Immigration, Ethnic Diversity and Political Outcomes:

Evidence from Denmark

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This version:
April 2014

First version:
December 2010

Abstract

I study the impact of immigration and increasing ethnic diversity on political outcomes in immigrant-receiving countries, focusing on immigration and election outcomes in Danish municipalities 1981-2001. A rich set of control variables isolates ethnic diversity effects from those of other immigrant characteristics and a novel IV strategy based on historical housing stock data addresses issues of endogenous location choices of immigrants. Increases in local ethnic diversity lead to right-ward shifts in election outcomes by shifting electoral support away from traditional "big government" left-wing parties and towards anti-immigrant nationalist parties in particular. These effects appear in both local and national elections.

This paper studies the impact of immigration and ethnic diversity on political outcomes. Both anecdotal evidence and existing work on ethnic diversity offer good reasons to expect that the arrival of immigrants and the associated increases in ethnic diversity may have a causal effect on politics. Perhaps the most striking piece of anecdotal evidence comes from recent European history: While immigration flows into Europe have risen dramatically over the last 30 years leading to large increases in ethnic diversity, European politics is viewed by many to to have taken a systematic rightward turn, fueled in large part by increased success of many anti-immigrant nationalist parties.[1] Beyond anecdote, much existing work in economics have already documented a cross-sectional relationship between ethnic diversity and political preferences as well as political outcomes.

This paper asks whether there are causal underpinnings to the European phenomenon described above, that is, whether the mere presence of immigrants has a causal effect on political leanings in immigrant-receiving countries. In particular I examine whether immigration-driven increases in ethnic diversity have systematic effects on overall left-right politics and whether they lead to increased success for anti-immigrant nationalist parties. If increasing ethnic diversity alters the political balance between the "big government" left wing and "small government" right wing, immigration may have important, indirect public finance implications by systematically impacting the level of redistribution or public spending. If immigration by itself also causes a surge in nationalism this may put an upper bound on the amount of immigration that is feasible before anti-immigration sentiments begin to dominate politically.

I examine the specific case of Danish election outcomes and immigration in Danish municipalities 1981-2001. The Danish immigration experience over the last 30 years is very similar to that of the rest of Europe. In 1981, the yearly net migration to Denmark from non-Western countries was just over 1,000 per year. Twenty years later, in 2001, this number had increased more than tenfold to 11,000, resulting in a corresponding increase in the stock of non-Western immigrants in Denmark from 55,000 to 269,000 - almost a fivefold increase in just 20 years. The increased immigration flows were not distributed evenly, however, resulting in very significant variation in the growth of ethnic diversity. While some municipalities experienced increases in the share of immigrants in the population of well over ten percentage points, others experienced essentially no

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[1]See for example "Continent Of Fear: The Rise Of Europe's Right-Wing Populists", *Der Spiegel*, September 28 2010.

change at all. Combined with the high-level of political autonomy of Danish municipalities, this makes the Danish setting well-suited for examining the ethnic diversity effects of immigration on political outcomes.

I present results from regressions of changes in election outcomes on changes in the immigrant share in the municipality and focus on changes in the success of the traditional "big government" left-wing parties as well as the the particular success of right-wing, anti-immigrant nationalists. In addition to controlling for time-invariant municipality attributes through first-differencing, I employ a rich set of controls to isolate the effects of ethnic diversity. In particular, a set of socioeconomic controls addresses the possibility that immigration affects political preferences simply because immigrants and refugees are poorer or because they adversely affect local labor market conditions.

Empirical studies of immigration have obvious endogeneity concerns, given that immigrants themselves choose where to live. To address this I develop a novel IV strategy based on the following two features of the Danish context: 1) Due to a law that constrains foreigners ability to purchase real estate, the availability of rental housing is a particularly strong predictor of where immigrants choose to locate in Denmark. 2) Historical data on the composition of the housing stock is available at the municipal level. Since highrises are much more likely to serve as rental housing and since the composition of the housing stock is very persistent over time, I therefore use the share of the 1970 housing stock comprised by highrises as an instrument for later immigration flows. The underlying identifying assumption is that the characteristics of the 1970 housing stock have no direct effect on changes in election outcomes between 1981-2001 conditional on appropriate controls.

The main IV results confirm that immigration-driven increases in ethnic diversity have a causal impact on political outcomes. In particular, higher ethnic diversity decreases political support for traditional left-wing parties in municipal elections and increases support for nationalist parties: a one percentage point increase in the share of immigrants decreases the percentage of left-wing seats on the municipal board by between 2.2 and 3.6 percentage points and increases the percentage of nationalist seats by between 0.9 and 2.0 percentage points. Increases in ethnic diversity thus shifts overall political power towards the right-wing block and towards anti-immigrant parties in particular. The same pattern of effects appear for national elections, although the results regarding

nationalist voting are somewhat weaker here. Given the very different political issues decided at the two levels of government, this similarity could suggest that the effects of ethnic diversity are related to an overall shift in preferences or "ideology" and are not driven by particular political issues. Finally, a comparison of IV and OLS estimates suggests that endogenous location choice of immigrants causes an overall pro-left bias in OLS estimates. This is consistent with existing evidence on immigrant location choice in Denmark.

This paper is directly related to existing work in economics that establishes a cross-sectional relationship between ethnic diversity, political attitudes and political outcomes. Luttmer (2001) and Senik et al. (2009), for example, find evidence that support for welfare spending is negatively related to local ethnic diversity in both the US General Social Survey and the European Social Survey. A negative cross-sectional relationship between ethnic diversity and the level of public spending or public goods have also been found by several authors both at the country level (Easterly and Levine (1997), Easterly (2001), Alesina et al. (2001), Alesina et al. (2003) and Lassen (2007)) within developing countries (Miguel and Gugerty (2005), Banerjee et al. (2005) and Okten and Osili (2004)) and within developed countries (Alesina et al. (1999) and Vigdor (2004)). If these cross-sectional relationships are taken to be causal, it seems natural to expect that the current level of international migration will affect political outcomes through its effect on ethnic diversity. At the same time, however, it has also been pointed out that such a simple extrapolation may be invalid and that modern institutions, such as democratic participation of minorities, may mitigate ethnic differences between natives and newly arrived immigrants (Easterly (2001) and Alesina and La Ferrara (2005)).

In contrast to the large body of cross-sectional evidence, relatively few papers directly examine the effects of immigration and changing ethnic diversity. Albeit not focusing specifically on ethnic diversity, Razin et al. (2002) and Mayr and Böheim (2005) both find negative effects of immigration on the size of the public sector using panels of countries. Neither paper is able to fully address the issue of immigrant location choice, however. More narrowly focused on ethnic diversity is Zwane and Sunding (2006) which looks at the effect of immigration on the size of the public sector in California and uses an IV-strategy based on the Immigration Reform and Control Act. They find a negative effect of immigration on various measures of public spending, however, the employed

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instrument is plagued by a weak first stage.[2]

Closest to the work presented here are recent papers by Gerdes and Wadensjö (2010) and Gerdes (2011) as well as concurrent work by Dahlberg et al. (2012). Like the present paper, Gerdes and Wadensjö (2010) and Gerdes (2011) focus on Danish municipalities and examine the effect of immigration on political outcomes. Their empirical strategy differs fundamentally from that of the current paper, however, since they assume that the number of immigrants in a municipality is exogenuous (conditional on controls) due to a refugee placement policy that aimed to secure an equal division of refugees across municipalities. Besides the possibility of political discretion in the implementation of the policy, their empirical strategy is particularly vulnerable to the endogenous relocation choices of immigrants not covered by the placement policy. Since many refugees indeed choose to relocate after their initial placement[3] and since non-refugee immigrants in Denmark are unaffected by the placement policy altogether, this may explain why they fail to find the systematic effects of immigration on left-right politics that I find in the present paper.[4]

The concurrent work by Dahlberg et al. (2012) focuses instead on Swedish municipalities and employ survey data regarding preferences for redistribution. Their empirical strategy also relies on a refugee placement policy but circumvents the issue of relocation by immigrants not covered by the policy by using a measure of the actual number of placed refugees as an instrument. In line with the present papers results regarding left-wing political support, Dahlberg et al. (2012) find that ethnic diversity lowers self-reported support for redistributive policies. Some questions have been raised, however, regarding the possibility of political discretion in the implementation of the placement policy in Sweden, as well as the appropriateness of the employed measure of placed refugees (Nekby and Pettersson-Lidbom (2012) but see also the response by Dahlberg et al. (2013)). The present paper complements the results in Dahlberg et al. (2012) both by showing the effect of immigration on actual voting outcomes and by showing corroborating results

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[2]Since the initial circulation of the present paper, Halla et al. (2013) and Otto and Steinhardt (2014) has added to the evidence regarding the effects of immigration on political outcomes and elections in particular. To deal with the location choice of new immigrants, their work relies on an IV strategy based on the settlement patterns of prior immigrants. In line with the present paper's results for Denmark, they document a positive effect of immigration on electoral support for anti-immigrant parties across communities in Austria and within the city of Hamburg.

[3]Damm (2009) reports that already three years after initial placement under the program 30% of refugees have moved to a new location.

[4]Gerdes and Wadensjö (2010) find a positive effect of ethnic diversity on voting for anti-immigrant nationalist but mixed results for other parties groups leading them to conclude that immigration does not lead to any general change in the electoral success of left-wing vs. right-wing parties. The OLS results in the present paper replicate these findings, although as I discuss later these are likely biased by immigrant location choice.

regarding the effects of ethnic diversity using a different empirical strategy.[5]

The layout of the rest of this paper is as follows: Section 1 presents the details of the institutional setting, section 2 presents the data and discusses the empirical strategy, section 3 present the empirical results regarding the effect of ethnic diversity on election outcomes and section 4 concludes.

