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ABSTRACT

Coordination Failures in Network Migration*

Previous migration facilitates future population moves, a phenomenon called network migration. However, thus far, network migration has been closely linked to network externalities. In contrast, this paper argues that the incumbent migration population can actively impact on future migration flows, yet fails to achieve a Pareto optimal network size due to coordination failures. In short, it stresses the active role incumbents take in the provision of network effects and, second, it provides theoretical evidence that self-perpetuating and sustained immigration is not at odds with rational acting individuals and must not simply be ascribed to pure network externalities.

JEL Classification: J60, J61, C70

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1 Introduction

Previous migration facilitates future migration as various studies on network effects have shown. “Once the number of network connections in an origin area reaches a critical level, migration becomes self-perpetuating because migration itself creates the social structure to sustain it. Every new migrant reduces the cost of subsequent migration for a set of friends and relatives; with the lowered costs, some of these people are induced to migrate, which further expands the set of people with ties abroad and, in turn, reduces the costs for a new set of people [...]” (Massey *et al.* [6]). This has commonly been labelled in the literature as network externalities.

But not only potential migrants benefit from migration networks, previous immigrant’s utility is increased as well. Firstly, costs of migration upon arrival in the destination country encompass all kinds of direct and indirect expenditures such as time and effort spent to acquire new employment and adjust to the new environment. Undoubtedly, this is the more pronounced the higher the alienation in the receiving region. An influx of people of the ‘same kind’ - family, friends but also other fellow countrymen - reduces the estrangement and helps creating subcultures and infrastructure (henceforth called *community effect*). This applies even for those individuals who have been in the country for some time. Secondly, incumbent immigrants may also care about the wellbeing of friends and relatives in their utility function (henceforth called *family effect*). In both cases, the utility of previous immigrants is increased by future migration. Yet, theoretical and empirical work on these aspects is still in its infancy.

On the other hand, there are negative effects of an ever-growing immigration population. By the very nature of migration, expected income differences between the sending and receiving country are reduced in the process of geographical movements. Following the seminal work of Todaro [7], individuals migrate in the pursuit of higher expected incomes. As a consequence, possible gains disappear over time as expected income differences between sending and receiving country are ironed out. For simplicity assume that immigration drives down wages in the receiving country but no assumption is made about income developments in the country of origin. In fact, wages in the sending country are assumed to be constant.

Since utility of previous migrants can be thought of as a function of wages among other things, reduced gains due to prolonged migration put a strain on their well-being. While there are empirical studies that analyse the effect of immigration on wages and employment of the indigenous population (for an overview see Gang and Batiz [4] and Friedberg and Hunt [3]) there is little on how growing networks affect the incumbent migration population.

Sustained migration in the presence of network effects, therefore, is two-edged (Bauer *et al* [1]). On the one hand, a larger network increases the utility of immigrants due to less alienation. At the same time, income is reduced, which causes a decline in utility. Assuming that the former effect dominates the latter in the initial phases of migration, there may be a threshold when more immigration is no longer desirable from the perspective of previous migrants.

This paper argues that network effects are driven by utility maximising individuals rather than pure externalities. Cost reduction for succeeding generations of migrants is not inevitably concatenated with the previous stock of immigrants but a deliberate means to increase utility. Hence, as will be seen, potential overcrowding is a result of a co-ordination failure among the incumbent immigrant population.

2 The Model

Assume the population of previous immigrants is of size N , where N is large ($N \geq 3$) and individuals are identical in their characteristics. Every member gains utility from only two sources: income in the form of wages and the stock of previous migrants.¹ For the time being assume this is solely due to the *community effect*. Furthermore, let wages be a function of the stock of immigrants. Hence, the individual utility can be expressed as

$$u_i(w_i(S), S)$$

where w_i is the wage individual i earns in the receiving country and S is the stock of previous migrants which is initially equal to $N - 1$. Assume that the overall network S consists of individual networks, s_i , made up of friends and relatives. For simplicity, immigrants can only be part of one individual network s at a time. Then, let the overall network simply be the sum of all individual networks,

$$S = \sum_{i=1}^N s_i$$

Furthermore, utility is a positive function in both wages and network size. Yet, wages are negatively affected by an increase in S . This is

$$\frac{\partial u_i}{\partial w_i} > 0; \frac{\partial u_i}{\partial S} > 0; \frac{\partial w_i}{\partial S} < 0$$

and, since S is a linear function of s_i for $i = (1, \dots, N)$,

$$\frac{\partial w_i}{\partial s_i} = \frac{\partial w_i}{\partial s_j} < 0 \tag{1}$$

It follows that the total change in utility u_i as a result of an increase in the number of immigrants S is ambiguous. First, individuals gain utility by increasing the number of fellow countrymen. Second, more immigrants reduce wages and therefore utility decreases. Depending on the relative magnitudes of these two effects, the overall change in u_i in response to a change in the network size may be positive, zero or negative. Formally

¹The implicit assumption is that all incumbents work and that all future immigrants seek employment.

