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Network Effects in Internal Migration

LÁSZLÓ LŐRINCZ – BRIGITTA NÉMETH

INSTITUTE OF ECONOMICS, CENTRE FOR ECONOMIC AND REGIONAL STUDIES,
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Hungarian Academy of Sciences

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Authors:

László Lőrincz
senior research fellow
Institute of Economics, Centre of Economics and Regional Studies,
Hungarian Academy of Sciences,
and Corvinus University of Budapest
lorincz.laszlo@krtk.mta.hu

Brigitta Németh
junior research fellow
Institute of Economics, Centre of Economics and Regional Studies,
Hungarian Academy of Sciences
nemeth.brigitta@krtk.mta.hu

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László Lőrincz and Brigitta Németh

Abstract

Previous studies have shown the impact of family, community, and ethnic networks on migration. Our research focuses on the role of social networks in Hungarian internal migration. We examine the factors determining out-migration rate from municipalities, and the factors influencing location choice by analysing migration volumes on the municipality-municipality level. We measure social network effects by the migration rate of previous years, and by the intensity of user-user connections on the iWiW online social network (representing 3.7 million users) between two municipalities. The migration volumes and the characteristics of the municipalities are included in the analysis based on administrative data, and the distance between municipalities are indicated by the travel time. We analyse longitudinal data for the 2000-2014 period, and cross-sectional models for the year 2014. Based on multilevel and fixed-effect regression models we show that both leaving and choosing municipalities is associated with network effects: the migration of previous years, and also the connections on iWiW social network influence the current migration rate, even after controlling for each other.

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Keywords: chain migration, internal migration, network effects, online social networks, social networks.

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Hálózati hatások a hazai migrációban

Lőrincz László és Németh Brigitta

Összefoglaló

A korábbi vizsgálatok elsősorban a nemzetközi vándorlásban mutatták ki a családi, közösségi és etnikai kapcsolathálók hatását a migrációra. Tanulmányunkban ezt a belföldi migráció kapcsán elemezzük. Modellünkben a származási települések és a célhely alternatíváinak infrastrukturális és gazdasági jellemzői mellett a hálózati hatások további push és pull faktorokként jelennek meg. Az elemzésbe bevontuk a települések jellemzőit a T–STAR-adatbázis alapján, a települések közti távolságot pedig az útidővel jelöltük. A kapcsolathálózatok hatását a korábbi évek migrációs rátája, valamint az iWiW-felhasználók (online közösségi oldal, 3,7 millió felhasználóval) két település közötti kapcsolatainak az intenzitása alapján mérjük. A longitudinális adataink a 2000–2014 közötti időszakra, a keresztmetszeti modellek pedig 2014-re vonatkoznak. A statisztikai elemzésekhez többszintű (multilevel) és fixhatás-modelleket használtunk. Eredményeink azt mutatják, hogy mind az elvándorlással, mind a letelepedéssel szignifikáns és pozitív összefüggésben vannak a kapcsolathálózati jellemzők: a korábbi évek vándorlása, és a közösségi hálón fenntartott kapcsolatok is hatással vannak az aktuális évi vándorlás mértékére, egymás hatására kontrollálva is.

JEL: R23

Tárgyszavak: láncmigráció, belföldi vándorlás, hálózati hatások, online kapcsolathálózatok, kapcsolathálózatok.

1. INTRODUCTION

Migration and its social and economic antecedents have long been the subject of scientific thinking. On the individual level the intention to migrate evolves along the individual goals, preferences, perceived opportunities and constraints. In addition to individual resources and cost-benefit calculations, family considerations, social contacts, economic, social, political circumstances and labour market opportunities also influence the realization of the migration intentions (Blaskó, Gödri 2014).

According to DaVanzo (1981), location-specific capital and information costs also influence the willingness of an individual to migrate. One of the most apparent functions of social networks is decreasing these information costs and risks. Additionally, the presence of family and friendship networks, or even same ethnicity peers increase the attractiveness of specific destinations for several further reasons. They may help the migrants on the labour market; provide services, emotional aid and companionship. Accordingly, previous migration experience in the community influences current out-migration and the location choice of the migrants (Deléchat 2001).

As migrants maintain some of their relationships after moving, they create new relationships between their place of origin and their new place of residence. Therefore, a self-enhancing chain migration can occur between the source and destination areas. However, a large inflow of migrants over a short period may have a negative impact, as saturation in the labour market may undermine their position, and lower their wage levels (Beaman 2012; Boeri et al. 2012). Nevertheless, studies show that previous movements have a positive impact on subsequent migration (Deléchat 2001; Bauer, Epstein, Gang 2002).

About the migration decision, two elements is often distinguished; the decision to move or stay, and the decision on the destination (Brown, Moore 1970; Sell, DeJong 1978). While previous studies usually analyse only one of these, our data provide the opportunity to examine the effects of networks on both of these decisions. Thus, we first examine, whether more people will leave municipalities with more outward connections, or with less inward connections, and that how previous migration contribute to subsequent out-migration. Second, we analyse the effect of the composition of outward connections, and test, if more connections between municipalities and higher volume of previous migration predict location choice.

A difficulty in analysing the role of social networks in migration is to collect the appropriate data. Previous studies most often use individual surveys about migration behaviour (Kobrin, Speare Jr 1983; Deléchat 2001; Bauer, Epstein, Gang 2002). In our study we use detailed administrative data on migration between municipalities, and combine these with the iWiW Hungarian social network site's archived database.

Although most of current literature's interest is in international migration, domestic migration also has its importance. Inadequate internal mobility is often blamed for regional inequalities on the labour market. During the last three years, employers at the more developed western regions of Hungary report shortage of skilled and unskilled labour and consequent excess production capacities (Hajdu, Köllő, Tóth 2018), which was also supported by our interviews, we carried out in the Central Transdanubia Region in 2017. The problem of "labour shortage" also often emerged in public discourse (Tóth, Nyírő 2018).

Two main migration patterns emerged in the post-soviet era in Hungary: one is the suburbanization movement from cities pointing towards agglomeration; the other is the movement of dismissed urban workers towards the countryside (Brown, Schafft 2002). On the other hand, after the transition, economic inequalities between regions increased, which resulted in high unemployment in the north-eastern part of the country, and in small peripheral municipalities (Fazekas 2002). Empirical studies have shown that labor market characteristics did not affect migration patterns directly after the transition (Kertesi 1997). However, in the later years, unemployment and wage differences moderately influenced migration (Cseres-Gergely 2005). Nevertheless, the equalizing role of migration on regional differences remained limited in Hungary, similarly to other countries (Hárs 2012).

