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MIGRATION, HOUSING AND REGIONAL DISPARITIES: A GRAVITY MODEL OF INTER-REGIONAL MIGRATION WITH AN APPLICATION TO SELECTED OECD COUNTRIES

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Abstract/Résumé

Migration, housing and regional disparities: a gravity model of inter-regional migration with an application to selected OECD countries

Inter-regional migration – the movements of the population from one region to another within the same country – can be an important mechanism of spatial economic adjustment, affecting regional demographic and growth patterns. This paper examines the economic and housing-related factors that affect the decision of people to migrate to another region within the same country, drawing empirical evidence from country-specific gravity models of inter-regional migration for 14 OECD countries. The results suggest that inter-regional migrants move in search of higher income and better employment opportunities, but are discouraged by high housing costs. In particular, house prices are found to be an important barrier to migration, especially in countries having experienced strong increases in the level and cross-regional dispersion of house prices. There is however large heterogeneity across countries in terms of what factors matter the most and in terms of the magnitude of the migration response.

JEL classification: R12, R23, R31, J61

Keywords: inter-regional migration, internal migration, regional mobility, housing, house prices, regional disparities, local labour markets

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Migrations, logement et inégalités inter-régionales : un modèle gravitationnel appliqué aux pays de l'OCDE

La migration interrégionale – les mouvements de la population d'une région à une autre à l'intérieur d'un même pays – peut être un important mécanisme d'ajustement spatial, puisqu'elle affecte la répartition de la population sur le territoire et la croissance des régions. Cet article examine les facteurs économiques et ceux liés au logement qui affectent la décision des personnes de migrer d'une région à une autre, sur la base d'estimations tirées de modèles gravitationnels de migration interrégionale appliqués à 14 pays de l'OCDE. Les résultats suggèrent que les migrants interrégionaux se déplacent à la recherche de revenus plus élevés et de meilleures opportunités d'emploi, mais sont découragés par le coût élevé du logement. Les prix immobiliers s'avèrent être un obstacle particulièrement important à la migration dans les pays ayant connu de fortes augmentations du niveau et de la dispersion interrégionale de ces prix. Il existe cependant une grande hétérogénéité entre les pays en termes de facteurs qui comptent le plus, et en termes d'ampleur de la réponse migratoire.

Classification JEL*:* R12, R23, R31, J61

Mots-clés *:* Migration interrégionale, migration interne, mobilité régionale, marché du logement, prix du logement, inégalités régionales, marchés du travail locaux

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Migration, housing and regional disparities: a gravity model of inter-regional migration with an application to selected OECD countries

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Introduction and motivation

Inter-regional migration[2] – the movements of the population from one region to another within the same country – can be an important channel of economic adjustment. It can cushion asymmetric shocks and reduce regional disparities by alleviating local imbalances between labour demand and supply. It can make economies more efficient, resilient and inclusive by promoting the matching between workers and jobs, and by allowing workers to find better-paid jobs and leave disadvantaged areas. However, inter-regional mobility can also widen regional disparities when it is a possibility only for relatively more privileged socioeconomic groups, such as high-skilled workers. In this case it can lead to persistent regional differentials in productivity, human capital composition and wages. It can cause depopulation and slow economic growth in those areas that are left behind, while it can spur congestion and concentration in attractive areas, contributing to environmental and health damage. Removing obstacles to geographic mobility is not an end in itself, but it can foster inclusive growth, especially when migration is accessible to all socioeconomic groups. It may then improve growth prospects, especially in countries where regional disparities are pronounced.

Inter-regional migration is attracting policy attention for two reasons. First, a decline in internal migration has been observed in some advanced economies, in particular in the United States (Molloy and Smith (2019[1]); Kaplan and Schulhofer-Wohl (2012[2])). Evidence suggests that declining returns to migration have arisen, because the expected income gains from moving no longer compensate for rising housing costs, especially for workers at the bottom of the wage and skill distribution (Bayoumi and Barkema (2019[3]); Gbohoui, Lam and Lledo (2019[4])). Second, internal migration is gaining traction in the context of the recovery from the COVID-19 crisis. The differential impact of the pandemic across sectors, occupations and locations suggests that a large number of jobs may become obsolete, while demand for new ones could rise (Barrero, Bloom and Davis, 2020[5]). Labour market reallocation likely requires some spatial mobility across regions within countries. The magnitude of reallocation is uncertain as it depends on the extent to which the impact of the crisis will have long-lasting effects on the structure of the economy and on working modalities, for example, via the adoption of teleworking. In the medium-term, labour mobility, including across regions, could help countries weather the storm of the pandemic and limit its economic costs nationwide. In addition, it could benefit workers by favouring job transitions out of declining sectors or firms, and by promoting shorter spells of unemployment. In the long-term, the increased capacity to achieve efficient spatial reallocation may foster adaptation and resilience.

This paper contributes to the literature on the relationship between inter-regional migration, the spatial allocation of activity and regional disparities. It examines whether inter-regional migration responds to economic and housing-related factors across regions, drawing empirical evidence from a selection of 14 OECD countries: Australia, Canada, Denmark, Finland, Italy, Korea, Japan, Netherlands, Poland, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The analysis makes use of bilateral gravity models of inter-regional migration flows, which link bilateral migration movements to the

[2] In this paper, inter-regional or internal migration is defined as the movements of the population from one region to another within the same country. This notion excludes movements to and from abroad, and movements within the same region. Changing slightly across data sources, these movements are usually officially registered changes of residence. Regions are defined based on the OECD territorial classification of sub-national units, which distinguishes primarily between larger (TL2) and smaller (TL3) regions. The territorial level (TL) classification is an official OECD standard used to subdivide the sub-national territory of OECD member countries. Regions have been classified according to two territorial levels. The higher level (TL 2) consists of macro-regions, generally corresponding to the first government layers after the national or federal one; for example, States in the United States and Provinces in Canada. The lower level (TL 3) is contained within large regions and is composed of micro-regions, such as Provinces in Denmark and Prefectures in Japan. For EU-OECD countries, the TL classification is largely consistent with the Eurostat NUTS standard. For more information, see: http://stats.oecd.org/wbos/fileview2.aspx?IDFile=cebce94d-9474-4ffc-b72a-d731fbdb75b9

characteristics of origin and destination regions, including the distance between them. The use of a country-by-country analytical approach allows to identify cross-country heterogeneities. In addition, it gathers granular evidence; because modelling bilateral migration flows enables to disentangle the role of origin and destination regions, and thus to shed light on the importance of cross-regional differences in shaping mobility patterns. The contribution to the literature is twofold: first, this paper estimates bilateral gravity models for a large set of countries using a harmonised approach, allowing to obtain country-specific evidence. Second, the paper then compares the results from individual country gravity models to draw cross-country and country-specific policy insights and explanations.

This paper finds that patterns of inter-regional migration vary significantly across OECD countries. The empirical results based on gravity regressions indicate that, consistently across the 14 OECD countries analysed in this paper, inter-regional migration is especially responsive to cross-regional differences in house prices, labour market conditions and income. This evidence confirms previous empirical and theoretical literature in this field. House prices and income are found to be the strongest factors affecting migration flows in a majority of countries; while labour market conditions, although most often relevant, are found to play a weaker role. House prices emerge as important barriers to migration in countries having experienced strong increases in the level and cross-regional dispersion of house prices (Sweden, Canada, the United Kingdom), while they are less important in countries where commuting is a relatively widespread alternative to migration (Netherlands, Switzerland). However, the responsiveness of internal migration to local economic factors varies across countries in terms of what factors matter the most and in terms of the magnitude of the response. This implies that policy requirements in this area will depend on country-specific context, challenges and social preferences.

The rest of this paper is structured as follows. The first section presents the patterns and trends of inter-regional migration across the countries considered in this study. The second section describes the empirical strategy based on bilateral gravity equations of inter-regional migration with a focus on three core drivers: income, local labour market conditions and house prices. The third section offers a cross-country assessment of the empirical results; while the following section discusses in detail the findings country-by-country, linking the empirical evidence with the national context and with previous literature. The fifth section examines the empirical findings of an alternative gravity specification based on cross-regional differences between destination and origin drivers, instead of estimating the regional drivers separately. The last section summarises the main findings and concludes with the policy implications of these results.

Stylised facts on inter-regional migration

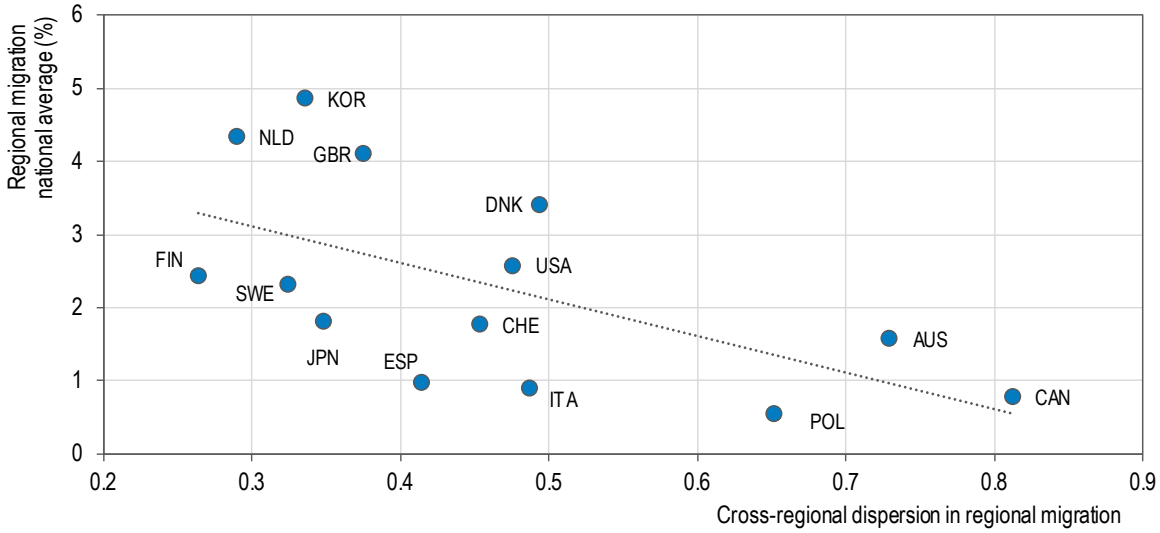
Inter-regional migration rates vary widely across OECD countries (Figure 1). On average, less than 1% of the population change region of residence each year in Italy, Poland and Canada, while annual mobility rates are above 3% in Korea, Netherlands, the United Kingdom, Australia and Denmark.[3] Countries where inter-regional migration is relatively low also tend to be more polarized, in the sense that some highly attractive locations receive a majority of migrants, while other regions have very small inflows. In these countries, internal migration tends to occur along a few mainstream bilateral routes, with migrants moving between locations that prove to be persistently attractive, most often metropolitan areas (OECD, 2020[6]). The increasing dominance of few attractive areas risks hindering regional convergence, as well as the spatial reallocation of labour and thereby labour market dynamism. One argument that has been put

[3] Inter-regional migration rates can vary depending on the classification (level) of territorial units considered. For example, in Australia and Canada, migration rates across smaller local units (TL 3 regions) are higher than across larger regions (TL 2 regions). Different data sources can also deliver different estimates of the intensity of internal migration and of its trends (for example, see Molloy and Smith (2019[1]) for alternative evidence on inter-state migration intensity in the United States). Nevertheless, the patterns of inter-regional migration are unaffected by the level of regional definition and the data source. For more details, see Annex B.

forward is that lower cross-regional inequalities could promote internal migration, with positive efficiency and equity implications (Gbohoui, Lam and Lledo, 2019[4]). This is because when economic opportunities are more evenly distributed across regions, there are more opportunities for people and firms to benefit from welfare-enhancing migration.

Figure 1. The level and dispersion of inter-regional migration rates

Annual average over the period 2014-2018



Note: Inter-regional migration rates are defined for each region as the number of migrants moving into the region from another region in the same country divided by regional population one year before. The national average is calculated as the sum across regions of new residents from another region, divided by the sum across regions of the regional population one year before. The regional dispersion is measured by the coefficient of decile variation (D9-D1)/(D9+D1) across the regional migration rates. Average of years 2014-2018 except for the United States (2012-2016). TL3 classification for all countries except for the United States, Canada and Australia (TL2). Because of gaps in the time series, the computations of migration rates for the United Kingdom exclude TL3 regions coded alphabetically from D33 to D47, from H15 to H17, from H34 to H37, from J25 to J28, from J35 to J46, and the regions of London and Scotland.
Source: OECD calculations using CPS (from IPUMS, (Flood et al., 2020[7])) data for the United States and the OECD Regional Statistics Database for the remaining countries.

Over recent decades, inter-regional migration has been declining in some countries such as Australia, Canada, Spain, Korea, Japan and the United States. On the contrary, migration rates have been rising in the Nordics and Switzerland. They have been stable in Italy, Poland and the United Kingdom (Figure 2).[4]

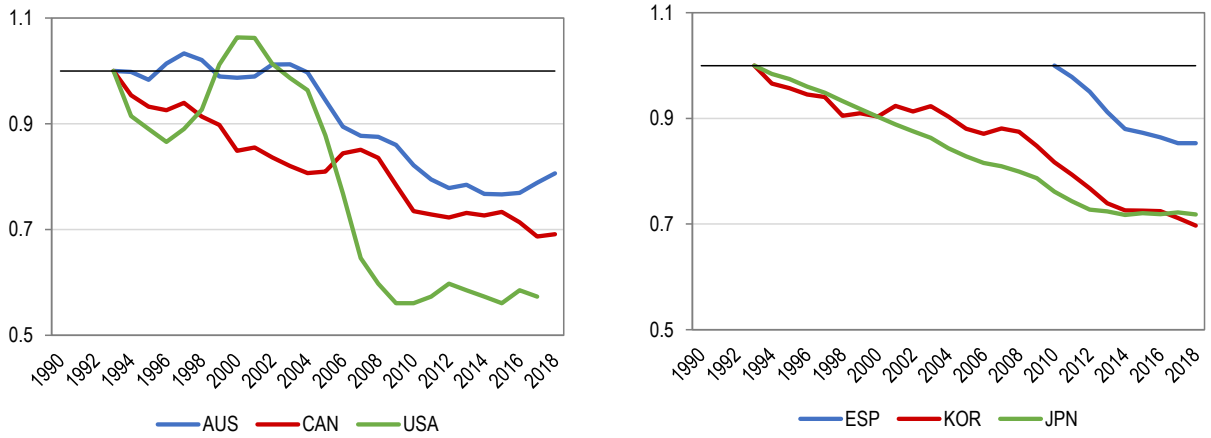
The debate over the causes and consequences of declining internal migration rates is vast and especially concentrated on the United States. Cross-state migration has become less responsive to labour demand shocks (Dao, Furceri and Loungani, 2017[8]), possibly because workers have reduced their tendency to engage in job transitions, contributing to lower labour market dynamism (Molloy, Smith and Wozniak, 2013[9]). In addition, the fall in mobility has been more prevalent among lower-educated and low-income workers (Davis and Haltiwanger, 2014[10]), with adverse distributional implications. As a result, less advantaged individuals have found themselves increasingly "trapped" in declining areas, contributing to exacerbate regional inequalities and potentially the "geography of discontent". The housing market has been recognised as another major factor explaining the decline in internal migration in the United States. Ganong and Shoag (2017[11]) have documented that rising house prices in growing areas deter inward migration of lower-skilled individuals. In turn, Hsieh and Moretti (2019[12]) have argued that declining

[4] These same patterns are also evident if TL3 regions are considered. See Annex B for more details.

migration is related to rising housing costs in a number of cities in the United States, especially in those where too stringent land-use regulation prevents an expansion of housing supply when demand rises.

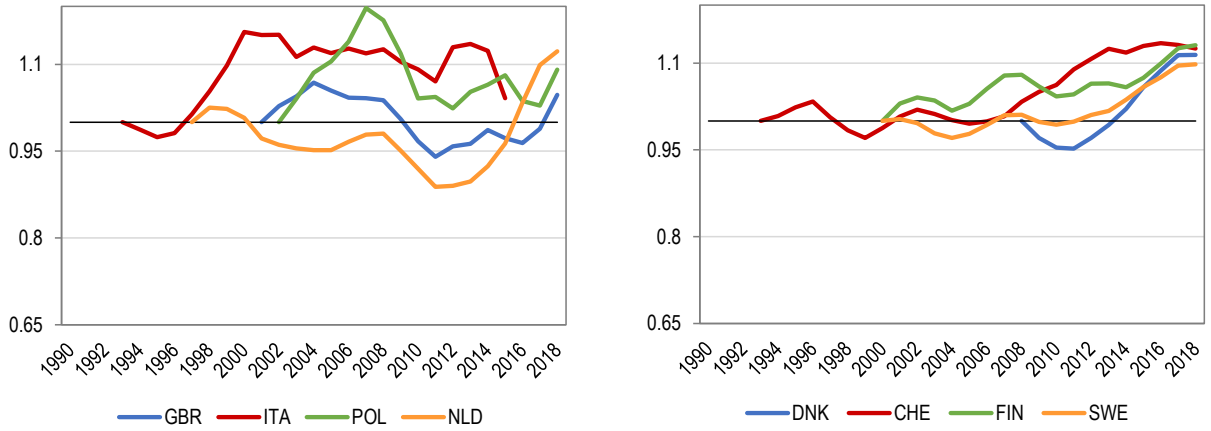
Figure 2. Trends in inter-regional migration across countries

2.A. Countries experiencing a decline in inter-regional migration



2.B. Countries experiencing a stable inter-regional migration

2.C. Countries experiencing an increase in inter-regional migration



Source: OECD calculations using CPS (from IPUMS, (Flood et al., 2020[7])) data for the United States and the OECD Regional Statistics Database for the remaining countries.

In Japan, Korea and some continental European countries, trends in inter-regional migration partially reflect the ageing of the population, which reduces the share of the most mobile age groups (Japan, Korea, and Spain). In other countries, internal migration fluctuates relatively more over time, potentially in response to the business cycle (Netherlands, Finland). A study covering several European Union countries (Arpaia et al., 2018[13]) found that unemployment is a strong predictor of migration flows within and across countries. However, some southern European countries, such as Spain and Italy, have structurally high

regional unemployment rates, wage rigidities and persistent regional disparities in labour market performance. Previous literature on these countries has found that internal migration is weakly responsive to labour market shocks (Mulhern and Watson (2010[14]); Ciani, David and De Blasio (2019[15])).

Modelling bilateral inter-regional migration flows: the gravity approach

To identify the determinants of cross-regional migration, the empirical analysis in this paper employs a gravity approach, which is inspired by the modelling of bilateral trade flows (Tinbergen, 1962[16]). This approach has been increasingly adopted by empirical migration studies as it allows to assess and compare origin and destination effects affecting individual migration choices. Destination effects represent factors attracting migrants into a region and are usually termed "pull" factors in the gravity literature. Origin effects are termed "push" effects insofar that they encourage outmigration from a region.

