LOCAL LABOUR MARKETS AND THE INTERREGIONAL MOBILITY OF ITALIAN UNIVERSITY STUDENTS

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SOMMARIO

Among the many roles universities can perform in regional development, this paper focuses on a less traditional one: universities can act as an instrument for brain gain, allowing regions to attract smart people who often stay after graduation. Thus, universities can also exacerbate the capability of regions with dynamic economies to attract smart persons from lagging regions. This mechanism is empirically verified in the Italian case, interesting because of its dual labour market and university system. With a gravity model, it is demonstrated that the attractiveness of provinces for university enrolment is strictly linked to surveyed forecasts on graduate job-openings.

JEL Codes: R11, R23, O15, I2.

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1 Introduction

In a neoclassical framework, inter-regional migrations flows are conceived as a mechanism to balance regional disparities in GDP per capita. Accordingly, more developed regions attract labour force from less developed regions through higher expected wages. In a simple Heckscher-Ohlin model, migration flows will persist as long as the gap in expected earnings between those groups of regions exists. More developed regions will experience an increase in labour supply, with a consequent decrease in expected wage, while an opposite mechanism will be in place in less developed regions. According to this view, interregional migration flows will assure a rebalance of both wages and GDP per capita. In other words, mobility will enhance regional convergence without recurring to economic policy. This approach, however, is likely to describe accurately the reality only if there is no heterogeneity in the workforce migrating from one region to another and if there are no sunk cost associated to labour mobility.

Building on the literature on brain drain, the growing literature on selective migration has pointed at the diverging effect of migration when it takes the form of human capital attraction from less developed areas (Fratesi and Percoco, 2010; Fratesi and Riggi, 2007; Kanbur and Rapoport, 2005). This phenomenon has been documented in U.S. cities, where Berry and Glaeser (2005) have found evidence of a diverging pattern in human capital accumulation occurred in past few decades. Furthermore, the Italian case is relevant given the large migrations from the South to the North during the Fifties and Sixties and that have been restarted significantly in the recent years. However, the decline of inter-regional mobility of labour between the mid-Seventies and the mid-Nineties has been followed by a new wave of South-North migrations. This new wave seems to be different from previous ones as 25% of Southern migrants holds a bachelor degree, while only 7% of total Southern working population has a bachelor degree (Banca d’Italia, 2005; Viesti, 2005). Ciriaci (2005) points out that of 43,459 graduates in the South in 1998, in 2001 only 27,170 had a job, 31.1% of which out of the Mezzogiorno. Push factors to migrate are even stronger for graduates in scientific matters, for whom the probability to obtain a job out of their region of origin is higher than for graduates in humanities (Ciriaci, 2005; Coniglio and Prota, 2008).

Building on this evidence, Fratesi and Percoco (2010) have found that selective migration in Italian regions have a diverging impact on the regional growth process: the drain of human capital by Northern regions results in a large contraction in the human capital stock and hence in the potential production of the South.

In the present paper we move from these results and make a first step in the understanding of the reasons why graduates migrate. In particular, it has been documented that Southern students graduating in Northern universities have a low probability to return to Southern
regions to work (Svimez, 2009). If this is true, then the human capital gain of the North takes the form of an early drain through university enrolment. We then think at universities as an important assets not only in terms of demand-driven effects or technological innovation spillovers through research activities, but also as a classical attractor of “future” human capital, i.e. the attraction of students that will have high skills after the completion of educational requirements and once they will enter the labour market.

In this paper, we consider students migration between Italian provinces (NUTS-3 level) and study it through the estimation of a gravity equation. We found that the presence of a good university in a given province joint with a dynamic labour market are among the drivers of students migration.

The remaining of the paper is organized as follows: Section 2 will present a brief survey of the many roles played by the university in regional development. Section 3 will present a descriptive analysis of the Italian situation, including the interesting dualism in both the attractiveness of universities and the local labour markets. Section 4 will investigate with 0-inflated gravity model estimations the factors explaining the mobility of students. Section 5 concludes the paper and opens to policies and further research.

2 Students migration, local labour markets and universities

The relevance of human capital for local development in a notion widely accepted in the literature (e.g. Pyke et al., 2006). To this end, universities are crucial because of their role in the production of innovation through research and, perhaps more importantly, because of the education of graduates, whose productivity is considered to be higher than workers with lower degrees.

To understand the role of university for territorial development, many approaches have been proposed in the literature, considering different university functions like research, education, attraction of human capital and urban effects, technology transfers and cooperation for community development.

The first approach considers universities as a public investment which produces direct and indirect effects on the surroundings given the attraction of many workers and students. Specifically, a university attracts a specific population, mainly students, determining a simple demand-driven impact, often estimated by means of input-output models. More complex is the role of ‘university as urban developer’ (Perry and Wiewel, 2005), both directly as promoter of a new university settlement, and indirectly as a tool for urban regeneration. University is generally conceived as a positive externality with positive effects on local consumption, but also for the image of a neighbourhood, which might be relevant to attract other investors.
The most ancient function of university, education, remains one of the most important ones. Since Middle Age, universities work as the most important higher education institution, although their history is complex and their function has changed through centuries. Focusing on more recent periods, universities are certainly the main producers of high skilled workers. The importance of this aspect rises moving toward the ‘economy of knowledge’, where human capital becomes more relevant. This is linked with the rise of interests of firms for high skilled workers that become one of the main political aim of recent years (Council of the European Union, 2000).

