Pushing and Pulling: Determinants of migration during Sweden's industrialisation

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Please note that this is a preliminary draft. In the final version, we will also consider emigration to the US as part of the emigration decision.

Introduction

Ravenstein's (1885, 1889) "The Laws of Migration" laid the foundation of the push and pull model of migration which has provided the basic framework for analysing migration for more than a century. Its simple intuition stands in contrast to the empirical challenges associated with estimating the parameters of the model. In his seminal work, Ravenstein used late nineteenth century censuses to generalize the predominant causes of migration. In this spirit we take a fresh look at the historical determinants of migration using linked historical census data.

There is a rich historical literature which considers the impact of economic conditions and individual characteristics on migration and destination choice using either aggregate or micro data.. Examples include studies of nineteenth century European circular and rural to urban migration (Söderberg 1985; Boyer 1997; Boyer and Hatton 1997; Lundh 1999; Dribe 2003; Grant 2005; Long 2005; Silvestre 2005) the trans-Atlantic emigration from Europe to North America (Gallaway and Vedder 1971; Hatton 1997; Hatton and Williamson 1998; Bohlin and Eurenius 2010; Abramitzky, Platt Boustan and Eriksson 2013) and the labour migration from the rural American South to the industrialised North (Collins and Wanamaker 2014, 2015; Hornbeck and Naidu 2014; Black et al. 2015). Aggregate analysis typically relies on some form of gravity model to estimate push and pull parameters based on migration flows. Micro data allows for the explicit modelling of either the migration decision or the choice of destination using discrete choice analysis. Both approaches have its shortcomings: aggregate analysis prohibits conclusions to be drawn regarding individual behaviour while micro data tends to be constrained geographically and limited to migrations between a subset of possible origins and destinations.

This paper seeks to improve on past studies through the use of new data and a more comprehensive empirical migration model. We contribute to the literature by modelling the complete migration decision at the individual level, considering both the decision between staying and migrating and the subsequent destination choice.[1] Our methodological approach facilitates simultaneous modelling of the migration decision and the destination choice, also

[1] Because of data limitations, emigration, which primarily took place to the US, has been omitted from the analysis.

accounting for individual characteristics. We are thus able to estimate push and pull factors as part of one individual utility maximizing decision, and not separately as normally done.

Our focus is on late nineteenth century Sweden, a country experiencing rapid economic growth and increasing rates of internal migration. The analysis is based on a cohort of men and women born between 1860 and 1870 that transitioned into adulthood during the height of Swedish industrialisation. These men and women are first observed as adolescents residing with their parents in 1880, and then again ten years later in 1890. Upon leaving their parental home, most moved a relatively short distance, often to a rural area not dissimilar to that in which they were born. By doing so, these migrants were following a well-established pattern dating back to pre-industrial Sweden. Many did however not follow in these well-trodden tracks, instead migrating further away. We focus on these medium and long range moves by considering inter county migration and the push and pull factors which determined the migration decision and the location choice.

Push and pull factors

Ravenstein's (1885) "The Laws of Migration" laid the foundation upon which the early push and pull factors of migration were developed. In this seminal work, Ravenstein used the 1871 and 1881 censuses from the United Kingdom to generalize the predominant drivers of migration. The main conclusions from his analysis were that individuals migrate to improve their economic prospects, a finding reiterated by Hicks (1932:75) who argued that "…differences in net economic advantages, chiefly differences in wages, are the main cause of migration".

From an individual perspective migration may be conceptualised as an investment decision in which each possible move is associated with certain costs and benefits. Expectations about the benefits of migrating to a certain locations are formed based on anticipated income gains and other non-pecuniary amenities.If the net return from moving is positive, migration subsequently takes place to the chosen destination (Sjastaad 1962). Several aspects relating to individual characteristics, the origin, potential destinations and intervening factors all form part of the decision process and affect the probability of migration and the destination choice (Lee 1966; Borjas 1987). This study is grounded in this framework through the explicit modelling of push and pull factors at both the macro and micro level. In doing so, one must consider the economic drivers of migration, the intervening obstacles, and the individual characteristics of the migrants.

Economic conditions

Important migration flows are typically analysed and understood as the result of economic differences between sending and receiving regions. Within this paradigm, individuals from regions with a large endowment of labour relative to capital migrate to destinations with higher wages and lower relative endowments of labour in order to improve their economic conditions, a process which proceeds until an equilibrium state between the source and destination is met (Barro and Sala-i-Martin 1991). Consequently, when modelling the migration decision, the economic characteristics at both the origin and possible destinations are important in order to accurately assess the push and pull mechanisms at play. Historically, economic differences has been shown to be an important explanation for migration from mainly agricultural and rural areas, with plentiful labour and low wages, to urban and industrialized areas where labour was in demand and wages accordingly higher (Bengtsson 1990; Boyer 1997; Boyer and Hatton 1997; Silvestre 2005; Grant 2000). As a consequence migration eroded geographic differences and drove wages to convergence both between and within countries (Boyer and Hatton 1997; Taylor and Williamson 1997). In Sweden, aggregate migration flows were an important factor in driving regional convergence, particularly in the period leading up to 1910 (Enflo, Lundh and Prado 2014; Enflo and Roses 2015).

At the micro-level, migration decisions are conducted at the individual level through a cost benefit analysis of expected returns to migration. Therefore, regional wage differentials may not systematically drive migration, as skilled and unskilled migrants are driven by separate economic influences. Differences in earnings and skill premiums may thus reflect distinct occupational structure and returns to skills between the destination and origin (Borjas 1987). By moving to a location with better prospects for upward occupational mobility, anticipated earnings increase as a result (Sjaastad 1962; Long 2005; Borjas 1989). Moreover, these expectations should be adjusted in order to account for differences in the probability of employment (Harris and Todaro 1970). The unemployment characteristics of the destination region may thus play an important role in determining migration (Todaro 1969, 1970)[2].

Intervening factors

Distance is one of the most consistently observed determinants of destination choice, with more remote locations being consistently less attractive destinations than those nearby. (see Thomas 1938:420-21; Schwartz 1973;) Ravenstein (1885: 199) noted that 'migrants enumerated in a certain centre of absorption will consequently grow less with the distance proportionately to the native population which furnishes them.'