$$\frac{du_i}{dS} = \frac{\partial u_i}{\partial S} + \frac{\partial u_i}{\partial w_i} \frac{\partial w_i}{\partial S} \begin{matrix} \geq \\ < \end{matrix} 0 \quad (2)$$

Most importantly, however, it is assumed that an increase in s_i raises utility of individual i by more than an equivalent increase in network s_j . In other words, friends and relatives receive a higher weight in the utility function compared to the effect of additional non-related fellow countrymen. That is,

$$\frac{\partial u_i}{\partial s_i} > \frac{\partial u_i}{\partial s_j} \quad (3)$$

and due to the (1)

$$\frac{du_i}{ds_i} > \frac{du_i}{ds_j}$$

Given the above model, a social planner in the receiving country maximises social utility for the current immigrant population by solving,

$$\max_S U(w(S), S)$$

where U is the overall utility derived from the individual utility functions u_i ; for example, U may simply be the sum of all u_i . As Bauer *et al.* [1] have shown, for given wages the optimal number of immigrants, S^* , is a Pareto solution to

$$\frac{\partial U}{\partial S} = - \frac{\partial U}{\partial w} \frac{\partial w}{\partial S} \quad (4)$$

For $S < S^*$, the positive network effect dominates the decline in wages and individuals will continue to attract new migrants. Respectively, for $S > S^*$, the incumbent population of immigrants should prevent any further migration. In both cases it is assumed that there is a positive expected payoff for emigrants in the first place. Clearly, S^* is the network size chosen by a social planner which allows no further increase in utility neither by increasing an individual network nor all N networks. However, in the absence of such a planner two questions arise. Firstly, do individuals have the means to reach the optimal network size and, secondly, if so, will they indeed choose S^* .

Previous literature suggests that positive network effects are an inevitable consequence of previous immigration.² Therefore, they are often referred to as network externalities. Yet, the view taken here is that this term might be misleading as it denies the incumbent immigration population to impact on succeeding migration. This is especially pronounced when it comes to the provision of information and assistance, for it is believed to make up the core of network effects. While the literature easily accepts the fact that previous migrants positively support their succeeding compatriots the opposite has been widely ignored. Yet, if support is in the scope of previous immigrants, it seems reasonable to consider a case where incumbents withhold information or reject

²See e.g. Massey *et al.* [6] for an overview on migration studies

assistance in order to hamper further migration. This seems the more plausible, the more negative the effect of further migration is on individuals utility. For the sake of simplicity, suppose incumbents can perfectly control future immigration. This is, previous immigrants can cease further migration by increasing the costs of emigration for friends and relatives.

Hence, theoretically incumbents may reach S^* even in the absence of a social planner. Yet, as will be shown, the Pareto solution turns out to be inconsistent with individual utility maximisation.

Proposition 1 *Individuals have an incentive to deviate from the optimal strategy and will choose a network size that is larger than S^* due to a lack of coordination.*

Proof. Suppose an optimal solution S^* exists. Then, the Pareto solution S^* implies that $du_i/ds_j < 0$ for $j \neq i$ but $du_i/ds_i > 0$ due to assumption (3) and the fact that individuals are identical. Hence, from the social planner's point of view no improvement of the overall utility is possible. Increasing S any further will lead to a decline in utility for at least one individual. However, from the individual's point of view utility can be improved by allowing more immigrants into the individual network, for $du_i/ds_i > 0$. In the Pareto optimum, four cases can be distinguished from the perspective of a single individual i :

- (a) All N members of the incumbent population discontinue their attraction of migrants; hence, the individual utility is $u_i^a(w_i(S^*), S^*) \forall i \in N$. Since individuals are identical the overall utility for S^* is $U^a(w(S^*), S^*)$.
- (b) All N members continue to provide assistance; in this case the individual utility will be $u_i^b(w_i(S^b), S^b) \forall i \in N$, where $S^b > S^*$; it follows that $U^b < U^a$ and $u_i^b < u_i^a$ since $du_i/dS < 0$ by the very nature of the Pareto optimum. Note that dS is large as all N incumbents increase their networks. This is, for $S > S^*$ the negative effect of the sum of du_i/ds_j dominates the positive effect of an increase in individual i 's network, du_i/ds_i .
- (c) Only individual i discontinues its assistance while all remaining $N - 1$ members continue their support. Then, let i 's utility be $u_i^c(w_i(S^c), S^c)$ and the utility for the remaining members $u_j^c(w_j(S^c), S^c)$ for $j \neq i$. Note that $S^c < S^b$ by $s_i^b - s_i^c$ and $u_i^c < u_i^b$ which is a result of $\partial u_i/\partial s_i > \partial u_i/\partial s_j$. Furthermore, $u_i^c < u_i^a$ as an increase in networks $j \neq i$ affects individual i negatively. However, whether $u_i^c \leq u_i^a$ is irrelevant for the following discussion and depends on the relative magnitude of du_i/ds_i and du_i/ds_j $j = (1, \dots, N - 1)$.
- (d) Finally, suppose only i continues to support migration while everybody else does not; let i 's utility be $u_i^d(w_i(S^d), S^d)$ and the utility of the $N - 1$ members $u_j^d(w_j(S^d), S^d)$ for $j \neq i$. By definition, $S^d > S^*$ by $s_i^d - s_i^a$ and $u_j^d < u_j^a < u_i^d$. This is, $u_j^d = u_j^a + du_j/ds_i$ and $u_i^d = u_i^a + du_i/ds_i$ where the latter exceeds the former due to $\partial u_i/\partial s_i > \partial u_i/\partial s_j$ and $du_j/ds_i < 0$.