From an historical point of view, the research function of universities has started after the education mission. However, nowadays this seems to be the most important activity. Under this definition there are many different activities, from basic to applied research and from innovative research to technology transfer.

Assuming a territorial perspective, university has to be conceived as a research institute located on a territory determining a significant positive externality (Jaffe, 1989). This means that if local firms have spatial proximity with scholars, then contacts and collaborations are boosted. However, the implementation of joint research programmes is not obvious and requires organizational adaptation for both categories.

In recent years, we assist to an extension of universities functions with the inclusion of technology transfer activities and as incubator of new firms (Etzkowitz & Leydesdorff, 2000). This function derives mainly from the success of Silicon Valley where the University of Stanford has been the incubator of many highly innovative firms (cf. Saxenian, 1994). Differently from the research activity firms-oriented, the technology transfer requires to university to support directly spin-off and start-up firms promoting entrepreneurship. This is relevant for territorial development because can boost one of the key-factor of economic growth. Finally, this determined a shift in the role of the institution towards models of ‘entrepreneurial universities’ (Etzkowitz, 2003).

The most recent function that has been identified is the partnership of university for territorial development. This function has been described by the ‘Manifesto of Oviedo’ (Gutierrez & Fermin Villeneuve, 2001) and included (directly or implicitly) in many other references, like the official communication of the EU Commission (EU-Commission, 2003). In this view, university is conceived as an actor for territorial development, not just as a positive externality for supra-local development processes. This means that all the previous functions have to be conceived in a territorial perspective, promoting explicit cooperation territorially-based. This is not a self-evident conclusion because any of the previous functions underlined different perspectives, as research that is generally science-driven and not development-oriented. Furthermore, research and education were generally considered as provider of a-spatial benefits, whereas this conception is shifting focusing on the relevance of territorial proximity.
Finally, since the Middle Age, universities have attracted students from other cities and countries. This role has certainly been exacerbated in recent years, given the decrease in transport costs and the increase in the mobility of people. This is what we would focus on in this paper because this attractor role has a role not only on the region where an university is located, but also on regions suffering emigrations of students.

The economics literature on the mobility of students can be divided into two main streams. The first group of studies considers the individual reasons and eventually the family background behind the choice to move from one place to another to enrol in a given university. Sà et al. (2006) study the choice of Dutch students to enrol in a university and find that talent and geographical variation into higher education (also in terms of proximity to colleges) play very important roles in explaining such choice. Similarly, Frenette (2004) finds that the distance between household residence and the nearest college decreases dramatically the probability to enrol in a university by Canadian high school students.

The second group of studies considers local and university-specific characteristics as determinants of students attraction. Most of these studies find a positive effect of university quality and of financial aid for students (Baryla and Dotterweich, 2001; Del Bianco et al., 2009; Dotterweich and Baryla, 2005; Mixon and Hsing, 1994a, Mixon and Hsing, 1994b). Similarly, Sà et al. (2004) find that distance and the level of housing rent are among the most important factors. Most of this literature uses a production-constrained gravity model (Fotheringham and O’Kelly, 1989), while in this paper we opt for an unconstrained model and, more importantly, we introduce variables related to the local labour market.

The migration of students is important as these flows of people with high skill potential and specific motivations are of great importance for the accumulation of human capital of receiving regions. Interestingly, Faggian and McCann (2009a) find limited support to the view that local universities promote regional innovation and also, in general, that only few universities play a significant role in their local economies (Faggian and McCann, 2009b). In this paper we will not verify statistically whether universities are catalysts of human capital or not. Rather, we will assume, starting from some evidence discussed in the next section, that the mobility of graduates is limited and that the matching function of Italian universities is still very important.

Hence, if the university is tightly linked to the local economy and operates as a catalyst for talents to be employed locally, then the attraction of students will result, in the long run, in human capital accumulation and further local development.

In this paper, we will then study the mobility behaviour of students in Italy, a country in which, starting from the Nineties, South-North migration of graduates have become a source of main concern because they are seen as a mechanism for the perpetuation of long standing
regional disparities and dualism between richer North and much poorer South (Fratesi and Percoco, 2010; Gagliardi and Percoco, 2010).

3 The mobility of university students in Italy

The Italian North-South dualism is one of the most studied topic in the regional economic literature. Large disparities in terms of GDP per capita and of labour market outcomes persist since the beginnings of the XX century (Gagliardi and Percoco, 2010).

In this paper, we advance the hypothesis that South-North selective migration is tightly linked to university students migration. According to Svimez (2009), about one quarter of Southern students enrol in a Centre-Northern university and, after the graduation, only one third of them returns to Southern regions, while the remaining two thirds (about 11,000 on average across the recent years) remain in the Centre-North. Overall, despite the large increase in the number of universities and campuses, the number of university students has remained stable over the period 1990-2006 (Table 1).