In terms of costs, the distance between two locations is a proxy for both upfront monetary costs associated with a particular move, and the psychological cost implied by the separation from amenities in the origin such as friends and family (Sjaastad 1962; Schwartz 1973). Apart from affecting the cost side of the migration decision, distance also captures differences in the information available about a given location. With distance, the uncertainty about conditions in a location thus increases, making migration to more remote places riskier (Greenwood 1975). More remote locations are also less likely choices because of what Stouffer (1940; 1960) termed "intervening opportunities": with increasing distance, the number of competing destinations increase, making distant locations less likely to be chosen.

Regional and individual characteristics may serve to mediate the effect of distance. At the regional level, access to transportation and communication infrastructure such as roads, railways and postal services serves to lower the cost associated with distances between locations (Killick 2013). Networks, defined as a community of family and friends (kinship networks), or migrants from the same origin (migrant network), can help to decrease the costs associated with migrating. In particular, psychological, information, job-search, and housing costs will be lower for individuals with large networks, as previously settled migrants can help more recent ones navigate life in the destination (Yap 1977; Hugo 1981; Taylor 1986; Massey and Garcia Espana 1987). As Carrington et al. (1996) points out, however, if networks reduce the costs associated with migration, migration costs will be endogenous to

[2] These expectations should be adjusted in order to account for differences in the probability of employment (Harris and Todaro 1970) we have yet to find an indicator of regional unemployment differences.

the volume of previous migrations to a given destination. Nonetheless, networks have received extensive theoretical and empirical support in the literature (Bodvarsson et al 2014).

Individual characteristics

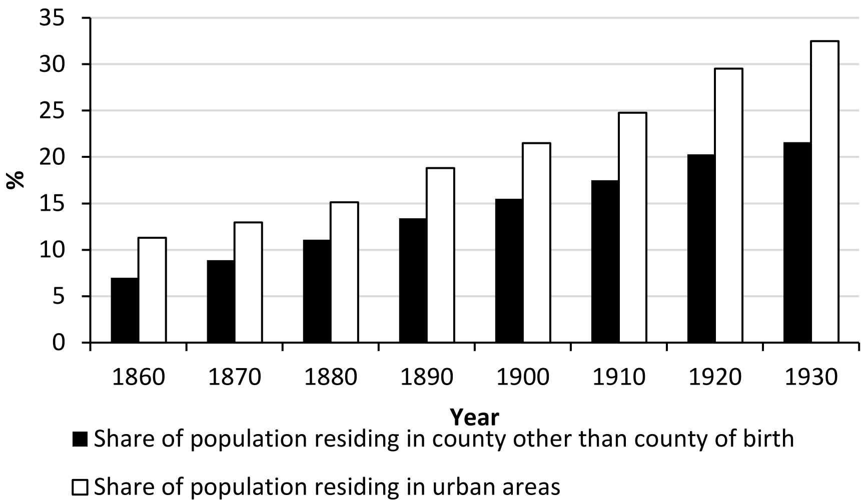
Expectations, ability, benefits, costs and resources are all characteristics that vary between individuals and simultaneously determine the incidence of migration and the return thereof. Migration is as a result a highly endogenous process undertaken by a certain groups and individuals, each differently selected depending on individual characteristics and circumstances. If costs are important, the expectation is selection of the most able, ambitious and entrepreneurial part of the population who are able to recoup costs in the form of substantial returns (Lee 1966). Similarly, costs may affect selection if cost is a negative function of ability, the able being, in Chiswick's (1999) words "more efficient in migration". Upfront migration costs may also serve as a more direct barrier by preventing the financially constrained from moving. Even when costs are fixed, as in the case of a train or boat ticket, migration is still relatively more expensive for the less able because fewer hours of work are required on the part of the more able to cover expenses associated with a move. Selection may also be negative if there are regional differences in terms of returns to skills which will result in opposing migrant streams of skilled and unskilled persons drawn to locations in which the returns to skills are consummate with individual ability (Roy 1951; Borjas 1987).

Although migrants tend to be younger, the relationship between age and the probability of migrating is less straightforward. Becker (1964) argues that the propensity to migrate decreases with age, because the net present value of benefits is higher from younger prospective migrants due to greater duration of stay in a particular destination. Older workers may also be less mobile the costs of liquidating physical and personal investments in the origin is higher (Gallaway 1969; Schwartz 1976; Lundborg 1991). Note, however, that migration costs may be more affordable for older prospective migrants than younger ones due to higher earnings and accumulated assets.

Swedish industrialisation and migration

In step with Sweden's industrial take off, migration increased in response to higher wages in industrialising regions (The Institute for Social Sciences 1941:42; Jörberg 1972: 348). As can be seen in Figure 1, only 7% of the population in 1860 resided in a county different from their county of birth; by 1900 however, the share of county migrants had more than doubled to 15.5% and continued to rise over the following decades (also see Thomas 1941:28). The inflow of migrants from the countryside resulted in a doubling of the urban share of the population between 1860 and 1900, with in particular the three largest cities, Stockholm, Gothenburg and Malmö growing particularly fast (Statistiska Centralbyrån 1969).

Figure 1. Migration and urbanisation, 1860-1930.



Source: Sveriges Officiella Statistik 1930: 84*; Statistics Sweden 1999: 42.

The shift in migration was underpinned by greater access to transportation. Real improvements to the infrastructure began with the canal construction boom between 1780 and 1830 which connected the hinterland of central Sweden with the Baltic and North Seas. This was followed by the opening of stagecoach lines connecting Stockholm with Gothenburg and Scania in the 1830s. The building of canals and stagecoach lines primarily served to lower the cost of transporting bulky goods and improving the flow of information through the post (Schön 2010:101-102). The real breakthrough in terms of affordable passenger transport followed the construction of railways which commenced in 1855. The arrival and expansion of the railway markedly reduced both costs and transit times for passengers. As a result the pace of urbanization began to accelerate as migrants started flocking to towns connected to the railway (Berger and Enflo 2013).

This transition was not unique to Sweden, but was reflected in many other European countries (Baines 1985; Moch 1992; van der Woude 1992). With the advent of industrialisation the population of Europe had entered a new phase of geographic mobility. As a result of falling transportation costs, a declining agricultural sector and new opportunities outside of farming, the nature of migration was changing. Instead of making a living in agriculture, increasing numbers of people were leaving the countryside in favour of cities.

The shift towards longer distance migration does however not mean that pre-industrial Sweden was geographically immobile. Rural Swedish societies were in fact characterised by high rates of geographic mobility (Gaunt 1977:195, Dribe 2000:5-6, Dribe 2003). Migration was to a large extent driven by frequent short distance moves between rural areas by young people working as servants (Eriksson and Rogers 1978; Dribe & Lundh 2005). Migration was tied to the seasons and was the means by which the young earned their keep and acquired skills in agricultural work (Moch 1992: 61).

