanchard and Katz (1992) provide the broadest framework, examining adjustment through *unemployment*, *participation*, *wages*, *prices*, and *worker mobility*. However, because these adjustment mechanisms unfold over varying time horizons, they are not all equally relevant given the strictly short-run focus of our study.

The timings of the labour-market adjustments are central, as they allow identification of the mechanisms most applicable to the case of Kalundborg. Decressin and Fatás (1995) firstly highlight how regional labour-market adjustment differs between Europe and the United States, where they note region-specific labour-demand shocks within Europe initially being absorbed through *labour-force participation*. *Migration* on the other hand becomes a more prominent adjustment mechanism in the long run (Decressin & Fatás, 1995). Kangasharju and Pekkala (2001) reach a similar conclusion in their case for Finland, where *unemployment* and *participation* are affected first, with *migration* lagging behind.

This means that *migration* can be understood as a lagged response. Decressin and Fatás (1995) argue that, within the United States, *migration* is more prominent from the outset. This difference may partly reflect that regional *migration* in Europe can involve greater friction than *migration* across U.S. states. Even though the EU allows free movement of labour, moving across Europe may still involve language barriers, differences in administrative systems and housing-market constraints. These frictions can make *migration* a slower adjustment mechanism, especially in the short run. The findings presented by Kangasharju and Pekkala (2001) similarly show that *migration* is not expected to act as the immediate adjustment mechanism, but that shock absorption primarily occurs through *labour-force participation* and *unemployment* within the first few years.

Commuting is a prominent adjustment mechanism, allowing labour supply from the regional labour-market to meet increased labour-demand. This is particularly important because it allows workers to respond to employment opportunities without needing to change their place of residence. Monte et al. (2018) emphasize that firms do not only attract workers through *migration*, but also through *commuters* from nearby locations. In their framework, *migration* and *commuting* jointly shape the response of local employment to a local labour-demand

shock. This makes *commuting* particularly relevant as a short-term adjustment mechanism. In the context of our scope, increased *in-commuting* can therefore be interpreted as an indicator that part of the labour-market adjustment is occurring beyond Kalundborg's resident workforce, through the wider regional labour-market.

A key distinction to be aware of is the spatial dimension of where the adjustments are studied. In the case of Blanchard and Katz (1992), they underline *migration* as the main long-run adjustment mechanism when regional labour-markets are analyzed at scale. However, this mechanism might not be apparent when the unit of analysis is smaller. Bartik (2024) distinguishes between demand shocks to smaller areas and shocks to the wider commuting zones in which they are embedded. His analysis suggests that the effects of local labour-demand shocks depend both on where jobs are created and on how the affected area is connected to a broader labour-market. Monte et al. (2018) similarly show that *commuting* can largely substitute for local *in-migration*, especially when assessing a narrower spatial dimension, or differently put, when analyzing smaller regions with finer granularity. This distinction is exceedingly important to our case, as the municipality of Kalundborg is a small region, not a broad regional labour-market. A positive labour-demand shock within Kalundborg, which is geographically small, may therefore be absorbed beyond the municipality itself. Instead of appearing only through local *resident employment* or *in-migration*, it may appear through increased *commuting* from surrounding municipalities, constituting adjustments in the broader regional labour-market.

Monte et al. (2018) also note that local employment responses to demand shocks differ strongly depending on *commuting openness*. They highlight spatial linkages through *goods markets, commuting, and migration* as having a strong impact on what they coin *employment elasticities*. This concept measures the response of local employment to a local labour-demand shock, as is the case with the Novo Nordisk investment waves, where the elasticity is shaped by *migration* and *commuting* (Monte et al. 2018, p. 3855). In Denmark's relatively small but highly integrated context, the concept is especially useful. Cross-municipal *commuting* may allow *workplace employment* to respond to the labour demand shock without requiring an increase in the municipality's *resident workforce*. Moretti (2010) similarly mentions elasticity, but instead the *elasticity of local labour supply*, noting that the local effect of labour-demand shocks depends on how flexible the labour supply is in response. This substantiates the broader point that when local resident labour supply cannot adapt quickly, *commuting openness* may allow the labour-market shock to be absorbed through *commuting*, especially in the short run. It is additionally worth noting that worker responsiveness to demand shocks may vary by skill level, with low-skilled workers tending to face greater mobility constraints than high-skilled workers (Bound & Holzer, 2000; Notowidigdo, 2020), although this dimension is beyond the scope of the present analysis.

Kangasharju and Pekkala (2001) introduce additional nuance to the adjustment debate by considering whether responses differ based on the positive or negative nature of a shock. They find that adjustments to region-specific shocks are "symmetric," with both positive and negative shocks primarily absorbed through *labour-force participation* and *unemployment*,

while migration only plays a significant role in the long run (Kangasharju & Pekkala, 2001, p. 7, table 1). The distinction between short- and long-run adjustments is particularly pertinent to our analysis, given the highly recent nature of the 2021 and 2023 Novo Nordisk investment waves. Within this short timeframe, slower or lagged responses such as migration are unlikely to have fully materialised. Consequently, commuting and local labour-market responses can be expected to act as the primary early absorption mechanisms to satisfy the surge in local labour demand.

3.3 Long-Run Mechanisms as Theoretical Background

Literature on regional economics and agglomeration mechanism suggests that through self-reinforcing mechanisms such as *firm clustering*, *labour pooling*, *supplier linkages* and *local demand effects*, may generate wider regional effects over time (Krugman, 1991; Moretti, 2010; Greenstone, Hornbeck and Moretti, 2010). The New Economic Geography framework coined by Paul Krugman (1991) provides a key theoretical starting point, where *scale economies*, *transport costs*, and *market-size effects* lead to clustering of firms and workers. In context of our study on Kalundborg and Novo Nordisk, it helps explain why the expansion waves were not a random choice of location, but building upon pre-existing infrastructure, firm-specific assets, and pharmaceutical production capabilities. Additionally, Greenstone, Hornbeck and Moretti (2010) show that large manufacturing plant openings generate *productivity spillovers* for geographically or economically connected firms, whilst Moretti (2010) shows that new tradable-sector jobs may increase demand for local non-tradable employment. In relation to the Kalundborg case, these findings suggest that Novo Nordisk's expansion may have effects beyond direct employment at the firm itself, particularly through supplier linkages, construction activity and increased demand for local services.

These mechanisms are, however, not a central empirical focus within this thesis. *Agglomeration*, *multiplier effects* and *spillovers* are generally considered longer-run adjustments, whereas our focus lies on early labour-market responses following the investment waves. These longer-run adjustment mechanisms are therefore regarded primarily as theoretical motivation, while also serving as a contrast to the short-run commuting mechanism. Alpino et al. (2026) caution against assuming that large firm investments automatically generate broad-based regional growth. They show that the effects of large facility openings may remain concentrated in the directly affected sector and related supplier industries, with limited *spillover* or *local multiplier effects*. This is noteworthy in relation to the Kalundborg case, where even an investment of Novo Nordisk's scale does not necessarily imply wider regional spillovers. Such spillovers are even less likely to be observable given the short time period following the investments analyzed in this thesis. We therefore treat agglomeration and multiplier mechanisms as potential long-run developments, rather than as central mechanisms in the empirical analysis.

4. Data

The data chapter presents the data used to analyze the positive labour-market demand shock in Kalundborg following the Novo Nordisk investment waves. We first present the data sources, before outlining the units of analysis and defining the sample selection. Lastly, we discuss the core measurement concepts, data-processing procedures, validation checks and data limitations.

4.1 Data Sources

4.1.1 Overview of Data Sources

The empirical analysis primarily relies on municipal-level, secondary register-based data from Danmarks Statistik's StatBank. The data are used to measure employment, unemployment, population, commuting, migration and resident employment. Official press releases and announcements from Novo Nordisk are used as contextual additions to identify the timing of the investments in Kalundborg. The press releases are not used as outcome data, but as the basis for defining treatment years in the descriptive analysis.

Data code	What the data shows
PEND100	Workers employed in a municipality, by municipality of residence
PEND101	Resident employment, workplace employment, in-commuting and out-commuting, all by municipality
FOLK1E	Population by municipality, age and ancestry
FLY66	Migration flows between municipalities, by age and direction
AULP01	Registered unemployment rates by municipality
RAS200	Resident employment rates and economic activity by municipality
RAS301	Workplace employment by municipality and industry

Source: Danmarks Statistik StatBank, tables PEND100, PEND101, FOLK1E, FLY66, AULP01, RAS200 and RAS301, Danmarks Statistik (2024a, 2024b, 2024c, 2025)

The exports from Danmarks Statistik's StatBank are processed in Stata and cleaned into panel datasets for the analysis. Detailed descriptions of the data-processing procedures are omitted from the main text, but can be found in *Appendix A*. The data section therefore

focuses primarily on the data themselves, their purpose, and their suitability for the analysis, while the use of the data and the relevant calculations are discussed in chapter 5.

4.1.2 Resident Employment & Commuting Data

We employ several StatBank tables, as no single dataset captures all the different adjustment channels relevant to our analysis. We use PEND101 to measure *resident employment*, *workplace employment*, *in-commuting* and *out-commuting* at the municipal level. PEND101 is central to the analysis, as it allows us to distinguish between jobs located in Kalundborg and employed individuals living in Kalundborg, as well as workers commuting into or out of the municipality. PEND100 is then used to assess whether individuals working in Kalundborg also reside within the municipality. This specifically allows us to analyze whether workers employed in Kalundborg live in Kalundborg, in neighbouring municipalities, or elsewhere.

4.1.3 Population & Migration Data

We also examine whether residential adjustment forms part of the response to the labour-demand shock. For this purpose, we use FOLK1E and FLY66. FOLK1E measures *population* by municipality, age and ancestry, while FLY66 captures *migration flows* into and out of Kalundborg. Together, these sources allow us to assess whether the period after the investment waves coincide with growth in the working-age population or positive net migration into Kalundborg.

4.1.4 Labour-market & Sectorial Employment Data

The local labour-market channel is examined using AULP01 and RAS200. AULP01 measures *registered unemployment* as full-time unemployed persons in percent of the labour force, which we use to assess whether *unemployment* among Kalundborg residents declined during the period of increased labour-demand. RAS200 provides *residence-based employment* and *economic activity rates* for residents aged 16–64. This allows us to assess whether local residents became more attached to the labour-market. Since these measures are residence-based, they capture the labour-market status of people living in Kalundborg, rather than jobs located in the municipality.

4.1.5 Summary Statistics Table

Table 1 shows the summary of statistics, for the main variables used in the analysis. Note that this is severely shortened, and additional tables for summary statistics can be found in the appendix, see Appendix B, figure B.1 and B.2. Observations refer to analytical observations, such as municipality-year, not individuals. Employment and commuting is measured in persons, while unemployment, employment, economic activity and commuting shares are in percent.

Table 4.1 - Summary Statistics - Broad Overview

Variable	Unit	Source	2019	2024	Change	Type
Workplace employment	persons	PEND101	19,577	23,355	3,778	Absolute
Resident employment	persons	PEND101	22,366	23,668	1,302	Absolute
In-commuting	persons	PEND101	5,838	8,416	2,578	Absolute
Out-commuting	persons	PEND101	8,627	8,729	102	Absolute
In-commuting share	percent	PEND101	29.8	36.0	6.2	Percentage points
Registered unemployment rate	percent	AULP01	3.6	2.2	-1.4	Percentage points
Employment rate, 16–64	percent	RAS200	72.00	75.4	3.4	Percentage points
Economic activity rate, 16–64	percent	RAS200	74.4	76.8	2.4	Percentage points

4.2 Unit of analysis and Sample Selection

Our primary unit of analysis is the *municipality-year*. The descriptive analysis spans from 2014 to 2024, focusing primarily on Kalundborg and the four municipalities neighbouring it, namely Slagelse, Sorø, Odsherred and Holbæk. These are the four neighbouring municipalities around Kalundborg, and they constitute the surrounding labour-market area from which commuting into Kalundborg is likely to occur. We acknowledge that, given the small scale of Denmark, commuting into Kalundborg can plausibly occur from municipalities beyond the immediate neighbours. However, the analysis focuses on the neighbouring municipalities because they represent the most immediate and theoretically relevant labour-market area around Kalundborg. We use the neighbouring municipalities as a regional benchmark rather than as a strict control group. We do this because the neighbouring municipalities are likely to supply labour to Kalundborg, subsequently making them part of the adjustment mechanism, whilst also making them inapplicable as untreated comparison units, as they are likely to take part in the shock adjustment.