1 Institutional details of the Danish setting

A few specific features of the Danish context will be important for the empirical analysis: 1) Knowledge of the political landscape will help in interpreting the election results and 2) understanding the sources of variation in migration and ethnic diversity across municipalities is crucial for assessing the identification assumptions. This section gives a brief overview of these features of the Danish context.

1.1 The Danish political landscape

At the national level, the Danish political system is a unicameral parliamentary system. Parliamentary elections are held at the discretion of the government but at least every four years. As is typical in many European countries, Denmark has a multitude of political parties and minority coalition governments are the norm, with power held by a stable group of several smaller parties. There are two very stable groups that either form governments together or act as supporting parties for minority governments: a left-wing "big-government" group led by the social democratic party (*Socialdemokraterne*) and a right-wing "small-government"[6] group, currently led by the free-market liberals (*Venstre*).

At the municipal level, each municipality is governed by a municipal board of varying size, which is chosen in a direct election every four years. Due to the high level of political autonomy of Danish municipalities, the municipal boards wield considerable power. They are, for example, to a large extent in charge of both the level of and nature of spending in local public schools. Correspondingly, they also control the level of the municipal property and income taxes which

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[5]In particular, the empirical strategy in the present paper does not rely on the exogeneity of refugee placement policies.

[6]Here and throughout the paper, terms such as "left", "right", "big-government" and "small-government" are used relative to Danish political spectrum, which is obviously very leftist compared to many other countries.

fund the majority of local public expenditures. While only Danish citizens can vote in the national parliamentary elections, non-nationalized immigrants and refugees can also vote in municipal elections after being in Denmark for 2-3 years. They generally have low turnout however (see for example Togeby (1999)).

Overall, municipal politics mirror those at the national level. While local party lists do field candidates and win seats in some areas, the majority of seats are won by the parties that are also active at the national level. Some deviations between the local and national political platform do exist for these parties,[7] however, the political platform of the national party remains a good approximation of the political position of the local branch. In particular, the picture of one "big government" left-wing group and one "small government" right-wing group generally continues to hold at the municipal level. Motivated by the existing evidence ethnic diversity and preferences for public spending and redistribution, the first part of the empirical analysis in section 3 examines how the relative success of these two groups changes in response to immigration.

The second part of my empirical analysis concerns the effect of immigration on the political success of the right-wing nationalist parties in particular. Similar to many other European countries, an anti-immigrant nationalist movement has gained strength in Denmark over the last 30 years. The anti-immigrant movement in Denmark originated with *Fremskridtspartiet* ("The Progress Party"), which entered the Danish parliament for the first time following the 1973 election. While initially an anti-tax movement, anti-immigrant sentiments soon became a central element of their political platform, especially as immigration became a bigger political issue in Denmark during the 1980s. In 1996, four of *Fremskridtspartiet*'s eleven MPs split-off from the party to form *Dansk Folkeparti* ("The Danish People's Party"). This quickly became the dominant anti-immigrant party, cannibalizing the support of *Fremskridtspartiet*, which disappeared completely from the national parliament already in 1999.

Dansk Folkeparti maintained *Fremskridtspartiet*'s anti-immigrant sentiments as a central element and was initially viewed as almost an exact copy of its predecessor party. Given the focus of the present paper, however, it is interesting to note that *Dansk Folkeparti* has since taken up a very

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[7]For the present paper, a particularly relevant example of this is the very clear anti-immigrant sentiments expressed by many social-democrats in the municipalities surrounding Copenhagen in the early 1990s, which raise some concerns about blindly identifying local party positions with that of the national parties. In the empirical analysis I provide some additional results from national elections to examine whether any of the results in the paper are related to idiosyncratic differences in local party platforms in the municipalities.

different rhetoric regarding the size of the public sector and has to some extent actually branded themselves as pro-government. At the same time, however, it has continued to act unequivocally as part of the right-wing political group and was the main supporting party for the right-wing coalition government that served between 2001 and 2011. While it is thus clear that increased nationalist success implies a tilting of political power towards the right-wing block, some caution is warranted in simply equating this with a change in political attitudes towards less support for the public sector.[8]

1.2 Sources of variation in immigration and ethnic diversity

The Danish immigration experience is very similar to that of other European countries. Large-scale immigration from non-western countries was encouraged and took off in the late 1960s in response to strong economic growth and a shortage of labor. Following the economic slowdown in the 1970s, however, immigration rules were quickly tightened. Since 1973 Denmark has thus had an "immigration stop" policy in effect, which as a rule of thumb has prevented new immigration. However, three channels have continued the migration-driven increase in ethnic diversity over the period 1981-2001: 1) Higher fertility among existing immigrants, 2) the possibility for existing immigrants to bring family members to Denmark under reunification rules[9] and 3) increasing refugee flows.

The main determinant of where new (second-generation) immigrants from the fertility and reunification channel locate will obviously be the existing stock of immigrants, since children and spouses tend to live with their parents and spouses. For refugees, Damm (2009) has studied their location choice in detail. Her results show that refugees move *away* from areas:

1. With few other immigrants or refugees

2. That are rural

3. With high unemployment

4. Without institutions for qualifying education

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[8]In particular, it has been argued that increased support for anti-immigrant policies may indirectly lead to more right-wing economic policies even if people's attitudes towards the public sector are unchanged. This is what Roemer and der Straeten (2006) term a "policy bundling" effect.

[9]Since many of the families being reunified are newly formed families, the English term *re*unification is something of a misnomer.

5. That is dominated by the right-wing politically.

6. With little rental (and social) housing

These findings have several implications for the empirical analysis in the present paper: The first point implies that (as with the fertility and reunification channel) the existing stock of immigrants and refugees should be an important predictor of later inflows and thus might be an important control in the empirical analysis because initial settlement patterns of immigrants could be proxying for a host of possible confounders. Similarly points two and three suggest two additional controls for the empirical analysis.

Points four and five imply that reverse causality can be an issue in the empirical analysis if refugees are likely to move away from areas cutting back on educational efforts or, even more worryingly, move directly in response to changes the political climate. The IV strategy developed below will be key in assessing and addressing potential reverse causality concerns.

Finally, point six shows the strong dependence on rental housing among refugees and other immigrants in Denmark. In addition to immigrants and refugees potentially having less existing savings and/or less access to credit, this dependence reflects the institutional constraints on real estate purchases for foreigners in Denmark. In particular, non-EU foreigners who have not previously resided in Denmark for at least five years need to apply and obtain a special permission from the Danish Ministry of Justice in order to purchase real estate.[10] The fact that the availability of rental housing is such a major predictor for immigrant settlement in Denmark will form the basis for the IV strategy discussed in section 2 below.

2 Data and empirical strategy

In this section I first present the data used in the paper. I then present the empirical specification and discusses identification issues. Finally I discuss the paper's IV strategy in detail.

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[10]While I have not been able to uncover any data on the likelihood of being granted permission to buy real estate, anecdotal evidence suggests a relatively high probability of success conditional on making a correct application. For many immigrants and refugees, the application process itself may therefore well be the main hurdle given language barriers and lack of familiarity with the Danish legal environment.

2.1 Data

The empirical analysis employs data on Danish municipalities between the 1981 and 2001. The choice of 1981 as the start of the sample is dictated by data availability, while 2001 is chosen as the end year because a series of reforms changed the municipal structure after the 2001 election.[11] During the sample period, Denmark consisted of 275 municipalities. From these I drop the two very populous and urban *Copenhagen* and *Frederiksberg* municipalities since these had a dual role as both counties and municipalities at the time and thus had a markedly different set of political tasks (in particular counties were responsible for the provision of public health).[12] This leaves me with a sample of 273 municipalities.

The municipal level variables for the empirical analysis are all based on the administrative data at Statistics Denmark (SD).[13] The only exception to this is the municipal-level vote shares for national elections. These vote shares were instead collected from the online database of election outcomes, *Den Danske Valgdatabase*.[14]

The main election outcomes I focus on are seat shares won in the municipal elections in 1981 and 2001. For supplementary results, I also employ data on vote shares received in the national elections held in those same years. For all the election outcome variables, I group parties and candidates into several non-overlapping groups. I first define a *left-wing group*, which includes the obvious far left parties (e.g. communist parties) plus all parties that over the period 1981-2001 were part of a left-wing coalition government but *not* a right-wing coalition government. Second, I define an anti-immigrant *nationalist group*, consisting of *Fremskridtspartiet* and *Dansk Folkeparti* (cf. the discussion in section 1). To shed light on the relationship between ethnic diversity and both left-right politics and anti-immigrant nationalist sentiments the main empirical analysis of the paper examines the effect of ethnic diversity on the electoral success of these two political groups. For use in the supplementary results I define three other groups: 1) A *non-nationalist right-wing group*, which includes all parties that were part of a right-wing coalition governments over the period 1981-2001 but *not* part of a left-wing coalition governmen. 2) A *centrist* group

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[11]Starting in 2003, five municipalities on the island of bornholm was combined into one. Moreover a general restructuring of the Danish municipal system was decided upon an announced in 2005 prior to the 2005 election.

[12]Redoing the empirical analysis with *Copenhagen* and *Frederiksberg* in the sample leads to similar results.

[13]In most cases the data are available from the public *Statistikbanken* database, although a few variables were calculated directly from raw databases at Statistics Denmark.

[14]A detailed description of how all variables were constructed are given in the supplementary appendix.

consisting of the most centrist parties from the national political stage, which either were not part of any governments over the sample period or were part of both a left and a right-wing government. 3) A residually defined *"other" group* consisting of independent candidates as well as local party lists from municipal elections.

The income data I use is denominated in 1,000 kr. and deflated to 1980 prices using the (chain-linked) GDP deflator from the Danish national accounts. To measure the sectoral composition of employment I split the salaried workers from each municipality into three sectors: *Agriculture and natural resources*, *Manufacturing* and *Services and retail*.

