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Social Mechanisms of class reconfiguration in Malmö

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*Oh, rent a flat above a shop
And cut your hair and get a job
And smoke some fags and play some pool
Pretend you never went to school
But still, you'll never get it right*
Common People – The Pulp, 1995

*Gimme, gimme, gimme, gimme todo el poder
So, I can come around to joder.*
Gimme The Power – Molotov, 1997

*För jag vet nu
Hur det går
För alla med huvet
I det blå
Det är aldrig som du tror*
Dom vet ingenting om oss – Joel Alme, 2019

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2. Abstract

Malmö is one of the largest cities in Sweden. Its industrial past has left a mark on the buildings, now occupied by sophisticated offices for new entrepreneurial businesses (Baeten, 2012; Holgersen, 2014). This shift also has implications for the city's social class structure; this research aims to identify social mechanisms that drive the reconfiguration of social classes in Malmö.

The purpose is to explain the mechanisms by which social classes are transformed over time, and to generate knowledge about the individual conditions that shape the formation of class. Using Qualitative Comparative Analysis, the research aims to underscore how economic, educational, residential, non-migrant, and occupational status interact in this context. Leading this to the following research questions:

1. “What social mechanisms underpin the reconfiguration of social class in Malmö since 1993?”
2. “How do these mechanisms change over time?”

Results of the thesis show that the reconfiguration of social class structure needs to be contextualised within the asset-based class, aligning with Adkins et al. (2022). The thesis utilises three layers of analysis: macro, meso, and macro-meso. The first one shows how neoliberal planning has impacted social stratification. The second level divides the longitudinal analysis into three phases -early, transitional, and late- in which the different status-sequences are analysed in the context of the city. Finally, in the third layer, patterns of status sequences reveal a class-structure incoherence and contradiction: while educational credentials, labour-market stability, and income possession should be reliable indicators of better outcomes, the key role of housing undermines this.

Keywords: *social class, wealth, asset economy, housing, Malmö, and Qualitative Comparative Analysis*

Word count: 21.920

3. Popular science summary

This research explores what is producing social change in Malmö over the past three decades. Instead of simply describing who is rich or poor, highly educated or not, it asks a more profound question: what actually makes some neighbourhoods to move up in the social structure while others remain stuck or fall behind?

It is important to make clear that this study does not intend to explain social classes or ranking neighbourhoods by income. It is about understanding the mechanisms that shape social distance to the best of the possibilities. In other words, it does not ask who lives where, but why.

Normally, social classes are explained mainly through work and education: what job you have and how much you earn. But Malmö, as the rest of the world has changed. In specific, the city has moved from an industrial economy to a knowledge-based and service-oriented economy, while housing has become increasingly expensive and market dominated. At the same time, the welfare state in Sweden has been weakened, and individuals are expected to manage their risk individually. These changes mean that having a job or a degree is no longer enough to guarantee one's stability or security.

This research shows that today, what you own matters more than what you earn. Specially, housing has become a central bridge towards social advantage. Neighbourhoods with high levels of homeownership tend to accumulate advantages over time, while areas dominated by renting are more exposed to insecurity, even when residents have jobs or are well educated. In this sense, Malmö has become an "asset-based" city, where wealth is increasingly built through property rather than work.

Still, educations remain important but in a different way. As a collective protection have declined, educational credentials now function as filters: they open or close doors, but they do not guarantee life success. Likewise, being employed is no longer a reliable tool against disadvantage. Many people are working but still struggle to access secure housing or stable futures.

This study also shows that migration background mattered more in the 1990s, when Malmö was changing rapidly due to refugee inflows. Over time, this factor became less decision, not because inequalities disappeared but because diversity became normal part of the city.

Overall, the research reveals a city in which advantage and disadvantage are no longer organised in clear and stable hierarchies. Instead, they are produced through unstable and sometimes contradictory combination of housing, education, work, and other resources. Malmö's social structure is not simply divided, it is reconfigured, and housing has become one of the most powerful forces shaping who can move forward and who cannot.

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5. Introduction

As an international student, when I first arrived in Sweden, I tried to observe the society around me and to understand what was happening in my environment. At the beginning, it was not easy, since I did not know the local people well enough to explain the specific dynamics behind the apparent. Personally, I came to Sweden with a backpack of common stereotypes that slowly disappeared.

Things like nice cars – apparently affordable for everyone, well-constructed dwellings, free schooling, or people dancing in the park during summer made me ask myself what kind of place I was in. It really looked like a place where all your dreams could become reality. A contradiction appeared: the electoral results. I did not understand how the far right would have significant political power in a country such as Sweden. Apparently, all necessities were well covered, so from my perspective, there was no necessity for anger against the system.

Slowly, I realised that in Sweden, public discussions and debates are often hidden, which is an essential feature of their culture. I assume that they think that if they do not talk about something, this will never become reality, although the truth is like a big rock that stamps into the sea in the middle of a storm; you can really try to deny it, but it will happen no matter what you do. Therefore, why are people angry or disappointed?

Doing basic research on Sweden shows that material conditions have worsened, unemployment has increased, and inflation has affected the common people in particular. Moreover, academia has focused on migration studies, gender studies, or education studies, which, for me, are relevant questions, but where is the class question in Sweden? In general, there have been references to class linked to social or spatial segregation, or even to low-income or wealth neighbourhoods, as if income per se is the only factor that explains social stratification in the XXI century.

From a structuralist perspective, one could ask, “Who works here?” “How do they work?” “How much is the basic income?” Surprisingly, there is no basic income in Sweden; it has been the negotiations between unions and companies that have set the income in each sector through a collective agreement. Initially, I thought that class was strictly related to work. Still, as discussed in the previous research section, it is not as central as I initially thought.

Coming from Spain, where deprivation is readily apparent in the construction of dwellings or car brands (i.e., material reality), it was challenging to see at first glance what material conditions underlie class stratification. Also, coming to Lund University was very shocking. My previous university was working-class-based, all my classmates -including me- worked during mornings and studied during afternoons. But here, some of them studied at LU because their ancestors had already attended this university. Others just had the social, cultural and economic capital to know that LU is a well-recognised university.

Then, where is the working class in Sweden? Where are the places that they inhabit, and how are their lives structured? These questions point to a deeper analytical problem. In a context where deprivation is less visible in a material form, where welfare institutions retain strong legitimacy, and where public discourse often centres on ethnicity rather than class, social stratification becomes more complex to observe but not less real. Class does not disappear; instead, it is reconfigured.

When you go to Malmö from Lund, you feel that you are going to the big city, where everything is more prominent, and there is more variety in people and everything; everything is even grosser: loud people doing illegal things. If you speak with a Swede, they will say, “Malmö is the most segregated city in Europe”. They talk about ethnicity and discrimination, but they do not talk about class. I went to Malmö University for the first time in December 2023 to meet a friend and discuss housing studies. Then I

realised that that is where working-class studies begin and where it leaves. It is not just about diversity but also about the way they behave, the tone of voice, and the clothes they wear.

The transformation of Malmö from an industrial city into a somewhat post-industrial, entrepreneurial and “green” hub illustrates this tension. While old factories have been converted into offices and innovation spaces, the social relations that once structured industrial labour have not simply vanished. Instead, they have been replaced, fragmented, and increasingly embedded in space, housing, and patterns of everyday life. If migration to Malmö has been driven largely by humanitarian reasons rather than labour-market logics, and if employment alone no longer guarantees social stability, then class cannot be understood solely through workplace position, nor labour-market dynamics.

This points to a broader shift in the organisation of inequality. In contemporary Sweden, class appears to be shaped not only by work, but by access to housing, education, social networks and inherited resources. Yet much of the existing literature continues to analyse inequality through income, employment, or ethnicity, often treating class as either a residual or self-evident factor. What remains underexplored is how class is actively reconfigured through concrete social mechanisms, and how these mechanisms change over time.

Precisely, this is the analytical gap that this thesis is situated in. Rather than asking whether class still exists in Sweden -the existence is assumed- it asks how class is being reconfigured, through which mechanisms. Malmö provides a fertile field for examining these processes, given its industrial past and its neoliberal planning as a driving force for the transformations.

Therefore, this reasoning leads to the following research questions:

“What social mechanisms underpin the reconfiguration of social class in Malmö since 1993?”

“How do these mechanisms change over time?”

Analysing since 1993 as a starting point allows us to capture the period following the initiation of neoliberal planning and the restructuring of housing and the welfare regime. Although this research may seem very ambitious at first glance, it has just one **aim**: to identify and make visible the individual constraints that, through social mechanisms, contribute to shifts in social class structure in Malmö. Moreover, the **purpose** is to explain the mechanisms by which social classes are transformed over time, and to generate knowledge about the individual conditions that shape the formation of class.

This paper is organised as follows. It starts with an explanation of why Malmö is a good case in Section 5, in which transformations are presented. It continues in Section 6 with previous research on social stratification and the key role of wealth in denying the centrality of labour in analyses of social classes. The theoretical framework is presented in Section 7, including the basic claims and reasoning to help understand the results and analysis. Basic elements for analysing the methods are presented in the method and epistemology section (Section 8). Results are presented using QCA reasoning in Section 9, and the analysis is carried out in Section 10. Finally, conclusions are given in Section 11. All the additional information, useful for an exhaustive overview of the process carried out, is compiled in the annexe (Section 12).

6. Why Malmö as a case?

Sweden and Malmö have undergone significant structural, political, and economic changes that have direct repercussions on the class structure. To justify Malmö as a case, it is fundamental to explain and contextualise those changes within the city.

6.1. Swedish welfare system

During the mid-20th century, Swedish welfare became a comprehensive system whose main objective was to reduce the dependence of children's life chances on their parents' economic resources (Dalman, 2022, p. 33).

Some of the universal benefits included child allowances and free school meals, alongside the abolition of higher education fees, all of which aimed to equalise opportunities based on educational attainment (Breen & Jonsson, 2007, as mentioned in Dalman, 2022, p. 33). These measures, complemented with investments in education, are associated with occupational upgrading and increased intergenerational mobility (Fischer et al., 2020; Meghir & Palme, 2005, as mentioned in Dalman, 2022, p. 33).

The transformation of the relationship between the state, family, and labour was particularly pronounced from the 1930s onwards, when universalistic welfare policies sought to provide benefits to all (Magnusson, 2000, as cited in Dalman, 2022, p. 33). Early family benefits, including maternity and child allowances (Dalman, 2022, p. 32), were followed by policies in the 1950s and 1960s designed to alleviate child poverty and enable women to combine work and family responsibilities (Stanfors, 2007, as mentioned in Dalman, 2022, p. 33).

By the 1970s, family policy reforms explicitly focused on gender equality, including individual taxation, individual maternity leave, and gender-neutral parental leave (Stanfors, 2007, as cited in Dalman, 2022, p. 33). Subsequent decades saw extensions to parental benefits, interrupted only temporarily by retrenchment during the 1990s fiscal crisis (Dalman, 2022, p.33). Overall, the Swedish welfare model provided the foundation for Malmö's post-war urban and social development, underpinning the expansion of housing, infrastructure, and social services.

6.2. Neoliberal planning

Scholars such as Baeten has analysed how neoliberalism has taken shape in the urban Swedish context, including Malmö (Baeten, 2012, p. 24). Here, economic restructuring and policy reforms from the late 20th century onwards have shifted municipal priorities towards market-oriented growth strategies and urban entrepreneurialism, influencing planning, housing, and redevelopment agendas.

The reconfiguration of urban space characterises neoliberal urbanism in Malmö, aligning with the city's new economic and cultural image. Older industrial areas and run-down neighbourhoods have been redeveloped into zones for high-income housing, retail, offices, and cultural amenities. At the same time, public investments in "image buildings" — spectacular architectural projects designed to enhance the city's attractiveness to investors — have become common (Ward, 1998 and Haila, 1997, as mentioned in Rodenstedt, 2014, p.63). These strategies form part of a broader shift towards place-marketing and urban competitiveness.

The Bo01 housing exhibition in the Western Harbour exemplifies these dynamics. While promoted as a sustainable and innovative housing project, Bo01 faced local criticism over its location on a polluted landfill, the high construction costs limited affordability, and the eventual bankruptcy of the organising company (Persson & Dalman 2005; Jansson, 2006; Dannestam, 2008 as mentioned in Holgersen, 2014, pp. 30-34). Similarly, the Turning Torso skyscraper, completed in 2005, failed to deliver expected economic returns (Jansson, 2006, as mentioned in Holgersen, 2014, pp. 30-34). These projects illustrate the tensions between symbolic urban renewal and inclusive urban development.

However, neoliberal planning is nothing new, as it has similarities with previous policy frameworks. Baeten found similarities between the neoliberal planning of Hyllie and that of the Million Program. Both programmes aimed to remove the past, hoping that capitalism, through economic development, could ever mitigate deprivation (Baeten, 2012, pp. 23-37). The same author suggests that the main feature of neoliberal planning is related to the outcome that this policy ideology aims to have, that is

the “creative class”, which must displace the old industrial city and its conjunctures (unemployment, ethnic poor, and outsiders of society) (Baeten, 2012, pp. 23-37).

Nevertheless, contrary to the perception that capitalism thrives on unregulated markets, scholars generally agree that it always depends on various forms of planning. Hobsbawm (2012, as mentioned in Holgersen, 2014, p. 37) traces planning debates back to the early 20th century, noting that even laissez-faire economies were “planned” in specific ways (Polanyi, 2001, as mentioned in Holgersen, 2014, p. 46). Capitalism’s competitive dynamics require coordinated legal, institutional, and infrastructural frameworks, often provided by the state, to ensure market stability and facilitate business planning.

6.3. *Structural changes*

6.3.1. Transformations of the welfare system

Historically, Sweden has been acknowledged for its model welfare system. Nevertheless, as Baeten and many other scholars argue, the city has turned into a “neoliberal planning” or “social neoliberalism, in this sense (Baeten, 2012; Jönsson & Baeten, 2024; Pries, 2020). The main characteristic of this neoliberalism is the privatisation of land (Baeten, 2012; Jönsson & Baeten, 2024; Pries, 2020). During privatisation, the centre-right coalition governed the city from 1985 to 1988; the main programme was the Real Estate department (Pries, 2017, as mentioned in Jönsson & Baeten, 2024, p. 6). In fact, the coalition ordered the immediate sale of public land (Jönsson & Baeten, 2024, p. 6)

By the early 2000s, Malmö’s social government had fully embraced neoliberalism, prioritising the attraction of high-skilled labour through urban planning (Baeten, 2012, p. 21). Social planning in Malmö became a mode of neoliberal government, where competition replaced welfare as the primary goal of social intervention. Malmö’s neoliberal social government has created deep socioeconomic divisions. The city’s planning system actively distinguishes between “desirable” and “undesirable” residents, reinforcing inequalities and exclusion.

6.3.2. Demographic change

Malmö lost 34.000 inhabitants from 1970 to 1984, after the population became more stable (Baeten, 2012, p. 29). At the beginning of the 1990s, the city experienced a significant influx of refugees from a war context, which helped to increase the population to around 300.000 (Baeten, 2012, p. 29). According to Baeten, the population increase was primarily due to people coming from the “east”. The same author argues that this fast demographic change “has triggered a variety of xenophobic reactions but also policies that are clearly reflected in the demographic hopes and aspirations for the new population of Hillie once completed” (2012, p.29)

Moreover, Baeten concludes that many poor neighbourhoods with higher concentrations of ethnic minorities also had a weak labour-market position (2012, p. 40). Additionally, low-income immigrants were more likely than both low-income native and high-income immigrants to enter and remain in the poorest neighbourhoods (Baeten, 2012, p. 40).

6.3.3. Economic development of the city

According to Andersson & Hedman (2016), during the 1990s crisis, income inequality and income segregation increased sharply, leading to higher unemployment and a greater share of low-income residents in poor neighbourhoods. During the stable economic period of 2000, segregation levels remained stable, indicating that inequalities within the population stabilised (Andersson & Hedman, 2016, p. 765). Moreover, the most affected neighbourhoods by the crisis were the poorest ones, meaning their residents experienced higher job losses (Andersson & Hedman, 2016, p. 765).

6.3.4. Housing system transformation

Swedish housing policies has historically been characterised by so-called “social mix policies”, which targeted both poor neighbourhoods with significant shares of social housing, and also wealthy areas dominated by owner-occupied housing, rather than specific social groups (Holmqvist and Bergsten, 2009, as mentioned in Scarpa, 2015, p. 909). Regarding housing, it is crucial to describe the Million Program (1965–1975). In post-war Sweden, the Social Democrats introduced this programme to “guarantee affordable housing for everyone” (Listerborn et al., 2020, p. 122). Its objective was to build one million new residences for ten years—an ambitious target in a country of only eight million inhabitants. Most of these new constructions were planned for the urban periphery (Baeten, 2012, p. 28).

However, this universalistic approach was abandoned in the 1990s, when policy attention shifted towards immigrant-dense neighbourhoods, which became the focus of the first national arena-based urban programme aimed at improving local economic and employment (Scarpa, 2015, p. 909). However, empirical evidence suggests that his program had no significant impact on reducing inequalities (Scarpa, 2015, p. 921).

In parallel, the dismantling of traditional housing policies since the early 1990s has led to a sharp decline in public housing construction expenditure, thereby reducing municipalities’ capacity to pursue traditional social mix strategies. It also had three significant consequences: rising housing costs – particularly in the rental sector- and increased pressure on the vulnerable population, thereby intensifying housing-related inequalities (Hedin et al., 2012, as mentioned in Scarpa, 2015, p. 910).

According to Listerborn et al., free-market principles started leading the Swedish housing system to become “one of the most liberal market-governed housing markets in the Western world (2020, p. 120), intensifying these trends during the 2008 financial crisis, when housing projects were halted and economic uncertainty encourage private-sector dominance in the rental market (Listerborn et al., 2020).

All these changing paths of housing policies reflect the broader transformation in urban and housing policy in Sweden, understood as part of the “economisation of the state and of social policy”, in which economic growth is positioned as the primary solution to social and housing problems (Listerborn et al., 2020, p. 123). Consequently, this context of urban development is a fertile field for competitiveness, investment, and land value maximisation.

Crucial examples of this process are the Western Harbour Urban Development Program¹, designed to attract affluent residents to the city centre through “fashionable architecture and high-class lifestyle amenities” (Baeten, 2012, pp. 23). Similarly, the Hyllie² Project represents a “depoliticised” form of urban development that largely disregards the everyday needs of common people (Baeten, 2012, pp. 26-28). Instead, it aims to attract a new class of residents who can rapidly transform the city’s social demography, and those who are wealthier (Baeten, 2012, pp. 26-28).

Both projects rely on international architectural competitions, the location of land to major developers without broad citizens’ consultation, and the marketing of new districts as spaces “for new people” (Baeten, 2012, p. 39). Within this neoliberal planning, the market excludes those residents that fall outside market logics, specifically those with non-professional profiles, reflecting the institutionalisation of neoliberal planning (Baeten, 2012, pp. 37-39)

¹ Started in the late 1990s.

² Started in 2007.

6.3.5. Spatial dimension of class structure

In public debates, residential segregation is often seen as a factor contributing to rising income inequality. In contrast, evidence from Malmö suggests a different perspective: segregation appears less as an independent driver and more as a spatial representation of underlying class inequalities (Scarpa, 2015, p. 920). In fact, between 1991 and 2010, rising household income inequality in Malmö was driven primarily by a growing concentration of labour-market earnings and capital income among high-income groups (Scarpa, 2015, p. 920).

These class-based inequalities became evident in widening income gaps between neighbourhoods, according to Scarpa. The most deprived areas experienced a decline in mean household income, mainly due to higher unemployment rates and greater reliance on social assistance (2015, pp. 920-921). As a result, socioeconomic divides between affluent and disadvantaged neighbourhoods deepened.

The conclusions of Scarpa (2015, pp. 920-921) support this interpretation, showing that the greater gap between rich and poor neighbourhoods is essentially a spatial representation of increasing household income inequality, rather than a result of neighbourhoods becoming more internally homogeneous in terms of demographic composition. In summary, the Malmö case illustrates how class inequality shapes urban space, with residential segregation emerging as an outcome—and amplifier—of broader class stratification, rather than being its root cause.

6.4. *And then why is Malmö a good case?*

Malmö offers a compelling case for studying social class reconfiguration because its recent economic, political, and urban transformations encapsulate the broader changes seen in Swedish society. The city's trajectories—from welfare state to neoliberal planning, demographic shifts, and policy reforms—provide fertile ground for analysing how social mechanisms analyse class structures at the urban level.

7. Previous Research

Three key PhD dissertations provide the foundation for the state of research on social class in Sweden, and specifically Malmö: Holgersen's "The Rise (And Fall?) of Post-Industrial Malmö" (2014), Rodenstedt's "Living in the Calm and Safe Part of the City: The Socio-Spatial Reproduction of Upper-Middle Class Neighbourhoods in Malmö" (2014), and Dalman's "Patterns of Persistence: Intergenerational Mobility and Sweden's Social Structure 1865-2015" (2022). Each presents a distinct theoretical framework and methodological approach to understanding social class.

7.1. *Social stratification*

Social stratification has been discussed mainly in the social sciences; authors such as Breen, Erikson, and Goldthorpe have presented their definitions and parameters for analysing social classes (Dalman, 2022, p. 19).

Previously, Max Weber and Karl Marx defined social classes differently. For example, Max Weber distinguishes between class and status group, the former linked to the production of capital and the purchase of goods, and the latter to the consumption behaviour of individuals within their lifestyle context (Rodenstedt, 2014, p. 40). On one hand, from a Weberian perspective, status is connected to the social sphere and reflects how groups assign value to specific elements. On the other hand, class relates to the economic sphere, with the economy as the primary framework of analysis (Rodenstedt, 2014, p. 40).

In Karl Marx's initial framework, social classes are primarily defined by the dialectics of social struggle embedded in the production of value and the ownership—or lack thereof—of the means of production (Holgersen, 2014, pp. 56-59). For this reason, authors such as David Harvey question the meaning of

capital, which he addresses by examining the relationship between capital and labour that generates surplus value (Holgersen, 2014, pp. 56-57). In this sense, the author explains that the reproduction of capitalist classes is the process of capital accumulation through their reproduction and dominance over labour. Therefore, the accumulation process cannot be distinguished from the class struggle (Holgersen, 2014, pp. 56-57).

For instance, Rodenstedt defines social classes not only in terms of the economic resources of neighbours in each district but also in relation to social constructs linked to class, the representation that members of each neighbourhood have of it, and how they perceive it (2014, p. 40). In her research, the author aims to highlight the dynamics within middle- and upper-class neighbourhoods in Malmö, including the names of these neighbourhoods. For this purpose, recognising the existence of the middle class was essential, and therefore, Marxian analysis could not be applied.

The middle class was not outlined in Marx's conceptualisation of class, but Max Weber did develop it. For him, social class is connected to class-situation in terms of "positions of interest"; moreover, people in the same class can potentially share interests but do not necessarily share space or communal activities (Rodenstedt, 2014, p. 40). The heterogeneity of social classes is evident in the Weberian model in terms of means of production, wealth, and other features (Rodenstedt, 2014, p. 40). In this sense, the main difference between the Weberian and Marxian models is the (lack of) acknowledgement of the confrontation between members of different social classes.

At the beginning of the 20th century, skills were among the most important factors in determining social class, as it was uncommon for workers to attain high levels of skill, which were linked to ownership of the means of production. Therefore, a Marxist lens for analysing social classes was more accurate in understanding the social structure of pre-industrial Swedish society (Dalman, 2022, p.35).

Moreover, with industrialisation, occupational status became a key factor in positioning people within different classes, because occupation not only relates to labour but also to the social environment. Dalman states that from this point onward, it is important to consider other aspects for defining social classes, such as income or wealth, as well as possible outcomes (2022, p. 37).

These theoretical perspectives are included to illustrate the different approaches to analysing social class stratification. This variety is essential because this study draws on arguments from both traditions, with a particular emphasis on the Mertonian perspective, which is itself rooted in Weber's conceptualisation of class and status. Highlighting these frameworks clarifies the theoretical groundings for the approach and underscores the study's methodological choices.

7.2. Wealth, Capital and Value

Here, three influential approaches to wealth, capital, and value are presented. Examining these debates is crucial for understanding the economic mechanisms that produce and reproduce social class differences—a central concern in this thesis.

Bourdieu's definition of capital relates to values, means, and resources (Bourdieu, 1986). Additionally, Donald Broady states that social groups should recognise capital in terms of its profitability, which is directly connected to the concept of status in terms of how social agents, i.e., institutions, people endorse and recognise prestige (Broady, 1991, p. 232, as cited in Rodenstedt, 2014, p.42).

According to Dalman, many scholars have found that inequality in Sweden is more closely related to wealth than to income (2022, pp. 28-29). Even more, intergenerational mobility, or lack thereof, is determined by wealth (Dalman, 2022, p. 61).

Another aspect concerns the productive meaning of labour. Holgersen distinguishes between productive and non-productive labour within a Marxian framework, defining productive labour as that which

generates value from the labour force (Holgersen, 2014, p. 54). This author endorses Roberts' distinction between productive sectors—manual work that creates value—and non-productive sectors, such as service sectors, such as finance or real estate (2007, p. 189, as cited in Holgersen, 2014, p. 54).

Moreover, Kliman states that value theory concerns the production of commodities solely for exchange (1982, as cited in Holgersen, 2014, p. 54). Instead, Harvey argues that productive work is just related to the surplus value generated by the labour force (1999, as cited in Holgersen, 2014, p. 54). As stated earlier, this kind of analysis is appropriate in contexts where there is a clear division between owners of the means of production and the labour force.

7.2.1. The labour Centrality?

Alejandro Portes explains in this book, "Labour, Class and International Systems", that, according to Hobson, the main issue faced by advanced economies is the increase of surplus capital, alongside a shortage of opportunities for profitable investment within the domestic economy (1971, as cited in Portes & Walton, 1981, p. 5). This explains the internationalisation of capital: while capital is produced in one place, the surplus is invested elsewhere. Thus, the capital does not return to the producers in a direct form.

This idea of capital mobility is also reflected in labour, i.e., migrant workers embody the circulation of labour, which affects the "relationships of production and promotes internal division within the working class" (Portes & Walton, 1981, p. 20). Moreover, the key factor in surplus extraction lies in the uneven exchange between the "perfect mobility of capital and relative immobility of labour" (Portes & Walton, 1981, p. 14).

However, labour still exists, and it will continue to do so. The issue lies in the unequal exchange and its effects on capital and wealth. In this context, Portes argues that higher "classes are those in which wealth liberates them from the need to sell their labour time for a living" (Portes, 2010, p. 81), one of the main reasons labour is not the most important factor, but wealth is.

Portes also explains how the working class was reproduced during the industrial era within the capitalist context. Essentially, the difference between wages and living costs was a benefit for the working class and a source of surplus value (Portes, 2010, p. 87). However, this mathematical logic can no longer be applied due to the complexity of modern societies; moreover, the working class cannot be confined to a simple box in which a particular type of labour stability is assumed.

Furthermore, Peña exposes that work – or in this case, labour as a synonym for work – no longer guarantees social inclusion. Additionally, some workers may find themselves vulnerable to poverty (Lope Peña, 2015, p. 126). From these findings, the conclusion is that labour is no longer the central question in analysing social classes, because it does not determine an individual's social position within the social structure, so labour cannot be said to avoid poverty. Even exchanging the labour force for capital social inclusion is not assured.

Le Grand & Tåhlin also highlighted a key idea that Merton introduced years earlier. When analysing social classes from an occupational perspective, there is a risk that workers in the same role may not be from the same social class, and one should not assume this when studying social classes (Le Grand & Tåhlin, 2013, p. 18; Merton, 1968, pp. 423-424). In conclusion, even if labour is no longer a central aspect in analysing social class, it remains a key determinant of another important factor: wealth.