Table 1 – Evolution of Italian University

<table>
<thead>
<tr>
<th>Year</th>
<th>1990-91</th>
<th>1999-00</th>
<th>2005-06</th>
</tr>
</thead>
<tbody>
<tr>
<td>University (n.)</td>
<td>55</td>
<td>70</td>
<td>79</td>
</tr>
<tr>
<td>Campus (n.)</td>
<td>62</td>
<td>89</td>
<td>342</td>
</tr>
<tr>
<td>Campus/Univ.</td>
<td>1,13</td>
<td>1.27</td>
<td>4.33</td>
</tr>
<tr>
<td>Univ. Mono-campus</td>
<td>89%</td>
<td>76%</td>
<td>33%</td>
</tr>
<tr>
<td>Univ. Pluri-campus</td>
<td>11%</td>
<td>24%</td>
<td>67%</td>
</tr>
<tr>
<td>Students enrolled</td>
<td>1,3 mln</td>
<td>1,6 mln</td>
<td>1,3 mln*</td>
</tr>
<tr>
<td>(bachelor and master students)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In central campus</td>
<td>97%</td>
<td>95%</td>
<td>11%</td>
</tr>
<tr>
<td>In peripheral campus</td>
<td>3%</td>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>

Sources: ISTAT and MIUR (Dotti, 2007). *data for MSc students are incomplete

Table 2 reports working conditions of Southern graduates according to their region of residence and of study. It emerges that studying in a Centre-Northern university has a clear advantage in terms of labour market outcomes. For this reason, when looking at actual trajectories followed by young people born in the poorer South, we understand why staying in the South to study and work is a choice whose expected value is low, and much more attractive is the perspective to move North to have a higher probability to find a job, and a more qualified one. Moreover, moving after having graduated is less common because of the lack of professional ties formed during the study period and because the most footloose persons would have already moved. This means that the most common trajectory for ambitious and high potential young southerners is the thicker one in Figure 1, which sees them moving North already to enrol in a university and then staying there to work. In the
same figure, arrows from North to south are dotted because they are very uncommon, as we will see next.

![Figure 1: Possible trajectories for students born in richer North or poorer South (from Dotti, 2007).](image)

![Table 2: Working conditions of Southern graduates (2007)](table)

<table>
<thead>
<tr>
<th>Current residence:</th>
<th>Employed</th>
<th>Not employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>South</td>
<td>36.8</td>
<td>61.3</td>
</tr>
<tr>
<td>Center-North</td>
<td>23.3</td>
<td>75.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Place of study</th>
<th>Employed</th>
<th>Not employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>South</td>
<td>35.1</td>
<td>63.5</td>
</tr>
<tr>
<td>Center-North</td>
<td>21.9</td>
<td>76.0</td>
</tr>
</tbody>
</table>

Source: Svimez (2009).

The characteristics of university system are extremely relevant to assess migrations of highly skilled people. We will assume first the perspective of attracting territories and then for territories that suffer brain drain.

If a region is able to attract university students from other regions, it means that this region is attracting potentially highly skilled people. This is a specific segment of the population with a specific impact, as mentioned above. Attractive regions receive an extra population increasing the demand for some specific kinds of consumption, although these people have generally a limited propensity to consume because generally they do not earn a real wage. Furthermore, attractive regions sells a service in terms of education. However, this service has a limited benefit, specifically in the case of Italy where the university system is largely dominated by public universities and private ones have significant public constraints.

This ‘quality’ is relevant because provides local firms with extra workforce that will develop knowledge in the territory. Therefore, university might adapt curricula to local needs,
implicitly or explicitly. Furthermore, the possibility for internships in the late period of university or just after graduation could represent a link between students, university and firms. Obviously, this is an opportunity for both local and incoming students, whereas immigration enlarges offers of students and graduates.

Moreover, the attraction of students is one of the few period of life where there is an increased willingness to move. Otherwise, for local firms the attraction of senior workers it is harder because this imply to attract also their families. This factor seems more relevant in the case of Italy, considering the features of Latin culture. However, it is a general trend the fact that young people are more adaptable and have higher inclination to move.

Finally, we have to consider the effects for territories suffering brain drain. First of all, students moving out have to be maintained by their families or other institutions. These costs constitute a transfer of income in favour of attracting regions. It is obvious that in the case of poorer regions not all the families might be able to support this expenditure which is twofold: the direct costs of fees and other living expenditures and the opportunity-costs. Secondly, families will pay studies just in worthwhile cases, this means that only for good students families will pay their education. Furthermore, this implies that if a student moves out from his/her region, this means that he/she will do to enrol in a ‘better’ university than the local one, although the criteria to define a ‘better’ university could be complex to define. For this reason, if a region loses young students, it is losing ‘good students’, although this might be temporary. However, this region do not have any specific guarantee to ‘have students back’ according to the freedom of movement assured in democratic countries. Therefore, the origin region might pay studies to people that will not pay back that. Finally, regions involved in this emigration process assumes a negative reputation that might affect the capability to attract external investments because firms will not invest in a territory where most productive workers are leaving.

With statistical data, of all university enrolment of Italian Students from 2003 to 2009 at (MIUR, 2010) at provincial level (NUTS-3) we are able to study the actual attractiveness of Italian universities and provincial labour markets. As in all places better universities attract students from areas with universities with lower reputation or lower course choice, and this also happens in Italy, where normally universities are located in cities and, for this reason, the provinces with the largest cities are attractors with respect to more peripheral provinces.