In the literature on inter-regional migration, some studies estimate separate effects for characteristics in origin and destination regions (e.g. Liu (2018[17]); Poghosyan (2018[18])), while others estimate the effect of the difference or the ratio of characteristics in origin and destination regions (e.g. Bayoumi and Barkema (2019[3]); Maza and Villaverde (2004[19])). The latter strategy simplifies the analysis and allows to reduce the number of variables in the model and to limit risks of overfitting and multicollinearity, especially when the pairs of regions are similar in characteristics. However, such a specification does not allow to disentangle the dissimilar impact of the same factor on inward versus outward migration, neither to identify whether both push and pull effect matter. This paper takes the more demanding approach of including each explanatory variable twice: one term representing the conditions in the origin region (push factor) and the other representing the destination region (pull factor). Yet, for the purpose of comprehensiveness, the alternative approach - delivering consistent results and complementing the baseline model with push and pull effects - is discussed in the section following the country-by-country discussions.

The baseline gravity models estimated in this paper include explanatory variables representing spatial, demographic, economic, labour and housing-related characteristics of regions:

$$MIG_{ij,t} = \beta_0 + \beta_1 DIS_{ij} + \beta_2 POP_{i,t-1} + \beta_3 POP_{j,t-1} + \sum_{s=1}^{3}(\gamma_s {X^s}_{i,t-1} + \delta_s {X^s}_{j,t-1}) +$$

$$\sum_{s=0}^{n}(\theta_s {Z^s}_{i,t-1} + \tau_s {Z^s}_{j,t-1}) + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ij,t} \qquad \forall\, i \neq j \qquad (1)$$

where $MIG_{ij,t}$ is the gross migration flow from origin region *i* to destination region *j* in year *t*. DIS_{ij} is the geographic distance between region *i* and *j,* capturing the transaction cost associated to mobility. Longer distances imply higher relocation costs; hence this term is expected to affect migration flows negatively. $POP_{i,t-1}$ and $POP_{j,t-1}$ are the total population in year *t-1* in the origin and destination region, respectively. Population in the destination region is expected to affect migration positively due to agglomeration effects, while the effect of population in the origin region is in theory ambiguous. A broad population base in the origin region implies a larger pool of potential out-migrants, but it can also signal a prosperous location, where incentives to move out would be lower.

${X^s}_{i,t-1}$ and ${X^s}_{j,t-1}$ are vectors of region *i* and *j* 's characteristics containing the three key economic drivers of migration analysed in this study: real regional GDP per capita, the regional unemployment rate and real regional house prices.

- ***Real regional GDP per capita***. The variable is used as a proxy for living standards, income and prosperity in a region. In several studies, GDP per capita has been found to be a strong determinant of migration, either in the destination or origin region (Poghosyan, 2018[18]). Intuitively, a higher level of GDP per capita at destination acts as an attractor and is positively correlated with inward

mobility. It represents expected earnings potential and it may be a proxy for the quality of local amenities. In the origin region, low levels of GDP per capita compared to other regions may incentivise people to look for opportunities elsewhere, thus being associated with more outflows.

- ***Regional unemployment rate***. Local labour market conditions are measured by the unemployment rate, which has been shown to be an important determinant of migration (Arpaia et al., 2018[13]). According to theory, people pursue job-related opportunities and move to regions where unemployment rates are low. Therefore, the unemployment rate in the destination region is expected to be negatively correlated with inward mobility, while in the origin region it is expected to be positively correlated with outward mobility. However, some recent studies have documented a reduced sensitivity of internal migration to labour market conditions and in some models there is no clear empirical evidence on the role of the unemployment rate (Maza and Villaverde, 2004[19]).
- ***Real regional house prices***. Housing market characteristics are increasingly relevant for migration decisions (Bayoumi and Barkema, 2019[3]). The literature has consistently found a negative relationship between house prices and migration inflows. High house prices in the destination region dampen in-migration as they increase relocation costs and thus reduce economic gains for potential incoming migrants (Cannari, Nucci and Sestito (2000[20]); Poghosyan (2018[18])). On the contrary, the effect of house prices for out-migration is ambiguous (Liu, 2018[17]). On the one hand, people may prefer to move out of regions where housing is becoming increasingly less affordable. Most inter-regional movers are young adults and prime-aged workers who do not (yet) own their dwelling and hence are more exposed to market fluctuations in house prices (Caldera Sánchez and Andrews, 2011[21]). On the other hand, homeowners may prefer to stay in regions where house prices are rising because this may lead to significant wealth effects. In this paper, real regional house prices are expressed as the real price per square meter.[5]

The vectors $Z^{s}{}_{i,t-1}$ and $Z^{s}{}_{j,t-1}$ include additional variables that vary across countries, depending on the country-specific context and on data availability. These variables are:

- ***Share of seniors in the population***. Evidence shows that young people represent a substantive share of regional migrants (OECD, 2020[6]), while elderly people tend to be less mobile. A region with a large proportion of seniors is thus expected to have low both in- and out-migration.
- ***Rental prices***. Homeownership is not the unique modality to access housing and rental prices at the regional level are included for the subset of countries for which such data are consistently available.
- ***Homeownership rates***. Many studies have shown that homeowners are less mobile than renters (Caldera Sánchez and Andrews (2011[21]); Causa and Pichelmann (2020[22])). As a result, a region with a large share of homeowners is expected to have fewer out-migrants and potentially fewer in-migrants, for instance, because of a lower supply of rental housing.
- ***Regional sectoral specialisation – manufacturing***. Evidence suggests that recent inter-regional migration flows are influenced by developments in regional industry specialisation (Rusticelli et al., 2018[23]). Workers have tended to move away from regions with shrinking industries and this pattern has been particularly pronounced in regions specialised in manufacturing activities (Bourne et al., 2020[24]). The manufacturing sector has been one of the most hard-hit by trade and automation shocks, with employment losses highly concentrated in certain regions. Overall, the trend decline in manufacturing implies that regions specialised in manufacturing are expected to attract fewer migrants and to experience more outflows, but this effect is likely to vary depending on country-specific specialisation within the manufacturing sector. To control for such effects, the regressions may include the share of employment in the manufacturing sector over total employment.

[5] The house price metrics used in the gravity regression can vary across countries depending on data availability. See Annex A for more details on the exact metrics used in each country.

- ***International migrants***. Regions with a large share of international migrants may attract migrants from other regions, having a positive effect on inward migration. In some countries (e.g. the United States, see Cadena and Kovak (2016[25])) a relatively large share of inter-regional movers are of foreign origins and they move towards areas where their community is established, reflecting network effects. Evidence suggests that international migrants are more mobile and more responsive to changing local economic incentives and labour market shocks than natives (Basso and Peri, 2020[26]), possibly because of a weaker attachment to the location they reside in due to lower homeownership rates or weaker family ties (Mincer, 1978[27]). In addition, a larger share of international migrants may signal agglomeration effects.

The model includes time, origin and destination region fixed effects, denoted by α_t, α_i, and α_j, respectively.[6] All variables (except for the dummies) are defined in logarithms so that the estimated parameters can be interpreted as elasticities. As the migration flows observed in year *t* possibly reflects mobility decisions made by the individuals in previous periods, the time-varying explanatory variables POP, X^s and Z^s are included with lags. This also alleviates reverse-causality concerns as migration itself changes local conditions in both origin and destination regions. Population, GDP per capita, the unemployment rate and most control variables are included with one-year lag. House prices are included with a two-year lag to reduce possible simultaneity bias with GDP per capita. Robust standard errors, clustered at the origin-to-destination pair, are imposed to account for potential spatial correlations of error terms.[7]

The analysis covers 14 OECD countries: Australia, Canada, Denmark, Finland, Italy, Korea, Japan, Netherlands, Poland, Spain, Sweden, Switzerland, the United Kingdom and the Unites States. The country coverage is determined by data availability. For most countries, the analysis is based on regions defined at the second level of territorial classification (TL 2),[8] except for Finland, Denmark, Japan and Korea where data allows to use a more granular classification (TL 3). A smaller regional definition is in theory preferable as it makes more likely to capture short-distance migration, such as relocations from urban to suburban areas where housing costs are lower, without job change if cross-regional commuting is possible. Instead, inter-regional migration across larger regions (TL2) is more likely to capture long-distance migration, potentially associated with job-related motivations. Data availability issues preclude from using systematically smaller regional definitions in the analysis.

Data on bilateral migration flows are from official national statistics, predominantly from administrative registries of the resident population. Such sources allow to have a comprehensive coverage of all regions and of all bilateral flows among them, with consistent measurement over time.[9] The time coverage, based

[6] It is in principle possible to include origin-to-destination dummy variables to control for regional-pair fixed effects: for example, cultural or climate differences across regions that can be interpreted as additional unobservable relocation costs. However, these variables are highly collinear with the distance term, while having no effects on any other independent variable. Distance alone is sufficient to control for time-invariant characteristics among the pairs of regions.

[7] Inter-regional flows are not independent of each other. To account for the potential spatial autocorrelation among origins and destinations, the empirical literature frequently clusters standard errors using origin-to-destination regional pairs (Ramos and Surinach (2013[82]); Yotov et al. (2016[81])). This is the approach used also in this study to account for potential spatial correlation across error terms.

[8] See Annex A for more details on the regional definition considered in this study for each country.

[9] The same analysis using bilateral flows drawn from survey data could be possible, but more prone to encounter attrition bias and coverage gaps. Because of the sampling structure, survey data do not generally allow to construct annual bilateral migration flows for each regional pair, especially when regions are narrowly defined. Population registry data allow a complete and correct account of all population movements within a country. The drawback is that such data do not generally allow to distinguish the migrant population by their socio-demographic characteristics and

on annual data, varies across countries but, on average, it corresponds to the period from the early 2000s to 2018.

Data on the explanatory variables are predominantly from the OECD Regional Statistics Database and National Statistical offices. Regional house price series, expressed in levels, are constructed for most countries for the purpose of this paper, based on the OECD Regional House Price Database, the database of price level estimates (Houselev) of the European Commission (Bricongne, Turrini and Pontuch, 2019[28]) and national sources.[10] Finally, distance between pairs of regions, expressed in kilometres, is computed ad-hoc for the purpose of this paper and is defined as the straight-line distance between the geographic centres of origin and destination regions.[11]

A cross-country assessment of the main findings

Table 1 provides a summary overview of the baseline gravity models estimated for each country, while detailed results for each country are presented in the next section, together with tests on alternative specifications and country-specific discussions of the results.

The results of the country-by-country bilateral gravity models – detailed in the next section – suggest that, in almost all countries, inter-regional migration is more responsive to regional conditions prevailing in the destination region than in the origin region (Figure 3). GDP per capita and house prices in the destination region tend to be the strongest drivers of migration in most countries, while labour market conditions seem to play a secondary role. At the same time, the results also point to large cross-country differences[12] in the estimated responsiveness of internal migration to local economic conditions and living costs. The remainder of this section proposes some interpretations of such differences.

that the time of registration may be partially influenced by fiscal or administrative reasons rather than representing the true moment of migration, especially in countries where there is no fixed time limit to report a change in residence. The annual frequency of the analysis should significantly reduce the concern of a mismatch between the time of migration and its registration.

[10] Annex A details the data sources and definitions, as well as the time and regional coverage for each country.

[11] For each region, the geographic centre (centroid) is derived from the regional geographic coordinates (i.e. longitude and latitude) available from geographic Information databases. See Annex A for more details on the sources of such data.

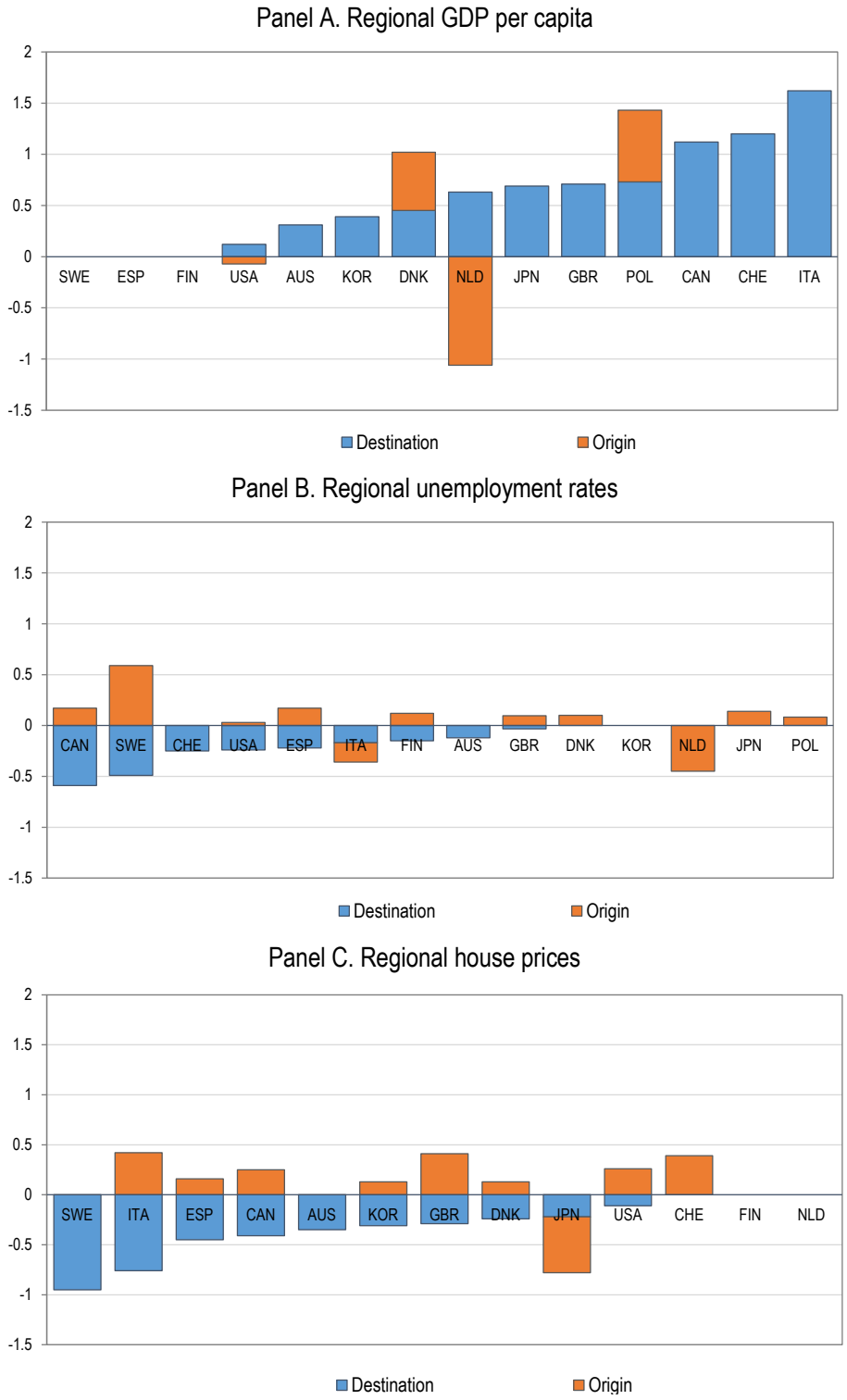
[12] Cross-country differences in estimated elasticities could partly reflect differences in the definition of regions and on their size. Most country estimates are based on the TL2 classification, with the exception of Korea, Japan, Finland, and Denmark (TL3). It is in principle possible to estimate gravity models at the TL2 level for these four countries. However, this is not recommended because: (i) aggregating the data from TL3 to TL2 triggers information losses and (ii) Denmark and Finland would need to be excluded from the empirical study due to an insufficient number of observations, as these countries have very few TL2 regions.

Table 1. Baseline estimation results

Dependent variable: number of persons moving from origin to destination region in a given year	AUS	CAN	DNK	FIN	ITA	JPN	KOR	NLD	POL	ESP	SWE	CHE	GBR	USA
Distance	**-0.52*** **	**-0.75*** **	**-1.21*** **	**-1.47*** **	**-0.57*** **	**-1.26*** **	**-1.32*** **	**-1.70*** **	**-1.74*** **	**-1.43*** **	**-1.10*** **	**-1.94*** **	**-0.96*** **	**-1.21*** **
Population t-1 - destination	0.37	0.65	0.25	**0.79*** **	-0.41	**1.32*** **	**1.10*** **	-0.85	**2.04*** **	-0.57	**2.05*** **	1.88	**1.26*** **	**0.39*** **
Population t-1 - origin	**1.53*** **	0.43	0.26	**0.63*** **	**1.32** **	**1.55*** **	**0.68** **	0.45	0.29	**1.12*** **	-0.2	0.36	**0.66** **	**0.81*** **
Real GDP per capita t-1 - destination	**0.31** **	**1.12*** **	**0.45***	0.007	**1.62*** **	**0.69*** **	**0.39*** **	**0.63** **	**0.73*** **	-0.4	-0.37	**1.20***	**0.71*** **	**0.12*** **
Real GDP per capita t-1 - origin	-0.14	0.25	**0.57** **	-0.067	0.042	-0.01	0.012	**-1.06*** **	**0.70*** **	0.36	-0.12	0.063	-0.11	**-0.071*** **
Unemployment rate t-1 - destination	**-0.12*** **	**-0.59*** **	0.032	**-0.15*** **	**-0.17** **	0.049	-0.02	0.19	-0.02	**-0.22*** **	**-0.49** **	**-0.25** **	**-0.033***	**-0.24*** **
Unemployment rate t-1 - origin	-0.008	**0.17** **	**0.10*** **	**0.12** **	**-0.19** **	**0.14*** **	0.01	**-0.45*** **	**0.083** **	**0.17*** **	**0.59*** **	0.1	**0.097*** **	**0.029*** **
Real house prices t-2 - destination	**-0.35*** **	**-0.41*** **	**-0.24*** **	-0.045	**-0.76*** **	**-0.22*** **	**-0.31*** **	-0.18	0.011	**-0.45*** **	**-0.95** **	-0.01	**-0.29*** **	**-0.11*** **
Real house prices t-2 - origin	-0.0074	**0.25** **	**0.13***	0.00	**0.42** **	**-0.56*** **	**0.13***	-0.39	**-0.20***	**0.16***	0.35	**0.39***	**0.41*** **	**0.26*** **
CONTROLS:														
Share of seniors	✓		✓	✓								✓		
Real rental prices		✓												
Homeownership rate					✓		✓			✓				✓
% of Employment in manufacturing				✓				✓						
International migrants					✓									✓
Observations (N*T)	1,176	1,080	880	4350	2,937	15,206	1,890	1716	2,198	3,059	690	252	1530	56,000
Regions	8	10	7	18	19	19	15	21	15	18	13	7	8	51
Years	21	12	8	16	13	17	9	9	11	10	13	6	16	22
R^2	0.35	0.66	0.94	0.76	0.90	0.76	0.67	0.84	0.86	0.73	0.57	0.74	0.92	0.75

Note: Variables are denoted in logarithmic scale, so the estimated coefficients are interpreted as elasticities. The table shows the control variables included for each country, but they may not be significant. In the model of USA, real GDP per capita is replaced by real wage per worker. The house price metrics used in the regression is usually the average price per square meter, for single residential dwelling; but it varies slightly across countries, depending on data availability. The table reports the estimation results of the baseline gravity model for each country. See the country tables in next Section for a complete overview of estimation results, inclusive of standard errors and coefficient estimates on the control variables. Statistically significant estimates are in bold. Statistical significance is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1.
Source: OECD Calculations.