For the historical housing stock data used in the IV estimation, the use of the term "1970 housing stock" is actually a slight misnomer since the variable only includes housing constructed in 1970 and earlier *that is still standing* in the current year, which explains why this variable changes between the 1981 and 2001 in the descriptive statistics below. For the IV estimation later I will only be using the earliest available year, which is 1981, thus missing any housing constructed before 1970 and torn down between 1970 and 1981.

The changes in ethnic diversity in my sample are being driven by the initially ethnically homogenous Danish population becoming less homogenous as more and more immigrants arrive. Thus as my measure of ethnic diversity I will simply use the percentage of people that are non-Danish (ND), based on SD's official definition that a person is Danish if at least one parent was both born in Denmark and have Danish citizenship.[15]

Tables 1 present descriptive statistics for the main variables in the 1981 cross-section, while Table 2 does so for the changes in variables between 1981 and 2001. As in the regression results presented later, the unit of observation is a municipality (so the unweighted means in the table differ from the overall population means in Denmark). Looking at the ethnic diversity variable, Table 2 clearly shows how immigration has increased the number of people not of Danish origin, with the mean percentage non-Danish increasing by 2.6 percentage points between 1981 and 2001. They also reflect the significant variation across municipalities in the number of immigrants received - the change in the percentage non-Danish over the period varies from 0.63 to 15.59 across

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[15]This measure of ethnic diversity differs from the standard Herfindahl-type fractionalization index used in much of the literature on ethnic diversity. Since the ethnically Danish group is such a large majority in all municipalities, however, the fractionalization index for Danish municipalities is virtually indistinguishable (beyond a scale factor) from the percentage non-Danish. For transparency I therefore focus simply on the percentage non-Danish and note that in comparing my estimated effects with those of the literature they should be scaled down by about 1.8.

municipalities with a standard error of 1.87.

2.2 Specification and identification issues

In discussing the empirical strategy, I begin with a linear expression relating election outcomes to ethnic diversity. Ignoring for now the possibility of adding control variables we can thus write:

$$(Election\ outcome)_{it} = \beta(Ethnic\ diversity)_{it} + \kappa + \mu_i + \alpha\,t + \eta_i\,t + \nu_{it} \tag{1}$$

Here i indexes municipalities and t indexes time periods. The parameter of interest is β, which is defined to be the causal effect of immigration-driven ethnic diversity on election outcomes. In addition, κ is a common intercept, μ_i is a municipality-specific fixed effect, α is a common trend, η_i is a municipality-specific trend and ν_{it} is the effect of all time varying factors affecting the outcome of interest.

As usual when dealing with panel data, time-differencing of equation (1) above will be used to cancel out the time-invariant fixed effect μ_i. Somewhat less standard, however, we will focus only on the difference across the first and last year in the sample and consider only the total changes over the sample period for each municipality. The use of such a "long difference" specification is prompted by the fact that the instrumental variable introduced later only varies across municipalities and not over time within a municipality: Since the employed instrument is based on characteristics of the municipal housing stock in a fixed year prior to the sample period, it predicts the overall change in ethnic diversity well but does not differentially predict year to year changes within the period.[16]

Letting $t = 1$ denote the first year in the sample, $t = 2$ the last year and letting Δ denote the difference between these two years, we can difference (1), to get the basic estimating equation:

$$\Delta(Election\ outcome)_i = \alpha + \beta\Delta(Ethnic\ diversity)_i + \eta_i + \Delta\nu_i \tag{2}$$

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[16]In principle it is possible to use a time-invariant instrument in the usual first-differenced equation that employs data from all the time periods. As is easily shown however, the resulting IV estimator is in fact numerically equivalent to the IV estimator based on the long difference equation in (2) (a derivation is given in the supplementary appendix). Intuitively this reflects that since the instrument does not differentially predict year to year changes in the endogenous regressor within the period, the inclusion of data from years in between the first and last period does not contribute additional information to the estimation.

Looking at the estimating equation (2), a major concern for identification is the possibility of reverse causality as a result of immigrants' relocation decisions. As discussed in section 1, immigrants are known to move away from areas with right-wing political domination, so a particular concern is that immigrants respond to rightward shifts in election outcomes by moving to different municipalities. This would imply that changes in ethnic diversity are correlated with the error term $\Delta \nu_i$, making OLS estimates of (2) biased towards finding a *positive* association between percentage immigrants and left-wing political success. The next subsection develops an IV strategy, which will be used to address the issue of endogenous relocation decisions of immigrants.

Another obvious concern stems from the fact that higher ethnic diversity in the sample is directly related to having more immigrants, which might have a direct impact on election outcomes beyond any ethnic diversity effects. In (2) this would imply a correlation between these omitted time varying factors, $\Delta \nu_i$ and any relevant instrument (that is any instrument that affects the number of immigrants). Of particular concern, since immigrants tend to be poorer, have higher unemployment rates and lower labor force participation, are the separate effects of lower income, higher unemployment and lower labor force participation.[17] In the same vein, one may also worry that immigration adversely impacts the local labor market also for natives, which might affect political preferences. In the empirical analysis I address these concerns by examining the robustness of the estimated effect to the inclusion of a control vector, ΔX_i, which includes changes in a rich set of socioeconomic indicators, including mean income, fraction not in the workforce, unemployment rate and Gini coefficient. To deal specifically with potential issues regarding changes in the age structure of the population, I also include the population shares of children and seniors in the set of socioeconomic indicators.

Relatedly, the fact that immigrants can vote in municipal elections after 2-3 years implies that having more immigrants can affect election outcomes directly (again introducing correlation between the ethnic diversity measure and $\Delta \nu_i$) simply because immigrants tend to vote differently than natives. This problem cannot be addressed by including additional controls or by the IV strategy discussed below; however, in practice the resulting bias in estimates should be relatively small, especially given the lower election turnout among immigrants. Additionally, since

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[17]The possibility of such a direct effect of having more "low-skilled" immigrants has received considerable attention in the literature, see for example the cited studies by Razin et al. (2002) and Mayr and Böheim (2005).

immigrants are generally left-leaning politically[18] the direction of the bias most likely goes in the direction of finding a *positive* association between percentage immigrants and left-wing political success.[19]

Finally, correlation between the employed instrument and the municipality specific trend, η_i, is a concern. In the empirical analysis I address this concern by examining the robustness of the estimated effect to including a control vector Z_{i1} containing different initial characteristics of the municipality which might correlate with the municipal trend. Since highrises are more likely to be located in urban areas, I control for the initial population size and density to address differential trends between urban/rural areas. The 1970 highrise stock may also be larger in areas that grew fast during the manufacturing boom of the 1960s but have been declining since. To address this, I therefore also try controlling for the initial economic characteristics of the municipality by controlling for the initial mean income and sectoral composition of the workforce. Finally, since highrises may also be correlated with the number of immigrants present at the beginning of the sample period, I also employ the initial level of ethnic diversity as a control.

With the two control vectors, ΔX_i and Z_{i1}, (and with a slight abuse of notation), we arrive at the final estimating equation:

$$\Delta(Election\ outcome)_i = \alpha + \beta\Delta(Ethnic\ diversity)_i + \Delta X_i'\gamma + Z_{i1}'\lambda + \eta_i + \Delta\nu_i \qquad (3)$$

The next section develops the IV strategy that will be used to estimate (3).

2.3   The IV strategy

As discussed in Section 1, the availability of rental housing is a major predictor of the location choice of immigrants in Denmark. This suggests using the initial amount of rental housing in a municipality as an instrument for the change in percentage non-Danish. Identification would then rest on the exclusion restriction that any association between initial rental housing and changes in the outcomes of interest is exclusively due to changes in the percentage non-Danish so that initial

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[18]This is evidenced by Damm (2009)'s result that refugees tend to move away from municipalities with right-wing political domination and is also confirmed by polling data focused on immigrants (see for example "Indvandrere stemmer i højere grad borgerligt", *NPinvestor.dk*, August 8, 2001).

[19]By a similar token, the possibility that a specific type of people of Danish origin move out when immigrants move in, would also seem to bias the results towards finding a positive association between percentage immigrants and left-wing political support, because of the association of anti-immigrant sentiments with the political right.

rental housing is uncorrelated with the composite error term $\eta_i + \Delta \nu_i$ in equation (3).

Because property owners are fairly free to choose between renting out their property and selling the property to would-be occupants, however, this exclusion restriction seems likely to fail. The most obvious problem is that the share of rental housing could respond to expectations about future political outcomes and how they will affect the profitability of renting versus owning.

To circumvent problems with using actual rental housing as an instrument I will instead utilize detailed data on the historical housing stock and the fact that (for obvious reasons) housing stock characteristics are very persistent over time. Combining this with the fact that highrises are much more likely to serve as rental housing suggests using the historical prevalence of highrises as an instrument. Thus the IV strategy will entail using the share of the 1970 housing stock that is comprised by highrise homes as an instrument for later changes in the percentage non-Danish (with the association working through the availability of rental housing during the sample period 1981-2001).

With the slightly abusive notation that $t = 0$ denotes 1970, equation (4) introduces the first stage relationship corresponding to IV estimation of (3). Figure 1 also provides a schematic illustration of the principle behind the IV strategy:

$$\Delta(Ethnic\ diversity)_i = \rho + \pi(highrise\ share)_{i0} + \Delta X_i' \gamma + Z_{i1}' \lambda + \xi_i \qquad (4)$$

Using the historical housing stock as the instrument makes the exclusion restriction much more plausible especially due to the introduced time distance between the period of interest (1981-2001) and the dating of the instrument (1970). For example, one concern with using higrises as an instrument is that highrises might affect the population composition also among natives, which could obviously have a direct effect on election outcomes. Under the reasonable assumption that any effect of the housing stock on population composition does not work with a lag of more than ten years, however, the effect of the 1970 housing stock on population composition would be fully reflected in the 1981 population. From the point of view of the sample period, this is a fixed municipality characteristic and is captured by the municipality fixed effect, μ_i which has been differenced out in the final estimating equation. Such population composition effects thus do not violate the exclusion restriction that the 1970 housing stock is uncorrelated with the composite

error term in (3), which only contains η_i and $\Delta \nu_i$.