For each Italian province we estimated an attraction index calculated as it is traditional in trade theory, using university enrolment flows rather than trade flows. The provincial attractiveness is calculated with the following formula, where $S_{in}$ represents the number of students resident in other provinces which enrol in the province and South are the resident which enrol as university students in other provinces:

$$PA = \frac{S_{in}}{S_{in} + S_{out}}.$$
This provincial attractiveness index is positive for attractive provinces and negative for sending ones. By looking at Figure 2a, we can observe that there are attractive provinces in all Italian regions, and that they tend to coincide with the most important cities as well as some traditional university towns (going back sometimes to the Middle Age). By looking at this map it appears that student university flows are disconnected from the economic dualism, since many attractive provinces can be found in southern Italy. Due to the relatively small distances in Italy, however, Figure 2a mainly represents commuting flows rather than relocations. It is in fact relatively easy and the norm for Italian students to commute to the university if they do not live too far because of the scarce number of dorms, which is about one fifth of France or one sixth of Germany (Biggeri and Catalano, 2006).

![UNIVERSITY ATTRACTIVENESS (all the students)](image1)

![UNIVERSITY ATTRACTIVENESS (>200 km)](image2)

*Figure 2: The attractiveness of university students of Italian provinces. A) Attractiveness of all students, B) Attractiveness of students resident more than 200 Km away.*

To detect the actual relocations, we map in Figure 2b the same provincial attractiveness index but computed for only those students for whom the province of residence and the one of study are more than 200 Km away, these are only those students who actually relocate to study. The picture which emerges is much different: many commuting attractive provinces in the North or the Centre remain attractive also from longer distances, however no Southern
province is attractive including from Naples, which has a long university tradition and whose attractiveness is mainly from farer southern provinces. On the contrary, some Northern provinces, such as in Emilia-Romagna, which are not commuter attractors are long-distance attractors.

In this paper we would like to demonstrate that this somehow strange pattern is not only linked to the quality of the university system, but is linked to the dualism in the labour market, so that the long-distance attractiveness of northern urban provinces is (also) explained by their dynamism in terms of labour market. Our hypothesis is that students who move out from home (not simply commuting), do this in favour of provinces and cities where they expect to find a qualified job once they are graduated.

We can first analyze descriptively if this pattern takes place. In Italy an official annual survey of job openings by province exists, where firms are asked if they plan to hire in the next year, how many persons, to do what kind of job and, most important to our purposes, with what level of education and field of study. This database is called Excelsior (see also the Appendix).

If we compute the ratio between the number of expected job openings and the provincial jobs, we could have a rough measure of the provincial attractiveness for graduate job-seekers. In Figure 3, this measure is compared to the attractiveness of non-commuting university students. We can immediately notice that most attractive Northern Universities are generally located in provinces whose labour market is attractive for graduates. On the contrary, all of the South is made of provinces which are neither attractive for long-distance university students nor for graduates, except in the cases of Naples and Bari where, consistently, labour market is relatively dynamic.
A smaller number of provinces in the Centre are attractive for students without having strong labour markets for graduates: this mainly applies to traditional university poles such as Siena and Perugia, which in part rely on closer labour markets such as Rome and Florence, and in part are towns with a strong and historical tradition of campus, where students can go to study and then back home. Finally, there is a non negligible number of northern provinces with attractive labour markets but without a significant university settlement. These are provinces whose residents tend to commute to the main universities around (especially those located in Milan, Venice and Padua), and go back home for work after graduation.

As such, it hence appears that the university system works quite well as a pipe which drains the South of Italy of a significant part the smartest young people in favour of the richer and more economically dynamic North. However, the analysis so far has been descriptive and anecdotic, so in the next sections of the paper we will recur to econometric evidence to investigate if this is confirmed by causal econometrics analysis.
4 The determinants of students migration

4.1 Methodology

In this section of the paper we aim to explain aggregated migration flows of students across Italian provinces. In order to justify our empirical model, let us first consider a very simple and stylized theoretical model in which individual i maximizes his utility across space and will move from place x to y to study if

\[ u_i^x z_i^x, \frac{E[w_i^x]}{(1+r)^\gamma} distance > u_i^y z_i^y, \frac{E[w_i^y]}{(1+r)^\gamma}, \]

where \( u \) denotes utility at location x (or y), \( z \) is a vector of individual characteristics, \( x \) is a vector of socio-economic characteristics of location x (or y), while \( E[w] \) denotes the net value of future wages (w) in location x (or y) discounted at the discount rate r. Variable distance is the distance between x and y.

If expectations are adaptive and are formed by observing current wage, i.e. and \( f \), then equation (2) becomes:

\[ u_i^x f_i(w_0^x) distance > u_i^y f_i(w_0^y), \]

If \( f \) is linear and constant across time, and if \( r \) is equal across locations, then the probability to move from location x to location y can be expressed as:

\[ Pr(move) = f(z, x, y, distance, w_0^x, w_0^y) \]

Hence, if the hypothesis of adaptive expectations is correct, then the choice to move will be made on the observation of current expected wages and in general by observing current labour market conditions.

The main hypothesis of this paper is hence that the characteristics of the local labour market are an important determinant of the choice on whether and where to move for undergraduate studies. As in our case we will make use of aggregated data, this hypothesis is suitable to be tested by estimating a gravity equation where local labour market characteristics are considered as an independent variable influencing the process of producing interregional students migration flows.