Figure 3. Estimated regional migration elasticities to local conditions in origin and destination



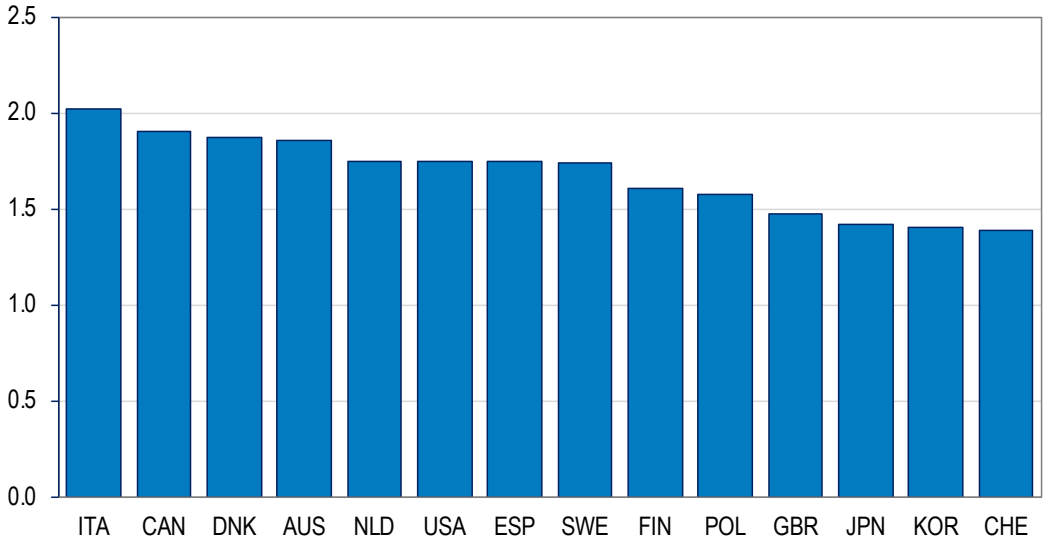
Note: The charts show the coefficients estimated in each country gravity model for the three core variables: regional GDP per capita, regional unemployment rates and regional house prices, by destination and origin region. The size of the bar represents how much, in percentage points, migration towards or out of a region would change following a 1% increase in the local conditions in that region. In each panel, countries are ranked in ascending order by the elasticity in the destination region.
Source: estimates from country gravity models (Table 1).

GDP, income and living standards

The perspective of higher living standards in the destination region tends to be the strongest driver of mobility in a majority of countries. On average across the countries covered, a 10% rise in GDP per capita in the destination region increases migration by about 5%. This effect is more pronounced in countries characterised by relatively large regional incomes disparities, such as Italy and Canada (Figure 4).

Figure 4. GDP per capita inequality across regions

Inter-decile P90/P10 ratio of regional GDP per capita; annual average over the period 2012-2017



Note: the figure shows the inter-decile ratio P90/P10 of regional GDP per capita as annual average over the period 2012-2017 or the latest available year. Data on regional GDP per capita are available for the period 2012-2017 for most of countries, with the following exceptions: AUS (2012-2016), CHE (2012-2013), ESP (2012-2016), GBR (2012-2016), JPN (2012-2014), NLD (2012-2016), POL (2014-2016), and USA (2012-2016). Only countries with more than four regions are considered. TL2 regional classification.
Source: OECD Annual national accounts and OECD Regional Statistics database.

Wage bargaining systems can influence economic incentives to move as well. Indeed, cross-country evidence suggests that more centralised wage bargaining is associated with lower migration responsiveness to local economic conditions (Causa, Abendschein and Cavalleri, 2021[29]). Centralised (decentralised) settings reduce (increase) the dispersion of wages across firms and locations, but also the link between local productivity and local wages (Boeri et al., 2019[30]). When regional dispersion in wages is low due to the centralised wage setting, workers may opt to remain in a low-productivity region where housing costs are relatively lower because the salary gains from moving into a high-productivity region are smaller in real terms and may not compensate for the higher housing costs. Empirical evidence based on the comparison between Italy and Germany suggests that centralised bargaining may unintendedly create barriers to mobility, resulting in an inefficient spatial allocation of labour and persistent regional inequalities (Boeri et al., 2019[30]). Consistently, in this study, internal migration appears to be more responsive to regional GDP per capita in countries where wage bargaining systems are relatively decentralised

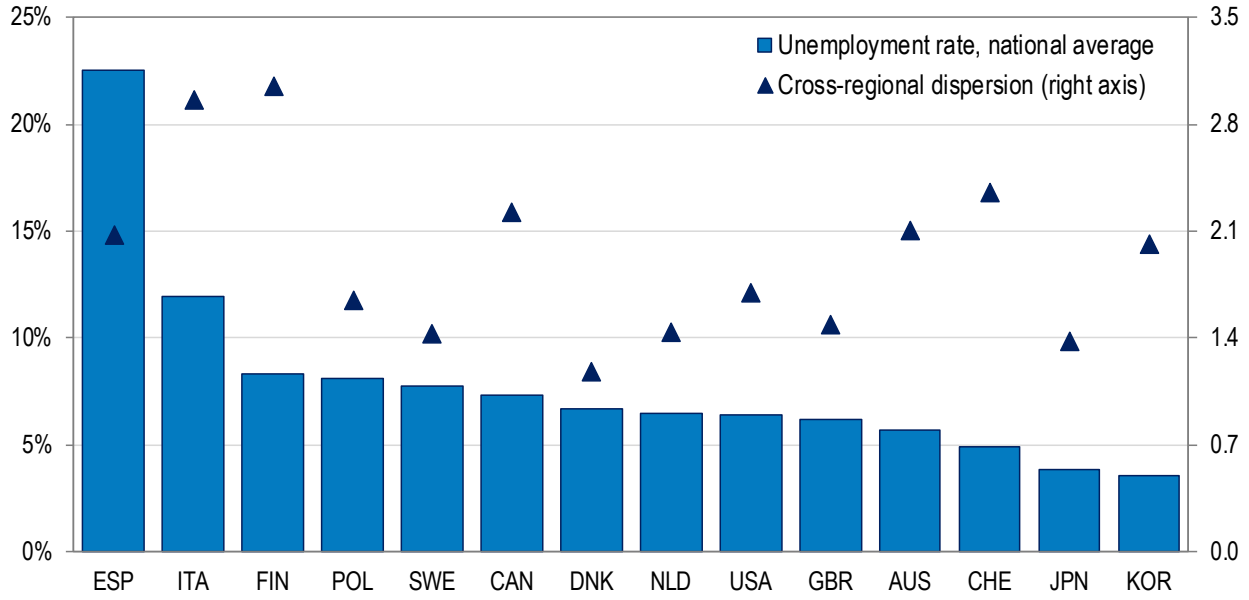
(e.g. Canada, Poland, Switzerland, Netherlands, and the United Kingdom) and less so in countries where wage bargaining systems are relatively centralised (e.g. Finland and Spain).[13]

Local labour markets

Local labour market conditions are significant drivers of inter-regional migration in all countries except for Korea. Yet, the magnitude of this effect is smaller than that of income and house prices: on average across the countries covered, a 10% rise in unemployment in the destination region is found to reduce migration by about 1.6%. This is consistent with evidence that employment opportunities are not the main reason for changing residence (Causa and Pichelmann, 2020[22]).

Figure 5. Unemployment levels and cross-regional dispersion

Annual averages over the period 2012-2017



Note. Unemployment rate is defined as number of unemployed people as a share of total active population. Country-level unemployment rate (left axis) is averaged over the period 2012-2017. Cross-regional dispersion (right axis) is measures as the inter-decile ratio P90/P10 of regional unemployment rates, averaged over the period 2012-2017. TL2 regional classification
Source: OECD Annual national accounts and OECD Regional Statistics database.

[13] However, Italy and Sweden are exceptions to this interpretation. In Sweden, the wage bargaining system is more decentralised but the gravity model does not yield significant estimates on the wage/income term. On the contrary, in Italy, the wage bargaining system is relatively more centralised, but the income elasticity of migration is very high. Other factors than the wage setting system likely explain migration decisions in these countries, including: i) regional inequalities in disposable incomes (relatively high in Italy and low in Sweden); and ii) the prevalence of homeownership (relatively high in Italy and low in Sweden), which is negatively associated with housing mobility (Causa and Pichelmann (2020[22]), Andrews and Caldera Sanchez (2011[21])).

Still, labour market conditions matter more in countries suffering from relatively high unemployment levels (e.g. Italy and Spain), or cross-regional dispersion (e.g. Canada, Switzerland, and Finland) (Figure 5). This may indicate that inter-regional migration can act as a labour market adjustment mechanism.[14] Labour market conditions have a consistently smaller effect on migration in countries where labour market adjustments are less needed, either because of low average unemployment (Korea, Japan) or because of low cross-regional dispersion in unemployment (Denmark).

Cross-country differences in labour market policies may explain cross-country differences in the responsiveness of migration to local labour market shocks. For example, strong job protection on regular contracts, high barriers to entrepreneurship and strict occupational licensing tend to reduce the responsiveness of internal migration to local labour market shocks (Causa, Abendschein and Cavalleri, 2021[29]). By contrast, policies that favour the portability of social protection and risk-taking at the individual level can encourage geographical and labour mobility. Such is the case of well-designed portable housing allowances as well as active and passive income support for the unemployed that do not discourage reallocation. In addition, the literature has pointed to the risk that social housing may unintentionally create lock-in effects (Salvi del Pero et al., 2016[31]) that can arise when households may not be willing to move to areas offering better labour market opportunities because of fear of losing entitlement to social housing. This could explain, for example, the low responsiveness of migration to labour market incentives observed in countries with large social housing sectors, such as Denmark, Netherlands and the United Kingdom. However, while housing allowances are in principle more mobility-friendly than direct housing support, they may also create disincentives to cross-regional mobility (Causa, Abendschein and Cavalleri, 2021[29]), especially when their portability is in practice limited due to the regional provision of such benefits. Overall, the extent of barriers to geographic mobility that housing-related social benefits can create depend crucially on the design of such schemes.

Housing costs

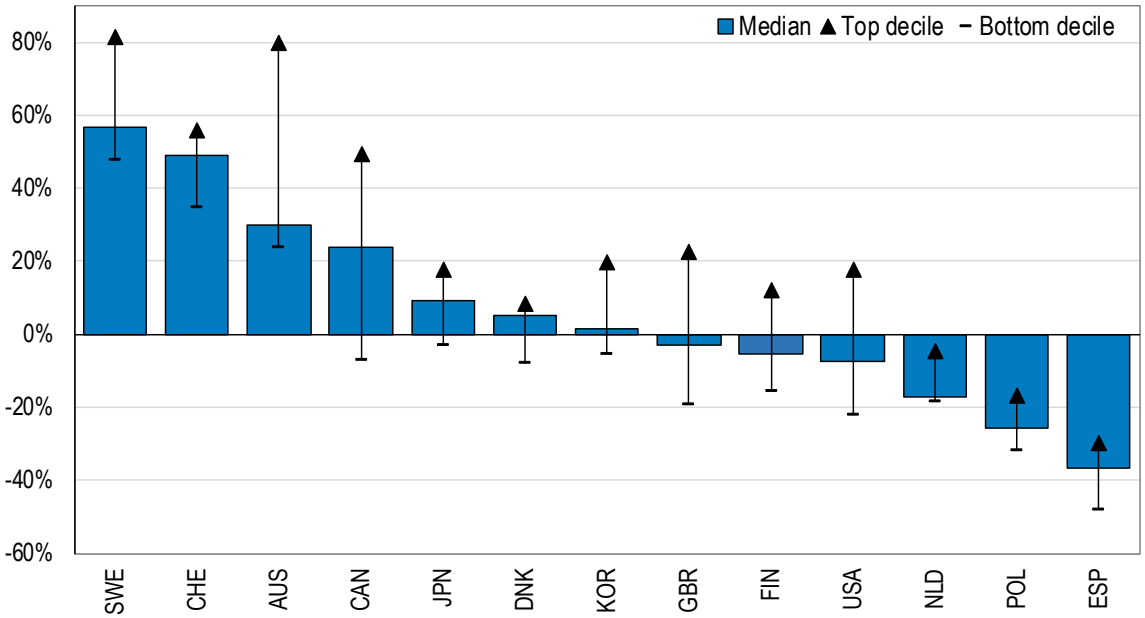
Housing costs matter for mobility decisions in almost all countries covered by this study. On average, a 10% increase in house prices in the destination region reduces inward migration by more than 3%. Yet, this average estimate masks substantial heterogeneity across countries. House prices have a strong impact on internal mobility in countries such as Sweden, Switzerland, Australia and Canada, where house prices have increased remarkably over the last decade (Figure 6). In other countries where the impact of house prices is estimated to be more muted, a modest decline in house prices for the median region hides widening regional house price dynamics (e.g. the United States and the United Kingdom), signalling that some areas are growing increasingly unaffordable relative to others. Rising cross-regional divides in house prices may have important consequences for the level and composition of inter-regional migration flows, for instance by creating barriers to the mobility of low-skilled workers from lagging regions to metropolitan areas, as shown in the case of the United States (Autor, 2019[32]).

Rising house prices or rents may not be particularly concerning if income and wages are able to keep the pace and maintain housing affordability across all socioeconomic groups. Yet, empirical evidence suggests that this is not the case. Estimates from Bricongne, Turrini and Pontuch (2019[28]) show that over the course of a generation, a number of countries covered in this study, especially Sweden, the United Kingdom and Australia, have experienced a sharp increase in the years of average household disposable income required to buy a home (Figure 7). This is in line with the finding that across many OECD countries, housing costs have risen faster than median incomes, earnings and overall inflation, contributing to eroding the purchasing power of the middle class (OECD, 2019[33]).

[14] Sweden is an exception to this rule, as the gravity regression reports a high elasticity of migration to local labour market effects despite small cross-regional differences in unemployment rates. However, a data-driven potential explanation is presented in the country-specific discussion.

Figure 6. Regional house prices: Growth and dispersion

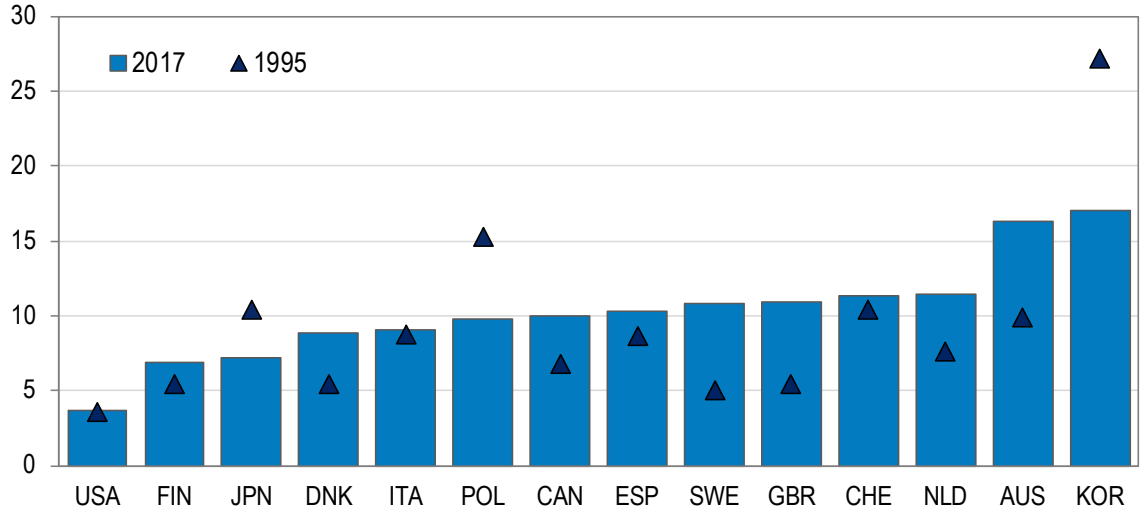
Annual average growth rate over the period 2005-2017



Note: The median, top and bottom region refer to the distribution of regional average growth rates. The average is over the period 2005-2017 with the following exceptions: ESP (2007-2016), JPN (2008-2017), POL (2006-2017). Only countries with more than four regions are considered.
Source: OECD Regional house price database.

Figure 7. The cost of buying a home

Years of average household disposable income required to purchase an average 100m^2 dwelling



Note: for Poland, the data refers to 2008 and 2017. For Australia, Canada and Korea the last observation is in 2016.
Source: Bricongne, Turrini and Pontuch (2019[28]).

Housing costs can also alter the nature of labour mobility to the extent that people choose to reside in a region and commute to work in another. When house prices tend to increase in urban areas and the transportation system is relatively effective, households can choose to live in suburbs around major cities.

In fact, the share of workers that commute for work to another region has increased in the past ten years across European countries and it is very high in some of the countries covered by this study, that is, the United Kingdom, Switzerland, Denmark and Netherlands (see Box 1). The current crisis-induced rise in teleworking may accentuate this phenomenon, potentially increasing the distance between workplace and residence (Davis, Ghent and Gregory, 2021[34]). This would also make housing-related factors even more relevant for migration decisions.