2. THEORIES AND HYPOTHESES

2.1 PUSH AND PULL FACTORS AND THE TWO PHASE DECISION MODEL

An early and influential approach to understand migration was the push and pull theory of Ravenstein (1889). His primary statement was that potential migrants are motivated by available possibilities in the destination area to move there, whilst adverse circumstances at their current residence urge them to leave. In addition to these two factors, distance also determines the volume of migration: the majority of migrants move only a short distance. Dorigo and Tobler (1983) describe push factors as situations, which are resulting in dissatisfaction with the individual's actual residence, and pull factors are those that make the destination area preferable. The distance between the two locations can be given in travel time, travel cost, social distance, etc. Brown and Moore (1970) describe the process of migration with two firm phases: (1) a decision to leave the current residence and (2) the "relocation decision" made between alternatives by their "place utility". This theory emphasizes the possible differences between the factors influencing the decision to leave and the factors influencing the choice of the destination (Sell, DeJong 1978).

2.1.1 Factors of Moving

The decision on leaving one's residence needs a trigger; a stress between the needs and affordances of the household (Brown, Moore 1970). Such a trigger is often the birth of children in families, which makes current housing space inadequate (Chevan 1971). Life events associated with migration also include marriage, divorce, completing studies, retirement or the children separating from parents. The costs of migration are also part of a human investment. For young people multiple years are available to realize such investment. Therefore, even lower difference in wages makes moving advantageous for them, so young people expect higher returns when investing in migration then elders. This difference explains selective migration without examining sociological differences between young and elders (Schultz 1961). Other life-cycle specific characteristics could be important as well. These include status of labour market, income, education, obtained skills and training, age, sex, and health status (Greenwood 1997).

Another common motivation for migration is to find new employment (Hansen, Niedomysl 2008). Residential satisfaction and home ownership also influences this decision (Speare 1974). The consideration of staying at or leaving a given neighbourhood also depends on the amenities and economic factors. Perceptions of crime and violence, for example increase out-migration of the middle income families (Droettboom et al. 1971), but civic community institutions decrease migration (Irwin et al. 2004).

2.1.2 Factors of Location Choice

Sjaastad (1962) developed an economic model of migration, and describes it as a mechanism aiming equilibrium. He understands migration as an investment decision, and separated monetary and non-monetary expenses; financial burden belongs to the former, psychological "expenses" to the latter. The returns of migration are coming from the change of nominal income, employment chances, consumer opportunities or the combination of these. Distance is also one of the most important predictors of location choice; it increases monetary costs of moving, but information costs and uncertainty is also higher for more distant locations. Moreover, psychic costs also increase when leaving the family and friends at the previous location (Greenwood 1997).

Clark and Hunter (1992) examined net migration data between counties of the United States to study the relationship between human capital, public goods and the accessible services in relation to age-specific migration. They found that work possibilities, tax policies and services also affecting migration in a life cycle specific manner. Employment possibilities are mostly important for men in active age, while services are rather important for middle-age men. Fiscal environment is also related to age, for example in older ages they do not prefer counties with high inheritance and property tax.

2.2 THE ROLE OF SOCIAL NETWORKS IN MIGRATION

2.2.1 Family Networks and Out-migration

From the 1960's the role of social and family networks was analysed as sociological incentives and disincentives of migration (Sell and DeJong 1978). For example, Johnston (1971) argues that presence of local kinship ties prevent migration for two reasons. First, members of a community network (such as Italian or Jewish communities) need spatial proximity, where only those migrate, who repudiates the community. Second, family is an important economic unit, where the tradition of sons succeeding their father in family business (such as crafting or farming) prevails.

Litwak (1960) proposed an opposing mechanism; that extended family networks can pool resources better and therefore aid their members with economic, social and psychological support when leaving the original community. Empirically he finds that among potential migrants, those with closer family identification were more likely to leave the city.

However, when analysing the number of migrants, the first effect appears to be stronger: people with more extended family relations are less likely to leave the community, considering English working class towns (Johnston 1971), or in Rhode Island ethnic communities (Kobrin, Speare 1983). Dawkins (2006) also finds that presence of relatives and friends of children impede the out-migration of families from the neighbourhoods.

2.2.2 Chain Migration and Cumulative Causation

In the same period researchers started to observe that immigrants do not randomly settle in cities. Even within ethnicities, Italian immigrants of certain towns of origin tend to settle together in American Little Italies. MacDonald and MacDonald (1964) describe three phases of this chain migration. Their observation that first breadwinners move to the destination area and their families follow after they found suitable jobs (and living in ethnic quarters) was also found about the great migration of blacks from the south to the north in the U.S. (Gottlieb 1987; Grossman 1991).

The significance of social networks about chain migration lies in the fact that during migration people face many expenses, such as gathering information about how to get a job, where to live, etc. These valuable pieces of information can be obtained through social networks, so networks reduce the costs and risks of migration (Massey et al. 1993; Deléchat 2001). In fact, relatives are the natural and most often utilized sources of information about orientation, housing or finding jobs (Blumberg, Bell 1958; Choldin 1973; Banerjee 1983).

Therefore, migration experience occurring in the family or community influences the decision of an individual whether to stay or move. Accordingly, Deléchat (2001) finds that the migration experience in the family and the prevalence of migration in the community both influence the decisions of individuals about migrating from Mexico to the U.S. Similarly, Bauer, Epstein and Gang (2002) finds significant effect of the stock migration experience of the sender village on subsequent migration.

In addition to costs associated with risk and information, further factors contribute to the self-sustaining nature of migration. The cumulative causation approach emphasizes that every single migratory act modifies the social context, which influences upcoming migratory decisions, therefore increasing the probability of following migration (Massey et al. 1993). On the long-term, as migration becomes a means of economic success for families and individuals, norms regarding the alternatives of staying or migrating can change (Reichert 1982; Massey et al. 1993; Greiner 2011).