Some concerns with the instruments remain, however. One is that the number of highrises might simply proxy for how urban a municipality is and only predicts immigrant settlement because immigrants are more likely to settle in urban areas. In Table 3 below I show that this is not the case. Another concern is that differences in pre-existing trends between municipalities (differences in η_i) may relate systematically to the housing stock. As discussed above, I address this by probing the robustness of my results to the inclusion of a control vector of various initial municipal characteristics (Z_{i1}).

As always with just-identified IV, the exclusion restriction discussed above is ultimately untestable. The hypothesized first stage relationship between variables shown in Figure 1 and equation (4), however, can be examined. Table 3 shows the empirical relationship. The first column examines the relationship between the historical housing stock and initial share of rental housing by regressing rental housing share in 1981 on the highrise share in 1970. The expected positive and significant coefficient is found, reflecting the fact that highrises are much more likely to serve as rental housing.

Column (2) examines the relationship between changes in ethnic diversity and rental housing by regressing the change in percentage non-Danish 1981-2001 (Δ % ND) on the rental housing share in 1981. Again a positive and significant relationship is found, showing that initial rental housing predicts later changes in ethnic diversity. Column (3) adds controls for initial population size and density to address the concern that the relationship between the variables is just working through urban/rural differences. The robustness of the positive relationship to the added controls shows that this is not the case. Column (4) adds the instrument to the regression and its slightly negative and insignificant coefficient shows that once the initial rental share is accounted for, the 1970 housing stock does not predict changes in percentage non-Danish.

Finally Columns (5) and (6) correspond to equation (4), the first stage of the IV-estimation. Here the change in percentage non-Danish is regressed on the instrument and (possibly) controls. The positive and significant relationship indicates that the instrument satisfies the rank condition, also when population size and density are included as controls. The F-statistic for testing the significance of the instrument is reported at the bottom to gauge the strength of the instrument (as proposed by Stock and Yogo (2005)). Using the usual "rule of thumb", neither column shows

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any indications of weak instrument problems since the F-statistic is well above 10. This remains true also as more control variables are added.[20] As a more direct check against weak instrument bias I have also performed "weak instrument"-robust Anderson-Rubin tests for the significance of all the paper's IV estimates. The results of these tests are *identical* to the results obtained in section 3 using standard inference, underscoring further that weak instruments is not a concern for the employed IV strategy.

3 Empirical results

This section presents the empirical results. To examine the effect of ethnic diversity on overall left-right politics and anti-immigrant nationalism in particular, I examine the effect of increasing ethnic diversity on the changing electoral success of the traditional "big government" left-wing parties and the anti-immigrant nationalists. I present the main results of the paper regarding the outcomes of municipal elections first using OLS and then using IV estimation. I then turn to additional results regarding national elections and the effect of ethnic diversity on the electoral success of other parties.

3.1 Results for municipal elections using OLS

Table 4 reports estimates of the effect of changes in percentage non-Danish on changes in the share of seats won by the left-wing political group between the 1981 and 2001 municipal elections. Table and 5 report corresponding estimates for the nationalist group. The estimates were obtained by OLS estimation of the regression equation (3).

The first column of the two tables show the raw estimates without controls, which suggest that an increase in the percentage non-Danish of one percentage point causes a drop in the percentage of seats held by the left-wing group of 0.569 percentage point and an increase in the percentage of seats held by nationalists of 0.920 percentage points. The effects for the nationalists is highly significant at the 1% level, however the effect for the left-wing group is not significantly different from zero at any conventional level.

In Column (2), the changes in the set of socioeconomic indicators are added as controls.

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[20]Throughout all the specifications presented later in Tables 6-11, the F-statistic for testing the significance of the instrument in the first stage remains above 20.

This causes the estimated effect for both the left-wing and nationalist to drop in magnitude: the estimated effect for the left-wing group becomes virtually zero and the positive effect for nationalists is halved. This suggests that much of the raw correlations stems from ethnic diversity being correlated with overall socioeconomic outcomes.

Next, Columns (3), (4) and (5) examine concerns regarding differential trends between municipalities by including various initial municipality characteristics that might correlate with municipal trends in election outcomes. Since immigrants are known to be more likely to settle in big urban municipalities, Column (3) controls for the initial (1981) population size and density to address the possibility of differential trends between urban and rural areas. Compared to Column (1) this is seen to make the estimated effect for the left change to a positive but insignificant 0.220, while increasing the magnitude of the effect for the nationalists to 0.684.

Column (4) instead adds initial economic characteristics of the municipality as controls, in particular the initial mean income and the initial sectoral composition of employment. This is done to address the possibility that trends are different for initially very high or low-income municipalities or for areas that had become highly industrialized during the post war years. The inclusion of these controls gives estimated effects that are almost identical to those in the previous column. Column (5) controls for the initial percentage non-Danish in the municipality as this is known to be a predictor of immigrant location choice and may also correlate with municipality trends. Again results are are relatively close to those obtained in the other columns.

Finally, Column (6) of the tables combines all the controls from the previous columns. This increases the estimated effect for the left-wing group to 0.311 but the estimate remains insignificantly different from zero at all conventional levels. For the nationalists, the estimated effect drops to 0.404 and becomes significant only at the 10 % level.

As mentioned in section 2, the possibility that immigrants move in response to election outcomes implies that OLS estimates are likely to biased. If we take the estimates at face value, however, they suggest that an increase in ethnic diversity corresponding to a one percentage point increase in the percentage non-Danish has a moderate but statistically significant positive effect on the fraction of seats held by nationalists group of between 0.4 and 0.9 percentage points depending on the specification. Conversely, there appears to be no systematic relationship between changes in ethnic diversity and changes in left-wing electoral success.

3.2 Results for municipal elections using IV

As discussed in section 1 there is evidence that refugees in Denmark prefer *not* to live in right-wing dominated municipalities, which suggests that immigrants might be moving away from municipalities where the right gains politically. To address the resulting issue of reverse causality, and bias in the OLS estimates, I repeat the analysis of the previous section using the highrise share of the 1970 housing stock as an instrument for the change in ethnic diversity. Tables 6 and 7 show the results.

Comparing Tables 6 and 7 to Tables 4 and 5, the differences between OLS and IV are very much consistent with reverse causality leading to "pro left-wing bias" in the OLS-estimates. Using IV, the small and insignificant effects for the left wing suggested by the OLS estimates is replaced by large negative effects in all six specifications, which are significant at least at the 10% level in all columns. Moreover, the moderately positive effects for the nationalist group found using OLS are replaced by larger positive effects in all specifications. The effects for the nationalists groups are also all significant at least at the 5 % level.

Overall, the IV estimates suggest that a one percentage point increase in ethnic diversity lead to between 0.9 and 2.0 percentage points more nationalist seats on the municipal board and between 2.2 and 3.6 percentage points fewer left-wing seats. After accounting for the endogenous location choice of immigrants, increases in ethnic diversity is thus clearly seen to shifts votes in municipal elections away from the traditional left-wing parties and towards anti-immigrant nationalists in particular.

3.3 Results for national elections

This section supplements the empirical analysis of the previous section by focusing on vote shares received in national elections rather than seats won in municipal elections. There are two reasons for doing this: First, focusing on national elections allows me to present results that are unaffected by local party lists with unclear political platforms and where local idiosyncratic differences in party positions can be expected to be smaller. Second, and more interesting, since the set of political issues decided by the national parliament is very different from those decided by the municipal board, a comparison of how national and municipal elections are affected by immigration can shed some light on the mechanisms underlying the effects of ethnic diversity on voting. In

particular, two prominent explanations for why local ethnic diversity could affect voting for "big government" left-wing parties in municipal elections are that individuals value public spending differently when other ethnic groups make up a larger share of the people benefitting from it (Vigdor (2004)) or when other ethnic groups make up a larger share of the people influencing the nature of the spending (Alesina et al. (1999)). Since national elections concern *national* spending, however, both of these explanations imply that voting in national elections should only respond to the national level of ethnic diversity and not the local level of ethnic diversity.

To examine whether voting in national elections respond differently to local ethnic diversity than voting in municipal elections, Tables 8 and 9 replicate the IV estimation exercise from Tables 6 and 7 but now focusing on the fraction of votes received in national elections. In contrast to the prediction above, the estimates for both the left-wing and nationalist groups follow a very similar pattern to the one found for municipal elections: across all specifications, increases in ethnic diversity has a negative effect on voting for the left-wing group and a positive effect for the nationalist group. Comparing the magnitude of the estimated effects to those found in Tables 6 and 7, however, the estimated effects for the nationalist groups appear noticeably smaller for national elections,[21] and are only marginally significant in Column (6).

Despite the slightly weaker results regarding nationalist voting in national elections, the data overall do suggest a very similar pattern of effects of local ethnic diversity on voting in both national and municipal elections. Given the very different issues decided at the two levels of government, this could suggest that the effects are not driven by a few particular policy issues but rather by more fundamental changes in voters' preferences or "ideology". In particular, the results do not seem in line with the two simple explanations for ethnic diversity effects discussed at the beginning of this section, unless there is some "party loyalty" in voting across municipal and national elections, or perhaps that high local ethnic diversity changes the salience of ethnic diversity also at the national level.

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[21]Note here that the definition of the dependent variable in the two tables differ somewhat: Tables 6 and 7 examine *vote* shares in national elections, while Tables 8 and 9 examine actual *seat* shares won in municipal elections because municipal level data on votes shares in municipal elections is not readily available. Since seats in municipal elections are assigned from vote shares based on d'Hondts rule, there is a monotonic relationship between vote shares and seat shares in municipal elections but it is not exactly linear.