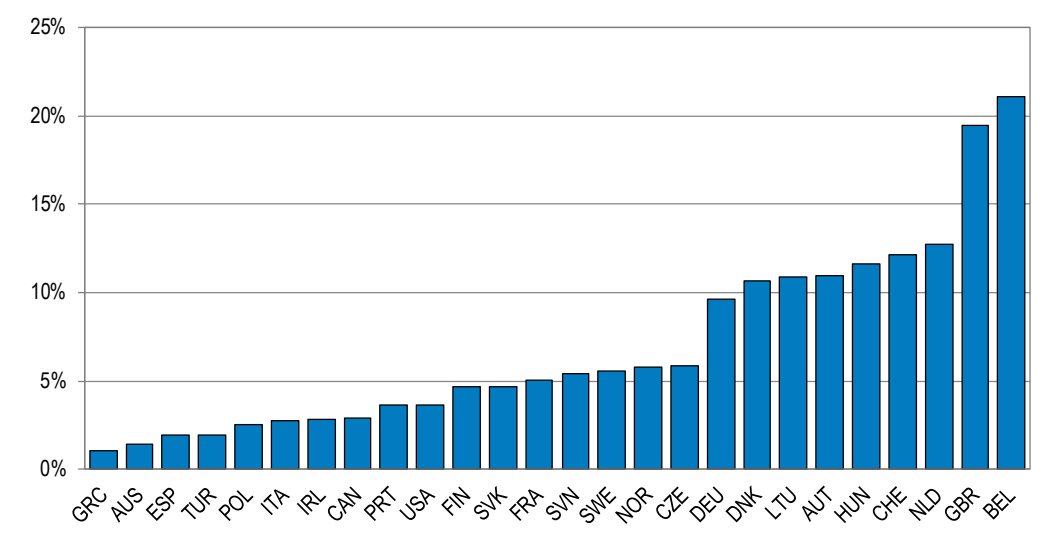
Box 1. Inter-regional commuting

Inter-regional commuting is an alternative to migration for working people. It allows to reside in a region but to work in another. The share of people in employment who commute inter-regionally for work has been increasing in several European OECD countries over recent years, a trend sustained by the improvement of transportation infrastructure, but also by the increase in housing costs and congestion in major metropolitan areas (Eurostat, 2018[35]). People – especially young families – may prefer to relocate to suburban areas where housing costs are lower and quality of living spaces, including green areas, are higher.

Today, inter-regional commuting is most frequent in Belgium and the United Kingdom, where about 20% of the employed population commutes to work in a region different from that of their residence (Figure 8). Instead, it is less frequent in Greece, Australia and Spain. Geographic factors clearly influence the possibility of people to commute inter-regionally; for example, inter-regional commuting rates are typically lower where regional areas are large. Natural barriers (such as the presence of sea or mountains) also reduce the possibility of people to commute. In Europe, commuters live mostly in close proximity of large urban agglomerations. For example, in the United Kingdom, the highest shares of commuting are in the regions surrounding London. A high incidence of commuting is also found in the eastern Danish region of Sjælland, and in the Dutch region of Flevoland; both of which are at the borders of their respective capital city region (Eurostat, 2020[36]).

Figure 8. Inter-regional commuting rates among workers

2019 or latest available year



Note: Inter-regional commuting rates are defined as the share of employed persons working in a region different from that of their usual residence. TL2 regions for all countries, equivalent to NUTS2 regions for European Countries, Provinces for Canada, States for Australia and the United States. For EU countries, the sample includes only the population aged 15 to 64 years. For the Unites States, the rate may include people working in neighbouring countries outside of the United States, representing about 0.1% of the employed population. For Australia, the rate is computed considering only dependent employment. Annual data for the year 2019 for all countries except for Canada (2011) and Australia (2016).
Source: EU Labour Force Survey, American Commuting Survey, Canadian Employer-Employee Dynamics Database, Australian Census of Population and Housing.

Country-by-country results

This section provides a detailed overview and a discussion of the results of gravity regressions on the drivers of inter-regional migration for each country. The gravity models – applied consistently across countries - includes as core explanatory variables: population size, regional GDP per capita (or average wages), regional unemployment rate and regional house price levels in both origin and destination regions. It also includes distance between origin and destination regions, and a set of control variables that vary across countries. In each table, the first column reports estimates of the baseline model (Model 1), as reported also in Table 1. For countries that have control variables in the baseline specification, the second column (Model 2) reports the results of a model without control variables. The remaining columns report estimation results of models with different sets of control variables, included as robustness checks. Real rental prices are included and tested when available.

Australia

The gravity regressions for Australia draw on internal migration data from 1995 to 2018 collected from the Australia Bureau Statistics. Table 2 reports the results of the baseline model (Model 1) and alternative specifications: without control variables (Model 2) and with different sets of control variables (Models 3 and 4). House prices and rental prices in Australia show a strong degree of collinearity,[15] making them mutually exclusive in the empirical exercise. For this reason, in Model 3, rental prices are used in place of house prices as an alternative proxy for housing market conditions.

The various models deliver similar results. House prices are found to be the primary driver of inter-regional moves in Australia, followed by income and labour market conditions. The effect of housing costs, especially rents, is large: a 10% rise in house prices or rental prices at destination is estimated to be associated with a decline in migration inflows by 3 and 8%, respectively. The effect of GDP per capita tends to be less stable across specifications. The results indicate that regions populated by older people tend to attract less migrants from other regions, probably because such regions may be less economically dynamic and located away from high-income agglomerations.[16]

The strong relevance of house prices is in line with previous studies suggesting that the decline in internal migration in Australia (Figure 2) is partly driven by real house prices growth, having more than doubled and outpaced wage growth over the last two decades (Charles-Edward et al., 2018[37]). Income is also relevant for mobility. For example, Andrews et al. (2019[38]) suggest that the recent decline of job mobility rates in Australia has been partially due to declining wage growth. The prevalence of jurisdictional occupation licensing in a large number of jobs may dampen workers' incentives to move geographically (Proctivity Commission, 2014[39]), especially when licenses and/or qualifications are not portable across states. This is consistent with evidence showing a low tendency of workers to move between regions for jobs (D'Arcy et al., 2012[40]). At the same time, inter-regional commuting has increased, particularly towards the regions with a large provision of seasonal jobs (Proctivity Commission, 2014[39]), and has probably reduced migration. This nature of movement, although important for efficient job matching, may mask the actual strong influence of housing factors on regional migration.

[15] Test results are provided upon request.

[16] See Houghton and Vonthethoff (2017[83]) for a study on ageing in Australia, which shows that the share of elderly people in the population has been growing fast, and is increasingly concentrated in some regions.

Table 2. Results of gravity equations – Australia

Dependent variable: number of persons moving from origin to destination region in a given year	Model 1 (Baseline)	Model 2	Model 3	Model 4
Population sample	**Total population**	**Total population**	**Total population**	**Total population**
Distance	**-0.52***** (0.099)	**-0.52***** (0.099)	**-0.52***** (0.099)	**-0.52***** (0.099)
Population t-1 - destination	0.37 (0.27)	**0.56**** (0.27)	**0.62**** (0.25)	0.38 (0.28)
Population t-1 - origin	**1.53***** (0.24)	**1.48***** (0.23)	**1.43***** (0.23)	**1.53***** (0.24)
Real GDP per capita t-1 - destination	**0.31**** (0.13)	0.15 (0.15)	0.083 (0.15)	**0.31**** (0.13)
Real GDP per capita t-1 - origin	-0.14 (0.13)	-0.10 (0.12)	-0.11 (0.12)	-0.14 (0.13)
Unemployment rate t-1 - destination	**-0.12***** (0.026)	**-0.12***** (0.024)	**-0.13***** (0.024)	**-0.12***** (0.025)
Unemployment rate t-1 - origin	-0.0080 (0.035)	-0.0092 (0.035)	-0.015 (0.034)	-0.0088 (0.035)
Real house prices t-2 - destination	**-0.35***** (0.049)	**-0.35***** (0.050)		**-0.35***** (0.049)
Real house prices t-2 - origin	-0.0074 (0.058)	-0.0089 (0.059)		-0.0085 (0.057)
Mean rental prices t-1 - destination			**-0.83***** (0.11)	
Mean rental prices t-1 - origin			-0.11 (0.095)	
Employment in manufacturing - destination				-0.029 (0.050)
Employment in manufacturing - origin				-0.0096 (0.039)
Share of seniors - destination	**-0.30**** (0.12)			**-0.29**** (0.12)
Share of seniors - origin	0.078 (0.15)			0.083 (0.15)
Observations	1,176	1,176	1,232	1,176
Clusters	56	56	56	56
Adj.R2	0.32	0.32	0.32	0.32

Note: The estimation period covers the years 1997 to 2018. Regional sample: 8 States of Australia. The share of seniors in the population is the share of people aged 65 or above over total population. Employment in manufacturing is the share of employment in the manufacturing sector over total regional employment. The house price metric is the average price per square feet of residential dwellings owned by households. All models include destination, origin and time fixed effects. Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1.
Source: See Annex A.

Canada

The gravity regressions for Canada draw on data on cross-provincial migration flows from Statistics Canada for the period 2006 to 2018. Table 3 reports the regression results of the baseline model (Model 1) as well as of alternative specifications considering different control variables.

Table 3. Results of gravity equations – Canada

Dependent variable: number of persons moving from origin to destination region in a given year	**Model 1 (Baseline)**	**Model 2**	**Model 3**	**Model 4**
Population sample	**Total population**	**Total population**	**Total population**	**Total population**
Distance	**-0.75***** (0.055)	**-0.81***** (0.058)	**-0.75***** (0.055)	**-0.75***** (0.056)
Population t-1 - destination	0.65 (0.40)	**1.00***** (0.36)	0.015 (0.48)	-0.52 (0.48)
Population t-1 - origin	0.43 (0.46)	**1.42***** (0.31)	-0.66 (0.63)	-0.73 (0.59)
Real GDP per capita t-1 - destination	**1.12***** (0.22)	**0.67***** (0.16)	**0.90***** (0.18)	**0.93***** (0.17)
Real GDP per capita t-1 - origin	0.25 (0.18)	-0.27* (0.14)	-0.12 (0.16)	-0.23 (0.15)
Unemployment rate t-1 - destination	**-0.59***** (0.069)	**-0.59***** (0.066)	**-0.63***** (0.068)	**-0.62***** (0.075)
Unemployment rate t-1 - origin	**0.17**** (0.080)	0.083 (0.078)	0.089 (0.079)	0.064 (0.074)
Real house prices t-2 - destination	**-0.41***** (0.14)	-0.12 (0.12)	**-0.50***** (0.14)	**-0.56***** (0.13)
Real house prices t-2 - origin	**0.25**** (0.12)	**0.21*** (0.12)	0.091 (0.11)	0.12 (0.13)
Mean rental prices t-1 - destination	-0.0046 (0.089)		-0.0040 (0.086)	-0.0099 (0.083)
Mean rental prices t-1 - origin	**0.20**** (0.094)		**0.20**** (0.092)	**0.23***** (0.082)
Employment in manufacturing - destination				-0.090 (0.14)
Employment in manufacturing - origin				**0.33**** (0.15)
Share of seniors - destination			-0.69 (0.43)	**-0.99**** (0.42)
Share of seniors - origin			**-1.19***** (0.45)	**-1.45***** (0.41)
Observations	1,080	2,052	1,080	1,044
Clusters	90	90	90	90
Adj.R2	0.64	0.64	0.64	0.64

Note: The estimation period covers the years from 2007 to 2018. Regional sample: 10 Provinces of Canada. Yukon, Northwest territories and Nunavut are excluded due to the unavailability of data on regional house prices. The house price metric is the median transaction value of single and semi-detached houses. All regressions include destination, origin and time fixed effects. Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1
Source: See Annex A.

The regression results are quantitatively consistent across specifications with little difference in the magnitude and significance of the key estimates. The model with just the inclusion of rental prices (Model 1) yields the best fit. Real income at the destination is found to be the primary driver of interprovincial migration in Canada, followed by housing costs and labour market conditions. The results indicate that both high house prices and high rental prices in origin regions tend to push people to move, with quantitatively similar effects. However, only high house prices are found to discourage regional inflows in a destination. In addition, the models consistently suggest a negative correlation between the share of seniors in the origin region and migration outflows. A significant positive tendency to move out of

manufacturing regions is also shown in Model 4, reflecting the decline in manufacturing employment experienced in Canada (Capeluck, 2015[41]).

The important role of income is consistent with previous studies that have shown how interprovincial migration in Canada improves the living standards of migrants, who can earn more than their counterparts in the home province (Breau and Saillant, 2016[42]). In recent years, a large number of internal migrants in Canada moved towards western provinces offering more job opportunities (Saunders, 2018[43]). However, the variation of occupational licensing standards across provinces may act as a barrier, impeding migration from relatively less to more performing regions (Amirault et al., 2016[44]). The sustained rise in house prices combined with growing cross-regional differences in housing costs may partially explain the decline in internal migration in Canada observed over the last two decades (Figure 2). In fact, regional disparities in incomes and labour market conditions in Canada are stark but have been declining; while regional house prices have been growing increasingly unequal (Figure 6). Hence, despite favourable incentives from higher wage and employment prospects, housing affordability may have dampened migration into provinces that could provide better job opportunities.

Denmark

The empirical analysis on Denmark uses data on bilateral migration flows collected by the National Statistics Office (Statistics Denmark), available from 2008. One advantage of such data is that they allow for considering migration of different age groups. Table 4 reports the results of the gravity regressions tested over different specifications. Model 1 – the baseline - excludes younger cohorts (i.e. those aged less than 30 years old) from the sample. Since students' mobility represents a significant share of internal migration flows in Denmark (OECD, 2020[6]) the baseline model excludes this group to gauge the economic drivers related to possibly long-term migration decisions. Models 2 to 5 test the robustness of the results across different samples and specifications.

The availability of regional data on unemployment allows estimating the models with two different time horizons: a shorter sample (from 2008 to 2015) where data are drawn from the OECD Regional statistics database, and a longer sample (up to 2018) where data are drawn from Statistics Denmark. The regression results indicate that inter-regional migrants in Denmark are responsive to variations in house prices across both samples. A 10% increase in house prices at destination reduces inward migration by between 1.7 and 2.4%. GDP per capita is significant in some specifications and when it matters, it is found the strongest driver of migration. Unemployment is significant only for the sample of migrants older than 30 years old, which may reflect that younger people tend to move for study-related reasons, rather than jobs. Finally, the share of seniors in a region does not generally affect migration.

These findings are broadly consistent with the literature that has shown that Denmark has been experiencing net positive internal migration towards large and more developed urban centres, especially Copenhagen and Aarhus, where living standards are higher (Kupiszewki, Illeries and Durham, 2001[45]). In Denmark, labour market dynamism is high and regional differences in labour market conditions are small, which may explain the finding of a relatively small effect of unemployment on regional migration. However, this may also point to reverse causality whereby higher inter-regional migration would contribute to lower cross-regional differences in employment opportunities. The results for house price show that migrants move out of areas where prices are rising, in line with evidence that a rising number of people – especially jobless individuals and young families – move to areas surrounding urban centres where housing costs are lower (Andersen, 2009[46]). Denmark is also a country where cross-regional commuting is frequent (see Box 1), especially around the capital and in the Southern region of Sjælland.

Table 4. Results of gravity equations - Denmark

Dependent variable: number of persons moving from origin to destination region in a given year	Model 1 (Baseline)	Model 2	Model 3	Model 4	Model 5	Model 5
Population Sample	**Population > 30 years**	**Population > 30 years**	**Population > 30 years**	**Total population**	**Working-age Population (20-69)**	**Young (20-29)**
	Short sample	**Short sample**	**Long sample**	**Long sample**	**Long sample**	**Long sample**
Distance	**-1.21*** **	**-1.21*** **	**-1.22*** **	**-1.17*** **	**-1.17*** **	**-1.12*** **
	(0.055)	(0.055)	(0.056)	(0.056)	(0.058)	(0.056)
Population t-1 - destination	0.25	0.16	-0.11	0.33	0.13	-0.57
	(0.64)	(0.41)	(0.56)	(0.42)	(0.45)	(0.37)
Population t-1 - origin	0.26	**0.56***	0.63	**1.36*** **	**1.14** **	0.47
	(0.61)	(0.33)	(0.50)	(0.41)	(0.44)	(0.38)
Real GDP per capita t-1 - destination	**0.45***	**0.42** **	0.097	-0.038	-0.014	-0.31
	(0.23)	(0.20)	(0.22)	(0.17)	(0.17)	(0.21)
Real GDP per capita t-1 - origin	**0.57** **	**0.67*** **	**0.75*** **	**0.49*** **	**0.53*** **	0.062
	(0.24)	(0.22)	(0.19)	(0.16)	(0.16)	(0.25)
Unemployment rate t-1 - destination	0.032	0.034	-0.043	-0.031	-0.014	0.088
	(0.055)	(0.055)	(0.074)	(0.057)	(0.066)	(0.071)
Unemployment rate t-1 - origin	**0.10*** **	**0.098*** **	0.013	-0.053	-0.048	-0.016
	(0.037)	(0.036)	(0.047)	(0.036)	(0.041)	(0.058)
Real house prices t-2 - destination	**-0.24*** **	**-0.24*** **	**-0.25*** **	**-0.17*** **	**-0.19*** **	**-0.22*** **
	(0.078)	(0.077)	(0.074)	(0.045)	(0.056)	(0.058)
Real house prices t-2 - origin	**0.13***	**0.15** **	0.080	**0.095** **	**0.16*** **	0.039
	(0.077)	(0.076)	(0.068)	(0.047)	(0.057)	(0.082)
Share of seniors - destination	0.070		0.092	0.18	0.32	
	(0.33)		(0.34)	(0.26)	(0.26)	
Share of seniors - origin	-0.23		-0.00052	**0.47***	**0.46***	
	(0.34)		(0.29)	(0.24)	(0.25)	
Observations	880	880	1,210	1,210	1,210	1,210
Clusters	110	110	110	110	110	110
Adj.R2	0.94	0.93	0.93	0.93	0.93	0.93

Note: the estimation period covers the years 2008 to 2015 in the short sample; 2008 to 2018 in the long sample. Regional sample: 11 Provinces of Denmark. The population sample consists of people aged above 30 years (Models 1, 2, and 3); total population (Model 4); and young adults (20-29) (Model 5). In the short sample, data on the regional unemployment rate are drawn from the OECD Regional statistics database; while in the long sample, the source is Statistics Denmark. The different availability of such data determines the length of the estimation horizon. The house price metric is the average price per square metre for a single detached house. All models include destination, origin and time fixed effects Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1
Source: See Annex A.

Finland

The gravity regressions for Finland rely on data on bilateral inter-regional migration flows collected from Statistics Finland, from 2000 to 2016. Table 5 details the regression results of the baseline model and alternative specifications.