In the concern of internal migration, we therefore hypothesize that past migration affects the probability of subsequent migration:

In those municipalities where out-migration rate was high in previous years, it will be high in the next year too (H.1).

2.2.3 The Utilities of Networks Influencing Location Choice

Investment in information also explains the effect of networks in destination choices. According to the human capital approach, migration is an investment with costs and expected benefits (Bowles 1970)., Gathering information about migration however is also costly. Consequently, potential migrants would only gather information which they can obtain easier, and that is about those places where their friends and relatives live (DaVanzo 1981).

The presence of friends and relatives is not only beneficial during the migration process, but also on the long term. They provide smaller and bigger services, financial aid, emotional support and companionship to the family members (Wellman, Wortley 1990). This influences location choices accordingly: closeness of family members is an important factor when choosing the place of residence. Furthermore, this effect is more pronounced for those families, which rely more heavily on family members when they need services (Stokenberga 2019).

These two effects of networks can be incorporated in the push-pull model of migration as non-monetary factors. The first can be phrased as “information hypothesis”, while the second as “affinity hypothesis” (Haug 2008).

Another network factor which influences location choice, is the size of the ethnic group at the destination area. Substantial ethnic minority can provide "ethnic goods" to the new arrivals, such as food, clothing, social organizations, religious services, media and marriage markets (Chiswick, Lee, Miller 2005). Immigrants therefore, tend to move in to location where similar ethnic minorities are already present; which was shown for example in OECD countries (Gross, Schmitt 2006), European regions (Nowotny, Pennerstorfer 2011), and for municipality choice of refugees (Aslund 2000; Damm 2009).

Helping the migrant to find a suitable job at the destination area is a further role of social networks. Personal networks are especially important for migrants, as they tend to rely on network referrals more than native workers (Elliott 2001; Patacchini, Zenou 2012). Increased network size was associated with higher wages and employment probabilities for Mexican migrants (Munshi 2003). Sudden inflow of immigrants however may increase competition; thus it may have an adverse impact. Beaman (2012) found that if the size of the ethnic network increases on a short term job-market outcomes worsen. In contrast, the stock size of employed immigrants increases the employment chances for the newcomers. Boeri et al. (2012) found nonlinear effects in Italian cities: the size of the immigrant community was found to be beneficial for employment prospects, however if migrants exceeded 15-20% of the local population and lived in segregated neighbourhoods, the effect turned to negative.

As previous migrants create social network connections between the source and the destination community, every new migrant lowers the cost associated with migration to a new set of friends and relatives (Massey et al. 1993). These network effects can be integrated to an economic model of migration: Carrington, Detragiache, and Vishwanath (1996) shows that the great migration of blacks from the south to the north cannot be properly described only by the wage differentials based on Sjastaad (1962); but a model with endogenous moving costs fits better, where previous migration decreases the costs of moving for future migrant. Bauer, Epstein and Gang (2002) also find a positive effect for the recent flow of migrants between the two municipalities when analysing Mexican migrants' US destinations. They find this being additional to the effect of the stock of migrants at the destination, and to the effect of the stock migration experience of the sender village. We similarly assume that:

High rate of migration between two municipalities in the previous year predicts high migration rate in the subsequent year. (H.2)

2.3 ONLINE SOCIAL NETWORKS AND MIGRATION

In the recent decade much of the communication between people occurs on social media platforms. It was therefore analysed, how these online social networks (OSNs) contribute to the social capital of users. In addition to making the distinction between „bridging" and

„bonding” social capital, Ellison, Steinfield, and Lampe (2007) introduced the category of maintained social capital. This describes the extent to which individuals keep valuable connections throughout different phases of life with the aid of social media. Brooks et al. (2014) reported that information-seeking and friendship-maintenance behaviour is positively associated with perceived bridging and bonding social capital, while transitivity of the ego-network affects bonding social capital adversely. Ellison et al. (2014) also found that friendship-maintenance on Facebook is positively associated with Facebook-related and general bridging social capital. They found that Facebook activity is positively related to each of these measures. Valenzuela, Park, and Kee (2009) found that intensity of Facebook use is in positive correlation with social trust, civic activity and political participation.

We assume that the geographic structure of this social capital influences migration in similar manner, as offline social networks do:

We hypothesize that more people migrate from municipalities, which have more online social network connections outside the community (H.3a), and

We assume that fewer people migrate from municipalities with more social network connections within the community (H.3b).

Social capital provided by OSNs interacts with the migration process at several points. Social media supports maintaining existing connections, the creation of new ones, and also to reactivate latent (lost) ties (Hiller, Franz 2004; Dekker, Engbersen 2014). About maintaining connections, social media offers cheap and easy synchronous communication platform, therefore also contributes to the feeling of proximity to the community of origin (Dekker, Engbersen 2014). For international migrants, online communication is a persistent source of social support (Ye 2006; Chen, Choi 2011). Even in the case of domestic migration, migrants with broadband internet provided were able to maintain the intensity of their social connections, while those without internet connection experienced a decrease (Hampton, Wellman 2001).

For international migrants new or reactivated ties at the destination provide assistance and information about the migration process, about the settlement, or to find housing and employment. They also facilitate integration into the new community after moving (Hiller, Franz 2004; Dekker, Engbersen 2014).

We assume that these benefits also exist in domestic migration. Therefore, our hypothesis is the following:

From a given municipality people rather tend to migrate to destinations where they have more contacts on social media. (H.4)

3. DATA AND METHODOLOGY

3.1 DATA

Our analysis relies on four databases and refers to the 2000-2014 years. The primary source of our analysis are the Central Statistical Office's (CSO) domestic migration data files, which include the source and destination municipalities of every migration acts in Hungary, their date; information on migrants' age, gender, and marital status. This database does not include person IDs, therefore individuals cannot be identified. We accessed the data in the research room operated by the Centre of Regional and Economic Studies of Hungarian Academy of Sciences (CERS-HAS) and the CSO.

The second data source is the user and network database of the iWiW OSN. Anonymized user data (registration date, gender, age, place of residence) and the links between users were archived by the service provider in 2013 and made available for research purposes in the OTKA K-112713 research project. For the present study we created the aggregate version of the individual network data to municipality - municipality level.

About amenities and characteristics of municipalities, we used the T-Star database of the CSO. This is a municipality-level statistical database that collects the most important quantified information from the municipal statistical information systems.