We additionally utilize quite specific units, mainly necessitated by the structure of the data exports from Danmarks Statistik. An example is the commuting-flow analysis grounded in data from PEND100, where the unit is *residence municipality-year*, meaning that each observation measures the number of workers living in a given municipality and working within Kalundborg in a given year. This is done to allow us to identify whether the positive demand shock within Kalundborg is absorbed through workers living outside of Kalundborg. We additionally include a sectorial analysis based on the data in RAS301. The unit here is *municipality-sector-year*, seeing as workplace employment in the RAS301 dataset is observed by industry.

In the case of migration, the analysis is structured around Kalundborg as the focus municipality. Some outputs are measured at the *Kalundborg-year level*, where *total in-migration*, *total out-migration*, as well as *net migration* are calculated for each year (the calculations are described in Section 5.5). Other outputs further distinguish migration flows by partner group. In this context, partner group refers to whether the other municipality in the migration flow is one of Kalundborg's neighbouring municipalities or another Danish municipality. This distinguishes the migration flows between Kalundborg and the neighbouring municipalities from migration flows between Kalundborg and other municipalities. This enables us to assess whether Kalundborg experienced positive or negative net migration, but also whether any migration adjustment was concentrated in nearby municipalities or were by broader movements across Denmark.

The time period of 2014–2024 is selected because it provides a consistent period across the datasets. Many of the datasets only have available observations up until 2024, while data for 2025 were not consistently available across the required sources. The chosen period also provides several pre-investment years and includes 2024, the most recent post-investment year with consistent data availability.

4.3 Measurement and Key Variables

A core distinction in the analysis is between *resident employment* and *workplace employment*. *Resident employment* measures employed individuals living in a municipality, regardless of where they work. *Workplace employment*, alternately, measures individuals working within a municipality, regardless of where they live. This distinction is important, as an increase in jobs within Kalundborg does not necessarily imply that those jobs are filled by residents from Kalundborg.

In-commuting measures workers employed in a municipality but living elsewhere, whilst *out-commuting*, on the other hand, measures employed residents who work outside of their municipality of residence. In the case of Kalundborg, a rise in *workplace employment* concurrent with increasing *in-commuting* would indicate that the increased labour-demand is being absorbed through the regional labour-market, rather than by the local workforce. With regards to commuting, it is important to note that it is measured both directly through PEND100 and indirectly through PEND101. PEND100 identifies where workers employed in Kalundborg have their residence, with us grouping these workers into three categories: workers working and living in Kalundborg, workers in Kalundborg living in the neighbouring municipalities, and workers in Kalundborg living in other municipalities outside of Kalundborg and its direct neighbours.

To examine whether the demand shock was absorbed through the local resident labour-market, we combine unemployment data from AULP01 with labour-market rate measures from RAS200. AULP01 provides the *registered unemployment rate*, defined as full-time unemployed persons relative to the labour force. RAS200 provides two residence-based indicators: the *employment rate* and the *economic activity rate*. The *employment rate* captures the share of residents aged 16 to 64 who are employed, while the *economic activity rate* captures the share of residents aged 16 to 64 who are registered as either employed or unemployed. We use the latter as the closest available municipality-level proxy for labour-force participation. Since these measures are residence-based, they describe the labour-market status of people living in Kalundborg, rather than the number of jobs located in Kalundborg.

Variables on migration and population are utilized to assess whether the shock was absorbed through migration, as existing research highlights this as a central adjustment mechanism, particularly in the long run. We therefore thought it prudent, although we are looking at early adjustments, to check whether there are early signs of residential adjustment. For this purpose, we look at *working-age population*, which is measured as residents aged 18–70. Whilst we realize that our upper parameter for working age is high, this is done to ensure that movements are captured. With the exception of RAS200, which uses different age groupings in the dataset, we have tried to apply uniformity across the data by using ages 18–70 consistently throughout our data-exports. We measure migration through *in-migration to Kalundborg* and *out-migration from Kalundborg*, allowing us to also compute *net migration* as in-migration minus out-migration. If the shock was absorbed through relocation into

Kalundborg, it can reasonably be assumed that there would be corresponding growth in the working-age population, or positive net migration into the municipality.

4.4 Data Quality and Limitations

4.4.1 Overall Assessment

We assess the data to be generally reliable for the purpose of our analysis, as the data is register-based statistics supplied by the official statistics agency of Denmark. Danmarks Statistik's documentation elaborate that the datasets we utilize are based on administrative register sources, including *Det Centrale Personregister* (CPR, the Central Population Register), *Registerbaseret Arbejdsstyrkestatistik* (RAS, register-based labour force statistics), *Arbejdsmarkedsregnskabet* (AMR, the labour-market accounts) and *registered unemployment records* (Danmarks Statistik, 2024a; Danmarks Statistik, 2024b; Danmarks Statistik, 2024c; Danmarks Statistik, 2025). This arguably strengthens the reliability of the data compared to survey-based sources, seeing as the variables are constructed from official administrative records rather than self-reported survey responses.

It is, however, important to note that although we regard the register-based data as generally reliable, we still acknowledge certain limitations. The main limitation is the inability to assess whether the variables fully capture the adjustment mechanisms we are examining, specifically regarding temporary labour mobility, firm-level employment and timing adjustments, as the data are captured yearly rather than continuously. A possible way to mitigate this limitation would be to augment the analysis with first-hand hiring data directly from Novo Nordisk, but we decided against this, as it is not core to our analysis when examining regional and municipal-level adjustment mechanisms.

4.4.2 Commuting Data

The commuting data is based on PEND and measures residence and workplace on the last working day of November, making it applicable for our purpose (Danmarks Statistik, 2024c). The annual November reference point, however, means that the data provide a yearly snapshot instead of a full-year measure of commuting behaviour, which is a clear limitation and something to keep in mind. It should additionally be noted that seasonal fluctuations in, for example, construction labour, which is likely to peak in the summer and autumn months, could influence the November snapshot, and should be kept in mind when interpreting the commuting figures.

Danmarks Statistik notes in its documentation that there is some uncertainty in the identification of workplace locations, particularly where employer-based reporting is incomplete (Danmarks Statistik, 2024b). This primarily poses a limitation if the data were to be used for detailed workplace and sectorial analysis, but given the focus of our analysis, we assess it as a moderate, albeit not detrimental limitation.

4.4.3 Population Data

The population and migration data which is based on CPR remains valid for measuring registered residence and formal migration. Danmarks Statistik considers the general quality and reliability of CPR to be very high, but they also note that migration registration can be imperfect, especially for persons who fail to register migration (Danmarks Statistik. 2024a). We do regard the FOLK1E and FLY66 datasets as reliable and appropriate for our intended use. They provide good measures for formal residential adjustments, but we simultaneously acknowledge that they are unable to measure temporary stays, contractual work without formal relocation (Danmarks Statistik. 2024a).

4.4.3 Employment Data

The data on unemployment are similarly register-based and measure registered unemployment through unemployment insurance funds, as well as public job centres (Danmarks Statistik, 2025). This makes the AULP01 dataset appropriate for analyzing registered unemployment. However, Danmarks Statistik's documentation notes that the data is not directly in line with the unemployment criteria set by the International Labour Organization (ILO), as they exclude individuals not registered for benefits (Danmarks Statistik, 2025). We therefore interpret AULP01 as a measure of registered unemployment, rather than as a complete measure capturing all unemployment.

5 Method

This chapter covers the methodological approach applied to examine the early labour-market adjustments following Novo Nordisk's investment waves in Kalundborg. The method is structured around the empirical focus of whether the early labour-demand shock following the investment waves was absorbed primarily through in-commuting or through local resident employment growth. This chapter first presents the overall methodological approach, followed by a discussion of case selection, treatment timing and the empirical strategy.

5.1 Methodological Approach

We apply a quantitative descriptive case-study approach. The case is Kalundborg municipality itself, where Novo Nordisk's investment waves in 2021 and 2023 are treated as a large, localized labour-demand shock. The aim is to identify early adjustments following the shock, and to assess whether there are visible patterns in the local and regional labour-market, rather than trying to establish direct causality between the adjustments and the investment waves by Novo Nordisk.

The analysis will primarily focus on commuting as the central short-run adjustment mechanism, reflecting its expected role as an early adjustment channel given the recent nature of the data. This aligns with the short time frame of the analysis, where commuting is likely to adjust more rapidly than migration and residential relocation. The analysis additionally

examines the local resident labour-market, as well as migration, as supporting mechanisms, testing whether adjustments are observable there as well. These can be regarded as alternative adjustment channels to in-commuting. Local resident labour-market absorption is examined through resident employment, unemployment and economic activity. Migration and population data are instead used to assess whether there are potential signs of early adjustment through relocation.

The empirical approach is descriptive. We do not apply a quasi-experimental design, nor attempt any regressions, and the results should therefore not be interpreted as causal estimates of Novo Nordisk's expansion on Kalundborg. Instead, the analysis examines whether subsequent developments in commuting, employment and migration are consistent with the anticipated early labour-market adjustments. The descriptive approach is appropriate given how recently the investment waves occurred. With data only being consistently available up until 2024, we only have one year of data following the latest investment-wave announcement. The scope has therefore been narrowed to early labour-market adjustment, with particular focus on whether the increase in labour-demand appears to have been absorbed through regional in-commuting.

5.2 Case Selection and Treatment Timing

As touched upon in the background section, Kalundborg has been chosen because Novo Nordisk's investment waves represent a large and geographically concentrated expansion relative to the size of Kalundborg municipality. The analysis is centred around the two investment-wave years, 2021 and 2023. These years are used as reference points in the empirical analysis and marked in figures where applicable.

The analyzed period spans from 2014 to 2024, providing several pre-investment years while including the most recent year for which the relevant datasets are consistently available. The year 2019 is utilized as the main baseline in the growth comparisons and index figures. This is due to 2019 being the most recent pre-COVID year, and it therefore acts as the last representative baseline year before the first investment wave in 2021. We additionally use 2021 as the robustness baseline year to assess whether the patterns observed with 2019 as the baseline remain observable when the baseline year is changed.

5.3 Empirical Strategy

The empirical strategy entails comparing developments in Kalundborg before and after Novo Nordisk's investment waves. We structure the analysis to examine patterns after 2021 and 2023, to assess whether they are consistent with the labour-market demand shock being absorbed through regional in-commuting, or whether local resident employment growth, migration or local resident labour-market indicators also appear to have contributed to the adjustment. The main comparisons use 2019 as the baseline year, while 2021 is used as a robustness baseline.

Commuting data will then be used to examine whether the increased demand for labour was absorbed regionally, namely whether in-commuting into Kalundborg increased while out-commuting remained comparatively stable. This would suggest that labour is being supplied by the regional labour-market, with Kalundborg increasingly functioning as a workplace destination for workers living outside the municipality. We utilize PEND101 to examine aggregate commuting flows, whereas PEND100 is used to identify where workers employed in Kalundborg live. This allows us to distinguish between workers living in Kalundborg, workers living in neighbouring municipalities and workers living in other Danish municipalities.

Kalundborg is additionally compared with its four neighbouring municipalities: Holbæk, Slagelse, Odsherred and Sorø. These municipalities are used as a regional benchmark, although not as a strict control group. The neighbouring municipalities are likely to supply labour to Kalundborg, and it is therefore plausible that they are part of the adjustment mechanism itself. It is therefore important to note that they do not act as untreated comparison units. Instead, they provide a regional reference point for assessing whether Kalundborg's development differs, while also allowing us to examine how the neighbouring municipalities may take part in the adjustment.

We additionally consider alternative adjustment mechanisms, including population and migration, to assess whether there are early signs of residential relocation following the investments. We do, however, acknowledge that migration is generally regarded as a longer-run adjustment mechanism, especially compared to commuting. These results are therefore interpreted cautiously, as migration responses are unlikely to be fully visible within the observed period. Absorption through the local resident labour-market is examined through registered unemployment, the economic activity rate and the employment rate. If unemployment falls, concurrently with increases in employment or economic activity within Kalundborg, this would suggest that the local resident labour-market is absorbing part of the shock.

The empirical strategy follows a descriptive logic. We do not seek to answer whether one isolated channel adjusts, but rather which mechanisms appear to be the most important in the short run. Disproportionate rises in workplace employment relative to resident employment would indicate that external labour supply matters, while rising in-commuting would support commuting as a viable absorption channel. Population growth or positive net migration would suggest residential relocation, whereas falling unemployment or rising employment and economic activity would indicate local resident labour-market absorption.