Table 5. Results of gravity equations – Finland

Dependent variable: number of persons moving from origin to destination region in a given year	Model 1 (Baseline)	Model 2	Model 3
Population Sample	**Total population**	**Total population**	**Total population**
Distance	**-1.47***** (0.057)	**-1.46***** (0.052)	**-1.47***** (0.057)
Population t-1 - destination	**0.79***** (0.19)	**0.77***** (0.18)	**0.77***** (0.20)
Population t-1 - origin	**0.63***** (0.19)	**1.06***** (0.17)	**0.63***** (0.19)
Real GDP per capita t-1 - destination	0.007 (0.087)	-0.026 (0.074)	-0.016 (0.081)
Real GDP per capita t-1 - origin	-0.067 (0.11)	0.052 (0.089)	-0.058 (0.099)
Unemployment rate t-1 - destination	**-0.15***** (0.063)	**-0.14***** (0.055)	**-0.16***** (0.062)
Unemployment rate t-1 - origin	**0.12**** (0.059)	**0.086*** (0.050)	**0.12**** (0.058)
Real house prices t-2 - destination	-0.045 (0.088)	-0.063 (0.083)	-0.06 (0.088)
Real house prices t-2 - origin	0.0045 (0.11)	0.07 (0.11)	0.0062 (0.11)
Employment in manufacturing - destination	**-0.12**** (0.066)		
Employment in manufacturing - origin	0.013 (0.071)		
Share of seniors - destination	-0.062 (0.22)		0.019 (0.22)
Share of seniors - origin	**-1.10***** (0.21)		**-1.11***** (0.23)
Observations	4,350	4,894	4,350
Cluster	272	306	272
Adj.R2	0.75	0.75	0.75

Note: The estimation period covers the years from 2002 to 2017. Regional sample: 18 Regions. The house price metric is the real average transaction price per m2 of a single detached house, drawn from Statistics Finland. All regressions include destination, origin and time fixed effects. Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1
Source: See Annex A.

Overall, the results of the key drivers of inter-regional migration are similar in size and significance across models. Regional labour market conditions have the strongest impact both at destination and origin regions, while the impact of GDP per capita and house prices are is not statistically significant. A 10% increase in the unemployment rate in a region discourages inflows by about 1.6%. A larger share of seniors in the regional population is associated with lower migration outflows, reflecting the tendency for seniors of being less geographically mobile.

Regional labour market conditions are found to be a primary driver of inter-regional migration in Finland, while income and housing costs are not significant. These results are broadly in line with previous studies (Poghosyan (2018[18]); Arpaia et al. (2018[13])). The lack of responsiveness of inter-regional migration to income has been attributed to small wage differentials across regions, partially driven by the highly centralised degree of wage bargaining (Johansson, 2006[47]) which tends to compress the wage distribution and results in the low responsiveness of wages to changes in labour market conditions. In a context where wages are sticky and where the degree of excess labour supply varies widely across regions (reflecting the large regional disparities in labour market conditions (Figure 5)), workers respond to such shocks by looking for job opportunities elsewhere. The lack of responsiveness of inter-regional migration to house prices could be due to the generosity of housing assistance schemes in Finland (OECD, 2020[48]). Housing

allowances, provided they are portable, can lower barriers to mobility associated to housing costs differentials across regions and this could explain the lack of significance of regional house prices.[17]

Italy

Inter-regional migration flows in Italy are sourced from the official registry of the resident population, collected by the national statistical office (ISTAT). Such data are available from 2002, but the different availability of house price data reduces the estimation horizon. Table 6 details the results of the gravity regressions tested over different specifications and data.

Table 6. Results of gravity equations – Italy

Dependent variable: number of persons moving from origin to destination region in a given year	**Model 1 (Baseline)**	**Model 2**	**Model 3**	**Model 4**
Population sample	**Total population**	**Total population**	**Total population**	**Total population**
	Short sample	**Short sample**	**Short sample**	**Long sample**
Distance	**-0.57***** (0.061)	**-0.57***** (0.061)	**-0.57***** (0.061)	**-0.56***** (0.062)
Population t-1 - destination	-0.41 (0.62)	**-1.04*** (0.56)	-0.61 (0.61)	**1.22***** (0.33)
Population t-1 - origin	**1.32**** (0.58)	0.82 (0.60)	**1.36**** (0.59)	**0.73**** (0.33)
Real GDP per capita t-1 - destination	**1.62***** (0.29)	**1.51***** (0.29)	**1.60***** (0.29)	**1.22***** (0.17)
Real GDP per capita t-1 - origin	0.042 (0.29)	0.018 (0.29)	0.045 (0.29)	**-0.40**** (0.17)
Unemployment rate t-1 - destination	**-0.17**** (0.083)	**-0.23***** (0.081)	**-0.16*** (0.084)	**-0.13***** (0.050)
Unemployment rate t-1 - origin	**-0.19**** (0.079)	**-0.17**** (0.078)	**-0.19**** (0.079)	**-0.24***** (0.061)
Real house prices t-2 - destination	**-0.76***** (0.19)	**-0.55***** (0.17)	**-0.58***** (0.22)	**-0.077** (0.095)
Real house prices t-2 - origin	**0.42**** (0.18)	0.28 (0.18)	**0.38*** (0.21)	**0.21**** (0.089)
Immigrants from abroad (% of population t-1) - destination	0.096 (0.063)		0.096 (0.063)	0.037 (0.033)
Homeownership rate - destination	0.014 (0.20)		-0.024 (0.20)	**0.34**** (0.15)
Homeownership rate - origin	**0.80***** (0.20)		**0.81***** (0.21)	**0.58***** (0.19)
Share of seniors - destination			**-0.94*** (0.53)	-0.17 (0.29)
Share of seniors - origin			0.22 (0.54)	**-1.93***** (0.26)
Observations	2,937	2,937	2,937	5,455
Clusters	420	420	420	420
Adj.R2	0.90	0.90	0.90	0.88

[17] This in line with Causa and Pichelmann (2020[22]) who find that more generous housing allowances tend to increase residential mobility.

Note: The estimation period covers the years from 2010 to 2018 in the short sample, and 2002 to 2018 in the long sample. In both samples, the house price metric is the average price of dwellings per square metre. Regional sample: 21 TL2 units. The regional sample coincides with Eurostat's NUTS2 definition. It covers 19 administrative regions and the two autonomous provinces of Trento and Bolzano. All regressions include destination, origin and time fixed effects. Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1
Source: See Annex A.

Models 1 to 3 use regional house price indices drawn from the OECD regional house price database, though the time coverage is limited. By contrast, Model 4 employs estimates of regional house prices indices produced by the Bank of Italy (Muzzicato, Sabbatini and Zollino, 2008[49]; Banca d'Italia, 2020[50]) and derived from transaction data. Despite the change in data and in the estimation horizon, the gravity regressions consistently indicate that GDP per capita is the strongest determinant of inward migration in Italy, followed by house prices. A 10% increase in GDP per capita in a region promotes migration inflows by about 14%, on average across models. Rising unemployment rates deter inward mobility and, at the same time, they discourage outward mobility, which is counterintuitive. House prices partly offset the incentives to move for economic opportunities, as evidenced by the strong negative elasticity associated with house prices at destination. Higher shares of seniors in the regional population are associated with lower migration, especially outflows, reflecting the lower mobility of older people. The effect of regional homeownership is positive and highly significant at origin. This may reflect the fact that homeownership is typically higher in rural areas relatively to metropolitan areas, indicating the prevalent direction of mobility. Immigration from abroad is not significant.

The results from the regressions are in line with previous literature on the strong role of income as a driver of inter-regional migration in Italy (see for example, Etzo (2011[51])). By contrast, labour market conditions are associated with counterintuitive effects on mobility, a result also found in previous analyses (Faini et al., 1997[52]). Geographic mobility has remained low for decades in Italy despite large unemployment differences between areas, a divide that would theoretically spur mobility for work reasons. The literature has proposed several explanations for this lack of responsiveness to labour market incentives. Some authors have argued that the decline in internal migration rates reflect persistent or widening inefficiencies in cross-regional job matching, or changes in the industry structure that have led to increased regional specialisation (Murat and Paba, 2001[53]). Housing costs are significant drivers of both in and out-migration, a result qualitatively in line with recent evidence by Cannari et al. (2000[20]) and Ciani, David and de Blasio (2019[15]).

Japan

The gravity regressions for Japan are based on internal migration data collected and published annually by the Statistical Bureau of Japan. The data refer to total population and are available for each of the 47 Prefectures of Japan and for major metropolitan areas, over the period 2007-2018. Table 7 reports the results of the baseline model (Model 1) and of alternative specifications that test the significance of different sets of control variables.

The results are robust across the different specifications. The three core drivers of migration – GDP per capita, the unemployment rate and regional house prices – all matter for inter-regional migration in Japan. GDP per capita is quantitatively the most important factor driving internal migration in Japan. A 10% rise in GDP in a region encourages inflows by almost 7 percentage points. Unemployment matters only at the origin region, encouraging people to move out in response to negative labour market shocks. The coefficients associated with house prices are significant and negative in the destination and in the origin region. The latter result may reflect the strong agglomeration phenomenon around major metropolitan areas where house prices are rising, but still population density increases. The effect of local homeownership is not significant (Model 3) nor is the effect of the share of seniors in the regional population.

Table 7. Results of gravity equations – Japan

Dependent variable: number of persons moving from origin to destination region in a given year	**Model 1 (Baseline)**	**Model 2**	**Model 3**
Population sample	**Total population**	**Total population**	**Total population**
Distance	**-1.26***** (0.020)	**-1.26***** (0.020)	**-1.26***** (0.020)
Population t-1 - destination	**1.32***** (0.25)	**1.32***** (0.25)	**1.32***** (0.25)
Population t-1 - origin	**1.55***** (0.24)	**1.57***** (0.24)	**1.57***** (0.24)
Real GDP per capita t-1 - destination	**0.69***** (0.093)	**0.69***** (0.093)	**0.69***** (0.093)
Real GDP per capita t-1 - origin	-0.0070 (0.090)	0.0015 (0.091)	0.0012 (0.091)
Unemployment rate t-1 - destination	0.049 (0.032)	0.049 (0.032)	0.049 (0.032)
Unemployment rate t-1 - origin	**0.14***** (0.032)	**0.14***** (0.032)	**0.14***** (0.032)
Real house prices t-2 - destination	**-0.22***** (0.083)	**-0.22***** (0.083)	**-0.22***** (0.084)
Real house prices t-2 - origin	**-0.56***** (0.076)	**-0.56***** (0.076)	**-0.56***** (0.077)
Share of seniors - destination		0.038 (0.20)	0.038 (0.20)
Share of seniors - origin		-0.20 (0.20)	-0.20 (0.20)
Homeownership rate - destination			0.00070 (0.26)
Homeownership rate - origin			-0.023 (0.26)
Observations	15,206	15,206	15,206
Clusters	2162	2162	2162
Adj.R2	0.76	0.76	0.76

Note: The estimation period covers the years from 2007 to 2018. Regional sample: 47 Prefectures. The house price metric is the real average residential land transaction price (yen/m2) from the Statistics Bureau of Japan. All models include destination, origin and time fixed effects. Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1

Source: See Annex A.

Inter-regional migration in Japan is found to be highly responsive to regional income and house prices, in line with previous literature (Kondo and Okubo (2012[54]), Ishikawa (2011[55])). Housing costs are negatively significant in both the origin and destination regions. Migrants refrain from moving into regions with rising housing costs, but they also do not leave areas becoming increasingly more expensive. This latter result may reflect disincentives to leave regions with increasing house prices due to wealth effects, all the more in a country characterised by high homeownership and an ageing population. It may also reflect strong agglomeration effects around the three large metropolitan areas of Tokyo, Osaka and Nagoya, where population growth and house prices have been on a steady rise (Ishikawa, 2020[56]). Net migration flows towards the capital city and its urban area is positive, though at lower pace than in the past. The decline in migration in the area of Tokyo could also reflect the success of local interventions to discourage migration, with the aim of alleviating congestion and activity concentration.

Korea

The gravity regressions for Korea rely on data on bilateral migration flows across provinces from Statistics Korea from 2006 to 2018. Baseline and extended regression results are presented in Table 8.

Table 8. Results of gravity equations – Korea

Dependent variable: number of persons moving from origin to destination region in a given year	Model 1 (Baseline)	Model 2	Model 3	Model 4
Population sample	**Working-age population**	**Working-age population**	**Total population**	**Total population**
Distance in km	**-1.32***** (0.12)	**-1.10***** (0.11)	**-1.32***** (0.12)	**-1.10***** (0.11)
Population t-1 - destination	**1.10***** (0.35)	0.12 (0.21)	**1.25***** (0.36)	**1.06***** (0.38)
Population t-1 - origin	**0.68**** (0.29)	**0.70***** (0.20)	**0.69**** (0.30)	**0.86***** (0.33)
Real GDP per capita t-1 - destination	**0.39***** (0.13)	**0.22*** (0.12)	**0.34***** (0.13)	**0.35***** (0.11)
Real GDP per capita t-1 - origin	0.012 (0.12)	-0.15 (0.11)	-0.014 (0.12)	-0.024 (0.10)
Unemployment rate t-1 - destination	-0.017 (0.020)	-0.033 (0.022)	-0.015 (0.020)	**0.04*** (0.022)
Unemployment rate t-1 - origin	0.0086 (0.024)	0.0024 (0.022)	0.000099 (0.024)	0.037 (0.025)
Real house prices t-2 - destination	**-0.31***** (0.086)	**-0.32***** (0.059)	**-0.34***** (0.088)	**-0.47***** (0.10)
Real house prices t-2 - origin	**0.13*** (0.076)	**0.070** (0.050)	**0.100** (0.079)	**-0.14*** (0.075)
Employment in manufacturing - destination				**0.15***** (0.037)
Employment in manufacturing - origin				0.017 (0.044)
Share of seniors - destination				**0.41***** (0.10)
Share of seniors - origin				**0.31**** (0.13)
Homeownership rate t-1 - destination	**0.34**** (0.16)		**0.29*** (0.16)	
Homeownership rate t-1 - origin	**0.37*** (0.21)		0.26 (0.21)	
Observations	1,890	2,640	1,890	1,920
Clusters	210	240	210	240
Adj.R2	0.66	0.61	0.66	0.61

Note: The estimation period covers the years from 2007 to 2015. Regional sample: 15 First-Tier Administrative Divisions (Special cities, metropolitan areas and provinces). The special city of Sejong is excluded because of the unavailability of house price data. In models 1 and 3, the TL3 region of Gyeonggi-do is also excluded due to the unavailability of homeownership data. The population sample consists of the working-age population (aged between 15 and 65) and the total population. The house price metric is the median transaction value of a single detached house from the Korea Appraisal Board (KAB). All regressions include destination, origin and time fixed effects. Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1
Source: See Annex A.

Income and house prices are found to drive inter-regional mobility in Korea, while the effect of regional labour market conditions is not statistically significant. These findings are statistically consistent across specifications with little difference in terms of magnitude. A 10% increase in GDP per capita at destination is associated with an increase of inward migrations by around 3 to 4% while a 10% rise in house prices at

destination is associated with a reduction in migration inflows by 3.1 to 4.2%. Homeownership is positively and significantly associated with migration, especially at destination. This may reflect the increased tendency of Koreans to move to non-metropolitan areas where housing is more affordable (Abel and Heo, 2018[57]). A higher proportion of seniors in the regional population is associated with larger migration flows. Yet, this result must be considered with caution given that the share of seniors is relatively high in Korea and increasing in all regions.

The income and unemployment results may be related to the high level of wage flexibility prevailing in Korea, partly driven by the decentralised nature of wage bargaining in the country and potentially contributing to a pattern of rising wage dispersion across regions (Oh, 2017[58]). Wage flexibility may promote labour mobility and narrow the disparities in regional unemployment, which, in turn, reduce the role of cross-regional differences in unemployment for migration decisions, in line with current findings. The overconcentration of the population in metropolitan areas, particularly Seoul and Busan, drives up house prices, making housing affordability in cities a major concern for incoming migrants and their families.[18] High house prices, together with government efforts in discouraging congestion in metropolitan areas, are helping shifting migration flows toward suburban and nonmetropolitan areas (Lee and Kim, 2020[59]). As a consequence, Seoul is experiencing a trend of negative net migration flows since 2006 (Abel and Heo, 2018[57]).

Netherlands

The gravity regressions for the Netherlands are based on bilateral migration flows from the official registry of the resident population in Dutch provinces, covering the period 2005 to 2017. Table 9 reports the results of the baseline model (Model 1), of a model without control variables (Model 2), and of extended versions.

The results point to a significant role of GDP per capita in affecting migration decisions in the Netherlands, both at destination and at origin. A 10% rise in regional income is estimated to rise inflows by around 7% and reduce outflows by slightly more than 10%. Unemployment is significant across all models at origin, but with a counterintuitive negative effect. Regional house prices are associated with insignificant effects in most models. Finally, the results indicate that migrants move from less to more manufacturing-intensive regions. Regions with a larger share of low-educated labour force also experience larger outflows of the population, possibly reflecting relatively lower labour market opportunities in the region.

The gravity analysis for the Netherlands is challenging due to the characteristics of the territory and the composition of its internal migration flows. First, the availability of an efficient transport system and small commuting distances tend to reduce the impulse of work reasons for geographic relocations and hence it may mask the true relevance of both housing and employment effects for people's residential decisions. In fact, previous studies relying on more granular data have found that migration in the Netherlands is sensitive to local housing supply conditions, especially to the spatial distribution of the housing stock (Vermeulen and van Ommeren, 2009[60]). Second, the population is concentrated in urban areas and most internal migration takes place within the city cluster of the Randstad, one of the most densely populated areas in Europe. As a result, inter-regional migration flows in the Netherlands are likely to be predominantly flows of people moving between the four largest cities (Amsterdam, Rotterdam, The Hague and Utrecht), or students moving from rural to urban areas, all of which is in line with the finding of a strong regional GDP per capita effect.

[18] House prices per square meter in Korea are amongst the highest in the OECD area (OECD, 2019[80]).

Table 9. Results of gravity equations – Netherlands

Dependent variable: number of persons moving from origin to destination region in a given year	Model 1 (Baseline)	Model 2	Model 3	Model 4
Population sample	**Total population**	**Total population**	**Total population**	**Total population**
Distance	**-1.70***** (0.061)	**-1.70***** (0.061)	**-1.70***** (0.061)	**-1.70***** (0.061)
Population t-1 - destination	-0.85 (0.66)	0.27 (0.62)	-0.75 (0.64)	-0.85 (0.64)
Population t-1 - origin	0.45 (0.69)	-0.52 (0.61)	0.54 (0.69)	0.44 (0.72)
Real GDP per capita t-1 - destination	**0.63**** (0.27)	**0.69***** (0.23)	**0.66**** (0.27)	**0.71**** (0.28)
Real GDP per capita t-1 - origin	**-1.06***** (0.37)	**-1.55***** (0.28)	**-1.03***** (0.38)	**-1.25***** (0.40)
Unemployment rate t-1 - destination	0.19 (0.14)	0.16 (0.15)	0.19 (0.14)	0.20 (0.14)
Unemployment rate t-1 - origin	**-0.45***** (0.12)	**-0.43***** (0.14)	**-0.45***** (0.12)	**-0.48***** (0.13)
Real house prices t-2 - destination	-0.18 (0.28)	-0.21 (0.26)	-0.32 (0.34)	-0.16 (0.28)
Real house prices t-2 - origin	-0.39 (0.26)	-0.087 (0.26)	**-0.52*** (0.27)	-0.45 (0.27)
Share of seniors - destination			-0.44 (0.70)	
Share of seniors - origin			-0.42 (0.36)	
Employment in manufacturing - destination	**1.09***** (0.19)		**1.04***** (0.22)	**1.10***** (0.19)
Employment in manufacturing - origin	**-1.03***** (0.18)		**-1.08***** (0.19)	**-1.04***** (0.18)
Lab. Force with elementary education - destination				-0.25 (0.20)
Lab. Force with elementary education - origin				**0.60***** (0.23)
Observations	1,716	1,848	1,716	1,716
Clusters	132	132	132	132
Adj.R2	0.85	0.85	0.85	0.84

Note: The estimation period covers the years from 2005 to 2017. Regional sample: 12 Provinces. The house price metric is the average price of dwellings per square metre from the European Commission estimates. All models include destination, origin and time fixed effects Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1
Source: See Annex A.