Fourth, the "Route" database provided by CERS HAS Databank is used to estimate the distance between the municipalities (given in travel time, by car).

3.2 VARIABLES AND ANALYTICAL METHODS

We apply two levels of analysis. To examine hypotheses H.1 and H.3a-H.3b, we analyse migration rates of municipalities, whereas about hypotheses H.2 and H.4 the units of analysis are dyads of municipalities.

Table 1

Overview of hypotheses

dependent: predictor:	out-migration	location choice
previous migration	H.1	H.2
online social network connections	H.3a, H.3b	H.4

3.2.1 Modelling the Willingness to Migrate

First we want to quantify, how the migration rate from each municipality is related to that rate of previous years and to the municipality's social network structure on iWiW. Our dependent variable is the annual rate of the population moving away from the municipality, relative to its total population.

Our key independent variable about chain migration is the out-migration rate in the previous year. In addition to this baseline specification, we also examine a model with lagged variables for the past five years as robustness check.

As migration is related to specific phases of life (Schultz 1961; Clark, Hunter 1992; Greenwood 1997), we control for the demographic profile of the settlements. We divided the population to 14 groups based on gender and age, and added the share of these groups as control variables.

Infrastructural characteristics, public services, and amenities of the municipality may also influence migration. We include the corresponding control variables obtained by principal component analysis based on the T-Star database (detailed description is given in the appendix).

We apply the following regression equation for examining H.1:

$$\frac{M_{it}}{Pop_{it}} = \alpha + \beta_1 \frac{M_{i,t-1}}{Pop_{i,t-1}} + \beta_2 f_{i,t-1} + \beta_3 D_{i,t-1} + \beta_4 pop_{i,t-1} + \beta_5 type_i + \varepsilon_{it} + \xi_i, \qquad (1)$$

where *"M"* represents the out-migration from municipality *"i"* in year *"t"*; *"pop"* is its population, and *"f"* contains the factors representing the characteristics of the municipality. *"D"* includes the share of demographic groups, and *"type"* represents dummies describing the urbanization of the municipality: whether it is a village, a town, a city, or the capital.

As our dependent variable is on municipality–year level, but our observations are clustered by municipalities, we used multilevel modelling technique for obtaining the correct standard errors[1]. Correspondingly, our equation includes error terms both on the municipality–year level (ε_{it}) and on municipality level (ξ_i)

It must be noted that even though we analyse longitudinal data, we use pooled cross-section identification, and not a fixed-effect panel (we did not include municipality dummies). We chose this specification, because in case of fixed-effect panel identification the interpretation of the β_2 parameter would be: "if the migration in the previous year is high, we expect the migration next year to be higher on the same municipality, compared to the years, when it was low in the previous years". In the pooled cross-section it is: "at those municipalities, where the migration was high in the preceding year, we expect higher migration in the next year compared to those municipalities, where it was low". We argue that it is definitely the second identification, which corresponds to our theoretical hypothesis.

[1] We used the „*meglm*" module of the Stata software for the analysis.

According to our hypotheses H.3a and H.3b external OSN connections increase, while internal connections prevent migration from a municipality. We use the data on the intensity of internal and external contacts from our OSN database (iWiW).

In contrast to the previous model, this time we do not use longitudinal comparison, but rely on a pure cross-section model. The reason is that the uptake of the iWiW network exhibited specific geographic patterns - it was first popular in Budapest; than it spread to bigger cities and finally to smaller villages (Lengyel et al. 2018) - and we assume that the evolution of internal and external connections over the years within a municipality would be heavily influenced by this pattern. However, we believe that social networks observed on iWiW in its most diffused stage are good indicators for comparison across municipalities.

Therefore, our dependent variable is the migration outflow compared to the population on each municipality (i), however, we analyse one year in a cross-sectional OLS regression:

$$\frac{M_{i,2014}}{Pop_{i,2014}} = \alpha + \beta_1 \frac{M_{i,2013}}{Pop_{i,2013}} + \beta_2 ext_{i,2013} + \beta_3 int_{i,2013} + \beta_4 C^{std}_{i,2013} + \beta_5 N^{iWiW}_{i,2013} + \beta_6 f_{i,2013} + \beta_7 D_{i,2013} + \beta_8 pop_{i,t-1} + \beta_9 type_i \ \varepsilon_i. \quad (2)$$

Our key independent variables here are *"ext"*, which is the average number of external connections per user on the iWiW, and *"int"* the average number of internal connections for a user. As controls, we add the number of users (N^{iWiW}), and also the clustering measure of the municipalities' networks, which indicates how open or closed the local network structure is.2 We also include the migration rate of the previous year, the factors describing the municipality characteristics, and the dummies for the demographic groups to the analysis. To detect the interactions between these effects, we include these variables in a stepwise manner.

3.2.2 Modelling Location Choice

When analysing location choices, our dependent variable is the migration volume between the pair of municipalities compared to the number of migrants leaving the given source municipality.

We measure the effect of previous migration (H.2) by the one year lagged version of the independent variable.

[2] We calculated the global clustering coefficient for this purpose, and standardized it by the average degree and the size of the networks: $C_i^{std} = \frac{C_i}{k_i / N_i^{iWiW}}$, following Neal (2017).

We use fixed effects for the source municipalities in this specification, thus we test, whether more people choose a destination in a year, if it was chosen by more migrants *from the same municipality* in the previous year. We estimate the following equation:

$$\frac{M_{ijt}}{M_{it}} = \alpha + \beta_1 \frac{M_{ij,t-1}}{M_{i,t-1}} + \beta_2 f_{j,t-1} + \beta_3 type_j + \beta_4 Pop_{jt} + \beta_5 size_{jt} + \beta_6 d_{ij} + \beta_7 d_{ij}^2 + \beta_8 SC_{ij} + \gamma D_i + \varepsilon_{ijt} + \xi_i \qquad (3)$$

where *"M"* = number of migrants, leaving *"i"* municipality in *"t"* year and choosing *"j"* municipality as destination. Once the fixed effects (D_i) are included for the source municipality, we only include parametric controls about the destination: the factor scores *"f"* describing the available services and characteristics, and the *"type"* (urbanization) of the destination. As our dependent variable is not standardized by the size of the destination, adding the destination's population is also necessary. We also include the distance (d) measured by travel time in linear and quadratic forms as dyad-level control. As social network connections tend to be structured by administrative regions (see Lengyel et al. 2015), we add a dummy representing whether the source and destination municipality is in the same county (SC).