As long as certain administrative requirements were met there were no legal obstacles to internal migration in Sweden during the nineteenth century. Before moving, a prospective migrant was required to notify the ministers of both the home and destination parish. Permission to settle in a new parish was given as long as it was not suspected that the migrant would have difficulty supporting him- or herself. Refusal of permission to move was exceedingly rare, with less than 1 per cent of applications denied (Eriksson & Rogers 1978:180-181). One institutional barrier to migration did however exist, the Servants Act, which in particular hampered migration for agricultural workers. The act mandated that yearly employment contracts for farmhands and maids must begin on the 1st of November and run until the 24th of October the following year. This resulted in little down time between employment contracts, which made it difficult for farm workers to find employment anywhere beyond the vicinity of their last place of work (Lundh 1999:61; Lundh 2003).

Data and descriptive statistics

This paper combines individual panel data and contextual level data in order to model the migration decision in a comprehensive manner. The individual level data comes from the complete Swedish censuses of 1880 and 1890. The contextual level data is drawn from historical official statistics and constructed regional wage and GDP series.

Linked census data

The censuses are the most comprehensive source of individual level data for Sweden around the turn of the century. The Swedish censuses differ from the U.S. and British censuses by not being the product of a census taking done by enumerators actually visiting and counting the populace. Instead, with one exception, that of the city of Stockholm, the Swedish censuses were the result of a compilation of excerpts from continuous parish registers which were kept by the Swedish Lutheran church and maintained by the parish priest. For Stockholm, the source of the census were excerpts from the Roteman register, an administrative register supervised by Mantalsnämnden (The population and tax registration board), which replaced the Church registers in 1878 in order to cope with the rapidly growing, and increasingly mobile, population of Stockholm at the end of the nineteenth century (Geschwind & Fogelvik 2000:207-208).

Because the Swedish census is no more than an excerpt from a continuous and consistent source rather than a recreation of a population register as in the case of the U.S. and British censuses, the quality of the raw data is comparatively better. Any errors resulting from the misreporting by the enumerated or recording mistakes by enumerators may thus be largely discounted. Moreover, because Swedes were entered into the parish books at the time of christening and not removed until time of death or emigration, the under-enumeration of the population as whole and specific groups is less of a problem than what is normally expected from historical censuses.

The analysis relies on a new panel sample which has been created by linking individuals between the 1890 and 1880 Swedish complete count censuses. The linking process relies on exact comparisons of sex, birth place and birth year, and probabilistic matching of names for identifying and linking individuals between the censuses. Importantly, and uniquely, women appear with their maiden name, even after marriage, in the Swedish censuses. This enabled women to be linked to nearly the same extent as men between the two censuses. For a thorough discussion of the linking process see Eriksson (2015; 2016)

From the linked sample a sub-sample of men and women that were born between 1860 and 1870 were selected. We further restrict the analytical sample to those that resided with their father in 1880 in order to collect information about social status. One significant group has by necessity been excluded from the analysis: emigrants. The reason is that in order to be linked between the censuses, an individual had to reside in Sweden in both 1880 and 1890. Anyone emigrating out of Sweden between the two time points was thus lost in the linking process. After restricting our sample according to the above criteria, we are left with 308,397 individuals evenly distributed by sex.

We include a number of individual characteristics theorised to affect migration. We use HISCO coded occupations and the HISCLASSS scheme to classify the social status of an individual's father into one of four categories; white collar (HISCLASS 1-5), farmer (HISCLASS 8 with a HISCO code that corresponds to the occupation of farmer), skilled and low skilled (HISCLASS 6-10) and unskilled (HISCLASS 11-12) (see van Leeuwen et al. 2002 and van Leeuwen et al. 2011). To account for the effect of previous migration experiences we coded any individual residing in a county in 1880 which was different from his or her county of birth as a previous migrant. The migrant status of an individual's mother or father was coded in the same manner. The definition of whether an individual was an urban resident in 1880 follows the definition from the 1880 census. Access to transportation infrastructure is measured by calculating the distance from each individual's parish of residence to the nearest railway in 1880 (The extent of the railway network comes from BISOS L 1881). In order to account for access to sea transport, the distance to the nearest coast was calculated in the same way as for railways. Finally, we calculated the distance from the parish of residence to the county border in order to control for the fact that individuals located closer to a county border are mechanically more prone to be defined as migrants. We use the log of all distances when estimating our models.

Table 1. Descriptive statistics of individual sample

	All	Non-migrants	Migrants
Age	13.86	13.83	14.11
	(2.76)	(2.76)	(2.68)
Sex (Female)	0.50	0.50	0.53
First born	0.36	0.36	0.39
Migration history			
Previous migrant	0.05	0.04	0.13
Mother migrant	0.17	0.16	0.31
Father migrant	0.15	0.14	0.29
Father social status			
White collar	0.07	0.06	0.13
Farmer	0.61	0.64	0.38
Skilled and low skilled	0.17	0.16	0.27
Unskilled	0.15	0.14	0.22
Urban resident	0.08	0.07	0.13
Distance to railway	31.11	32.74	16.11
	(75.95)	(78.63)	(41.03)

Distance to county border	23.37	23.94	18.15
	(24.16)	(24.75)	(17.00)
Distance to coast	51.74	51.61	52.87
	(50.18)	(50.77)	(44.34)
Migrant 1880-90	0.10		
No of observation	308,397	278,297	30,100

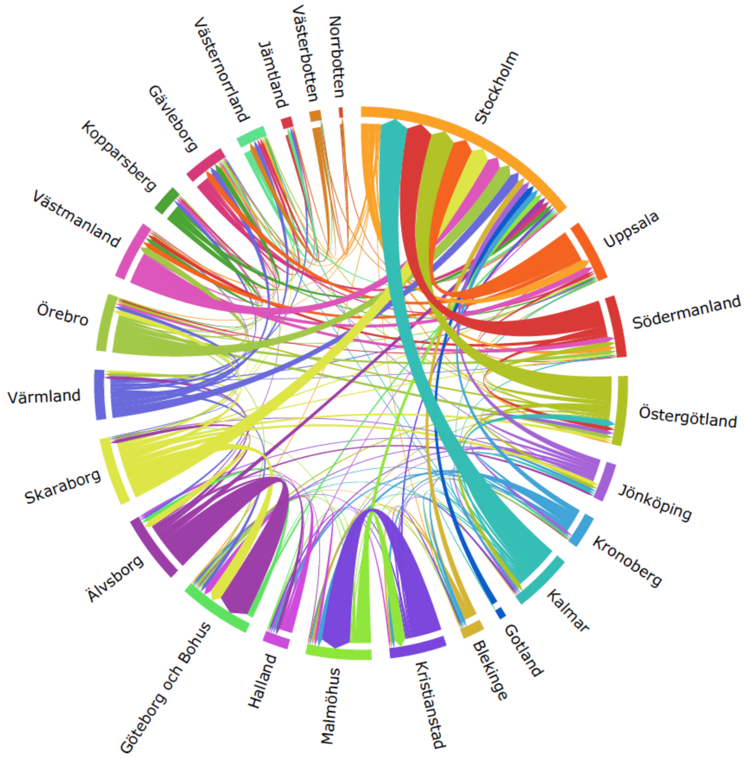
Note: Reported statistic is mean. Standard deviations for continuous variables within parentheses.