5.4 Calculations

For the analysis in Chapter 6, the empirical results will rely on two primary modes of presentation. Time-series developments are presented using indexed line graphs (baseline 2019 = 100) to visually illustrate relative trends across Kalundborg and the neighbouring municipalities. Meanwhile, summary tables are utilized to report absolute changes, percentage growth, and structural shifts between the 2019 baseline and the end of the period in 2024. The specific summary measures computed for these figures and tables are defined below:

Absolute Change

$$\text{Absolute change} = \text{value in later year} - \text{value in baseline year}$$

Used for employment, commuting, population, migration and sectoral employment.
such as change 2019–2024 = value2024 – value2019

Percentage Growth

$$\text{Percentage growth} = ((\text{value}_{2024} - \text{value}_{2019}) / \text{value}_{2019}) \times 100$$

Used in growth tables.

Index, 2019 = 100

$$\text{Index}_{2019} = (\text{value } t / \text{value}_{2019}) \times 100$$

Used in main figures.

100 = same level as 2019

120 = 20 per cent above 2019

90 = 10 per cent below 2019

Net Commuting

$$\text{Net commuting} = \text{in_commuting} - \text{out_commuting}$$

Used to assess commuting balance.

Positive value = more workers commute into the municipality than out.

Negative value = more residents commute out than workers commute in.

Workplace-minus-Resident Employment

$$\text{Workplace minus resident} = \text{workplace employment} - \text{resident employment}$$

Used to compare jobs located in the municipality with employed residents.

Positive value = more jobs located in the municipality than employed residents.

Negative value = more employed residents than jobs located in the municipality.

In-commuting Share

$$\text{Incommuting share} = \text{in_commuting} / \text{workplace employment}$$

Used to show how much of workplace employment is filled by non-residents.

For percentages:

$$\text{In - commuting share (\%)} = (\text{in_commuting} / \text{workplace employment}) \times 100$$

Out-commuting Share

$$\text{Out_commuting share} = \text{out_commuting} / \text{resident employment}$$

Used to show how much resident employment works outside the municipality.

For percentages:

$$\text{Out_commuting share (\%)} = (\text{out_commuting} / \text{resident employment}) \times 100$$

Net Migration

$$\text{Net migration} = \text{in_migration} - \text{out_migration}$$

Used for migration adjustment

Positive value = more people move into Kalundborg than out.

Negative value = more people move out of Kalundborg than in.

Residence-group Share

$$\begin{aligned} \text{Residence_group share} \\ = \text{workers from group} / \text{total workers employed in Kalundborg} \end{aligned}$$

Used in PEND100 commuting-origin analysis.

For percentages:

$$\begin{aligned} \text{Residence_group share (\%)} \\ &= (\text{workers from group} / \text{total workers employed in Kalundborg}) \times 100 \end{aligned}$$

Groups: Kalundborg residents, neighbouring municipalities, other municipalities.

Neighbouring Municipality Average

Used as regional benchmark.

Neighbouring average = average of Holbæk, Odsherred, Slagelse and Sorø

$$\begin{aligned} \text{Neighbouring average in year } t \\ &= (\text{Holbæk}_t + \text{Odsherred}_t + \text{Slagelse}_t + \text{Sorø}_t) / 4 \end{aligned}$$

Used for: employment, commuting, population, unemployment, employment rate, and economic activity rate.

Participation-employment Gap

$$\text{Participation_employment gap} = \text{economic activity rate} - \text{employment rate}$$

Used in local labour-market summary.

approximates the difference between people active in the labour-market and those employed.

Mainly reflects registered unemployment within the active population.

5.5 Robustness

The analysis also includes robustness and validation checks. The primary robustness check uses 2021 as an alternative baseline year, while the core validation check compares PEND100 and PEND101 to assess whether the two commuting datasets harmonise. This helps guard against counting errors, missing values and inconsistencies in the construction of the commuting variables. These checks are reported after the empirical results, as their purpose is to assess the reliability of the observed patterns. For more information see section 6.4, robustness and validation.

5.6 Methodological Limitations

The main methodological limitation is the descriptive design of the thesis. The analysis can identify patterns consistent with early labour-market adjustment, but it cannot estimate the causal effect of Novo Nordisk's expansion. For this reason, the neighbouring municipalities are used as a regional benchmark, not as clean control units, since they may themselves be part of the adjustment mechanism through commuting flows into Kalundborg.

A second limitation concerns the short post-investment period. The analysis only observes the early years following the investment waves, with data available up to 2024. This is especially important for migration and residential adjustment, as these mechanisms may take longer to materialize than commuting. The results should therefore be interpreted as evidence of early adjustment, rather than as a complete assessment of the long-run regional effects.

Finally, the data also limits what we can observe directly. The analysis uses municipal-level data, and does not include firm-level employment data from Novo Nordisk or individual worker data. As a result, it cannot distinguish between permanent Novo Nordisk employees, contractors, construction workers or workers employed in related firms. Additionally, the annual structure of the data also means that short-term fluctuations, weekly commuting, temporary accommodation and contractor housing cannot be observed. These are important when we interpret the results, especially because the investment waves may involve both permanent production employment and temporary construction-related labour-demand.

6. Empirical Analysis

In this chapter we present our empirical results and discuss how they relate to the literature on adjustment mechanisms following shocks in the labour-market. We have organized the analysis around the main adjustment mechanisms within the scope of our research. The analysis will therefore assess the following mechanisms chronologically: commuting, migration and local resident labour-market absorption. We further detail robustness and validation checks to assess whether the main interpretation is sensitive to measurement choices. We stress that our analysis interprets our results as descriptive evidence on adjustment mechanisms, without claiming causality.

6.1 Commuting as a Regional Absorption Mechanism

This section examines whether commuting acted as a core short-run adjustment mechanism following the labour-demand shock. Here, we assess whether the increase in labour-demand was absorbed mainly by residents within the municipality or by workers commuting in from surrounding areas. To do so, we begin with overall commuting trends, then compare workplace and resident employment, and finally break down external commuters by place of residence.

6.1.1 Kalundborg Commuting Trends

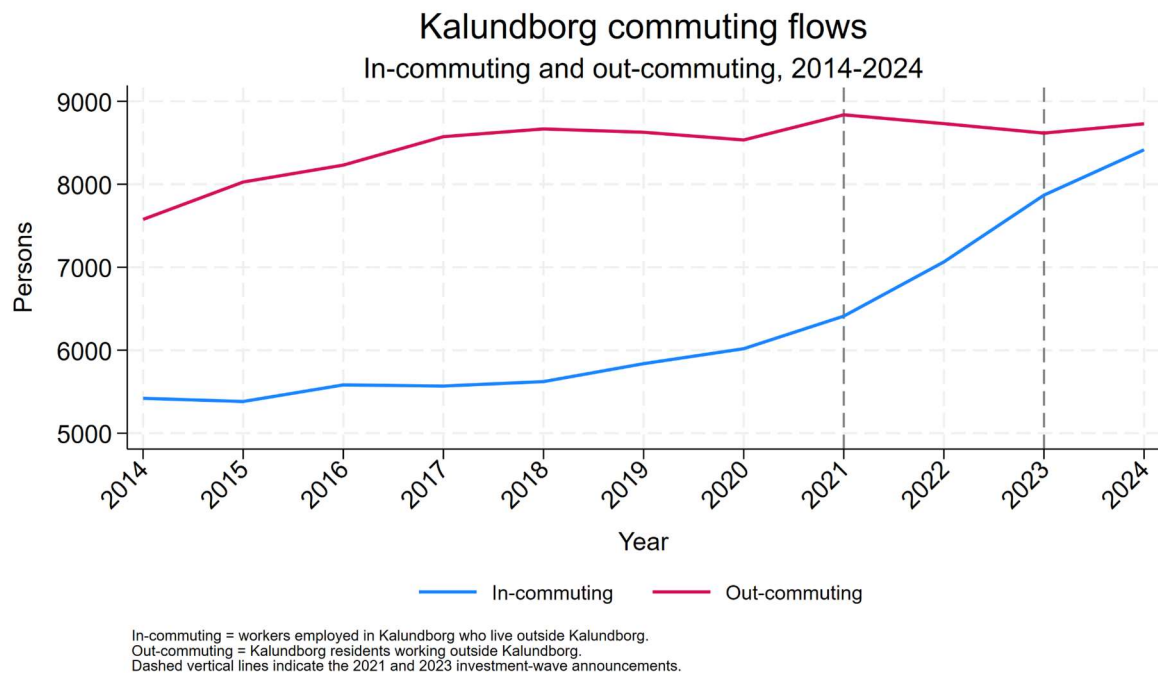


Figure 6.1: Kalundborg Commuting Flows

Source: Danmarks Statistik, StatBank PEND101, own calculations.

As seen in Figure 6.1, In-commuting into Kalundborg has increased significantly since 2014. Although pre-investment trends indicate that in-commuting was slowly rising, the 5 year period between 2019 and 2024 shows a relatively steep increase in the number of in-commuters. In 2019 the number of in-commuters was 5838 and in 2024 the number of in-commuters had grown to 8 416, which is an increase of 2578 persons or 44.2%. In contrast, the trends for out-commuting are not as explosive, seeing only a slight change between 2019 and 2024 where out-commuters increased from 8627 to 8729 or 1.2%. This asymmetry is important because it suggests that Kalundborg's changing commuting pattern was driven mainly by an increased inflow of labour, rather than fewer Kalundborg residents commuting out. In other words, the municipality appears to have become more important as a workplace destination, whilst the number of residents commuting out remained relatively stable.

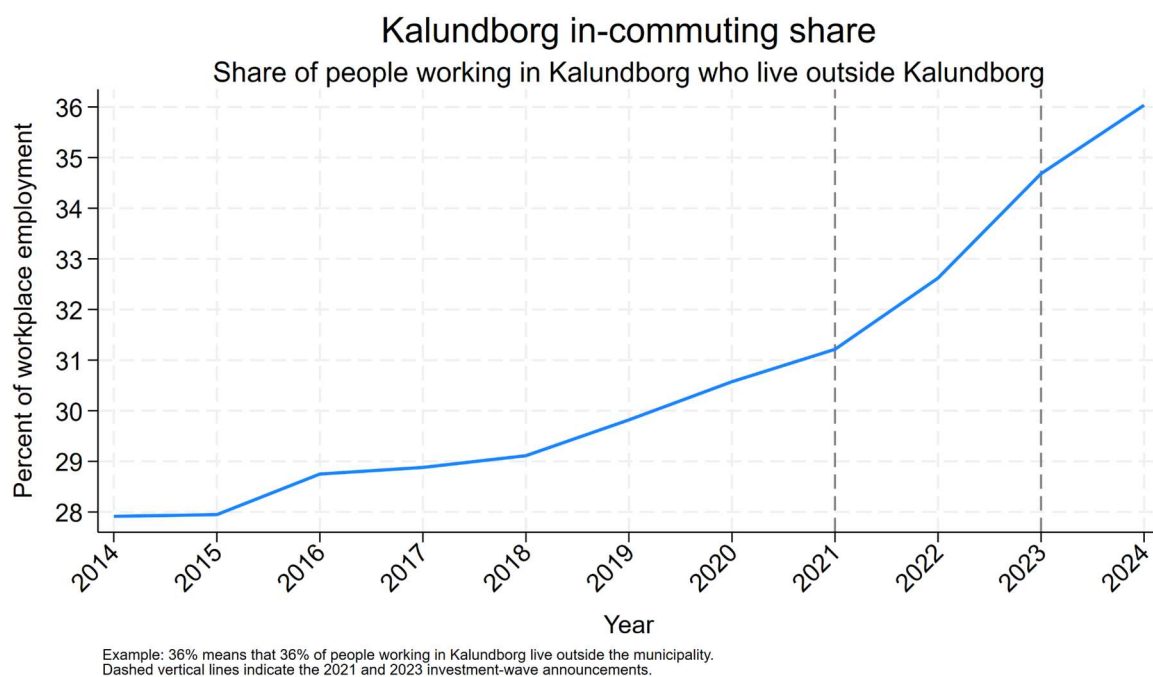


Figure 6.2: Kalundborg In-commuting Share

Source: Danmarks Statistik, StatBank PEND101, own calculations.

This intuition is reinforced by the change of in-commuting share represented in Figure 6.2. The share of people working in Kalundborg who lived outside the municipality rose from 27.9% in 2014 to 29.8% in 2019, which increased further to 36% in 2024. This illustrates, that more than one third of jobs located in Kalundborg were filled by non-residents by the end of 2024. The acceleration after the Novo Nordisk 2021 shock is especially evident, indicating that in-commuting has played a growing role in absorbing workplace employment growth in Kalundborg.