Beside the above baseline specification, we estimate different versions of the model to check the robustness of the results. First we include more (five) lagged variables of the previous migration. Next, we added destination municipality fixed effects in addition to the source municipality fixed effects. Third, we add both the five lagged variables and the destination municipality fixed effects. From the models with destination municipality fixed effects we omit the parameters describing destination municipalities (factors, urbanization types, population).

Note that even in the double fixed-effect models we do pooled cross-section identification, as we did not include the D_{ij} fixed-effect dummies for the municipality pairs. Thus our model can be interpreted as "whether from a selected municipality more migrants choose a destination, which was popular among its migrants in the previous year, controlling for the popularity of this destination across all migrants?", and not "whether in case of a pair of municipalities, more migration is expected, if migration was high in the previous year?"

About H.4 we assume that dense networks on the OSN makes a destination more popular among migrants from the source municipality. Accordingly, our key independent variable is the weight of the destination municipality in the outgoing OSN connections from the source municipality.

As we described about equation (2), we cannot use the longitudinal variance of the iWiW network as a proxy for the dynamics of the social network over time. Similarly to equation (3), we compare destinations across the same source municipality; therefore we include source municipality fixed effects (D_i). Thus, we estimate the following model:

$$\frac{M_{ij,2014}}{M_{i,2014}} = \alpha + \beta_1 \frac{M_{ij,2013}}{M_{i,2013}} + \beta_2 conn_{ij,2013} + \beta_3 C^{std}_{i,2013} + \beta_4 N^{iWiW}_{i,2013} + \beta_5 f_{j,2013} + \beta_6 Type_j + \beta_7 Pop_{j,2013} + \beta_8 d_{ij} + \beta_9 d^2_{ij} + \beta_{10} SC_{ij} + \gamma D_i + \varepsilon_{ij} + \xi_i , \quad (4)$$

where *"connij"* stands for the number of connections between municipality *"i"* and *"j"* divided by the number of all external connections of municipality *"i"*. We add controls for the size (N_j^{iWiW}) and clustering coefficient (C_j^{std}) of the OSN similarly to equation (2). We also control for previous migration, size, type, and characteristics of the destination, and included distance and same county dummy.

We also examine alternative models. First, we add five lagged variables of previous migration. Second, we add fixed effects for the destination municipalities. Third, we examine a model with adding both of these. When adding destination fixed effects, we omit the observable parameters describing the destination municipalities (factors, type and population).

3.2.3 Descriptive Statistics

The distribution of the population in Hungary shows that 17,7% lives in the capital, 17,4% lives in county seats, 33,5% lives in towns and 31,4% in villages. Comparing this to the iWiW users, we find a higher share of the urban population (capital and county seats), and a lower share of population from villages. The yearly out-migration rate is around 4-5% in each category (Table 2).

Table 2

Descriptive statistics by urbanization of municipalities

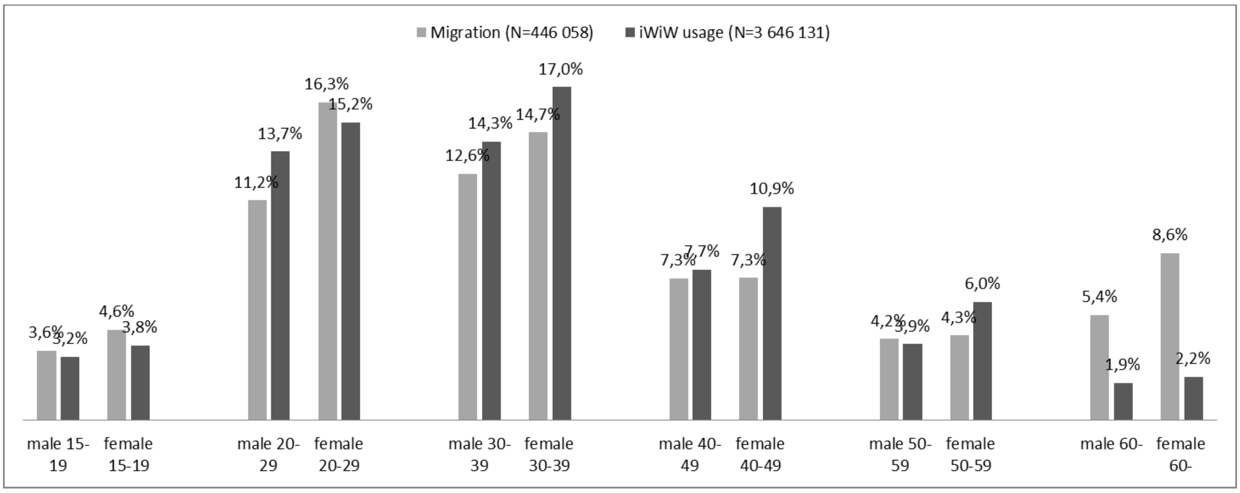
		Capital (N=1)	County seats (N=18)	Towns (N=287)	Villages (N=2,844)
Population	mean	1,744,665	95,528	11,520	1,091
	standard deviation		48,715	9,696	1,161
	Sum	1,744,665	1,719,496	3,306,268	3,103,232
	%	17.7%	17.4%	33.5%	31.4%
N user on iWiW	mean	772,388	39,679	3,717	292
	standard deviation		21,164	3,618	370
	sum	772,388	714,230	1,062,941	662,254
	percent of population	44.3%	41.5%	32.1%	21.3%

Out-migration rate	mean	5,64%	4.19%	4.22%	5.60%
	standard deviation		0.70%	0.92%	5.55%

There were 44,2% male and 55,8% female among domestic migrants in 2014. The most mobile age groups are 20-29 and 30-39 - they give half of the movements.3 The distribution of the iWiW users show similar pattern, but its peak is at the age group 30-39. The youngest and the oldest groups appear less frequently on iWiW, compared to their share among migrants. (Figure 1) The distribution of migration by distance shows that 80,3% of migrants move only short distance, to places within two-hour drive.