As from equation (4), students migration across provinces can be conceived of as a form of spatial interaction, thus being studied within the framework of gravity models. In analogy with Newton’s gravity law, students flows (i.e. interaction intensity) can be predicted according to the following formula:
Where $I_{xy}$ is the interaction intensity or the number of students resident in province $x$ enrolling for graduate courses in province $y$, $K$ is a proportionality constant, $M_x$ is the mass of the province of origin (in this case the number of students resident in province $x$ enrolling for graduate courses in province $x$), $M_y$ is the mass of the province of destination (in this case the number of students resident in province $y$ enrolling for graduate courses in province $y$), $d_{xy}$ is the physical distance between the two provinces, $\theta$ is the potential to generate flows, $\psi$ is the potential to attract flows, and $\lambda$ is an impedance factor reflecting the distance decay in trade (Burger et al., 2009). This model can also accommodate the inclusion of additional variables (Feenstra, 2004).

The choice of estimating a gravity model is not new in the migration literature and Sà et al (2004) also use this approach to estimate a movement law for Dutch students. However, in such case, the authors focused on some universities, so that their origin-destination flow matrix was rectangular, with very few zeroes. In our case, we focus on all provinces because we aim to highlight the potential of a province to attract people with high skills potential.

Traditionally, the usual estimation strategy of gravity models involved the log-linearization of both sides of the equation, the addition of a random disturbance term, so that to convert the multiplicative form into a linear stochastic form, to be estimated by means of ordinary least square methods (OLS). More recently, a series of papers have questioned this estimation strategy pointing to the limitations, inconsistencies and biases it yields. One of the main problem was the failure of the log-linear model to predict flows as $E[\log(I_{xy})] = \log(E[I_{xy}])$.

In addition, this estimation strategy does not allow to properly deal with the presence of zero values in the dependent variable (Burger et al. 2009; Peri, 2005; Santos Silva and Tenreyro, 2006). In fact, whereas gravitational force can be negligible but different from zero, two provinces are likely not to be linked at all by means of students migration (Santos Silva and Tenreyro, 2006).

In several cases, the option pursued was to drop those province pairs with zero flow from the dataset and estimate the log linear form by OLS, while in others, the option pursued was to add a positive constant term to the dependent variable or to use a Tobit estimator. Santos Silva and Tenreyro (2006), however, warn that these procedures generally lead to inconsistent estimates of the parameters of interest.

The dissatisfaction with these strategy has stimulated the search of alternatives; in particular, the possible use of Poisson and modified Poisson models progressively gained attention (e.g. Burger et al., 2009; Peri, 2005; Santos Silva and Tenreyro, 2006). Whereas originally developed to estimate count data, this family of models can easily accommodate applications to non-negative continuous variables, such as students flows across provinces.
The main problem of the Poisson model is that it assumes that the mean and the variance of the dependent variable (students migration, in our case) are equal. Very often, however, the variance exceeds the mean, giving rise to the phenomenon of over-dispersion which produces biased estimates (Cameron et al., 2004). In addition, the Poisson model underestimates the probability of having zero flows, which is crucial for our analysis since about 60% of our observations are zeroes.

In this paper, we specifically make use of the application of zero-inflated models (Long, 1997), which are a specific modified Poisson models family that enables to take into account for the highly skewed distribution of the dependent variable and the extremely large number of zeros it shows. More in details, our model of reference is the zero inflated negative binomial model because of the presence of over-dispersion (i.e. the variance is different from the mean). Relevantly, this specific model enables to distinguish, in the estimation procedure, between two different processes, the one leading to zero outcomes and the one leading to positive count.

The key hypothesis is that there are two latent (i.e., unobserved) groups; in the former i.e. the Always-0 Group, provinces pairs show no student flows from one to another with a probability of 1, while in the latter, i.e. the Not Always-0 Group, students flows from region i to region j might be zero, but there is a nonzero probability that flows can also take on a positive value. In the zero-inflated negative binomial model the first regression (i.e. the inflation regression) provides the estimates of the probability of belonging to the Always-0 Group (by estimating a logit model where the dependent variable takes value 1 when flows are zero and 0 otherwise), whereas the second (i.e. the count regression) provides the estimates of the probability of each count (by estimating a negative binomial model). Therefore, in what follows, we will report two sets of estimates, one for the count regression and one for the inflation regression.

Finally, as all models in the Poisson family, this is inherently heteroschedastic, and requires a robust estimator. It is perhaps worth noting that this is the first time that such modelling framework is applied to study interregional migration flows (the data sources are described in the Appendix of the paper).

4.2 Results

In section 4.1, we have proposed a simple theoretical model where individuals (students) maximize utility across locations and form expectations over future earnings under the assumption of adaptive expectations. Given equation (4), we estimate an econometric model in the form:

\[ \%I_{xy} = f(\text{origin characteristics}, \text{destination characteristics}, \text{distance}, \text{controls}) \]
Where the number of students resident and enrolling for graduate courses in the same province for both province x and y represent the ‘masses’ of province x and y, respectively. This variable is also very correlated with the human capital stock of a given province. It should be noted that our model is fully symmetric, with the sole exception of the dummies indicating the size and attractiveness of the university and the ones for the location of the province of origin. Furthermore, we do not impose the condition of equal coefficient for origin and destination.