Sources: see text.

Table 1 presents the descriptive statistics for the complete sample and by migrant status. All variables refer to characteristics observed in 1880. Three things are apparent from the descriptive statistics. The first is the low incidence of migration for the sons and daughters of farmers. The second is the higher mobility of urban residents. The final point to note is the higher mobility of individuals with either a personal or family history of migration.

As a result of the linking we have information about the location of each individual in 1880 and ten years later in 1890. Although we have information on the parish level, we use Sweden's 24 counties as the geographic level of division in order to make data collection and modelling feasible. The resulting flows are depicted in Figure 2. Stockholm County is clearly the most popular destination, attracting migrants from all parts of Sweden. Malmöhus County and Göteborg and Bohuslän County (in which Sweden's two other major cities of Malmö and Gotheburg are located) display a markedly different pattern, primarily attracting migrants from neighbouring counties. It is also possible to identify counties which were clearly sending regions such as Kalmar, Älvsborg and Skaraborg.

Figure 2. Interregional migration flows, 1880-1890.



County level data

We use a number of sources to collect data on county specific variables. All data refers to the year 1880. Although it is likely that conditions in both origin and destination would have changed between the time of observation in 1880 and the year in which an individual choose to migrate, we are limited in this regard because we do not know the exact time at which migration took place. In addition, even if we had information about the exact time point of migration, most of the county level characteristics lack annual data.

To approximate the economic conditions in an individual's origin and possible destinations we use data on the real wage level and GDP per capita for each county. The wage data comes Jörberg and reflects the wages of agricultural day labourers (except for Stockholm county, where the wages are those of unskilled labourers). We deflate wages by the county specific prices of a food basket from Dribe (2008). The measure of GDP per capita for each county comes from Enflo, Henning and Schön (2014). Although both variables captures the economic conditions in a specific county, each measure also reflect different aspects of economic conditions. Since the real wage index is based on the wages of day labourers, it is likely to primarily capture differences in living conditions of low skilled labour. In contrast, GDP per capita is a broader measure, reflecting differences between counties in terms of economic development. To ease the interpretation and comparison of the estimates of wages and GDP we use standardised variables (mean = 0, s.d.= 1) when estimating our migration models.

The degree of urbanisation of each county has been calculated using the complete census of 1880 and is reported as the share of the population in each county that resided in an urban area. The area of each county comes from BISOS I (1881) and is measure in Swedish square miles (approximately equal to 106.89 km^2). Information about access to transportation has been collected from official statistics. The data on railways can be found in BISOS L (1881) and the data on roads in BISOS H (1884). Both are measured as kilometres of road/railway per Swedish square mile. The data on roads only include public roads, while the railroad data includes both public and privately owned railways. Two variables, distance and the historical migration stream, are constructed based on specific information about the origin and a possible destination and are thus different for each unique combination of county of origin and potential destination. Distance has been calculated as the number of kilometres between the centroid of the origin of each county. Similarly, the migration stream variable has been calculated for each county by identifying all individual living outside their county of birth according to the 1880 census, and then calculating the share residing in each possible destination.

The county level characteristics are presented in table 2. In terms of economic conditions there is considerable variation between counties. Real wages are more than twice as high in the best paying region compared to the lowest paying. GDP per capita displays a similar pattern in terms of the variation in regional development. Wages and GDP are, as may be expected, positively correlated (0.18 and 0.04 for male and female wages respectively) although not very strongly.

Table 2. County level variables

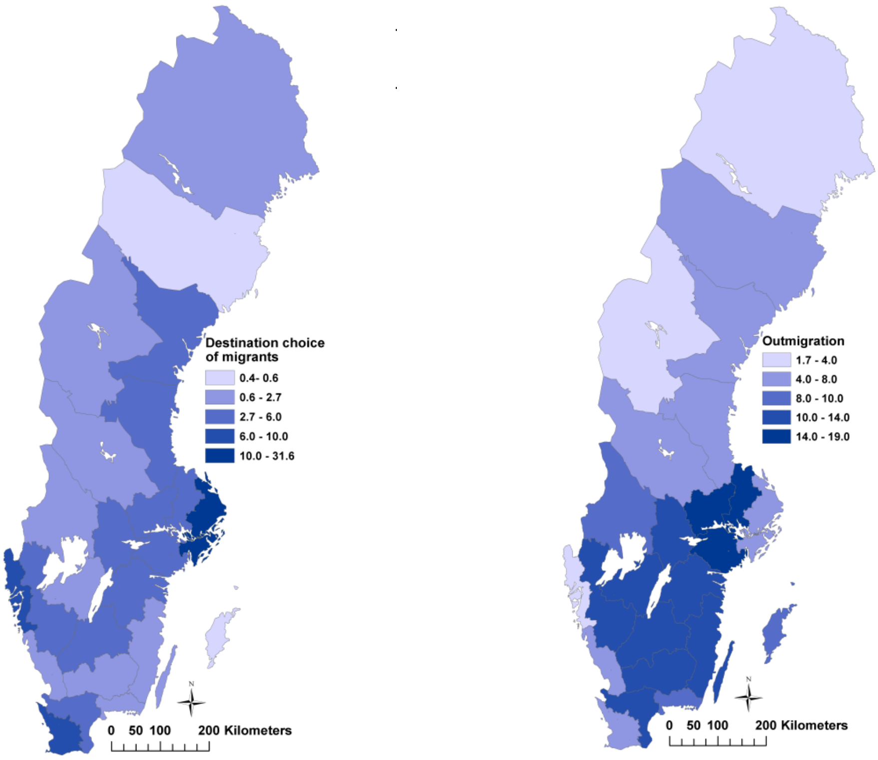
County code	County	Male real wages	Female real wages	GDP per capita	Urban population share	Share employed in agriculture
1	Stockholms län	112.50	53.75	607.4	56.2	11.9
3	Uppsala län	118.96	59.37	347.6	16.4	21.9
4	Södermanlands län	112.95	61.83	335.2	11.4	26.1
5	Östergötlands län	95.14	60.65	337.8	15.4	21.9
6	Jönköpings län	118.55	60.81	315	10.4	28.7
7	Kronobergs län	139.44	77.31	258.6	2.9	30.8
8	Kalmar län	106.35	51.34	282	10.4	21.5