Poland

The gravity models for Poland rely on inter-regional migration flows from the Official Population Registry (from Statistics Poland) from 2006 to 2018. Table 10 reports the regression results of the baseline model and its extensions.[19]

[19] Data on the share of employment in manufacturing for Poland is not of sufficient length to be included in the regression.

Table 10. Results of gravity equations – Poland

Dependent variable: number of persons moving from origin to destination region in a given year	Model 1 (Baseline)	Model 2	Model 3
Population sample	**Total population**	**Total population**	**Total population**
Distance in km	**-1.74*** **	**-1.74*** **	**-1.71*** **
	(0.053)	(0.053)	(0.058)
Population t-1 - destination	**2.04*** **	**2.18*** **	**2.29*** **
	(0.36)	(0.36)	(0.38)
Population t-1 - origin	0.29	**0.65** **	0.42
	(0.34)	(0.33)	(0.36)
Real GDP per capita t-1 - destination	**0.73*** **	**0.65*** **	**0.71*** **
	(0.21)	(0.22)	(0.22)
Real GDP per capita t-1 - origin	**0.70*** **	**0.50*** **	**0.53*** **
	(0.19)	(0.18)	(0.20)
Unemployment rate t-1 - destination	-0.018	-0.032	-0.047
	(0.030)	(0.029)	(0.037)
Unemployment rate t-1 - origin	**0.083** **	0.048	0.011
	(0.033)	(0.032)	(0.042)
Real house prices t-2 - destination	0.011	0.042	0.042
	(0.10)	(0.10)	(0.11)
Real house prices t-2 - origin	**-0.20***	-0.12	-0.17
	(0.11)	(0.11)	(0.12)
Share of seniors - destination		-0.28	
		(0.20)	
Share of seniors - origin		**-0.71*** **	
		(0.20)	
Lab. Force with elementary education t-1 - destination			-0.059
			(0.0046)
Lab. Force with elementary education t-1 - origin			**-0.2*** **
			(0.0048)
Observations	2,198	2,198	1,976
Clusters	210	210	182
Adj.R2	0.86	0.86	0.85

Note: The estimation period covers the years from 2008 to 2018 for all models. Regional sample: 15 Provinces: Kujawsko-Pomorskie / Kuyavian-Pomerania and Warszawski stołeczny are excluded due to data unavailability. The house price metric is the average price of dwellings per square metre from the European Commission estimates. All regressions include destination, origin and time fixed effects. Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1
Source: See Annex A.

Gravity estimates for Poland deliver mixed results, though they show some degree of consistency across specifications. The unemployment rate is consistently found to be non-significant for migration inflows, while it is positive and significant in the origin region. Higher GDP per capita is positively and significantly associated with migration inflows. House prices matter only at origin. Higher shares of seniors in the origin region are associated with lower outflows, consistent with the fact that migration strongly declines with age.[20] Finally, regions with a larger share of the labour force with elementary education see less migration outflows, partially reflecting the low tendency for low-skilled workers to migrate to other local labour markets (Schmutz, Sidibé and Vidal-Naquet, 2020[61]). Overall, conditions prevailing in the origin region seems to

[20] However, in comparison to the baseline model, the strong significance of ageing comes with a reduced significance of the variables representing origin effects, suggesting that including ageing in the model may cause collinearity issues.

matter more for internal migration in Poland than conditions prevailing in the destination, which could reflect imperfect information for migration decisions (Ghatak, Mulhern and Watson, 2008[62]).

The results from the gravity regressions are broadly in line with available literature on Poland. The effect of income at destination region is in line with Okolski and Topinska (2012[63]). However, income in the origin region is found to have a counter-intuitive positive elasticity, which may reflect that in Poland the predominant direction of migration is between large urban centres. Labour market incentives are weak determinants of migration, a finding in line with existing literature (Lewandowska-Gwarda and Antczak, 2015[64]) that has found that most migrants move cross-regionally for non-economic reasons, such as family and education. Similarly, the mixed house price effects could be explained by Poland's extremely high rate of homeownership, which could create lock-in effects and reduce the propensity of homeowners to migrate in response to price signals. Moreover, the widespread decline in regional house prices in Poland over the last decade could have hit homeowners' wealth especially hard and raised relocation costs. Like Japan, wealth effects are very likely to take place in Poland, given widespread homeownership and a rapidly ageing population (OECD, 2018[65]).

Spain

The gravity estimations for Spain are based on bilateral migration data from the National Statistics Institute of Spain, covering the period 2006 to 2018. Table 11 reports the regression results of the baseline model (Model 1) and alternative model specifications without control variables (Model 2) or incorporating different sets of control variables.

Inter-regional migration in Spain is highly responsive to unemployment and house prices in both the origin and destination region, consistently so across specifications. House prices are the main driver of inter-regional migration in Spain. A 10% increase in house prices lowers incoming migration by around 4%, while it rises outward migration by around 2%. The effect of GDP per capita is significant only in one specification, but with counter-intuitive signs: it is found to be negatively correlated with migration inflows and positively with migration outflows. Finally, higher rates of homeownership deter both migration inflows and outflows.

The strong relevance of housing conditions to inter-regional migration in Spain is consistent with previous studies (Liu, 2018[17]). The widespread decline in regional house prices over the past years, although uneven across regions, may have reinforced the relevance of housing costs, especially in a country with relatively high homeownership rates. This may have accentuated both the weight of house prices for migration decisions and exacerbated lock-in effects associated with homeownership, particularly for households with mortgage debt. Previous studies have found significant effects of labour market conditions on migration (Liu (2018[17]); Clement et al. (2016[66])), possibly reflecting large and persistent cross-regional differences in labour market performance (Figure 5). In addition, a relevant share of employees in Spain is on temporary contracts, a phenomenon that may increase mobility to the extent that people move geographically at the beginning or end of an appointment. Conversely, the lack of responsiveness of inter-regional migration to income could reflect the stagnation of income growth observed in Spain over the last two decades (Liu, 2018[17]). Overall, subdued income growth and declining house prices are likely to have at least in part contributed to the observed decline in inter-regional migration (Figure 2).

Table 11. Results of gravity equations – Spain

Dependent variable: number of persons moving from origin to destination region in a given year	Model 1 (Baseline)	Model 2	Model 3
Population sample	**Total population**	**Total population**	**Total population**
Distance in km	**-1.43***** (0.054)	**-1.44***** (0.054)	**-1.44***** (0.054)
Population t-1 - destination	-0.57 (0.37)	**-0.86**** (0.38)	0.016 (0.32)
Population t-1 - origin	**1.12***** (0.32)	**0.97***** (0.32)	**0.56*** (0.32)
Real GDP per capita t-1 - destination	-0.40 (0.34)	-0.25 (0.34)	**-0.77**** (0.33)
Real GDP per capita t-1 - origin	0.36 (0.32)	0.44 (0.33)	**0.65**** (0.31)
Unemployment rate t-1 - destination	**-0.22***** (0.053)	**-0.20***** (0.056)	**-0.12**** (0.059)
Unemployment rate t-1 - origin	**0.17***** (0.064)	**0.18***** (0.065)	0.099 (0.066)
Real house prices t-2 - destination	**-0.45***** (0.10)	**-0.43***** (0.10)	**-0.40***** (0.098)
Real house prices t-2 - origin	**0.16*** (0.099)	**0.18*** (0.100)	0.12 (0.092)
Employment in manufacturing - destination			**-0.10**** (0.044)
Employment in manufacturing - origin			0.0523 (0.066)
Share of seniors - destination			**1.40***** (0.25)
Share of seniors - origin			**-1.43***** (0.25)
Homeownership rate - destination	**-0.72***** (0.22)		**-0.49**** (0.20)
Homeownership rate - origin	**-0.37**** (0.18)		**-0.60***** (0.19)
Observations	3,059	3,059	3,059
Clusters	306	306	306
Adj.R2	0.73	0.73	0.73

Note: For all models, the estimation period covers the years 2009 to 2018. Regional sample: 18 Regions. Balearic Islands is excluded due to unavailable data on housing prices. The house price metric is the average price of dwellings per square metre from the European Commission estimates. All regressions include destination, origin and time fixed effects. Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1

Source: See Annex A.

Sweden

The gravity models for Sweden are based on inter-regional migration flows from two alternative sources: the European Labour Force Survey (EULFS) and the official population registry from Statistics Sweden. In both cases, the estimation is possible for the period 2002 to 2017. The Labour Force Survey allows isolating different groups, for example, based on age or labour market status. Table 12 presents the results and the various alternative specifications.

Table 12. Results of gravity equations – Sweden

Dependent variable: number of persons moving from origin to destination region in a given year	Model 1 (Baseline)	Model 2	Model 3	Model 4	Model 5
Population Sample	**Total population**	**Total population**	**Working-age Population (15-64)**	**Active Population**	**Total population**
Source dep. Variable	**LFS**	**Official**	**LFS**	**LFS**	**LFS**
Distance	**-1.10***** (0.054)	**-1.12***** (0.043)	**-1.10***** (0.053)	**-1.13***** (0.056)	**-1.10***** (0.054)
Population t-1 - destination	**2.05***** (0.69)	**1.03***** (0.14)	**2.09***** (0.70)	**2.10**** (0.88)	1.93 (1.55)
Population t-1 - origin	-0.20 (0.58)	-0.035 (0.18)	-0.41 (0.60)	-1.27 (0.82)	0.49 (0.96)
Real GDP per capita t-1 - destination	-0.37 (0.61)	0.14 (0.12)	-0.23 (0.60)	-0.53 (0.96)	-0.31 (0.82)
Real GDP per capita t-1 - origin	-0.12 (0.87)	-0.19 (0.13)	-0.11 (0.83)	-0.26 (0.87)	-0.53 (0.81)
Unemployment rate t-1 - destination	**-0.49**** (0.19)	0.034 (0.041)	**-0.51***** (0.19)	**-0.68***** (0.25)	**-0.50**** (0.20)
Unemployment rate t-1 - origin	**0.59***** (0.22)	**0.066*** (0.040)	**0.57**** (0.22)	**0.92***** (0.25)	**0.60***** (0.21)
Real house prices t-2 - destination	**-0.95**** (0.40)	**-0.30***** (0.10)	**-0.90**** (0.40)	-0.58 (0.50)	**-0.95**** (0.39)
Real house prices t-2 - origin	0.35 (0.38)	0.15 (0.12)	0.38 (0.37)	0.56 (0.53)	0.27 (0.40)
Share of seniors - destination					-0.28 (2.27)
Share of seniors - origin					2.78 (1.91)
Employment in manufacturing - destination					-0.018 (0.58)
Employment in manufacturing - origin					-0.26 (0.54)
Observations	816	816	816	811	816
Clusters	56	56	56	56	56
Adj.R2	0.84	0.96	0.83	0.81	0.84

Note: For all models, the estimation period covers the years 2002 to 2017. Regional sample: 8 National Areas (NUTS 2). The house price metric is the average price of dwellings per square metre. All models include destination, origin and time fixed effects. Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1
Source: See Annex A.

The results indicate that internal migration in Sweden is largely driven by labour market conditions, similar to other Nordic countries covered in this study. The unemployment rate is the most significant factor, both at destination and origin, with estimated elasticities that are quantitatively similar across models. The finding of a strong unemployment effect is consistent across all models estimated with labour force survey data, and this effect is even stronger when focusing on the active population. When the same baseline specification is estimated with population registry data, labour market conditions are found to play a minor role. This different result in the broader population likely reflects the fact that young inactive people – included in this sample - represent a significant share of the internal movers and respond more to study than employment opportunities. House prices are also found to play an important role, especially in the destination region, and this result emerges independently of the data source used. The effects of GDP per capita is, by contrast, not significant.

These findings are broadly in line with previous studies on Sweden. The literature has consistently found that regional differences in employment opportunities have a large impact on inter-regional migration flows (see for example, Aronsson, Lundberg and Wikström (2001[67])). This may partly reflect that active labour market polices promote labour mobility, especially among the unemployed. Moreover, higher house prices in the destination region can be a barrier to mobility. This effect is likely a consequence of the stark rise in the level and cross-regional dispersion of real house prices in Sweden over the last decade. Boverket (2016[68]), for example, shows that this has acted as a barrier to mobility towards the largest Swedish cities, where prices have increased the most. Consistent with the results from the gravity models, the literature has reached inconclusive results on the role of wage or income differentials across regions (see, for example, Westerlund (1998[69]) and Gartner (2014[70])).

Switzerland

The gravity estimations for Switzerland are based on bilateral migration data across cantons from 2011 to 2018, from the Swiss Federal Statistical Office. Table 13 summarises regression results of the baseline model as well as its alternative specifications without control variables (Model 2) and with different sets of control variables.

Table 13. Results of gravity equations – Switzerland

Dependent variable: number of persons moving from origin to destination region in a given year	**Model 1 (Baseline)**	**Model 2**	**Model 3**
Population sample	**Total population**	**Total population**	**Total population**
Distance in km	**-1.94***** (0.20)	**-1.94***** (0.20)	**-1.95***** (0.19)
Population t-1 - destination	1.88 (3.09)	2.63 (1.72)	**8.84*** (4.76)
Population t-1 - origin	0.36 (3.40)	**5.15***** (1.38)	1.68 (4.37)
Real GDP per capita t-1 - destination	**1.20*** (0.70)	**1.09*** (0.60)	**3.67***** (1.33)
Real GDP per capita t-1 - origin	0.063 (0.61)	-0.66 (0.59)	0.15 (1.11)
Unemployment rate t-1 - destination	**-0.25**** (0.11)	**-0.25**** (0.11)	-0.12 (0.10)
Unemployment rate t-1 - origin	0.10 (0.071)	0.094 (0.071)	**0.25***** (0.083)
Real house prices t-2 - destination	-0.0057 (0.26)	0.0089 (0.24)	-0.38 (0.38)
Real house prices t-2 - origin	**0.39*** (0.22)	**0.48**** (0.21)	0.63 (0.38)
Employment in manufacturing - destination			0.046 (0.76)
Employment in manufacturing - origin			0.92 (1.10)
Share of seniors - destination	-0.44 (1.25)		0.92 (1.70)
Share of seniors - origin	**-2.79*** (1.55)		**-9.08***** (2.18)
Observations	252	252	168
Clusters	42	42	42
Adj.R2	0.71	0.71	0.68

Note: For all models, the estimation period covers the years 2013 to 2018. Regional sample: 7 cantons (NUTS 2). The house price metric is the average price of dwellings per square metre. All regressions include destination, origin and time fixed effects. Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1
Source: See Annex A.

The results are relatively robust across specifications. Real income in the destination region is found to be the main driver of inter-regional migration in Switzerland, followed by house prices and labour market conditions. House prices have a significant and strong effect in the origin region: a 10% increase in house prices is estimated to increase out-migration by almost 4%. Finally, the share of seniors in the regional population have different effects across specifications, both in terms of significance and magnitude. However, the coefficients are most often significantly negative in the origin region, suggesting a reduced propensity to move when a larger share of the population includes seniors.

The high responsiveness of inter-regional migration to GDP per capita is in line with previous studies that have highlighted, for example, how different income tax systems across regions have an impact on migration decisions, especially among young graduates and those at the top of the skill and earnings distribution (Liebig et al. (2007[71]); Martinez (2017[72])). Rising housing costs encourage people to move out of their region, a result that may have implications given that house prices in Switzerland have increased by around 75% during the past 20 years. The lack of responsiveness of inter-regional migration to housing costs in the destination region may be explained by the possibility to commute instead of migrate in Switzerland, due to the availability of an efficient transportation system that makes it possible for people to reside in a relatively less expensive place while still working in another. This is consistent with evidence that inter-regional commuting rates are relatively high in Switzerland as compared to other European countries (Figure 8).

United Kingdom

The gravity model for the United Kingdom is based on data produced by the Office for National Statistics. Results are reported in Table 14. The baseline model (Model 1) only covers migration between regions of England and Wales (TL2 - NUTS1) due to lack of data for Scotland and Northern Ireland before 2012. Model 4 covers all regions, but over a limited, more recent period.

Gravity estimates suggest that inter-regional migration flows in the United Kingdom are highly responsive to regional income and house prices, and only marginally to local employment conditions. A 10% increase in GDP per capita in the destination region is estimated to increase population inflows by around 7 %. House prices are the second most important driver, being significant both in the origin and destination region. Migration is also responsive to labour market conditions. However, the magnitude of the elasticity is lower relative to those on income and house prices. Finally, people tend to move from manufacturing areas and areas with a relatively large share of older persons, potentially reflecting the secular decline in manufacturing employment and lower economic dynamism and opportunities in areas where most residents are seniors.

These results are largely in line with available evidence on the United Kingdom. Most internal migrants are young adults, moving for study or job-related reasons (Swinney and Williams, 2016[73]). Housing conditions are important in a country where cross-regional differences in house prices are rising (Figure 6). Indeed, evidence suggests that the housing affordability crisis in London has pushed out several residents, especially the young, who relocated to suburban areas with their families (Thomas, Serwicka and Swinney, 2015[74]). Labour market conditions are only marginally significant, but this result masks the fact that the country has a very high share of cross-regional commuters, especially concentrated in the South-West area around London. This suggest that labour market opportunities matter for people's residential decisions, as they move to affordable areas but sufficiently close to urban centres offering them favourable employment prospects.

