

Regression models for estimating the propensity to return of the brain drain in Italy

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Abstract The article presents new estimates of the brain drain, experienced by Italian country, based on a new data set that draws on sample data and register data collected in different countries with high attraction of scientific research. Motivation is a critical dimension of capacity, defined as “*the ability of people, institutions and societies to perform functions, problems solving and set and achieve objectives*”. Incentives and incentive systems are fundamental to developing capacities and to translating developed capacities into a better performance. Regression models are used to identify the determinants of these components and factors that influences the propensity to return.

1 Introduction

Recently the Italian press, popular newspapers as well as more academic oriented articles, have reported the uneasiness of many Italian college graduates forced to work abroad for the lack of job and research opportunities in the country (Mountford, 1997; Beine et al., 2001; Beine, Docquier and Rapoport, 2006).

However, the situation of the Italian research sector, that still employs a very small fraction of Italian college graduates, is not the only factor pushing “Italian brains” to emigrate or to remain abroad after studying in foreign universities. The Italian labor market exhibits a combination of institutions and traditions that protect those who already have a job and harm those who are looking for a job. These features are present also for the highly skilled segment of the labor market and affect mostly young graduates who are searching for their first job. Therefore, young people at the end of their studies are most affected by the lack of competitiveness and transparency in hiring

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practices; personal and family contacts are still a prevalent instrument used in finding a first job.

The article presents new estimates of the brain drain¹ experienced by Italian country based on a new data set that draws on sample data. The analysis model represents the starting point for an empirical research line to study on different aspects generated by the brain drain in the world. Motivation is a critical dimension of capacity, defined as “the ability of people, institutions and societies to perform functions, solve problems and set and achieve objectives”. Incentives and incentive systems are fundamental to developing capacities and to translating developed capacities into better performance.

The analysis starts with a simple multiplicative decomposition of the brain drain into multivariate components: qualitative and quantitative. This work develops a platform of data, in relation to the participation and involvement in the chain of Italian immigrants researchers sample in countries with a strong appeal research: Canada, Germany, France, Suisse and Australia. The data set presents the innovative aspects of the research obtained through a questionnaire. The data set consists of the general aspects of the job, the field of employment, the types of contract, the assessment of academic preparation in the Italian market for foreign workers, the reasons for migration, the quality of work, quality of social life and the propensity to return. An original data set on international migration by educational attainment is used to analyze the determinants of brain drain from Italian country.

The analysis starts with a simple decomposition of the brain drain in multiplicative components (PCA). Regression models (GLM) are used to identify the determinants of these components and explain cross-country differences in the migration of skilled workers.

Moreover, the multivariate analysis models are used to classify the Italian researcher reports in the mentioned aspects. With the rapid evolution of international migration and the policy issues at stake, the international community must be prepared to address the major challenges raised by the brain drain. Assessing the economic impact of skilled workers emigration requires better knowledge of the educational structure of international migration, its determinants, the reasons and conditions for their return.

2 The theoretical approach

Research for the study of factors that explain the satisfaction in the employment generation have recently compared the process of industrialization. This research attempt to identify what are the main factors the lead to the satisfaction in the working world. This work was difficult for the identification of the influences in changing the workplace, the tasks and the personal characteristics of workers [2].

Over time, other studies have analyzed the multidimensionality of the concept of job satisfaction. It depends on individual factors (personality or ability), social factors

¹ This contribution is the result of reflections shared between the authors. The paragraph 2 - 6 shall be awarded to Simona Monteleone, paragraphs 1- 3- 4- 5- 6 can be attributed to Benedetto Torrisi. The data base and the project to collect contacts, counting of data and processing can be attributed to the group StatEcon-Area of Economic Statistics, University of Catania.

(relationships with colleagues, membership of a working group), cultural factors (beliefs and values), environmental factors (political influences, economic and social) and, finally, organizational factors (personal policies, organizational structure, technology and systems management) [6- 8- 9- 10- 4]. These are factors in the appeal of researcher working. During the 70s, migration out of foreign countries tried to decline thanks to the economic and social favourable conditions. Conversely, they began to observe the significant increase of researchers from developing countries located in Asia and Africa, decided to emigrate to developed countries, attracted by better economic conditions for a good career. These were the fundamental reasons for the study of a new theoretical approach that generated two major changes compared to those that were the basis of these studies: first, the term "brain drain" is no longer intended to keep researchers, but "migration of skilled personnel from developing countries to developed countries" and no longer took into account only the exodus of scholars but the more general category of qualified personnel agents.