9	Gotlands län	118.51	63.73	322.1	12.7	23.2
10	Blekinge län	96.67	59.21	299.5	19.1	23.1
11	Kristianstads län	146.52	65.82	279.4	5.7	28.2
12	Malmöhus län	100.43	57.85	403.3	24.1	22.5
13	Hallands län	124.66	73.30	276.4	11.2	31.0
14	Göteborg och Bohus län	81.47	56.48	381.1	33.7	20.2
15	Älvsborgs län	101.36	59.15	240.4	5.7	29.7
16	Skaraborgs län	110.74	75.79	295.1	6.9	28.5
17	Värmlands län	76.87	40.68	266.8	5.9	28.6
18	Örebro län	99.01	58.24	283.4	9.1	25.5
19	Västmanlands län	95.33	56.46	365.8	13.9	23.7
20	Kopparbergs län	103.50	59.80	315.1	4.9	27.9
21	Gävleborgs län	130.41	60.10	475.1	17.4	19.7
22	Västernorrlands län	152.19	69.07	392.9	8.6	22.8
23	Jämtlands län	182.14	94.19	415.8	3.4	29.7
24	Västerbottens län	167.10	80.21	313.7	3.5	29.8
25	Norrbottens län	152.38	87.91	407.4	7.2	30.9

Sources: see text

The differences in real wages and GDP are reflected in the incidence of migration at the county level and in the destination choice of migrants. Figure 3 displays maps of the regional variation in real wages and GDP together with rate of outmigration and the destination choice of migrants. The rate of outmigration for each county has been calculated as the share that

Figure 3. Migration and economic conditions



(a) Destination choice of migrants, 1880-90 (%) (b) Outmigration, 1880-90 (%)

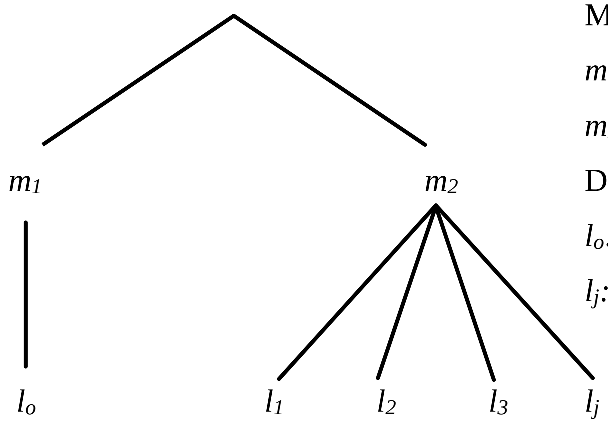
(d) GDP per capita, 1880 (d) Wages, 1880

choose to leave the county between 1880 and 1890 using the linked census sample defined above. The destination choice has been calculated as the share of all county migrants between 1880 and 1890 that choose to settle in a specific county. The urbanised counties of Stockholm, Malmöhus and Göteborg was clearly the favoured destination of the migrants in our sample. The migrants to these counties were primarily drawn from neighbouring counties and the central counties in southern Sweden. Outmigration from the northern counties was low, a pattern which is consistent with the relatively higher wages and high level of GDP in the north. Although the maps provides clear descriptive evidence between economic conditions and migration, these correlations tell us little about their magnitude and importance relative to other factors which affected individuals migration decisions. This is the question to which we turn next.

Modelling the migration decision

Migration may be conceptualized as a decision tree with two levels (see figure 1). The top level entails the choice of migrating or remaining in the place of origin. The second choice, which is conditional on migration, concerns the choice of which destination to move to.

Figure 3. Two tier nested structure of migration and destination choice



Mobility (*m*):

m_1: stay

m_2: move

Destination choice (*l*):

l_o: origin location

l_j: migration location, $l = 1,2, \ldots, j$

To account for the fact that destination choice is nested within the migration branch of the decision tree, thus making destination choice conditional on migration, we employ the utility maximizing nested logit model developed by McFadden (1978; 1981, 1984). The nested logit is a less restrictive alternative to the multinomial logit model since the independence of irrelevant alternatives (IIA) assumption is relaxed. The IIA assumption requires the response elasticities of choices to be equal. In our case, the use of a multinomial logit model and the associated IIA assumption would mean that the introduction of a new destination would require an equal decrease the predicted probability of choosing a specific destination location and remaining in the origin. By nesting the destination choice within the migration decision, the IIA assumption only needs to hold between the choice to migrate or not or between choosing a specific location, and not across the two choice sets. Moreover, the model allows us to simultaneously assess both the push and pull factors which affect migration. By using this approach, push factors are evaluated in a binomial migration choice model and pull factors are assessed in a multinomial destination choice model. This allows for individuals to value the conditions in the origin differently from those in the destination. Although the choice is conceptualized as sequential in the decision tree, the nested logit does not impose a sequential decision process. Or in other words, the model does not imply the unrealistic assumption that an individual first chooses whether to migrate or not, and only thereafter considers which destination to choose. The two equations are estimated simultaneously using maximum likelihood.

Results

The results from the regression analysis are to be interpreted in the two levels as specified in the decision tree. The top panel in Table 3 presents the results corresponding to the first level decision, the push factors that are associated with the decision whether to migrate or remain in the origin.[3] In this case, individual characteristics, as well as the conditions in the origin county influence the decision to migrate or stay. The lower panel in table 3 displays the impact of the pull factors, the characteristics of the destination counties that influenced the destination choice. In general, the results are entirely consistent with theoretical expectations.

In order to understand the economic mechanisms that drive the migration decision, we estimate 3 model specifications. Model one only contains GDP per capita of the origin and destination counties, to understand the relationship between the broader macro-economic conditions and migration decisions. Model two, on the other hand, includes wages in the origin and destination counties in order to understand whether migration decisions are driven by labour market conditions. Finally, Model 3 contains both GDP per capita and wages. The final model specification is used to test whether different economic factors exert a push or pull force on migration decisions.

