Push and pull forces and migration in Vietnam

Huy Huynh Truong and Nonneman Walter

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Huynh Truong Huy[1]

W. Nonneman[2]

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[1] School of Economics & Business Administration (Can Tho University), e-mail: hthuy@ctu.edu.vn
[2] University of Antwerp, Faculty of Applied Economics, e-mail: walter.nonneman@ua.ac.be

Abstract

This paper adopts the push and pull model of migration to explain inter-provincial migration flows across 63 provinces or cities of Vietnam in the period 2004-2009. We used a solution to a quadratic cost migration problem by combining the total number of in and out-migration of various provinces and inverse distances between provinces that aims at calculating the push and pull factors of each province. The result confirms the hypothesis that push factors correlate well with total out flows of provinces and pull factors with total inflows of provinces. In addition, it is found that pull and push factors are explained rather well by population size and income, but not so by urbanization and poverty.

Keywords: push factors, pull factors, migration, distance.

1. Introduction

In Vietnam – as in many other emerging economies – internal migration, predominantly rural to urban migration, has increased rapidly over the past three decades. Interprovincial migration increased from 1.3 million in 1989 to 2 million in 1999 to 3.4 million in 2009 or, in relative terms, from 2.5% of the population in 2009, to 2.9% in 1999 and 4.3% in 2009 (VGSO, 2010b, 99). Rural to urban migration creates "urban congestion problems" in different forms such as urban unemployment, environmental pollution, traffic congestion, housing shortage, and lack of public sanitation and access to clean water. This creates challenging problems in a wide range of policy domains. Hence, a proper understanding of what drives migration and its consequences is important to underpin fact and science driven policies.

Rural to urban migration in particular is challenging as it tends to increase socio-economic disparities between typically rural regions of origin and more urban regions of destination. The growing disparity between the main rural areas of Vietnam - namely the Central Coast and the Mekong River Delta (MRD) region – and the urban areas – the large cities and the Southeast region - is of particular policy concern.

The main purpose of this paper is to explain recent migration flows in Vietnam by using a push-pull framework of analysis. The first section of the paper briefly reviews stylized facts on internal migration in Vietnam. Next, some key references to literature on internal migration and specifically on a push pull framework are discussed. The following section presents a simple push-pull-cost model suited to estimate an indicator of "pull" separately from an indicator of "push" for each location. Beside, estimates of both pull and push indicators for each of the 63 provinces of Vietnam are presented by solving the model. Finally, results and applications are discussed.

2. Stylized facts about internal migration in Vietnam

The VGSO (Vietnam General Statistics Office) recently published a monograph on "Migration and Urbanization in Vietnam: Patterns, Trends and Differentials" - based on a 15% sample survey included in the 2009 Census – from which a number of stylized facts on internal migration[3] in Vietnam (VGSO, 2010b, 99-100). The most important stylized facts on interprovincial migration[4] are:

- A rapid increase in interprovincial migrants – both in absolute and relative terms – over the last two decades namely from 1.3 million (or 2.5% of the total population of Vietnam) in 1989 to 3.4 million (or 43% of the total population of Vietnam) in 2009. Feminization of migration with females accounting for more than half the migrant population for the whole of Vietnam.

- Clear evidence of a positive relationship between migration and urbanization with central city provinces of Vietnam having a high migrant share of the population;

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[3] Migrants are defined as "people whose place of residence 5 years prior to the time of the census is different from their current place of residence" and non-migrants are "people whose place of residence 5 years prior to the time of the census is their current place of residence". Only the population aged 5 or older are taken into consideration (VGSO, 2010b, 19).
[4] Vietnam is divided into a hierarchy of regions, provinces, districts and communes (6 regions, 63 provinces, 690 districts and 11,066 communes).

- Migrants are typically young (especially females) while the non-migrant population is ageing. The median age of interprovincial migrants is 24 compared to a median of 30 years for non-migrants for the whole country;

- The differences in the share of total regional and provincial population of in-migrants are large. For the whole of Vietnam some provinces have more than 10% of total population in-migrants but others have less than 1% in-migrants.

These stylized facts on internal migration in Vietnam and more specific the MRD echo the “laws of migration” [5] established in the late 1800s by the British demographer Ravenstein (Ravensteins, 1885, 1889). This is no surprise as in Ravenstein’s time the industrial structure of the British economy underwent a structural transformation from agriculture to manufacturing (and services) and coped with a similar process of rural to urban migration not too different from the structural shift and urbanization of present day Vietnam.

Ravenstein’s main “laws” are empirical generalizations rather than “natural” laws. They were derived from a painstakingly careful analysis of census data rather than from some logically consistent theory or mathematical model. Although Ravenstein’s laws do not have an explicit theoretical basis, most of his laws can be derived from a simple mathematical formulation emphasizing the importance of “pull” and “push” factors in combination with distance as a limiting factor.