7.2.2. Conclusion

In conclusion, while these debates are interconnected, the traditional link between value and labour cannot be understood as the key factor when analysing social classes, given the evolution of labour's nature and social significance. By highlighting these theoretical tensions, I position my analysis to better

account for contemporary shifts in class structure, including other individual factors, in explaining the reconfiguration of social classes.

8. Theoretical Framework

The objective of this theoretical framework is to provide a coherent, analytically solid foundation for understanding and explaining how social classes are configured and reconfigured over time in the city of Malmö. The chapter brings together classical and contemporary sociological theories—specifically those of Merton, Weber, Bourdieu, Portes, and Granovetter—to explain the underlying mechanisms that structure unequal access to resources, opportunities, and Power. These mechanisms shape and distribute life chances, leaving identifiable imprints on the city's neighbourhoods.

The chapter proceeds as follows. Section 1 outlines the theoretical meaning of social structure and its institutional foundations. Section 2 defines social classes and social status. Section 3 elaborates on the role of Wealth and capital in class formation, drawing primarily on Portes and Bourdieu. Section 4 discusses Power, institutional embeddedness, and their spatial consequences. Finally, section 5 presents the causal mechanisms of class reconfiguration used in this thesis and links them to the operationalisation in the empirical model.

8.1. Social Structure and Institutional Context

8.1.1. Social structure as a patterned organisation

Social structure refers to the patterns of relationships and institutional expectations that shape social life. It includes the enduring arrangements through which individuals and groups access opportunities, acquire resources, and maintain their social positions. This definition aligns with Merton's stance on social structure: durable patterns of social relations, a system of positions and roles, normatively regulated and unequally distributed (Merton, 1968).

8.1.2. Merton: Cultural goals and institutionalised means

Merton's framework provides a functional theory for analysing how institutions shape social behaviour and outcomes. Although primarily developed as a theory of individual adaptation, two of its core concepts—cultural goals and institutional norms—offer insights into the societal norms that govern expectations around achievement and the legitimate paths to attaining social success (Merton, 1968, 1996).

Cultural goals refer to how achievements are socially constructed, not just in the collective imaginary but also in how others legitimise them. From the social structure perspective, those goals are organised hierarchically and incorporated into members of the social structure (Merton, 1968, p. 186). Institutionalised norms refer to the socially accepted course through which individuals are expected to pursue these goals.; Consequently, institutionalised norms designate, monitor, and command these routes (Merton, 1968, p.187)

This context is important for understanding how Malmö's social structure shapes opportunities, as well as constraints. Welfare institutions continue to shape the distribution of life chances, though not on the same principles on which they were founded.

8.2. *Social Classes and Social Status*

8.2.1. Social classes

8.2.1.1. Definition

Social classes are conceptualised as durable social categories defined by unequal access to resources, opportunities, and life chances. This perspective follows Portes (2010, p. 102), who argues that classes are structured around differential access to resources that Power confers, thereby shaping individuals' positions within society. Specifically, Portes states that social classes are the "discrete and durable categories" into which the population is divided and defined (2010, p. 102). Unlike status groups or identity categories, social classes are anchored in material inequalities and institutionalised economic relations.

8.2.1.2. Why social Class remains analytically central

Portes (2010, p.73) argues that although social science has increasingly focused on identity-related inequalities (gender, ethnicity, sexuality), social classes remain fundamental because they structure access to economic resources and Power. Class continues to shape the distribution of life chances, even in contexts with strong welfare institutions.

In Malmö, this is particularly evident through spatial patterns of housing tenure, educational attainment, income distribution, and labour-market integration. Class shapes who can access stable employment, high-quality education, secure housing, and opportunities for capital accumulation. These processes occur in specific places, reinforcing the spatial dimension of Class.

8.2.1.3. Class as a contextual and dynamic concept

Class is not simply an individual attribute; it is a relational and contextual position. It depends on one's location within the social structure, institutions, markets, and social networks shape constraints. It is also dynamic, changing over time as economic conditions, welfare policies, and demographic patterns evolve.

This thesis adopts a view of Class that is both contextual and structurally grounded. Social classes are understood as outcomes of interactions between institutions, economic structures, and local demographic compositions. These interactions create shifting class profiles in Malmö's districts over time.

8.2.2. Social Status

8.2.2.1. Definition

According to Robert Merton's theory, a status is a person's position in a social system (Merton, 1968, pp. 41-42). In contrast, roles are the expected behavioural patterns and responsibilities associated with that status (Merton, 1968, pp. 41-42). Given the complexity of social reality, one can see that a single status involves multiple roles because it connects an individual to many others. At the same time, each individual embodies a role set, the collection of all their roles and relationships linked to a single status.

Moreover, Merton seeks to maintain the relation between reference group behaviour and social categories. According to Merton, a person can belong to multiple groups, social categories, and shared social statuses (Merton, 1968 and 1996). These social statuses do not imply interaction between people within the same social category or who share norms. These shared norms are more related to the social structure.

8.2.2.2. Status-set and status sequences

When it comes to the interconnection between status sets and status sequences, Merton highlights five main ideas (Merton, 1968, p. 434). First, a status set is a complex collection of social positions an individual holds simultaneously; for example, a cleaner can be a man and also a migrant with children (Merton, 1968, p. 434). There is no fixed number of status sets depending on the context. This complexity has clear implications for the organisation of role activities, given the many roles across social systems.

Second, there is an interdependence between the role-set and the social-set, with implications for role-set adaptation (Merton, 1968, p. 434). Each status-set has different connections with social institutions and their subsystems, again because the same person may occupy multiple statuses across them (Merton, 1968, p. 434).

Third, social and psychological mechanisms can reduce conflict, because empathy among colleagues in the same role may help reduce pressure as a psychological mechanism (Merton, 1968, p. 434). Fourth, individuals tend to avoid statuses with values that conflict with their dominant status (Merton, 1968, p. 434). Finally, fifth, some status pairs are neutral, meaning that their values and obligations do not create conflict; they allow variability in status-sets without inherent conflict (Merton, 1968, p.434).

8.2.2.3. Social status in the social structure

Social roles and statuses provide the structural context for how people relate to reference groups and behave in society. Each status corresponds to multiple roles, and a single person can hold multiple statuses (a status set) (Merton, 1968, pp. 41-42). This shows the complexity of the social structure as a system formed by these overlapping, sequential statuses and roles, and the challenge individuals face in balancing their multiple roles demands and social status constraints. However, understanding this complexity is key to explaining how social order is maintained despite the potential for role conflict and instability, because the variability and conflict inherent to social life influence how individuals adapt to their status sets. In the following sections, each status – economic, educational, residential, ethnic, labour, and family status - and its conceptualisation will be explained using Portes and Bourdieu's framework.

8.2.3. Conclusion

In short, class refers to durable social categories defined by unequal access to resources and opportunities. Status refers to a person's position in a social system, whereas the roles are the expected behavioural patterns and responsibilities associated with that status (Merton, 1968, pp. 41-42). Class is the interplay of consequences from the configurations of statuses, not just an abstract category linked to values.

8.3. *Wealth, Capital, and the Reproduction of Advantages*

8.3.1. Wealth as a multi-dimensional resource

Wealth is treated here not only as an accumulation of economic assets but also as an expression of more profound structural inequalities in access to capital. Wealth provides economic security, enables long-term planning, and facilitates intergenerational transmission of advantages. It is particularly significant in urban contexts, where housing and labour markets reproduce spatial inequalities. Portes (2010, p. 81) emphasises the role of Wealth as a determinant of access to Power.

8.3.2. Bourdieu's theory of capital

Bourdieu's framework provides a comprehensive model for understanding the forms of capital that shape class structure. Each form of capital can be converted into other forms, depending on the institutional context. The Scandinavian welfare state, with its emphasis on educational attainment and institutional pathways to employment, creates a strong link between cultural capital and future economic capital. Housing markets create another link between economic capital and intergenerational Wealth.

However, what is capital? According to Bourdieu, there are four types of capital: economic, cultural, social, and symbolic. The first pertains to the quantification and the purely financial interest in converting capital into money (Bourdieu, 1986, p. 16). Cultural capital is the institutionalised form expressed through educational qualifications (Bourdieu, 1986, p. 18). The present paper also assumes that cultural capital relates to the knowledge of the rules and norms of the social structure and political context. Third, social capital can be summarised as "good connections" used to achieve specific goals (Bourdieu, 1986, p. 18). Finally, symbolic capital is a particular form that is not achieved directly but recognised by others, providing a specific kind of legitimacy (Bourdieu, 1986, p. 18).

According to these definitions, capitals can be connected to statuses through sequences or status sets. This means that if each status is a social category, then capital is what the individual can take profit from each status.

8.3.3. Linking capital to spatial inequality

Bourdieu defines capital as "accumulated human labour" (Bourdieu, 1986, p. 15) that generates profits in different ways. It requires time and effort to create and leverage the same capital; therefore, it is an object of interest. However, as discussed earlier, labour is not central to the class question in this thesis; instead, Wealth can be generated by labour and other accumulation processes, such as intergenerational inheritance. In a capitalist society, capital is the primary focus. Still, it also serves as the guarantor of the rule and stability of the social world, though it involves both objective and subjective inscriptions within its structures (Swartz & Zolberg, 2005, p. 241). In conclusion, the spatial distribution of capital is essential for understanding neighbourhood-level class profiles. Economic, cultural, and social capital cluster in specific areas, creating accumulative advantages.

8.4. *Power, Embeddedness, and Institutions*

8.4.1. Power as a structural resource

Power is the faculty and capability to force one's will on others (Portes, 2010, p.24). This is a component of social embeddedness, according to Portes (2010, p. 24). However, in the present paper, a particular assumption will be key when analysing the social classes in Malmö. For Weber, the key determinant of Power is "imposed" (Portes, 2010, p. 24); therefore, it can be a blurred line to navigate, as consensus from others is required, and it is difficult to measure quantitatively. Nevertheless, here, the idea of Power will not be discussed between the holder of Power and the other, but rather just the possibility of imposing Power. That is why the forms of "capital" discussed previously will serve as a means of quantifying Power.

8.4.2. Institutional embeddedness

In this sense, as Portes does, it is essential to recall Granovetter and his term of social embeddedness, which helps to understand that values, norms, and roles are key tasks of institutions that shape the social structure, which behave "as rules and their embodiment in legal codes and legally sanctioned organisations" (Portes, 2010, p.68). In Malmö, the institutional landscape—including schools, housing

policy, labour-market regulations, and social services—affects residents' life chances in ways that vary across districts.

8.5. *Causal Conditions of Social Class (Re)configuration*

Causal conditions are categories used to elaborate sets of explanatory mechanisms, i.e., abstract ideas that are used to comprehend, explain, and sometimes predict social events (Portes, 2010, p. 2). Portes presents three explanatory mechanisms in his book: social capital, social classes, and social institutions (Portes, 2010, p. 5). Nonetheless, because this paper focuses on social classes, they cannot serve as an explanatory mechanism. Therefore, the explanatory mechanisms for understanding social classes are articulated directly from the Mertonian theory of Social Status and from the analysis's results, in the form of status-sets. This is not the first time that this type of research is carried out. Sanberg carried out a similar research, although focusing on "segregation as a multidimensional phenomenon" in Stockholm (Sandberg, 2023, p. 2371)

This thesis identifies five conditions, in various combinations, that correspond to the explanatory mechanisms identified through Qualitative Comparative Analysis (Rihoux & Ragin, 2009) and explain social class changes. Each condition reflects a specific form of capital and a set of structural constraints.

8.5.1. Economic Status (v1)

The first causal condition is economic status. It shapes the ability to secure stable housing, invest in education, and accumulate Wealth. The author of the research assumes that districts with higher income levels, i.e., higher economic status, tend to exhibit more favourable class profiles and greater resilience to economic shocks. This status refers to the extent to which people in each district possess capital and, therefore, direct or indirect control over the means of production. This is the key causal condition, which is linked to Wealth and capital and transformed into direct Power. For this mechanism, it is essential to consider Bourdieu's economic capital, since this economic status serves as the mechanism that translates capital into direct money (Bourdieu, 1986, p. 16).

8.5.2. Educational Status (v2)

For educational status to serve as a causal condition, it is necessary to recall Bourdieu's concept of cultural capital. Possessing specific skills can translate into access to certain types of jobs, while lacking or outdated skills can lock a person into a lower or more precarious labour market (Portes, 2010, pp. 90-91). Therefore, educational attainment is the institutionalised form of cultural capital. It influences labour-market outcomes and impacts long-term opportunities. It is assumed that districts with higher educational profiles tend to have higher cultural and symbolic capital.

8.5.3. Residential Status (v3)

Given the scope of this research, which covers each district of Malmö, it was decided to examine residential status, as it reflects property ownership and housing stability. Housing tenure is a key mechanism of wealth accumulation, enabling intergenerational transmission of advantage. Districts dominated by owner-occupied dwellings tend to exhibit more favourable class conditions over time. Property ownership confers prestige, recognition, and legitimation to owners; consequently, a district with higher property ownership will have higher symbolic capital.

8.5.4. Migration Status

Migration status is operationalised as the background origin of residents. These definitions are based on Portes' theoretical distinction between labour migration and other forms of mobility. Portes and Walton (1981, p. 21) argue that labour migration is typically regionally specific rather than national,

driven by both inducements and spontaneous decisions, and occurs within a shared international system in which destination countries are known in advance. The primary motivation for the migration decision is economic, sustained over time, undertaken by individuals whose central aim is to sell their labour in the receiving country (Portes & Walton, 1981, pp. 21, 81).

In recent Swedish contexts, migration has been shaped by humanitarian logics, with substantial inflows from conflict-affected countries (Taşan-Kok & Baeten, 2012, p. 29). However, upon arrival, migrants must enter the labour market, often under conditions they would not have been accepted in their countries of origin, despite holding high skills. These disadvantages are not limited to the first generation. As Dalman (2022, p. 19) shows, foreign-born individuals and their descendants face persistent disadvantages in labour market participation, occupational status, and residential segregation.

For these reasons, migration status is closely linked to social capital. Limited access to established networks and industrial resources constrains labour market integrations and reinforces long-term disadvantage. In this sense, migrant status captures not only demographic differences but also structurally embedded debts in social capital that shape class trajectories.

8.5.4.1. Non migrant status (v4)

Given the construction of the ideal type representing the absence of inequality and the highest-class position, the condition used in this analysis is non-migrant status (v4), defined as being born in Sweden with a Swedish background. Since migrant status is associated with cumulative disadvantages across the labour market, occupational, and residential sectors, non-migrant status was treated as the absence of these constraints. It therefore functions as a proxy for the most advantageous position in terms of social capital and structural social integration. It is central to capturing the best-case configurations of class position in Malmö.

8.5.5. Occupational Status (v5)

Occupational status represents the share of the population employed in each district. In this sense, higher occupational levels indicate greater employment stability, enhancing income security, therefore it is linked with symbolic capital. In comparison, employment instability undermines long-term planning. However, occupational status per se does not explain the reconfigurations of social classes, since in the current asset economy, property ownership has assumed a more central role in generating wealth (Adkins et al., 2022; Jacobs et al., 2024).

Moreover, as Portes states—recalling Marxist approaches—labour generates Wealth when one sells their labour in exchange for income (Portes, 2010, pp. 81-84). Income is located or understood as an economic status. Then, occupational status is the level at which a district is fully employed.

9. Method and Epistemology

9.1. General and meta-theoretical assumptions

Continuing with Portes' approach, the general and meta-theoretical assumptions need to be considered when researching economic sociology. In general, they are very complex to falsify, but worth considering when analysing economic relations. First, socially oriented economic action means examining the hidden aspects of the economy that directly impact the behaviour of social actors (Portes, 2010, p. 16). Then, the unexpected consequences of purposive action follow Granovetter's framework, reflecting the idea that markets are social entities, with their interactions organised as networks, rather than the typical image of them and their "rational behaviour". Portes argues that the linkage between achievements and individual or collective outcomes is not always what it is intended to be (Portes, 2010,

p.19). Finally, the perversion of power in terms of the one should account for power being everywhere when analysing economic dynamics and the actors involved (Portes, 2010, p. 24).

Another important aspect of this research is the neglect of theoretical puritanism. As Portes states, one should use theoretical pluralism, which basically represents the usage of different theories that, at first glance, could appear contradictory, but when applied in a specific context appear to be complementary (Portes, 2010, pp.36-38).

In this sense, it is acknowledged that Merton is classified in the sociology academy as a structural functionalist. For this thesis, a structuralist perspective has been chosen over a structural-functionalist one since the analysis focused solely on the relations between structure and the city, including social actors, policies, statuses, and the spatial dimension, rather than analysing the functions that classes could have within the social structure (Merton, 1996).

9.1. Middle Range Theory

Given these assumptions, the question concerns the scope of the analysis; this is why the middle-range perspective has been adopted in both the abstraction and empirical phases. Merton defines middle range as *“theories that lie between the minor but necessary working hypotheses that evolve in abundance during day-to-day research and the all-inclusive systematic efforts to develop a unified theory that will explain all the observed uniformities of social behaviour, social organisation, and social change. Middle-range theory is principally used in sociology to guide empirical inquiry. It is intermediate to general theories of social systems, which are too remote [...] and to those detailed, orderly descriptions of particulars that are not generalised. Middle-range theory involves abstractions, of course, but they are close enough to observed data to be incorporated in propositions that permit empirical testing”*(Merton, 1968, p.41).

It has been included as a direct quote to ensure transparency. The dimension of the theory has direct repercussions on the analysis. For instance, Marxian scholars would argue this matter from a dialectical perspective, and Weberian scholars would say it from a network-relations perspective. Here, the question is what the differences between them are, since both agree on the interconnection between the social sphere and the manner of analysis. This epistemological debate has been discussed extensively, and there is no further space for it here, but it would be interesting to pursue additional research on this topic.

9.2. Analytical design

The analytical design connects the theoretical framework to the methodological strategy. The analysis is structured as a year-by-year application of fuzzy-set Qualitative Comparative Analysis³ (Rihoux & Ragin, 2009). This design is necessary because, as documented in the annexe 14. 6. Definitions, several indicators undergo definitional and measurement changes across the period. Conducting separate fsQCA solutions for each year prevents artificial comparability and ensures that each configuration is derived from the definitions actually in use at that time.

Following the annual analyses, a longitudinal comparison of the resulting sufficiency solutions is conducted. This makes it possible to examine whether the causal structures associated with neighbourhood trajectories in Malmö remain stable or undergo substantive transformation over time.

The analytical structure follows Goertz’s (Goertz, 2020, p. 281) levels of analysis. At the level of **concepts**, the questions “what is?” or “What do you mean?” (Goertz, 2020, p.67) concern the

³ From now on fsQCA.

(re)configuration of social status, understood as the hierarchical organisation of economic, educational, residential, migrant-origin, and occupational dimensions at the neighbourhood level.

At the level of **causal mechanisms**, the theoretical claim is that unequal access to resources, i.e., forms of capital, generates differentiated distributions of power, producing distinct configurations of social status. In contrast, the **explanatory mechanisms** are not theoretical claims but empirical instances: in this study, they correspond to the yearly fsQCA solutions, following Goertz's (2020, p. 8) and Portes' (2010, p. 2) clarification that explanatory mechanisms emerge during analysis rather than being prespecified. In parallel, the explanatory mechanisms need to be allocated at the meso-level of the analysis.

Two levels of analysis are applied. The **basic level** consists of the main causal conditions explaining the outcome in set-theoretic terms (Goertz, 2020, p. 275). These are operationalised through five status dimensions: economic, educational, residential, non-migrant-origin, and occupational. For each year, the analysis considers the resulting configurations, the number of solutions, and their consistency and coverage. Because indicators differ across years due to official redefinitions, treating each year separately ensures conceptual validity before moving to longitudinal interpretation. The resulting annual sequence forms the empirical basis for detecting causal periods.

The **secondary level** specifies how configurations change over time. Here, the yearly solutions are compared to identify periods of stability or turning points. At this level of analysis, it is possible to show the causal period, which is the evolution of the explanatory mechanisms over the period analysed. This is key because, as has been argued, the social mechanisms underlying social class configuration are not stable, impermeable patterns to social change. Consequently, the combination of yearly analysis and cross-year comparisons will provide a set of statuses and a more accurate understanding of how the five mechanisms evolve and how the causal structure unfolds over the 1993-2023 period. Moreover, the secondary level is ontologically related to the basic level (Goertz, 2020, p. 278): it does not introduce new concepts but rather analyses temporal patterns in the empirical instantiations of the basic level.

Finally, at the **data-indicator level** (Goertz, 2020, p. 273), the operationalisation follows the official definitions reproduced in the Annexe 14.6. Definitions:

The economic indicators do not represent a single stable concept over the period but transition from income distribution (1993–1995) to disposable family income (1996–2006), and later to population-wide disposable resources, including transfers (2007–2023), with additional methodological breaks in 1999 and 2020. The educational indicator shows the share of individuals aged 16–64 (from 1993 to 1995) and 20–64 (from 1996 to 2023) in each area by the highest completed formal educational level.

Regarding the residential indicators, although “äganderätt” is used consistently in the analysis, the underlying definition changes. Between 1993 and 2008 the indicator refers to the share of *dwellings* by ownership form and functions as a structural housing-stock measure. From 2012 onward, it refers to the share of *residents* by tenure category.

For the non-migrant background causal condition, indicators related to the migrant population⁴ were selected and kept separate to ensure that the non-migrant background is captured for each year. Moreover, to build the ideal type, the idea was to resemble the non-migrant population; therefore, it is defined as the share of residents not classified as having migrant origin (based on year-specific definitions).

⁴ This indicator has key differences in its definitions across years - from combined citizenship and parental origin to birth-based classifications. See annexe 14.6. Definitions for details.

The occupational indicator does not represent a single stable concept over time, either. Between 1993 and 2006, it measured the share of employed residents aged 20–64 using population-based counts. From 2007 to 2018, it adopted an AKU-aligned definition based on employer statement data. In 2019, a new payroll-based data source was introduced, creating a break in comparability. Since 2022, a new variable (sysselsättningsgrad) and a new data system (BAS) have been implemented, alongside a shift to the 20–65 population. As a result, the indicator cannot be compared across these periods without caution.

9.3. Collection of the data

In this section, I have decided to use a personal voice, since I have made many critical decisions. The final goal was to have the best dataset for fsQCA, in which the logic is not to compare values but configurations of the different conditions. Consequently, I do not think that the creation of the dataset should be oriented towards numbers, but rather towards ensuring all the conditions that, according to the theoretical framework and Malmö as a case study, are needed for the analysis.

9.3.1. Data sources and selection criteria

The primary data source is the Malmö Statistical Portal (Incegül & McShane, 2025). The data is secondary because before 2008, there was no availability on the SCB⁵ data portal, the primary data source in Sweden. Additionally, data from 2008 was better organised in Malmö's statistical portal. It is fundamental to highlight that I decided to use "GeSO, Geografisk områdesindelning" because it divides the city into 14 areas, which are assumed to be a Small N and allows to a better fit for fsQCA (Mello, 2021, p. 36)

I collected data from 1993 to 2008 from "Historik Statistik", in which I found yearly statistics summaries of the city (Hvarvenius et al., 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008; Nilsson et al., 1993). In this data, the spatial unit is "Dolmoråden", which divides the city into 136 areas and is a subdivision of "GeSO". All five variables were found in those books.

Moreover, I collected data from 2008 to 2023 from the dataset "Statistik för Malmös områden" (Incegül & McShane, 2025). In this case, the data already had "GeSO". It is key to explain that in this dataset, the relationship between "Dolmoråden" is specified in "Statistik för Malmös områden" (Incegül & McShane, 2025, sheet "Grundläggande information")⁶. I checked whether assuming that this table or performing a geospatial harmonisation was better for converting Delområden to GeSo.

However, variable three was just available from 2017. So, I looked for alternative sources and found in the "Segregationbarometern" (Boverket, 2025) the necessary data for RegSo areas from 2012 to 2023, which was a problem to address.

9.3.2. Limitations

One limitation is the conversion of data from "Dolmoråden" to "GeSO", which affects the generation of the final dataset. This procedure was done for two reasons. First, in the yearly statistics summary, around 40 areas were missing because the data collectors only recorded data for areas with more than 50 inhabitants (Hvarvenius et al., 1994, 1995, 1996, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008; Nilsson et al., 1993).

⁵ Statistikmyndigheten SCB

⁶ Found the table in the annexe 14.1. Correspondence table GeSO Delområden (Incegül & McShane, 2025, sheet "Grundläggande information")

To address this limitation, I am considering whether geospatial harmonisation⁷ would be a better option for converting Delområden to GeSo. The results show that in almost all cases, the correspondence table method (median-based) showed lower RMSE and higher correlation. These results led me to conclude that the Medina-based correspondence-table harmonisations were a better fit as the primary strategy for constructing the 1993-2023 GeSO dataset, given their consistently lower error and greater alignment with Malmö's official mapping⁸.

An additional inconvenience was the format of the yearly statistics summary, which was in .pdf. First, I tested OCR software to convert the PDFs to .csv. However, the book quality was not ideal for OCR to recognise the data. I concluded that manually collecting the data was the better approach for this thesis. Moreover, the data from "Statistik för Malmö områden" (Incegöl & McShane, 2025) are in .xlsx format, but I easily converted them to .csv for easier management in R.

9.4. Selection of the best geospatial conversion

During the data collection phase, a significant methodological problem emerged. The unavailability of housing ownership data for the period 2009-2016 created a seven-year gap that could affect the longitudinal aspect of my analysis, potentially leading to inconsistent geographies for "Residential Status (v3)". Therefore, the goal for this key step is to find the best harmonisation method for all the data⁹.

To overcome this challenge, I made concerted efforts to obtain the missing data from other sources. I reached out to both Statistics Sweden (SCB) and Malmö Stad. SCB, while requiring a fee for the data and geospatial conversion, was unable to provide data in the GeSo or "Dolmoråden" formats. Malmö Stad, on the other hand, could only supply data from 2015 onwards. In contrast, the "Segregationsbarometern" platform already offered housing-ownership data in percentage format in the DeSO and RegSo geospatial units. To overcome this problem, I evaluated four harmonisation strategies:

- RegSO → GeSO
- DeSO → GeSO
- RegSO → Delområden
- DeSO → Delområden

I used simple areal weighting to assess the best geospatial conversion, converting from RegSO to GeSo, using two primary evaluation criteria: fragmentation and reconstruction error. Among all tested mappings, the harmonisation from RegSO to GeSO produced the fewest total fragments (202), substantially fewer than the Delområden-based alternatives (752). This indicates that RegSO boundaries align more coherently with GeSO areas, minimising artificial subdivisions created during the overlay. The second criterion, the reconstruction error for this mapping was among the smallest across all candidates ($ERF_mean_abs \approx 0.1835$), ensuring that the areal weighted redistributions of values preserve source-unit information with minimal distortion. The results table can be found in the annexe¹⁰ alongside the script.

⁷ Formulas are found in the annexe 14.2. Geospatial (area-weighted) harmonisation (Delområden to GeSO)

⁸ This process is reflected in the annexes with the script (14.7) about the data cleaning process (14.3) and a results table (14.4.).

⁹ All the formulas can be found in the annexe: 14.2. Geospatial (area-weighted) harmonisation (Dlområden to GeSO)

¹⁰ The script is in the annexe 14.7. Code to compare geospatial dimension, and the results are in the annexe 14.4. Table of results for geospatial harmonisation

In conclusion, together, these metrics demonstrate that RegSO-to-GeSO is the most spatially stable and least lossy conversion, providing the strongest basis for harmonising residential status (variable 3) onto the GeSO geographical unit.

9.5. Data cleaning

A rigorous data-preparation workflow was implemented to construct a longitudinal and internally consistent dataset for all GESO units from 1993 to 2023. Given the heterogeneity of the sources—institutional origin, geospatial aggregation units, and measurement conventions—the dataset required extensive cleaning, harmonisation, and imputation before it could support the empirical analyses. All this workflow can be found in the annexe 14.3. Code for cleaning the data. Instead, this section will describe the discussion of key decisions.