Push factors:

The top panel in table 3 present the results of the individual and contextual push factors, the first level decision. The results indicate that females and individuals residing in urban origins experience higher odds of choosing to migrate across each of the models. Additionally, a one year increase in age is associated with roughly a 5 percentage point increase in the odds of choosing to migrate. The magnitude of the coefficient for age is large, because the sample is restricted to individuals that are 10 to 20 years of age in 1880, with the higher age groups being the most likely to migrate. Father's social status also seems to exert an important push force. Children of farmers display a roughly 60 percentage point lower odds of choosing to relocate, while those of white collar workers display a 16 percentage point higher odds compared to those with skilled fathers.

[3] The model has been estimated using a 10% sample. We intend to estimate all models using the full sample. When using the full sample it does however take more than 24 hours for the maximum likelihood estimation to converge…

The most important individual level push factor, however, is having previously migrated or having a parent that previously migrated. Individuals who were residing in a county in 1880 that was different than their birth location experienced approximately a 43 percentage point higher odds of migrating again. Similarly, having a parent that previously migrated increased the odds of migrating for that individual by between 45-60 percentage points. The mechanisms for these associations are potentially two-fold. First, individuals that have previously migrated may have existing networks outside of their county of residence. Second, the costs associated with migration are reduced with every subsequent act of migration as an individual develops migration specific human capital. The results further suggest that urban resident are more mobile, but that the overall share of urban residents in a county has a negative effect on outmigration. The effect of railway access seems to be limited, while the distance to the coast line is positive.

Next we turn to the county-level push factors. The results indicate that individuals are less likely to relocate from counties with better economic prospects. Specifically, a one standard deviation increase in GDP per capita is associated with an 11-14 percentage point decrease in the odds of resettling. The wage level does not appear to play a role in the first level decision. This indicates that general economic conditions are a more important push factor than wages of the origin county.

Table 3. Odds ratio estimates from nested logit models of migration and destination choice

	1	2	3
Panel A: Migration Choice			
County level variables			
GDP per capita	0.888**		0.865**
	(0.043)		(0.055)
Wages		0.986	1.022
		(0.027)	(0.036)
Urban share	0.976***	0.968***	0.977***
	(0.005)	(0.004)	(0.005)
Agricultural share	0.948***	0.955***	0.945***
	(0.010)	(0.009)	(0.011)
Individual level variables			
Age	1.047***	1.047***	1.047***
	(0.008)	(0.008)	(0.008)
First born	1.065	1.060	1.065
	(0.045)	(0.045)	(0.045)
Sex	1.163***	1.165***	1.163***
	(0.047)	(0.047)	(0.047)
White collar status	1.163**	1.164**	1.162**
	(0.084)	(0.084)	(0.084)
Farmer status	0.407***	0.411***	0.406***
	(0.022)	(0.022)	(0.022)

Skilled status	ref.	ref.	ref.
Low skilled status	0.929	0.930	0.930
	(0.055)	(0.055)	(0.055)
Previous migrant	1.433***	1.429***	1.434***
	(0.108)	(0.108)	(0.108)
Mother migrant	1.612***	1.600***	1.611***
	(0.082)	(0.082)	(0.082)
Father migrant	1.473***	1.455***	1.471***
	(0.079)	(0.078)	(0.079)
Urban resident	1.684***	1.646***	1.693***
	(0.119)	(0.116)	(0.119)
Distance to railway	0.989	0.987	0.987
	(0.014)	(0.014)	(0.014)
Distance to border	0.789***	0.781***	0.791***
	(0.020)	(0.020)	(0.020)
Distance to coast	1.066***	1.037**	1.074***
	(0.018)	(0.017)	(0.019)
Constant	12.838***	27.583***	11.914***
	(5.881)	(12.737)	(5.446)
Panel B: Destination choice			
County level variables			
GDP per capita	1.091***		1.103***
	(0.015)		(0.019)
Wages		1.040***	0.985
		(0.010)	(0.010)
Urban share	1.004***	1.008***	1.003***
	(0.001)	(0.001)	(0.001)
Agricultural share	0.998	0.988***	1.000
	(0.003)	(0.003)	(0.003)
Distance	0.735***	0.738***	0.739***
	(0.028)	(0.026)	(0.028)
Migrant stock	1.034***	1.041***	1.033***
	(0.004)	(0.004)	(0.004)
No. of observations	30766	30766	30766
χ^2	1798.2	1796.0	1800.1

Note: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Pull factors:

The estimated pull factors are found in the bottom panel of table 3. The characteristics of each destination county in the year 1880 are used to estimate the parameters. The covariates are measured in the year 1880 so as to ensure that they represent the conditions prior to the year of migration, and are not themselves an outcome of migration flows between 1880 and 1890. The results again corroborate a priori expectations.

The estimates suggest that a distance has a negative effect. This is expected as the emotional and financial cost of migration and distance are positively correlated. Additionally, the migration flows tend to be pulled to more urbanized destinations, with urban share of a given county slightly increases the likelihood of selecting that destination. The dynamics of network or chain migration seem to play an important role in determining the destination location. Network theories of migration postulate that existing migrant networks decrease the cost of migration by providing access to housing or labour market opportunities. Although we are unable to identify the channel through which this relationship exists, the results indicate that a 1 percent increase in the origin migrant stock leads to a 3-4 percentage point increase in the odds of selecting that given location.

The final pull factor tested in our models are the economic conditions in each given destination. Similar to the push factors, we first test a model that includes GDP per capita. According to model 1, a one standard deviation increase in wages was associated with a 9 percentage point increase in the odds of selecting a given destination. This model suggests that broader macroeconomic conditions may be an important pull factor. In model 2, we replace GDP per capita with wages for each destination location. In this model, the results indicates that a one standard deviation increase in wages increases the odds of selecting a given destination by 4 percentage points. The final model which includes both wages as well as GDP per capita suggests that wages are not an important pull factor relative to GDP. Rather general economic conditions seem to drive destination selection. The magnitude of the estimate for GDP per capita remains unchanged from model 2, while the estimate for wages are no longer statistically significant.

Stratified models

Our basic models show that women were significantly more prone to migrate than men. When stratifying the models by sex (see table 4), we find gender differences in the responsiveness to different push and pull factors. In particular, the results indicate that females are generally more responsive to economic push factors relative to males. In terms of GDP per capita, females display a negative relationship between the likelihood of emigrating and the GDP per capita in their county of residence. The same is not the case for males in which we find no statistically significant result. This could be an indication that more industrialized counties provide more labor market opportunities to females relative to males. GDP per capita in the destination, on the other hand, is positive and significant for both sexes indicating that this remains an important pull factor regardless of sex.