3. Economic models of migration

Most economic models explain the choice to migrate as the outcome of a maximization or a rational choice process.

The human capital model considers migration as an investment (Sjaastad, 1962). Migration occurs when the net present value of the income differentials between source and destination exceed the cost of migration. The larger the net present value of income gains over costs, the more likely people will migrate. The fact that it takes time for the accumulated benefits to exceed the costs of migration predicts that younger people are more likely to migrate than older people.

In a seminal article Todaro (1969) explicitly included labor market risk by comparing expected income at source and at destination over the life cycle. Expected income depends on both labor earnings and on the probability of finding a job. Hence, differences in unemployment rates at source and destination, determining job opportunities, also enter the decision. The model predicts that migration increases with increasing wage differentials but also with differences in employment opportunities. The model also implies that as individual with more human capital are less likely to be unemployed, the model implies that migrants typically are better educated than non migrants.

[5] Keeping in mind that Ravenstein talked about “centers of absorption” as destinations and “centers of dispersion” as sources, his original seven laws were: (i) most migrants proceed over a short distance, towards centers of absorption (ii) migrants moving to centers of absorption leave gaps filled by migrants from more distant regions (iii) the process of dispersion is inverse to that of absorption (iv) each current of migration produces a countercurrent (v) migrants for a far prefer to go to great centers of commerce or industry (vi) natives of towns are less migratory than those of rural areas and (vii) females are more migratory than males.

The “new economics of labor migration” – term coined by Stark and Katz (Katz & Stark, 1986; O Stark & Bloom, 1985) – argues that migration should be looked at in a family context rather than at the level of an individual. The decision to migrate is seen as a strategy to diversify the portfolio of risky income sources and is a way to insure against the risks of agricultural activity.

Stark also developed a model based on “relative deprivation” as a reason for migration (O Stark, 1991; O. Stark & Yitzhaki, 1988). It assumes that people are not motivated by absolute income gains but rather by their rank and relative income position at the source. The possibility to improve their relative position, will be a strong push factor for migration.

Some economic models focus on differences in the utility of consumption at source and destination countries (Faini & Venturini, 1994). In these models utility does not solely depends upon consumption but also upon a location factor summarizing the attractiveness and the amenities of a location. Income differentials are a necessary but not sufficient condition for migration as differences in attractiveness of regions may or may not be compensated by wage differentials.

Sociological approaches recognize that differences in life time prospects between source and destination are major determinants of migration (Massey et al., 1993) but also emphasize the presence of earlier migrants. The “chain migratory” approach stresses that these earlier migrants are channels of information and support for newcomers or act as role models. This approach offers an explanation for many dynamic paths of migration flows.

A common feature in all models is that potential migrants are “repelled” by conditions and circumstances at the source or ”pushing” people to emigrate, and attracted by conditions and circumstances at the destination or “pulling” people into immigration. This “push-pull” model of migration is not based on an explicit choice theoretic foundation but on the assumption that the resultant of contradicting repelling at source and enticing forces at destination is only counteracted by migration costs.

4. A mathematical formulation of a push-pull-cost model

A very simple but powerful mathematical formulation, intended to underpin Ravenstein’s ideas on the pulling forces of regions of “absorption” and the pushing forces of regions of “dispersion”, both kept apart by some restrictive factor “distance”, is offered by Dorigo and Tobler (Dorigo & Tobler, 1983). This model aims to put a measurement on the total forces that repel people from a region - or “push” forces - and the total forces that attract them to a region – or “pull” forces.

4.1 Cost minimization of migration in a congested network

Dorigo and Tobler start a simple equation namely

$$M_{ij} = (R_i + E_j) / d_{ij} \qquad \text{for } i \neq j \qquad (1)$$

with

- M_{ij} the number of people migrating from location i to location j during some time period,
- d_{ij} the "distance" between both locations measured in some appropriate units be it physical, perceived or social distance,
- R_i standing for "rejection" or "repulsion" or the "push" forces pushing people to move away from a location;
- E_i a variable standing for "enticing" or summarizing the "pull" forces pulling people into a location.

Usually self-migration (M_{ii}) is not reported so that the total number of independent equations in (1), if the total number of locations is n, corresponds to n(n-1).

In this model, the size of migration flows is proportional to the sum of push (R) and pull (E) forces but inversely attenuated by "distance". Dorigo and Tobler point out that their postulated model is the solution of a quadratic programming problem similar to minimizing the cost of transporting flows of materials in a system, with transport costs increasing with the size of the flows[6].