Table 14. Results of gravity equations – United Kingdom

Dependent variable: number of persons moving from origin to destination region in a given year	Model 1 (Baseline)	Model 2	Model 3	Model 4
Population sample	**Total population**	**Total population**	**Total population**	**Total population**
Regional sample	**only England and Wales**	**only England and Wales**	**only England and Wales**	**All UK regions**
Distance	**-0.96***** (0.096)	**-0.96***** (0.096)	**-0.98***** (0.10)	**-0.99***** (0.096)
Population t-1 - destination	**1.26***** (0.27)	0.12 (0.33)	**1.52***** (0.41)	**1.64***** (0.42)
Population t-1 - origin	**0.66**** (0.32)	**1.01***** (0.31)	**0.88*** (0.47)	**1.09***** (0.39)
Real GDP per capita t-1 - destination	**0.71***** (0.15)	-0.048 (0.14)	**0.75***** (0.17)	**0.68***** (0.22)
Real GDP per capita t-1 - origin	-0.11 (0.16)	0.019 (0.15)	-0.075 (0.19)	-0.34 (0.21)
Unemployment rate t-1 - destination	**-0.033*** (0.019)	**-0.033*** (0.017)	-0.022 (0.023)	**-0.053*** (0.032)
Unemployment rate t-1 - origin	**0.097***** (0.020)	**0.091***** (0.018)	**0.12***** (0.024)	0.036 (0.036)
Real house prices t-2 - destination	**-0.29***** (0.032)	**-0.29***** (0.031)	**-0.33***** (0.041)	**-0.17***** (0.045)
Real house prices t-2 - origin	**0.41***** (0.035)	**0.41***** (0.034)	**0.37***** (0.044)	**0.50***** (0.042)
Share of seniors - destination		**-1.38***** (0.21)		
Share of seniors - origin		0.034 (0.26)		
Employment in manufacturing - destination		-0.020 (0.078)		
Employment in manufacturing - origin		**0.15**** (0.076)		
Incoming residents from abroad (% pop t-1) - destination			-0.0099 (0.023)	
Incoming residents from abroad (% pop t-1) - origin			0.012 (0.021)	
Observations	1,530	1,530	1,224	1,740
Clusters	90	90	72	132
Adj.R2	0.92	0.92	0.89	0.94

Note: The estimation period covers the years from 2002 to 2018 in Models 1 to 3; while Model 4 only from 2012 to 2018. Regional sample: 12 TL2 regions. This classification coincides with the NUTS1 definition of regions. Northern Ireland and Scotland are excluded from Models 1 to 3 because of data unavailability. In Model 4, the sample comprises Scotland, Northern Ireland, Wales and the 9 statistical regions of England. The house price metric is the average residential property sales price. All models include destination, origin and time fixed effects. Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1
Source: See Annex A.

United States

The gravity regressions for the United States are based on the Internal Revenue Service (IRS)' State-to-State migration data from 1996 to 2017. Table 15 presents the results of the baseline model and several extensions.

Table 15. Estimation results – United States

Dependent variable: number of persons moving from origin to destination region in a given year	Model 1 (baseline)	Model 2	Model 3	Model 4	Model 5	Model 6
Population sample	**Total population**	**Total population**	**Total population**	**Total population**	**Total population**	**Total population**
Distance	**-1.21***** (0.018)	**-1.21***** (0.018)	**-1.20***** (0.018)	**-1.20***** (0.018)	**-1.21***** (0.018)	**-1.21***** (0.018)
Population t-1 - destination	**0.39***** (0.043)	**0.53***** (0.040)	**0.59***** (0.050)	**0.57***** (0.056)	**0.39***** (0.043)	**0.41***** (0.041)
Population t-1 - origin	**0.81***** (0.042)	**0.82***** (0.043)	**0.98***** (0.050)	**1.05***** (0.060)	**0.81***** (0.042)	**0.82***** (0.042)
Real wage per capita t-1 - destination	**0.12***** (0.032)	**0.11***** (0.031)	**0.073***** (0.028)	**0.14***** (0.033)	**0.12***** (0.032)	**0.097***** (0.029)
Real wage per capita t-1 - origin	**-0.071***** (0.025)	**-0.075***** (0.024)	**-0.067***** (0.025)	-0.030 (0.029)	**-0.071***** (0.025)	**-0.081***** (0.024)
Unemployment rate t-1 - destination	**-0.24***** (0.0092)	**-0.24***** (0.0091)	**-0.26***** (0.010)	**-0.25***** (0.012)	**-0.24***** (0.0092)	**-0.24***** (0.0087)
Unemployment rate t-1 - origin	**0.029***** (0.0092)	**0.031***** (0.0091)	-0.0057 (0.0093)	0.0090 (0.011)	**0.029***** (0.0092)	**0.032***** (0.0090)
Real house prices t-2 - destination	**-0.11***** (0.014)	**-0.12***** (0.014)	**-0.21***** (0.014)	**-0.16***** (0.015)	**-0.11***** (0.014)	**-0.12***** (0.014)
Real house prices t-2 - origin	**0.26***** (0.015)	**0.26***** (0.014)	**0.21***** (0.014)	**0.23***** (0.015)	**0.26***** (0.015)	**0.26***** (0.014)
Foreign immigrants (% of pop t-1) - destination	**0.050***** (0.0071)		**0.057***** (0.0072)	**0.028***** (0.0066)	**0.050***** (0.0071)	**0.048***** (0.0069)
Homeownership rate (t-1) - destination	**-0.25***** (0.040)		**-0.068*** (0.039)	**-0.21***** (0.047)	**-0.25***** (0.040)	**-0.21***** (0.037)
Homeownership rate (t-1) - origin	-0.038 (0.037)		0.034 (0.038)	**-0.099**** (0.044)	-0.038 (0.037)	-0.022 (0.036)
Empl. share in manufacturing (t-1) - destination			-0.011 (0.025)			
Empl. share in manufacturing (t-1) - origin			**-0.14*****			
			(0.024)			
Share of seniors (t-1) - destination			**-0.51***** (0.061)			
Share of seniors (t-1) - origin			**-0.31***** (0.055)			
Lab. Force with elem. educ. (t-1) - destination				**-0.043***** (0.017)		
Lab. Force with elementary educ, (t-1) - origin				**-0.084***** (0.017)		
Average annual temperature - destination					-0.020 (0.29)	
Average annual temperature - origin					**-2.14***** (0.30)	
Oil production (% of nat. production) (t-1) - destination						**0.036***** (0.0046)
Oil production (% of nat. production) (t-1) - origin						**0.014***** (0.0034)
Observations	56,000	56,000	48358	43266	56,000	56,000
Clusters	2550	2550	2550	2550	2550	2550
Adj.R2	0.75	0.75	0.75	0.75	0.76	0.75

Note: The sample covers the 50 US States plus the District of Columbia. The estimation period ranges from 1996 to 2017. The house price metric is the median house prices per square feet of owner-occupied housing units. All regressions include destination, origin and time fixed effects. Standard errors (in parentheses) clustered at the pair of regions. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1.
Source: See Annex A.

The three core variables – real wages, the unemployment rate and house prices – are always highly significant and exhibit the expected sign across all models. Inter-state migration in the United States is particularly responsive to local labour market conditions, followed by house prices and income. Dynamism in the labour market has always been strongly correlated with inter-regional mobility in the United States as the proportion of migrants moving for employment reasons is generally much higher than in other advanced economies (Basso and Peri, 2020[26]). However, the relevance of economic conditions have declined over time in the United States in comparison with other factors and in particular house prices (Bayoumi and Barkema, 2019[3]). The increasing importance of house prices for migration partially reflects the increase in living costs in certain cities of the United States, partly attributed to low housing supply in the face of increases in demand. Despite being high in an international perspective (Cavalleri, Cournède and Özsöğüt, 2019[75]), the responsiveness of housing supply to demand has declined in recent years, particularly in fast growing areas, such as California (OECD, 2018[76]). The resulting widening divide in house prices across areas reduces incentives for mobility and can partly explain the decline in internal migration in the United States (Figure 2) and, in turn, the decline in job mobility and labour market dynamism (Autor, 2019[32]). The share of international migrants is positive and significant. Homeownership is only significant in the destination region. A high share of homeowners may reduce incentives for incoming migrants who may prefer areas with a large rental market.

Models 2 shows the regression results of a model without any control variables, while Models 3 to 6 include additional control variables as compared to the baseline. Most inter-regional movers are prime-age workers and students and it is not surprising that mobility rates (both in and out) are lower in States with a larger share of elderly people (Model 3). Manufacturing represents a large sector in the United States, employing a large portion of the labour force. The changing spatial distribution of manufacturing activities can play a role in the geographic distribution of workers and their reallocation. Locations with a higher share of low-educated workers are associated with fewer population inflows and outflows (Model 4), consistent with the fact that geographical mobility increases with education (Molloy and Smith, 2019[1]). Recent OECD research (OECD, 2020[77]) has found that internal migration in the United States occurs along two major trajectories: retirees moving North-to-South in search of better climate conditions, and workers moving towards Western States for job opportunities originating from the oil boom. These results also emerge from the gravity results (Models 5 and 6). Some outmigration is associated with movements out of colder states, but there is no significant effect of the climate on in-migration in the destination (Model 5). Major oil producing regions are able to generate significant in- and out-flows of workers (Model 6). The changing geography of oil production contributes to a visible migration flow of workers in this industry that move from one site to another across the country.

Aggregate results hide heterogeneity with respect to the choice of short- versus long-distance migration. Confirming previous OECD research (OECD, 2020[77]), Figure 9 shows that the responsiveness of cross-regional migration to local conditions in the destination region increases with distance from origin. This suggests that long-distance migration requires higher benefits compared to short-distance migration, presumably because it also entails higher pecuniary and non-pecuniary relocation costs. This finding applies to real wages, the unemployment rate and house prices, suggesting that long-distance moves are often associated with upward income transitions.

Figure 9. United States – the difference in responsiveness between short- and long-distance migrations

Estimated elasticity of inter-regional migration in the destination region

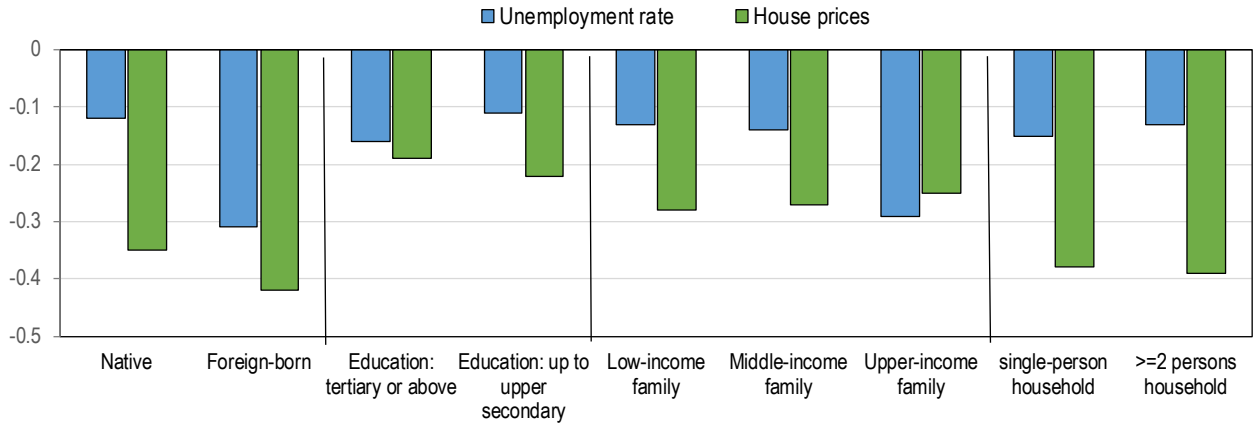
Note: The figure shows estimated elasticities of inter-regional migration with respect to real average wage per capita, the unemployment rate and house prices in the destination region. These are derived from estimating Model 1 in Table 15 on different sub-samples (groups of regional pairs) depending on the distance between origin and destination States. Near- and far-distant migration are identified using the median bilateral distance of the whole sample excluding Alaska and Hawaii. Only estimates significant at least at the 90% level are reported.
Source: IRS data on migration flows and Annex A.

Microdata[21] allow analysing differences in migration drivers between various socio-demographic groups (Figure 10). The results indicate that foreign-born residents are much more mobile in response to unemployment than natives, confirming their crucial role in labour market adjustment and dynamism in the United States, as discussed recently in Basso and Peri (2020[26]). In addition, foreign-born residents are also found to be relatively more responsive to local house prices. The results show that low-educated and low-income groups react less strongly to unemployment compared to high-educated and high-income groups, consistent with evidence that the propensity to move geographically increases with education and income (Molloy and Smith, 2019[1]). It may also reflect better information on out-of-region options among more advantaged groups. Employment opportunities are found to be more relevant for singles compared to larger households, in line with lifecycle priors.

[21] Data from the Annual Social and Economic Supplement (ASEC) of the Current Population Survey (CPS), sourced from IPUMS (Flood et al., 2020[7]).

Figure 10. United States – Responsiveness by socio-demographic groups

Estimated elasticity of inter-regional migration in the destination region



Note: The figure shows the estimated elasticities of inter-regional migration with respect to the unemployment rate and real house prices in the destination region. They are derived from gravity models similar to Model 1 in Table 15 but without control variables. For each model, the dependent variable is the migration flow of the group in the x-axis, derived from microdata from the Current Population Survey (CPS), sourced from IPUMS (Flood et al., 2020[7]). Only estimates significant at least at the 90% level are reported.
Source: Current Population Survey (CPS) data on migration flows by socio-demographic group, and Annex A.

Overall, the empirical analysis confirms that internal migration in the United States is linked to labour market conditions and dynamism. However, house price divergence across locations is eroding the gains from migration and potentially hurting both labour market efficiency and social mobility.

The responsiveness of migration to inter-regional differences

The gravity regressions deliver estimates on the responsiveness of migration to characteristics in the destination and origin regions, allowing identifying pull and push factors for migration. The results show indeed that most often the two effects are clearly different. However, at the same time, it is interesting to analyse whether migration is also sensitive to the difference in characteristics between destination and origin regions, and whether the magnitude of the difference matters. Thus, the baseline gravity models of each country have been estimated according to Equation (2): using the difference across pairs of variables (e.g. the difference in GDP per capita, unemployment rates and house prices) between destination and origin regions instead of estimating separate destination and origin effects.

$$MIG_{ij,t} = \gamma_0 + \gamma_1 DIS_{ij} + \gamma_2\left(\frac{POP_{i,t-1}}{POP_{j,t-1}}\right) + \sum_{s=1}^{3}\left(\gamma_s \frac{X^s{}_{i,t-1}}{X^s{}_{j,t-1}}\right) +$$

$$\sum_{s=0}^{n}\left(\varphi_s \frac{Z^s{}_{i,t-1}}{Z^s{}_{j,t-1}}\right) + \alpha_i + \alpha_j + \alpha_t + \varepsilon_{ij,t} \qquad \forall\, i \neq j \qquad (2)$$

Table 16 reports the results of this exercise. The results confirm that cross-regional differences matter for the decision of people to migrate. The coefficient on GDP per capita differences is positive and significant for most countries, indicating that migration is higher when cross-regional income differences are larger. The coefficients on unemployment differences are generally negative and often close to zero. However, this average effect hides large cross-country differences: for example, migration is highly responsive to

cross-regional unemployment differences in Sweden and Canada. The coefficient on house price differences is negative and significant for most countries, indicating that migration is lower when house price differences are larger. This result confirms the findings in the literature showing that rising cross-regional differences in house prices create obstacles to migration. This has adverse distributional implications, especially for low-income groups, who find themselves crowded out and excluded from richer metropolitan areas because housing costs are too high (Bayoumi and Barkema, 2019[3]).

Table 16. Baseline regressions using regional differences

Baseline gravity models with variables expressed as relative values between regions

country	GDP per capita difference t-1	Unemployment rate difference t-1	House price difference t-2
AUS	0.19	**-0.049****	**-0.18*****
CAN	**0.43*****	**-0.38*****	**-0.33*****
DNK	**-0.33****	-0.028	**-0.16*****
FIN	0.069	**-0.14****	-0.025
ITA	**0.78*****	0.0034	**-0.58*****
JPN	**0.55*****	**-0.056***	**0.17****
KOR	**0.19****	-0.013	**-0.22*****
NLD	**0.43****	**0.20*****	0.13
POL	0.015	**-0.050****	0.11
ESP	**-0.41***	**-0.20*****	**-0.31*****
SWE	-0.12	**-0.54*****	**-0.65*****
CHE	**0.87***	**-0.17*****	-0.24
GBR	**0.41*****	**-0.065*****	**-0.35*****
USA	**0.090*****	**-0.13*****	**-0.19*****

Note: the table shows the coefficients estimated from baseline gravity models for each country where all variables are expressed as log difference between the destination and origin region. Only the coefficients for GDP per capita, the unemployment rate and house prices are reported. See Model 1 in each country table in the previous section for the exact specification of the baseline model for each country. All regressions include destination, origin and time fixed effects. Statistical significance (in bold) is expressed as follows: *** p<0.01, ** p<0.05, * p<0.1
Source: See Annex A for more details on the data sources, and Table 1 for the baseline specification of each country.

Summary of the main findings and conclusion

The country-by-country gravity models of bilateral internal migration flows presented in this paper provide granular evidence of the factors that drive inter-regional migration. The regression results from the gravity models show that, across 14 OECD countries, three factors – income, the unemployment rate and house prices – emerge as key drivers of inter-regional migration flows. These factors reflect the interplay between costs and opportunities to move.

- GDP per capita (as a proxy for living standards and income) and house prices are found to be the strongest factors affecting mobility in or out of a region. High GDP in a region tends to attract migrants while high local housing costs tend to keep them away and also promote out-migration. Similarly, declining living standards encourage out-migration.
- The unemployment rate is a significant driver of inter-regional migration rates in almost all countries covered by this study, although the magnitude of the estimated responsiveness is smaller than for GDP per capita and house prices and with large cross-country differences.
- House prices are found to be important barrier to migration in countries having experienced strong increases in the level and cross-regional dispersion of house prices (Sweden, Canada, the United

Kingdom), while they are less important in countries where commuting is a relatively widespread alternative to migration (Netherlands, Switzerland) (Table 17).

Table 17. The responsiveness of inter-regional migration to economic factors in the destination region

Absolute value of the responsiveness of regional migration in the destination region with respect to:	GDP per capita	Unemployment rate	House prices
Responsiveness >= Median	ITA CHE CAN POL GBR JPN	CAN SWE CHE USA	AUS SWE ITA ESP CAN
Responsiveness < Median	NLD DNK KOR AUS USA	ESP ITA FIN AUS GBR	KOR GBR JPN DNK USA
Responsiveness = 0	SWE FIN ESP	NLD KOR DNK POL JPN	FIN NLD POL CHE

Note: migration responsiveness refers to the responsiveness of inter-regional migration with respect to GDP per capita, unemployment and house prices in destination regions, based on estimates of elasticities from country-specific bilateral gravity models in Table 1. The ranking is constructed by taking the absolute value of the elasticity, so that countries with higher values are those with a stronger responsiveness. Median refers to the median across countries of the absolute value of statistically significant estimated elasticities. Country names are ranked from highest to lowest based on the absolute value of the elasticity. "Responsiveness = 0" refers to non-significant estimates at 10% level.
Source: based on estimates in Table 1.