6.1.2 Workplace Employment and Resident Employment

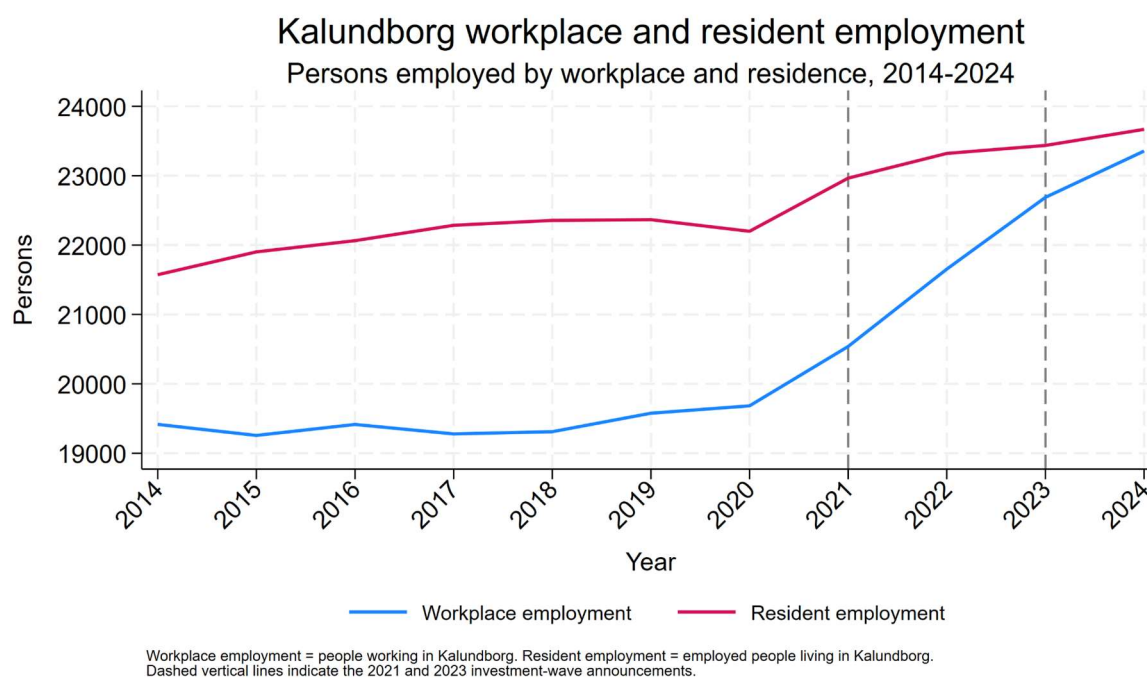


Figure 6.3: Kalundborg Workplace and Resident Employment

Source: Danmarks Statistik, StatBank PEND101, own calculations.

Workplace employment within Kalundborg grew considerably stronger than resident employment over the period, as illustrated in Figure 6.3. The divergence is particularly evident after 2021, where workplace employment accelerated sharply whilst resident employment continued on a more gradual trajectory. Between 2019 and 2024, workplace employment rose from 19,577 to 23,355, an increase of 3,778 persons or 19.3%. Over the same period, resident employment rose from 22,366 to 23,668, an increase of 1,302 persons or 5.8%. The narrowing gap between the two series reflects a labour market change where job growth within Kalundborg outpaced the growth of its resident workforce, pointing to an external source of labour supply as an increasingly important part of the adjustment.

Table 6.1: Growth in Employment and Commuting, 2019-2024

Municipality	Workplace employment	Resident employment	In-commuting	Out-commuting
	%	%	%	%
Holbæk	6,4	8,5	9,8	12,7
Kalundborg	19,3	5,8	44,2	1,2
Odsherred	4,5	-0,4	18,2	0,1
Slagelse	3,2	5,7	6,7	12,5
Sorø	3,3	4,4	7,3	8,0

Source: Danmarks Statistik, StatBank PEND101, own calculations.

Table 6.1 reinforces this pattern whilst placing it in a regional context. Kalundborg shows the strongest workplace employment growth in the group at 19.3%, compared to growth ranging from 3.2% to 6.4% amongst its neighbouring municipalities. The most striking divergence, however, appears through the growth of in-commuting. Whilst the neighbouring municipalities saw modest increases, Kalundborg experienced in-commuting growth of 44.2%, far exceeding the range of 6.7% to 18.2% observed among its neighbours. This combination of exceptionally strong workplace employment growth and a disproportionate rise in in-commuting is difficult to attribute to a general regional trend, with the observed changes instead pointing to adjustment dynamics concentrated within Kalundborg itself.

6.1.3 Commuting as an Adjustment Mechanism

The residence-origin data from PEND100 make the interpretation clearer than if we assess commuting adjustment solely through the PEND101 data, which detail in-commuting to Kalundborg. PEND101 shows that in-commuting into Kalundborg increased, but by augmenting this with PEND100, we can assess whether the in-commuting, i.e. the supply of labour, came from within Kalundborg, the neighbouring municipalities or other Danish municipalities.

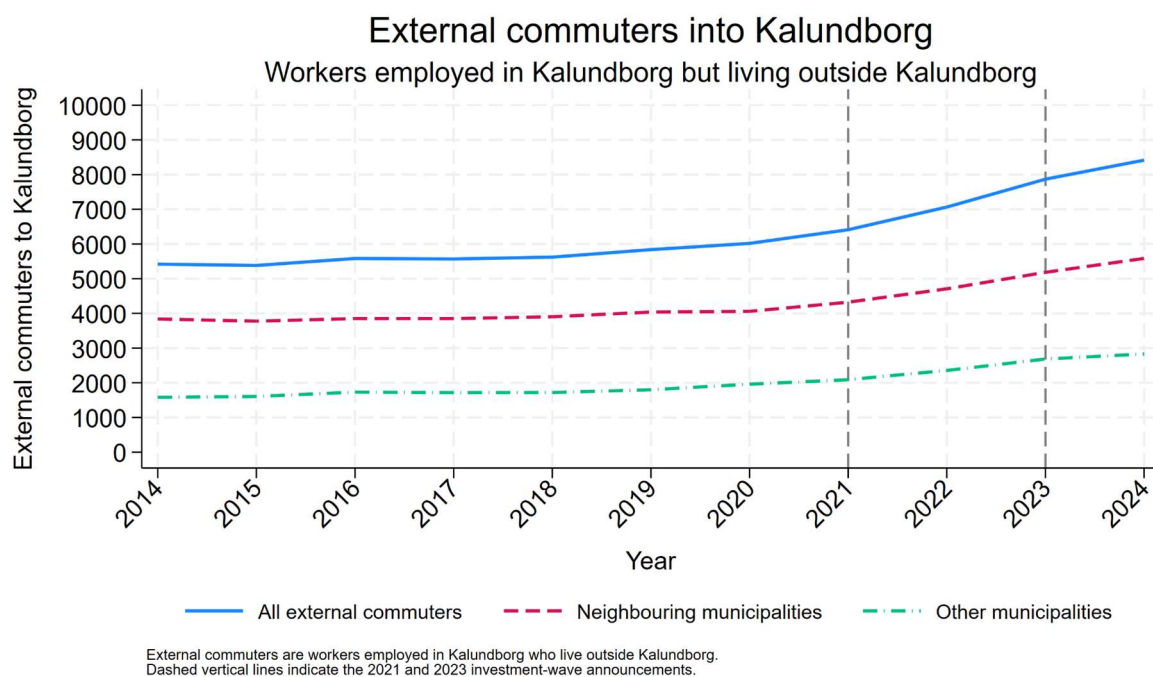


Figure 6.4 - External Commuters into Kalundborg

Source: Danmarks Statistik, StatBank PEND100, own calculations.

As evident from Table 6.2, Kalundborg residents maintained the majority share of employment within Kalundborg throughout the entire period. It is, however, worth noting that their share of total employment fell from 70.2% in 2019 to 64.0% in 2024. Concurrent with this shift, and throughout the same period, the share of workers living in the neighbouring municipalities but working in Kalundborg increased from 20.6% to 23.9%, while the share living in other Danish municipalities increased from 9.2% to 12.1%. This shows a clear shift in the residence composition of workers in Kalundborg, with external workers taking up an increasing share of employment following the investment waves.

Table 6.2 - Workers Employed in Kalundborg by Residence Group, 2019-2024

Residence group	Workers 2019	Workers 2024	Change	Growth (%)	Share 2019 (%)	Share 2024 (%)	Share change (pp)
Kalundborg residents	13 739	14 939	1 200	8,7	70,2	64,0	-6,2
Neighbouring municipalities	4 038	5 585	1 547	38,3	20,6	23,9	3,3
Other municipalities	1 800	2 831	1 031	57,3	9,2	12,1	2,9

Source: Danmarks Statistik, StatBank PEND100, own calculations.

Table 6.2 shows that this shift in composition is not solely visible in the shares, but also in the absolute number of workers. From 2019 to 2024, the number of Kalundborg residents working within Kalundborg increased by 1,200, corresponding to growth of 8.7%. In contrast, the number of workers living in neighbouring municipalities increased by 1,547, while the number living in other Danish municipalities increased by 1,031. Combined, the number of workers employed within Kalundborg but living outside the municipality increased by 2,578. This shows that workers from outside Kalundborg accounted for the majority of the increase in workplace employment from 2019 to 2024. We do not imply that local resident employment was unaffected, but rather that the increase in labour-demand was not primarily absorbed by Kalundborg residents.

We additionally pose the question of whether the influx of labour was primarily supplied by the neighbouring municipalities, or whether the wider Danish labour-market also played a significant role. Table 6.3 is therefore structured to show the main origin municipalities for workers employed in Kalundborg.

Table 6.3 - Top External Residence Municipalities for Workers Employed in Kalundborg, 2024

Residence municipality	Residence group	Workers 2019	Workers 2024	Change	Growth (%)
Slagelse	Neighbouring municipalities	1.625,0	2.473	848	52,2
Holbæk	Neighbouring municipalities	1.354	1.822	468	34,6
Sorø	Neighbouring municipalities	532	709	177	33,3
Odsherred	Neighbouring municipalities	527,0	581	54	10,2
Copenhagen	Other municipalities	295,0	438	143	48,5
Roskilde	Other municipalities	183,0	272	89	48,6
Odense	Other municipalities	99	266	167	168,7
Næstved	Other municipalities	189	258	69	36,5
Lejre	Other municipalities	119	173	54	45,4
Ringsted	Other municipalities	116	157	41	35,3
Høje-Taastrup	Other municipalities	42	94	52	123,8
Køge	Other municipalities	62	72	10	16,1
Frederiksberg	Other municipalities	44	67	23	52,3
Nyborg	Other municipalities	32	62	30	93,8
Frederikssund	Other municipalities	38	41	3	7,9

Source: Danmarks Statistik, StatBank PEND100, own calculations.

Table 6.3 shows that the supply of labour to Kalundborg was, at its core, a regional adjustment, although not exclusively limited to the neighbouring municipalities. As evident from Table 6.3, Slagelse and Holbæk, two neighbouring municipalities, act as the origin municipalities providing the largest supply of labour, with substantial growth in residents working in Kalundborg, showing 52.2% and 34.6% growth from 2019 to 2024, respectively. Sorø and Odsherred also supply a significant amount of labour, but Odsherred experienced much more modest growth in the aforementioned period. Whilst the absolute volumes of labour supplied from Copenhagen, Roskilde, Næstved, Odense et cetera, remain well below those of Slagelse and Holbæk, these further-away municipalities nonetheless exhibit positive growth over the period. Most notably, in-commuting from Odense expanded by 168.7%. This large percentage increase, however, reflects a high statistical sensitivity to a small absolute baseline, as the underlying absolute measure grew from just 99 to 266 workers. These patterns indicate that while Kalundborg successfully captures labour from the wider region, the most robust commuting responses remain heavily concentrated within the immediate regional labour-market.