The flow of people M_{ij} in a network of locations, having to overcome deterrent factor d_{ij} to go from origin to destination at minimal effort, is comparable to the minimum loss distribution of people in a network, when costs of distribution are linear in the flow volumes, so that a quadratic objective function should be minimized or

Minimize $$\sum_i \sum_j M_{ij}^2 d_{ij} \qquad (2.a)$$

subject to $$\sum_j M_{ij} = O_i \qquad (2.b)$$

and $$\sum_j M_{ij} = I_j \qquad (2.c)$$

A closed network should be also be balanced so that $\sum_j O_i = \sum_i I_j$

The solution to this quadratic programming problem is

$$M_{ij} = (R_i + E_j)/d_{ij} \qquad \text{for } i \neq j \qquad (3)$$

with R_i and E_j are directly proportional to the Lagrange multipliers or "shadow prices" corresponding to equalities (2.c) respectively equalities (2.b). R_i is the effect on the minimum loss if the outflow at an outflow location increases with one unit (the push effect); E_j is the effect on minimum loss if the inflow at a point of inflow increases with one unit (the pull effect).

[6] There is also a physical analog namely a (DC) electricity network where total energy losses in transporting flows over the network are minimized.

Hence, the model postulated in (1) by Dorigo and Tobler, initially set up as a basic and simple explanatory model of migratory flows in a country, corresponds to the solution a quadratic network cost minimization problem.

4.2 Push and Pull Measurements

If distances (d) and the total number of incoming (I) and outgoing (O) movers in a migratory network are known, then it is possible to calculate an indicator of "push" (R) and "pull" (E) for each region. These "push" and "pull" factors are empirical indicators of the total repelling power and total attractive power of a particular region. The difference between pull and push (E-R) is net attractiveness (if positive); the sum of pull and push (E+R) is an indicator of total turnover in the region.

These push and pull indicators (R and E) can be calculated from the matrix of distances and total in- and outflow of locations.

Summing (1) over rows and over columns yields the total number of people outgoing from each location (O_i) and total number of movements incoming in each location or (I_j) or

$$\begin{aligned} \sum_j M_{ij} &= O_i = R_i \sum_j \frac{1}{d_{ij}} + \sum_j \frac{E_j}{d_{ij}} \\ \sum_i M_{ij} &= I_j = \sum_i \frac{R_i}{d_{ij}} + E_j \sum_i \frac{1}{d_{ij}} \end{aligned} \qquad (4)$$

The equations in (4) form a system of 2n equations. However, if the country is a closed system, then the sum of all out-migration equals the sum of all in-migration so that there are 2n-1 independent equations. The full system can be rewritten in matrix notation as

$$\begin{bmatrix} U & V \\ V & U \end{bmatrix} \begin{bmatrix} R \\ E \end{bmatrix} = \begin{bmatrix} O \\ I \end{bmatrix} \qquad (5)$$

where U is an n by n diagonal matrix with zero off diagonal values and V a n by n matrix and where the elements are given by

$$u_{ii} = \sum_j \frac{1}{d_{ij}}$$

$$v_{ij} = \frac{1}{d_{ij}}$$

Given the values of "distance" and of total outgoing and incoming numbers this system may be solved[7] for the pulling and pushing factors viz.

[7] The solution only exists if the square matrix in (5) is not singular.

$$\begin{bmatrix} R \\ E \end{bmatrix} = \begin{bmatrix} U & V \\ V & U \end{bmatrix}^{-1} \begin{bmatrix} O \\ I \end{bmatrix} \quad (6)$$

Hence, with information on the total number of outgoing persons from each region (O) and the total number of incoming persons in each region (I) and the "distance" matrix separating regions, an indicator of the "push" and the "pull" factor for each region can be calculated using (6).

4.3 Forecasting

Note that the inverse matrix in (6) is determined by the values of distances, those are by the geographical (physical) or socio cultural (perceptual) structure of a country. Except for major changes in the infrastructure network of the country or other exceptional social circumstances that changes perceptions of distance between locations (e.g. civil war) this underlying "distance" structure is quite stable over time. This makes this approach attractive for forecasting purposes. If changes in the pulling or pushing forces are subject to reasonable forecasting procedures, then future outflows and inflows can be directly estimated using equation (1).

4.4 Disentangling push and pull

An interesting aspect of this model is that each region has component of "pull" and a component of "push". If the push component is larger than the pull component or R-E>0 then the region is a region of "dispersion"; if the reverse or E-R>0 holds, then the region is a region of "absorption".

A standard gravity model does not offer this possibility of disentangling a "pull" and "push" factor for a single region. Take for example a simple gravity model such as

$$M_{ij} = k\frac{y_i^{\alpha} y_j^{\beta}}{d_{ij}^{\gamma}} \quad (7)$$

with y_i and y_j some measure of welfare in region i and in region j and with parameters $\alpha<0$, $\beta>0$ and $\gamma>0$.