In terms of individual characteristics, we find that father's social status is an important determinant of emigration for males, while only daughters of farmers are impacted by their father's social status. We also find gender differences in birth order, with first born males being more likely to emigrate relative to later born children, but no such relationship for females. This may indicate that first born females play a more important role in terms of household labor.

The models stratified by sex shed light on the result that females are more migratory than males and that the reason may be that females were more responsive to push factors when it comes to internal migration. This reflects the claims of Ravenstein (1885, 1889) that females are more internally migratory, while males more likely to migrate internationally.

Table 4. Odds ratio estimates from nested logit models of migration and destination choice stratified by sex

	Men			Women		
	1	2	3	1	2	3
Panel A: Migration Choice						
County level variables						
GDP per capita	0.994		0.990	0.829***		0.781***
	(0.077)		(0.100)	(0.053)		(0.058)
Wages		1.022	1.002		1.009	1.072
		(0.043)	(0.054)		(0.038)	(0.047)
Urban share	0.987*	0.983**	0.987	0.968***	0.958***	0.970***
	(0.007)	(0.007)	(0.008)	(0.006)	(0.005)	(0.006)
Agricultural share	0.971*	0.968**	0.970*	0.931***	0.940***	0.920***
	(0.016)	(0.014)	(0.017)	(0.012)	(0.013)	(0.014)
Individual level variables						
Age	1.046***	1.046***	1.046***	1.048***	1.049***	1.048***
	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)
First born	1.167**	1.163**	1.167**	0.982	0.974	0.982
	(0.072)	(0.072)	(0.072)	(0.057)	(0.057)	(0.057)
White collar status	1.243**	1.240**	1.243**	1.106	1.113	1.108
	(0.131)	(0.131)	(0.131)	(0.111)	(0.111)	(0.111)
Farmer status	0.357***	0.360***	0.357***	0.454***	0.459***	0.453***
	(0.028)	(0.028)	(0.028)	(0.033)	(0.034)	(0.033)
Skilled status	ref.	ref.	ref.	ref.	ref.	ref.
Low skilled status	0.844**	0.841**	0.844**	1.014	1.023	1.013
	(0.072)	(0.072)	(0.072)	(0.083)	(0.084)	(0.083)
Previous migrant	1.485***	1.483***	1.485***	1.393***	1.391***	1.395***
	(0.163)	(0.163)	(0.163)	(0.145)	(0.144)	(0.145)
Mother migrant	1.536***	1.528***	1.536***	1.673***	1.655***	1.674***

	(0.116)	(0.115)	(0.116)	(0.116)	(0.115)	(0.116)
Father migrant	1.559***	1.548***	1.557***	1.408***	1.376***	1.408***
	(0.122)	(0.121)	(0.122)	(0.105)	(0.102)	(0.105)
Urban resident	1.728***	1.695***	1.731***	1.648***	1.610***	1.656***
	(0.176)	(0.173)	(0.177)	(0.161)	(0.157)	(0.161)
Distance to railway	0.972	0.972	0.971	1.006	0.998	1.004
	(0.020)	(0.021)	(0.020)	(0.020)	(0.019)	(0.020)
Distance to border	0.825***	0.817***	0.826***	0.761***	0.753***	0.762***
	(0.031)	(0.030)	(0.031)	(0.026)	(0.026)	(0.026)
Distance to coast	1.088***	1.063**	1.092***	1.050**	1.023	1.060**
	(0.027)	(0.025)	(0.030)	(0.023)	(0.022)	(0.024)
Constant	4.952**	11.915***	4.653**	26.342***	63.877***	31.734***
	(3.369)	(8.036)	(3.208)	(16.622)	(42.008)	(20.428)
Panel B: Destination choice						
County level variables						
GDP per capita	1.167***		1.181***	1.058***		1.065***
	(0.042)		(0.051)	(0.014)		(0.016)
Wages		1.071***	0.986		1.018*	0.989
		(0.022)	(0.022)		(0.010)	(0.010)
Urban share	1.008***	1.015***	1.007**	1.002**	1.004***	1.002*
	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
Agricultural share	1.002	0.988**	1.004	0.997	0.990***	0.999
	(0.006)	(0.006)	(0.006)	(0.003)	(0.003)	(0.003)
Distance	0.622***	0.640***	0.624***	0.792***	0.793***	0.791***
	(0.060)	(0.056)	(0.060)	(0.030)	(0.027)	(0.030)
Migrant stock	1.029***	1.036***	1.029***	1.034***	1.042***	1.034***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
No. of observations	15305	15305	15305	15461	15461	15461
χ^2	922.647	922.282	922.958	882.985	881.111	886.627

Concluding remarks

The results in this paper constitutes a first attempt at modelling push and pull factors using a micro level population based sample which considers all possible origins and destinations. The results clearly show that economic push and pull factors drove migration decisions during the period. Although macro level push forces seemed to play a role, individual level factors dominate. Specifically, having a previous migration experience or having a parent that migrated was the strongest push effect. GDP per capita was the most important determinant of destination location. This finding is consistent with the idea that migration decisions are made with imperfect information. Individuals may be guided by GDP per capita simply because it is easier to judge the attractiveness of a given destination by its macro conditions rather than wages: Individuals are unable to know what their specific outcomes may be in a given destination, but can better judge the positive externalities of locating in a more developed destination.

The implications of these are important to the literature as they are consistent with existing theories of migration. The validity of theoretical push and pull factors are uncompromised when comprehensively modelling the decision process. More work remains to be done in order to identify the mechanisms through which some of these factors are operating.

It is important to note that this paper does not explicitly test individual level pull factors, which theoretically must exist, but we intend to address this at a later time. One important individual level pull factor is the existence of specific kin-based networks. Although our results indicate that networks are an important pull factor, at what level networks matter. We intend to disentangle this effect further by capturing networks at a more detailed level in the future.