This will create two lines of research of a micro and macro social. From a micro-social, the Human Capital theory [2] analyzes the individual and autonomous choices of individuals as rational and optimizing, leading to the decision to migrate to places with a higher return on education. From a macro-social theory to highlight the array of neo-Marxist 'Reports Center-periphery ', which examines the differences between developed and industrialized countries (which constitute the so-called "center ") and developing countries ("edge"). From the conjunction of the two theories arises precisely the Standard View. It explains that skilled migration is made up of unidirectional movement from developing countries to developed countries. Among the elements of the Standard View is the autonomous choice to emigrate from the subject, according to your reasoning, and does not take into account the influence exerted by the policies of governments, multinational companies, the regional blocs or other actors.

This new feature gave rise to the second generation of studies [5], and explains how skilled migration have adverse effects. There are many studies from the theoretical [3] and a few are empirical [1]. Detects the low quantity and quality of official data on the phenomenon of brain drain, particularly specialized type (phd and researchers).

3 Data set and Methods

It was constructed a sample of 383 contacts between PhD researcher (assistant professor) and professors in different universities of the world. The sample of respondents is represented by individuals who are highly specialized in different fields of scientific research or highly skilled labor force. The lack of official statistics or surveys that are the size of population, did not allow any estimate on the number to be sampled and primarily to a criterion of selection of units. The 383 respondents (year 2009) were created starting from the author's personal contacts of colleagues, abroad who have engaged in a chain system fellow Italian immigrants. Given the issues under examination, we received significant cooperation from them. The 91% of respondents (350) has demonstrated full cooperation, 2% (6) showed very incomplete answers, while 7% (27) did not cooperate.

It was obtained a database of 350 contacts in 67 variables classified into the following macro areas of interest (*see Table 1*). Related to the studied phenomenon the land subdivision in homogeneous areas presupposes the individuation of specific indicators able to synthesize the demanded statistic information.

An exhaustive variables set was individuated in relation to the hypothesis regarding the follow aspects of the phenomenon grouped in 5 groups:

Table 1 - Classification of variables

<i>Groups</i>	<i>Single variables</i>	<i>Variables types</i>
General aspects	X ₁ Sector	Nominal scales
	X ₂ Sex	"
	X ₃ Age	Interval scales
	X ₄ under study	Ordinal scales
	X ₅ Current Position	"
	X ₆ Type of contract	Nominal scales
	X ₇ Current works	"
	X ₈ Host State	"
	X ₉ Time Abroad	Interval scales
	X ₁₀ Prepare basic Italy	Scale Likert
	X ₁₁ Experiences in Italy	"
	X ₁₂ Findings on in Italy	"
Evaluation and comparison of the Italian system and host	X ₁₃ Findings on the funding of research in Italy	
	X ₁₄ Access funding	
	X ₁₅ Ratio of Basic Research and Applied	
	X ₁₆ promotion of research by the Italian firms	
	X ₁₇ Universities and Enterprise Value in Italy	Scale Likert
	X ₁₈ Value Universities and Enterprise Abroad	"
	X ₁₉ possibility of development of research abroad	"
	X ₂₀ Current salary	"
	X ₂₁ Possibility of career advancement abroad	"
	X _{22a} Relation between anzianità and career	
	X _{22b} relationship between curriculum and career	
	X _{22c} relationship between knowledge and career	
Justification migration	X ₂₃ Guest rewarding system in Italy	
	X _{24a} Bureaucracy in Italy	Scale Likert
	X _{24b} Interest in specific research	"
	X _{24c} Extension of powers	"
	X _{24d} Prestige in host institution	"
	X _{24e} Enhancement of skills	"
	X _{24f} Availability of new technologies	"
	X _{24g} Employment opportunities	"
	X _{24h} Economic reasons	"
	X _{25a} Entry permit	"
Difficulties in host country	X _{25b} Social integration	"
	X _{25c} Accommodation	"
	X _{25d} Local travel	"
	X _{26a} Organization	Scale Likert
Satisfaction levels the following factors in host country	X _{26b} Place	"
	X _{26c} Policies	"
	X _{26d} Freedom	"
	X _{26e} Prospects	"
	X _{26f} Hours	"

	X _{26g} Relaz.superiori	“
	X _{26h} Relaz.colleghi	“
	X _{26i} Equipment	“
	X _{26l} work team	“
	X _{26m} bureaucracy.	“
	X _{26n} Access information.	“
	X _{26o} Security	“
Motivation to return	X ₂₇ Trend to return in Italy	Scale Likert
	X _{28a} Career possibilities	“
	X _{28b} Availability of funds for research	“
	X _{28c} Review research system	“
Pull factors for return	X _{28d} Access new tech.	“
	X _{28e} Salary	“
	X _{28f} Reunion career	“
	X ₂₉ Assessment of quality of life abroad	“
	X ₃₀ Assessment of quality of life in Italy	“
	X ₃₁ Social inclusion abroad	“