The data are very detailed in their spatial and educational characteristics but short as a time series. For this reason, the model has to be estimated as a cross section, with the independent variables lagged in order to reduce the problems of endogeneity. In particular the dependent variable is the number of students resident in one province which enrol at an university in another province, and the lagged explanatory variables are variables which the student should have already observed before taking her choice. Beyond those presented in Table 3, we also considered all other available university characteristics, such as the level of fees or the amount of support for students, which however turn out as non significant because the fees are very similar and very low in all the country. Other variables have been dropped out because they are very university specific and cannot be aggregated as provincial level.

In table 3, we report econometric estimates of our baseline regressions. In particular, in model (1), consistently with the prediction of the gravity model, the greater the masses the greater the number of students moving for region x to region y; also, the effect of geographical distance is negative and statistically significant.

Per-capita income in the destination province positively affects students migration flows while per-capita income in the origin province has no significant effect, consistently with the idea that more developed provinces are able to attract more students. Occupational level in both provinces significantly affects the number of students moving from province x to province y; however, whereas the occupational level in the province of origin has a negative effect, the occupational level in the province of destination has a positive effect, being the effect of the former greater than the effect of the latter. Students migration therefore can be conceived as a reaction to low occupational level in the province of origin and is primarily directed towards provinces with better occupational opportunities. This might also explain why we do not find any significant effect for per-capita income in the origin provinces. It seems in fact that occupational level captures the effect of the actual conditions in the local labour market and, more generally, of the local economy, while per-capita income captures the attractiveness (e.g. the living standards/quality of life) of a province.
Table 3. Estimation results

<table>
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<tr>
<th>VARIABLES</th>
<th>MODEL</th>
<th>IMM 2008</th>
<th>S.E.</th>
<th>SIGN</th>
<th>IMM_ROMA&amp;MILANO</th>
<th>S.E.</th>
<th>SIGN</th>
<th>IMM_SCI</th>
<th>S.E.</th>
<th>SIGN</th>
<th>IMM_SAN</th>
<th>S.E.</th>
<th>SIGN</th>
<th>IMM_SOC</th>
<th>S.E.</th>
<th>SIGN</th>
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<td>Mass (log of remaining students)</td>
<td>destination</td>
<td>0.642</td>
<td>0.057***</td>
<td>0.178</td>
<td>0.046***</td>
<td>0.133</td>
<td>0.061**</td>
<td>0.106</td>
<td>0.072</td>
<td>0.074</td>
<td>0.046</td>
<td>0.034</td>
<td>0.065</td>
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<tr>
<td>Mass (log of remaining students)</td>
<td>origin</td>
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<td>0.047***</td>
<td>0.100</td>
<td>0.030***</td>
<td>0.100</td>
<td>0.030***</td>
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<td>Per capita income (log)</td>
<td>destination</td>
<td>1.678</td>
<td>0.615***</td>
<td>1.384</td>
<td>0.664**</td>
<td>0.237</td>
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<td>Per capita income (log)</td>
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<td>0.152</td>
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<td>0.023</td>
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<td>Presence of rectorate</td>
<td>destination</td>
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<td>0.143**</td>
<td>0.432</td>
<td>0.152**</td>
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<tr>
<td>Presence of rectorate</td>
<td>origin</td>
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<td>0.148***</td>
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<td>0.158</td>
<td>-0.379</td>
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<td>0.172</td>
<td>-0.402</td>
<td>0.210*</td>
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<td>Job openings on jobs (log)</td>
<td>destination</td>
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<td>0.686</td>
<td>0.147***</td>
<td>0.311</td>
<td>1.115</td>
<td>0.107</td>
<td>0.310</td>
<td>0.372</td>
<td>1.041</td>
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<td>0.387</td>
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<td>Job openings on jobs (log)</td>
<td>origin</td>
<td>0.203</td>
<td>0.171</td>
<td>0.145</td>
<td>0.179</td>
<td>0.192</td>
<td>0.128</td>
<td>-0.219</td>
<td>0.196</td>
<td>0.638</td>
<td>0.180***</td>
<td>0.324</td>
<td>0.214</td>
<td>0.137</td>
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<td>House prices (log)</td>
<td>destination</td>
<td>-0.357</td>
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<td>-0.393</td>
<td>0.210*</td>
<td>-1.194</td>
<td>0.341***</td>
<td>-0.189</td>
<td>0.360</td>
<td>0.401</td>
<td>0.223*</td>
<td>-0.046</td>
<td>0.226*</td>
<td>-0.074</td>
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<td>House prices (log)</td>
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<td>-0.119</td>
<td>0.337</td>
<td>0.128</td>
<td>0.325</td>
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<td>0.311</td>
<td>0.035</td>
<td>0.264</td>
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<td>-0.191</td>
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<td>National university attraction poles (dummy)</td>
<td>destination</td>
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<td>0.039</td>
<td>0.158</td>
<td>0.237</td>
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<td>origin</td>
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<td>0.199</td>
<td>0.165</td>
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<td>-0.366</td>
<td>0.213*</td>
<td>0.608</td>
<td>0.163***</td>
<td>0.177</td>
<td>0.187</td>
<td>0.441</td>
<td>0.081***</td>
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<td>Centre (dummy)</td>
<td>destination</td>
<td>0.222</td>
<td>0.161</td>
<td>0.084</td>
<td>0.161</td>
<td>0.160</td>
<td>0.190</td>
<td>-0.155</td>
<td>0.189</td>
<td>0.253</td>
<td>0.162</td>
<td>-0.090</td>
<td>0.197</td>
<td>-0.028</td>
<td>0.203</td>
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<tr>
<td>South (dummy)</td>
<td>destination</td>
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<td>0.450***</td>
<td>1.552</td>
<td>0.459***</td>
<td>1.538</td>
<td>0.521***</td>
<td>0.489</td>
<td>0.576</td>
<td>2.173</td>
<td>0.414***</td>
<td>1.335</td>
<td>0.524***</td>
<td>1.517</td>
<td>0.528***</td>
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</tbody>
</table>