9.5.1. Initial standardisation

All datasets were imported and checked for inconsistencies in naming, formatting, and variable types. Indicators stored as character strings were converted to numeric formats, and decimals were rounded to two digits. During the earlier collection phase, I also collected duplicate variables and removed them afterwards. Duplicated or ambiguous fieldnames were standardised. This step ensured that all variables, both within and across years, followed a uniform structure, enabling systematic harmonisation and later merging.

Here, it is important to explain why I chose to use some variables, even though their definitions changed over time. When selecting indicators, I prioritised those with the most significant conceptual continuity over the period and avoided variables with multiple incompatible definitions whenever alternatives were available. However, some definitions changed, and I assumed data providers changed them for policy, administrative, or methodological reasons.

These changes could create comparability challenges. In this thesis, the risk is mitigated by the analytical design itself. Because the fsQCA is conducted year by year, each year is evaluated according to the definitions valid at that time. The analysis does not require strict metric invariance across decades; instead, it evaluates configurations of relative status differences within each year. For this purpose, all selected indicators – despite definitional updates – remain conceptually coherent and appropriate for capturing the yearly distance between neighbourhoods and the ideal-type configuration.

9.5.2. Harmonising v4 (non-migrant background) scale

To ensure ontological coherence between the data and the ideal type, in line with the theoretical framework, the variable capturing migrant background (v4) was transformed. The original measure represented the percentage of residents with some migrant background (definition differences are detailed in the annexe 14.6. Definitions). However, analytically, the framework required a measure of non-migrant background that was consistent with the directionality of the other indicators, with higher values indicating greater socioeconomic advantage.

Therefore, v4 was inverted using the following transformation:

$$v4_{new} = 100 - v4_{old}$$

Were:

- $v4_{new}$ = The percentage of inhabitants with non-migrant backgrounds in the neighbourhoods.

- $v4_{old}$ = The percentage of inhabitants with migrant backgrounds in the neighbourhoods.

So, the higher values reflect a greater proportion of residents without a migrant background. This reorientation ensured conceptual alignment across all five causal conditions and maintained consistency throughout the calibration and ideal-type construction.

9.5.3. Merging 1993-2008 with 2007-2023

After selecting the harmonisation methods, the 1993-2008 harmonised dataset was merged with the 2008-2023 Malmö Stad dataset. Key steps are: (1) I restructured the 2007-2023 data from long to wide format, (2) I ensured variable-year consistency between the two data series. I continued with (3) removing duplicated columns in overlapping years. Then, (4) the field names were standardised and organised in alphabetical order. Finally, (5) some variables used for the preprocessing phase were deleted. As a result, a unified data frame with standard names and format was created, although specific year variables were missed.

9.5.4. Imputation strategy

Another problem with data arose. There was missing data for variable 1 (economic status) in 2001, variable 2 (educational status) in 1994, 1995, and 1996, and variable 3 (residential status) in 2009, 2010, and 2011. Additionally, data for variable three from 2012 to 2023 is in the RegSo geospatial unit.

9.5.4.1. Missing values v3 (residential status)

Since Segregationbarometern (Boverket, 2025) provided ownership data from 2012 onwards, the values for 2009 to 2011 needed to be reconstructed. First, RegSO polygons were intersected with GeSO geometries. Second, ownership values for 2012 to 2023 were harmonised to GeSO using weighted medians¹¹. Third, to ensure continuity, the resulting GeSO series was rescaled with 2008 values¹². Finally, missing years from 2009 to 2011 were imputed using linear interpolation¹³. Linear interpolation was used because I assume that ownership evolves gradually at a neighbourhood level, especially since Malmö Stad privatised land and promoted private construction (Baeten, 2012; Jönsson & Baeten, 2024; Pries, 2020). In this sense, interpolation preserves the empirical trends without imposing additional modelling assumptions. Alternative smoothed methods were rejected to avoid overfitting temporally. In conclusion, this procedure ensures that the ownership trajectory after 2012 smoothly connects to the historical series.

9.5.4.2. Missing values v1 and v2

Remaining gaps were imputed using midpoint interpolation, using temporal alignment and some trajectories across the series. This strategy balances methodological transparency, theoretical consistency and empirical plausibility. In other words, this approach maintains each indicator's temporal structure without imposing model-based assumptions. Both workflow and formulas are found in the annexe¹⁴.

¹¹ The formulas are allocated in the annexe 15.5. Formulas in the spatial conversion assessment.

¹² The formulas are allocated in the annexe 15.5. Formulas in the spatial conversion assessment.

¹³ The formulas are allocated in the annexe 15.5. Formulas in the spatial conversion assessment.

¹⁴ The workflow is in annexe 14.8. Code for the analysis and the formulas are allocated in the annexe 15.5. Formulas in the spatial conversion assessment.

9.5.5. Final dataset

After harmonisation, margin, escalation, and interpolation, a final dataset was constructed containing all five indicators for all 14 GeSO units, with each indicator converging annually from 1993 to 2023. Some final steps were taken to improve the data frame format (two-digit decimal places, alphabetising columns, removing redundant variables, and ensuring that all year series were internally coherent).

9.6. *Qualitative Comparative Analysis*

Explanations and justifications of decisions regarding the fsQCA are provided as follows. QCA is the best method to analyse set statuses since it can provide a configuration of the different conditions, i.e., statuses presented in the theoretical framework. The script for this analysis is found in the annexe 14.8.

9.6.1. Why QCA fits this research?

QCA is particularly well-suited to this research because it aligns with a middle-range, theoretically guided, and case-based approach to social mechanisms. As Rihoux & Ragin noted, QCA combines qualitative and quantitative logics, allowing macro-level social units – such as neighbourhoods – to be analysed in terms of configurations (2009, p. 6). The authors also emphasised that QCA integrates the strengths of qualitative case knowledge and formalised, set-theoretic measurement (Rihoux & Ragin, 2009, pp. 6-15). This method has also been applied to the logic of an ideal type (Kvist, 2007; Schneider & Rohlfing, 2016; Verweij & Vis, 2021), as it is here.

The main idea of this method is to analyse a small number of cases, considering macrosocial units, and then to identify configurations that better align with the research outcomes, thereby identifying theoretical aspects that distinguish or resemble the cases in the study (Finn, 2022, p. 3815). Moreover, Hug explains that QCA combines necessary and sufficient conditions across cases to compare them, allowing for causal explanations of the research question (Mello, 2021, pp. 90-92).

In this thesis, the outcome -distance from the ideal type of configuration of social advantage- is assumed to emerge from combinations of socio-economic mechanisms rather than from single variables, which Merton names the status-set (Merton, 1968, pp. 41-42). QCA's capacity to capture complex causality, conjunctural explanations, and equifinality (Mello, 2021, p. 19), with the theoretical expectation that neighbourhood trajectories result from multiple interacting structural factors.

Furthermore, QCA focuses on “explicit connections” between conditions and outcomes (Rihoux & Ragin, 2009, p. 13), which is consistent with the detection of how the structure of the socio-economic mechanism classifies inequalities in Malmö.

9.6.2. Fuzzy-set QCA

There are three types of QCA: crisp set, multi-value, and fuzzy set (Rihoux & Ragin, 2009, pp. 17-19). As this thesis has argued, social class analysis cannot be conducted through fixed lenses. Therefore, it has been assumed that fuzzy sets are better suited for this purpose. Fuzzy sets allow partial membership between 0 and 1, capturing the relational and continuous nature of income, education, housing tenure, (non) migrant background, and occupational status in each neighbourhood (Rihoux & Ragin, 2009, pp. 5-10). This approach reflects the conceptual argument presented in the theoretical framework that social class attributes operate on a continuum rather than in dichotomies.

9.6.2.1. Multiple QCAs / Longitudinal logic

Multiple QCAs is incorporated as a methodological strategy because the aim is not only to analyse the configuration of social classes but also their temporal dimension. The outcome in this research—the distance from the ideal type—captures the degree to which a neighbourhood belongs to the advantaged class. Given that the objective is to analyse how explanatory mechanisms evolve, the study applies the longitudinal logic proposed by Verweij & Vis (2021), which requires conducting separate QCA analyses for each year and then comparing the resulting solution formulas across time. This approach is also well-suited for handling definitional changes in the indicators, which would make a pooled analysis conceptually and empirically invalid.

According to Verweij & Vis (2021, pp. 103–105), a longitudinal QCA must follow four principles: (1) temporal separation, meaning the analysis should not pool years but treat each year as its own configuration space; (2) comparison of solution formulas, which requires examining how sufficient configurations change from year to year; (3) assessment of condition stability, to identify whether mechanisms act persistently or only episodically; and (4) detection of structural trends, which involves identifying long-term patterns, critical shifts, or path-dependent processes.

Following these principles, the longitudinal-QCA procedure compares sufficient configurations across consecutive years to detect configurational change. Each year's sufficient solutions were decomposed into tokens (e.g., $v1$, $\sim v3$, $v4$, $v5^*$) to isolate their constituent elements and then translated into a canonical form so that syntactic differences—such as condition ordering—did not artificially inflate variation. Using these canonical expressions, causal periods were defined as sequences of consecutive years that share the same underlying configuration logic. Conversely, turning points were identified when a configuration appeared, disappeared, or changed its internal structure relative to the previous year.

This strategy enables the detection of meaningful long-term patterns in causal pathways rather than imposing arbitrary temporal cutoffs. It reveals whether causal structures stabilise, fragment, or reorganise over the 31 years, and how the five conditions shift in their relative importance. More broadly, it shows that the mechanisms shaping social-class configurations are not fixed structural constants but reorganise in response to demographic, economic, and institutional change. Conducting yearly fsQCAs and comparing them only afterwards is therefore essential: pooling all years would wrongly assume temporal stability in indicator definitions, distributions, and causal relations. This assumption does not hold in this context. Annual analyses combined with cross-year comparison solutions ensure that temporal change is not obscured and that causal periods can be meaningfully identified.

9.6.3. Calibration of the set and the outcome

Each year was calibrated independently to maintain conceptual equivalence within that year's distribution, according to the following criteria:

V1: This is the median income in the district that was calibrated through year-specific min-max scaling.

$$v1_{g,t} = \frac{income_{g,t} - \min(income_t)}{\max(income_t) - \min(income_t)}$$

V2: The tertiary education percentage in the district, standardised by dividing by 100.

$$v2_{g,t} = \frac{tertiary\ education\ percentage_{g,t}}{100}$$

V3: The household ownership percentage in the district, standardised by dividing by 100.

$$v3_{g,t} = \frac{\text{houshold onwership percentage}_{g,t}}{100}$$

V4: Non-migrant background percentage in the district, standardised by dividing by 100.

$$v4_{g,t} = \frac{100 - \text{migrant bakcground percentage}_{g,t}}{100}$$

V5: occupational percentage in the district, standardised by dividing by 100.

$$v5_{g,t} = \frac{\text{occupational percentage}_{g,t}}{100}$$

All resulting fuzzy memberships equal to exactly 0.5 were shifted to 0.0501, ensuring that no condition or outcome had ambiguous central membership. The outcome for each case-year was defined as 1 - mean (v1...v5), with 0.5 shifted to 0.0501. This approach preserves within-year interpretability while keeping the calibration aligned with the theoretical construct of class advantage.

9.6.4. Fuzzy-set Ideal Type construction

The outcome was constructed as the distance from the mean fuzzy membership -across all calibrated conditions each year- to the “ideal type configuration”. As Portes suggests, the ideal type embodies specific assumptions regarding equality, or, better said, the absence of inequality, in specific social events (in Calhoun, 2011, p. 40). The same author assumes that this type of research is inductively conducted; however, a deductive process has also been employed, since most of the key concepts derive directly from Portes and Bourdieu.

The ideal type is conceptualised as a neighbourhood displaying the highest possible membership across all five socio-economic mechanisms, representing minimal structural constraints and maximal ascription to the highest possible social class. Following Verweij & Vis (2021, p. 105), a fuzzy-set ideal-type is used to track how cases move across ideal types over time. The focus is on cases as configurations rather than solution formulas. The method is handy for descriptive and case-focused research (Verweij & Vis, 2021, p. 109).

A key difference is that this method differs from standard fuzzy-set ideal-type analysis. The ideal type of membership should follow the weakest-link principle (Verweij & Vis, 2021); however, it has been argued that the mean better reflects the data. This choice is justified because the weakest-link rule would have been dominated by the wide variability across values, making it harder to identify meaningful differences.

9.6.5. Necessity analysis

A necessity analysis was conducted for each condition and each year. Necessity scores were calculated manually using the standard set-theoretic minimum operator, producing both necessity consistency and coverage. Consistency assesses whether the condition is present whenever the outcome is present – that is, whether the outcome set is a subset of the condition set (Mello, 2021, pp. 90-92). Coverage evaluates how empirically informative this relation is by indicating how much of the condition’s membership is relevant for explaining the outcome, rather than reflecting a ubiquitous background characteristic (Mello, 2021, p. 175). To distinguish non-trivial necessary conditions from those that are widespread, the Relevance of Necessity (RoN) was also computed. Only conditions reaching a consistency of 0.90 or higher were examined substantively. This approach ensures that the analysis determines not only whether a condition is almost always present when the outcome occurs, but also whether this pattern is meaningful for explanation rather than a statistical artefact of its distribution (Cangialosi, 2023, p. 6).

9.6.6. Sufficiency analysis

For each year, sufficiency was assessed using a truth-table analysis with an inclusion cutoff of 0.75 and a frequency cutoff of 1. Minimisation was performed using the complex solution, which avoids counterfactual assumptions and therefore relies exclusively on empirically observed configurations (Mello, 2021, p. 213). The yearly truth tables list all configurations that meet the thresholds and report the key sufficiency metrics: consistency, PRI (Proportional Reduction in Inconsistency), overall coverage, and unique coverage. This procedure generated a complete record of yearly sufficient configurations, distinguishing between configurations that result from actual minimisation and those that are merely syntactically valid but substantively uninformative. Because definitions of the indicators related to the conditions vary over time, sufficiency was estimated separately for each year rather than pooling data, ensuring that causal relations were not artificially homogenised across decades marked by changing socio-economic contexts.

10. Results

In this section the results will be presented following the logics of QCA. To complete the overview of them, it is important to check annexes 10.9, 10.10, 10.11, and 10.12.

10.1. *Necessity analysis (per year)*

The conditions "educational status" and "residential status" present very high necessity consistency throughout the entire time period of this research. For instance, the consistency of the "educational status" variable is never below 0.92 and reaches a perfect value of 1 in the first years, with coverage ranging from 0.65 to 0.93. Still key, RoN increases over time, starting at relatively modest levels in the early 1990s (around 0.4-0.5) and increasing uniformly to values above 0.85 from the mid-2010s onwards.

This pattern suggests that educational status evolves from a somewhat limited condition to a clearly non-trivial necessity in later years, with cases with this outcome concentrated within the set defined by this status. In other words, educational status serves as a structural constraint on the outcome across the entire period, and it is substantively relevant as a necessary condition that becomes stronger over time.

The other condition, residential status, is also consistently necessary across years, with consistency levels of 0.94-0.98 and coverage ranging from 0.61 to 0.68. Nevertheless, unlike educational status, the RoN for this condition remains relatively low. It even decreases slightly over the period, ranging from 0.37 to 0.52, indicating that residential status is widespread across all neighbourhoods, not only among those with higher outcome membership (i.e., but also those farther from the ideal type and therefore facing stronger social constraints).

Other conditions behave differently. For instance, the non-migrant status is clearly time-bound. Between 1993 and 2006, it consistently satisfied the necessity criterion, with consistency values around 0.90-0.94 and coverage around 0.60-0.66. During the same period, the necessity value is moderate, ranging from 0.38 to 0.48, suggesting that non-migrant status remains the dominant factor in the data, though not as much as educational status. However, after 2006, consistency falls below the established threshold and stays there for the rest of the years analysed. These temporal profiles indicate that non-migrant status serves as a temporary condition in the early stages of the data, before becoming less relevant as a necessity in later decades. Substantively, this points to a reconfiguration of the background composition of neighbourhoods over time: what was once a near-universal prerequisite for the outcome ceases to be strongly required as the city's demography changes.

The remaining conditions, the economic and occupational statuses, do not function as enduring structural necessities but become necessary only in specific episodes. For example, the economic status reached the necessity thresholds in five years (1994, 2002–2004, 2006), with consistency around 0.91

and 0.93 and comparatively high RoN (0.76–0.82), combined with high coverage (about 0.80–0.85). When this condition becomes necessary, it captures a large share of the highest outcome cases and plays a significant role. However, in recent years, its consistency has declined substantially, and it no longer influences the outcome. Moreover, occupational status shows a similar pattern, with only four years above the established threshold (2002, 2021–2023). In those years, consistency lies between 0.90 and 0.96, coverage is around 0.66 and 0.70, and RoN is between 0.51 and 0.62, which again shows an important condition regarding necessity, but only within a specific temporal context rather than a stable precondition.

In conclusion, the results show that the outcome can occur under different background conditions, since no condition remains required stably and substantively across the whole period. Therefore, no single condition is always necessary for outcomes to reach higher levels of the outcome (i.e., being more distant from the ideal type), and this pattern does not hold over time.

While educational status and residential status are formally necessary in all years, only educational status becomes a clearly substantive necessary condition. In contrast, residential status remains close to a structural constant, adding little explanatory power. On the one hand, non-migrant status is necessary for the early stages of the period, and economic and occupational status appear as episodic necessities associated with particular configurations of neighbourhood status rather than as long-term mechanisms.

For these reasons, I treat the necessity results primarily as a defining basis within which the outcome can happen, rather than as evidence of the causal mechanisms in the complete development. The substantive interpretation of how combinations of all statuses are linked to the outcome is deferred until the sufficiency analysis and the longitudinal comparison of configurations in the following sections.

10.2. Sufficiency analysis (per year)

As explained, for every event, a truth table was constructed using all logically possible combinations of the states observed in the data.

A frequency cutoff of $n\text{-cut}=1$ was implemented to ensure that only configurations with at least one empirical instance were considered in the minimisation process. The sufficient inclusion threshold was set at 0.80, indicating that configurations were retained only when their consistency suggested they nearly always led to the outcome.

Additionally, counterfactual assumptions did not simplify logical reminders, and the analysis therefore relied on complex solutions that preserve the observed configuration and avoid imposing additional theoretical expectations already accounted for during the calibration process.

For each year, the results include one or more sufficient configurations that satisfy the consistency threshold. As a result, a summary was created using three metrics: overall consistency, which reflects how well the solutions correspond to the subset relations; and overall coverage, which measures the share of the outcome that can be exclusively assigned to a specific configuration. The degree of causal overlap between configurations is assessed using the PRI (Proportional reduction in Inconsistency), which distinguishes genuinely sufficient patterns from those that also lead to the outcome being absent.

Across years, the number of sufficient configurations varies, and no single combination has appeared in all annual solutions. The solution for each year comprised one or more adequate configurations, usually exhibiting negated and current conditions, such as $\sim v_1 * v_2 * \sim v_3 * \sim v_5$ or $\sim v_2 * \sim v_3 * v_4 * v_5$.

Overall, their consistency values remained elevated (≥ 0.90). In contrast, the coverage fluctuated significantly over time, indicating differences in the extent to which the outcome could be explained across intervals—the analysis centred on the trends suggested by the arrangements rather than on

specific instances. Every configuration illustrates a potential route by which neighbourhoods achieve the outcome, without asserting that all cases follow the same pattern.

Finally, this per-year sufficiency strategy allows for the identification of changing causal patterns over time without assuming temporal stability. Following this, a detailed report of annual results, including the specific configurations, their consistency and coverage levels, and shifts in the number of pathways, is presented.

10.3. Annual fsQCA results (1993-2023)

To understand this section, it is relevant to clarify some concepts. The symbol "~" denotes the absence (or negation) of the condition, whereas the symbol "*" means the logical conjunction (AND) of conditions within a configuration. For example, an expression such as "~v2*v4*v5" indicates the simultaneous absence of v2 and the presence of v4 and v5. The tokens v1 to v5 refer respectively to economic status (v1), educational status (v2), residential status (v3), non-migrant status (v4), and occupational status (v5).

10.3.1. Descriptive overview

The annual fsQCA identifies between two and eight minimally sufficient configurations each year, indicating that the outcome can be reached through multiple pathways rather than a single causal pathway. On one hand, across all years, solution consistency remains high (typically 0.90-1.00), confirming that the identified configuration reliably forms subsets of the outcome. On the other hand, solution coverage shows greater variation: while some yearly solutions account for more than 80% of the outcome cases, others account for 55-60%, suggesting fluctuating levels of explanatory concentration over time. However, no configuration appears in every annual solution, and the solution structure changes from one period to the next, reflecting shifts in combinations of conditions (i.e., statuses) linked to the outcome rather than stability around a single dominant causal route.

10.3.2. Year-to-year patterns

Two general patterns emerge from the annual comparison. Firstly, some elements repeat more often across years than the complete configurations themselves. For instance, negated forms of educational status and residential status appear in many solutions, indicating that these conditions are often part of the pathways leading to the outcome. However, these repeated elements do not combine into the same configurations across years, meaning that there is no fixed recipe, but rather a shifting recombinant of similar components. In other words, the pathways are made up of similar pieces that are rearranged over time.

Secondly, the number of configurations and the extent to which they explain the outcome fluctuate rather than following a linear trend. So, they change year to year. In some periods, higher coverage tends to coincide with fewer, more encompassing pathways. In contrast, years with lower coverage exhibit greater causal diversification, with multiple configurations accounting for smaller shares of the outcome. This pattern implies that the outcome becomes easier or harder to account for at different periods, not because consistency declines, but because the range of possible pathways either narrows or expands over time.

10.4. Longitudinal fsQCA

10.4.1. Periodisation logic

To capture temporal structure beyond year-by-year changes, the annual fsQCA solutions were grouped into 19 periods. The periods are defined by similarity in the solution formula, not by arbitrary time

blocks; they express consecutive years assigned to the same period when they share the same or highly similar disjunctive combination of configurations, and a new period begins when the configuration pattern changes in the following year.

In practice, this means that the period boundaries occur at the same time as tuning points where at least one of the following situations happens: either a configuration disappears from the solutions, a new configuration appears or the internal structure of a configuration changes (e.g. from $\sim v3^* \sim v5$ to $\sim v3^* v5$, or from exclusively negated conditions to mixtures of presence and absence).

This resulted in 19 periods, ranging from single-year phases to multi-year stretches: for example, period 1 spans 1993 to 1997, and period 16 spans 2015 to 2018. This approach ensures that the periodisation process accurately reflects changes in the causal pathways towards the outcome, rather than relying on infrequent temporal cutoffs.

10.4.2. Period descriptions

Although there are 19 different periods, they can be read as a sequence of three broader waves, each with its own dominant configuration logic. Within each period, the first- and last-year mark tuning points where the configuration pattern either stabilises within the period or shifts into the next one.

10.4.2.1. Early phase: periods 1 to 8 (1993 – 2006)

Period 1 (1993-1997) is featured by a solution with two main pathways, typically of the form:

$$\sim v1^* \sim v2^* \sim v3^* \sim v5 \mid \sim v2^* \sim v3^* v4^* v5$$

The first configuration combines the joint absence of economic, educational, residential and occupational status. In contrast, the second configuration builds on the absence of the educational and residential status, combined with the presence of non-migrant and occupational status. This pattern is a five-year table, meaning that 1993 and 1997 are the turning points that delineate the first period.

Periods 2 and 3 (1998-2001) retain the same basic logic but introduce a few variations. In some years, all five conditions appear in their negated form in one path (e.g. $\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5$), while alternative paths still centre on $\sim v2^* \sim v3$ with $v4^* v5$ present, or include an additional disjunction involving $\sim v1^* \sim v2^* v4^* v5$. These short periods (often lasting one or two years) reflect micro-adjustments around the same elemental idea: sufficiency based on a block of negated conditions and a compensatory path involving non-migrant and occupational statuses.

In the years 2002 and 2006, periods 5 to 8 appeared. Those continue these paths of solutions, but with greater internal complexity. New paths appear that combine $\sim v3$ with $v4^* v5$ or switch the presence of $v4$ (non-migrant status) and $v5$ (occupational status) while suggesting that the underlying configuration group remains the same. However, its specific expression is unstable from year to year. The turning points between periods thus mark suitable reorganisations in how non-Swedish nets and occupational status enter the solutions, rather than wholesale shifts in the logic of sufficiency.

10.4.2.2. Transitional phase: periods 9 to 14 (2007 – 2012)

From period 9 onward (2007-2012), there is a visible shift. One configuration still involves a block of negated conditions (for example $\sim v1^* \sim v2^* \sim v3^* \sim v4$ or variants), but additional paths now systemically introduce $v4^* v5$ and sometimes $v1$ (economic status) in its present form. The meaningful solutions for periods from 9 to 14 are diverse:

$$\sim v1^* \sim v2^* \sim v3^* \sim v4 \mid \sim v2^* v4^* v5 \mid v1^* \sim v3^* v4^* v5$$

or

$$\sim v1 * \sim v2 * \sim v3 \mid \sim v2 * v4 * v5 \mid \sim v3 * v4 * v5.$$

Across these periods, the dominant structure is a three-path solution: one configuration that retains the "all-or almost all-negated" pattern, a second path built on $\sim v2$ with $v4 * v5$, and a third path built on $\sim v3$ with $v4 * v5$.

In this transitional phase, non-migrant status and occupational status, both in their present form, become increasingly central as compensatory or alternative pathways to the outcome. At the same time, the entirely negated configuration gradually loses exclusivity. Each of the periods, from 9 to 14, is again short (mostly one year), but together they form a transitional bloc in which the solution oscillates between more and less pronounced versions of this three-path structure. The turning point between them marks changes in how strongly economic status appears in positive form and how tightly the $\sim v2 * v4 * v5$ and $\sim v3 * v4 * v5$ paths are embedded in the solution.

10.4.2.3. Late phase: periods from 15 to 19 (2013 – 2023)

Period 15 occurs in 2013 and 2014, when the solutions are more stable than in the previous year. Although the solutions contain four configurations, they share the same underlying structure: one combination based on multiple absent solutions ($\sim v1 * \sim v2 * \sim v3 * \sim v4$), combined with additional pathways that link either $\sim v2$ (negation of educational status) or $\sim v3$ (negation of residential status) with the presence of $v4 * v5$, i.e., non-Swedish status and occupational status. During this period, positive economic status also begins to appear in some paths, indicating that mixed combinations of absent and present conditions can now lead to the outcome.

Period 16 (2015 to 2018) is one of the longest in the series, and it is featured by a stable family of solutions in which the core elements remain $\sim v1 * \sim v2 * \sim v3 * \sim v4$ and the twin paths $\sim v2 * v4 * v5$ and $\sim v3 * v4 * v5$, and additional disjunctions involving economic status and occupational status. The repetition of these elements across four consecutive years suggests a phase of consolidation: although the solution is complex, its internal logic does not change substantially. In other words, the causal mechanism presents a complex structure but does not change dramatically year to year.

In the last period, from 17 to 19 (2019 – 2023), the role of occupational statuses has become even more central. Representative solutions feature configurations such as $\sim v1 * \sim v2 * \sim v3 * v5 \mid \sim v1 * \sim v2 * v4 * v5 \mid \sim v3 * v4 * v5 \mid \dots$. That is, sufficiency paths where occupational status is present rather than negated, combined with continued emphasis on $\sim v1$ (economic status) $* \sim v2$ (educational status) $* \sim v3$ (residential status) and $v4$ (non-migrant status) $* v5$ (occupational status). Thus, the final periods mark a reorientation of the solution space, in which the outcome is linked less to an "all-negative" bloc and more to combinations that systematically include occupational statuses and, in some paths, positive economic status. The last unit point (in 2023) reflects this final variant of the configuration logic.