3.4 Results for other parties

The results above show that increasing ethnic diversity leads to decreased electoral success of left-wing parties and increased success for nationalists. Looking at the magnitude of the estimated effects, however, the negative effect of ethnic diversity on the left-wing seat and vote shares is generally estimated to be larger than the positive effect for the anti-immigrant nationalists. This suggests that other parties are also benefitting from the loss of seats/votes experienced by left-wing parties in response to increasing ethnic diversity. For completeness, Tables 10 and 11 therefore summarize IV estimates of the effect of ethnic diversity on seat shares won in municipal elections and votes shares received in national elections, respectively, for the remaining political groups defined in section 2: the non-nationalist right-wing group, the centrist group and the residually defined "other" group which captures independent candidates as well as local parties from municipal elections. Each of the first four rows of the tables correspond to the estimated effect on a different political group, while columns correspond to the different sets of control variables that were also included in Tables 4-9.

Looking first at Table 10, the estimates for municipal elections are fairly noisy and imprecise but do provide some evidence that an increase in ethnic diversity has a positive effect on electoral outcomes for local party lists and independents: the estimated effect for the "other" group is sizably positive in all specifications and significantly different from zero in three of the six specifications. There is also some indications of a positive effect for the centrist group, where all estimates are again positive, although the effect is only significantly different from zero in Column (2). Results for the non-nationalist right-wing group do not seem to suggest a systematic effect.

The estimates regarding national elections in Table 11 paint a somewhat clearer picture. All specifications shows a sizeable and significantly positive effect for the centrist group and five of the six specifications also show a significant positive effect on the non-nationalist right-wing group. Estimates for the "other" group are very small throughout (although sometimes significant) reflecting the unimportance of independent candidates in national elections.[22]

Besides the anti-immigrant nationalists, the parties that benefit from increases in local ethnic diversity thus overall seem to be the centrist and non-nationalist right-wing parties in national

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[22]The maximum vote share received by the "other" group in any municipality is less 0.5 % in both the 1981 and 2001 national elections.

elections, and the local parties and possibly also the centrists in municipal elections.[23]

4 Conclusion

The present paper provides evidence on how immigration and increasing ethnic diversity affects political outcomes in immigrant-receiving countries by undertaking a case study of immigration and election outcomes in Danish municipalities 1981-2001. A rich set of control variables isolates ethnic diversity effects from the effects of other immigrant characteristics and a novel IV strategy based on historical housing stock data addresses issues of endogenous location choice of immigrants.

The paper's results confirm that immigration-driven increases in ethnic diversity have systematic effects on political outcomes. In particular, increasing ethnic diversity has a significant negative effect on the electoral success of traditional left-wing parties and a significant positive effect on the electoral success of anti-immigrant nationalist parties. In addition, these effects of ethnic diversity on election outcomes appear fairly similar across national and municipal elections in spite of the very different sets of issues decided at these two levels of government. This could suggest that the effect of ethnic diversity might not be driven by particular political issues but rather a more fundamental shift in preferences or "ideology".

The findings have important implications for immigration policy and suggests several topics for future research. Perhaps most striking is the finding that immigration and increasing ethnic diversity shifts political support towards the "small government" right-wing block which suggests that immigration may lower the level of redistribution or public spending. Further examination of the effect of immigration and ethnic diversity on more direct measures of redistribution and public spending thus seems an important topic for future work.[24]

Additionally, the finding that immigration-driven increases in ethnic diversity cause a surge in anti-immigrant nationalist sentiments suggests that there may be an upper bound on how much immigration is feasible before anti-immigrant sentiments begin to dominate politically. This seems

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[23]It is interesting that increases in local ethnic diversity does not appear to benefit non-nationalists right-wing parties in municipal elections but instead seems to benefit local parties. Since the political platforms of these local parties can not be determined, it is difficult to provide a broader interpretation of this result however.

[24]Due to institutional details of the Danish setting immigrants have direct budgetary effects on both expenditures and revenues in Danish municipalities, so the Danish context is unfortunately not well suited for a direct examination of the effect of increasing ethnic diversity on the size and structure of public budgets.

particularly interesting given the suggestive evidence that the effects on election outcomes are not driven by particular political issues but reflect a more fundamental change in attitudes. Further exploration of the mechanisms linking ethnic diversity and political outcomes, as well as their implications for immigration policy thus also seems like an important topic for future work.

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Figures and tables

Figure 1: The IV strategy

Instrument: *Historical share of highrises* (1970)

   affects
   ⇓

Intermediate channel: *Initial share of rental housing* (1981)

   affects
   ⇓

Endogenous regressor: *Change in percentage non-Danish* (1981-2001)

   affects
   ⇓

Dependent variable: *Changes in election outcomes* (1981-2001)
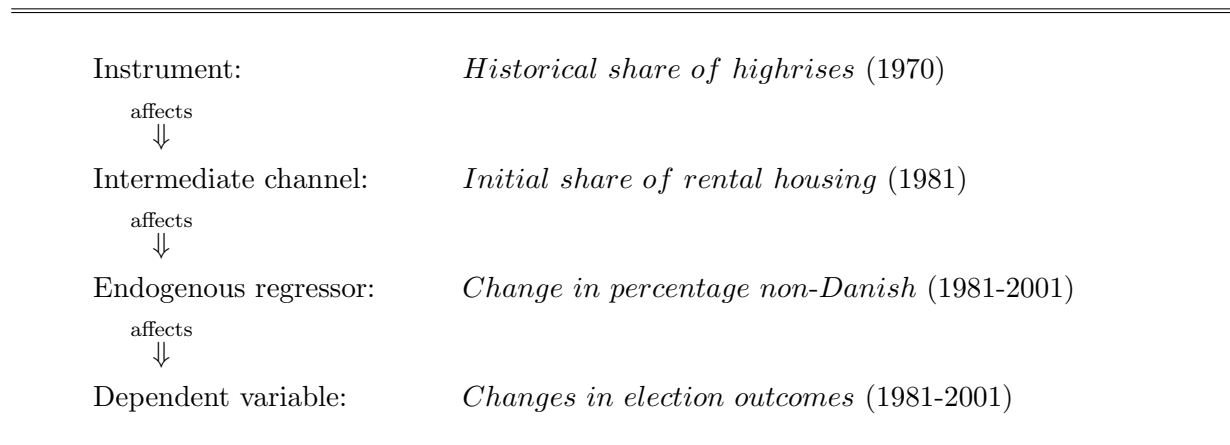
Table 1: Descriptive statistics, 1981 cross-section

VARIABLES	Obs.	Mean	S.D.	Min.	Median	Max.
Share non-Danish (%)	273	1.81	1.56	0.31	1.28	11.41
Total population (1000s)	273	16.64	22.85	2.68	9.82	245.57
Population density (1000s/km^2)	273	0.20	0.41	0.02	0.07	3.11
Mean income (1,000s, 1980-kr)	273	50.95	8.15	37.35	49.18	85.82
Unemployment rate (%)	273	7.06	2.05	2.16	7.28	15.14
Share not in workforce (%)	273	46.71	2.69	35.00	47.16	55.36
Gini-coefficient	273	0.48	0.04	0.37	0.47	0.60
Share aged 0-16 years (%)	273	27.62	3.14	17.88	27.44	38.28
Share older than 65 years (%)	273	13.73	3.85	2.34	14.20	26.03
Employment share, nat. res. and agric. (%)	273	4.75	3.07	0.19	4.62	18.55
Employment share, manuf. and constr. (%)	273	31.23	6.83	14.60	31.52	61.09
Employment share, services and retail (%)	273	64.02	8.13	36.80	63.13	84.28
Share highrises in 1970 (%)	273	15.92	16.72	0.15	8.86	70.92
Share rental housing (%)	273	24.31	13.65	8.34	18.96	72.70
Share municicipal seats, left-wing (%)	273	36.34	14.64	5.88	33.33	78.95
Share municicipal seats, right-wing (%)	273	39.64	15.04	0.00	41.18	72.73
Share municicipal seats, nationalists (%)	273	5.94	3.93	0.00	5.88	19.05
Share municicipal seats, centrists (%)	273	4.56	5.13	0.00	4.76	30.77
Share municicipal seats, other (%)	273	13.52	18.39	0.00	6.67	90.91
Share votes nat. election, left-wing (%)	273	40.69	9.41	16.84	40.81	69.91
Share votes nat. election, right-wing (%)	273	30.18	6.86	13.94	29.85	55.49
Share votes nat. election, nationalists (%)	273	10.61	3.81	0.00	10.84	20.59
Share votes nat. election, centrists (%)	273	18.50	3.36	10.40	18.06	29.96
Share votes nat. election, other (%)	273	0.02	0.04	0.00	0.00	0.31

The table shows descriptive statistics for the Danish municipalities in 1981, excluding *Copenhagen* and *Frederiksberg*. Details of the variables used can be found in the supplementary appendix.