**Notes:**

- Wald Chi2
- N obs
- Nonzero obs
- Zero obs
- Wald Chi2
- Significance levels:
  - **p < 0.01**
  - *p < 0.05**
  - *p < 0.10**

- Centre (dummy) is the base category for the model.
Related to this, the existence of a vibrant local labour market in the destination province acts as an attractor for students’ migration, while the effect of the number of job vacancies in the origin province does not have a significant effect on students' migration flows. Students migration therefore responds to labour market incentives, i.e. flows are directed towards more dynamic areas in terms of job vacancies. This result seems to confirm our hypothesis that students make the migration choice on the basis of adaptive expectations. These results seem to confirm two hypotheses we have advanced. First, that students make the choice to migrate also on the basis of local labour market outcomes, and that they make their expectations by observing current outcomes in terms of expected income and of the job opportunities, as measured by job vacancies.

The housing price level does not significantly affect migration flows; the effect of rent prices might be already captured by the per-capita income variable, as meant to be a proxy for a province attractiveness and living standards. This result is interesting if we move from the theory of spatial equilibrium. Glaeser and Gottlieb (2009) find that, once amenities and housing prices are fully considered, the level of utility is equal all across U.S. cities. We do not know yet whether also Italy (and Europe in general) is characterized by such equilibrium, but our analysis points out that housing prices do not affect the decision of students to migrate. In other words, if we consider housing prices as a price index to discount expected income across the space, then it emerges from our results that it is not relevant.

As for university related variables, the number of university campuses does not have a significant effect on students migration; on the other side, students are likely to migrate from provinces that do not host university “Rettorato” (the place with the offices of the Rector) towards provinces that do host it. In fact, “Rettorato” can be interpreted as a proxy for university reputation and attractiveness. This result is also consistent with the observation that the “Rettorato” is generally placed in larger cities which are more likely to host a larger number of university campuses. Differently, the size of the campus, as captured by the dummy ‘nationals’ and ‘locals’ does not have a significant effect. This effect however might be already captured by the effect of the ‘masses’ variables discussed above.

Finally, our results also suggest that students coming from Southern provinces are more likely to migrate pointing to the well know North-South divide that characterizes the Italian economy.

The inflation regression largely confirms these findings although some new interesting indications come out. In particular, the effect of masses variable and distance is consistent with the count regression. On the other side, the effect of the occupational level and number of job openings variables is anymore significant while the effect of per-capita income of the origin province is positive whereas that of the destination province is negative. It might be argued that the labour market conditions in the origin province, measured in terms of occupational level and the number of job openings, do not affect the probability that no flow
takes place (i.e. the probability of a zero count) but rather the actual number of students moving from one specific province to another (i.e. students migration intensity). Differently, once per-capita income is interpreted as a proxy for local attractiveness, it is reasonable that per capita income of the origin province positively affects the probability not to observe students outflows; in fact, wealthier cities experience lower level of students migration than cities affected by worse socio-economic conditions as well as wealthier cities attract more students (which is consistent with the count regression results too).

Additionally, the rent level of the origin province has a negative impact on the probability to observe no migration: the higher the rent level the greater the probability to observe students migration out of the province. This is consistent with the idea that rent level can be considered a proxy for the local living standards; the higher the rent level the lower the living standards, the greater the probability to observe outflows.

Differently from the count regression, the presence of a ‘Rettorato’ either in the destination or in the origin province does not significantly affect the probability not to observe students migration. Rather, the number of campuses in both in the destination and in the origin province significantly affects the probability not to observe students migration.

Finally, as for the control variables (i.e. ‘National university attraction poles’, ‘Small universities’, ‘Centre’, ‘South’) provinces hosting universities which have a national market area, albeit small, are less likely to be affected by students outflows; also, northern origin provinces are more likely to generate students outflows as compared to central and southern ones.

In sum, the attractiveness of the destination province not only in terms of greater living standards but also in terms of labour opportunities and occupational level, as well as the presence of high reputation university largely explain students flows form one province to another. However, this is conditional especially upon certain characteristics of the origin province, such as the local living standards (for example, according to the local housing market conditions), the local educational supply, hosting university with a national market area. Interestingly, by looking at marginal effects (available from the authors), the effect of geographical distance, albeit significant, is almost negligible (both in the count and in the inflation regression) as compared to the effect of the other variables, especially those capturing the effect of the destination local labour market. This results are also confirmed if we remove from the analysis those province pairs in which the destination is either Rome or Milan, the two stronger local labour market in Italy with a likely greater attraction potential (model 2 in Table 3).

