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MIGRATION ACROSS SPANISH PROVINCES: EVIDENCE FROM THE SOCIAL SECURITY RECORDS (1978-1992)

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This paper uses Social Security records to study internal migration in Spain. This is the first paper that uses this data source, which has some advantages with respect to existing data sources: it includes only job-seeking migrants and it allows to identify temporary migration. Within the framework of an extended gravity model, we estimate a Generalized Negative Binomial regression on gross migration flows between provinces. We quantify the effect of local labor market imbalances on workers' mobility and discuss the equilibrating role of internal migration in Spain. Our results suggest that the effect of employment opportunities have increased during the sample period: after 1984 migrants seem to be more responsive to economic conditions. Consistently with previous studies for the Spanish labor market, our analysis also confirms the larger internal mobility of highly qualified workers.

Keywords: Geographic labor probility, inmigrant workers, revisional migration.

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1. Introduction

This paper studies internal labor mobility in Spain during the period 1978-1992. Within the framework of an extended gravity model, we estimate a Generalized Negative Binomial regression on gross migration

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flows between provinces. We quantify the effect of local labor market imbalances on workers' mobility, allowing for a different response across skill qualifications, and discuss the equilibrating role of internal migration in Spain.

The way migration reacts to local economic conditions is a key issue: if workers move away from depressed labor markets (relatively high unemployment rates and low wages), this might help in reducing the geographical mismatch between local labor demand and supply. Indeed, internal migration is expected to be one of the main vehicles for labor market adjustment in the European Monetary Union. The case of Spain is informative in this respect, since migration flows are likely to behave differently across countries, due, for instance, to geographical characteristics, cultural reasons, or alternative institutional regimes.

The equilibrating role of internal migration has been addressed in a number of studies. There exist excellent surveys, starting with the influential work by Greenwood (1975); see Greenwood (1993), Greenwood (1997), Hergoz *et al.* (1993). In general, the conclusion is that the response of migration to local labor markets imbalances remains ambiguous.

As far as Spain is concerned, the issue has been addressed by Antolín and Bover (1997), Bentolila and Dolado (1991) and Ródenas (1994b) by focusing on interregional migration (Spanish "*Comunidades Autónomas*"). Bentolila and Dolado, using aggregate migration flows, find that both an increase in a region's relative wage and a fall in its relative unemployment rate cause a (very small) increase of net migration to that region. Antolín and Bover use individual data and conclude that a regional unemployment differential has a strong, wrong-signed effect. They also find that people tend to leave from high real wage regions. Ródenas (1994b) uses three cross-sections of gross migration flows (1973, 1985, 1989) and estimates a gravity model similar to the one presented here. Her main conclusion is that, during the decade of the 1980s, migration has become more responsive to local conditions such as local real estate markets or the local composition of the labor force, and less responsive to traditional economic variables such as wages or unemployment rates.

With respect to these previous studies, two main contributions of this paper are worth emphasizing. First, we provide a new data source for

studying internal migration in Spain, by using the records of Spanish Social Security. Second, we conduct a more disaggregated analysis, by looking at the effect of local labor market conditions on migration flows between provinces (Spanish "*Provincias*"). Section 2 describes the data, points out pros and cons of looking at provinces rather than regions and discusses some related literature.

Our analysis suggests that the response of migration to local economic conditions has increased along the sample period. During the period 1986-1992 we find that workers move to locations with more developed service sectors, higher wages and higher growth of employment. However, the equilibrating role of migration seems to have been lower during the period 1978-1984, when employment opportunities are found to have no significant effect on labor mobility.

In both periods, the effect of unemployment rate differentials varies across categories of workers. For highly qualified workers (qualification 1) a higher unemployment rate prompts people to change province; on the contrary, it has a perverse effect on low qualified workers (qualification 3). Our analysis also confirms the larger internal mobility of highly qualified workers.

The remainder of the paper is organized as follows: Section 2 describes the data and discusses the choice of the dependent variable; Section 3 introduces the framework of analysis; Section 4 presents the results; Section 5 concludes. The construction of the data base is explained in Appendix 1. Appendix 2 contains all tables and figures.

2. The data

The main statistical sources for studying internal migration in Spain are[1]: the general census (*Censos de la población de España* and *Padrón municipal de habitantes*), used, among others, by Olano (1990) and Ródenas (1994a); the data on residential changes (provided by the National Institute of Statistic, INE), used, for instance, by Arellano and Bover (2001), Bentolila and Dolado (1991) and Ródenas (1994b); the Spanish Labor Force Survey (*Encuesta de Población Activa*, thereafter EPA), which has been used by Antolín and Bover (1997); finally, migration can be studied as a residual variable, as in Bentolila and Jimeno (1995), where the behavior of migration is captured by the

[1] See Olano (1990).

difference between the change in employment, on the one hand, and those of unemployment and participation, on the other[2].