Table 2: Descriptive statistics, changes 1981-2001

VARIABLES:	Obs.	Mean	S.D.	Min.	Median	Max.
Share non-Danish (%)	273	2.60	1.87	0.63	2.03	15.59
Total population (1000s)	273	0.79	2.96	-3.12	0.22	41.10
Population density (1000s/km^2)	273	0.00	0.02	-0.15	0.00	0.10
Mean income (1,000s, 1980-kr)	273	20.92	4.26	9.48	21.14	37.12
Unemployment rate (%)	273	-3.00	1.89	-8.29	-3.00	3.04
Share not in workforce (%)	273	-0.45	2.65	-6.18	-0.86	10.08
Gini-coefficient	273	-0.12	0.04	-0.25	-0.12	-0.02
Share aged 0-16 years (%)	273	-4.13	2.06	-11.82	-3.87	4.01
Share older than 65 years (%)	273	1.74	2.18	-5.46	1.44	9.87
Employment share, nat. res. and agric. (%)	273	-1.40	1.40	-8.70	-1.14	2.51
Employment share, manuf. and constr. (%)	273	-2.60	3.89	-14.67	-3.09	9.35
Employment share, services and retail (%)	273	4.01	3.75	-8.30	4.24	17.04
Share highrises in 1970 (%)	273	0.80	2.29	-5.31	0.55	10.47
Share rental housing (%)	273	6.30	3.61	-8.08	6.34	14.46
Share municicipal seats, left-wing (%)	273	1.28	11.50	-45.25	0.00	37.25
Share municicipal seats, right-wing (%)	273	6.29	13.92	-30.59	5.88	60.00
Share municicipal seats, nationalists (%)	273	-2.44	5.14	-18.18	0.00	20.00
Share municicipal seats, centrists (%)	273	-2.16	4.76	-20.00	0.00	19.05
Share municicipal seats, other (%)	273	-2.97	16.45	-71.28	0.00	76.92
Share votes nat. election, left-wing (%)	273	-5.93	5.03	-19.88	-5.86	15.17
Share votes nat. election, right-wing (%)	273	13.68	3.70	-3.82	14.04	22.08
Share votes nat. election, nationalists (%)	273	2.66	4.13	-8.66	2.73	14.19
Share votes nat. election, centrists (%)	273	-10.42	2.88	-21.45	-10.01	-3.26
Share votes nat. election, other (%)	273	0.01	0.08	-0.26	0.00	0.40

The table shows descriptive statistics for the *changes* in the variables in Danish municipalities between 1981 and 2001, excluding *Copenhagen* and *Frederiksberg*. Details of the variables used can be found in the supplementary appendix.

Table 3: Relationship between rental housing, highrises and changes in ethnic diversity

VARIABLES:	(1) % rental 1981	(2) Δ % ND 1981-2001	(3) Δ % ND 1981-2001	(4) Δ % ND 1981-2001	(5) Δ % ND 1981-2001	(6) Δ % ND 1981-2001
% rental housing, 1981		0.100*** (0.012)	0.082*** (0.015)	0.126*** (0.035)		
% highrises, 1970	0.731*** (0.026)			-0.024 (0.025)	0.068*** (0.008)	0.038*** (0.010)
Total population, 1981			0.004 (0.005)			0.011** (0.004)
Population density, 1981			0.658 (0.438)			1.404** (0.622)
Constant	12.68*** (0.429)	0.176 (0.237)	0.396* (0.234)	-0.083 (0.430)	1.517*** (0.107)	1.541*** (0.098)
Observations	273	273	273	273	273	273
R^2	0.801	0.527	0.540	0.536	0.368	0.437
F-stat					157.8	22.24

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The table presents OLS regression results. Each observation corresponds to a municipality. The dependent variable in Column (1) is the share of rental housing in 1981. In all other columns the dependent variable is the change in the percentage non-Danish (ND) between 1981-2001. The set of possible independent variables are the percentage rental housing in 1981, the percentage of highrises in 1970, the total population in 1981 and the population density in 1981. The reported F-statistic is the measure of instrument strength proposed by Stock and Yogo (2005) and corresponds to a test of the hypothesis that the percentage of highrises in 1970 can be excluded from the regression.

Table 4: Effect of ethnic diversity on left-wing voting in municipal elections, OLS

Dependent var.: Change in the % of *left-wing* seats

OLS estimates   Time period: 1981-2001

VARIABLES:	(1)	(2)	(3)	(4)	(5)	(6)
Change in % non-Danish	-0.569	0.046	0.220	0.162	-0.104	0.311
	(0.374)	(0.460)	(0.435)	(0.400)	(0.453)	(0.528)
Change in mean income		0.067				0.168
		(0.201)				(0.199)
Change in unemp. rate		-0.494				-0.271
		(0.434)				(0.501)
Change in the % not in workf.		-0.194				-0.508
		(0.517)				(0.533)
Change in Gini coefficient		-47.75**				17.87
		(20.40)				(29.11)
Change in % aged 0-16		-0.326				-0.154
		(0.499)				(0.541)
Change in % aged 65+		-0.054				0.350
		(0.509)				(0.631)
Initial total population			-0.078**			-0.060**
			(0.031)			(0.027)
Initial population density			-2.795*			3.558
			(1.475)			(2.272)
Initial mean income				-0.262**		-0.495**
				(0.122)		(0.218)
Initial % secon. sect. empl.				-0.160		-0.216
				(0.301)		(0.357)
Initial % tert. sect. empl.				-0.250		-0.259
				(0.310)		(0.354)
Initial % NDOs					-0.985*	0.731
					(0.551)	(0.705)
Constant	2.762**	-8.741	2.564**	35.19	3.341**	44.34
	(1.183)	(6.314)	(1.161)	(24.78)	(1.299)	(33.44)
Observations	273	273	273	273	273	273

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The table reports OLS estimates of the effect of changes in percentage non-Danish on changes in the percentage of seats won by the left-wing group between the 1981 and 2001 municipal elections. Each observation corresponds to a municipality. The potential controls used are the changes in mean income, fraction not in the workforce, unemployment rate, share of population between 0 and 16 years old, share of population older than 65 years and Gini coefficient, as well as the initial (1981) level of total population, population density, mean income, share of total employment in the secondary sector (manufacturing and construction), share of total employment in the tertiary sector (retail and services) and percentage non-Danish.

Table 5: Effect of ethnic diversity on nationalist voting in municipal elections, OLS

Dependent var.: Change in the % of *nationalist* seats

OLS estimates   Time period: 1981-2001

VARIABLES:	(1)	(2)	(3)	(4)	(5)	(6)
Change in % non-Danish	0.920***	0.464***	0.684***	0.626***	0.725***	0.404*
	(0.136)	(0.174)	(0.191)	(0.152)	(0.155)	(0.231)
Change in mean income		-0.177**				-0.218***
		(0.071)				(0.067)
Change in unemp. rate		0.128				-0.046
		(0.170)				(0.190)
Change in the % not in workf.		0.090				0.171
		(0.162)				(0.165)
Change in Gini coefficient		27.67***				14.48
		(8.07)				(13.13)
Change in % aged 0-16		-0.022				-0.107
		(0.188)				(0.219)
Change in % aged 65+		0.006				-0.166
		(0.212)				(0.297)
Initial total population			0.005			0.001
			(0.009)			(0.010)
Initial population density			1.686**			-0.347
			(0.758)			(0.986)
Initial mean income				0.122**		0.136
				(0.053)		(0.084)
Initial % secon. sect. empl.				-0.020		-0.086
				(0.112)		(0.139)
Initial % tert. sect. empl.				0.031		-0.014
				(0.120)		(0.137)
Initial % NDOs					0.412*	-0.251
					(0.222)	(0.258)
Constant	-4.827***	3.665	-4.638***	-11.66	-5.069***	-0.265
	(0.488)	(2.266)	(0.497)	(9.506)	(0.561)	(13.97)
Observations	273	273	273	273	273	273

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The table reports OLS estimates of the effect of changes in percentage non-Danish on changes in the percentage of seats won by the nationalist group between the 1981 and 2001 municipal elections. Each observation corresponds to a municipality. The potential controls used are the changes in mean income, fraction not in the workforce, unemployment rate, share of population between 0 and 16 years old, share of population older than 65 years and Gini coefficient, as well as the initial (1981) level of total population, population density, mean income, share of total employment in the secondary sector (manufacturing and construction), share of total employment in the tertiary sector (retail and services) and percentage non-Danish.

Table 6: Effect of ethnic diversity on left-wing voting in municipal elections, IV

Dependent var.: Change in the % of *left-wing* seats   Time period: 1981-2001

IV estimates: Highrise share in 1970 instrumenting for change in % non-Danish

VARIABLES:	(1)	(2)	(3)	(4)	(5)	(6)
Change in % non-Danish	-2.708***	-2.830***	-5.376**	-2.226**	-3.599***	-3.554*
	(0.696)	(1.042)	(2.232)	(1.047)	(1.275)	(1.918)
Change in mean income		-0.238				-0.207
		(0.221)				(0.256)
Change in unemp. rate		-1.004**				-0.934
		(0.436)				(0.571)
Change in the % not in workf.		0.430				0.029
		(0.594)				(0.642)
Change in Gini coefficient		-6.33				14.34
		(25.17)				(30.21)
Change in % aged 0-16		-0.485				-1.061
		(0.596)				(0.786)
Change in % aged 65+		-0.040				-0.039
		(0.563)				(0.672)
Initial total population			0.063			0.020
			(0.054)			(0.041)
Initial population density			8.442			9.692**
			(6.073)			(4.082)
Initial mean income				-0.181		-0.759***
				(0.134)		(0.262)
Initial % secon. sect. empl.				0.132		-0.255
				(0.302)		(0.364)
Initial % tert. sect. empl.				0.142		-0.143
				(0.321)		(0.336)
Initial % NDOs					1.412	2.676**
					(1.320)	(1.266)
Constant	8.323***	8.120	12.52***	3.074	8.077***	58.14
	(1.906)	(8.32)	(4.194)	(26.146)	(1.929)	(35.38)
Observations	273	273	273	273	273	273

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The table reports IV estimates of the effect of changes in percentage non-Danish on changes in the percentage of seats won by the left-wing group between the 1981 and 2001 municipal elections. The employed instrument is the share of highrises in 1970 and each observation corresponds to a municipality. The potential controls used are the changes in mean income, fraction not in the workforce, unemployment rate, share of population between 0 and 16 years old, share of population older than 65 years and Gini coefficient, as well as the initial (1981) level of total population, population density, mean income, share of total employment in the secondary sector (manufacturing and construction), share of total employment in the tertiary sector (retail and services) and percentage non-Danish.