Figure 1

Distribution of migration and iWiW usage by age groups



Descriptive statistics for the OSN are displayed in Table 3. We have data on the iWiW network for 2,576 municipalities. When analysing pairs of municipalities, we have 523,619 observations. The average number of iWiW users by municipality is 1,247. Users tend to have more external connections (on average 174), then internal ones (on average 52).

Table 3

iWiW users and their connections by municipality

	mean	median	standard deviation
Number of users (N=2576)	1247	219	15725
External connections per user (N=2576)	173,6	169,4	39,3
Internal connections per user (N=2576)	52,3	45,6	32,8
Clustering coefficient (N=2573)	3,947	2,668	10,415
Connections between municipalities (N=523,619)	0,00492	0,00024	0,02990

[3] We do not include the age group 0-14 in the analysis.

4. RESULTS

4.1 LEAVING MUNICIPALITIES

Our longitudinal regressions indicate that out-migration rate of the previous year is significantly associated with the subsequent year's out-migration. This is true when we analyse the previous year's effect on the out-migration rate, (Table 4, Column 1), and also, when we add out-migration rates of the previous five years (Table 4, Column 2). These support our H.1 hypothesis, and allow us to conclude, that cumulative causation has an impact on migratory decisions. Interestingly, we observe that the coefficient of the previous year's migration rate is even augmented in Column 2, where we controlled for a longer history of out-migration in the model.

Among the factor scores measuring municipality characteristics, the first four of them represent positive amenities (services and public services, strength of the local economy). Coefficients of these are generally negative (2-4) and significant (1-3) indicating that amenities are associated with lower out-migration. The population of the municipality is negatively associated with out-migration, so municipalities with high population face lower out-migration rate, than low populated ones with similar attributes.

Table 4

Results of longitudinal regressions on out-migration

	1	2
	Out-migration rate (percentage points)	
Out-migration rate (percentage points, t-1)	0.144***	0.253***
	(0.0093)	(0.0071)
Out-migration rate (percentage points, t-2)		0.0929***
		(0.0074)
Out-migration rate (percentage points, t-3)		0.0993***
		(0.0074)
Out-migration rate (percentage points, t-4)		0.171***
		(0.0076)
Out-migration rate (percentage points, t-5)		0.133***
		(0.0076)
Population (100 000)	-2.43***	-0.927***
	(0.387)	(0.182)
Characteristics of the municipality (factor scores, previous year):		
Urban services	0.0960***	0.0432***
	(0.0171)	(0.0093)
Local economy	-0.166***	-0.124***
	(0.0113)	(0.0088)
Basic public services	-0.0778***	-0.0145*
	(0.0139)	(0.0085)
Labor market	-0.0564***	-0.0053
	(0.0120)	(0.0069)
Service orientation of local econ.	-0.0161	0.0258***
	(0.0132)	(0.0086)
Industrial orientation of local econ.	-0.0740***	-0.0404***
	(0.0120)	(0.0084)
Additional controls:		
Shares of demographic groups, type (urbanization)	yes	yes
Municipality fixed-effects	no	no
Observations (municipality x years)	20,273	20,253
Number of groups (municipalities)	2,908	2,905

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

Models concerning the impact of online connections on out-migration are presented in Table 5. The variables measuring the internal (within-municipality) and external connections are included separately in all regressions, and their effects are significant in each specification. Results indicate that as the intensity of connections within the municipality increases (measured on the iWiW OSN), out-migration rate decreases. So results confirm that the density of connections inside a community prevents migration (H.3a). Coefficients of the external connections also support our hypothesis H.3b that external connections prone leaving a municipality. In each model we included controls for the shares of the demographic groups in the population, the population of the settlement, the type of the settlement (urbanization), and the characteristics (factor scores).

In Table 5 Column 2 we added the out-migration rate of the previous years to the model, thus we can examine the impact of H.1 and H.3a-b simultaneously. Comparing the coefficient of the internal connections across the two columns, its magnitude decreases by about 50%; and the coefficient of the external connections also decreases by 12%. This suggests that there are overlaps between the network effects of the previous migration and the OSN connections, but basically they measure different mechanisms. Including the migration of the previous year decreases the effect of the internal connections more, than the effect of the external connections, which suggests that if other people move from the community, people will be likely to leave, even if they have a many local connections.

According to Column 3 these effects are still significant while including the 5 year lagged values of out-migration. Our control for the clustering (local closeness) of the online network connections within the municipality is significant before including previous migration, but loses significance afterwards.

Table 5

Regression models considering the effect of social networks

	1	2	3
	Out-migration rate (percentage points, 2014)		
External connections (100) on iWiW per user (previous year)	0.263***	0.247***	0.180**
	(0.0987)	(0.0878)	(0.0818)
Internal connections (100) on iWiW per user (previous year)	-1.27***	-0.710***	-0.302***
	(0.116)	(0.108)	(0.104)
Clustering coefficient on iWiW (standardized, previous year)	0.0272**	0.0152	0.0133
	(0.0133)	(0.0119)	(0.0111)
Out-migration rate (percentage points, previous year)		0.457***	0.246***
		(0.0227)	(0.0248)
Additional controls:			
Shares of demographic groups, population, type (urbanization), characteristics (factor scores)	yes	yes	yes
Out-migration rate, t-2, t-3, t-4, t-5	no	no	yes
R^2	0.246	0.392	0.476
Number of groups (municipalities)	1,715	1,715	1,715

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

4.2 CHOICE OF DESTINATION

In the longitudinal analysis of location choice, we analyse the impact of previous migration between two municipalities in three specifications (Table 6). In columns 1-2 fixed effects of the source municipality absorb the cross-sectional differences in push factors. In these columns the control for the population of the destination municipality is necessary, as our dependent variable is not standardized by the destination size. Additionally, we included the type of the destination municipality and its characteristics as controls for the pull factors. In column 2-3 we added controls for the previous five year's migration volumes between the municipalities. In Columns 3 adding the source and destination municipality fixed effects absorb the average levels of both the source and destination municipalities; therefore, we did not include parametric controls for them.

We can see that mobility between settlement pairs is positively associated with the previous mobility between them, in each of the three specifications, corresponding to H.2.

The distance between the source and destination municipality is negatively associated with the likelihood of migration. The negative squared term indicates a diminishing effect of distance on location choice.