Taking logs on both sides yields a log-linear equation of which parameters could be statistically estimated. However, even if the parameters are known or estimated the simultaneous and opposing effects of push and pull in each region could not be disentangled. This is seen by substituting (1) in (7) and eliminating the distance term which yields

$$R_i - E_j = k.y_i^{\alpha} y_j^{\beta} \quad (8)$$

Only the net push or net pull effect of a region can be approximated with a gravity model.

5. An empirical application to Vietnamese provinces

The model is applied to migration over a five year period (2004-2009) between Vietnamese provinces. Applying this model yields "push" and "pull" factors for each of the 63 Vietnamese provinces.

5.1 Data

5.1.1 Interprovincial migration flows

Data on interprovincial in-migration and out-migration from over the period 2004 to 2009 are available from the Population Census 2009[8] (VGSO 2011, 242-277). In this census, migrants are defined as the population aged 5 years and over that moved its place of usual residence in the period from 1/4/2004 until 1/4/2009. The number of in-migrants equals the total population aged 5 years and over that immigrated to that province during this period; out migrants correspond to the total population aged 5 years and over that moved out of the province in this period. In appendix A, the total number of in-migrants and out-migrants in each the 63 provinces of Vietnam over this five year period are listed.

[8] VGSO (2010a), Population Census 2009 Part III, "Table B.11 – Population aged 5 years and over by province/city that was place of usual residence at 1/4/2004 and 1/4/2009, Sex": 242-277.