Table 7: Effect of ethnic diversity on nationalist voting in municipal elections, IV

Dependent var.: Change in the % of *nationalist* seats   Time period: 1981-2001

IV estimates: Highrise share in 1970 instrumenting for change in % non-Danish

VARIABLES:	(1)	(2)	(3)	(4)	(5)	(6)
Change in % non-Danish	1.411***	0.993***	1.983***	0.930***	1.476***	1.277**
	(0.221)	(0.308)	(0.676)	(0.311)	(0.397)	(0.565)
Change in mean income		-0.121				-0.133
		(0.078)				(0.081)
Change in unemp. rate		0.222				0.104
		(0.181)				(0.213)
Change in the % not in workf.		-0.025				0.049
		(0.170)				(0.181)
Change in Gini coefficient		20.06**				15.28
		(9.90)				(12.99)
Change in % aged 0-16		0.008				0.098
		(0.191)				(0.250)
Change in % aged 65+		0.004				-0.079
		(0.212)				(0.284)
Initial total population			-0.027			-0.017
			(0.017)			(0.013)
Initial population density			-0.923			-1.731
			(1.556)			(1.253)
Initial mean income				0.112**		0.196**
				(0.050)		(0.091)
Initial % secon. sect. empl.				-0.057		-0.078
				(0.120)		(0.138)
Initial % tert. sect. empl.				-0.019		-0.040
				(0.134)		(0.136)
Initial % NDOs					-0.103	-0.690*
					(0.415)	(0.418)
Constant	-6.105***	0.567	-6.948***	-7.564	-6.087***	-3.38
	(0.699)	(2.897)	(1.306)	(10.63)	(0.686)	(13.98)
Observations	273	273	273	273	273	273

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The table reports IV estimates of the effect of changes in percentage non-Danish on changes in the percentage of seats won by the nationalist group between the 1981 and 2001 municipal elections. The employed instrument is the share of highrises in 1970 and each observation corresponds to a municipality. The potential controls used are the changes in mean income, fraction not in the workforce, unemployment rate, share of population between 0 and 16 years old, share of population older than 65 years and Gini coefficient, as well as the initial (1981) level of total population, population density, mean income, share of total employment in the secondary sector (manufacturing and construction), share of total employment in the tertiary sector (retail and services) and percentage non-Danish.

Table 8: Effect of ethnic diversity on left-wing voting in national elections, IV

Dependent var.: Change in the % of *left-wing* votes   Time period: 1981-2001

IV estimates: Highrise share in 1970 instrumenting for change in % non-Danish

VARIABLES:	(1)	(2)	(3)	(4)	(5)	(6)
Change in % non-Danish	-2.642***	-2.130***	-4.069***	-1.187***	-2.659***	-2.106***
	(0.315)	(0.331)	(1.049)	(0.285)	(0.558)	(0.642)
Change in mean income		-0.092				-0.044
		(0.086)				(0.107)
Change in unemp. rate		-0.088				-0.166
		(0.182)				(0.183)
Change in the % not in workf.		0.346				0.145
		(0.217)				(0.180)
Change in Gini coefficient		-50.74***				-24.39**
		(9.46)				(12.43)
Change in % aged 0-16		-0.040				-0.294
		(0.238)				(0.270)
Change in % aged 65+		-0.189				-0.145
		(0.229)				(0.234)
Initial total population			0.042			0.013
			(0.026)			(0.013)
Initial population density			4.018			4.241***
			(2.941)			(1.511)
Initial mean income				-0.204***		-0.313***
				(0.043)		(0.101)
Initial % secon. sect. empl.				-0.664***		-0.582***
				(0.102)		(0.132)
Initial % tert. sect. empl.				-0.532***		-0.429***
				(0.112)		(0.133)
Initial % NDOs					0.028	0.723
					(0.668)	(0.534)
Constant	0.941	-4.443	3.152	62.39***	0.936	55.36***
	(0.854)	(3.117)	(1.998)	(8.74)	(0.834)	(12.62)
Observations	273	273	273	273	273	273

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The table reports IV estimates of the effect of changes in percentage non-Danish on changes in the percentage of votes received by the left-wing group between the 1981 and 2001 national elections. The employed instrument is the share of highrises in 1970 and each observation corresponds to a municipality. The potential controls used are the changes in mean income, fraction not in the workforce, unemployment rate, share of population between 0 and 16 years old, share of population older than 65 years and Gini coefficient, as well as the initial (1981) level of total population, population density, mean income, share of total employment in the secondary sector (manufacturing and construction), share of total employment in the tertiary sector (retail and services) and percentage non-Danish.

Table 9: Effect of ethnic diversity on nationalist voting in national elections, IV

Dependent var.: Change in the % of *nationalist* votes   Time period: 1981-2001

IV estimates: Highrise share in 1970 instrumenting for change in % non-Danish

VARIABLES:	(1)	(2)	(3)	(4)	(5)	(6)
Change in % non-Danish	0.730***	0.219**	0.609***	0.526***	0.645***	0.332*
	(0.089)	(0.109)	(0.135)	(0.109)	(0.126)	(0.192)
Change in mean income		-0.263***				-0.273***
		(0.072)				(0.080)
Change in unemp. rate		-0.087				-0.084
		(0.149)				(0.173)
Change in the % not in workf.		0.101				0.148
		(0.178)				(0.169)
Change in Gini coefficient		26.13***				10.50
		(6.87)				(11.65)
Change in % aged 0-16		-0.036				-0.028
		(0.169)				(0.206)
Change in % aged 65+		0.029				-0.083
		(0.182)				(0.233)
Initial total population			-0.004			-0.010
			(0.007)			(0.007)
Initial population density			1.175*			-0.473
			(0.642)			(0.685)
Initial mean income				0.078		0.116
				(0.048)		(0.074)
Initial % secon. sect. empl.				0.217**		0.194
				(0.104)		(0.120)
Initial % tert. sect. empl.				0.170*		0.176
				(0.098)		(0.113)
Initial % NDOs					0.182	-0.368*
					(0.185)	(0.189)
Constant	0.757**	10.27***	0.902***	-20.30**	0.650*	-13.71
	(0.336)	(2.09)	(0.342)	(8.34)	(0.378)	(11.60)
Observations	273	273	273	273	273	273

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The table reports IV estimates of the effect of changes in percentage non-Danish on changes in the percentage of votes received by the nationalist group between the 1981 and 2001 national elections. The employed instrument is the share of highrises in 1970 and each observation corresponds to a municipality. The potential controls used are the changes in mean income, fraction not in the workforce, unemployment rate, share of population between 0 and 16 years old, share of population older than 65 years and Gini coefficient, as well as the initial (1981) level of total population, population density, mean income, share of total employment in the secondary sector (manufacturing and construction), share of total employment in the tertiary sector (retail and services) and percentage non-Danish.

Table 10: Effect of ethnic diversity on voting for remaining parties in municipal elections, IV

IV estimates   Time period: 1981-2001   Instrument: Highrise share in 1970

EFFECT ON:	(1)	(2)	(3)	(4)	(5)	(6)
Non-nationalist right	-0.736	-0.617	-1.466	-0.895	-0.934	-0.581
	(0.604)	(0.890)	(1.582)	(0.873)	(0.898)	(1.834)
Centrists	0.184	1.002***	0.566	0.571	0.420	0.964
	(0.248)	(0.381)	(0.678)	(0.375)	(0.406)	(0.683)
Other	1.849**	1.452	4.294**	1.620	2.636**	1.894
	(0.766)	(1.124)	(2.038)	(1.014)	(1.124)	(2.007)
Observations	273	273	273	273	273	273
CONTROLS:						
Socioeconomic controls	No	Yes	No	No	No	Yes
Initial population and density	No	No	Yes	No	No	Yes
Initial economic characteristics	No	No	No	Yes	No	Yes
Initial % non-Danish	No	No	No	No	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The table reports IV estimates of the effect of changes in percentage non-Danish on changes in the percentage of seats won by the different political groups 1981-2001. The employed instrument is the share of highrises in 1970 and each observation corresponds to a municipality. Each of the three first rows of the table corresponds to the estimated effect on a different political group, while columns correspond to different specifications. The potential controls used are the changes in a set of socioeconomic indicators (mean income, fraction not in the workforce, unemployment rate, share of population between 0 and 16 years old, share of population older than 65 years and Gini coefficient), the initial population size and density, a set of initial economic characteristics (mean income, share of total employment made up by manufacturing and construction and share of total employment made up by retail and services) and the initial percentage non-Danish.

Table 11: Effect of ethnic diversity on voting for remaining parties in national elections, IV

IV estimates   Time period: 1981-2001   Instrument: Highrise share in 1970

EFFECT ON:	(1)	(2)	(3)	(4)	(5)	(6)
Non-nationalist right	0.776***	0.911***	1.436**	0.040	0.933***	1.285**
	(0.195)	(0.238)	(0.601)	(0.271)	(0.327)	(0.530)
Centrists	0.875***	0.824***	1.188***	0.701***	0.671***	0.611*
	(0.161)	(0.186)	(0.453)	(0.199)	(0.242)	(0.335)
Other	-0.001	-0.000	0.032**	0.005	0.003	0.024**
	(0.005)	(0.007)	(0.014)	(0.006)	(0.007)	(0.012)
Observations	273	273	273	273	273	273
CONTROLS:						
Socioeconomic controls	No	Yes	No	No	No	Yes
Initial population and density	No	No	Yes	No	No	Yes
Initial economic characteristics	No	No	No	Yes	No	Yes
Initial % non-Danish	No	No	No	No	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The table reports IV estimates of the effect of changes in percentage non-Danish on changes in the percentage of votes received by the different political groups 1981-2001. The employed instrument is the share of highrises in 1970 and each observation corresponds to a municipality. Each of the three first rows of the table corresponds to the estimated effect on a different political group, while columns correspond to different specifications. The potential controls used are the changes in a set of socioeconomic indicators (mean income, fraction not in the workforce, unemployment rate, share of population between 0 and 16 years old, share of population older than 65 years and Gini coefficient), the initial population size and density, the initial level of mean income and the initial percentage non-Danish.