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Appendix

Table A1. Odds ratio estimates from nested logit models of migration and destination choice stratified by SES

	White collar			Farmer		
	1	2	3	1	2	3
Panel A: Migration Choice						
County level variables						
GDP per capita	0.941		0.963	0.873***		0.822***
	(0.040)		(0.054)	(0.022)		(0.027)
Wages		0.971	0.975		1.011	1.057***
		(0.025)	(0.033)		(0.014)	(0.019)
Urban share	0.979***	0.975***	0.978***	0.999	0.989***	1.002
	(0.004)	(0.004)	(0.004)	(0.003)	(0.002)	(0.003)
Agricultural share	0.959***	0.965***	0.963***	0.972***	0.976***	0.964***
	(0.009)	(0.008)	(0.010)	(0.005)	(0.005)	(0.005)
Individual level variables						
Age	1.057***	1.057***	1.057***	1.059***	1.059***	1.059***
	(0.007)	(0.007)	(0.007)	(0.004)	(0.004)	(0.004)
First born	1.003	1.000	1.003	0.991	0.985	0.990
	(0.039)	(0.039)	(0.039)	(0.021)	(0.021)	(0.021)
Sex	0.837***	0.837***	0.837***	1.208***	1.211***	1.207***
	(0.031)	(0.031)	(0.031)	(0.024)	(0.024)	(0.024)
Previous migrant	1.906***	1.907***	1.906***	1.666***	1.660***	1.667***
	(0.097)	(0.097)	(0.096)	(0.075)	(0.075)	(0.076)
Mother migrant	1.483***	1.477***	1.483***	1.486***	1.482***	1.487***
	(0.063)	(0.063)	(0.063)	(0.040)	(0.040)	(0.040)
Father migrant	1.420***	1.414***	1.420***	1.665***	1.653***	1.665***
	(0.060)	(0.059)	(0.060)	(0.051)	(0.050)	(0.051)
Urban resident	1.330***	1.308***	1.329***	2.004***	2.021***	2.002***
	(0.065)	(0.063)	(0.065)	(0.165)	(0.166)	(0.164)
Distance to railway	1.008	1.008	1.007	0.959***	0.958***	0.958***

	(0.012)	(0.012)	(0.012)	(0.007)	(0.007)	(0.007)
Distance to border	0.951**	0.948**	0.951**	0.793***	0.780***	0.795***
	(0.023)	(0.022)	(0.023)	(0.010)	(0.009)	(0.010)
Distance to coast	1.023*	1.005	1.022	1.055***	1.016*	1.064***
	(0.013)	(0.012)	(0.014)	(0.010)	(0.010)	(0.011)
Constant	5.361***	8.563***	5.023***	5.729***	16.211***	6.113***
	(2.127)	(3.421)	(1.981)	(1.381)	(3.936)	(1.510)
Panel B: Destination choice						
County level variables						
GDP per capita	1.073***		1.095***	1.123***		1.096***
	(0.015)		(0.019)	(0.009)		(0.010)
Wages		1.025***	0.976**		1.086***	1.030***
		(0.009)	(0.011)		(0.007)	(0.007)
Urban share	1.009***	1.012***	1.008***	1.002***	1.007***	1.003***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Agricultural share	0.999	0.992***	1.002	0.994***	0.980***	0.990***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
Distance	0.713***	0.720***	0.718***	0.669***	0.660***	0.665***
	(0.032)	(0.029)	(0.031)	(0.014)	(0.014)	(0.015)
Migrant stock	1.026***	1.031***	1.026***	1.042***	1.049***	1.042***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
No. of observations	21089	21089	21089	188258	188258	188258
χ^2	1385.426	1383.492	1385.594	4937.566	4977.823	4947.502

Table A2. Odds ratio estimates from nested logit models of migration and destination choice stratified by SES

	Skilled			Unskilled		
	1	2	3	1	2	3
Panel A: Migration Choice						
County level variables						
GDP per capita	0.883***		0.897***	0.868***		0.863***
	(0.026)		(0.034)	(0.028)		(0.037)
Wages		0.960**	0.982		0.963*	1.003
		(0.018)	(0.023)		(0.019)	(0.026)
Urban share	0.966***	0.958***	0.966***	0.977***	0.967***	0.978***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)
Agricultural share	0.926***	0.935***	0.929***	0.955***	0.962***	0.956***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.007)
Individual level variables						
Age	1.046***	1.047***	1.046***	1.047***	1.049***	1.047***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
First born	1.033	1.026	1.033	1.003	0.996	1.004
	(0.027)	(0.027)	(0.027)	(0.029)	(0.029)	(0.029)
Sex	1.008	1.008	1.008	1.135***	1.138***	1.135***
	(0.025)	(0.025)	(0.025)	(0.031)	(0.031)	(0.031)
Previous migrant	1.603***	1.595***	1.604***	1.716***	1.700***	1.717***
	(0.069)	(0.068)	(0.069)	(0.087)	(0.086)	(0.087)
Mother migrant	1.485***	1.472***	1.484***	1.358***	1.348***	1.357***
	(0.046)	(0.046)	(0.046)	(0.048)	(0.048)	(0.048)
Father migrant	1.489***	1.472***	1.488***	1.258***	1.234***	1.257***
	(0.046)	(0.045)	(0.046)	(0.047)	(0.045)	(0.046)
Urban resident	1.467***	1.417***	1.468***	1.312***	1.284***	1.317***
	(0.054)	(0.052)	(0.054)	(0.059)	(0.058)	(0.059)
Distance to railway	0.980**	0.980**	0.979**	0.985	0.985	0.983*
	(0.008)	(0.008)	(0.008)	(0.009)	(0.010)	(0.010)

Distance to border	0.889***	0.881***	0.889***	0.848***	0.841***	0.848***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)	(0.015)
Distance to coast	1.056***	1.023**	1.058***	1.037***	1.006	1.041***
	(0.010)	(0.009)	(0.011)	(0.011)	(0.010)	(0.012)
Constant	17.992***	41.273***	16.399***	22.767***	49.016***	20.937***
	(5.081)	(11.864)	(4.594)	(7.086)	(15.413)	(6.466)
Panel B: Destination choice						
County level variables						
GDP per capita	1.108***		1.136***	1.099***		1.123***
	(0.011)		(0.014)	(0.009)		(0.012)
Wages		1.040***	0.968***		1.039***	0.972***
		(0.006)	(0.007)		(0.006)	(0.006)
Urban share	1.002***	1.006***	1.000	0.997***	1.001**	0.996***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Agricultural share	0.989***	0.978***	0.993***	0.986***	0.975***	0.990***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Distance	0.738***	0.749***	0.745***	0.771***	0.783***	0.778***
	(0.017)	(0.016)	(0.017)	(0.015)	(0.013)	(0.014)
Migrant stock	1.031***	1.040***	1.031***	1.042***	1.049***	1.042***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
No. of observations	52985	52985	52985	46065	46065	46065
χ^2	2800.589	2784.388	2802.474	1932.974	1925.695	1938.392