For collection data we administered a questionnaire to a sample of contacts who have agreed to participate in the survey. In descriptive analysis, we reclassified the results in pivot tables and we used association measures with the Chi-square test ($p < 0.05$) and analytical techniques for the relationship between ordinal variables (*Kendall's Tau b*). For estimating the prediction model, we used models of multivariate analysis (PCA, GLM).

4 The descriptive results

The descriptive analysis has generated the following results:

The Italian researchers abroad mainly have an age between 31 and 40 years (46.6%), most migrating with the title of a PhD (47.7%), 53.1% are fixed-term contracts and mostly working at public universities (70.8%); The 59% of respondents are men; Most people who are living abroad for more than a year; Already abroad at the age of 30 years will become researchers exceeded this range and you become teachers, compared with advanced age in Italy.

Young migrate people have a basic preparation (degree) and education (PhD or specialization) and abroad is certainly valued, given the results of respondents for both the period of stay, both for the type of host research body, which for the job awarded.

The reasons for emigrating are: 1th employment (X_{24g}) opportunities (95.7%), 2th prestige (X_{24d}) the host organization (82.7%), 3th the enhancement (X_{24e}) of their skills (78.3%), 4th extension (X_{24c}) skills (75.5%), 5th economic (X_{24h}) reasons (72.8%) and to follow in relation to the possibility of using new technologies (X_{24f}), particularly the host country's interest for the topics of proposed research and finally to a bureaucratic system fully functional and functional system.

At 30 years abroad to become researchers and beyond this age group to become teachers. The targets for young migrants are significantly dependent on age.

The main factors that discourage the propensity to return to Italy, (the greater the positive perception of the most decreases the propensity to return in Italy) have access

to funding for research, development of new research abroad, the earnings and more job opportunities, better perception of work and organization of work, perception on the life's quality and the possibilities for inclusion in the social fabric of the host country (Kendall's tau b negative).

5 The model results

It has been considered a database of 350 lines (statistical units) and 67 rows (variables). In relation to the complexity of variables the propensity to return was studied through multivariate analysis models. For the type of variables, we have applied different regressive models (OLS and GLM) and finally, we chose the best on data fit.

We have performed an multivariate analysis on the information provided by the PCA. We have analyzed the number of principal component's that explain the 73% of the total variance of the dataset.

The PCA analysis produced two components that show the higher variability. In the first component there are 22 indicators over all 52 and in the second one 23 over all 52.

It has been generated a multiple regression model (GLM) that has estimated the regression coefficients (β_i, γ_i) between the covariates (Z_i, W_i) of main factors and the propensity to return (*see table II*).

The model measures the intensity that each predictor or combination their exerts on the propensity to return (X_{27}):

$$X_{27} = \alpha_i \pm \beta_i X_i \pm \gamma_i Z_i + \varepsilon' \quad [1]$$

The coefficients included in the function are highly significant, and confirm that the X_{27} depends on the predictors's combination at 95% probability and a good adaptation of 0,9831 ($p=0,000$) (*see table 2*).

Table 2 - GLM significant results

			R ²	R ² Adjusted	F	p
			0,995	0,983	135,76	0,0000
X_i	β_i	p-value	Z_i	γ_i	p-value	
X_{24b}	-0.265	0,00000	$X_{24b} * X_{24d}$	-0.440	0,00000	
X_{24d}	-0.322	0,00118	$X_{24b} * X_{24g}$	-0.436	0,00000	
X_{24g}	-0.394	0,00072	$X_{24d} * X_{24g}$	-0.541	0,00011	
X_{25b}	-0.156	0,00000	$X_{25b} * X_{25d}$	+0.236	0,00000	
X_{26l}	-0.265	0,00663	$X_{24b} * X_{26l}$	-0.436	0,00000	
X_{28a}	+0.450	0,00013	$X_{28b} * X_{28c}$	+0.246	0,00035	
X_{29}	-0.233	0,00079	$X_{28b} * X_{28e}$	+0.577	0,00000	

Model was obtained the residues distribution that is significantly linear (p-value = 0.000).