Figure 1: In and out migration in the provinces of Vietnam 2004-2009

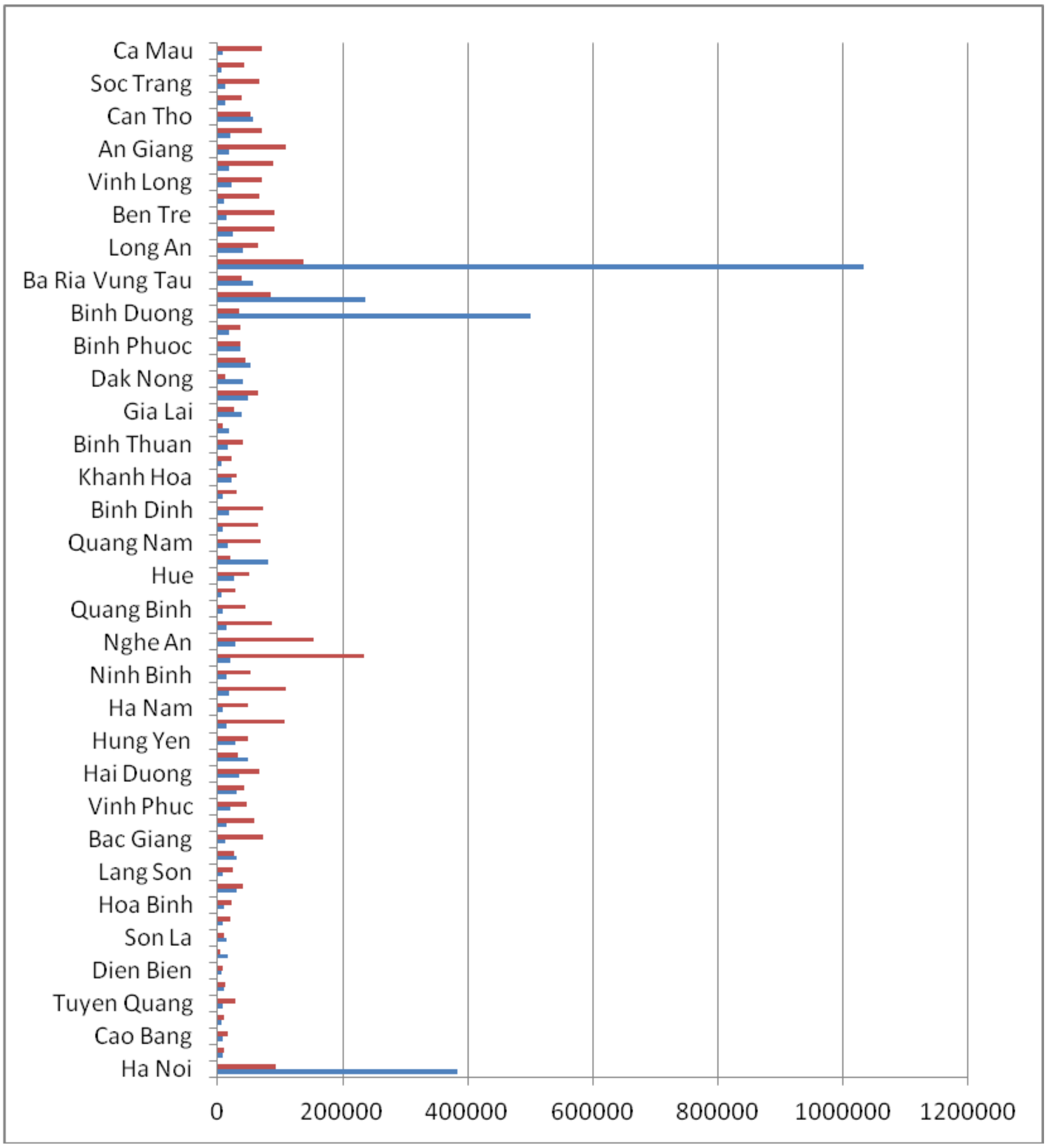


Figure 1 shows the strong concentration of in-migration. The 3 major cities of Vietnam namely Ho Chi Minh, Binh Duong and Ha Noi are the main poles of attraction for in-migrants (blue). Ho Chi Minh City attracts 30.3% of all in-migrants in Vietnam; Binh Duong 14.7% and Ha Noi 11.2%. The origin of out-migrants is geographically much more dispersed. The most important outflows (red) are from the predominantly rural provinces for the MRD region and Central Coast region. Hence, there is a strong concentration of destinations compared with weak concentration of sources[9].

5.1.2 Distances

Interprovincial distances were estimated by measuring the distance between provincial centers using the line measurement tool on Google Earth. Distances of migrants within provinces were calculated assuming

[9] The Herfindahl index of concentration for in-migrants is 0.1344; for out-migrants it is 0.0243.

that provinces are approximately circular and that within province migrants are moving from one random location to another location[10].

5.2 Results on Push and Pull Factors

As there are 63 provinces in Vietnam, the system defined in (6) has 125 equations. The system is solved for 63 the push (R) and 62 pull (E) factors for each region. As the sum of in-migrants equals out-migrants, the 63th pull factor is calculated using the equation (4) for j=63.

In appendix B, the solutions for push (R) and pull factors (E) are tabled.

The strong correlation (R^2=0.689) between net in-migration flows and the net attraction (or pull factor + push factor) is illustrated in Figure 2. This relationship is the net result of a strong relationship between pull and in-migration (R^2=0.92) illustrated in Figure III and the weak relationship between push and out-migration (R^2 = 0.281) as seen in Figure IV.

From Table 1 it follows that the differences in pull between the provincial are much larger than the differences in pull. This is explained by the strong pull factor of the major urban areas (Ho Chi Minh City, Binh Duong and Ha Noi), that dominate the weaker and geographically dispersed push forces. The average value of pull and push factors does not differ much, but the range and impact of the pull factor is much larger than that of the pull factor.

Table 1: Statistics on push and pull

	Push (R)	Pull (E)
Minimum	-0.643	-0.374
Maximum	1.527	5.168
Average	0.164	0.138
Std.dev.	0.380	0.807

[10] Numerical simulation shows that in this case, the average distance (in km) is approximately $0.416\sqrt{A}$ with A the area (in km²).