In conclusion, the last five periods show not a reduction in complexity, but a change in how sufficiency is organised: from early reliance on configuration dominated by multiple absences to later periods, where mixed, more diverse combinations lead to the outcome. Overall, these 19 periods document a gradual shift from a simple, strongly "all-negated" pattern (especially in the early 1990s) to more diversified, mixed-status pathways in the 2010s and early 2020s.

10.4.3. Comparison across periods

Across periods, the longitudinal analysis shows that the causal mechanisms underlying the outcome, i.e., the distance to the ideal type, are neither fully stable nor completely random. Variability towards the outcome is present throughout, but its form changes. In the early periods, sufficiency is predominantly organised around a small number of configurations in which multiple conditions are

simultaneously absent (e.g., $\sim v1 * \sim v2 * \sim v3 * \sim v5$), supplemented by a single alternative path with $v4$ (non-migrant status) and $v5$ (occupational status). This produces a relatively homogeneous pattern: most pathways to the outcome resemble each other and bundle similar absences.

From the mid-2000s onwards, paths such as $\sim v2 * v4 * v5$ and $\sim v3 * v4 * v5$ emerge and consolidate, signalling a structural reorganisation: instead of being tied mainly to blocks of negated conditions, the result increasingly manifests through hybrid blends of presence and absence throughout $v1$ - $v5$. In later periods, the coexistence of: (1) pathways characterised by numerous absences, and (2) pathways with positive $v4$ -non-migrant status- and $v5$ -occupational status- (and occasionally $v1$ -economic status-), indicates a type of causal diversification or polarisation: the same result may be achieved through "low-status-like" combinations (multiple denied conditions) as well as from more diverse or favourable profiles (presence of non-migrant and occupational status).

In this sense, Malmö's trajectory over the three decades is best described as one of structural reconfiguration rather than linear convergence. The longitudinal fsQCA does not reveal a single stable mechanism that becomes stronger or weaker, but rather a sequence of recomposed causal mechanisms, within which the relative weight and role of all five statuses change over time. The periods mark phases in which bundles of conditions dominate the pathways to the outcome, and the transitions between them can be interpreted as moments when the status combinations underlying the outcome are reconfigured rather than intensified or diminished.

11. Analysis

The analytical framework is organised around three analytical layers. The first concerns macro-level structures: the cultural norms, institutional mechanisms, and economic arrangements that shape patterned social behaviour. The second focuses on meso-level mechanisms through which class advantages and disadvantages are reproduced, emphasising the role of Wealth, different forms of capital, and embeddedness in networks and institutions. The third level connects the structural and meso-level mechanisms to the concrete causal conditions -empirical indicators- used in this study. Specifically, the five QCA conditions—economic status, educational status, labour-market status, migration status, and residential status—are interpreted as the material manifestations of deeper theoretical mechanisms.

This multi-level approach is analytically necessary for two reasons. First, Scandinavian welfare states—including Sweden—feature powerful institutional mediation in the allocation of life chances, making the context itself a causal mechanism. Second, Malmö has experienced substantial demographic, economic, and spatial transformations over the period analysed (1993–2023), resulting in spatially uneven shifts in socioeconomic status. Understanding these changes requires a theoretically grounded model that links macro-level structures, meso-level mechanisms, and neighbourhood-level outcomes.

The analysis demonstrates that configurations of causal conditions influencing social class reconfiguration differ across social contexts. Causal conditions shape access to resources, specifically various forms of capital, resulting in unequal power distribution. The findings support the view that no single causal condition accounts for the emergence of this uneven distribution. Instead, the pathways through which neighbourhoods attain higher levels of outcome membership in the ideal type are contingent on contextual factors.

11.1. *Macro-level analysis*

In Malmö, the interplay between capitalism and planning is evident in large-scale development projects, infrastructure investments, and policy frameworks that actively shape the city's spatial and social structure. Planning operates not only as a tool of urban management but also as a mechanism that

enables capital accumulation and spatial restructuring in line with market priorities. Urban space is therefore not a neutral container of social life, but a politically and economically produced landscape.

Neoliberal planning is not a uniform or monolithic process; its implementation is deeply context-dependent, producing variegated forms across different institutional and national settings (Brenner and Theodore 2002; Peck and Tickell 2002, as cited in Rodenstedt, 2014, p. 63). In the case of Malmö, the concept of the “knowledge city” captures the recodification of the old industrial city, reflecting a hybrid configuration in which neoliberal market logics coexist with a lingering social democratic planning heritage (Baeten & Christophers, 2012; 2013, as cited in Rodenstedt, 2014, p. 63). This hybridity does not neutralise neoliberalisation; instead, it reshapes it through local institutional arrangements.

This also shows that institutions behave as active mechanisms for class design, institutions design legitimate life paths and regulate access to resources. Therefore, class reconfiguration in Malmö is not only shaped by markets and capital flows, but is actively produced through institutional design and policy frameworks as it is reflected in the concept of “neoliberal planning” or “social neoliberalism” (Baeten, 2012; Jönsson & Baeten, 2024; Pries, 2020), and administrative logics that distribute advantage and constraint unevenly across space.

Holgersen similarly argues that Malmö and Sweden are not fully deindustrialised, noting the persistence of industrial activities alongside post-industrial restructuring (Holgersen, 2014, pp. 52–53). At the same time, he emphasises that the scale of economic transformation justifies conceptualising Malmö as a post-industrial city. This transition has reoriented the city’s economic base, labour market structure, and spatial organisation, with significant implications for class formation.

In stratified societies, social structure is not merely an abstract arrangement of roles and institutions; it is fundamentally tied to the distribution of power and resources. In Malmö, the uneven allocation of economic, cultural, and spatial resources is central to processes of class reconfiguration. These structural arrangements shape individuals’ capacities to accumulate wealth, access education, secure stable employment, and obtain housing. As a result, class positions are increasingly mediated through institutional access and spatial location rather than solely through occupational status.

Here, power is not just a simple resource it is the capacity that enables in individuals to impose their interests. The spatial configurations reflected in the next section, shows that uneven distributions of power, whereby certain neighbourhoods possess the structural capacity to attract investment, influence planning priorities, and secure institutional support, while others remain positioned as passive recipients of policy and market decisions. This can be shown in the intentional predisposition of Malmö Stad to attract a new type of residents, facilitating their arrival and promoting their lifestyle (Baeten, 2012, p. 39).

Cultural norms and institutional logics reinforce this macro-structural configuration. Drawing on Merton’s framework, Swedish society exhibits strong tendencies toward ritualism, whereby individuals internalise institutional norms even as the underlying cultural goals of equality and security become harder to attain (Merton, 1996, pp. 146–147). An example of this is the common cultural concept “Jante Lagen” (Cappelen & Dahlberg, 2018), in which the idea is to promote modesty, discouraging individuals success and boasting collectivist values over the individuality. Clearly, this underscores institutions as shapers of norms, values and legitimacy. Translating this to Malmö context, institutional arrangements not only distribute resources, but also define the norms of legitimacy and success, shaping which social class are socially recognised and which are devalued.

The welfare state has historically regulated access to rights, income security, education, and housing, establishing institutions as the legitimate channels for pursuing well-being. This has produced a normative emphasis on institutional compliance and social order, contributing to the muted and often depoliticised expression of social conflict. In this context, inequalities are not necessarily contested, but

normalised and reproduced through everyday practices embedded in institutional and spatial arrangements.

In conclusions, this analysis also brings to the light that the initial claim about wealth as a main causal mechanism behind class reconfiguration in Malmö is partially true. As it will be exposed in the later section, wealth plays a key role in the asset-based economy, but it is not the only causal mechanism. In this context, institutional choices in terms of policy frameworks, normative regulation in terms of legitimisation of success pathways and spatial power are also key determinants in terms of restructuring of social classes.

11.2. Explanatory mechanisms

It is important to note that the findings of this research do not intend to compare neighbourhoods in Malmö, to identify differences in their demographic and social features, but rather to identify the explanatory mechanisms that make them distant towards the ideal type -the highest class possible-. Additionally, the explanatory mechanisms presented below are status sequences, meaning that different combinations of statuses drive the reconfiguration of social classes in Malmö.

The embeddedness of causal condition configurations within social context is evident in the fact that certain conditions recur more frequently across solutions than do complete configurations. This pattern corresponds with Merton's concept of the status set, defined as a complex and dynamic collection of social positions within the broader social structure (Merton, 1968, p. 434).

The sufficiency analysis indicates that no single combination of statuses serves as a universal pathway across all periods. Thus, analytical relevance lies not in fixed configurations but in the composition of statuses. The roles of specific causal conditions are conceptualised as statuses that position individuals and neighbourhoods within the social structure.

The following analysis focuses on status-sets as the configurations that structure social class. But at this point, it is equally important to acknowledge that the sets are embedded in status sequences and the process of adaptation over time. Following the Mertonian framework, individuals and neighbourhoods do not just embody static combinations of statuses; they move through ordered sequences of positions shaped by institutional constraints and opportunities.

As will be seen in the later phase, access to education, stable employment, or homeownership is structurally limited; these sequences are truncated, producing patterns of blocked mobility in which transitions to higher-status positions are systematically impeded. Such blockages generate role conflict, as individuals are required to reconcile improbable expectations -for instance, having labour-market stability without access to housing stability, or having high educational credentials without corresponding in the occupational position.

Moreover, this instability has been normalised by institutions, individuals, and markets. These tensions are not simply personal but structurally induced, reflecting the unequal distribution of power across institutions, markets, and spatial context. From this perspective, power also refers to the capacity of institutions and dominant groups to shape the rules governing status transitions, thereby determining whose adaptations are rewarded and which are neutralised. In Malmö, this helps explain why certain configurations persist across periods: status sequences are driven by housing markets, educational systems, and labour-market structures in ways that stabilise advantage for some groups while locking others into enduring trajectories of disadvantage.

11.2.1. Early phase: periods 1 to 8 (1993 – 2006)

In this early phase, the combination of the driving forces behind education and housing is the primary explanatory mechanism that increases distance, thereby disadvantaging neighbourhoods toward the ideal type and, accordingly, toward the highest social class possible in the city of Malmö. This indicates that in the early 1990s, low tertiary education attainment and weak housing ownership were central constraints shaping neighbourhood disadvantage, regardless of the presence or absence of other statuses.

Here, educational credentials and homeownership serve not only as material resources but also as markers of legitimacy and social recognition. On the one hand, educational status reflects the institutionalisation of education and thus the materialisation of cultural capital, in line with Bourdieu's theoretical framework (1986, p. 18). On the other hand, in this context, homeownership functions as symbolic capital, conferring legitimacy, stability, and social recognition within neighbourhood hierarchies, beyond its direct economic value. Thus, cultural and symbolic capital are the main drivers for the class reconfiguration during this first period.

As shown in the results, in this early phase, two main sufficient solutions. The first configuration represents a pattern of cumulative disadvantage, in which low economic, educational, residential, and occupational status coincide. This pathway reflects neighbourhoods where multiple forms of deprivation overlap, resulting in a substantial distance from the ideal type due to the simultaneous absence of key resources.

In this context, occupational positioning and non-migrant status were insufficient to compensate for deficits in education and residence status. This is reflected in the second solution, in which the absence of educational and residential status does not balance the distance towards the ideal type, even accounting for the presence of non-migrant (v4) and occupational status (v5). In other words, this configuration indicates that the presence of occupational and non-migrant statuses is insufficient to outweigh the disadvantages associated with educational and residential statuses.

On one hand, non-migrant status can be interpreted as a proxy for differential access to dominant social networks and institutional embeddedness, representing social capital. On the other hand, occupational status reflects access to economic capital through income acquisition through labour market attachment. Consequently, rather than functioning as compensatory mechanisms, social and economic capital operate within constraints imposed by deficits in cultural and symbolic capital. Therefore, certain forms of social integration are insufficient to offset deficits in education and housing.

This interpretation aligns with existing evidence from the early 1990s in Malmö, a period marked by economic crisis, industrial restructuring, and rising unemployment. In line with one of the research's claims, labour-market participation and occupational attachment did not uniformly translate into stable class positions during this phase, particularly when combined with educational disadvantages and increasing residential segregation. Consequently, even neighbourhoods displaying some elements of labour-market stability could still experience persistent disadvantages.

Additionally, the privatisation of the land and the consequences of this in terms of housing inequalities (Baeten, 2012, pp. 23-37), and also the transformation of the welfare, as reflected in the role of the education status (since education is one of the significant matters of the Swedish welfare system), shows that the exclusion in the solution formulas of education and residential status leads to considerable distance towards the ideal type. Moreover, occupation and demographic factors appear as secondary elements, relevant but not fundamentally altering the pathways leading to neighbourhood disadvantage during this phase.

One of the most repeated conditions across solutions is the absence of educational status. Indicating the relevant role of this condition, and by extension the cultural capital in shaping distance from the ideal

type, since the condition is strictly linked to the regulation of education in the form of credentials (Bourdieu, 1986, p. 18). The repetition of $\sim v2$ across solutions indicates that low educational attainment constitutes a key structural constraint, regardless of the specific combinations of other statuses.

With these results, one can also exemplify why economic capital is insufficient for analysing and, consequently, comprehending social classes; it is not just about income and its acquisition; it is also about power and the reproduction of advantage. Although income plays a role in some pathways, disadvantage is not reducible to economic resources; instead, it is also mediated by forms of power and the durable reproduction of inequality associated with cultural and occupational positions.

Taken together, the configurations observed in this phase suggest that, during the early part of the researched period, class reconfiguration in Malmö was shaped by multiple pathways to disadvantage, whether through cumulative deprivation or through integration that failed to compensate for structural deficits in education and housing. This pattern reflects a context in which the thresholds for avoiding disadvantage were relatively high, and the absence of key structural resources played a decisive role in shaping neighbourhood outcomes.

11.2.2. Transitional phase: periods 9 to 14 (2007 – 2012)

This phase happened during the Great Financial Crisis (Jacobs et al., 2024, p. 962), and it is particularly interesting that within the context analysed, this is a transitional phase because the explanatory mechanism also includes educational and housing as driving forces (the same factors from the previous phase remain relevant), and additionally, economic status plays a context-dependent role. However, unlike the earlier phase, in which educational and housing together structured most pathways, this transitional phase is characterised by a loosening of that coupling and the emergence of alternative sufficient routes.

Moreover, within this transitional phase, an internal sequencing can be observed: in the early crisis years (2007-2008), configurations are characterised by status-sequences variation across economic, educational and residential status, whereas in the later years (2009-2012) stabilisation increases around a limited set based on education and housing.

In this phase, the status set of cumulative disadvantages persists. This solution addresses factors such as low economic and educational status and residential challenges. In some cases, non-migrant and occupational status are also absent. This configuration reproduces pathways observed in pre-crisis periods, pointing to the persistence of deeply entrenched forms of disadvantage.

In the early stages of this phase, the context-dependent role of economic capital is characterised. This means that economic advantage does not serve as a universally protective factor; rather, its effects depend on residential ownership and educational credentials. In particular, it demonstrates that even high economic status may fail to offset disadvantage when combined with housing precarity.

Moreover, there is a crisis-induced reconfiguration of class dynamics, in which housing continues as a critical driver of the distance to the ideal type. Additionally, while non-migrant and occupational status appear as alternative sufficient paths in this phase, their compensatory capacity remains partial and conditional, constrained by housing and educational deficits. Rather than producing a single dominant pathway, the crisis period appears to intensify configurational diversity, revealing multiple, context-dependent routes to disadvantage.

Here it is important to note that the Hyllie project just started in 2007, so during this phase. This project aimed to recall a new class of residents, excluding common residents and non-professional profiles (Baeten, 2012, pp. 26-28). Having this ambitious project clearly impacted the class reconfiguration of the city's neighbourhoods (Baeten, 2012, pp. 26-28). It is essential to recall the idea of symbolic capital

behind the residential status, because the social recognition of the neighbourhoods is not just about a shared image of them, but also the ability to contain and reproduce power through wealth.

The use of high-profile architects and international architectural competitions, the allocation of land to major developers without broader public consultation, the marketing of newly constructed districts at prominent construction fairs, and the overarching ambition to build a new city for new people were first pioneered in Western Harbour and continued in Hyllie and continued by the Hyllie project.

This clearly exemplifies the social capital power, i.e., the recognition of inhabitants by what they embodied (their professions and wealth). In this sense, it is possible to observe how Malmö has changed over time, especially with the interventions of the Hyllye project, in which the old industrial city has been oriented towards a new kind of entrepreneurial population, leaving behind the people of Malmö in favour of new types of inhabitants.

Accordingly, the housing-led pathway has become increasingly relevant during this phase. Therefore, the absence of residential status, even when combined with the presence of non-migrant and occupational statuses, remains sufficient to produce distance from the ideal type, thereby reinforcing the interpretation of housing as a dominant structural constraint. For instance, housing emerges earlier and more consistently as an autonomous pathway than education. This suggests that symbolic capital operates as the primary constraint through which other forms of capital are filtered during this phase.

However, the increasing independence of both housing and education is reflected in the emergence of distinct sufficient pathways, each centred on educational and residential absence, rather than a single cumulative configuration. In parallel, economic status does not appear to be a defining condition across configurations, suggesting that disadvantage is increasingly shaped by deficits in cultural and symbolic capital rather than by income alone. In this sense, the asset-based class appears as a contextual factor in explaining social class stratification in a city like Malmö (Adkins et al., 2022).

Finally, in the late stages of this phase, a clear dualization of the disadvantages becomes apparent. Extreme cumulative deprivation coexists with more selective pathways centred on education or housing, suggesting that inequality in this period is reproduced through both deep structural exclusion and through the increasing autonomy of specific forms of capital.

11.2.3. Late phase: periods from 15 to 19 (2013 – 2023)

In this post-crisis context, multiple, qualitatively distinct solutions towards the ideal type coexist, indicating that inequality is no longer driven by a single dominant mechanism but instead produced through a complex interplay of cumulative deprivation, housing and education-centred constraints, and the increasingly conditional effects of economic advantage.

The late phase is not internally homogeneous. For instance, period 15 marks the normalisation of diversified pathways and the conditional re-entry of economic advantage; period 16 represents a peak of hyper equifinality and full configurational diversification; and periods 17 to 19 represent partial re-consolidation through the repetition and reduction of a limited set of sufficient pathways.

The configurational diversity also includes cumulative disadvantage across all these late periods. In periods 15 to 17, this pattern combines low economic (~v1), educational (~v2), and residential (~v3) and non-migrant (~v4). This pattern resembles earlier configurations showing persistence of deep structural constraints.

Although in a slightly less extreme form than those including all five absent conditions. In periods 18 to 19, the cumulative disadvantage patterns change non-migrant status to occupational status (v5), indicating that labour market attachment alone does not offset disadvantages rooted in income,

education, and housing, reinforcing the limited compensatory role of occupational status in the contemporary period.

In the initial stage of this phase, the selective pathways are centred on education and housing. The absence of educational or residential status is sufficient to generate distance from the ideal type despite the presence of non-migrant and occupational status. These pathways confirm the continued autonomy of cultural and symbolic capital as a structuring dimension of inequality.

Another recurring feature from previous phases is the conditional and context-dependent role of economic capital, which, rather than operating as a universally protective resource, appears embedded in broader configurations that can still generate disadvantage, possibly reflecting pressures associated with housing markets, spatial segregation, or asset-based inequalities.

This pattern consists of an asset-based class structure in which employment no longer guarantees security or advantage. At the same time, housing ownership increasingly mediates the conversion of other forms of capital. This finding strongly resonates with Adkins et al.'s theorisation about the asset economy (Adkins et al., 2022, p. 15).

Additionally, in period 16, a wide range of selective and mixed pathways continues to emerge. Some configurations combine low economic or educational status with occupational and non-migrant status. In contrast, others show that even high economic and educational status ($v1*v2$) or high economic and residential status ($v1*v3$) can coexist with disadvantage when embedded in particular contextual configurations. These latter further underscore the conditional and non-protective role of some advantage in the contemporary period. Moreover, as Merton (1968, p. 434) notes, a status set is a complex configuration and is not necessarily morally coherent.

The contrasting pathway in which high economic and educational status, together with non-migrant and occupational status, lead to distance from the ideal type persists in periods 17 and 18. This pattern demonstrates that even strong enforcement of economic and cultural capital does not universally protect against disadvantage when a neighbourhood is embedded in constrained residential and spatial contexts. Rather than favouring upward class mobility, these configurations reveal the limits of advantage in housing-centred, spatially stratified contexts.

The repeated sufficiency of configurations combining high economic and educational status with occupation and non-migrant status indicates a failed re-stabilisation of economic advantage. Instead of restoring a hierarchical class structure in which economic resources secure proximity to the ideal type, those remain unable to compensate; thus, economic capital cannot compensate for housing inequalities, underscoring the centrality of housing as an obstacle mechanism through which other forms of capital are filtered.

Moreover, the increasing presence of occupational status in late-period configurations suggests a reorganisation of disadvantage around labour-market attachment in a context of widespread employment but persistent housing and educational inequalities. Thus, occupational status increasingly serves as a weak anchor rather than a compensatory resource, highlighting labour-market attachment without guaranteeing class stability or protection from neighbourhood disadvantage.

A plausible explanation lies in the spatial and relational dimensions captured by theories of embeddedness. Following Bourdieu (1986, p. 18) and Portes -drawing on Granovetter's theory- (2010, p. 68), economic behaviour and resource mobilisation are embedded in social networks and institutional contexts. Therefore, neighbourhoods do not merely reflect individuals' resources; they actively influence educational trajectories, labour-market stabilisation and access to the "good" social network. In this sense, residential context mediates the convertibility of economic and cultural capital, helping to explain why advantage fails to translate into prosperity for the ideal type in this late phase in Malmö.

Housing-led pathways, in which the absence of residential ownership is sufficient to generate distance from the ideal type even when non-migrant and occupational status are present, are repeated in periods 17, 18, and 19. This recurrent configuration confirms the continued autonomy of housing as a structuring axis of inequality and reinforces its role as a central mechanism within the class structure. Wealth provides a key causal mechanism for understanding these housing-led pathways. Wealth enables individuals and households to reduce their reliance on unstable labour markets, secure housing in desirable, well-equipped areas (Rodenstedt, 2014, pp. 237-238), and accumulate assets over time.

In this sense, wealth operates not only as a material resource but also as a mechanism of class reproduction, facilitating the maintenance and intergenerational transmission of advantage. The persistence of housing-led configurations thus reflects an asset-based class structure in which access to property and residential security mediates the convertibility of other forms of capital and shapes long-term proximity to the ideal type.

The latter stage of this phase also reflects the late stabilisation within fragmentation. Unlike the transitional phase, where configurational diversity reflected crisis-induced volatility, the late phase is characterised by the stabilisation and repetition of a limited set of mixed-status pathways. Inequality is reproduced through a small number of recurrent configurations that combine cumulative deprivation, housing-led constraints, and context-dependent forms of advantage. This pattern suggests the consolidation of a mature, housing-centred and asset-based class structure in which multiple, non-hierarchical pathways to disadvantage coexist.

The configurations present in this phase reveal a growing incoherence in the class structure, understood as the weakening alignment between traditionally coupled statuses such as education, occupation, income, and residential security. These dimensions tended to stabilise one another in previous industrial contexts: educational credentials translated into occupational positions, securing income and enabled access to homeownership, thus producing coherent class trajectories.

However, in the current context of Malmö repeated appearance of configurations in which high economic and educational status coexist with housing disadvantage indicates a disconnects the balancing effect that could have one status to the other in class stratification. This incoherence is not random but structurally produced, reflecting the erosion of institutional linkages that once integrated labour markets, welfare provision, and housing systems. As a result, class positions become internally contradictory, combining elements of advantage and disadvantage in unstable ways.

This pattern points to a process of failed stabilisation of advantage. Despite the presence of strong economic, cultural, and occupational resources in some configurations, these do not consolidate into secure proximity to the ideal type. In this sense, forms of advantage turn into precariousness rather than generate stability on the social class structure. Specifically, the forms of advantage are somehow weaker than housing constraints and spatial exclusion.

In Mertonian terms, this reflects a disruption in the expected relationship between institutionalised means and culturally valued goals: the means (education, employment) no longer reliably deliver the goal (class security and residential stability). From a Bourdieusian perspective, it also points to the limits of capital convertibility, as economic and cultural capital fail to translate into symbolic and spatial capital in constrained housing markets. Stabilisation fails because the institutional channels through which advantage should be consolidated are blocked or distorted.

At a deeper level, these dynamics express a structural contradiction within the contemporary asset-based economy. On the one hand, individuals are increasingly required to secure their life chances through labour-market participation or credential accumulation. On the other hand, access to the key asset that now organises class security, such as housing ownership, is increasingly restricted by price inflation, privatisation, and speculative logics, producing a contradiction between the normative

demand for self-sufficiency and the structural impossibility of achieving security through legitimised routes.

The result is a class structure in which even “successful” trajectories in education and employment have not guaranteed stability. While those without asset ownership face durable disadvantage. In this sense, incoherence, failed stabilisation, and structural contradiction are not anomalies but defining features of Malmö’s contemporary class configuration, revealing a regime in which inequality is reproduced not through clear hierarchies, but through unstable, and internally contradictory pathways.

11.3. Casual conditions

Above, it has been analysed how statuses combine to form the explanatory mechanisms for the class reconfiguration in Malmö. In parallel, these statuses are the causal conditions when considered individually, meaning they are not merely descriptive categories but embody broader institutional transformations, power relations, and normative shifts, i.e., societal changes. Their relevance is not based on their numerical value that they represent but in the structural processes and societal change that they embody. The main findings for each causal condition are presented as follows.

First, educational status emerges as a key structural constraint on outcomes, with its significance increasing over time. This trend is particularly notable in Sweden, where education has historically served as a central pillar of the welfare state (Dalman, 2022, p. 33). As the Swedish welfare system has weakened due to neoliberal planning and privatisations (Baeten, 2012), educational status has become a more influential factor in shaping class configurations.

As collective mechanisms of social protection diminish, individualised credentials such as educational attainment become increasingly crucial in structuring access to advantageous class positions. Education thus functions not as a direct causal trigger, but as an increasingly restrictive structural condition within which class outcomes are determined. Even the welfare system is more weakened over time, the institutional responsibility on education increases since it has been described as a key causal condition for social class differences.

Residential status is also identified as a formally necessary condition throughout the period, though its substantive role differs from that of educational status. Its relevance extends across all neighbourhoods, regardless of their level of outcome membership, including those distant from the ideal type and subject to greater social constraints. This suggests that residential status serves less as a differentiating factor and more as a general structural background condition. Since the early 1990s, successive Swedish governments have dismantled housing policy, leading to increased housing costs and greater exposure to housing-related constraints (Scarpa, 2015, p. 909).

For instance, the privatisation of land was a central component of the housing strategy implemented by the centre-right coalition governing Malmö between 1985 and 1988 (Pries, 2017, as mentioned in Jönsson & Baeten, 2024, p. 6) exemplifies the institutional shift in the view of housing as a social right to another asset. As a result, access to secure housing becomes increasingly dependent on the market flows and the inhabitant’s accumulated wealth.

Thus, residential status structures the spatial conditions under which other forms of capital can be converted, helping to explain why housing emerges as a dominant constraint and why advantage fails to stabilise in its absence. This is a key site of failed stabilisation, where education and income no longer guarantee residential security, producing internally contradictory class positions.

The analysis finds that non-migrant status plays a time-limited role. In the early 1990s, Malmö experienced a substantial influx of refugees from conflict-affected countries, resulting in rapid population growth and demographic change (Baeten, 2012, p. 29). In this context, non-migrant status functioned as a powerful marker of social integration, institutional familiarity, and access to dominant

networks, effectively operating as a proxy for social capital. Its relevance in early configurations reflects that the “Swedishness” was implicitly associated with legitimacy, belonging, and entitlement.

Over time, however, as migration became normalised and embedded in the city’s demographic structure, the relevance of non-migrant status declined. This fading reflects a normative shift: non-migrant status becomes less effective as a structuring boundary for class advantage. Rather than indicating inclusion, non-migrant status loses its distinctiveness as a condition, even though structural inequalities associated with migration persist. This helps explain why non-migration status becomes less relevant as a necessary condition: not because inequalities disappear, but because the symbolic boundary weakens.