This paper provides a new piece of evidence for studying internal workers' mobility in Spain. We use the records of Spanish Social Security (*Cuentas de Cotización de la Seguridad Social, Fichero Técnico de Cuentas de Cotización*, SSR, hereafter). For each match between firm and employee the records report the province where the firm is located; by checking changes through the working history of employees, we can reconstruct their geographical movements. At some moment in time we observe a worker employed in province i; afterwards, the same worker is observed to be employed in province j. In this case we say that the worker migrates. As a consequence, we only observe migration following a successful job seeking activity.

The main shortcoming of this measure of labor mobility is that we actually do not know when migration occurs. It can be the case that a worker migrates from i to j at the beginning of his/her unemployment spell, but we only observe this movement when the new match occurs. This discrepancy can be relevant when unemployment spells are large. As an extreme case, migrants who never find a job in the province of destination are not observed at all. Workers who get their first job by migrating to a new province are not counted either.

The SSR data set has, however, some appealing features with respect to the other available data sources, which are worth to be emphasized. First of all, it allows to identify temporary migration. In general, administrative data do not record short-run migration (people do not need to change residence). The EPA too fails to measure temporary migration. Indeed, in the EPA migration is defined by referring to previous year place of residence. As a consequence, if a worker finds a temporary job in another province, but returns within the year, this is not registered as migration in the EPA; on the contrary, it is recorded twice in SSR, both when the migrant leaves the province and when he/she returns. In fact, if one is interested in the equilibrating role of labor mobility, temporary migration might be as important as long-run migration. This aspect is particularly relevant in Spain, which has experienced a dramatic increase in the proportion of temporary jobs

[2]Indirect evidence of workers mobility across Spanish regions can also be found in Castillo *et al.* (1998).

after the 1984 labor market reform[3]. Of course some of the workers who find a job in a nearby province may actually not change their residence. Only if the provinces are sufficiently far away there is no doubt that what we observe is an actual change of residence. Therefore our migration flows could more accurately be called flows, though most of them are actually migration events.

A second, remarkable feature of the SSR is that they allow us to focus exclusively on job-seeking migration. People move for many different reasons or combinations of reasons (as quality of life, family links, studying) other than as a reaction to local economic conditions. Of course, factors influencing migration are likely to differ between people seeking to change employment (and residence, if necessary) and people moving for other reasons. This problem, known in the literature as multi-stream migration problem[4], is often handled by restricting the analysis to a subset of flows, expected to be more homogeneous. In particular, long-distance (interregional) migration is expected to be mostly determined by job-seeking reasons, while short distance (intraregional) migration, by residential choices[5]. However, this identification strategy is questionable. On the one hand, in fact a large proportion of long-distance migration is not determined by job-seeking reasons. For instance, Bentolila and Dolado (1991) look at migration across Spanish regions (long distance migration) and find that 60% of migrants were "non-active". On the other hand, some job-seeking migrants actually move between provinces in the same region, and it would be a loss of information to exclude them from the analysis. Since SSR data only record labor flows, they are almost exempted from this problem.

2.1 Specification of the dependent variable

From the original data we construct a panel of migration flows, by counting the number of migrants - as defined above - between provinces every two years. We do not use yearly flows both in order to reduce the dimensionality of the data-set and to make the data comparable with disposable provincial figures, which are available in odd num-

[3] Temporary workers comprised 10% of total employment in 1983, the year before the reform. In 1992, the last year of our sample, the proportion had reached 33% of total employment; cfr. Aguirregabiria and Alonso-Borrego (1998) and Segura *et al.* (1991).

[4] See Gordon (1991).

[5] Cfr. Molho (1984).

bered years. Previous studies[6] find that internal migration in developed countries is mostly migration of high-skilled workers. For this reason, we distinguish migration flows according to workers' qualification. Workers are grouped into four categories[7]: types from 1 to 3 are in descending order of qualification; type 4 are pensioners. For each year, and each qualification, the square matrix of gross flows has 50 rows, corresponding to the Spanish provinces (Ceuta and Melilla were excluded from the analysis); the entries in the diagonal, which we later ignore, are zero by definition. The panel of migration flows has 80,000 observations (8 biannual dates from 1978 to 1992, by 4 qualification groups, by 50 multiplied by 50 province pairs).