Table 6

Results of longitudinal regressions on location choice

	1	2	3
Dependent variable Independent variables	Choice of the destination among migrants of the municipality (percentage points, 2014)		
Migration rate (percentage points, previous year)	0.240***	0.128***	0.128***
	(0.0023)	(0.0026)	(0.0004)
Distance (in hours)	-0.497***	-0.290***	-0.299***
	(0.0025)	(0.0032)	(0.0026)
Distance (in hours) squared	0.0688***	0.0414***	0.0421***
	0.0004	0.0005	0.0004
Same county	0.0985***	0.0357***	0.0198***
	(0.0023)	(0.0026)	(0.0023)
Additional controls:			
Population, type (urbanization), characteristics (factor scores) of destination municipality	yes	yes	no
Migration rate, t-2, t-3, t-4, t-5	no	yes	yes
Source municipality fixed-effects	yes	yes	yes
Destination municipality fixed-effects	no	no	yes
R^2	0.292	0.359	0.342
Observations (municipality pairs x years)	6,546,306	4,472,336	5,057,240

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

We examine four specifications on the effect of social networks on location choices. As we use the connections on the OSN as cross-sectional data, these are all cross-sectional models for the year 2014 (Table 7). First, we enter the intensity of OSN connections and the clustering coefficient of the destination settlements to the model (Column 1). Next, we add the intensity of migration in 2013 to examine hypotheses H.4 and H.2 simultaneously (Column 2). Each of these models contains fixed effects for the source municipality, which absorb the cross-sectional differences in push factors. In Column 3 we enter the additional four year's lagged variables. In each of these models (Columns 1-3) we include the population, the settlement type (urbanization) and the characteristics (factor scores) of the destination municipality as parametric controls for the pull factors. Furthermore, in Column 4 we add both source and destination municipality fixed effects and examine the model with five lagged variables together with the double fixed effects. All four specifications (Column 1-4) contain distance, squared distance and same county variables.

The coefficient of the social network variable (intensity of connections on iWiW) is consistently significant and positive in each specification, suggesting that the more intensive the network connection is, the likelihood of choosing that given municipality grows comparing to other alternatives, corresponding to H.4. The clustering coefficient of the destination settlement is not significant in any specifications.

The effect of the previous year's migration shows similar tendencies to the longitudinal analysis. Migration is more intensive, if its intensity was high in the previous year - as we assumed based on the theory of chain migration. After adding the previous year's migration to the model, coefficients of the intensity of network connections decreases by about 14%, after adding the five year lagged values it drops with 30%. It is not surprising; it indicates that people sustain some of their previous social connections after moving, which creates a positive correlation between the intensity of previous migration and the strength of network connections between municipalities.

Table 7

Regression models considering the effect of social networks

	1	2	3	4
Dependent variable Independent variables	Choice of the destination among migrants of the municipality (percentage points, 2014)			
iWiW connections (percentage points, previous year)	0.120***	0.107***	0.0753***	0.0730***
	(0.0027)	(0.0025)	(0.0023)	(0.0008)
Clustering coefficient of destination iWiW	7.22e-06	7.44e-06	4.37e-06	
(standardized, previous year)	(8.01e-06)	(7.97e-06)	(7.85e-06)	
Migration rate (percentage points, previous year)		0.0954***	0.0700***	0.0882***
		(0.0057)	(0.0054)	(0.0013)
Additional controls:				
Population, type (urbanization), characteristics (factor scores) of destination municipality	yes	yes	yes	no
Migration rate, t-2, t-3, t-4, t-5	no	no	yes	yes
Distance, distance^2, same county	yes	yes	yes	yes
Source municipality fixed-effects	yes	yes	yes	yes
Destination municipality fixed-effects	no	no	no	yes
R2	0.201	0.209	0.229	0.431
Observations (municipality pairs)	295,061	295,061	295,009	523,432

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

5. CONCLUSIONS

We examined the role of social networks in Hungarian internal migration. We analysed separately the factors determining the decision to leave a municipality and the decision on the place of resettling – so the out-migration and the choice of destination. The results show that both leaving and settling have a significant and positive association with network effects. Both previous migration and online social network connections influence the magnitude of current migration in every specification we examined.

We found that the intensity of former migration in the community of origin has a significant correlation with subsequent migration over the period 2000-2014, and those destinations, which have been popular among the out-migrants of a municipality in the previous year, will be popular in the subsequent year too. The former of these findings can be linked to literature on cumulative causation (Massey et al. 1993; Deléchat 2001), while the latter is consistent with previous findings on chain migration (Carrington, Detragiache, Vishwanath 1996; Bauer, Epstein, Gang 2002).

Considering online social networks, we have found that less people migrate from municipalities with dense internal linkages, and more people from ones with more external linkages. Additionally, our models suggest that if there are more online social network connections between residents of the source and the destination municipality compared to other alternatives, it makes the given destination more popular among migrants. These results are consistent with the information and affinity hypotheses (Haug 2008), about the networks' influence on migration. Although several previous studies illustrated the effect of the networks on migration and location choice based on these arguments (Deléchat 2001; Bauer, Epstein, Gang 2002; Nowotny, Pennerstorfer 2011), to our knowledge, our one is the first, which utilized online social network connections to show this. For this hypothesis, we assumed – based on previous studies – that online social networks are important sources of social capital (affinity hypothesis), similarly to real networks, or they can be used as the proxies of "real" networks. We also relied on previous studies by assuming that online social networks are efficient tools for collecting information about migration. It must be added however, that these mechanisms explaining network effects (information about getting around and work, utility of nearby friends and relatives) are individual level explanations, and our analysis is on the community level. In this sense, our analysis deviates from previous literature, which analysed migration at the individual level (eg. Kobrin, Speare 1983; Banerjee 1983; Deléchat 2001; Dawkins 2006), however, we find examples for similar analysis, where observations are on the community level (Johnston 1971; Carrington, Detragiache, Vishwanath 1996; Nowotny, Pennerstorfer 2011). Therefore, our analysis also assumes that these individual mechanisms add up to the community level.