Economic and occupational status do not emerge as enduring structural conditions in configurations associated with higher membership in outcomes. Instead, they seldom appear during years marked by temporary stability. Their absence from the core set of necessary conditions indicates that economic and occupational status are not critical components of configurations linked to the most advantaged class positions. Therefore, they no longer function as reliable conditions for class stability.

From a power perspective, this reflects a reconfiguration of the relationship between labour and life chances. In the industrial and welfare-state contexts, stable employment translated into income security, social rights, and access to housing. In the contemporary asset-based regime, however, labour has been politically and institutionally weakened as a source of power.

A possible explanation is that wage income is increasingly insufficient to secure access to housing and to stabilise class position, while asset ownership becomes the primary site of accumulation and protection. Occupational status thus loses its compensatory capacity and becomes a weak anchor rather than a stabilising resource. This power shift helps explain why occupational and economic status fail to re-establish hierarchical order, even when present in configurations of advantage.

In conclusion, these patterns reveal a class structure characterised by incoherence and structural contradiction. Educational credentials, labour-market stability, and income no longer align reliably with residential security and long-term advantage.

12. Conclusions

The most relevant conclusion of this thesis is that class reconfiguration is produced by institutional decisions, normative regulation, and spatial power, not only by markets or capital. This is reflected in the weight of key policy decisions and their implications for the city's social structure. Consequently, this intertwined production of class also shows that wealth is not the sole causal mechanism of class reconfiguration, contradicting the thesis's initial claim. Moreover, this is reflected in the fact that, in the late phase of the study period, reconfigurations show some initial incoherence.

The link between statuses and conditions is the bridge between the micro and macro spheres. Therefore, the definitions presented in this thesis establish the relationship between members of a structure and the social structure in terms of social classes. Many scholars in the sociological field have claimed this link as necessary (Le Grand & Tåhlin, 2013; Merton, 1968; Portes, 2010).

The annual results indicate a system in which multiple pathways to the outcome coexist, but no single stable configuration dominates throughout the period. The persistence of high consistency indicates that whenever a configuration appears, it reliably yields the same outcome. Nevertheless, the absence of recurring complete configurations suggests that the causal framework is fluid rather than fixed in structure. Therefore, what remains stable over time is not the identity of a specific course, but the logic of many different solutions oriented to the outcome, meaning that various combinations of statuses can produce the outcome in different years.

The analysis implies that the outcome is not driven by a single explanatory mechanism but by the context-dependent recomposing of the same underlying conditions. Consequently, the interpretation does not focus on individual yearly solutions but on the broader implication that the outcome can emerge through multiple interchangeable pathways.

However, the key role of residential status reflects the shift towards an asset economy, in which wealth owned by city residents determines their class position. In this thesis, wealth has been conceptualised as the key causal mechanism in the reproduction of social classes, yet it is also the outcome of those classes. Wealth is not just a property that ascribes to individuals within a certain social class. Still, it has also become a reinforcing cycle or a self-perpetuating dynamic that impedes social class mobility.

Here, the key role of neoliberal planning and neoliberal policies is noticeable. The process of weakening public policies towards redistributing wealth is an institutionalised tool that perpetuates a cycle of reinforcing class stratification. Even though this thesis has not examined segregation dynamics in the city, the configurational diversity reflects crisis-induced volatility. Meaning that various forms of set-statuses can generate deprivation, even though some statuses should logically have compensatory mechanisms to promote class stabilisation or class improvements.

The main conclusion of this thesis is that the social class reconfiguration in Malmö comprises different pathways and that status-set solutions depend profoundly on context, but one key remark needs to be made. Neighbourhoods are socially stratified not just by occupational share or educational level, but even more importantly, by what residents own in terms of assets and how those possessions can reproduce their social class.

Moreover, additional research needs to be conducted either in Malmö or in other globalised, post-industrial, and entrepreneurial cities. Firstly, there is a need to research how class reconfiguration is transferred on a societal level in Malmö; this means how class recomposing affects the community and the ties between individuals. This can be carried out by following the main ideas of the status set and status sequences that Merton provided to academia. In this research, only the first idea has been analysed, but further questions regarding the role-set and social-set remain. Also, where are the psychological mechanisms and the individual principles placed in these reconfigurations?

Secondly, this research can be replicated in other cities, but it should examine the specific causal conditions that may vary across cities. One should not assume they are the same, even though they are elementary in the current capitalist context. Additionally, the individualisation process that is examined today needs to be placed within the social class debate, not just as a context, but also as a mechanism for the reconfiguration and reproduction of social classes. Therefore, accordingly, where is the community allocated in all those questions?

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14. Annexes

14.1. Correspondence table GeSO Delområden (Incegül & McShane, 2025, sheet "Grundläggande information")

GeSO, Geografisk områdesindelning		
Område	Benämning	Delområden
1	Västra hamnen, Gamla staden m fl	Davidshall, Frihamnen, Gamla staden, Inre hamnen, Lugnet, Malmöhus, Mellersta hamnen, Norra hamnen, Oljehamnen, Rörsjöstaden, Spillepengen, Västra hamnen, Östra hamnen
2	Kirsebergsstaden, Värnhem m fl	Bulltofta, Ellstorp, Håkanstorp, Johanneslust, Katrinelund, Kirsebergsstaden, Norra Sorgenfri, Rostorp, Sege industriområde, Segemölla, Segevång, Slussen, Valdemarsro, Värnhem, Östervärn
3	Riseberga, Jägersro m fl	Almgården, Elisedal, Fortuna hemgården, Höja, Jägersro, Jägersro villastad, Kvarnby, Riseberga, Stenkällan, Södra Sallerup, Toftanäs, Videdal, Virentofta, Östra Skrävlinge
4	Oxie Kyrkby, Oxievång m fl	Glostorp, Kristineberg, Kungshög, Kåglinge, Lockarp, Oxie kyrkby, Oxievång, Toarp
5	Bunkeflostrand, Tygelsjö by m fl	Bunkeflostrand, Klagshamn, Naffentorp, Skumparp, Tygelsjö by, Tygelsjö vång, Vintrie, Västra Klagstorp
6	Limhamns hamnområde, Elinelund m fl	Annetorp, Djupadal, Elinelund, Gamla Limhamn, Hyllieby, Kalkbrottet, Limhamns hamnområde, Rosenvång, Sibbarp
7	Ribersborg, Bellevue m fl	Bellevue, Fridhem, Fågelbacken, Hästhagen, Kronprinsen, Mellanheden, Nya Bellevue, Ribersborg, Ribersborgsstranden, Rönneholm, Solbacken, Teatern, Västervång
8	Lorensborg, Bellevuegården m fl	Bellevuegården, Dammfri, Kronborg, Lorensborg, Pildammsparken, Stadion, Ärtholmen
9	Möllevången, Rådmansvången m fl	Allmänna sjukhuset, Annelund, Lönngården, Möllevången, Norra Sofielund, Rådmansvången, Sofielund industriområde, Södervärn, Södra Sofielund, Västra Sorgenfri, Östra Sorgenfri
10	Örtagården, Herrgården m fl	Apelgården, Emilstorp, Herrgården, Kryddgården, Persborg, Rosengård centrum, Törnrosen, Västra Kattarp, Örtagården, Östra kyrkogården
11	Nydala, Almhög m fl	Almhög, Augustenborg, Eriksfält, Gullvik, Gullviksborg, Heleneholm, Hermodsdal, Hindby, Nydala
12	Lindängen, Almvik m fl	Almvik, Fosieby, Fosieby industriområde, Fredriksberg, Kastanjegården, Lindängen, Svågertorp
13	Lindeborg, Borgmästaregården m fl	Borgmästaregården, Flensburg, Gröndal, Kulladal, Lindeborg, Södertorp, Västra Söderkulla, Östra Söderkulla
14	Hyllievång, Kroksbäck m fl	Holma, Hyllievång, Kroksbäck, Kroksbäcksparken

14.2. Geospatial (area-weighted) harmonisation (Delområden to GeSO)

14.2.1. Area weighted for each intersected polygon fragment

$$w_{dg} = \frac{\text{Area}(d \cap g)}{\text{Area}(d)}$$

Where:

- d = Delomrade unit
- g = GESO unit
- w_{dg} = weight of fragment

14.2.2. Weighted mediana for proportional variables (v1-v5)

$$x_g = \text{median}_w(X_d, w_{dg})$$

Where:

- $x_{g,t}$ = harmonised value for variable X in GESO g and year t
- $X_{d,t}$ = original value for the variable in Delomrade d and year t
- w_{dg} = weight of fragment calculated previously
- median_w = weighted mediana, defined as the value where the cumulative sum of weights reaches 0.5

14.2.3. Area-weighted allocation for count variables

$$X_g = \sum_{d \in D_g} w_{dg} X_d$$

Where:

- $x_{g,t}$ = harmonised value for variable X in GESO g and year t
- D_g = set of Delomrade intersecting GESO g
- $X_{d,t}$ = value of the count variable in Delomrade d and year t
- w_{dg} = weight of fragment

14.3. Code for cleaning the data

```
#LIBRARIES  
library(dplyr)  
library(ggplot2)  
library(gt)  
library(Hmisc)  
library(purrr)  
library(readr)  
library(sf)  
library(stringr)  
library(tmap)  
library(tidyr)  
library(zoo)  
library(webshot2)
```

```
## 1.Upload dataset 1993-2008
```

```
df_9308 <-  
read_delim("/Users/danielaestefaniagilgamboa/Desktop/malmo_research/datasets/hsc_1993_2007.csv",  
           delim = ",", show_col_types = FALSE)
```

```
###1.1. Review columns
```

```
colnames(df_9308)
```

```
###1.2. To convert a numbers
```

```
cols_to_numeric <- c(  
  "v1_1990", "v2_1990", "v3_1993...7", "v3_1993...8",  
  "v5_1991", "v1_1991", "v2_1993", "v3_1994", "v4_1994",  
  "v5_1992", "v1_1992", "v2_1993_b", "v3_1995", "v4_1995",  
  "v5_1995...19", "v1_1993", "v2_1993_c", "v3_1996", "v4_1996",  
  "v5_1994", "v1_1994", "v1_1995", "v2_1997", "v3_1997",  
  "v4_1997", "v5_1995...30", "v1_1996", "v1_1997", "v2_1999",  
  "v3_1999", "v4_1999", "v5_1996", "v5_1997", "v1_1999",  
  "v2_2000...39", "v3_2001", "v4_2001", "v5_1999", "v5_2005...43",  
  "v2_2007", "v3_2007", "v4_2007", "v5_2005...47", "v1_2006",  
  "v2_2008", "v3_2008", "v4_2008", "v5_2006", "v1_1998",  
  "v2_2000...54", "v3_2000", "v4_2000", "v5_1998", "v1_2000...58",  
  "v_2002", "v3_2002", "v4_2002", "v5_2000", "v1_2000...63",  
  "v2_2003", "v3_2003", "v4_2003", "v5_2001", "v1_2002",  
  "v2_2004", "v3_2004", "v4_2004", "v5_2002",  
  "v1_2003", "v2_2005", "v3_2005", "v4_2005", "v5_2003",  
  "v1_2004", "v2_2006", "v3_2006", "v4_2006", "v5_2004", "v2_1998",  
  "v3_1998", "v4_1998"
```

```
)

df_9308 <- df_9308 %>%
  mutate(across(
    all_of(cols_to_numeric),
    ~ as.numeric(str_replace_all(trimws(.), ",", ".")),
    .names = "{col}"
  ))

###1.2. Rename and delete unnecessary columns
colnames(df_9308)
df_9308 <- df_9308 %>%
  rename(
    v3_1993 = `v3_1993...7`,
    v4_1993 = `v3_1993...8`,
    v5_1993 = `v5_1995...19`,
    v5_1995 = `v5_1995...30`,
    v2_2000 = `v2_2000...54`,
    v1_2000 = `v1_2000...58`,
    v4_2001 = `v4_2001`,
    v1_2005 = `v5_2005...43`,
    v5_2005 = `v5_2005...47`,
    v2_2002 = `v_2002`,
  ) %>%

  select(
    -`v1_1990`, -`v2_1990`,
```

```
-`v5_1991`, -`v5_1992`,  
-`v2_1993_b`, -`v2_1993_c`,  
-`v2_2000...39`, -`v1_2000...63`,  
  
)  
  
###1.3. Set in alphabetic order  
df_9308 <- df_9308 %>%  
  select(sort(names(.)))  
colnames(df_9308)  
  
###1.4. Revert v4  
df_9308 <- df_9308 %>%  
  mutate(across(starts_with("v4_"), ~ 100 - as.numeric(.)))  
  
###2. Intersect Delområden → GESO (clean version), to see if median geospatial ponderate is worth  
it  
  
### 2.1 Load geospatial data  
geso <- st_read("/Users/danielaestefaniagilgamboa/Desktop/malmo_research/gis/geso.gpkg")  
delomr <- st_read("/Users/danielaestefaniagilgamboa/Desktop/malmo_research/gis/delomr_p_4326.gpkg")  
  
### 2.2 Parameters  
sliver_threshold_m2 <- 10  
  
### 2.3 Prepare CRS, validity and attach socio-economic data  
if (st_crs(delomr)$epsg != 3008) delomr <- st_transform(delomr, 3008)  
if (st_crs(geso)$epsg != 3008) geso <- st_transform(geso, 3008)
```

```
delomr <- st_make_valid(delomr)
geso  <- st_make_valid(geso)

### Attach df_9308 attributes
delomr <- delomr %>%
  left_join(df_9308, by = "id")

### 2.4 GEOMETRIC INTERSECTION
inter_p <- st_intersection(delomr, geso)

inter_p <- inter_p %>%
  mutate(area_int_m2 = as.numeric(st_area(wkb_geometry)))

### Compute full delområde areas
delomr <- delomr %>%
  mutate(area_del_m2 = as.numeric(st_area(wkb_geometry)))

inter_p <- inter_p %>%
  left_join(
    delomr %>% st_drop_geometry() %>% select(id, area_del_m2),
    by = "id"
  ) %>%
  mutate(prop_of_del = area_int_m2 / area_del_m2)

### 2.5 QUALITY CHECK OF SLIVERS AND AREAS
```

```
bins <- c(0, 10, 50, 100, 500, 1000, 5000, Inf)

frag_summary <- inter_p %>%
  st_drop_geometry() %>%
  summarise(
    n_fragments = n(),
    total_area_fragments_m2 = sum(area_int_m2, na.rm = TRUE),
    median_m2 = median(area_int_m2, na.rm = TRUE),
    mean_m2 = mean(area_int_m2, na.rm = TRUE),
    min_m2 = min(area_int_m2, na.rm = TRUE),
    max_m2 = max(area_int_m2, na.rm = TRUE)
  )

print(frag_summary)

inter_p2 <- inter_p %>%
  mutate(size_bin = cut(area_int_m2, breaks = bins,
    include.lowest = TRUE, right = FALSE))

size_table <- inter_p2 %>%
  st_drop_geometry() %>%
  group_by(size_bin) %>%
  summarise(
    n = n(),
    area_m2 = sum(area_int_m2, na.rm = TRUE)
  ) %>%
  mutate(pct_of_total_area = 100 * area_m2 / sum(area_m2))
```

```
print(size_table)

### 2.6 REMOVE SLIVERS

inter_clean <- inter_p %>%
  filter(area_int_m2 > sliver_threshold_m2)

### 2.7 Prepare for harmonisation

meta_cols <- c("id", "delomr", "do_kod", "delomradeno_name")

num_cols <- df_9308 %>%
  select(-one_of(meta_cols)) %>%
  select(where(is.numeric)) %>%
  colnames()

weighted_vars <- grep("^[1-5]_\\d+", num_cols, value = TRUE)
count_vars <- setdiff(num_cols, weighted_vars)

inter_attr <- inter_clean %>% st_drop_geometry()

#### 2.8 Weighted median

if (length(weighted_vars) > 0) {

  weighted_res <- inter_attr %>%
    select(geso, benamning, area_int_m2, all_of(weighted_vars)) %>%
    pivot_longer(
      cols = all_of(weighted_vars),
```

```
names_to = "variable",
values_to = "value"
) %>%
filter(!is.na(value)) %>%
group_by(geso, benamning, variable) %>%
arrange(value) %>%
mutate(
  weight = area_int_m2 / sum(area_int_m2),
  cum_weight = cumsum(weight)
) %>%
summarise(
  value = value[which.min(abs(cum_weight - 0.5))],
  .groups = "drop"
)

} else {
  weighted_res <- tibble()
}

### 2.9 Count variables
if (length(count_vars) > 0) {

  count_res <- inter_attr %>%
  select(geso, benamning, prop_of_del, all_of(count_vars)) %>%
  pivot_longer(
    cols = all_of(count_vars),
    names_to = "variable",
```

```
      values_to = "value"
    ) %>%
    mutate(
      value_alloc = value * prop_of_del
    ) %>%
    group_by(geso, benamning, variable) %>%
    summarise(
      value = sum(value_alloc, na.rm = TRUE),
      .groups = "drop"
    )
  } else {
    count_res <- tibble()
  }

### 2.10 Assemble results
all_res <- bind_rows(weighted_res, count_res)

geso_values <- all_res %>%
  pivot_wider(
    names_from = variable,
    values_from = value
  )

### 2.11 Join back to GESO polygons
geso_final <- geso %>%
  left_join(geso_values, by = c("geso", "benamning")) %>%
```

```
mutate(across(where(is.numeric), ~ round(., 2)))

### 2.12 Export

st_write(
  geso_final,

  "/Users/danielaestefaniagilgamboa/Desktop/malmo_research/gis/geso_harmonized_multivariable.g
  pkg"
)

### 2.13 Visualize one variable

tmap_mode("view")
tm_shape(geso_final) +
  tm_polygons(col = "v1_1993", palette = "viridis") +
  tm_borders()

write_csv(geso_final,
  "/Users/danielaestefaniagilgamboa/Desktop/malmo_research/datasets/202511169308_h.csv")

##3. Joint and to do the median deomraden to geso based on malmö's stad document

###3.1. Upload delomrade to geso document

df_dtog
read_delim("/Users/danielaestefaniagilgamboa/Desktop/malmo_research/gis/geso_delomr.csv",
  delim = ";", show_col_types = FALSE)
df_9308_2 <- df_9308 %>%
  left_join(df_dtog, by = "do_kod")
```

```
###3.2. See columns, and delete duplicate columns
```

```
colnames(df_9308_2)
```

```
df_9308_2 <- df_9308_2 %>%
```

```
  rename(
```

```
    do_code = `do_kod`,
```

```
  ) %>%
```

```
  select(
```

```
    -`do_kod.y`,
```

```
  )
```

```
###3.3. Set in alphabetic order
```

```
df_9308_2 <- df_9308_2 %>%
```

```
  select(sort(names(.)))
```

```
colnames(df_9308_2)
```

```
###3.4. Calculate median for variables
```

```
# median without na
```

```
median_safe <- function(x) {
```

```
  x_non_na <- x[!is.na(x)]
```

```
  if (length(x_non_na) == 0) return(NA_real_)
```

```
  median(x_non_na)
```

```
}
```

```
#To calculate the mediana by each area
```

```
median_by_zone <- df_9308_2 %>%
```

```
  group_by(geso_code, geso_name) %>%
```

```
  summarise(across(
```

```
starts_with("v"),
~ median_safe(.x),
.names = "{col}"
),
.groups = "drop")

#To see results
head(median_by_zone)

df_9308_2 %>%
  group_by(geso_code) %>%
  summarise(across(starts_with("v"), ~sum(is.na(.x))))

#Delete the last row
colnames(median_by_zone)
median_by_zone <- median_by_zone %>%
  slice(1:(n() - 1))

###4. To manage 2007-2023 dataset
####4.1. To upload the dataframe 2007-2023
df
read_csv("/Users/danielaestefaniagilgamboa/Desktop/malmo_research/datasets/df_2007_2023.csv"
)
View(df)

####4.2. To comprehend the structure of the dataframe
glimpse(df)
```

```
###4.3. To convert long to wide
```

```
df_wide <- df %>%  
  mutate(variable_year = paste0(variable, "_", year)) %>% # crea noms com "v5_2018"  
  select(geso_code, geso_name, variable_year, value) %>%  
  pivot_wider(  
    names_from = variable_year,  
    values_from = value  
  ) %>%  
  arrange(geso_code)
```

```
###4.4. To save the new dataframe
```

```
write_csv(df_wide,  
"/Users/danielaestefaniagilgamboa/Desktop/malmo_research/datasets/20251116_wide0723.csv")
```

```
##5. To test which measurement suits better the official data 07-93
```

```
###5.1. To include in a new dataset and change names
```

```
df_ms <- df_wide %>%  
  select(  
    geso_code, geso_name,  
    v2_2007_ms = v2_2007,  
    v2_2008_ms = v2_2008,  
    v4_2007_ms = v4_2007,  
    v4_2008_ms = v4_2008  
  )
```

```
df_med <- median by zone %>%
```

```
select(
  geso_code, geso_name,
  v2_2007_med = v2_2007,
  v2_2008_med = v2_2008,
  v4_2007_med = v4_2007,
  v4_2008_med = v4_2008
)

df_h <- geso_final %>%
  mutate(
    geso_code = as.character(benamning)
  ) %>%
  st_drop_geometry() %>%
  select(
    geso_code, benamning,
    v2_2007_h = v2_2007,
    v2_2008_h = v2_2008,
    v4_2007_h = v4_2007,
    v4_2008_h = v4_2008
  ) %>%
  rename(geso_name = benamning)

df_h <- geso_final %>%
  mutate(
    geso_code = as.character(benamning)
  ) %>%
  st_drop_geometry() %>%
```

```
select(  
  geso_code, benamning,  
  v2_2007_h = v2_2007,  
  v2_2008_h = v2_2008,  
  v4_2007_h = v4_2007,  
  v4_2008_h = v4_2008  
) %>%  
  
rename(geso_name = benamning)
```

###5.2. Comparative table

```
df_compare <- df_ms %>%  
  
left_join(df_h, by = c("geso_name")) %>%  
  
left_join(df_med, by = c("geso_name"))
```

###5.3. To Rename and delete unnecessary columns

```
colnames(df_compare)  
  
df_compare <- df_compare %>%  
  
select(  
  -`geso_code.y`, -`geso_code.x`,  
)
```

###5.4. Set in alphabetic order

```
df_compare <- df_compare %>%  
  
select(sort(names(.)))  
  
colnames(df_compare)
```