Figure 2: Net in-migration and net attraction

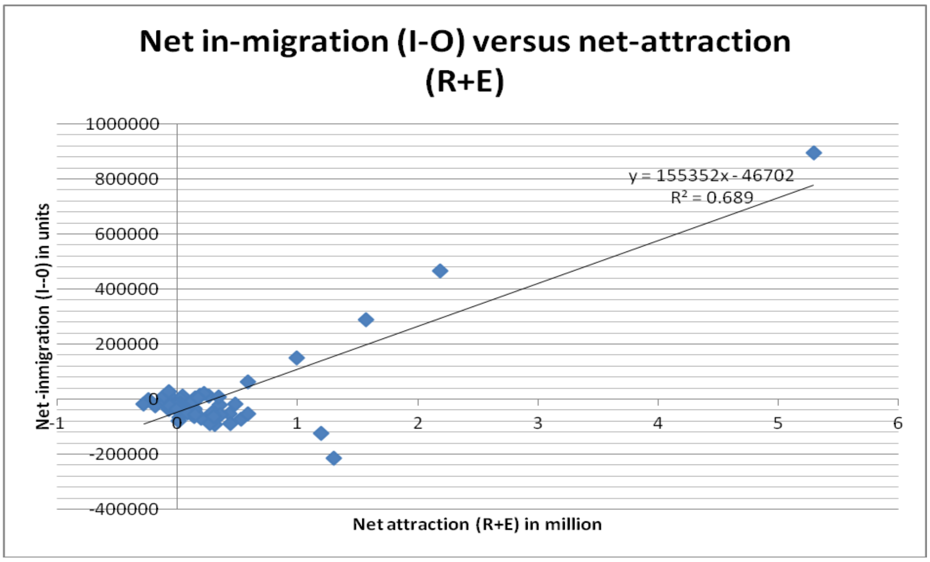


Figure 3: Push and out-migration

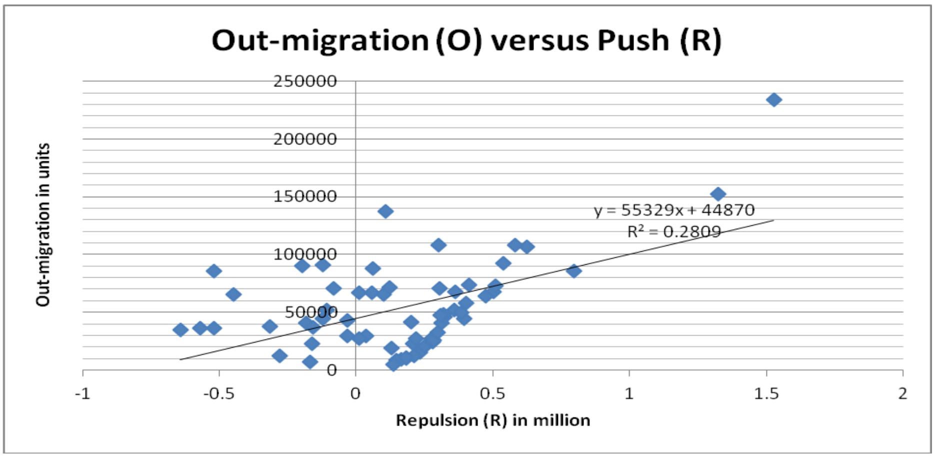
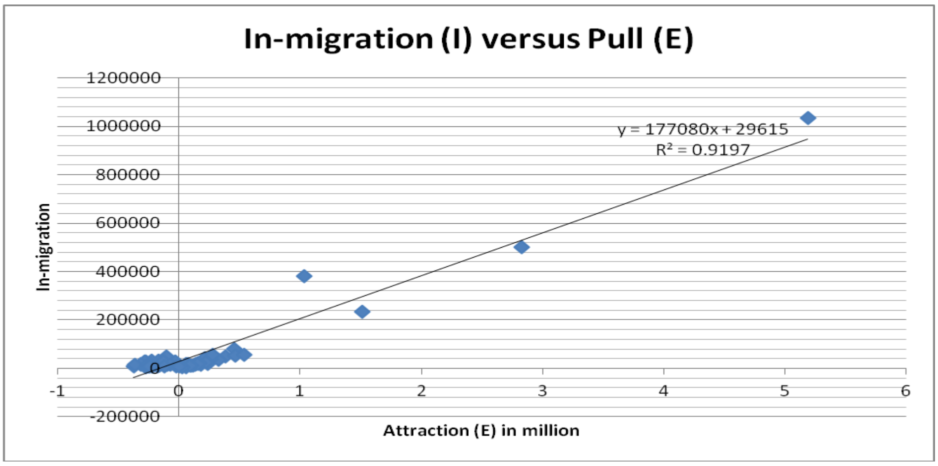


Figure 4: Pull and in-migration



5.3 Explaining Push and Pull

As the indicators R and E are a summary measurement of pull and push of a province, it may be useful to check empirically which factors seem to matter in explaining the differences in this aggregate measure of pull and push between provinces.

The repulsion and attractiveness of a province may be a combination of several characteristics. First, the strength of push and pull of a factor is likely to depend upon sheer population size. The likelihood of strong push and pull increases with population. Second, the opportunities offered by urban life most likely have a pull effect on people whereas the lack of opportunities in rural areas is expected to have a push effect. Third, basic economic theories of migration suggest that income differentials are a key driving force. Hence high income provinces are likely to exert a strong pull effect compared to low income provinces having rather a push effect. Fourth, the state of the labor market has an effect on the prospects of finding a job. High unemployment is a push factor; low unemployment a pull factor. Finally, poverty may exert a push effect as the theory of "relative" deprivation argues.

In Table 2 the results of a regression analysis are reported with the push factor R (in millions) and pull factor E (in millions) of the provinces as calculated above as dependent variables, POP = the total population (in millions)[11], URB = the percentage of urban population in total population[12], INC = income per capita (in VND million)[13], UNEMP= unemployment rate [14] and POV = the percentage of people below the poverty line[15].

As provinces are heterogeneous, especially as poles of attraction due to the major urban areas of Ho Chi Minh City, Binh Duong and Ha Noi, the assumption of homoscedasticity does not hold for the pull equation. Reported results for the push equation are OLS but for the pull equation robust estimation results are reported.