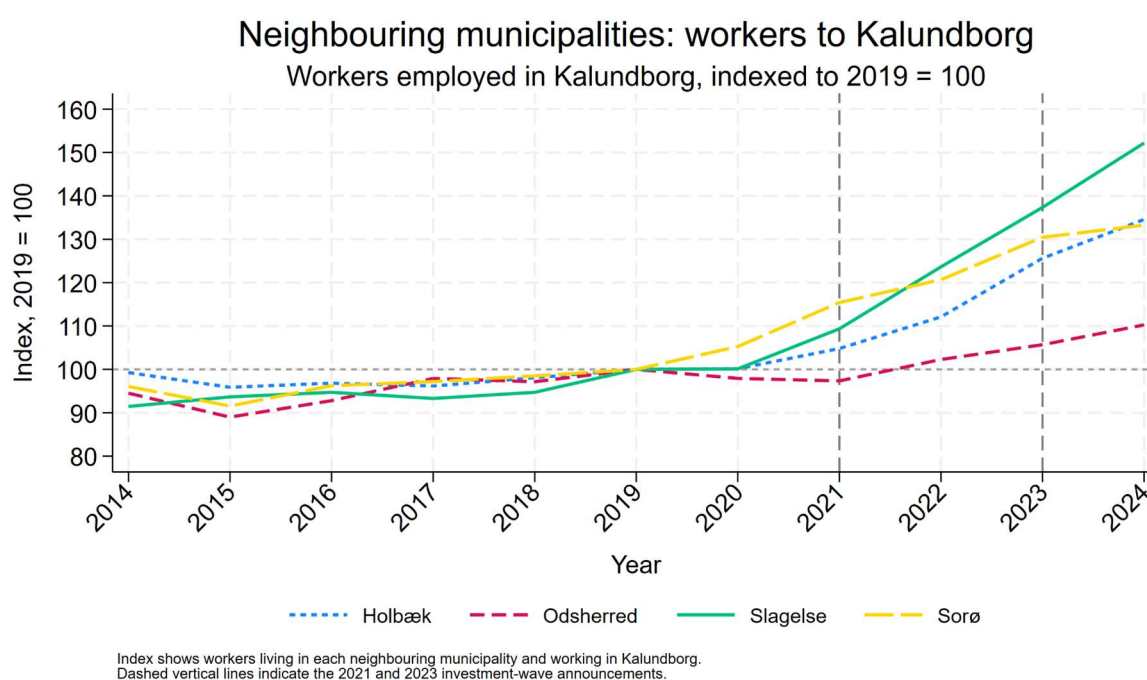


Figure 6.5 - Neighbouring Municipalities: Workers to Kalundborg

Source: Danmarks Statistik, StatBank PEND100, own calculations.

The evidence supports the interpretation that commuting is acting as a dominant early adjustment mechanism. The labour-demand shock following the investment waves did not affect the municipal labour-market of Kalundborg alone. Rather, the shock was absorbed through an increasing amount of labour being supplied especially from the municipalities surrounding Kalundborg, as evident from Figure 6.5. These findings broadly align with Monte et al. (2018), who argue that labour-markets are spatially

connected, allowing for joint adjustment. In the case of Kalundborg, the evidence suggests that it does not function as an isolated municipal labour-market, but rather as part of a broader regional labour-market with joint labour pooling, allowing labour to be supplied from the wider region.

6.2 Migration and Residential Adjustment

This section examines whether the labour-demand shock was followed by residential adjustment into Kalundborg. Whilst the previous section showed that commuting increased, this section asks whether workers also moved to Kalundborg in larger numbers. First, we analyze working-age population developments, then examine net migration, and finally separate migration flows by municipality group. This allows the migration evidence to be compared with the commuting evidence.

6.2.1 Working-age Population Development

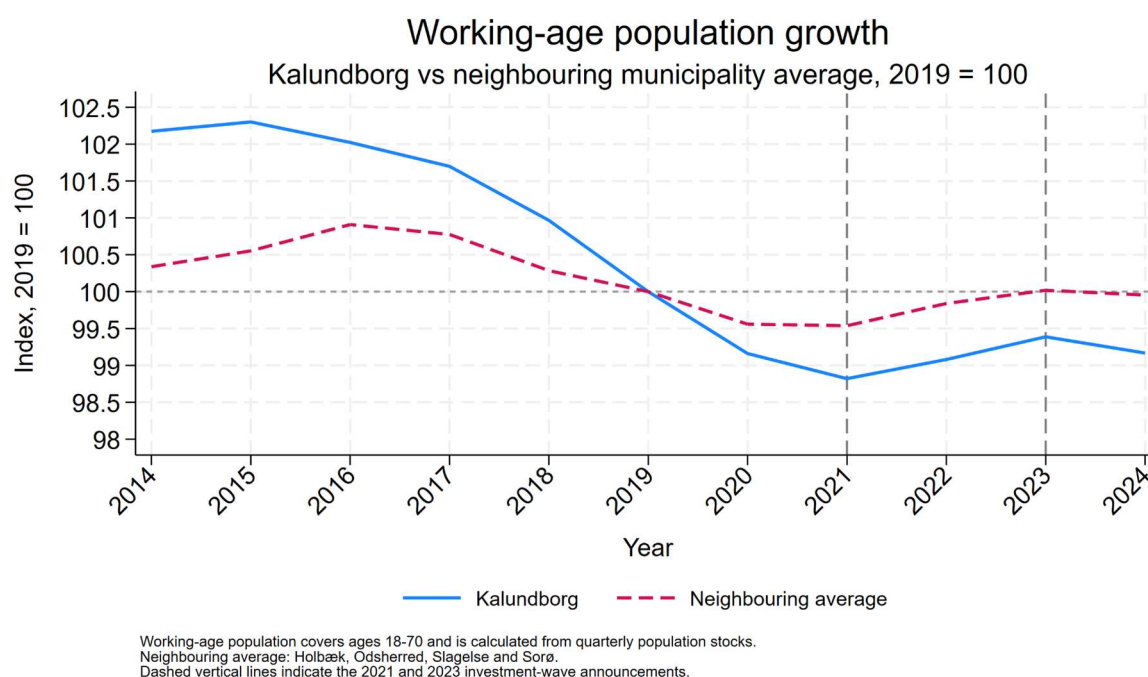


Figure 6.6 - Working-age Population Growth

Source: Danmarks Statistik, StatBank FOLK1E, own calculations

Figure 6.6 shows that Kalundborg's working-age population did not increase meaningfully after the investment waves. This is supported by Table 6.4, which shows that Kalundborg's working-age population declined only slightly, with a decline of -0.8%. The noteworthy aspect here, is that there is absence of working-age population growth despite the supposed

increase in labour-demand following the investment-waves. If residential relocation had acted as a primary adjustment channel following the labour-demand shock, it would be logical to expect visible growth in the working-age population after 2021. Instead, Kalundborg remained below 2019 levels throughout 2021, with limited recovery by 2023. This suggests that residential absorption did not act as an adjustment mechanism in the observed period, as expected.

Table 6.4 - Working-age Population Growth, 2019-2024

Municipality	Population 2019	Population 2024	Growth (%)
Holbæk	46.981	48.176	2,5
Kalundborg	31.631	31.368	-0,8
Odsherred	21.138	20.089	-5,0
Slagelse	52.729	53.079	0,7
Sorø	19.458	19.763	1,6

Source: Danmarks Statistik, StatBank FOLK1E, own calculations.

6.2.2 Net Migration and Municipality-group Flows

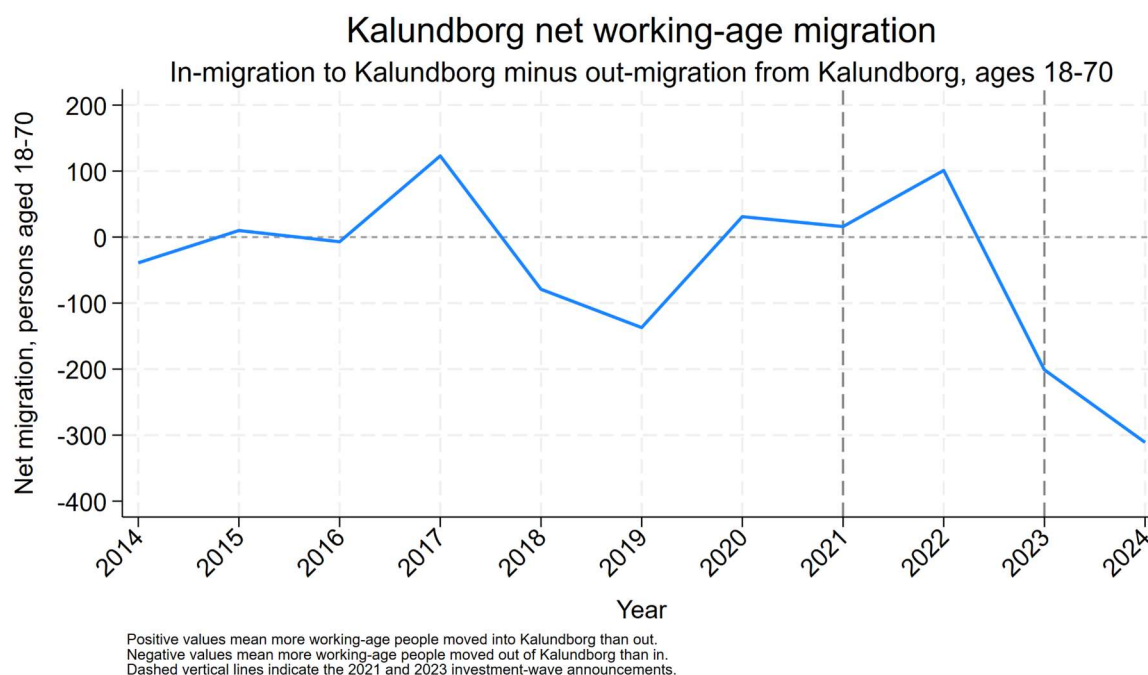


Figure 6.7 - Kalundborg Working-age Net Migration

Source: Danmarks Statistik, StatBank FLY66; own calculations.

Figure 6.7 shows that net working-age migration to Kalundborg fluctuates considerably over the period, but does not show a clear positive residential adjustment following the investment waves. In 2021 and 2022, net migration turned briefly positive, with working-age in-migration exceeding out-migration by 16 and 101 persons respectively. However, this pattern reverses after the 2023 investment wave, with net migration falling to -201 in 2023 and -311 in 2024. This decline may appear visually pronounced in Figure 6.7, however Table 6.4 shows that the percentage working-age population change was small, amounting to only around -0.8% between 2019 and 2024. The important point is therefore not the size of the population change, but that neither the population nor migration data show a sustained residential inflow into Kalundborg. Rather than indicating increasing residential relocation into Kalundborg, as would be expected if migration acted as an early adjustment mechanism. The migration balance, on the contrary, shows a negative trend in most recent years, supporting the interpretation that no immediate adjustments in migration are observable within the time-frame of the analysis.

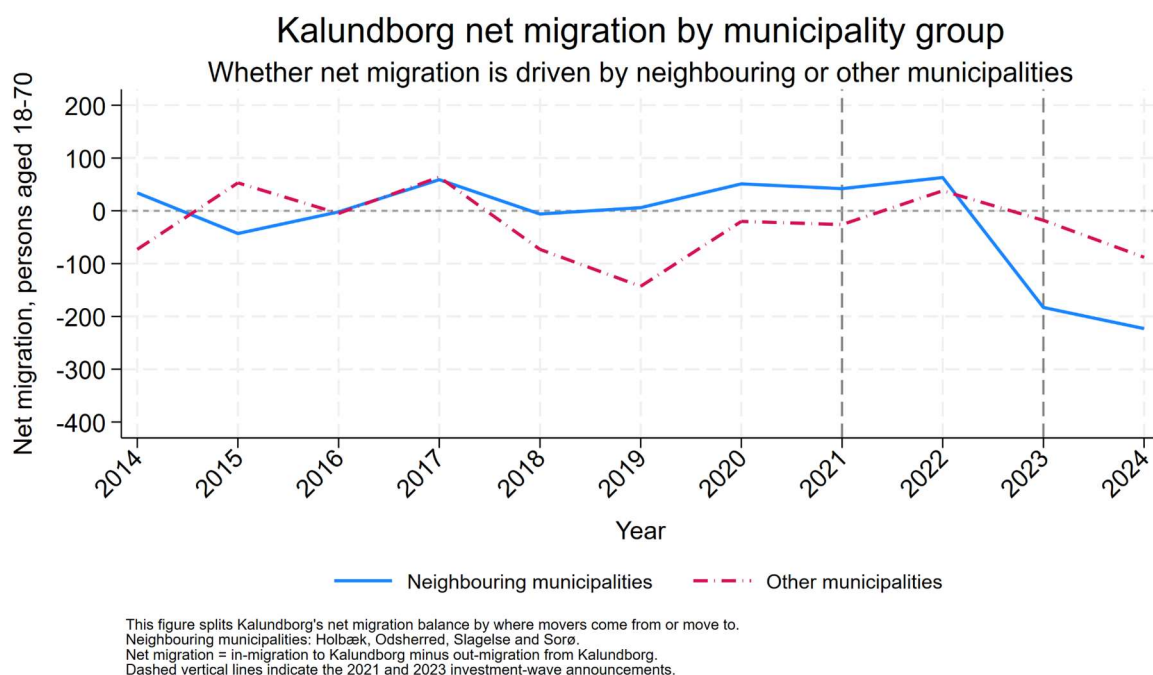


Figure 6.8: - Kalundborg Net Migration by Municipality Group

Source: Danmarks Statistik, StatBank FOLK1E and FLY66, own calculations.