###5.3. To visualise differences

```
#Reshape data

df_long <- df_compare %>%

select(
  geso_code, geso_name,
  v2_2007_ms, v2_2007_med, v2_2007_h,
  v2_2008_ms, v2_2008_med, v2_2008_h,
  v4_2007_ms, v4_2007_med, v4_2007_h,
  v4_2008_ms, v4_2008_med, v4_2008_h
) %>%

pivot_longer(
  cols = -c(geso_code, geso_name),
  names_to = c("variable", "year", "source"),
  names_pattern = "(v[24])_(20\\d{2})_(.*)",
  values_to = "value"
) %>%

pivot_wider(
  names_from = source,
  values_from = value
) %>%

mutate(
  source_label = case_when(
    med != 0 ~ "Median (weighted)",      # Blue
    TRUE ~ "Median"
  ),
  facet_label = paste(variable, year)
)
```

```
#Prepare dataset for plotting with aesthetic color mapping

df_plot <- df_long %>%

  select(facet_label, ms, med, h) %>%

  pivot_longer(

    cols = c(med, h),

    names_to = "estimate_type",

    values_to = "estimate_value"

  ) %>%

  mutate(

    estimate_type = factor(estimate_type,

                          levels = c("med", "h"),

                          labels = c("Median (weighted)",

                                     "Harmonised weighted median"))

  )

#Plot with legend

ggplot(df_plot, aes(x = ms, y = estimate_value, color = estimate_type)) +

  geom_point(size = 3) +

  geom_abline(slope = 1, intercept = 0, linetype = "dashed") +

  facet_wrap(~ facet_label, scales = "free") +

  scale_color_manual(

    values = c(

      "Median (weighted)" = "blue",

      "Harmonised weighted median" = "red"

    ),

    name = "Estimate type"

  ) +
```

```
labs(
  title = "Comparision of data Median (weighted) vs Harmonised weighted median",
  x = "Data from Malmö Stad (MS)",
  y = "Estimate value",
  color = ""
) +
theme_minimal(base_size = 13) +
theme(legend.position = "bottom")

###5.4. to calculate RMSE and correlation
#function to calculate RMSE
rmse <- function(actual, predicted) {
  sqrt(mean((actual - predicted)^2, na.rm = TRUE))
}
#Named the variables to analyse
vars <- c("v2_2007", "v2_2008", "v4_2007", "v4_2008")

#Calculate RMSE and correlation
results <- map_dfr(vars, function(v) {

  ms <- df_compare[[paste0(v, "_ms")]]
  med <- df_compare[[paste0(v, "_med")]]
  h <- df_compare[[paste0(v, "_h")]]

  tibble(
    variable = v,
    rmse_median = rmse(ms, med),
```

```
rmse_harmon = rmse(ms, h),
cor_median = cor(ms, med, use = "complete.obs"),
cor_harmon = cor(ms, h, use = "complete.obs")
)
})

#improve table
results <- results %>%
  mutate(
    best_rmse = ifelse(rmse_median < rmse_harmon, "median", "harmonised"),
    best_cor = ifelse(cor_median > cor_harmon, "median", "harmonised")
  )

#create a table:
table_png <- results %>%
  gt() %>%
  tab_header(
    title = "Methods comparision: Median vs Harmonised Median",
    subtitle = "RMSE and Correlation for v2_2007, v2_2008, v4_2007 i v4_2008"
  ) %>%
  fmt_number(
    columns = c(rmse_median, rmse_harmon, cor_median, cor_harmon),
    decimals = 3
  ) %>%
  tab_style(
    style = cell_fill(color = "#d0f0c0"),
    locations = cells_body(columns = c(best_rmse, best_cor))
```

```
)

gtsave(table_png,
"/Users/danielaestefaniagilgamboa/Desktop/malmo_research/comparacio_median_vs_harmonised.
png")

###6. To join final dataframes

merged_df <- df_wide %>%

  left_join(median_by_zone, by = "geso_name")

###6.1. To see the first lines

colnames(merged_df)

###6.2. To rename columns and delete duplicates

merged_df <- merged_df %>%

  rename(

    geso_code = `geso_code.x`,
    v2_2007 = `v2_2007.x`,
    v2_2008 = `v2_2008.x`,
    v4_2007 = `v4_2007.x`,
    v4_2008 = `v4_2008.x`,

  ) %>%

  select(

    -`geso_code.y`, -`v2_2007.y`,
    -`v2_2008.y`, -`v4_2007.y`,
    -`v4_2008.y`,

  )
```

```
###6.3. To save the new dataframe

write_csv(merged_df,
"/Users/danielaestefaniagilgamboa/Desktop/malmo_research/datasets/20251116_9323_wov3.csv")


##7. V3 creation: Harmonize REGSO -> GESO (SCB 2012-2023) and interpolate 2009-2011

# 7.1 Paths

geso_path <- "/Users/danielaestefaniagilgamboa/Desktop/malmo_research/gis/geso.gpkg"

regso_path <- "/Users/danielaestefaniagilgamboa/Desktop/malmo_research/gis/RegSO_2025.gpkg"

scb_path <- "/Users/danielaestefaniagilgamboa/Desktop/malmo_research/datasets/v3_2012-2023.csv"

merged_path <- "/Users/danielaestefaniagilgamboa/Desktop/malmo_research/datasets/20251116_9323_wov3.csv"

output_path <- "/Users/danielaestefaniagilgamboa/Desktop/malmo_research/datasets/FINAL_GESO_1993_2023.csv"


# 7.2 Spatial layers

geso <- st_read(geso_path, quiet = TRUE)

regso <- st_read(regso_path, quiet = TRUE)


# 7.3 GESO code

if (!"geso_code" %in% names(geso)) {
  if ("geso" %in% names(geso)) {
    geso <- geso %>% mutate(geso = as.numeric(geso),
                           geso_code = sprintf("GESO%02d", geso))
  } else {
    numeric_like <- names(geso)[sapply(geso, function(x)
```

```
is.numeric(x) || all(!is.na(as.numeric(as.character(x))), na.rm = TRUE))])

if (length(numeric_like) == 0) stop("GESO has no usable ID column")

idcol <- numeric_like[1]

geso[[idcol]] <- as.numeric(as.character(geso[[idcol]]))

geso <- geso %>% mutate(geso = .data[[idcol]],
                        geso_code = sprintf("GESO%02d", geso))
}
}

# 7.4 CRS + validity

if (st_crs(geso) != st_crs(regso)) geso <- st_transform(geso, st_crs(regso))

geso <- st_make_valid(geso)
regso <- st_make_valid(regso)

# 7.5 Tables

scb <- read.csv2(scb_path, check.names = FALSE, stringsAsFactors = FALSE)
merged_2 <- read.csv(merged_path, check.names = FALSE, stringsAsFactors = FALSE)

# 7.6 Join SCB → REGSO

regso <- regso %>% mutate(regsokod = as.character(regsokod))
scb <- scb %>% mutate(regsokod = as.character(regsokod))
regso <- regso %>% left_join(scb, by = "regsokod")

# 7.7 REGSO area

regso_area <- regso %>%
  mutate(area_regso = as.numeric(st_area(sp_geometry))) %>%
  st_drop_geometry() %>%
```

```
select(regsokod, area_regso)

# 7.8 Intersection
regso_geso_inter <- st_intersection(regso, geso)

# 7.9 Weights
regso_geso_inter <- regso_geso_inter %>%
  mutate(area_inter = as.numeric(st_area(sp_geometry))) %>%
  left_join(regso_area, by = "regsokod") %>%
  mutate(weight = ifelse(area_regso > 0, area_inter / area_regso, 0))

# 7.10 SCB year columns (pure years)
vars_scb <- names(regso)[grepl("^20(1[2-9]|2[0-3])$", names(regso))]
if (length(vars_scb) == 0) stop("No SCB columns 2012–2023 found")

# 7.11 Ensure geso_code in intersection
if (!"geso_code" %in% names(regso_geso_inter)) {
  if (!"geso" %in% names(regso_geso_inter))
    stop("Missing geso or geso_code in intersection")

  regso_geso_inter <- regso_geso_inter %>%
    mutate(geso = as.numeric(geso),
           geso_code = sprintf("GESO%02d", geso))
}

# 7.12 Rename geso_inter
```

```
regso_geso_inter <- regso_geso_inter %>%
  rename(
    `2012` = X2012,
    `2013` = X2013,
    `2014` = X2014,
    `2015` = X2015,
    `2016` = X2016,
    `2017` = X2017,
    `2018` = X2018,
    `2019` = X2019,
    `2020` = X2020,
    `2021` = X2021,
    `2022` = X2022,
    `2023` = X2023
  )

# 7.13 Weighted median SCB → GESO
# Function for weighted median
weighted_median <- function(x, w) {
  Hmisc::wtd.quantile(x, weights = w, probs = 0.5, na.rm = TRUE)
}

geso_scb <- regso_geso_inter %>%
  st_drop_geometry() %>%
  group_by(geso_code) %>%
  summarise(
    across(
```

```
all_of(vars_scb),
~ weighted_median(.x, weight),
.names = "v3_{col}"
),
.groups = "drop"
)

# 7.13.1. Rename 2012–2023 → v3_YYYY
names(geso_scb)[names(geso_scb) %in% vars_scb] <-
  paste0("v3_", vars_scb)

# 7.14 Prepare merged_2
merged_2 <- merged_2 %>%
  left_join(geso_scb %>% st_drop_geometry() %>% select(geso_code),
    by = "geso_code")

for (y in 1993:2008) {
  nm <- paste0("v3_", y)
  if (!nm %in% names(merged_2)) merged_2[[nm]] <- NA_real_
}

# 7.15 Join historical + SCB
df <- merged_2 %>% left_join(geso_scb, by = "geso_code")

# 7.16 Rescale 2008 → 2012
if ("v3_2008" %in% names(df) && "v3_2012" %in% names(df)) {
  df <- df %>%
```

```
rowwise() %>%
  mutate(factor_rescale = ifelse(!is.na(v3_2012) && v3_2012 != 0,
                                v3_2008 / v3_2012, 1)) %>%

  ungroup()
for (y in 2012:2023) {
  col <- paste0("v3_", y)
  df[[col]] <- df[[col]] * df$factor_rescale
}
} else {
  df$factor_rescale <- NA_real_
}

# 7.17 Ensure v3_1993–2023
v3_cols <- paste0("v3_", 1993:2023)
for (nm in v3_cols) if (!nm %in% names(df)) df[[nm]] <- NA_real_

# 7.18 Interpolate 2009–2011
for (i in seq_len(nrow(df))) {
  vals <- as.numeric(df[i, v3_cols])
  if (sum(!is.na(vals)) >= 2) {
    df[i, v3_cols] <- as.list(na.approx(vals, na.rm = FALSE))
  } else {
    df[i, v3_cols] <- as.list(vals)
  }
}

# 7.19 Order and export
```

```
final_order <- c("geso_code", v3_cols, "factor_rescale")
final_order <- c(final_order, setdiff(names(df), final_order))

df_final <- df[, final_order] %>%
  mutate(across(where(is.numeric), ~ round(., 2)))

write_csv(df_final, output_path)

##8. To create predictions for missing columns

macro_df <- df_final
names(macro_df)

##8.1. To create predictions --> V1

v1_cols <- names(macro_df)[grepl("^v1_\\d{4}$", names(macro_df))]

df_v1 <- macro_df %>% select(geso_code, geso_name, all_of(v1_cols)) %>% mutate(across(
  c(geso_code, geso_name), as.numeric))

if(!"v1_2001" %in% names(df_v1)) df_v1$v1_2001 <- NA_real_

df_v1 <- df_v1 %>% mutate(v1_2001 = ifelse(is.na(v1_2001) & !is.na(v1_2000) & !is.na(v1_2002),
  (v1_2000 + v1_2002)/2, v1_2001))

##8.2. To create predictions --> V2

v2_cols <- names(macro_df)[grepl("^v2_\\d{4}$", names(macro_df))]

df_v2 <- macro_df %>% select(geso_code, geso_name, all_of(v2_cols)) %>% mutate(across(
  c(geso_code, geso_name), as.numeric))

missing_v2 <- c("v2_1994", "v2_1995", "v2_1996", "v2_2001")

for (col in missing_v2) if (!col %in% names(df_v2)) df_v2[[col]] <- NA_real_

df_v2 <- df_v2 %>%
  mutate(
```

```
v2_1994 = ifelse(is.na(v2_1994) & !is.na(v2_1993) & !is.na(v2_1997), (v2_1993 + v2_1997)/2,
v2_1994),

v2_1995 = ifelse(is.na(v2_1995) & !is.na(v2_1994) & !is.na(v2_1997), (v2_1994 + v2_1997)/2,
v2_1995),

v2_1996 = ifelse(is.na(v2_1996) & !is.na(v2_1995) & !is.na(v2_1997), (v2_1995 + v2_1997)/2,
v2_1996),

v2_2001 = ifelse(is.na(v2_2001) & !is.na(v2_2000) & !is.na(v2_2002), (v2_2000 + v2_2002)/2,
v2_2001)

)

colnames(macro_df)

##8.4. To merge everything

macro_df_complete <- macro_df %>%

  select(

    -matches("^v1_\\d{4}$"),

    -matches("^v2_\\d{4}$")

  ) %>%

  left_join(df_v1, by = c("geso_code", "geso_name")) %>%

  left_join(df_v2, by = c("geso_code", "geso_name"))


###8.5. alfabetic order

macro_df_complete <- macro_df_complete %>%

  select(sort(names(.)))

###8.6. Just two decimals

macro_df_complete <- macro_df_complete %>%

  mutate(across(where(is.numeric), ~ round(., 2)))


###8.7. Delete innecessary columns

macro_df_complete <- macro_df_complete %>%
```

```
select(-factor_rescale, -v4_2024, -v2_2024, -v1_1991, -v1_1992)
```

```
###9. To save the final dataset
```

```
colnames(macro_df_complete)
```

```
write_csv(macro_df_complete,  
"/Users/danielaestefaniagilgamboa/Desktop/malmo_research/datasets/20251120_df_final.csv")
```

14.4. Table of results for geospatial harmonisation

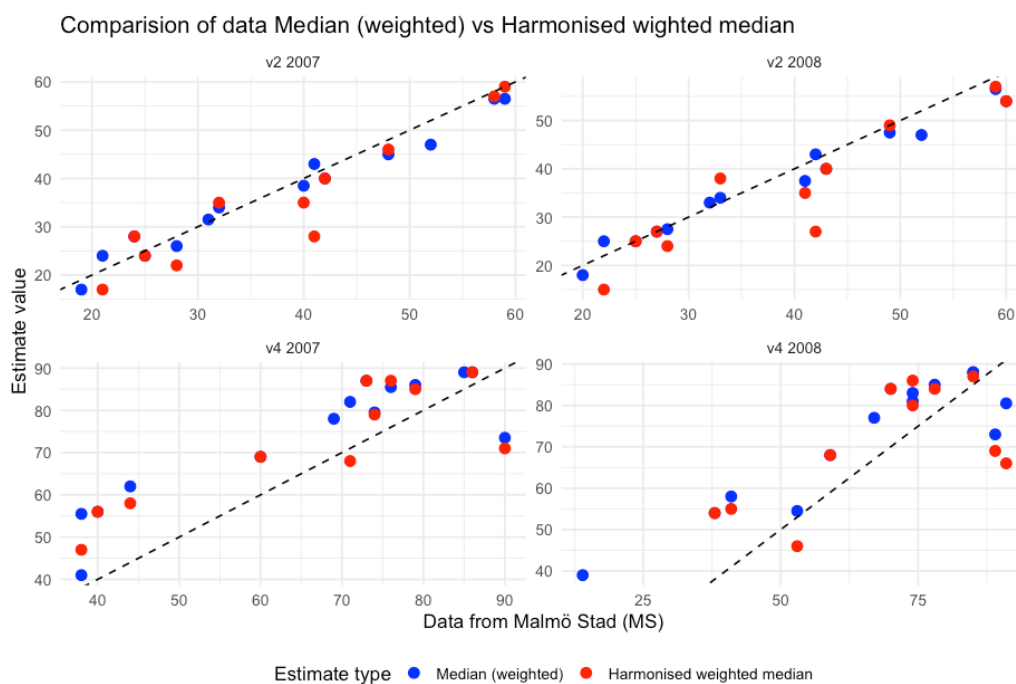


Figure 1 Geospatial harmonisation results. Author's own elaboration, 2025.

Methods comparison: Median vs Harmonised Median						
RMSE and Correlation for v2_2007, v2_2008, v4_2007 i v4_2008						
variable	rmse_median	rmse_harmon	cor_median	cor_harmon	best_rmse	best_cor
v2_2007	2.550	5.054	0.985	0.942	median	median
v2_2008	2.765	6.030	0.988	0.925	median	median
v4_2007	11.467	11.164	0.889	0.843	harmonised	median
v4_2008	12.284	13.561	0.907	0.660	median	median

Figure 2 Geospatial harmonisation comparison. Author's own elaboration, 2025.

14.5. Formulas used in the spatial conversion assessment

14.5.1. Area weighted of each fragment

$$w_{i,j} = \frac{A_{i,j}}{A_i}$$

Where:

- $A_{i,j}$ = intersected area between source unit S_i and target unit T_j
- A_i = total area of the source unit S_i
- $w_{i,j}$ = weight used for proportional redistribution (0-1)

14.5.2. Number of spatial fragments generated

$$Fragments = \sum_i \sum_j 1 \quad (A_{i,j} > 0)$$

Where:

- $x_{g,t}$ = indicator function (1 if true, 0 otherwise).
- Each non-zero intersection counts as one fragment.

14.5.3. Reconstruction Error factor (absolute)

$$ERF_i = \left| 1 - \sum_j w_{i,j} \right|$$

Where:

- $\sum_j w_{i,j}$ should ideally equal 1 for each source unit
- Deviations reflect loss or duplication of each area due to geometry mismatch

14.5.4. Area-weighted allocation for count variables

$$X_g = \sum_{d \in D_g} w_{dg} X_d$$

Where:

- $x_{g,t}$ = harmonised value for variable X in GESO g and year t
- D_g = set of Delomrade intersecting GESO g
- $X_{d,t}$ = value of the count variable in Delomrade d and year t
- w_{dg} = weight of fragment

14.6. Definitions

v1: economic status		
Year	Literal definition (Swedish)	English translation
1993 - 1995	<i>Medianinkomst. Hälften av inkomsttagarna ligger under denna inkomst och hälften över.</i>	Median income. Half of income earners lie below this income and half above.
1996	<i>Bruttoinkomst minus slutlig skatt plus positiva transfereringar. Avser familjer 20- år. Fr o m Områdesfakta 1996 redovisas medelinkomst istället för medianinkomst. Disponibel medel-</i>	Gross income minus final tax plus positive transfers. Refers to families aged 20- and older. From Områdesfakta 1996, mean income is reported instead of median income. Disposable mean-
1997	<i>Disponibel inkomst: Bruttoinkomst minus slutlig skatt plus positiva transfereringar. Avser familjer 20- år. Disponibel medel-</i>	Disposable income: Gross income minus final tax plus positive transfers. Refers to families aged 20- and older. Disposable mean-
1998	<i>Inkomst. Disponibel inkomst: Bruttoinkomst minus slutlig skatt plus positiva transfereringar. Avser familjer 20- år. Variabel: disponible medelink.</i>	Income. Disposable income: Gross income minus final tax plus positive transfers. Refers to families aged 20- and older. Variable: disposable mean income.
1999	<i>Disponibel medelinkomst: Bruttoinkomst minus slutlig skatt plus positiva transfereringar. Avser familjer 20- år. (Ej samtaxerade över 20 år räknas som egen inkomstenhet). Variabel: disponible medelink.</i>	Disposable mean income: Gross income minus final tax plus positive transfers. Refers to families aged 20- and older. (Those not jointly taxed over age 20 are counted as their own income unit). Variable: disposable mean income.
2000 - 2006	<i>Disponibel medelinkomst: Bruttoinkomst minus slutlig skatt plus positiva transfereringar. Avser familjer 20- år (Hemmaboende barn över 20 år räknas inte som egen inkomstenhet). Disponibel medelinkomst.</i>	Disposable mean income: Gross income minus final tax plus positive transfers. Refers to families aged 20 and older (co-resident children over age 20 are not counted as their own income unit). Disposable mean income.

2007 - 2019	<i>Visas som ett genomsnitt av årsinkomsten för boende i området. Består av summan av alla skattepliktiga och skattefria inkomster minus skatt och övriga negativa transfereringar. Skattepliktiga inkomster består bland annat av: löneinkomst, inkomst från näringsverksamhet, inkomst av kapital, pension, sjukpenning, sjukpenning i särskilda fall, schablonintäkter, boendetillägg, arbetsmarknadsstöd, föräldrapenning och sjuk- och aktivitetsersättning. Skattefria inkomster består bland annat av: bostadsbidrag, barnbidrag, studiestöd inkl. studielån, ekonomiskt bistånd och underhållsbidrag (fr.o.m. inkomstregistret 2013). Negativa transfereringar består bland annat av: skatt, återbetalning av studielån och utbetalt underhållsbidrag. Uttaget följer 2004 års definition vilket även inkluderar kapitalvinster och kapitalförluster brutto. Notera att inkomster som bara beskattas utomlands inte finns med. Detta berör t.ex. de som arbetare i Danmark; deras inkomster räknas ingår inte i statistiken. Siffrorna visas i löpande priser vilket betyder att de inte är inflationsjusterade. Det bör understrykas att disponibel inkomst inte ger ett mått av ekonomisk välfärd i vid mening. Utanför mätningarna ligger bland annat egen produktion i hemmen, nyttan av offentlig konsumtion samt eventuella "svarta" inkomster. Från och med 2012 exkluderas introduktionsersättningen ur redovisningen av ekonomiskt bistånd. Notera att denna variabel visas för befolkningen i alla åldrar. Visas som ett genomsnitt av årsinkomsten för området. Variabeln finns uppdelad på kön. Data från Inkomst- och taxeringsregistret (IoT). Variabel: Medel.</i>	Displayed as the average annual income for residents in the area. Consists of the sum of all taxable and tax-free income minus tax and other negative transfers. Taxable income includes, among other things: wage income, business income, capital income, pension, sickness benefit, special sickness benefit, standard income, housing supplement, labour market support, parental benefit, and sickness and activity compensation. Tax-free income includes, among other things: housing allowance, child allowance, student support including student loans, social assistance and maintenance support (from the income register 2013). Negative transfers include, among other things: tax, student loan repayment and paid maintenance support. The extraction follows the 2004 definition, which also includes gross capital gains and capital losses. Note that income taxed only abroad is not included, e.g. those working in Denmark; their incomes are not included in the statistics. Figures are shown in current prices, meaning they are not adjusted for inflation. It should be emphasized that disposable income does not measure economic welfare in a broad sense. Excluded are, among other things, home production, the value of public consumption and any undeclared income. From 2012, the introduction benefit is excluded from the reporting of social assistance. Note that this variable is shown for the population of all ages. Displayed as the average annual income for the area. The variable is disaggregated by sex. Data from the Income and Taxation Register (IoT). Variable: Mean.
2020 - 2023	<i>Visas som ett genomsnitt av årsinkomsten för boende i området. Består av summan av alla skattepliktiga och skattefria inkomster minus skatt och övriga negativa transfereringar. Skattepliktiga inkomster består bland annat</i>	Displayed as the average annual income for residents in the area. Consists of the sum of all taxable and tax-free income minus tax and other negative transfers. Taxable income includes, among other things: wage income, business income, capital income, pension, sickness benefit, special

<i>av: löneinkomst, inkomst från näringsverksamhet, inkomst av kapital, pension, sjukpenning, sjukpenning i särskilda fall, schablonintäkter, boendetillägg, arbetsmarknadsstöd, föräldrapenning och sjuk- och aktivitetsersättning. Skattefria inkomster består bland annat av: bostadsbidrag, barnbidrag, studiestöd inkl. studielån, ekonomiskt bistånd och underhållsbidrag (fr.o.m. inkomstregistret 2013). Negativa transfereringar består bland annat av: skatt, återbetalning av studielån och utbetalt underhållsbidrag. Uttaget följer 2004 års definition vilket även inkluderar kapitalvinster och kapitalförluster brutto. Från och med data för 2020 ingår inkomster från arbete och pension från övriga nordiska länder i statistiken. Detta gör att jämförelser bakåt i tiden blir missvisande då inkomster från de som arbetspendlar till Danmark tidigare inte ingått i statistiken. Siffrorna visas i löpande priser vilket betyder att de inte är inflationsjusterade. Det bör understrykas att disponibel inkomst inte ger ett mått av ekonomisk välfärd i vid mening. Utanför mätningarna ligger bland annat egen produktion i hemmen, nyttan av offentlig konsumtion samt eventuella "svarta" inkomster. Från och med 2012 exkluderas introduktionsersättningen ur redovisningen av ekonomiskt bistånd. Notera att denna variabel visas för befolkningen i alla åldrar. Visas som ett genomsnitt av årsinkomsten för området. Variabeln finns uppdelad på kön. Data från Inkomst- och taxeringsregistret (IoT). Variabel: Medel.</i>	sickness benefit, standard income, housing supplement, labour market support, parental benefit, and sickness and activity compensation. Tax-free income includes, among other things: housing allowance, child allowance, student support including student loans, social assistance and maintenance support (since the 2013 income register). Negative transfers include, among other things: tax, student loan repayment and paid maintenance support. The extraction follows the 2004 definition, which also includes gross capital gains and capital losses. From 2020, income from work and pensions from other Nordic countries is included in the statistics. This means that comparisons backward in time become misleading, since cross-border commuters to Denmark were previously not included. Figures are shown in current prices, meaning they are not inflation-adjusted. It should be emphasized that disposable income does not measure economic welfare in a broad sense. Excluded are, among other things, home production, the value of public consumption and any undeclared income. From 2012, the introduction benefit is excluded from reporting of social assistance. Note that this variable is shown for the population of all ages. Displayed as the average annual income for the area. The variable is disaggregated by sex. Data from the Income and Taxation Register (IoT). Variable: Mean.
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v2: educational status		
Year	Literal definition (Swedish)	English translation
1993-2006	<i>Utbildningsnivå (20–64 år), Variabel: Eftergymnasial %.</i>	Educational level (ages 20–64). Variable: Post-secondary %.
2007-2023	<i>Visar antalet invånare i varje område efter utbildningsnivå. Utbildningsnivå anger den formella nivån på respektive individs högsta avslutade utbildning. Det finns fyra kategorier: "Förgymnasial utbildning" inkluderar upp till 9 års Förgymnasial utbildning. "Gymnasial utbildning" inkluderar både dagens 3-åriga program och kortare gymnasieprogram. Den tredje kategorin, "Eftergymnasial utbildning" innefattar de som har en eftergymnasial utbildning oavsett längd, inklusive de med forskarutbildning. Den sista kategorin "Övriga" innefattar de individer där uppgifter saknas samt de som inte ingår i utbildningsregistret. Uppdelningen bygger på kategorierna i SUN2000. Gäller befolkningen 20–64. Variabeln finns uppdelad på kön. Data från SCB:s utbildningsregister (UREG). Variabel: Eftergymnasial.</i>	Shows the number of residents in each area by educational level. Educational level indicates the formal level of each individual's highest completed education. There are four categories: "Pre-upper secondary education" includes up to 9 years of schooling. "Upper secondary education" includes today's 3-year programmes and shorter programmes. The third category, "Post-secondary education," includes those with post-secondary education of any length, including doctoral education. The last category, "Other," includes individuals with missing information and those not included in the education register. The classification is based on SUN2000 categories. Applies to the population aged 20–64. The variable is disaggregated by sex. Data from Statistics Sweden's education register (UREG). Variable: Post-secondary.

v3: residential status		
Year	Literal definition (Swedish)	English translation
1993-1997	<i>Bostäder, upplåtelseform. Allmännyttiga bostadsföretag: MKB, Bunkeflobyggen. Bostadsrättsföreningar: HSB, Riksbyggen, SBC och privata bostadsrättsföreningar. Upplåtelseform. Variabel: Äganderätt %.</i>	Dwellings, tenure form. Municipal housing companies: MKB, Bunkeflobyggen. Housing cooperatives: HSB, Riksbyggen, SBC and private housing cooperatives. Tenure form. Variable: Owner-occupation %.
1998 - 2008	<i>Bostäder, upplåtelseform. Allmännyttiga bostadsföretag: MKB. Bostadsrättsföreningar: HSB, Riksbyggen, SBC och privata bostadsrättsföreningar. Upplåtelseform. Variabel: Äganderätt %.</i>	Dwellings, tenure form. Municipal housing companies: MKB. Housing cooperatives: HSB, Riksbyggen, SBC and private housing cooperatives. Tenure form. Variable: Owner-occupation %.
2012–2023	<i>Bostaden spelar en central roll för människors välbefinnande. Det gäller vilken typ av bostad (äganderätt, bostadsrätt eller hyresrätt), dess standard och dess läge. Människors välbefinnande påverkar möjligheten till bostad. Det finns nämligen inträdeshinder både på hyresmarknaden och marknader för ägda bostäder. Långa kötider till hyresbostäder och höga bostadspriser påverkar individernas möjlighet till boende i exempelvis expansiva regioner. Möjligheterna att träda in på bostadsmarknaden samt att äga en bostad är mer begränsade för finansiellt begränsade hushåll (SOU 2020:46). Indikatoren avser andel boende per upplåtelseform. Lägenheternas upplåtelseform (hyresrätt, bostadsrätt och äganderätt) utgår från ägarförhållandet och inte från hur de boende förfogar över lägenheterna. Äganderätt: avser lägenheter i småhus (friliggande en- och tvåbostadshus samt par-, rad-</i>	Housing plays a central role in people's welfare. This concerns the type of dwelling (owner-occupied, cooperative, or rental), its standard, and its location. People's welfare affects their access to housing. There are entry barriers both in the rental market and in markets for owned housing. Long waiting times for rental housing and high housing prices affect individuals' opportunities for housing in, for example, expanding regions. The possibility of entering the housing market and owning a dwelling is more limited for financially constrained households (SOU 2020:46). The indicator refers to the share of residents by tenure form. The tenure form of dwellings (rental, cooperative, and owner-occupied) is based on ownership and not on how residents occupy the dwellings. Owner-occupation refers to dwellings in single-family houses (detached one- and two-dwelling houses and semi-detached, terraced, and linked houses) owned by private individuals or estates. It also

	<i>och kedjehus) som ägs av fysiska personer eller dödsbon. Det avser även lägenheter i flerbostadshus med äganderätt (ägarlägenheter).</i>	includes dwellings in multi-dwelling buildings with owner-occupation (owner-apartments).
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v4: non-migrant status		
Year	Literal definition (Swedish)	English translation
1993 - 1994	<i>Personer med utländsk bakgrund: Utländska medborgare, svenska medborgare med utländsk bakgrund. Födda i utlandet. Barn under 18 år födda i Sverige med en eller båda föräldrarna födda i utlandet. I tabellen redovisas de fem nationaliteter, efter medborgarskapsland, som är störst i resp område. Variabel: Andel av folkmängd %.</i>	Persons with foreign background: foreign citizens, Swedish citizens with foreign background. Born abroad. Children under 18 born in Sweden with one or both parents born abroad. The table reports the five nationalities, by citizenship country, that are largest in each area. Variable: Share of population %.
1995	<i>Utländska medborgare. Svenska medborgare med utländsk bakgrund. Födda i utlandet. Barn under 18 år födda i Sverige med en eller båda föräldrarna födda i utlandet. I tabellen redovisas de fem nationaliteter, efter medborgarskapsland, som är störst i resp område. Variabel: Andel av folkmängd %.</i>	Foreign citizens. Swedish citizens with foreign background. Born abroad. Children under 18 born in Sweden with one or both parents born abroad. The table reports the five nationalities, by citizenship country, that are largest in each area. Variable: Share of population %.
1996 - 1998	<i>Personer med utländsk bakgrund: Utländska medborgare. Svenska medborgare med utländsk bakgrund. Födda i utlandet. Barn under 18 år födda i Sverige med en eller båda föräldrarna födda i utlandet. I tabellen redovisas de fem största nationaliteterna i resp område, efter totalt antal</i>	Persons with foreign background: foreign citizens. Swedish citizens with foreign background. Born abroad. Children under 18 born in Sweden with one or both parents born abroad. The table reports the five largest nationalities in each area, based on total persons with foreign background. Variable: Share of population %.