Supplementary appendix:

A Details of variables used

Below the detailed construction of each of the main variables is described. Table names refer to the *Statistikbanken* database (*http://www.statistikbanken.dk/*) unless otherwise noted.

- *Share non-Danish* is constructed as the sum of the *indvandrere* and *efterkommere* categories (immigrants and descendants) divided by the total population, based on the *BEF3* table.

- *Total population* is based on the *BEF3* table.

- *Population density* is constructed as total population divided by the mean of the land area 1985-2001 based on the *ARE2* table. The mean over the years available is taken because the measured land area actually shows some very small changes (less than 1 square kilometer) over the period despite the fact that municipal borders did not change.

- *Mean income* is constructed as the mean of total taxable income (*SKPLINK*) according to the *IDA* database of SDs individual-level administrative data, deflated to 1980 prices by the chain-linked GDP deflator from the Danish national account, table *NAT01*.

- *Unemployment rate* is constructed as the number of unemployed divided by the sum of unemployed and employed, according to the *RAS1* table.

- *Gini coefficient* is computed across households using total taxable income, according to the *IDA* database of SDs individual-level administrative data.

- *Share of the population aged 0 to 16* is computed as the total number of people aged 0 to 16 divided by the total population, according to the *BEF3* table.

- *Share of the population older than 65* is computed as the total number of people older than 65 divided by the total population, according to the *BEF3* table.

- *Share rental housing* is computed as the number of homes rented out divided by the sum of owner occupied homes, rented out homes and non-specified, using the *BOL1* table.

- *Share highrises (1970)* is computed as the sum of all highrise homes built before 1970 divided by the sum of all housing built before 1970, in the *BOL3* table.

- *Share seats, left-wing group* is computed as the total number of seats won by *Socialdemokraterne*, *Socialistisk Folkeparti*, *Enhedslisten*, *Internationalen-SAP*, *Danmarks Kommunistparti*, *Arbejderpartiet KAP* and *Venstresocialisterne* divided by the total number of seats, based on the *VALG1*, *VALG9*, *VALG2* and *VALGK3X* tables.

- *Share seats, nationalist group* is computed as the total number of seats won by *Fremskridtspartiet* and *Dansk Folkeparti* divided by the total number of seats, based on the *VALG1*, *VALG9*, *VALG2* and *VALGK3X* tables.

- *Share seats, non-nationalist right-wing group* is computed as the total number of seats won by *Venstre* and *Det Konservative Folkeparti* divided by the total number of seats, based on the *VALG1*, *VALG9*, *VALG2* and *VALGK3X* tables.

- *Share seats, centrist group* is computed as the total number of seats won by *Det Radikale Venstre*, *Centrum Demokraterne*, *Kristeligt Folkeparti* and *Retsforbundet* divided by the total number of seats, based on the *VALG1*, *VALG9*, *VALG2* and *VALGK3X* tables.

- *Share seats, "other" group* is computed as one minus the percentage of seats won by the four other groups defined above, based on the *VALG1*, *VALG9*, *VALG2* and *VALGK3X*.

- *Share votes in national elections, left-wing group* is computed as the total number of votes received by *Socialdemokraterne*, *Socialistisk Folkeparti*, *Enhedslisten*, *Internationalen-SAP*, *Danmarks Kommunistparti*, *Arbejderpartiet KAP* and *Venstresocialisterne* divided by the total number of votes cast, according to the election data from *Den Danske Valgdatabase* (downloaded from *http://valgdata.ps.au.dk/*).

- *Share votes in national elections, nationalist group* is computed as the total number of votes received by *Fremskridtspartiet* and *Dansk Folkeparti* divided by the total number of votes cast, according to the election data from *Den Danske Valgdatabase* (downloaded from *http://valgdata.ps.au.dk/*).

- *Share votes in national elections, non-nationalist right-wing group* is computed as the total number of votes received by *Venstre* and *Det Konservative Folkeparti* divided by the total number of votes cast, according to the election data from *Den Danske Valgdatabase* (downloaded from *http://valgdata.ps.au.dk/*).

- *Share votes in national elections, centrist group* is computed as the total number of votes received by *Det Radikale Venstre*, *Centrum Demokraterne*, *Kristeligt Folkeparti* and *Retsforbundet* divided by the total number of votes cast, according to the election data from *Den Danske Valgdatabase* (downloaded from *http://valgdata.ps.au.dk/*).

- *Share votes in national elections, "other" group* is computed as one minus the percentage of votes received by the four other groups defined above, according to the election data from *Den Danske Valgdatabase* (downloaded from *http://valgdata.ps.au.dk/*).

- *Employment share, agriculture and natural resources* is constructed as the number of workings salaried workers living in the municipality and classified as working in agriculture or natural resources, divided by the total number of salaried workers living in the municipality without missing industry information based on the *PDB932* and *PSTILL2* variables of the *IDA* database of SDs individual-level administrative data.

- *Employment share, manufacturing* is constructed as the number of workings salaried workers living in the municipality and classified as working in manufacturing, divided by the total number of salaried workers living in the municipality without missing industry information based on the *PDB932* and *PSTILL2* variables of the *IDA* database of SDs individual-level administrative data.

- *Employment share, services and retail* is constructed as the number of workings salaried workers living in the municipality and classified as working services or retail, divided by the total number of salaried workers living in the municipality without missing industry information based on the *PDB932* and *PSTILL2* variables of the *IDA* database of SDs individual-level administrative data.

B Equivalence of IV-estimators with time-invariant instrument

This section shows that when using a time-invariant instrument the IV estimator obtained from a usual first-difference specification is equivalent to the IV estimator from the "long difference" specification used in the paper.

Mirroring the discussion in section 2 of the paper, consider the following regression equation, where we have data on N different municipalities (index i) across T different elections (index t):

$$y_{it} = \beta x_{it} + \kappa + \mu_i + \alpha\,t + \eta_i\,t + \nu_{it} \tag{5}$$

As in section 2 we let Δ denote the long difference operator, that is $\Delta x_i = x_{iT} - x_{i1}$. We can then consider the long differenced version of the equation:

$$\Delta y_i = \alpha + \beta \Delta x_i + \psi_i \tag{6}$$

To simplify notation, we have here defined a composite error term $\psi_i \equiv \eta_i + \Delta \nu_i$.

Next we also introduce D as the usual first difference operator, that is $Dx_{it} = x_{it} - x_{it-1}$. We can then write the first differenced version of the equation:

$$Dy_{it} = \alpha + \beta Dx_{it} + \phi_{it} \tag{7}$$

Again, we have here defined a composite error term $\phi_{it} \equiv \eta_i + D\nu_{it}$.

We will now consider instrumental variable estimation of both the "long difference" specification, (6), and the usual first difference specification, (7). Mirroring again the empirical analysis in the paper, we will consider IV estimation using a time-invariant instrument variable z_i to instrument for Δx_i and Dx_{it} respectively. We will show that the two estimators obtained for the parameter β are identical.

If we let $\bar{x}$ denote the mean across the first differenced sample so that $\bar{x} = \frac{1}{N}\sum_{i=1}^{N} x_i$, the IV estimator in the long-differenced equation is:

$$\hat{\beta}_{IV,\Delta} = \frac{\sum_i (z_i - \bar{z})\left(\Delta y_i - \bar{\Delta y}\right)}{\sum_i (z_i - \bar{z})\left(\Delta x_i - \bar{\Delta x}\right)} \tag{8}$$

Similarly if we let $\tilde{x}$ denote the mean across the first-differenced sample so that $\tilde{x} = \frac{1}{N(T-1)} \sum_{i=1}^{N} \sum_{t=2}^{T} x_{it}$, the IV estimator in the first-differenced equation is:

$$\hat{\beta}_{IV,D} = \frac{\sum_{i=1}^{N} \sum_{t=2}^{T} (z_i - \tilde{z}) \left(Dy_{it} - \tilde{Dy} \right)}{\sum_{i=1}^{N} \sum_{t=2}^{T} (z_i - \bar{z}) \left(Dx_{it} - \tilde{Dx} \right)} \tag{9}$$

Since the instrument does not vary with time, we can rewrite this as follows:

$$
\begin{aligned}
\hat{\beta}_{IV,D} &= \frac{\sum_{i=1}^{N} (z_i - \tilde{z}) \sum_{t=2}^{T} \left(Dy_{it} - \tilde{Dy} \right)}{\sum_{i=1}^{N} (z_i - \bar{z}) \sum_{t=2}^{T} \left(Dx_{it} - \tilde{Dx} \right)} \\
&= \frac{\sum_{i=1}^{N} (z_i - \tilde{z}) \left(\sum_{t=2}^{T} Dy_{it} - \sum_{t=2}^{T} \tilde{Dy} \right)}{\sum_{i=1}^{N} (z_i - \bar{z}) \left(\sum_{t=2}^{T} Dx_{it} - \sum_{t=2}^{T} \tilde{Dx} \right)}
\end{aligned} \tag{10}
$$

Now we note the following:

$$\sum_{t=2}^{T} Dx_{it} = \sum_{t=2}^{T} (x_{it} - x_{it-1}) = x_{iT} - x_{i1} = \Delta x_i \tag{11}$$

and

$$\sum_{t=2}^{T} \tilde{Dx} = (T-1) \cdot \tilde{Dx} = \tfrac{1}{N} \sum_{i=1}^{N} \sum_{t=2}^{T} Dx_{it} = \tfrac{1}{N} \sum_{i=1}^{N} \Delta x_i = \bar{\Delta x_i} \tag{12}$$

Similar calculations show that $\sum_{t=2}^{T} Dy_{it} = \Delta y_i$ and $\sum_{t=2}^{T} \tilde{Dy} = \bar{\Delta y_i}$. If we plug these into (10) we see that $\hat{\beta}_{IV,\Delta} = \hat{\beta}_{IV,D}$. When using a time-invariant instrument, the first difference and long difference IV-estimators are thus numerically equivalent.