Figure 6.8 further splits net migration by municipality group. The negative net migration after 2023 is mainly driven by flows between Kalundborg and neighbouring municipalities. Net migration with neighbouring municipalities falls from 63 in 2022 to -183 in 2023 and -223 in 2024. Net migration with other Danish municipalities is also negative in 2024, at -88, but the decline is smaller than for the neighbouring municipalities. This indicates that the weak residential adjustment is not only a broader national-migration pattern, but is particularly visible in relation to nearby municipalities.

Overall, the migration evidence complements and reinforces the commuting findings. Whilst commuting increased substantially, working-age relocation into Kalundborg did not follow. This pattern is consistent with theoretical expectations, given that migration is generally regarded as a longer-run adjustment mechanism. The absence of residential inflows therefore does not undermine the adjustment story, but rather refines it: the increased labour-market activity in Kalundborg was met by workers commuting from surrounding municipalities rather than by new residents relocating into the municipality. The combination of rising commuting and flat or negative net migration points to a predominantly regional, rather than residential, form of early adjustment.

However, this should still be treated cautiously. The post-treatment period is limited, meaning that later migration effects cannot be ruled out. This is significant in relation to European adjustment literature, which shows that regional labour-demand shocks are often absorbed first through changes in the labour-force participation and unemployment, whilst migration becomes more prominent later (Decressin and Fatás, 1995; Kangasharju and

Pekkala, 2001). The limited migration response observed here should therefore be understood as an early-stage result, consistent with the expected sequencing of adjustment mechanisms, rather than as evidence against future residential adjustment.

6.3 Local Resident Labour-Market Absorption

The analysis thus far indicates that commuting is acting as a central factor in the early adjustment, with workplace employment and in-commuting increasing more substantially than resident employment. That does not necessarily mean that the residents of Kalundborg have been unaffected by the labour-demand shock. To assess whether the local resident labour-market has adjusted as well, we examine resident employment, registered unemployment, the employment rate, and labour-force participation. We utilize these indicators as a contrasting adjustment mechanism to the commuting evidence. This is done to assess whether the increased labour-demand was partly, if at all, absorbed by residents living within Kalundborg, rather than by external workers through in-commuting.

6.3.1 Resident Employment, Unemployment and Participation

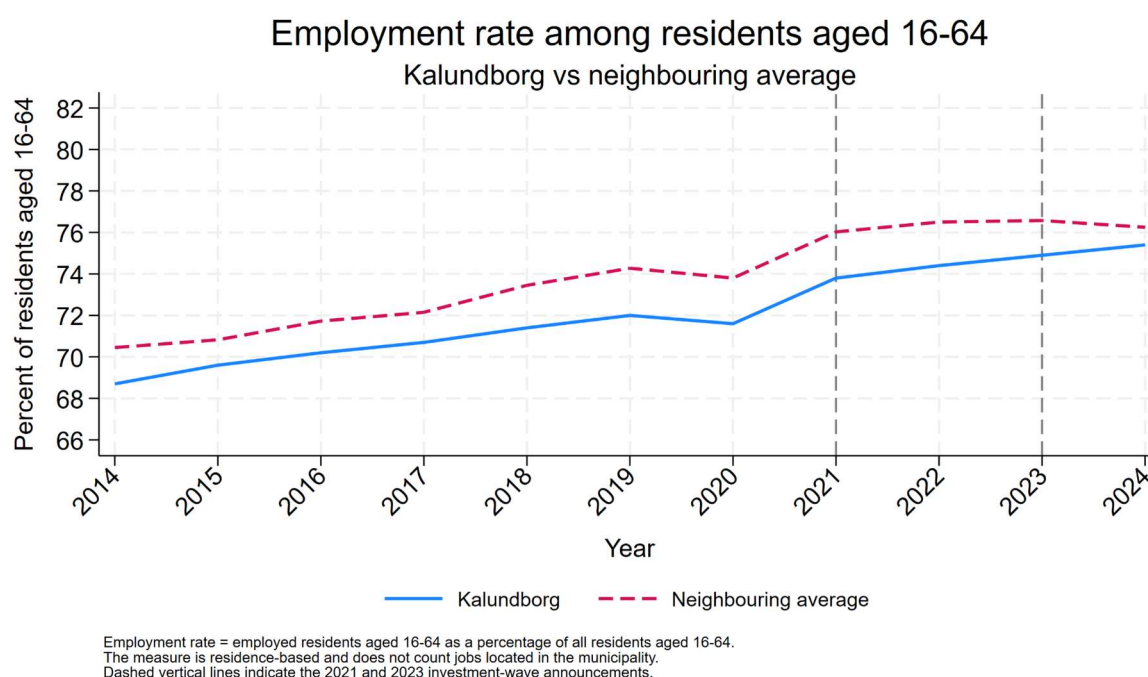


Figure 6.9 - Employment Rate among Residents Aged 16-64

Source: Danmarks Statistik, StatBank RAS200; own calculations.

Figure 6.9 illustrates the employment rate among residents aged 16-64 in Kalundborg compared to the average of its neighbouring municipalities. Between 2019 and 2024, Kalundborg's employment rate increased from 72.0% to 75.4%, reflecting a growing share of employed working-age residents. Although the neighbouring average remained consistently higher throughout this timeframe, the gap between the two narrowed slightly. Ultimately, this

demonstrates an improvement in Kalundborg's resident labour-market, despite not overtaking the surrounding region-average.

Table 6.5 - Kalundborg Local Labour-market Adjustment, 2019-2024

Outcome	Unit	2019	2024	Change
Registered unemployment rate	percentage points	3,6	2,2	-1,4
Employment rate, ages 16-64	percentage points	72,0	75,4	3,4
Labour-force participation rate, ages 16-64	percentage points	74,4	76,8	2,4
Participation-employment gap	percentage points	2,4	1,4	-1,0
Resident employment	persons	22.366	23.668	1.302
Workplace employment	persons	19.577	23.355	3.778
In-commuting	persons	5.838	8.416	2.578
Out-commuting	persons	8.627	8.729	102

Source: Danmarks Statistik, StatBank AULP01, RAS200 and PEND101, own calculations.

These developments are further detailed in Table 6.5, which captures the main local labour-market indicators for Kalundborg between 2019 and 2024. The data demonstrates that the employment rate increased by 3.4 percentage points, registered unemployment fell from 3.6% to 2.2%, and resident employment grew by 1,302 individuals. Cumulatively, these indicators suggest that the local labour-market was actively engaged following the expansions. While we do not assert strict causality between the Novo Nordisk investments and these trends, it is evident that local labour absorption occurred, suggesting the adjustment was not driven solely by external in-commuting.

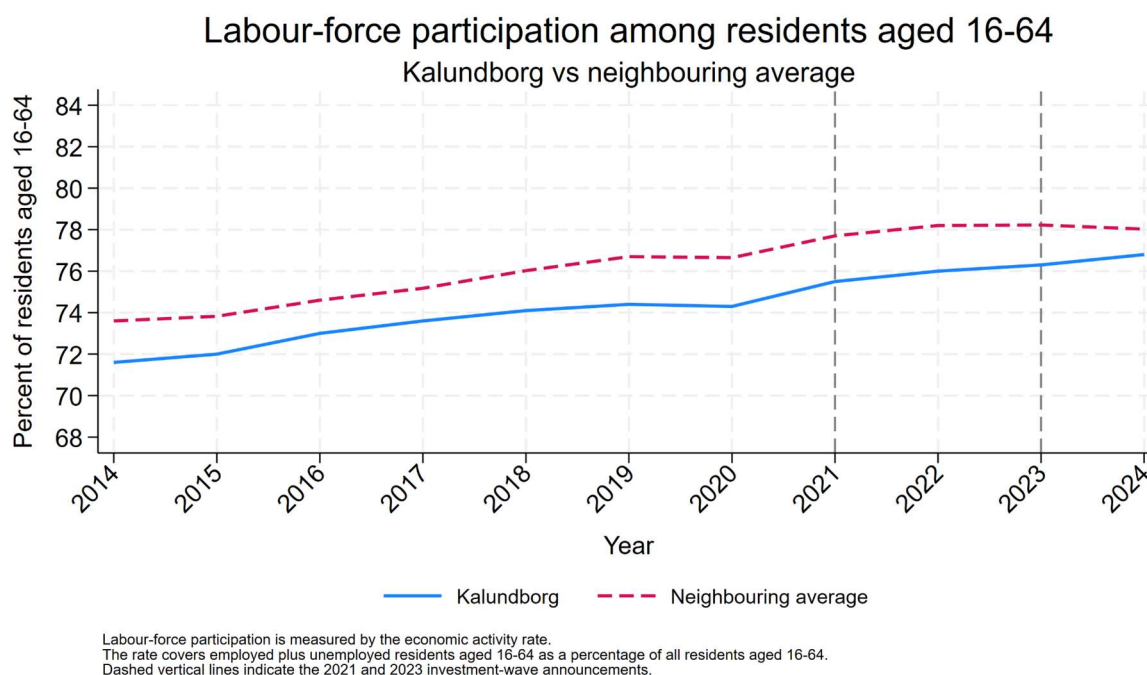


Figure 6.10 - Labour-force Participation

Source: Danmarks Statistik, StatBank RAS200; own calculations.

Figure 6.10 introduces labour-force participation as another dimension by graphing the economic activity rate among residents aged 16–64. The economic activity rate within Kalundborg increased from 74.4% in 2019 to 76.8% in 2024. This suggests that the local labour-market improved through lower unemployment, concurrent with an increasing share of Kalundborg residents being active participants in the workforce. Despite this improvement, Kalundborg consistently remained below the average of its neighbouring municipalities, yet the developments do indicate a tightening of the local labour-market.

The indicators used for the resident labour-market collectively demonstrate a distinct local improvement, driven by rising employment, declining registered unemployment, and increased labour-force participation. This aligns with the interpretation that residents of Kalundborg account for some of the absorption, but does not constitute the dominant adjustment mechanism.

6.3.2 Scale of Local Absorption Relative to Workplace Growth

To properly assess the magnitude of the local response, it can be useful to compare the local resident adjustment with workplace employment growth and in-commuting to ensure appropriate perspective in scale and variable measure. Despite improvements in the local resident labour-market, the scale of this adjustment was smaller than the increase in jobs located in Kalundborg. As shown in Table 6.5, resident employment increased by 1,302 persons between 2019 and 2024, while workplace employment increased by 3,778 persons. Consequently, whilst employment among Kalundborg residents rose, it was insufficient in scale, to fully account for the workplace-employment expansion within the municipality.

The limits of local absorption become clearer when resident employment growth is compared with in-commuting: From 2019 to 2024, in-commuting increased by 2,578 persons, whereas out-commuting increased by only 102 persons. This suggests that the additional jobs located in Kalundborg were not commensurately matched by a corresponding increase in employed residents. Local resident absorption therefore occurred, but it appears to have been partial. The larger increase of in-commuting indicates that regional labour supply functions as the stronger short-run response.

6.4 Robustness and Validation

This section presents our robustness and validation checks for the main descriptive results. We do not attempt to establish causal identification, as we do not employ a quasi-experimental design. The checks are instead done to assess whether our core commuting interpretation is sensitive to baseline choice, or as a result of inconsistencies between the commuting data.

6.4.1 Baseline Robustness

Throughout the analysis, we utilize 2019 as the baseline year, as it is the latest representative year pre-COVID, and before the first investment wave in 2021. To assess whether the main interpretation is dependent on this choice, we additionally recalculate the commuting variables using 2021 as a baseline.