	<i>personer med utländsk bakgrund. Variabel: Andel av folkmängd %.</i>	
1999 - 2002	<i>Personer med utländsk bakgrund: Födda i utlandet. Födda i Sverige med minst en förälder född i utlandet. I tabellen redovisas de fem största länderna i resp område. Sortering efter gruppen födda i utlandet. Variabel: Andel av folkmängd %.</i>	Persons with foreign background born abroad. Born in Sweden with at least one parent born abroad. The table reports the five largest countries in each area. Sorting based on the group born abroad. Variable: Share of population %.
2003 - 2006	<i>• Födda i utlandet. • Födda i Sverige med minst en förälder född i utlandet. I tabellen redovisas de fem största länderna i resp. område. Sortering efter gruppen födda i utlandet. Om färre än 10 observationer redovisas endast totalsumma. 1 och 2 observationer redovisas inte. Fr.o.m. 2003 redovisas Födda i Sverige med båda föräldrarna födda i utlandet i stället för minst en förälder född i utlandet, därför kan jämförelser med tidigare år inte göras. Variabel: Andel av folkmängd %.</i>	• Born abroad. • Born in Sweden with at least one parent born abroad. The table presents the five largest countries in each area. Sorting based on the group born abroad. If fewer than 10 observations, only totals are reported. 1 and 2 observations are not reported. From 2003, those born in Sweden with both parents born abroad are reported instead of at least one parent born abroad; therefore, comparisons with earlier years cannot be made. Variable: Share of population %.
2007- 2021	<i>Variabeln anger om en individ är utlandsfödd, född i Sverige med två utlandsföräldrar eller övrig svenskfödd befolkning. Data från Registret över Totalbefolkningen (RTB). Finns uppdelat på kön. Variabel: Inrikes född med två utrikes födda föräldrar; Utrikes född.</i>	The variable indicates whether an individual is foreign-born, born in Sweden with two foreign-born parents, or other Swedish-born population. Data from the Total Population Register (RTB). Available disaggregated by sex. Variable: Born in Sweden with two foreign-born parents; Foreign-born.
2022- 2023	<i>Variabeln anger om en individ är utlandsfödd, född i Sverige med två utlandsföräldrar eller övrig svenskfödd befolkning. Data från Registret över Totalbefolkningen (RTB). Finns uppdelat på kön. Variabel: Inrikes född med två utrikes föräldrar; Utrikes född.</i>	The variable indicates whether an individual is foreign-born, born in Sweden with two foreign-born parents, or other Swedish-born population. Data from the Total Population Register (RTB). Available disaggregated by sex. Variable: Born in Sweden with two foreign-born parents; Foreign-born.

v5: occupational status		
Year	Literal definition (Swedish)	English translation
1993-1996	<i>Förvärvsarbete förvärvsintensitet (20–64 år). Förvärvsintensitet, % Antal förvärvsarbete 20–64 år av folkmängd 20–64 år.</i>	Gainfully employed, employment intensity (ages 20–64). Employment intensity, % Number of gainfully employed aged 20–64 as a share of the population aged 20–64.
1997 - 2006	<i>Förvärvsarbete, % Antal förvärvsarbete 20–64 år av folkmängden 20–64 år. Variabel: Andel förvärvsarb. (20–64 år): Totalt %.</i>	Gainfully employed, % Number of gainfully employed aged 20–64 as a share of the population aged 20–64. Variable: Share employed (ages 20–64): total %.
2007–2018	<i>Variabel: Förvärvsgrad. Visar andelen förvärvsarbete bland befolkning i området i åldrarna 20–64 år. Datan är baserad på data från det så kallade kontrolluppgiftsregistret. Alla som betalar ut lön, arvode, andra ersättningar eller förmåner som utgör skattepliktig inkomst av tjänst ska anmäla kontrolluppgifter. Definitionen är densamma som i arbetskraftsundersökningen (AKU): för lönearbetare måste man ha arbetat minst en timme i veckan under november. För personliga företagare räknas istället inkomst av aktiv näringsverksamhet under året. Även de som är tillfälligt frånvarande från en anställning under mätperioden, t.ex. p.g.a. sjukdom, räknas som förvärvsarbete. Personer med väldigt låg inkomst räknas inte som förvärvsarbete. Datan finns uppdelad på kön. Visas för åldersspannet 20–64. Från och med referensår 2019 använder SCB en ny datakälla och metod för att</i>	Variable: Employment rate. Shows the proportion of employed persons among the population in the area aged 20–64. The data is based on the so-called employer statement register. Anyone who pays wages, fees, other compensation, or benefits that constitute taxable earned income must report employer statements. The definition is the same as in the Labour Force Survey (AKU): wage earners must have worked at least one hour per week in November. For self-employed persons, income from active business activity during the year is counted instead. Those temporarily absent from employment during the measurement period—for example due to illness—are counted as employed. Persons with very low income are not counted as employed. The data is disaggregated by sex. Shown for ages 20–64. From reference year 2019, Statistics Sweden uses a new data source and method to classify employed persons in RAMS. The change of source and method means that comparisons between 2019 and

	<i>klassificera förvärvsarbete i RAMS. Bytet av källa och metod innebär att jämförelser av statistik avseende 2019 och tidigare referensår måste göras med stor försiktighet. Läs mer på SCB.se. Data från SCB RAMS.</i>	earlier years must be made with great caution. See more at SCB.se. Data from SCB RAMS.
2019–2021	<i>Variabel: Förvärvsgrad. Visar andelen förvärvsarbete bland befolkning i området i åldrarna 20–64 år. Från och med referensår 2019 använder SCB en ny datakälla och metod för att klassificera förvärvsarbete i RAMS. Bytet av källa och metod innebär att jämförelser av statistik avseende 2019 och tidigare referensår måste göras med stor försiktighet. Datan är från och med 2019 baserad på data från det så kallade arbetsgivardeklarationerna på individnivå (AGI). Har personen fått en lön i november som överstiger 99 kronor klassificeras personen som förvärvsarbete. För egenföretagare gäller, liksom tidigare, att de personer som under referensåret har deklarerat för aktiv näringsverksamhet klassificeras som förvärvsarbete. Även de som är tillfälligt frånvarande från en anställning under mätperioden, t.ex. p.g.a. sjukdom, räknas som förvärvsarbete. Läs mer på SCB.se. Visas för åldersspannet 20–64. Data från SCB RAMS.</i>	Variable: Employment rate. Shows the proportion of employed persons among the population in the area aged 20–64. From reference year 2019, Statistics Sweden uses a new data source and method to classify employed persons in RAMS. The change of source and method means that comparisons between 2019 and earlier years must be made with great caution. From 2019 onward, the data is based on employer payroll declarations at the individual level (AGI). If a person has received a wage in November exceeding 99 SEK, the person is classified as employed. For self-employed persons, as before, those who declared income from active business activity during the reference year are classified as employed. Those temporarily absent from employment during the measurement period—for example due to illness—are counted as employed. See more at SCB.se. Shown for ages 20–64. Data from SCB RAMS.
2022–2023	<i>Variabel: Sysselsättningsgrad. Visar andelen sysselsatta bland befolkning i området i åldrarna 20–65 år. Data från BAS ("Befolkningens arbetsmarknadsstatus"). I BAS kategoriseras man som sysselsatt om man under november månad referensåret har erhållit ersättning enligt de arbetsgivardeklarationer som redovisas till Skatteverket (eller motsvarande för de som arbetar i övriga Norden),</i>	Variable: Employment rate. Shows the proportion of employed persons among the population in the area aged 20–65. Data from BAS ("Population Labour Market Status"). In BAS, an individual is classified as employed if during November of the reference year they received compensation according to employer payroll declarations reported to the Swedish Tax Agency (or equivalent for those working in other Nordic countries), are assessed as

<i>bedöms vara verksam som näringsidkare, handels- eller kommanditbolagägare, eller tidigare under året erhållt ersättning enligt ovan och under november månad fått vissa ersättningar från Försäkringskassan (föräldrapenning, graviditetspenning, sjukpenning och liknande). Från och med referensår 2022 används en ny datakälla då SCB byter datakälla till BAS från tidigare RAMS. Det finns skillnader mellan hur RAMS definierar förvärvsarbete och hur BAS definierar sysselsatta. Till exempel klassar RAMS de som arbetar i Danmark som ej förvärvsarbete medan de i BAS under vissa omständigheter räknas som sysselsatta. Det sker därför ett tidsseriebrott för denna tidsserie med start med data från 2022. Bytet av källa och metod innebär att jämförelser av statistik avseende dagbefolkning 2022 och tidigare referensår måste göras med stor försiktighet. Läs mer på SCB.se.</i>	operating as a business owner, owner of a trading or limited partnership, or earlier in the year received such compensation and in November received certain benefits from the Social Insurance Agency (parental benefit, pregnancy benefit, sickness benefit, and similar). From reference year 2022, a new data source is used as Statistics Sweden switches to BAS from the previous RAMS. There are differences between how RAMS defines employed persons and how BAS defines employed persons. For example, RAMS classifies those working in Denmark as not employed, while BAS counts them as employed under certain conditions. Therefore, a time-series break occurs starting with data from 2022. The change of source and method means that comparisons of population-day statistics for 2022 and earlier reference years must be made with great caution. See more at SCB.se.
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14.7. *Code to compare the geospatial dimension*

```
# Spatial overlay comparison: DeSO → GeSO; RegSO → GeSO; DeSO → Delomr; RegSO → Delomr

##0. Libraries

library(sf)

library(dplyr)

library(ggplot2)

library(readr)

library(tidyr)

library(gt)

library(webshot2)

##1.Input paths

paths <- list(

  geso = "/Users/danielaestefaniagilgamboa/Desktop/malmo_research/gis/geso.gpkg",

  regso = "/Users/danielaestefaniagilgamboa/Desktop/malmo_research/gis/RegSO_2025.gpkg",

  deso = "/Users/danielaestefaniagilgamboa/Desktop/malmo_research/gis/DeSO_2025.gpkg",

  delomr = "/Users/danielaestefaniagilgamboa/Desktop/malmo_research/gis/delomr_p_4326.gpkg"

)

###1.1. Parameters for the analysis

proj_epsg <- 3008

sliver_threshold_m2 <- 50

output_dir <- "./spatial_comparison_outputs"

if (!dir.exists(output_dir)) dir.create(output_dir, recursive = TRUE)
```

##2.Helper functions

```
get_id_field <- function(sf_obj) {  
  cols <- names(sf_obj)  
  geomcol <- attr(sf_obj, "sf_column")  
  cols <- setdiff(cols, geomcol)  
  possible  
  c("id", "ID", "Id", "objectid", "OBJECTID", "gid", "GID", "kod", "KOD", "desokod", "regsokod") <-  
  found <- intersect(possible, cols)  
  if (length(found) > 0) return(found[1])  
  if (length(cols) == 0) stop("No non-geometry field available as ID.")  
  return(cols[1])  
}
```

##3. Basic function for the analysis

```
analyze_mapping <- function(source_sf, target_sf, src_name = "src", tgt_name = "tgt") {  
  message(sprintf("Analyzing %s → %s", src_name, tgt_name))
```

###3.1. Validation

```
source_sf <- st_make_valid(source_sf) |> st_transform(proj_epsg)  
target_sf <- st_make_valid(target_sf) |> st_transform(proj_epsg)
```

###3.2. To detect id fields

```
src_id <- get_id_field(source_sf)  
tgt_id <- get_id_field(target_sf)
```

###3.3. Temporal dielts to preserve id in intersection

```
source_sf <- source_sf |> mutate(.src_id_temp = .data[[src_id]])  
target_sf <- target_sf |> mutate(.tgt_id_temp = .data[[tgt_id]])
```

```
###3.4. To deactivate s2 -because it is generating problems-
```

```
sf::sf_use_s2(FALSE)
```

```
###3.5. Intersection
```

```
inter <- st_intersection(source_sf, target_sf)
```

```
if (nrow(inter) == 0) stop(sprintf("No intersections between %s and %s", src_name, tgt_name))
```

```
###3.6. To use the areas for the intersection
```

```
inter <- inter |> mutate(area_int_m2 = as.numeric(st_area(geometry)))
```

```
###3.7. in the original source —> use st_area for the object
```

```
source_areas <- source_sf |>
```

```
  mutate(area_src_m2 = as.numeric(st_area(geometry))) |>
```

```
  st_drop_geometry() |>
```

```
  select(.src_id_temp, area_src_m2)
```

```
###3.8. joint source is and to make the proportion
```

```
inter <- inter |> left_join(source_areas, by = ".src_id_temp")
```

```
inter <- inter |> mutate(prop_of_src = area_int_m2 / area_src_m2)
```

```
###3.9. Summary
```

```
fragments_total <- nrow(inter)
```

```
n_distinct_sources <- n_distinct(inter$.src_id_temp)
```

```
total_area_inter <- sum(inter$area_int_m2, na.rm = TRUE)
```

```
sliver_count <- sum(inter$area_int_m2 <= sliver_threshold_m2, na.rm = TRUE)
```

```
sliver_area_pct <- 100 * sum(inter$area_int_m2[inter$area_int_m2 <= sliver_threshold_m2],  
na.rm = TRUE) / total_area_inter
```

```
###3.10. Summary for each source using prop_of_scf and to calculate deviations
```

```
prop_summary <- inter |>
```

```
  st_drop_geometry() |>
```

```
  group_by(.src_id_temp) |>
```

```
  summarise(
```

```
    n_frag = n(),
```

```
    prop_total = sum(prop_of_src, na.rm = TRUE),
```

```
    area_src_m2 = first(area_src_m2),
```

```
    .groups = "drop"
```

```
  )
```

```
n_sources_lossy <- sum(prop_summary$prop_total < 0.999, na.rm = TRUE)
```

```
pct_sources_lossy <- 100 * n_sources_lossy / nrow(prop_summary)
```

```
###3.11. Summary table for mapping
```

```
summary_row <- tibble(
```

```
  mapping = paste0(src_name, " → ", tgt_name),
```

```
  fragments_total,
```

```
  n_distinct_sources,
```

```
  sliver_count,
```

```
  sliver_area_pct = round(sliver_area_pct, 4),
```

```
  n_sources_lossy,
```

```
  pct_sources_lossy = round(pct_sources_lossy, 4),
```

```
  ERF_mean_abs = mean(abs(1 - prop_summary$prop_total), na.rm = TRUE),
```

```
  ERF_median_abs = median(abs(1 - prop_summary$prop_total), na.rm = TRUE),
```

```
  total_area_inter_m2 = total_area_inter
```

```
)

###3.12. Results summary

list(

  summary = summary_row,

  inter = inter,

  prop_summary = prop_summary,

  src_id = src_id,

  tgt_id = tgt_id

)

}

##4. Read geometries

geso <- st_read(paths$geso, quiet = TRUE)
regso <- st_read(paths$regso, quiet = TRUE)
deso <- st_read(paths$deso, quiet = TRUE)
delomr <- st_read(paths$delomr, quiet = TRUE)

####4.1. Change name of geometries

normalize_geom <- function(sf_obj) {
  geom_col <- attr(sf_obj, "sf_column")
  sf_obj <- sf_obj |> dplyr::rename(geometry = !!geom_col)
  attr(sf_obj, "sf_column") <- "geometry"
  return(sf_obj)
}
```

```
geso <- normalize_geom(geso)
regso <- normalize_geom(regso)
deso <- normalize_geom(deso)
delomr <- normalize_geom(delomr)

##5. Mappings to analyze
mappings <- list(
  list(src = deso, tgt = geso, src_name = "DeSO", tgt_name = "GeSO"),
  list(src = regso, tgt = geso, src_name = "RegSO", tgt_name = "GeSO"),
  list(src = deso, tgt = delomr, src_name = "DeSO", tgt_name = "Delomr"),
  list(src = regso, tgt = delomr, src_name = "RegSO", tgt_name = "Delomr")
)

##6. Run analysis
results_list <- lapply(mappings, function(m) {
  analyze_mapping(m$src, m$tgt, m$src_name, m$tgt_name)
})

summary_table <- bind_rows(lapply(results_list, `[`, "summary"))
print(summary_table)

##7. Create transposed summary table
summary_long <- summary_table |>
  pivot_longer(cols = -mapping, names_to = "metric", values_to = "value")

summary_wide <- summary_long |>
  pivot_wider(names_from = mapping, values_from = value)
```

```
###7.1. To generate the table
```

```
gt_table <- summary_wide |>
```

```
  gt() |>
```

```
  tab_options(
```

```
    table.font.size = px(14),
```

```
    data_row.padding = px(3),
```

```
    table.width = px(1200)
```

```
  ) |>
```

```
  tab_style(
```

```
    style = cell_text(weight = "bold"),
```

```
    locations = cells_column_labels()
```

```
  ) |>
```

```
  cols_width(
```

```
    metric ~ px(150),
```

```
    everything() ~ px(100)
```

```
  )
```

```
###7.2. To save the table
```

```
out_path
```

```
"/Users/danielaestefaniagilgamboa/Desktop/malmo_research/gis/spatial_comparison_table.png"
```

```
<-
```

```
gtsave(gt_table, out_path, vwidth = 1600, vheight = 900)
```

14.8. Code for the analysis

```
# MALMÖ QCA — Year-by-year fsQCA, then detect periods from necessity & sufficiency
```

```
# Outcome = distance to ideal (1 - mean(fuzzy conditions per year))
```

```
##1. Load Libraries
```

```
library(tidyverse)

library(QCA)

library(stringr)

###1.1. Paths and parameters

input_csv <- "Users/danielaestefaniagilgamboa/Desktop/malmo_research/datasets/20251120_df_final.csv"
out_dir <- "Users/danielaestefaniagilgamboa/Desktop/malmo_research/qca_multiannual_output"
dir.create(out_dir, recursive = TRUE, showWarnings = FALSE)

incl_cut <- 0.75 # inclusion cutoff used in truthTable
n_cut <- 1 # frequency cutoff for truthTable
need_cut <- 0.90 # optional threshold to mark 'strong' necessity
conds <- c("v1", "v2", "v3", "v4", "v5")

##2.Utilities

# Parse numeric results captured from capture.output(superSubset(...))
parse_super_text <- function(txt_lines) {
  txt <- paste(txt_lines, collapse = " ")

  # Try to extract triplet consistency RoN coverage (common superSubset layout)
  # Pattern tries to find first three floats after a variable label
  pattern <- "([0-9]+\\.?[0-9]+)\\s+([0-9]+\\.?[0-9]+)\\s+([0-9]+\\.?[0-9]+)"
  m <- str_match(txt, pattern)

  if (!is.na(m[1,2])) {
    tibble(necessity_consistency = as.numeric(m[1,2]),
           necessity_RoN = as.numeric(m[1,3]),
           necessity_coverage = as.numeric(m[1,4]))
  } else {
```

```
tibble(necessity_consistency = NA_real_,
       necessity_RoN = NA_real_,
       necessity_coverage = NA_real_)
}
}

# Manual necessity metrics (safe fallback)
calc_necessity_metrics <- function(x, y) {
  s_min_xy <- sum(pmin(x, y), na.rm = TRUE)
  sum_y <- sum(y, na.rm = TRUE)
  sum_x <- sum(x, na.rm = TRUE)
  consistency <- ifelse(sum_y > 0, s_min_xy / sum_y, NA_real_)
  coverage <- ifelse(sum_x > 0, s_min_xy / sum_x, NA_real_)
  list(consistency = consistency, coverage = coverage)
}

# Extract solution strings (complex / intermediate / parsimonious) from minimize() result
extract_solutions_list <- function(minres_obj) {
  sol_list <- list()
  if (is.null(minres_obj)) return(sol_list)
  if (!is.null(minres_obj$solution)) {
    sol_list <- append(sol_list, lapply(unlist(minres_obj$solution),
                                         function(s) list(type="complex", config = s)))
  }
  if (!is.null(minres_obj$intermediate)) {
    sol_list <- append(sol_list, lapply(unlist(minres_obj$intermediate),
                                         function(s) list(type="intermediate", config = s)))
  }
}
```

```
}  
  
if (!is.null(minres_obj$parsimonious)) {  
  sol_list <- append(sol_list, lapply(unlist(minres_obj$parsimonious),  
                                     function(s) list(type="parsimonious", config = s)))  
}  
sol_list  
}  
  
##3.Load data and detect year-columns  
  
raw_df <- read_delim(input_csv, delim = ",", show_col_types = FALSE)  
  
# Identify v1_YYYY ... v5_YYYY columns dynamically  
var_names <- names(raw_df)[grepl("^v[1-5]_\\d{4}$", names(raw_df))]  
var_info <- tibble(var = var_names,  
                  base = str_extract(var_names, "v[1-5]"),  
                  year = as.integer(str_extract(var_names, "\\d{4}"))  
  
years <- sort(unique(var_info$year))  
  
##4.Prepare containers for outputs  
  
year_results <- list()      # stores per-year objects (df_qca, truthTable, minimize, necessity)  
necessity_rows <- list()    # rows for necessity metrics CSV  
solutions_summary <- list() # summary per year (n_cases, n_configs, consistency, coverage,  
solutions)  
solutions_detailed <- list() # per-solution detailed metrics (inclS, PRI, covS, covU)  
cond_freq_rows <- list()    # tokens frequency per year
```

```
##5.Main loop: per-year processing (calibrate per year -> QCA)

for (yr in years) {
  message("Processing year: ", yr)
  vars_y <- var_info %>% filter(year == yr)
  if (nrow(vars_y) != 5) {
    warning("Year ", yr, " does not have 5 condition columns; skipping.")
    next
  }
  # Select and rename the 5 condition columns to v1..v5
  df_y <- raw_df %>%
    select(geso_code, geso_name, all_of(vars_y$var)) %>%
    rename_with(.fn = ~ vars_y$base, .cols = all_of(vars_y$var))

  # Check we have numeric values
  if (!all(paste0("v", 1:5) %in% names(df_y))) {
    warning("Year ", yr, ": expected v1..v5 after renaming — skipping.")
    next
  }

  # Per-year calibration:
  # - v1 (income-like) min-max per year
  # - v2..v5 percentages -> divide by 100
  # Avoid division by zero (constant columns).
  v1_min <- min(df_y$v1, na.rm = TRUE)
  v1_max <- max(df_y$v1, na.rm = TRUE)
  if (is.infinite(v1_min) || is.infinite(v1_max)) {
    warning("Year ", yr, ": v1 all NA — skipping.")
  }
}
```

```
    next
  }
  if (v1_max - v1_min == 0) {
    # constant column → set calibrated value to 0.5 for that year (neutral), then shift 0.501 later if
    # needed
    df_y <- df_y %>%
      mutate(fz_v1 = 0.5)
  } else {
    df_y <- df_y %>%
      mutate(fz_v1 = (v1 - v1_min) / (v1_max - v1_min))
  }
  # v2..v5 as percentages
  df_y <- df_y %>%
    mutate(
      fz_v2 = v2 / 100,
      fz_v3 = v3 / 100,
      fz_v4 = v4 / 100,
      fz_v5 = v5 / 100
    )
  # Avoid ambiguous 0.5 exactly (shift slightly)
  df_y <- df_y %>%
    mutate(across(starts_with("fz_v"), ~ ifelse(. == 0.5, 0.501, .)))

  # Outcome: 1 - mean of fuzzy conditions (distance to ideal)
  df_y <- df_y %>%
    mutate(fz_mean = rowMeans(across(starts_with("fz_v")), na.rm = TRUE),
      outcome = ifelse(1 - fz_mean == 0.5, 0.501, 1 - fz_mean))
```

```
# Prepare QCA data: remove fz_ prefix for conditions naming

df_qca <- df_y %>%

  select(geso_code, geso_name, starts_with("fz_v"), outcome) %>%

  rename_with(~ sub("^fz_", "", .x), starts_with("fz_v")) %>%

  as.data.frame()


# Save a per-year calibrated CSV (optional, helpful for inspection)

df_qca_export <- df_qca %>%

  mutate(across(where(is.numeric), ~ round(., 2)))


write_csv(df_qca_export, file.path(out_dir, paste0("calibrated_df_", yr, ".csv")))


##6. Necessity analysis: attempt superSubset; fallback to manual
for (cnd in conds) {

  ss_out <- tryCatch({

    capture.output(superSubset(df_qca,

                               outcome = "outcome",

                               conditions = cnd,

                               relation = "necessity",

                               incl.cut = need_cut))

  }, error = function(e) {

    paste("ERROR:", e$message)

  })

  # If superSubset returned a string with "ERROR:" then fallback manual metrics

  parsed <- parse_super_text(ss_out)

  if (all(is.na(parsed$necessity_consistency))) {
```

```
# fallback manual

metrics <- calc_necessity_metrics(df_qca[[cnd]], df_qca$outcome)

necessity_rows[[length(necessity_rows)+1]] <- tibble(

  year = yr, condition = cnd,

  method = "manual",

  raw_output = paste(ss_out, collapse = "\n"),

  necessity_consistency = metrics$consistency,

  necessity_RoN = NA_real_,

  necessity_coverage = metrics$coverage

)

} else {

  necessity_rows[[length(necessity_rows)+1]] <- tibble(

    year = yr, condition = cnd,

    method = "superSubset",

    raw_output = paste(ss_out, collapse = "\n"),

    necessity_consistency = parsed$necessity_consistency,

    necessity_RoN = parsed$necessity_RoN,

    necessity_coverage = parsed$necessity_coverage

  )

}

}

##7. Truth table and minimization (sufficiency)

tt <- tryCatch({

  truthTable(df_qca,

    conditions = conds,

    outcome = "outcome",
```

```
      incl.cut = incl_cut,
      n.cut = n_cut,
      show.cases = FALSE,
      sort.by = "incl")
}, error = function(e) {
  warning("truthTable error for ", yr, ": ", e$message)
  NULL
})

if (is.null(tt)) {
  message("No truth table for year ", yr, " — skipping minimization.")
  year_results[[as.character(yr)] <- list(year=yr, df_qca = df_qca, truthTable = NULL,
minimization = NULL)
  next
}

# Save truth table as csv for inspection
if (!is.null(tt$tt)) {
  tt_export <- as_tibble(tt$tt) %>%
    mutate(across(where(is.numeric), ~ round(., 2)))

  write_csv(tt_export, file.path(out_dir, paste0("truth_table_", yr, ".csv")))
}

minimization <- tryCatch({
  minimize(tt, details = TRUE, show.cases = FALSE)
}, error = function(e) {
  warning("minimize error for ", yr, ": ", e$message)
```

```
NULL

})

# Save minimization details to text
if (!is.null(minimization)) {
  capture.output(minimization, file = file.path(out_dir, paste0("minimization_", yr, ".txt")))
}

# Collect summary info for this year
solution_text <- if (!is.null(minimization$solution)) paste(unlist(minimization$solution), collapse = " | ") else NA_character_
overall_cons <- if (!is.null(minimization$overall)) minimization$overall$incl else NA_real_
overall_cov <- if (!is.null(minimization$overall)) minimization$overall$cov else NA_real_
n_configs <- if (!is.null(minimization$solution)) length(unlist(minimization$solution)) else 0

solutions_summary[[length(solutions_summary)+1]] <- tibble(
  year = yr,
  n_cases = nrow(df_qca),
  n_configs = n_configs,
  overall_consistency = overall_cons,
  overall_coverage = overall_cov,
  solution_text = solution_text
)

# Detailed solution table: extract IC inclusion/coverage if available
if (!is.null(minimization) && !is.null(minimization$IC)) {
  ic_tab <- as.data.frame(minimization$IC$incl.cov)
  if (nrow(ic_tab) > 0) {
```

```
ic_tab$configuration <- rownames(ic_tab)

# rows that match each solution

sols_list <- extract_solutions_list(minimization)

for (sol in sols_list) {

  cfg <- sol$config

  matching_rows <- ic_tab[str_detect(ic_tab$configuration, fixed(cfg)), ]

  if (nrow(matching_rows) == 0) {

    solutions_detailed[[length(solutions_detailed)+1]] <- tibble(

      year = yr,

      solution_type = sol$type,

      configuration = cfg,

      is_real_solution = FALSE,

      solution_consistency = NA_real_,

      solution_PRI = NA_real_,

      solution_coverage = NA_real_,

      solution_unique_coverage = NA_real_

    )

  } else {

    solutions_detailed[[length(solutions_detailed)+1]] <- tibble(

      year = yr,

      solution_type = sol$type,

      configuration = cfg,

      is_real_solution = TRUE,

      solution_consistency = matching_rows$inclS,

      solution_PRI = matching_rows$PRI,

      solution_coverage = matching_rows$covS,

      solution_unique_coverage = matching_rows$covU

    )

  }

}
```

```
)  
}  
  
# token frequency for configs  
tokens <- str_extract_all(cfg, "(~?v[1-5])")[[1]]  
  
if (length(tokens) > 0) {  
  cond_freq_rows <- append(cond_freq_rows, lapply(tokens, function(tok) tibble(year = yr,  
token = tok, configuration = cfg)))  
}  
}  
}  
} else {  
  # still attempt to extract token frequencies from raw solution_text if present  
  if (!is.na(solution_text)) {  
    tokens <- str_extract_all(solution_text, "(~?v[1-5])")[[1]]  
    if (length(tokens) > 0) {  
      cond_freq_rows <- append(cond_freq_rows, lapply(tokens, function(tok) tibble(year = yr,  
token = tok, configuration = solution_text)))  
    }  
  }  
}  
  
##8. Store per-year objects  
  
year_results[[as.character(yr)]] <- list(year = yr, df_qca = df_qca, truthTable = tt, minimization =  
minimization)  
}  
  
##9.Export consolidated results  
  
# NECESSITY
```

```
if (length(necessity_rows) > 0) {  
  necessity_df <- bind_rows(necessity_rows) %>%  
    # Round all numeric variables to 2 decimals  
    mutate(across(where(is.numeric), ~ round(., 2)))  
  
  write_csv(necessity_df, file.path(out_dir, "necessity_metrics_by_year.csv"))  
  
} else {  
  necessity_df <- tibble()  
}  
  
# SUMMARY (SUFFICIENCY GLOBAL)  
if (length(solutions_summary) > 0) {  
  summary_df <- bind_rows(solutions_summary) %>%  
    arrange(year) %>%  
    mutate(across(where(is.numeric), ~ round(., 2)))  
  
  write_csv(summary_df, file.path(out_dir, "qca_solutions_summary_by_year.csv"))  
  
} else {  
  summary_df <- tibble()  
}  
  
# DETAILED SOLUTIONS  
if (length(solutions_detailed) > 0) {  
  detailed_df <- bind_rows(solutions_detailed) %>%  
    mutate(across(where(is.numeric), ~ round(., 2)))  
}
```

```
write_csv(detailed_df, file.path(out_dir, "qca_solutions_detailed_by_year.csv"))
}

# CONDITION FREQUENCY
if (length(cond_freq_rows) > 0) {
  cond_freq_tbl <- bind_rows(cond_freq_rows) %>%
    group_by(year, token) %>%
    summarise(freq = n(), .groups = "drop") %>%
    mutate(across(where(is.numeric), ~ round(., 2)))

  write_csv(cond_freq_tbl, file.path(out_dir, "condition_token_frequency_by_year.csv"))
}

##10. Detect periods & turning points from sufficiency solutions
if (nrow(summary_df) > 0) {

  #Prepare solution labels and sorting
  summary_df <- summary_df %>%

    mutate(solution_label = ifelse(is.na(solution_text), "NO_SOLUTION", solution_text)) %>%
    mutate(solution_label = str_replace_all(solution_label, "\\s+", " ")) %>%
    mutate(solution_label_sorted = map_chr(solution_label, function(txt) {
      parts <- unlist(str_split(txt, "\\s*\\|\\s*"))
      parts <- parts[parts != ""]
      if (length(parts) == 0) return("NO_SOLUTION")
      paste(sort(parts), collapse = " | ")
    })
  }
```

```
    ))) %>%  
    arrange(year)  
  
# Detect periods (groups of identical solutions)  
summary_df <- summary_df %>%  
  mutate(period_id = cumsum(c(1, as.integer(solution_label_sorted[-1] != solution_label_sorted[-  
n()]))))  
  
# Build the periods table  
periods_tbl <- summary_df %>%  
  group_by(period_id, solution_label_sorted) %>%  
  summarise(  
    start_year = min(year),  
    end_year = max(year),  
    n_years = n(),  
    n_cases_mean = mean(n_cases, na.rm = TRUE),  
    .groups = "drop"  
  ) %>%  
  arrange(start_year)  
  
# Turning points  
turning_points <- summary_df %>%  
  arrange(year) %>%  
  mutate(prev_label = lag(solution_label_sorted)) %>%  
  filter(!is.na(prev_label) & prev_label != solution_label_sorted) %>%  
  select(year, prev_label, solution_label_sorted)  
  
# Summary with periods
```

```
summary_df_clean <- summary_df %>%
  mutate(across(where(is.numeric), ~ round(., 2)))
write_csv(summary_df_clean, file.path(out_dir, "qca_summary_with_periods.csv"))

# Periods table
periods_tbl_clean <- periods_tbl %>%
  mutate(across(where(is.numeric), ~ round(., 2)))
write_csv(periods_tbl_clean, file.path(out_dir, "qca_detected_periods.csv"))

# Turning points
turning_points_clean <- turning_points %>%
  mutate(across(where(is.numeric), ~ round(., 2)))
write_csv(turning_points_clean, file.path(out_dir, "qca_turning_points.csv"))

} else {
  periods_tbl <- tibble()
  turning_points <- tibble()
}

##11. Optional visualisations
#Timeline tile plot of solution_label_sorted colored by number of configs (or consistency)
#Save one trajectory plot example (if you want)

if (nrow(summary_df) > 0) {
  timeline_plot <- ggplot(summary_df, aes(x = year, y = 1, label = str_trunc(solution_label_sorted,
60))) +
  geom_tile(aes(fill = n_configs), height = 0.6) +
```

```

geom_text(size = 3) +
scale_y_continuous(NULL, breaks = NULL) +
labs(title = "Timeline of fsQCA solutions (year-by-year)",
      subtitle = "Tile = solution set; number = number of configs (parsed from minimization)",
      x = "Year", fill = "n_configs") +
theme_minimal() +
theme(axis.title.y = element_blank(), axis.text.y = element_blank(), panel.grid = element_blank())
ggsave(file.path(out_dir, "qca_solutions_timeline.png"), timeline_plot, width = 14, height = 4, dpi
= 300)
}