		N-1	
		Support	Rejection
i	Support	$u_i^b ; u_j^b$	$u_i^d ; u_j^d$
	Rejection	$u_i^c ; u_j^c$	$u_i^a ; u_j^a$

Figure 1: Decision matrix from the perspective of individual i

The four scenarios (a) – (d) can be summarised in matrix form from the perspective of individual i facing the remaining $N - 1$ members of the current immigration population (Figure 1). From (a) – (d) follows that for $S > S^*$,

$$\begin{aligned} u_i^c &< u_i^b \\ u_i^a &< u_i^d \end{aligned}$$

but

$$\begin{aligned} u_j^b &\leq u_j^d \\ u_j^c &\leq u_j^a \end{aligned}$$

depending on $du_j/dS \leq du_j/ds_i$ and the relative magnitude of du_i/ds_i and du_i/ds_j $j = (1, \dots, N - 1)$. Given the above, it can be seen that in a Nash solution either individual i continues its support while the remaining $N - 1$ members of the incumbent immigration population choose to abandon their assistance or everyone increase their network, depending on $du_j/dS \leq du_j/ds_i$. Hence, the optimal strategy from the individual's point of view is therefore to increase the network. Yet, if this is true for one individual, it must be the case for all N members; therefore, the only sustainable solution on aggregate is S^b which is larger than S^* . ■

As a result, the network is growing beyond its Pareto optimum, S^* , as immigrants can raise their utility by increasing individual networks. Suppose individual i increases her network in the optimum. As a consequence, her utility increases while all other incumbents face a decline in their utilities. In order to offset part of this decline, it is then optimal for everyone to increase networks as well. Hence, in the absence of co-ordination and a collective punishment mechanism there is always an incentive to deviate from S^* . Consequently, even though individuals anticipate the fall in utility as a result of their behavior, they are still better off by increasing their individual networks to avoid an even stronger decline in utility. Hence, potential inefficiencies can be ascribed to a lack of commitment among the N incumbent immigrants; despite having the

means to avoid an *overcrowding*, they fail to co-ordinate a Pareto solution.³

Finally, note that the main results remain valid even when previous immigrants have only imperfect control over future migration, i.e. if some of the network effect is indeed a result of externalities; in this case, network migration might simply be slowed down due to the withholding of information. Similarly, one might want incumbents to care about their friends and families utility too (*family effect*). In the above framework, this merely raises the left-hand side of equation (4) and therefore increases the optimal network size and, at the same time, the incentive to deviate.

3 Conclusion

Migration networks are thought to increase the utility of the stock of previous immigrants. At the same time, increased immigration puts a strain on income differences between sending and receiving country and leads to a decline in incumbent's utility. A trade-off is born and there exists a Pareto optimal network size from the perspective of previous migrants. Yet, since almost all network effects require some kind of involvement of the incumbent immigration population, the network literature is mainly confined to the case where incumbents provide support for future immigrants. Hence, it seems natural to consider the opposite case, where incumbents withhold information and discontinue their assistance. In this case, it can be shown that sustained immigration beyond the optimal network size is due to a co-ordination failure among previous immigrants. While it is collectively optimal to terminate support, individuals find it still beneficial to accept an increment in their individual networks.

The paper, therefore, accomplishes two things. First, it stresses the active role incumbents take in the provision of network effects and, second, it provides theoretical evidence that self-perpetuating and sustained immigration is not at odds with rationally acting individuals and should not simply be ascribed to pure network externalities.

Empirically, two issues arise from the above. First, there is a demand for studies on the economic impact of sustained migration on the incumbent immigration population, for as one expect the focus has been mainly on the impact on the indigenous population. Second, and related to the former, the migration literature has little to say about the attitudes of incumbents towards succeeding immigrants which is most certainly a consequence of the under-representation of these groups in social attitude studies. While these surveys provide insights into the attitudes of natives towards foreigners (e.g. Gang *et al.* [5] and Dustmann and Preston [2]) there is little known about the perceptions of former

³Depending on the perspective of the social planner, the optimal network size may differ. For example, if the social planner's objective is to maximise the joint welfare of incumbents and future migrants, the network size might be larger, for succeeding migrants can compensate incumbents for their loss occurring for network sizes beyond S^* . Similarly, a social planner taking into account the welfare of incumbents and natives may also want to chose a larger network size in order to efface differences in expected incomes. In both cases Pareto optimality is not the appropriate concept.

immigrants. The framework developed in this paper predicts growing negative sentiments over the course of immigration on the side of incumbents as negative effects start to dominate positive network gains which will mainly be directed against immigrants outside individual networks.

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