In addition, in almost all countries, internal migrants are more responsive to better economic opportunities at destination than to worsening conditions at origin. This is particularly true for the responsiveness to GDP per capita, a potential reflection of the attractiveness of metropolitan areas. By contrast, a smaller responsiveness to variations in origin conditions may reflect lock-in effects.

Although such findings are broadly found in each country model, the evidence points to substantial cross-country differences in the size, sign and significance of the estimated elasticities of migration to economic and housing-related factors. This implies that policy requirements in this area will depend on country-specific context, challenges and social preferences. Still, one common finding is that high house prices push prospective migrants away from prosperous regions, which is very likely to dampen social mobility and perpetuate regional inequalities. One implication is thus that national and local policies, for instance in the area of housing, should remove obstacles to inter-regional migration whenever disadvantaged socioeconomic groups find themselves “trapped”, segregated in lagging regions and excluded from growing opportunities.

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Annex A. Sample, data sources and definitions

Data sources and definitions

This section provides information on the data used, as well as on the procedures applied to construct regional house prices in levels. The analysis covers 14 OECD countries, selected based on data availability: Australia, Canada, Denmark, Finland, Italy, Japan, Korea, Netherlands, Poland, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Table A A.1 summarises for each country the population sample, time coverage and territorial level used in the baseline estimation (Table 1). Table A A.2 details the data sources for each country and variable.

Table A A.1. Overview of the estimation sample for baseline estimates

Country	Population sample	Estimation period	Regional sample (TL)[22]
Australia	Total population	1997-2018	TL2 (States)
Canada	Total population	2007-2018	TL2 (Provinces)
Denmark	Population above age 30	2008-2015	TL3 (Provinces)
Finland	Total Population	2002-2017	TL3 (Regions)
Italy	Total population	2010-2018	TL2 (Regions)
Japan	Total population	2007-2018	TL3 (Prefectures)
Korea	Working-age population	2007-2015	TL3 (Provinces)
Netherlands	Total population	2005-2017	TL2 (Provinces)
Poland	Total population	2008-2018	TL2 (Regions)
Spain	Total population	2009-2018	TL2 (Regions)
Sweden	Total population	2002-2017	TL2 (National areas)
Switzerland	Total population	2013-2018	TL2 (Cantons)
United Kingdom	Total population	2002-2018	TL2 (Regions)
United States	Total population	1996-2017	TL2 (States)

[22] In some countries and specifications, a few regions are excluded due to data unavailability. See the footnote of country tables for details when this happens.

Table A A.2. Data sources

Country	Bilateral migration flows	Bilateral distance	Regional GDP per capita	Regional unemployment rate	Regional house prices	Other variables
Australia	Australia Bureau of Statistics	Australian Government ASGS	OECD Regional Statistics	OECD Regional Statistics	Australian Bureau of Statistics – base year 2018; OECD Regional House Price Database	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Regional employment share in manufacturing (OECD Regional Statistics), Rental prices (Australia Bureau of Statistics)
Canada	Statistics Canada	Statistics Canada	OECD Regional Statistics	OECD Regional Statistics	Canada Mortgage and Housing Corporation – base year 2018; OECD Regional House Price Database	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Regional employment share in manufacturing (OECD Regional Statistics), Rental prices (Canada Mortgage and Housing Corporation)
Denmark	Statistics Denmark	Eurostat GISCO	OECD Regional Statistics	OECD Regional Statistics	Association of Danish mortgage banks	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics). Regional unemployment rate (long sample) (Statistics Denmark)
Finland	Statistics Finland	Eurostat GISCO	Statistics Finland	OECD Regional Statistics	Statistics Finland	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Regional employment share in manufacturing (OECD Regional Statistics)
Italy	Istituto Nazionale di Statistica	Eurostat GISCO	OECD Regional Statistics	OECD Regional Statistics	European Commission estimates (Houselev database[23]) – base year 2017; OECD Regional House Price Database	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Homeownership rate (National Institute of Statistics), Share of international migrants (National Institute of Statistics), House price indices in long sample (Estimates from Bank of Italy: Muzzicato, Sabbatini and Zollino (2008[49]) and Banca d'Italia (2020[50]))
Japan	Statistics Bureau of Japan	Geospatial Information Authority of Japan	OECD Regional Statistics	Statistics Bureau of Japan	Statistics Bureau of Japan	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Homeownership rate (Statistics Bureau of Japan, Housing and Land Survey)
Korea	Statistics Korea	Statistics Korea	OECD Regional Statistics	OECD Regional Statistics	Korea Appraisal Board (KAB) – base year 2018; OECD Regional House Price Database	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Regional employment share in manufacturing (OECD Regional Statistics), Homeownership rate (Statistics Korea, Korean Housing Survey)
Netherlands	Statistics Netherlands	Eurostat GISCO	Statistics Netherlands	Statistics Netherlands	European Commission estimates (Houselev database) – base year 2017;	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Regional employment share in manufacturing (OECD Regional Statistics), Labour force with elementary education (OECD Regional Statistics)

[23] (Bricongne, Turrini and Pontuch, 2019[28])

					OECD Regional House Price Database	
Poland	Statistics Poland	Eurostat GISCO	OECD Regional Statistics	OECD Regional Statistics	European Commission estimates (Houselev database) – base year 2017; OECD Regional House Price Database	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Share of labour force by educational attainment (OECD Regional Statistics)
Spain	Instituto Nacional de Estadística	Eurostat GISCO	OECD Regional Statistics	OECD Regional Statistics	European Commission estimates (Houselev database) – base year 2017; OECD Regional House Price Database	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Regional employment share in manufacturing (OECD Regional Statistics), Homeownership rate (Estimated from the European Union Survey on Income and Living Conditions)
Sweden	EU Labour Force Survey data (EU-LFS)	Eurostat GISCO	OECD Regional Statistics	OECD Regional Statistics	European Commission estimates (Houselev database) – base year 2017; Statistics Sweden	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Regional employment share in manufacturing (OECD Regional Statistics)
Switzerland	Swiss Federal Statistics Office	Eurostat GISCO	OECD Regional Statistics	OECD Regional Statistics	European Commission estimates (Houselev database) – base year 2017; OECD Regional House Price Database	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Regional employment share in manufacturing (OECD Regional Statistics)
United Kingdom	Office for National Statistics	Eurostat GISCO	OECD Regional Statistics	OECD Regional Statistics	HM Land Registry Open Data – base year 2016; OECD Regional House Price Database	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Regional employment share in manufacturing (OECD Regional Statistics), Share of international migrants (Office for National Statistics)
United States	Internal Revenue Services	US Census Bureau	Current Population Survey from IPUMS (real wage per capita)	OECD Regional Statistics	American Community Survey – base year 2015; OECD Regional House Price Database	Regional population (OECD Regional Statistics), Regional share of seniors (OECD Regional Statistics), Homeownership rate (computations from CPS ASEAN microdata), Regional employment share in manufacturing (OECD Regional Statistics), Share of labour force by educational attainment (OECD Regional Statistics), Share of international migrants (Internal Revenue Services), National crude oil production (US - EIA), average annual temperature (NOAA)

Construction of regional house price levels

Regional house prices in levels are defined as the real value of dwellings per square metre. This measure can be derived from national sources for all countries covered in the study. However, the available time dimensions are usually not of sufficient length for regression purposes. To fill this gap, for some countries, time-series of regional house price levels are derived using cross-sectional data on regional house price values in combination with regional house price indices.

Regional dwelling values refer to the average house price per square metre in a reference year. When information on mean prices is not available, median prices per square metre[24] are used instead. The reference year can differ across countries, as well as the source of the average dwelling value (see Table A A.2). Real house price indices refer to the evolution of the residential property price by regions over time. The data on indices is mostly drawn from the OECD regional house price database. Such data is classified according to the OECD Territorial Level classification.

For each region, house price levels in year *j* are thus derived as follows:

$$p_j = p_i^* \frac{HPI_j}{HPI_i}$$

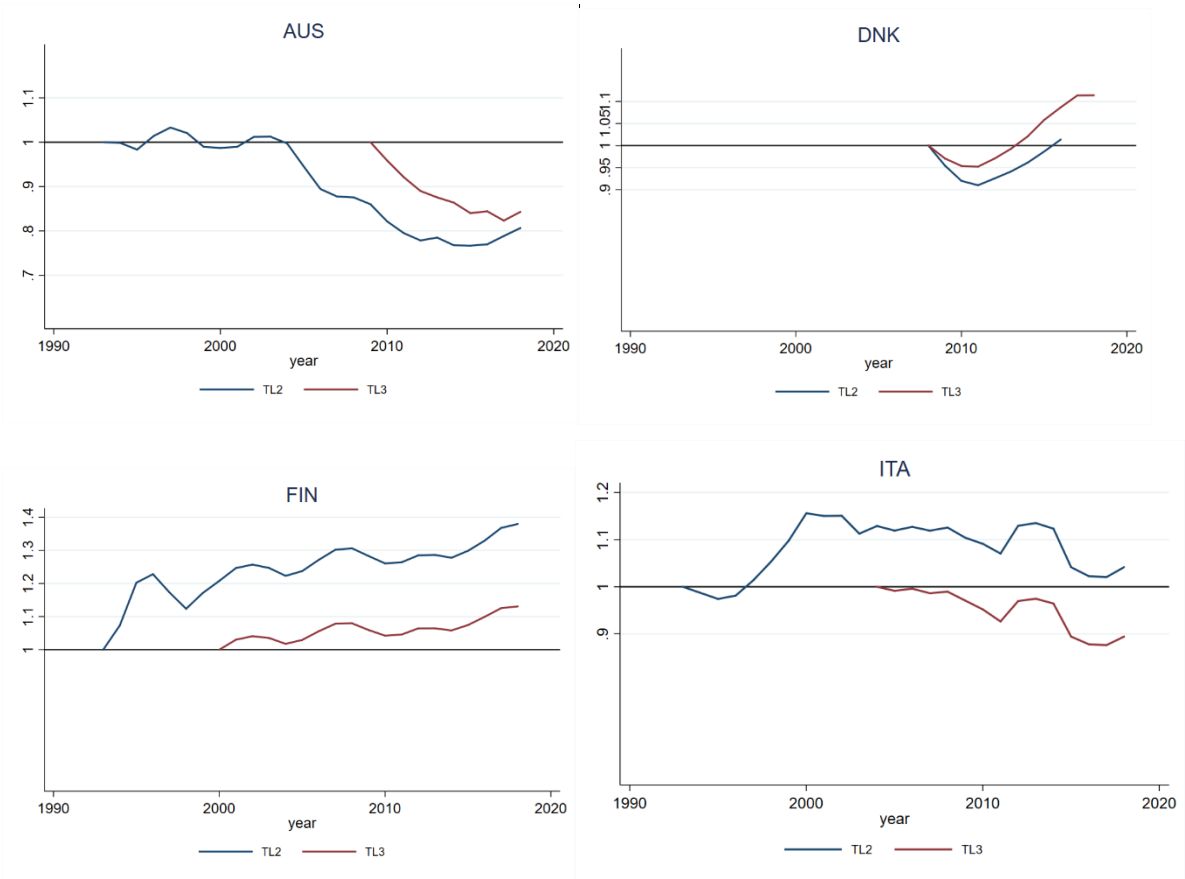
where p_j denotes the regional house price level in year *j*; p_i^* is the house price level associated to the same region in the reference year *i;* HPI_j and HPI_i are the real house price indexes of the region in year *j* and *i*, respectively. For each country, the latest available data point of the p_i^* series has been chosen as the base year. Table A A.2 provides details on the reference base for each country and the data sources for the computation.

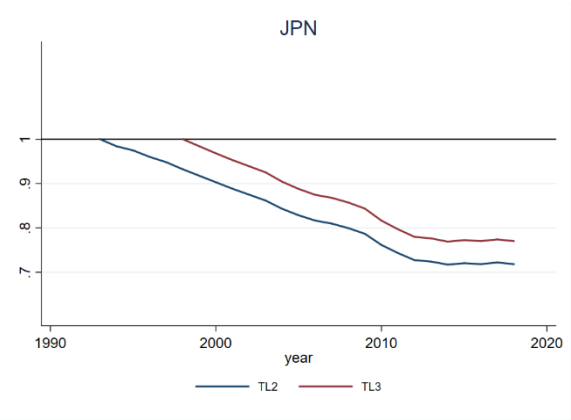
[24] For Australia and the United States, the metric used is the square feet. See the footnotes in each country table for the details on the exact definition of the house price metric in each country.

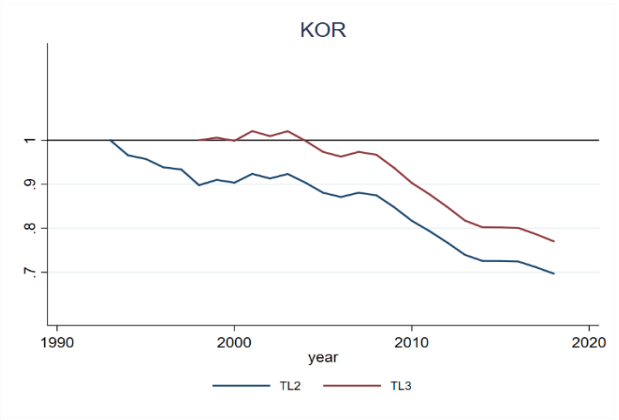
Annex B. Trends in inter-regional migration with different regional definitions

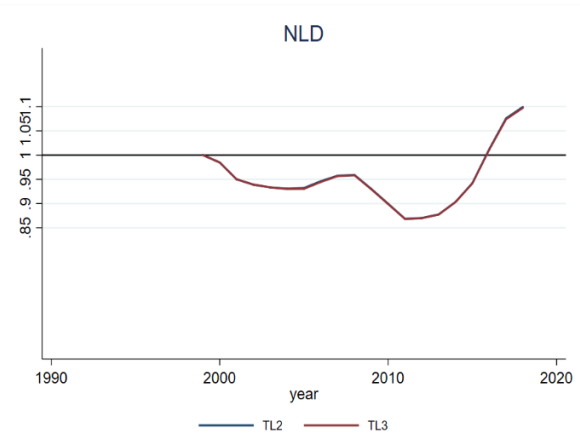
Figure A B.1 shows the trend in inter-regional migration across countries using both the TL2 and TL3 regional definition. The intensity of migration varies depending on the regional definition adopted. Still in a majority of cases, the patterns of migration over time remain consistent independently of the regional classification adopted.

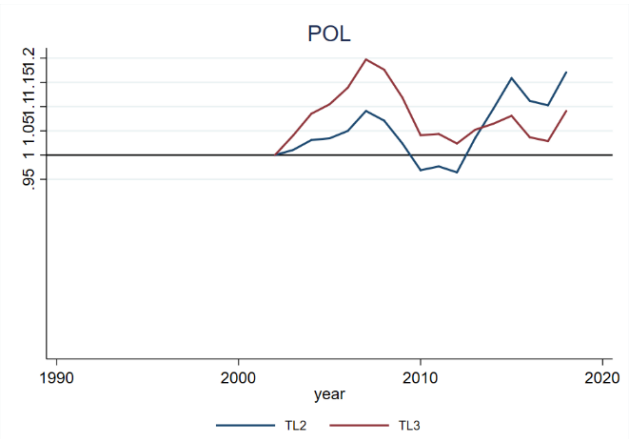
Figure A B.1. Trends in inter-regional migration across countries

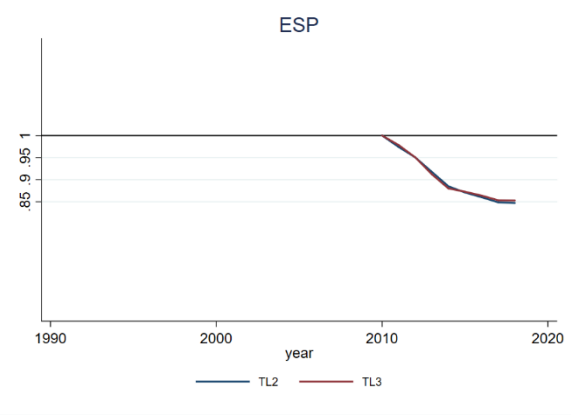


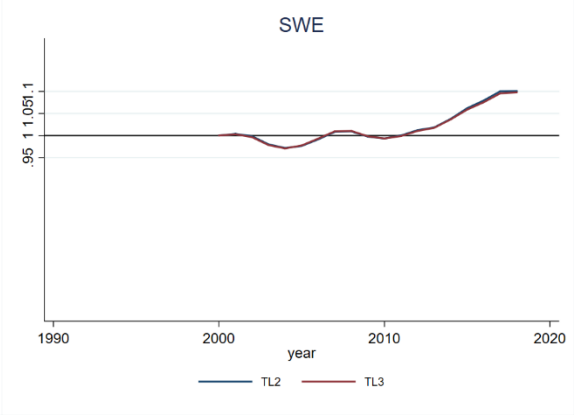

JPN
1
.9
.8
.7
1990
2000
2010
2020
year
TL2
TL3


KOR
1
.9
.8
.7
1990
2000
2010
2020
year
TL2
TL3


NLD
1.05
1
.95
.9
.85
1990
2000
2010
2020
year
TL2
TL3


POL
1.15
1.1
1.05
1
.95
1990
2000
2010
2020
year
TL2
TL3


ESP
1
.95
.9
.85
1990
2000
2010
2020
year
TL2
TL3


SWE
1.05
1
.95
1990
2000
2010
2020
year
TL2
TL3

Note: Inter-regional migration rates are defined as the number of migrants moving into the region from another region in the same country, divided by regional population one year before. The national average is calculated as the sum across regions of new residents from another region, divided by the sum across regions of the regional population one year before. The charts show a smoothed national average of cross-regional migration rate rescaled to 1 in 1993 or the earliest data point available for each series. The smoothing method is a 3-year moving average. Data at the TL3 regional level for Canada are not available and this country is hence not shown. For the United States, the chart shows migration rates derived from the Current Population Survey (CPS) (only at TL2 level) and the American Community Survey (ACS) (TL2 and TL3 from 2008). Because the ACS is run every two years, the data is interpolated for graphical reasons. Because of gaps in the time series, the computation of cross-regional migration rates for the United Kingdom excludes TL3 regions coded alphabetically from D33 to D47, from H15 to H17, from H34 to H37, from J25 to J28, from J35 to J46, and the regions of London and Scotland.

Source: OECD calculations using Current Population Survey (CPS) (from IPUMS, (Flood et al., 2020[7])) and American Community Survey (ACS) data for the United States and the OECD Regional Statistics Database for the remaining countries.