```

14.9. *fsQCA results: necessity*

year	condition	method	necessity_consistency	necessity_RoN	necessity_coverage
1993	v1	manual	0.55	NA	0.62
1993	v2	superSubset	1	0.38	0.65
1993	v3	superSubset	0.96	0.51	0.68
1993	v4	superSubset	0.94	0.43	0.64
1993	v5	manual	0.89	NA	0.73
1994	v1	superSubset	0.91	0.82	0.85
1994	v2	superSubset	1	0.47	0.69
1994	v3	superSubset	0.96	0.46	0.67
1994	v4	superSubset	0.94	0.45	0.66
1994	v5	manual	0.88	NA	0.74
1995	v1	manual	0.53	NA	0.59
1995	v2	superSubset	1	0.49	0.69

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1995	v3	superSubset	0.97	0.44	0.65
1995	v4	superSubset	0.93	0.45	0.64
1995	v5	manual	0.87	NA	0.72
1996	v1	manual	0.52	NA	0.61
1996	v2	superSubset	1	0.51	0.71
1996	v3	superSubset	0.97	0.44	0.66
1996	v4	superSubset	0.91	0.48	0.65
1996	v5	manual	0.86	NA	0.73
1997	v1	manual	0.56	NA	0.59
1997	v2	superSubset	1	0.52	0.7
1997	v3	superSubset	0.97	0.44	0.65
1997	v4	superSubset	0.9	0.46	0.63
1997	v5	manual	0.85	NA	0.71
1998	v1	manual	0.53	NA	0.58
1998	v2	superSubset	1	0.52	0.7
1998	v3	superSubset	0.97	0.45	0.66
1998	v4	manual	0.9	NA	0.64
1998	v5	manual	0.86	NA	0.71
1999	v1	manual	0.54	NA	0.57
1999	v2	superSubset	1	0.51	0.68
1999	v3	superSubset	0.98	0.52	0.67
1999	v4	superSubset	0.94	0.38	0.6
1999	v5	manual	0.86	NA	0.68
2000	v1	manual	0.52	NA	0.57

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2000	v2	superSubset	1	0.57	0.71
2000	v3	superSubset	0.98	0.46	0.65
2000	v4	superSubset	0.94	0.4	0.61
2000	v5	manual	0.88	NA	0.69
2001	v1	manual	0.49	NA	0.58
2001	v2	superSubset	1	0.6	0.73
2001	v3	superSubset	0.98	0.44	0.65
2001	v4	superSubset	0.93	0.42	0.62
2001	v5	manual	0.89	NA	0.7
2002	v1	superSubset	0.92	0.79	0.81
2002	v2	superSubset	0.99	0.63	0.74
2002	v3	superSubset	0.98	0.46	0.66
2002	v4	superSubset	0.93	0.43	0.62
2002	v5	superSubset	0.9	0.62	0.7
2003	v1	superSubset	0.93	0.76	0.8
2003	v2	superSubset	1	0.64	0.76
2003	v3	superSubset	0.98	0.47	0.67
2003	v4	superSubset	0.92	0.44	0.64
2003	v5	manual	0.88	NA	0.72
2004	v1	superSubset	0.92	0.81	0.83
2004	v2	superSubset	0.98	0.69	0.77
2004	v3	superSubset	0.98	0.44	0.65
2004	v4	superSubset	0.92	0.45	0.63
2004	v5	manual	0.88	NA	0.71

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2005	v1	manual	0.47	NA	0.58
2005	v2	superSubset	0.98	0.7	0.78
2005	v3	superSubset	0.98	0.42	0.64
2005	v4	superSubset	0.92	0.47	0.64
2005	v5	manual	0.87	NA	0.71
2006	v1	superSubset	0.91	0.8	0.82
2006	v2	superSubset	0.98	0.72	0.79
2006	v3	superSubset	0.97	0.46	0.65
2006	v4	superSubset	0.92	0.48	0.63
2006	v5	manual	0.87	NA	0.69
2007	v1	manual	0.63	NA	0.71
2007	v2	superSubset	0.99	0.78	0.83
2007	v3	superSubset	0.94	0.43	0.64
2007	v4	manual	0.82	NA	0.66
2007	v5	manual	0.87	NA	0.71
2008	v1	manual	0.66	NA	0.67
2008	v2	superSubset	0.98	0.78	0.82
2008	v3	superSubset	0.95	0.43	0.63
2008	v4	manual	0.8	NA	0.63
2008	v5	manual	0.86	NA	0.7
2009	v1	manual	0.65	NA	0.66
2009	v2	superSubset	0.98	0.8	0.84
2009	v3	superSubset	0.94	0.43	0.63
2009	v4	manual	0.81	NA	0.66

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2009	v5	manual	0.83	NA	0.72
2010	v1	manual	0.64	NA	0.67
2010	v2	superSubset	0.97	0.82	0.86
2010	v3	superSubset	0.95	0.44	0.65
2010	v4	manual	0.75	NA	0.67
2010	v5	manual	0.83	NA	0.72
2011	v1	manual	0.63	NA	0.67
2011	v2	superSubset	0.97	0.84	0.86
2011	v3	superSubset	0.95	0.43	0.64
2011	v4	manual	0.8	NA	0.69
2011	v5	manual	0.85	NA	0.71
2012	v1	manual	0.62	NA	0.67
2012	v2	superSubset	0.97	0.85	0.88
2012	v3	superSubset	0.95	0.44	0.64
2012	v4	manual	0.78	NA	0.69
2012	v5	manual	0.84	NA	0.71
2013	v1	manual	0.63	NA	0.67
2013	v2	superSubset	0.96	0.85	0.87
2013	v3	superSubset	0.95	0.43	0.63
2013	v4	manual	0.79	NA	0.66
2013	v5	manual	0.85	NA	0.7
2014	v1	manual	0.61	NA	0.66
2014	v2	superSubset	0.95	0.87	0.89
2014	v3	superSubset	0.95	0.42	0.64

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2014	v4	manual	0.73	NA	0.69
2014	v5	manual	0.84	NA	0.7
2015	v1	manual	0.6	NA	0.66
2015	v2	superSubset	0.96	0.88	0.89
2015	v3	superSubset	0.95	0.41	0.64
2015	v4	manual	0.73	NA	0.68
2015	v5	manual	0.85	NA	0.7
2016	v1	manual	0.6	NA	0.66
2016	v2	superSubset	0.95	0.87	0.89
2016	v3	superSubset	0.95	0.42	0.63
2016	v4	manual	0.72	NA	0.66
2016	v5	manual	0.86	NA	0.68
2017	v1	manual	0.59	NA	0.67
2017	v2	superSubset	0.96	0.88	0.9
2017	v3	superSubset	0.96	0.4	0.62
2017	v4	manual	0.81	NA	0.66
2017	v5	manual	0.88	NA	0.68
2018	v1	manual	0.59	NA	0.69
2018	v2	superSubset	0.94	0.89	0.9
2018	v3	superSubset	0.96	0.41	0.63
2018	v4	manual	0.81	NA	0.72
2018	v5	manual	0.89	NA	0.7
2019	v1	manual	0.59	NA	0.69
2019	v2	superSubset	0.93	0.9	0.91

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2019	v3	superSubset	0.96	0.4	0.64
2019	v4	manual	0.71	NA	0.74
2019	v5	manual	0.89	NA	0.71
2020	v1	manual	0.6	NA	0.67
2020	v2	superSubset	0.94	0.91	0.92
2020	v3	superSubset	0.95	0.39	0.62
2020	v4	manual	0.7	NA	0.68
2020	v5	manual	0.88	NA	0.7
2021	v1	manual	0.57	NA	0.64
2021	v2	superSubset	0.93	0.92	0.92
2021	v3	superSubset	0.96	0.39	0.62
2021	v4	manual	0.71	NA	0.69
2021	v5	superSubset	0.91	0.6	0.69
2022	v1	manual	0.6	NA	0.67
2022	v2	superSubset	0.92	0.92	0.91
2022	v3	superSubset	0.96	0.37	0.61
2022	v4	manual	0.76	NA	0.69
2022	v5	superSubset	0.95	0.51	0.66
2023	v1	manual	0.62	NA	0.67
2023	v2	superSubset	0.92	0.93	0.93
2023	v3	superSubset	0.96	0.37	0.61
2023	v4	manual	0.76	NA	0.74
2023	v5	superSubset	0.96	0.51	0.66

14.10. fsQCA results: periods

period_id	solution_label_sorted	start_year	end_year	n_years	n_cases_mean
1	~v1*~v2*~v3*~v5 ~v2*~v3*v4*v5	1993	1997	5	14
2	~v1*~v2*~v3*~v4*~v5 ~v2*~v3*v4*v5	1998	1998	1	14
3	~v1*~v2*~v3*~v5 ~v1*~v2*v4*v5 ~v2*~v3*v4*v5	1999	1999	1	14
4	~v1*~v2*~v3*~v5 ~v2*~v3*v4*v5	2000	2001	2	14
5	~v1*~v2*~v3*~v4*~v5 ~v1*~v3*v4*v5 ~v2*~v3*v4*v5	2002	2002	1	14
6	~v1*~v2*~v3*~v5 ~v2*~v3*v4*v5	2003	2003	1	14
7	~v1*~v2*~v3*~v5 ~v3*v4*v5	2004	2005	2	14
8	~v1*~v2*~v3*~v4*~v5 ~v3*v4*v5	2006	2006	1	14
9	~v1*~v2*~v3*~v4 ~v2*v4*v5 v1*~v3*v4*v5	2007	2007	1	14
10	~v1*~v2*~v3 ~v1*~v2*v4*v5 v1*~v3*v4*v5	2008	2008	1	14
11	~v1*~v2*~v3*~v5 ~v1*~v2*v4*v5 ~v3*v4*v5	2009	2009	1	14
12	~v1*~v2*~v3*~v4*~v5 ~v1*~v2*v4*v5 ~v3*v4*v5	2010	2010	1	14
13	~v1*~v2*~v3 ~v2*v4*v5 ~v3*v4*v5	2011	2011	1	14
14	~v1*~v2*~v3*~v4*~v5 ~v2*v4*v5 ~v3*v4*v5	2012	2012	1	14
15	~v1*~v2*~v3*~v4 ~v2*v4*v5 ~v3*v4*v5 v1*v4*v5	2013	2014	2	14
16	~v1*~v2*~v3*~v4 ~v1*~v2*~v3*~v4 ~v1*~v2*v4*v5 ~v1*~v3*v4*v5 ~v2*v3*v4*v5 v1*v2*v4*v5 v1*v3*v4*v5 v2*~v3*v4*v5	2015	2018	4	14
17	~v1*~v2*~v3*~v4 ~v1*~v2*v4*v5 ~v3*v4*v5 v1*v2*v4*v5	2019	2020	2	14
18	~v1*~v2*~v3*v5 ~v1*~v2*~v3*v5 ~v1*~v2*v4*v5 ~v1*~v2*v4*v5 ~v1*~v3*v4*v5 v1*v2*v4*v5 v1*v2*v4*v5 v2*~v3*v4*v5	2021	2022	2	14
19	~v1*~v2*~v3*v5 ~v1*~v2*v4*v5 ~v3*v4*v5 v1*v2*v4*v5	2023	2023	1	14

14.11. fsQCA results: turning points

year	prev_label	solution_label_sorted
1998	$\sim v1^* \sim v2^* \sim v3^* \sim v5 \mid \sim v2^* \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5 \mid \sim v2^* \sim v3^* v4^* v5$
1999	$\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5 \mid \sim v2^* \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v5 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v2^* \sim v3^* v4^* v5$
2000	$\sim v1^* \sim v2^* \sim v3^* \sim v5 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v2^* \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v5 \mid \sim v2^* \sim v3^* v4^* v5$
2002	$\sim v1^* \sim v2^* \sim v3^* \sim v5 \mid \sim v2^* \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5 \mid \sim v1^* \sim v3^* v4^* v5 \mid \sim v2^* \sim v3^* v4^* v5$
2003	$\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5 \mid \sim v1^* \sim v3^* v4^* v5 \mid \sim v2^* \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v5 \mid \sim v2^* \sim v3^* v4^* v5$
2004	$\sim v1^* \sim v2^* \sim v3^* \sim v5 \mid \sim v2^* \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v5 \mid \sim v3^* v4^* v5$
2006	$\sim v1^* \sim v2^* \sim v3^* \sim v5 \mid \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5 \mid \sim v3^* v4^* v5$
2007	$\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5 \mid \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v4 \mid \sim v2^* v4^* v5 \mid v1^* \sim v3^* v4^* v5$
2008	$\sim v1^* \sim v2^* \sim v3^* \sim v4 \mid \sim v2^* v4^* v5 \mid v1^* \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3 \mid \sim v1^* \sim v2^* v4^* v5 \mid v1^* \sim v3^* v4^* v5$
2009	$\sim v1^* \sim v2^* \sim v3 \mid \sim v1^* \sim v2^* v4^* v5 \mid v1^* \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v5 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5$
2010	$\sim v1^* \sim v2^* \sim v3^* \sim v5 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5$
2011	$\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3 \mid \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5$
2012	$\sim v1^* \sim v2^* \sim v3 \mid \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5 \mid \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5$
2013	$\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5 \mid \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v4 \mid \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5 \mid v1^* v4^* v5$
2015	$\sim v1^* \sim v2^* \sim v3^* \sim v4 \mid \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5 \mid v1^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v4 \mid \sim v1^* \sim v2^* \sim v3^* \sim v4 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v1^* \sim v3^* v4^* v5 \mid \sim v2^* v3^* v4^* v5 \mid v1^* v2^* v4^* v5 \mid v1^* v3^* v4^* v5 \mid v2^* \sim v3^* v4^* v5$
2019	$\sim v1^* \sim v2^* \sim v3^* \sim v4 \mid \sim v1^* \sim v2^* \sim v3^* \sim v4 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v1^* \sim v3^* v4^* v5 \mid \sim v2^* v3^* v4^* v5 \mid v1^* v2^* v4^* v5 \mid v1^* v3^* v4^* v5 \mid v2^* \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* \sim v4 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5 \mid v1^* v2^* v4^* v5$
2021	$\sim v1^* \sim v2^* \sim v3^* \sim v4 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5 \mid v1^* v2^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* v5 \mid \sim v1^* \sim v2^* \sim v3^* v5 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v1^* \sim v3^* v4^* v5 \mid v1^* v2^* v4^* v5 \mid v1^* v2^* v4^* v5 \mid v2^* \sim v3^* v4^* v5$
2023	$\sim v1^* \sim v2^* \sim v3^* v5 \mid \sim v1^* \sim v2^* \sim v3^* v5 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v1^* \sim v3^* v4^* v5 \mid v1^* v2^* v4^* v5 \mid v1^* v2^* v4^* v5 \mid v2^* \sim v3^* v4^* v5$	$\sim v1^* \sim v2^* \sim v3^* v5 \mid \sim v1^* \sim v2^* v4^* v5 \mid \sim v3^* v4^* v5 \mid v1^* v2^* v4^* v5$

14.12. fsQCA results: solutions detailed by year

year	solution_type	configuration	is_real_soluti on	solution_cons istency	solution_PRI	solution_cove rage	solution_uniq ue_coverage
1993	complex	~v1*~v2*~v3*~ v5	TRUE	1	1	0.57	0.04
1993	complex	~v2*~v3*v4*v5	TRUE	0.92	0.76	0.85	0.31
1994	complex	~v1*~v2*~v3*~ v5	TRUE	1	1	0.61	0.04
1994	complex	~v2*~v3*v4*v5	TRUE	0.91	0.73	0.84	0.28
1995	complex	~v1*~v2*~v3*~ v5	TRUE	1	1	0.59	0.05
1995	complex	~v2*~v3*v4*v5	TRUE	0.89	0.68	0.84	0.3
1996	complex	~v1*~v2*~v3*~ v5	TRUE	1	1	0.6	0.06
1996	complex	~v2*~v3*v4*v5	TRUE	0.9	0.7	0.83	0.29
1997	complex	~v1*~v2*~v3*~ v5	TRUE	1	1	0.59	0.06
1997	complex	~v2*~v3*v4*v5	TRUE	0.88	0.64	0.82	0.3
1998	complex	~v2*~v3*v4*v5	TRUE	0.89	0.68	0.83	0.45
1998	complex	~v1*~v2*~v3*~ v4*~v5	TRUE	1	1	0.43	0.05
1999	complex	~v1*~v2*~v3*~ v5	TRUE	1	1	0.6	0.06
1999	complex	~v1*~v2*v4*v5	TRUE	0.95	0.84	0.72	0
1999	complex	~v2*~v3*v4*v5	TRUE	0.91	0.67	0.84	0.12
2000	complex	~v1*~v2*~v3*~ v5	TRUE	1	1	0.59	0.05
2000	complex	~v2*~v3*v4*v5	TRUE	0.89	0.66	0.86	0.32
2001	complex	~v1*~v2*~v3*~ v5	TRUE	1	1	0.59	0.04
2001	complex	~v2*~v3*v4*v5	TRUE	0.89	0.66	0.86	0.31
2002	complex	~v1*~v3*v4*v5	TRUE	0.93	0.79	0.81	0.01
2002	complex	~v2*~v3*v4*v5	TRUE	0.92	0.74	0.87	0.06
2002	complex	~v1*~v2*~v3*~ v4*~v5	TRUE	1	1	0.41	0.03
2003	complex	~v1*~v2*~v3*~ v5	TRUE	1	1	0.62	0.04
2003	complex	~v2*~v3*v4*v5	TRUE	0.94	0.8	0.86	0.28
2004	complex	~v3*v4*v5	TRUE	0.85	0.58	0.85	0.27
2004	complex	~v1*~v2*~v3*~ v5	TRUE	1	1	0.63	0.05
2005	complex	~v3*v4*v5	TRUE	0.84	0.55	0.84	0.27
2005	complex	~v1*~v2*~v3*~ v5	TRUE	1	1	0.62	0.04
2006	complex	~v3*v4*v5	TRUE	0.85	0.57	0.85	0.41
2006	complex	~v1*~v2*~v3*~ v4*~v5	TRUE	1	1	0.47	0.03
2007	complex	~v2*v4*v5	TRUE	0.82	0.4	0.81	0.1

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2007	complex	$\sim v1^* \sim v2^* \sim v3^* \sim v4$	TRUE	1	1	0.59	0.11
2007	complex	$v1^* \sim v3^* v4^* v5$	TRUE	0.82	0.1	0.57	0
2008	complex	$\sim v1^* \sim v2^* \sim v3$	TRUE	0.97	0.91	0.79	0.2
2008	complex	$\sim v1^* \sim v2^* v4^* v5$	TRUE	0.96	0.7	0.64	0.05
2008	complex	$v1^* \sim v3^* v4^* v5$	TRUE	0.81	0.08	0.6	0.14
2009	complex	$\sim v3^* v4^* v5$	TRUE	0.82	0.41	0.74	0.16
2009	complex	$\sim v1^* \sim v2^* \sim v3^* \sim v5$	TRUE	1	1	0.62	0.11
2009	complex	$\sim v1^* \sim v2^* v4^* v5$	TRUE	0.96	0.78	0.63	0.06
2010	complex	$\sim v3^* v4^* v5$	TRUE	0.82	0.38	0.7	0.17
2010	complex	$\sim v1^* \sim v2^* v4^* v5$	TRUE	0.95	0.65	0.59	0.05
2010	complex	$\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5$	TRUE	1	1	0.6	0.14
2011	complex	$\sim v1^* \sim v2^* \sim v3$	TRUE	0.98	0.95	0.77	0.21
2011	complex	$\sim v2^* v4^* v5$	TRUE	0.85	0.4	0.76	0.05
2011	complex	$\sim v3^* v4^* v5$	TRUE	0.82	0.38	0.72	0.02
2012	complex	$\sim v2^* v4^* v5$	TRUE	0.86	0.45	0.76	0.05
2012	complex	$\sim v3^* v4^* v5$	TRUE	0.83	0.43	0.73	0.02
2012	complex	$\sim v1^* \sim v2^* \sim v3^* \sim v4^* \sim v5$	TRUE	1	1	0.59	0.11
2013	complex	$v1^* v4^* v5$	TRUE	0.72	0.06	0.63	0
2013	complex	$\sim v2^* v4^* v5$	TRUE	0.85	0.37	0.75	0
2013	complex	$\sim v3^* v4^* v5$	TRUE	0.8	0.33	0.72	0.02
2013	complex	$\sim v1^* \sim v2^* \sim v3^* \sim v4$	TRUE	1	1	0.64	0.19
2014	complex	$v1^* v4^* v5$	TRUE	0.72	0.06	0.61	0
2014	complex	$\sim v2^* v4^* v5$	TRUE	0.86	0.35	0.71	0
2014	complex	$\sim v3^* v4^* v5$	TRUE	0.81	0.34	0.68	0.02
2014	complex	$\sim v1^* \sim v2^* \sim v3^* \sim v4$	TRUE	1	1	0.7	0.24
2019	complex	$\sim v3^* v4^* v5$	TRUE	0.85	0.33	0.67	0.02
2019	complex	$\sim v1^* \sim v2^* \sim v3^* \sim v4$	TRUE	1	1	0.73	0.25
2019	complex	$\sim v1^* \sim v2^* v4^* v5$	TRUE	0.93	0.45	0.58	0.01
2019	complex	$v1^* v2^* v4^* v5$	TRUE	0.83	0.01	0.58	0
2020	complex	$\sim v3^* v4^* v5$	TRUE	0.79	0.21	0.65	0.02
2020	complex	$\sim v1^* \sim v2^* \sim v3^* \sim v4$	TRUE	1	1	0.67	0.25
2020	complex	$\sim v1^* \sim v2^* v4^* v5$	TRUE	0.94	0.41	0.56	0.01
2020	complex	$v1^* v2^* v4^* v5$	TRUE	0.8	0	0.59	0
2023	complex	$\sim v3^* v4^* v5$	TRUE	0.8	0.28	0.72	0.04
2023	complex	$\sim v1^* \sim v2^* \sim v3^* v5$	TRUE	0.99	0.95	0.74	0.17
2023	complex	$\sim v1^* \sim v2^* v4^* v5$	TRUE	0.96	0.63	0.61	0.01
2023	complex	$v1^* v2^* v4^* v5$	TRUE	0.78	0.01	0.61	0