Municipality characteristics show mostly the expected effect on migration. Municipalities with better infrastructure (local economy, basic public services, labor market) face less out-migration. When choosing across destinations, municipalities with better conditions in the dimensions of urban services, basic public services, and labour market are more attractive. We did not find significant effects of the structure of the communities' network by analysing local clustering after controlling for previous migration. While an important source of network effects in internal migration is ethnicity, in this study we also did not analyse ethnic factors. A reason for this is that Hungary is ethnically highly homogenous, the most numerous ethnic minority is the Roma population.

We analysed two indicators of network effects: the previous migration and the online social network connections. By including both to the models we saw that the coefficients decrease, but remain significant, which we interpreted as these effects partly overlap, but each contribute additionally to explaining migration.

It is important to discuss the limitations of the results. First, one needs to be cautious about the interpretation of the effect of previous migration. We argued that previous migrants maintain the relationship with their place of origin; therefore, they can provide information and benefits to the subsequent migrants. The effect of previous migration, however, probably also includes additional unobserved effects, which we could not control fully in our regressions. In case of the out-migration, such factor can be an ongoing economic or social decline of the community, or the effect of agglomeration externalities. In case of the location choice, transport linkages, administrative relationships, or cultural factors can contribute to the fact that it is natural to select some destinations from some sources, beyond the network effects, and the economic, administrative and distance factors, we were able to control for.

The iWiW data also has its own limitations. It includes 3.77 million users, which is about the two third of the internet user population at that time, but it has selective coverage by urbanization and age. An additional issue is that how up-to-date user's data are. If they did not properly update their hometown, when they moved, and they gained new iWiW connections at their new places of residence than we overestimate the connections between the two municipalities and also overestimate the external links on the expense of internal links. Moreover, there is a trade-off between these limitations: we chose to analyse the latest available date of the iWiW database to decrease its selectivity; however, with this we possibly sacrificed up-to-dateness of its information to some extent.

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APPENDIX

FACTORS DESCRIBING MUNICIPALITY CHARACTERISTICS

We have chosen a total of 22 variables from the T-Star database about education, unemployment, housing, cultural facilities, public utilities, retail outlets, economy and healthcare, to describe the infrastructure and characteristics of municipalities. When selecting variables, a key condition was that they have observations annually for the analyzed period (2000-2014). In order to reduce complexity of the selected variables, principle component analysis was performed. This compiled the information into six factors, which we named after their content. (Table 8.)

"Urban services" factor includes the logarithm of the number of retail stores in the municipalities, the logarithm of the number of bars and restaurants, the logarithm of the number of hospital beds, the number of nursery places per capita and the dummy variable for the existence of museum in the municipality. Then a separate factor, *"Basic public services"* embraces the number of primary school teachers per capita, kindergarten capacity per capita, and the number of general practitioners.

"Local economy" factor includes the number of private and corporate businesses, the proportion of taxpayers in population and the average amount of taxable income by one taxpayer. *"Labor Market"* contains the ration of long-term unemployment (over 180 days) with negative correlation, and the proportion of dwellings connected to the drinking water network. This can be interpreted as a reverse deprivation index.

The local economy is characterized by the following two factors. *"Service orientation of local economy"* contains the share of agricultural sector within local businesses, with negative correlation, the share of service businesses with positive correlation and the share of dwellings connected to the gas network. *"Industrial orientation of local economy"* includes the proportion of enterprises in the industrial sector with positive correlation and the service oriented ones with negative sign.

Table 8

Correlation matrix of principle component analysis

Variables	Infrastructure & services				Orientation of local economy		
	1	2	3	4	5	6	
	Urban services	Local economy	Basic public services	Labour market	Service	Industrial	Unexplained
Number of corporations per capita	0.0641	**0.2698**	-0.0764	0.0484	0.1455	-0.0480	.5981
The number of private businesses per capita	-0.0314	**0.6305**	0.0223	-0.2502	-0.0643	-0.0417	.3303
Corporations in industry sector (within all corporate enterprises)	-0.0063	-0.0205	-0.0141	-0.0086	0.0927	**0.8144**	.04683
Corporations in the agricultural sector (within all corporate enterprises)	0.0191	0.0448	0.0401	0.0162	**-0.6483**	-0.1684	.1834
Corporations in service sector (within all corporate enterprises)	-0.0121	-0.0236	-0.0246	-0.0075	**0.5105**	**-0.5192**	.0546
Log number of retail stores	**0.3688**	-0.0701	0.1494	-0.0280	0.1967	0.0428	.1906
Log number of bars & restaurants	**0.3566**	-0.0088	0.1144	-0.0034	0.1986	0.0290	.197
Proportion of taxpayers in population	-0.0181	0.3751	0.0138	**0.3923**	-0.0792	-0.0011	.2204
Average taxable income by taxpayer	0.0198	**0.4653**	-0.0201	0.1864	0.0359	0.0136	.228
Share of jobseekers over 180 days in the population	0.0098	0.1282	-0.0023	**-0.6506**	-0.0407	0.0131	.3119
The number of general practitioners per person	-0.0333	0.0573	**0.5362**	0.0569	-0.0824	-0.0428	.4535
Log number of hospital beds	**0.4177**	-0.0273	-0.0730	0.0204	-0.1250	-0.0491	.3461
Number of nursery places per capita	**0.2628**	0.1538	-0.0218	-0.1013	-0.0266	0.0292	.6569
Number of kindergarten places per capita	-0.0198	0.0458	**0.5333**	-0.0498	-0.0223	-0.0162	.4617
The number of primary school teachers per capita	0.0287	-0.0586	**0.6029**	-0.0051	0.0235	0.0204	.2985
Log number of high school teachers	**0.4430**	-0.0021	-0.0483	-0.0315	-0.0251	0.0006	.2212
Log number of college students	**0.3411**	0.0064	-0.0813	0.0196	-0.1739	-0.0605	.5583
Availability of library	**0.2394**	-0.1592	0.0286	0.1651	-0.1103	-0.0474	.7308
Availability of museum	**0.3250**	0.0333	-0.0119	-0.0445	-0.0304	0.0215	.5763
Share of drinking water network connected dwellings	-0.0069	-0.0204	-0.0107	**0.4958**	-0.0761	-0.0053	.5992
Share of sewer network connected dwellings	0.0842	**0.2755**	-0.0019	0.1051	0.1177	0.0949	.5605
Share of gas network connected dwellings	0.0432	0.1096	0.0634	0.1340	**0.3317**	0.1028	.4989