The results on what drives migratory push suggest that population and income are highly significant, but urbanization, unemployment and poverty are not. High population means more emigration pressure. Higher income means less emigration pressure. The regression on push suggests that there is also a small effect on push from more urbanization, but the effect is statistically not significant. Unemployment has a significant (5%) effect on push but the sign is not what is expected. A high unemployment seems to reduce push which is contrary to expectations. Further research should look into this in more detail (see later essays). Also poverty has the "wrong" sign but the coefficient is so close to zero and not significant.

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[11] Source: VGSO (2010c), Population and Employment 2006, "Average population by province".
[12] Source: VGSO (2010c), Population and Employment 2006, "Average urban population by province".
[13] Source: VGSO (2006), Result of the Vietnam household living standards survey 2006, Section V: Income, "Table 5.4 – Monthly income per capita by sources of income and province": 206-218.
[14] Source: VGSO (2010c), Population and Employment 2005, "Labor force aged 15 and over by province" and "percentage of employed laborers by province".
[15] Source: VGSO (2006), Result of the Vietnam household living standards survey 2006, Section 9: Involvement in poverty alleviation program, "Table 9.4 – Poverty rate by region and province": 330-331.

The results on what pulls migrants into a province indicate that population, income and poverty are significant drivers, but not so for urbanization and unemployment. A high population is an attractor and so is high income. Urbanization has the wrong sign but it is statistically not significant. This variable is correlated with population and this co-linearity probably explains why it does not show an independent impact. Poverty seems to have a pull effect. Again part of this effect may be due to co-linearity between poverty and population.

In sum, from both regressions it follows that push and pull factors are clearly influenced by population and income. The influences of urbanization and poverty are less straightforward to verify.

Table 2 Regression results of push and pull

	Push model *(b/se)*	Pull model *(b/se)*
POP (million)	0.344***	0.200*
	(0.06)	(0.08)
URB (%)	0.006	-0.005
	(0.00)	(0.00)
INC (million)	-2.173***	4.756***
	(0.54)	(0.59)
UNEMP (%)	-0.178*	0.162
	(0.07)	(0.13)
POV (%)	-0.007	0.040***
	(0.00)	(0.01)
Constant	1.800***	-4.239***
	(0.41)	(0.73)
R^2	0.580	0.863
N	63	63

* p<0.05, ** p<0.01, *** p<0.001

6. Summary and conclusion

In this paper the summarizing “push” and “pull” factors for the Dorigo and Tobler model were estimated for the 63 provinces of Vietnam. Dorigo and Tobler (1983) model migration flows between two locations as the sum of a push and pull factor divided by a distance measure. This model is the solution to a quadratic cost minimization migration problem with congestion – congestion linear in the flows of migration – and constraint by total in-migration and total out-migration of the different provinces. The push and pull factors of each location can be calculated by solving a system of linear equations that is defined by the total number of in- and out-migration of the different provinces and inverse distances between provinces. Based on migratory flows between provinces between 2004 and 2009 from Census data 2009, push and pull factors for all provinces in Vietnam are calculated. It is shown that push factors correlate well with total out flows of provinces and pull factors with total inflows of provinces. Using regression analysis, it is found that pull and push factors are explained rather well by population size and income, but not so by urbanization and poverty. Although the Dorigo and Tobler models summarizes push and pull factors into single measures, with results that are useful and helpful in predicting migration flows, such model does not explain which specific factors are the main driving forces of migration. That is subject for more research.

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APPENDICES

Appendix 1: In-migration and out-migration in provinces of Vietnam (2004-2009)