Table 6.6 - Baseline Robustness for Employment and Commuting in Kalundborg

Variable	Unit	2019	2021	2024	Change 2019–2024	Growth 2019–2024	Change 2021–2024	Growth 2021– 2024
Resident employ ment	Persons	22.366	22.965	23.668	1.302	5,8%	703	3,1%
Workpla ce employ ment	Persons	19.577	20.539	23.355	3.778	19,3%	2.816	13,7%
In- commuti ng	Persons	5.838	6.411	8.416	2.578	44,2%	2.005	31,3%
Out- commuti ng	Persons	8.627	8.837	8.729	102	1,2%	-108	-1,2%

Source: Danmarks Statistik, StatBank PEND101, own calculations.

Note: Growth rates are reported as percentages and values refer to Kalundborg municipality.

Table 6.6 shows that the same overall pattern remains visible when 2021 is used as the point of comparison. Between 2021 and 2024, workplace employment in Kalundborg rose by 13.7%, compared with a 3.1% increase in resident employment. In-commuting grew even more strongly, increasing by 31.3%, while out-commuting declined slightly by 1.2%. The robustness check therefore supports the same interpretation as the main baseline comparison: the increase in labour-demand appears to have been absorbed more through in-commuting than through local resident employment growth.

Table 6.6 additionally shows the absolute changes alongside the percentage growth. This is relevant, as percentage growth can overstate developments when baseline values differ. In the case of Kalundborg, in-commuting increased by 2,578 individuals from 2019 to 2024, and by 2,005 individuals from 2021 to 2024. The commuting pattern is therefore observable both as a percentage increase and as a substantial absolute increase in workers commuting into Kalundborg.

6.4.2 Internal Validation of Commuting Data

The commuting analysis relies on two related datasets in the PEND series. PEND101 provides aggregate measures of workplace employment, resident employment, in-commuting and out-commuting. PEND100 instead provides a residence-origin breakdown, showing where workers employed in Kalundborg live. Since both datasets are utilized to support the interpretation of commuting adjustment, their consistency is particularly important.

Table 6.7 - Internal validation of PEND100 and PEND101 Commuting Totals

Year	PEND101 workplace employment	PEND100 workers employed in Kalundborg	Difference	PEND101 in- commuting	PEND100 external workers	Difference 2
2014	19.416	19.416	0	5.420	5.420	0
2015	19.257	19.257	0	5.382	5.382	0
2016	19.415	19.415	0	5.582	5.582	0
2017	19.279	19.279	0	5.568	5.568	0
2018	19.311	19.311	0	5.622	5.622	0
2019	19.577	19.577	0	5.838	5.838	0

2020	19.683	19.683	0	6.018	6.018	0
2021	20.539	20.539	0	6.411	6.411	0
2022	21.654	21.654	0	7.064	7.064	0
2023	22.688	22.688	0	7.869	7.869	0
2024	23.355	23.355	0	8.416	8.416	0

Source: Danmarks Statistik, StatBank PEND100 and PEND101, own calculations.

Table 6.7 is used to check whether the two commuting datasets produce the same aggregate totals for Kalundborg. PEND101 provides the aggregate figures for workplace employment and in-commuting, whereas PEND100 provide the same commuting relationship from the residence side, by showing where workers employed in Kalundborg actually live. For the validation, we sum PEND100 across residence municipalities for each year, thereafter excluding regional aggregate rows, such as landsdel, to avoid double-counting. This summed PEND100 total is then compared with PEND101 workplace employment.

The second check compares external workers in PEND100 with in-commuting in PEND101. External workers are calculated by subtracting workers living in Kalundborg from all workers employed in Kalundborg. Since this should correspond to workers commuting into Kalundborg from other municipalities, it can be directly compared with PEND101 in-commuting. The two sources match exactly across 2014–2024, with zero differences in both validation checks. This supports the reliability of the commuting evidence used in the analysis.

Collectively, we assess that the robustness and validation checks support the descriptive interpretation of the results presented in the analysis. They do not, however, imply causality. Rather, they show that the observed commuting patterns remain visible when applying an alternative baseline, and that the two commuting datasets are consistent.

6.5 Multi-Channel Adjustment in the Short Run

The empirical evidence presented reveals a multi-channel adjustment process, where multiple mechanisms operate at different magnitudes. The most distinct dynamic observed is the surge in regional in-commuting. As shown in Figures 6.1 and 6.2, in-commuting into Kalundborg expanded considerably following 2019, both in absolute terms and relative to total workplace employment. Table 6.1 corroborates that Kalundborg outpaced the neighbouring municipalities both in terms of workplace employment and in-commuting growth between 2019 and 2024. Throughout the same period, workplace employment within Kalundborg expanded by 3,778 persons, with in-commuting concurrently rising by 2,578 persons (see Table 6.5). The conducted robustness check in Table 6.6 verifies that the observed patterns remain visible with 2021 as the alternative baseline.

The PEND100 residence-origin data further supports this interpretation. Figure 6.4 and Table 6.2 illustrate that workers not residing in Kalundborg accounted for the majority of the employment expansion between 2019 and 2024. More specifically, the influx of workers commuting from neighbouring municipalities grew by 1,547 individuals, whilst workers from other Danish municipalities increased by 1,031. This external supply of labour was heavily drawn from the immediate regional labour-market around Kalundborg, particularly Slagelse and Holbæk (see Figure 6.5 and Table 6.3). The data thus indicates that the localized labour-demand shock was absorbed across an integrated regional labour-market, rather than being confined to Kalundborg municipality.

The findings nonetheless prohibit a purely commuting-centric interpretation, given that the residents of Kalundborg also experienced tangible improvements in the local labour-market. Figure 6.9 shows an upward trajectory in the employment rate for residents aged 16–64 post-2019, whilst Figure 6.10 showcases a concurrent rise in labour-force participation. Table 6.5 then quantifies these shifts: resident employment increased by 1,302 individuals, the employment rate rose from 72.0% to 75.4%, labour-force participation increased from 74.4% to 76.8%, and registered unemployment dropped from 3.6% to 2.2%. Whilst these developments verify that local labour-market absorption did occur, the magnitude of this adjustment was exceeded by growth in workplace employment and in-commuting. Local absorption instead functioned as a secondary, partial mechanism rather than the dominant adjustment channel.

The migration data additionally substantiates the dominance of in-commuting. If residential relocation had functioned as a core adjustment mechanism in the short run, Kalundborg would theoretically exhibit pronounced growth in its working-age population or sustained positive net migration. Figure 6.6 and Table 6.4 conversely show a marginal decline in the working-age population of Kalundborg between 2019 and 2024. Net migration simultaneously turned marginally negative after 2023 (see

Figure 6.7), a trend particularly pronounced in exchanges with neighbouring municipalities (see Figure 6.8). This downward trajectory does not preclude the possibility of demographic shifts in the future, but it clearly establishes that residential relocation has yet to materialize, playing no role in the early adjustment within the analyzed timeframe.

Synthesizing these findings, the early labour-demand shock associated with Novo Nordisk's expansion was absorbed mainly through a combination of strong regional in-commuting alongside a more limited local labour-market tightening. This pattern is consistent with regional labour-market literature, which suggests that unemployment and labour-market participation may adjust relatively quickly in the short run. Migration, conversely, requires an extended time horizon to start adjusting and fully materialize (Decressin & Fatás, 1995; Kangasharju & Pekkala, 2001). The findings similarly support Monte et al. (2018) in that localized labour-demand shocks can be absorbed through commuting linkages across spatially connected labour-markets. In the case of Kalundborg, the evidence therefore suggests that the relevant labour-market extends beyond the municipality itself, with commuting functioning as the clearest short-run absorption channel in the observed period.

7 Conclusion

7.1 Research Aim

The aim of this thesis was to examine whether early labour-market changes are visible in Kalundborg following Novo Nordisk's recent expansion, and whether the associated labour-demand shock was absorbed mainly through regional in-commuting or through local resident adjustment. The thesis did not aim to estimate the full economic impact of the expansion, or establish direct causality. Instead, it set out to provide descriptive evidence of whether employment, commuting, and demographic patterns changed in ways consistent with a short-run labour-market adjustment.

The findings suggest that the early adjustment was primarily regional and commuting based. Workplace employment in Kalundborg increased substantially after 2021, while resident employment grew more modestly. Additionally, in-commuting increased strongly, and the share of workers in Kalundborg but living outside the municipality rose. This indicates that the increased labour-demand was not absorbed solely by Kalundborg residents, but more through workers commuting from surrounding municipalities.

This is broadly consistent with the theoretical expectations developed in Chapter 3. Following Blanchard and Katz (1992), the Novo Nordisk expansion-waves can be understood as a localized labour-demand shock that triggers adjustment across several labour-market channels. However, the strongest early response aligns most clearly with Monte et al. (2018), as commuting appears to have functioned as the main short-run adjustment channel. Additionally, Kalundborg's limited migration response is consistent with European

adjustment literature that treats migration as a slower-moving mechanism (Decressin and Fatás, 1995; Kangasharju and Pekkala, 2001).

7.2 Research Objectives

The first research objective was to assess whether in-commuting into Kalundborg significantly adjusted following the investment waves. The analysis shows that in-commuting rose substantially during the analysis period, where it increased by 44.2%. The increase is particularly evident after 2021, suggesting that commuting became a central channel through which labour-demand in Kalundborg was absorbed.

The second objective was to examine whether workplace employment in Kalundborg grew faster than resident employment. The analysis supports this. Workplace employment grew by 19.3%, whilst resident employment increased by 5.8%. This widening difference suggests that job growth in Kalundborg exceeded the growth of the resident workforce, making external labour supply a more important channel of labour-market adjustment.

The third objective was to assess whether there was evidence of local resident labour-market adjustment through higher employment, lower unemployment, or increased labour-force participation. The results show some evidence of local adjustment, but the changes were relatively modest. Employment rates and activity rates increased, while registered unemployment declined, suggesting that the local resident labour market tightened somewhat during the period. However, this adjustment was relatively small compared to the growth in commuting and workplace employment, indicating that local residents did not absorb the bulk of the labour-demand shock.

The final objective was to examine whether residential adjustment through working-age population growth or net-migration occurred, or if it was limited. The findings show that, although small in magnitude, the working-age population declined slightly, and net migration did not show a sustained positive inflow after the investment waves. Instead, net migration became negative in the most recent years. This suggests that residential adjustment was limited in the short run. Rather than indicating early relocation into Kalundborg, the migration findings reinforce the interpretation that the labour-demand shock was absorbed primarily through regional commuting. However, since the post-investment period is short, the results should not be interpreted as evidence that migration will not occur later, but rather that it was not yet visible as a dominant early adjustment mechanism.

7.3 Practical Implications

The findings suggest that large firm expansions in small municipalities should be understood as regional labour-market events rather than purely local employment changes. In

Kalundborg, employment growth was increasingly supported by workers from surrounding municipalities. This means that the effects of industrial expansion may depend not only on local labour supply, but also on commuting links, regional accessibility, and the ability of nearby municipalities to supply workers, as suggested by Monte et al. (2018) and Bartik (2024).

For municipalities and regional planners, this suggests that linkages and coordination of transport across municipal boundaries may be important when large industrial investments are concentrated in smaller places. If labour-demand is absorbed through commuters, the relevant labour-market extends beyond the municipality where the investment originates from. At the same time, the limited evidence of residential adjustment suggests that local population growth should not be assumed to follow immediately from workplace expansion.

7.4 Future Research

As this thesis focused on early labour-market adjustments, with particular attention to commuting as an absorption mechanism, future research can build upon this when Novo Nordisk's facilities become operational. Since the present analysis can only cover the early years after the 2021 and 2023 investment announcements, later studies could assess whether commuting remains the dominant adjustment mechanism or whether migration and local resident employment become more important over time.

A second direction for future research would be to examine broader regional spillovers, which were outside the scope of this thesis. The original research problem raised questions about whether large firm investments generate wider dispersion or distortion effects in regional economies. This included wage changes, housing-market pressures, supplier-network formation, local multiplier effects, and more. These outcomes may become more visible over a longer period of time and would require more detailed data, such as firm-level or worker-level information, as well as stronger identification strategies. With a longer post-investment window, future studies could apply methods such as difference-in-differences, event-study designs, or synthetic control to assess more directly whether observed regional changes can be attributed to Novo Nordisk's expansion.

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Statement on Artificial Intelligence

Generative artificial intelligence tools were used in a supporting capacity during the preparation of this thesis. The tools used include ChatGPT by OpenAI, Claude by Anthropic, and Gemini by Google. These tools were used for learning support, idea development, coding assistance, language feedback, and quality control, in line with the course recommendations on responsible AI use.