The GLM model produces the following reports: if it increases the interest in specific research (X_{24b}), the prestige in host institution (X_{24d}), the employment opportunities (X_{24g}), the difficulties in host country in (X_{25b}) social integration, the

work team (X_{26l}) and the life quality in host country (X_{29}) and the propensity to return decreases. While, the propensity to grow back, if you should increase the employment career possibilities in your country (X_{28a}).

Furthermore, the GLM results showed that the propensity to return decreases more in presence of highest views in the combination of variables ($X_{24b} * X_{24d}$, or $X_{24b} * X_{24g}$, or $X_{24d} * X_{24g}$, or $X_{24b} * X_{26l}$).

The difficulties in host country ($X_{25b} * X_{25d}$) not discourage the return. While, the combination of the main factors ($X_{28b} * X_{28c}$ or $X_{28b} * X_{28e}$), stimulate greater propensity to return.

In particular through the interpretation of the model [1] can be observed that:

- the greater trial on the factors that led to migration from Italy (X_{24}) and the lower the propensity to return; between the variables that significantly explain the justification for migration and that adversely affect the propensity to return are: the interest in specific research (X_{24b}) ($\beta = -.265$ p <.05), the prestige in host institution (X_{24d}) ($\beta = -.322$ p <.05), the employment opportunities (X_{24g}) ($\beta = -.394$ p <.05). This decreases the propensity to return to a greater extent than individual predictors, at the double combination of variables. Indeed, the combination the prestige in host institution (X_{24d}) with the employment opportunities (X_{24g}) has a greater impact in discouraging to return (X_{27}) ($\beta = -.541$ p <.05), following the combination the interest in specific research (X_{24b}) with the prestige in host institution (X_{24d}) ($\beta = -.440$ p <.05) and finally, the combination the interest in specific research (X_{24b}) with the employment opportunities (X_{24g}) ($\beta = -.436$ p <.05).
- the difficulties in host country (X_{25}) not discourage the return, although, greater difficulties in social integration coincides greater propensity to return ($\beta = -.156$ p <.05). This result is overturned by the combination of the difficulties of social integration (X_{25b}) with the difficulties with local transport (X_{25d}) ($\beta = +.236$ p <.05).
- the greater the satisfaction in work team (X_{26l}) the lower the propensity to return ($\beta = -.265$ p <.05). That effect seems more pronounced at the combination of satisfaction in work teams (X_{26l}) with the prestige in host institution (X_{24d}) generates a significant impact ($\beta = -.436$ p <.05).
- the return (X_{28a}) is stimulated by growth in employment opportunities in Italy ($\beta = +.450$ p <.05), followed by the combination of increased funding for research (X_{28b}) with a review of the recruitment system in research (X_{28c}) ($\beta = +.246$ p <.05) and combination between X_{28b} with the increase of wages (X_{28e}) ($\beta = +.577$ p <.05). The most significant regressors are associated with those variables that would create greater propensity to return to Italy.
- finally, the quality life perception in host country (X_{29}) significant impact on the propensity to return. Judgement on the greater X_{29} the lower the propensity to return to Italy ($\beta = -.233$ p <.05).

6 Conclusion

This analysis indicate a research's profile with clarity. The researchers are very young, with a good education, they decided to emigrate to enhance their knowledge and works experience have higher quality than in Italy.

The researchers abroad is not disappointed in his expectations. Generally, the satisfaction and social level work is very good.

Researchers says that their work abroad for a long time, that longer stay abroad and lower is their propensity to return to Italy. Therefore a real brain drain, a not a simple temporary mobility motivated by a professional or cultural growth, the remuneration, professionalism, interpersonal relations represents the strengths of the working environments in these countries.

Who works at the foreign is, in fact, more happy with his own job and more incentive to increase their productivity as living in an economic and social position to appreciate, both in terms of pay (wage) and in terms of recognition, work done (appreciation of the job).

The model studied has led to the estimation of single or multiple factors report affecting willingness to return at home.

These results are in line with the recent literature which sees the growing phenomenon and the difficulty of importing so many brains as they export.

The propensity to return is very low and this confirms the decrease in the degree of research appeal.

This work represents a first attempt to estimate the main factors that determine the migration research in Italy. It's the first study on specialists brain drain (doctors and researchers). The models and the additional motivations estimation, are the elements that provide greater knowledge to study the degree of appeal of country research. It contains many tools for analyzing policy decisions.

The evidence obtained in this study should lead policymakers in both developing and developed countries not to focus their attention in restricting migration flows of educated individuals. Not only are destination countries likely to benefit from the inflow of these skilled immigrants, as is relatively undisputed, but these flows may also be beneficial for origin countries.

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