No	Code	Province	In-mig	Out-mig	No	Code	Province	In-mig	Out-mig
1	1	Ha Noi	382832	92773	33	49	Quang Nam	15650	67939
2	2	Ha Giang	7158	9939	34	51	Quang Ngai	8496	64053
3	4	Cao Bang	8738	15212	35	52	Binh Dinh	18683	73148
4	6	Bac Kan	6349	9587	36	54	Phu Yen	8142	29834
5	8	Tuyen Quang	7947	27319	37	56	Khanh Hoa	22071	29881
6	10	Lao Cai	10694	12227	38	58	Ninh Thuan	5858	22555
7	11	Dien Bien	6932	8242	39	60	Binh Thuan	16006	40630
8	12	Lai Chau	15486	4587	40	62	Kon Tum	17613	7325
9	14	Son La	13230	10775	41	64	Gia Lai	39272	27273
10	15	Yen Bai	7241	20943	42	66	Dak Lak	48266	65295
11	17	Hoa Binh	10794	22634	43	67	Dak Nong	41061	12324
12	19	Thai Nguyen	31268	40963	44	68	Lam Dong	52793	44868
13	20	Lang Son	8840	24656	45	70	Binh Phuoc	36255	36556
14	22	Quang Ninh	29911	25699	46	72	Tay Ninh	17386	36231
15	24	Bac Giang	11666	73671	47	74	Binh Duong	500003	34732
16	25	Phu Tho	13949	57940	48	75	Dong Nai	235273	85626
17	26	Vinh Phuc	20456	46335	49	77	Ba Ria Vung Tau	57004	37429
18	27	Bac Ninh	29789	41454	50	79	Ho Chi Minh	1033028	137031
19	30	Hai Duong	33568	67401	51	80	Long An	39533	65331
20	31	Hai Phong	47630	32289	52	82	Tien Giang	24368	89891
21	33	Hung Yen	28257	48573	53	83	Ben Tre	13569	91280
22	34	Thai Binh	13409	106853	54	84	Tra Vinh	11042	66702
23	35	Ha Nam	8876	47564	55	86	Vinh Long	21811	71107
24	36	Nam Dinh	19031	108544	56	87	Dong Thap	19029	88252
25	37	Ninh Binh	14764	51949	57	89	An Giang	18382	108149
26	38	Thanh Hoa	20107	233946	58	91	Kien Giang	19907	71431
27	40	Nghe An	28472	152499	59	92	Can Tho	55865	52127
28	42	Ha Tinh	13237	85963	60	93	Hau Giang	11675	37395
29	44	Quang Binh	7678	44742	61	94	Soc Trang	11428	67358
30	45	Quang Tri	6582	27666	62	95	Bac Lieu	6323	42673
31	46	Hue	27112	49497	63	96	Ca Mau	7965	70618
32	48	Da Nang	81467	19273					

Appendix 2: Push (R) and pull (E) factors

No	Code	Province	R (push)	E (pull)	No	Code	Province	R (push)	E (pull)
1	1	Ha Noi	538420	1030071	33	49	Quang Nam	502880	-73350
2	2	Ha Giang	182282	-225213	34	51	Quang Ngai	474177	-119117
3	4	Cao Bang	232062	-215639	35	52	Binh Dinh	510065	74451
4	6	Bac Kan	165421	-277878	36	54	Phu Yen	35155	-26277
5	8	Tuyen Quang	276403	-265191	37	56	Khanh Hoa	-33027	159001
6	10	Lao Cai	210485	-170871	38	58	Ninh Thuan	-162807	54851
7	11	Dien Bien	145703	-174031	39	60	Binh Thuan	-183289	179251
8	12	Lai Chau	136791	-91640	40	62	Kon Tum	-169676	59530
9	14	Son La	184670	-157648	41	64	Gia Lai	11120	254373
10	15	Yen Bai	252647	-263920	42	66	Dak Lak	101824	379749
11	17	Hoa Binh	208941	-291759	43	67	Dak Nong	-279742	212384
12	19	Thai Nguyen	310416	-171765	44	68	Lam Dong	-122552	463409
13	20	Lang Son	280536	-251026	45	70	Binh Phuoc	-570177	330412
14	22	Quang Ninh	281681	-131175	46	72	Tay Ninh	-520583	239660
15	24	Bac Giang	412327	-275626	47	74	Binh Duong	-642717	2826492
16	25	Phu Tho	400543	-256897	48	75	Dong Nai	-520989	1515905
17	26	Vinh Phuc	322049	-248939	49	77	Ba Ria Vung Tau	-315525	539508
18	27	Bac Ninh	202601	-274005	50	79	Ho Chi Minh	108772	5185711
19	30	Hai Duong	363905	-224183	51	80	Long An	-447331	265234
20	31	Hai Phong	297429	-106338	52	82	Tien Giang	-196726	217921
21	33	Hung Yen	319129	-279878	53	83	Ben Tre	-121615	134129
22	34	Thai Binh	624780	-317787	54	84	Tra Vinh	9717	112726
23	35	Ha Nam	307125	-374386	55	86	Vinh Long	-82847	162495
24	36	Nam Dinh	582098	-315233	56	87	Dong Thap	61617	136524
25	37	Ninh Binh	359769	-363095	57	89	An Giang	301315	139712
26	38	Thanh Hoa	1527113	-229488	58	91	Kien Giang	123163	159261
27	40	Nghe An	1324242	-126073	59	92	Can Tho	-108372	279470
28	42	Ha Tinh	794495	-263625	60	93	Hau Giang	-158656	96811
29	44	Quang Binh	393037	-252142	61	94	Soc Trang	57171	92656
30	45	Quang Tri	219690	-240702	62	95	Bac Lieu	-32751	30233
31	46	Hue	384585	-31698	63	96	Ca Mau	303931	1119
32	48	Da Nang	128744	458523					