Our data allows also to split the number of students enrolling for graduate courses in a province different from that of residence according to the discipline of study (models 3 to 6 in Table 3). In particular, we are able to classify students according to four broad fields: Science & Technology (S&T), Humanities, Social Sciences and Medicine and Health care.
Additionally, data on the number of job openings can be split according to company main sector of activity. We thus replicated the previous analysis by regressing the number of mover students enrolling in each of the four scientific disciplines over the number of job openings in the destination province in the corresponding main sector of activities rather than on the total number of job openings in the destination province. Since results are again largely confirmed, we here report for the sake of the brevity only about students enrolling into S&T courses. Only a couple of minor differences stand out in the count regression. In particular, the “Rettorato” variables lose their significance and the rent level in the destination province shows a significant and negative effect on students migration level. As of the inflation regression, several results differ from the baseline model. In particular, differently from the baseline model, the occupational level in the destination province is significant, the per capita income is not significant either in the destination or in the origin, nor it is the “Rettorato” variable of the destination country. Also, the number of job openings in S&T sectors in the destination province is significant with a counterintuitive positive effect on the probability of no migration. Finally, the rent level in the home province, the number of campuses of the destination province and the dummy indicating southern origin provinces lose their significance.

It might be argued that our data prevent us to distinguish between commuters and pure movers whereas, in principles, their enrolment decisions might be affected by different motivations and respond to different incentives. To address this, we restricted in model (7) of Table 3 our attention to large distance migration flows (i.e. more than 200 km distance); this threshold is likely to help us to exclude commuters. Overall, results are confirmed. Some differences, however, stand out. In particular, the effect of the occupational level is anymore significant as well as the presence of a “Rettorato” in the origin province. The number of university campuses in both the origin and destination provinces positively influences students migration flows between two provinces; the number of campuses can actually be considered as a proxy for students population and, ultimately, as a proxy for students masses, making this result consistent with the expectations of the gravitational model. Finally, provinces hosting university with a national market area, albeit small, are more likely to benefit from greater students inflows.

5 Conclusions

In this paper we analyzed the role of universities in regional economic growth by focusing on a less traditional one, the one by which they can act as an instrument for brain gain, allowing regions to attract smart people who often remain after graduation. Thus, universities can also exacerbate the capability of regions with rich economies and dynamic labour markets to attract smart persons from lagging regions.
The paper has verified empirically this mechanism in the Italian case, interesting because of its dual labour market and university system, as evidenced by the descriptive analysis which has shown that no province in the lagging South is a net attractor of university students coming from more than 200 Km away, and only two of them offer above average job perspectives for graduates.

With a 0-inflated gravity model, it has been demonstrated that the attractiveness of provinces for university enrolment is strictly linked to their forecasted job-openings for graduates, meaning that university characteristics are only part of the explanation for the mobility of students and local characteristics are also very important. All variables have the expected signs and the results are robust to geographical controls and to different fields of education.

The results point out that there might be a reinforcing mechanism between university attractiveness and economic development, since universities benefit from the dynamism of the labour market in their area in order to attract smart students, while richer provinces benefit from the presence of attractive universities in order to gain smart young people from lagging areas of the country. This also suggests that university policy cannot be disjoint from other local development policies it has to be effective for an area.

Further research could, hence, be directed towards a more causal link between migration flows and labour market outcomes: although to mitigate the risk of endogeneity we ran our estimates by using one year lagged independent variables as compared to the dependent variable, we had to rely on a pure cross-section.

In addition, the only available measure for the role of physical space in this paper was the metric distance between the province of residence and the province of study. An ampler analysis of the role of spatial spillovers, especially in terms local labour market interactions, could prove to be beneficial for the overall understanding of the phenomenon.
6 References

Banca d’Italia (2005), Relazione Annuale, Banca d’Italia, Rome.


Gagliardi, L. and Percoco, M. (2010), Regional Disparities in Italy Over the Long Run: The Role of Human Capital and Trade Policy, Università Bocconi, mimeo.


Appendix - Data Sources

Housing prices are from the *Annuario immobiliare* and considers the price in euro per squared meter of a house in semi-periphery of the provincial chieftown.

As a proxi for the attractiveness of labour market we make use of a set of very new variables, never used in other analysis, i.e. we use the number of job vacancies in Italian provinces. Our dataset is in particular very detailed, so that we are allowed to distinguish job vacancies into the four categories into which students are classified: Science & Technology (S&T), Humanities, Social Sciences and Medicine and Health care. This is of particular interest when we test our hypothesis for different types of bachelor degrees. The source of these data is the micro-data of Excelsior database (excelsior.unioncamere.net).

Population, employment, GDP and all economic variables apart from housing prices are from ISTAT (the Italian official Institute of Statistics).

Housing price indexes are from Muzzicato et al. (2008).

University students are from ISTAT, “Indagine sulla mobilità degli studenti” and “Anagrafe Nazionale degli Studenti” (National Registry Office for Students) provided by the Ministry of University (MIUR). In this database, there are all the bachelor and master student, with their home province (NUTS3 level) and the municipality (NUTS5) where is located the university campus. This was also used to calculate the average of fees paid by students and how many students receive a scholarship.