AI was used to assist with the construction, debugging and revision of Stata do-files used to process raw data exports from Danmarks Statistik, as well as assisting with cleaning datasets, formatting exports of figures and tables, and perform validation checks. AI was also used to help identify coding errors, improve graph formatting, revise table presentation, and support the organisation of appendices. All generated code was reviewed and tested by the authors before use.

AI was further used to process text written by the authors and provide feedback on grammar, spelling, clarity, structure and argument coherency. It was also used as a discussion tool when refining the research question, and empirical strategy. AI assisted with checking consistency between in-text citations, reference-list entries and table/figure source notes. All AI-assisted suggestions were manually reviewed, edited and checked against the relevant data, sources and thesis argument before inclusion.

AI was not used to fabricate data, invent empirical results, generate unverified citations, replace source reading, or replace the authors' own interpretation of the findings. No confidential information beyond thesis material intended for academic submission was provided to AI tools. The choice of research question, theoretical framework, empirical strategy, variable definitions, analysis, interpretation and conclusions are the authors' own.

Appendices

Appendix A - Data processing

Data Exports

Some of the StatBank exports are split into multiple files due to export-size limits. Some files are split across municipalities, while others are split across years. In cases where the split files overlap in 2019, duplicate 2019 observations are removed before appending. This prevents double-counting. This is especially relevant for the migration and sectoral employment data, where the raw exports cover separate time intervals with an overlapping baseline year.

Language formatting

The data from Danmarks Statistik's Statbank, are exported as CSV files, ready for utilization in Stata. A core difficulty of the processing is the table formatting, as the files are encoded in Latin-1, instead of UTF-8. This format poses an issue when using the tables in Stata, as the column and row structure are hierarchical, leaving empty rows and cells where the hierarchy is unchanged. Stata cannot read this format directly, necessitating data restructuring to utilize the data. We start by using "encoding("ISO-8859-1")", so the Danish characters in the Municipality names are presented correctly, preventing later merge failures.

Row & Column Corrections

The CSV files come with column names such as "v1" and "v2", holding little meaning. We therefore rename them accordingly, based on their order in the file, referencing the export parameters. Next, we tackle arguably the most challenging aspect, namely the hierarchical issues in table-formatting. We do this by "forward-filling", as the hierarchy value such as Kalundborg, with binary variables for sex, presents a range of empty cells between the two binaries. The forward-fill, copy each value down through the empty cells until the next change. This results in every row having a complete label, without gaps. We then drop the header rows, such as those for municipality, with no data presented in said rows. A majority of the exported Statbank tables include rows for "total", but additionally include rows broken into sex, age, industry etc. for analysis, we drop redundant rows, or compute totals, whilst only keeping the total rows for analysis.

Regional Aggregates

Some of the exports present regional aggregates such as "Region Hovedstaden", "Hele Landet" and such, alongside the specific municipalities within said regions. The aggregate data are sums of the municipalities within, and including them would introduce double-counting, and skew results. We therefore drop the regional aggregates, to ensure municipalities are only counted once.

Panel-Data Shaping

To introduce uniform data structure, we ensure that the data is shaped from “wide to long”, where the year columns become a single year variable, with only one row per municipality x year (note, one column per year). In the data with increased granularity, where aggregation can benefit, namely, when totals for each municipality based on sex, year etc. can be computed, we aggregate totals, to get the sum across variables such as sex and age, to get a single total value per municipality and year.

Appendix B - Key variables in Kalundborg

Table B.1 - Summary Statistics in Kalundborg

Variable	Unit	Data Source	2019 (Kal)	2024 (Kal)	Abs. change	% change (or pp)
Workplace employment (total jobs)	persons	PEND101	19,577 (day)	23,355	3,778	+19.3%
Resident employment (local jobs)	persons	PEND101	22,366 (night)	23,668	1,302	+5.8%
In-commuting (workers to Kal)	persons	PEND101	5,838	8,416	2,578	+44.2%
Out-commuting (workers from Kal)	persons	PEND101	8,627	8,729	102	+1.2%
Net commuting (in – out)	persons	PEND101	–2,789	–313	+2,476	+88.8%
In-commuting share (Kal jobs held by non-residents)	%	PEND101	29.8	36.0	+6.2 pp	(points)
Working-age pop (18–70 avg)	persons	FOLK1E	31,631	31,368	–263	–0.8%
Net migration (Kalundborg)	persons	FLY66	–137	–311	–174	–126.9%
Unemployment rate (Kal)	%	AULP01	3.6%	2.2%	–1.4 pp	(points)

Employment rate (16–64, Kal)	%	RAS200	72.0%	75.4%	+3.4 pp	(points)
Activity rate (16–64, Kal)	%	RAS200	74.4%	76.8%	+2.4 pp	(points)
Act./Emp. gap (Kal, pp)	pp	RAS200	2.4	1.4	–1.0 pp	(points)
Pharmaceutical sector (Kal)	persons	RAS301	3,071	4,897	1,826	+59.5%
Construction sector (Kal)	persons	RAS301	1,594	1,793	199	+12.5%
Chemicals sector (Kal)	persons	RAS301	1,603	1,737	134	+8.4%

PP = percentage points. All variables refer to Kalundborg. “Data sources” refer to the StatBank table where the data is pulled from.

Percent changes are $100 \times (2024 - 2019) / 2019$. Kalundborg’s net commuting turned from –2789 to –313 (smaller deficit), hence an 88.8% increase (more in-commuting relative to out-commuting).

Table B.2 - Municipality Summary

Variable	Unit	Sample (Muniyears, 2014–24)	N	Mean	Std. dev.	Min	Median	Max
Workplace employment (total jobs)	persons	Kal, Holbæk, Odsherred, Slagelse, Sorø	55	10,690	10,333	1,925	9,762	46,307
Resident employment (local jobs)	persons	as above	55	11,852	11,482	2,343	11,287	55,056
In-commuting (into muni)	persons	as above	55	2,514	2,612	348	928	10,442
Out-commuting (out of muni)	persons	as above	55	2,364	3,116	220	991	10,179

Net commuting persons (in – out)	as above	55	150	1,249	–5,438	79	2,782
In-commuting share	% as above	55	29.8	13.9	6.8	27.0	70.2
Out-commuting share	% as above	55	21.1	11.7	3.1	19.6	59.1
Working-age pop (18–70)	persons as above	55	29,006	12,732	5,623	32,000	60,075
Unemployment rate	% as above	55	3.3	1.3	0.7	3.0	7.3
Employment rate (16–64)	% as above	55	73.0	7.6	57.3	75.4	86.4
Activity rate (16–64)	% as above	55	74.6	6.2	64.0	76.1	88.2
Act.–Emp gap	pp as above	55	3.0	2.3	0.1	2.7	9.2

Note: N = number of municipality-year observations The following figures present sectoral workplace employment developments in Kalundborg, based on RAS301 data from Danmarks Statistik. These are included as supplementary context and were not incorporated into the main empirical analysis.

Appendix C - Sectoral developments in Kalundborg

The two figures below illustrate the development of sectoral workplace employment within Kalundborg. Derived from the RAS301 dataset (Danmarks Statistik, 2024c), these visualisations were excluded from the main text due to spatial constraints. They are provided here as supplementary context and do not form part of the primary empirical analysis.

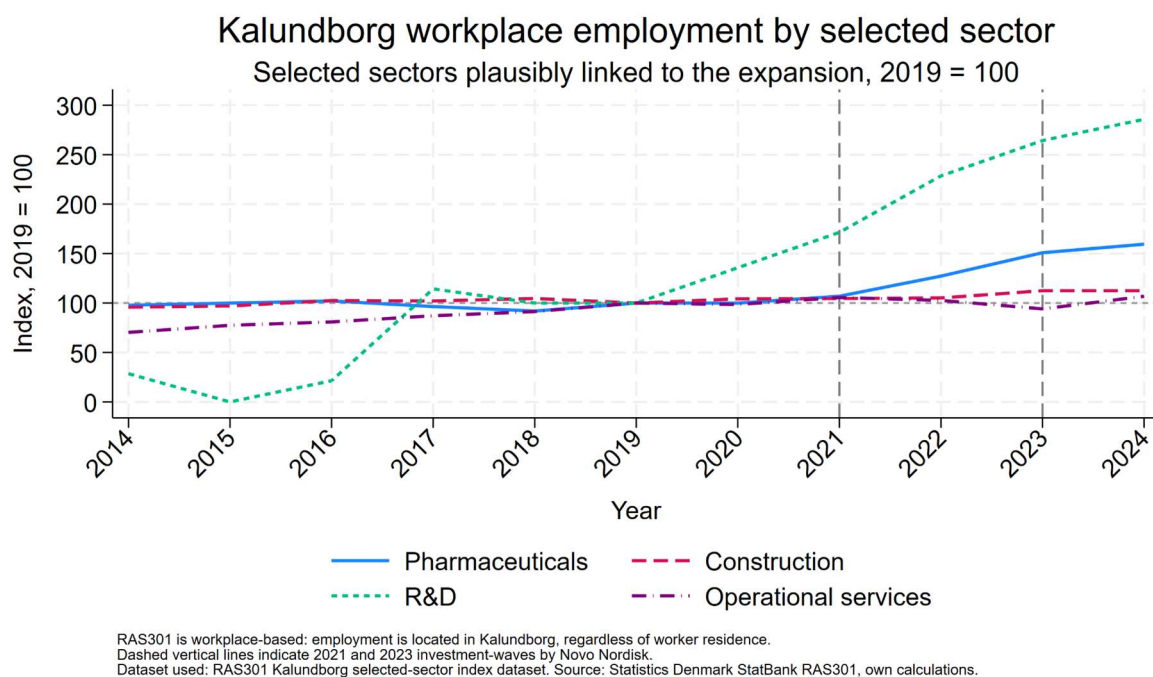


Figure D.1 - Kalundborg Workplace Employment by Sector

Source: Danmarks Statistik, 2024c, own calculations

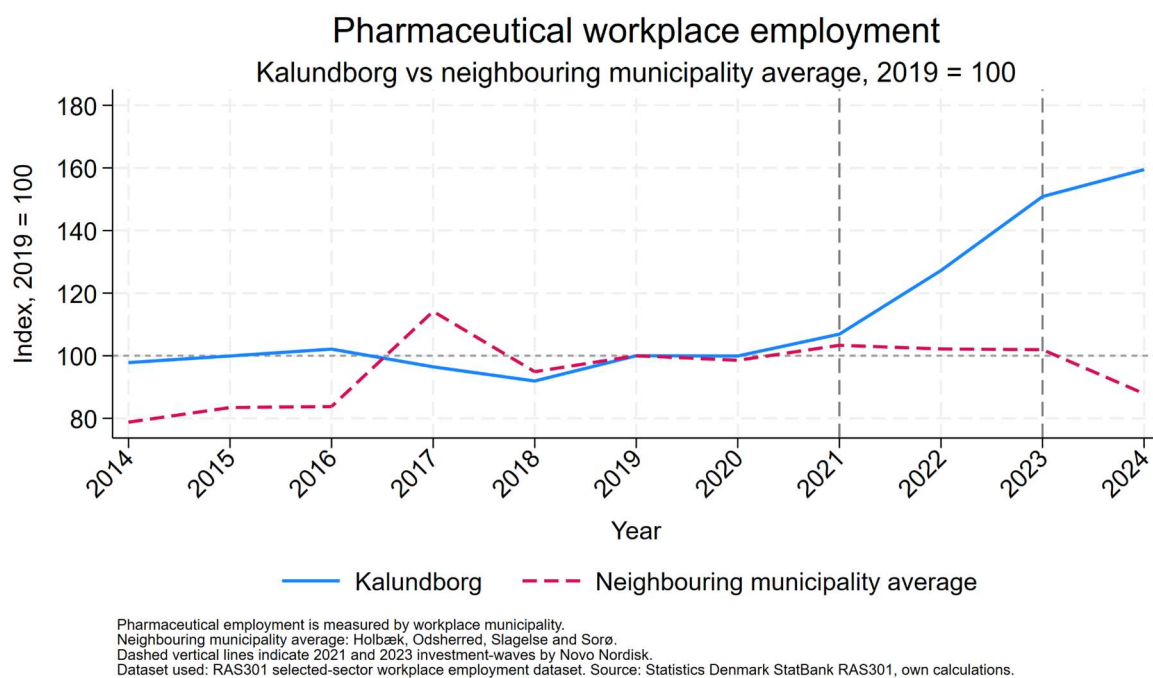


Figure D.2 - Pharmaceutical Workplace Employment

Source: Danmarks Statistik, 2024c, own calculations