Since our focus on gross interprovincial migration raises several issues of data availability for the regressors, econometrics tools and computational dimensionality, we next try to motivate these choices.

First, we look at migration across provinces, while most of existing studies[8] focus on interregional migration (mainly, in order to deal with non-economic migration). As discussed in the previous section, the dichotomy interregional/interprovincial mobility might not be fully appropriate to get rid of the multi-streams nature of migration. This problem is particularly relevant for Spain, since the path of economic development during the last 30 years has not been homogeneous across regions and, within regions, across provinces of Spain, with some provinces taking-off after the second oil crisis[9]. As a consequence, job-seeking migrants might have progressively shifted to closer destinations: if the cost of migration increases with distance, people might optimally move to a province in the same region, rather than to a richer (and more distant) destination. Indeed, short-distance migration in Spain has steadily increased, beginning from the early 1970's; this increase has been dramatic after 1982[10]. According to our data, more than 25% of labor migration takes place within regions.

[6] See, for instance, Antolín and Bover (1993), Bean *et al.* (1990), Burda and Wyplosz (1992), Greenwood (1997), Huges and McCormick (1994) and Shioji (1995).

[7] See Appendix 1.

[8] See Antolín and Bover (1997), Bentolila and Dolado (1991), Bentolila and Jimeno (1995), Castillo *et al.* (1998) and Ródenas (1994b). Arellano and Bover (2001) have recently investigated the determinants of within region migration, looking both at the effect of individual characteristics and of aggregate regional economic variables.

[9] References in Ródenas (1994a).

[10] See Olano (1990), Ródenas (1994a) and Arellano and Bover (2001).

Second, we focus on bilateral flows. By looking at bilateral flows, we can express market incentives for migration in terms of the relative attractiveness of origin and destination. Previous studies[11] for Spain regress migration on the difference between local variables and nation-wide levels. This approach does not allow one to pick-up pull factors of migration (features of the destination areas which attract immigrants). Furthermore, it is not clear why the local push factors (characteristics of the origin areas which generate out-migration) should be caught either. The reason is, once again, that moving is costly and the cost of migration is likely to increase with distance. With only two regions this observation is pointless, but with more than one possible destination, the attractiveness of alternatives definitely depends on their relative distance[12].

Finally, we use gross flows. Gross and net migration flows have a quite different behavior and restricting the analysis to the latter would entail a substantial loss of information[13]. We come back to this point in the next section.

2.2 A descriptive analysis of migration flows

During the whole sample period, we observe 15,293 migrants over 678,695 total registered workers, corresponding to the 2.25% of the sample. This value is higher than the one obtained from other sources. The annual emigration rates reported by Ródenas (1994a) reached at most 1.69% in 1989, the last year of the sample. Two reasons could help to explain the difference. First, as already noted, official data from INE fail to take into account temporary migration; this inevitably underestimates migration. Second, the migration rate computed by Ródenas refers to the whole population; in fact, active population is more mobile than non-active population[14]. Antolín and Bover (1997) use pooled cross-sections from the EPA and find that only the 0.295% of the sample migrate. Since Antolín and Bover are concerned with interregional migration, we checked whether the huge difference with our findings is due to higher interprovincial mobility, relative to inter-

[11] See, for instance, Antolín, Bover (1997) and Bentolila, Dolado (1991).

[12] Feder' s aggregation method solves the problem by collapsing the information in all other provinces into a single variable, using distance between i and j (d_{ij}) as a weighting mechanism. Cfr. Feder (1980), Foot, Milne (1990) and Milne (1991).

[13] Ródenas (1994b) studies interregional migration in Spain using gross bilateral flows.

[14] Ródenas (1994a), pag. 252.

regional mobility. However, the rate of interregional mobility is 1.68% (11,453 migrations across regions). Even when we focus on the last two periods of our sample (the period considered by Antolín and Bover) figures change only slightly.

Table 1 provides the number (and percentage) of interregional and interprovincial migrants by qualifications. The resulting picture is that of a labor market much more integrated for high skill workers. Pensioners do not show great mobility.

TABLE 1
Number (%) of migrants over the period 1978-92*

Category	Total Affiliates	Interregional	Interprovincial
Qualification 1	62159	1418 (2.28%)	2088 (3.36%)
Qualification. 2	127555	2365 (1.85%)	3175 (2.48%)
Qualification. 3	345969	6400 (1.84%)	8401 (2.42%)
Pensioners	143012	1279 (0.88%)	1629 (1.14%)
TOTAL	678693	11453 (1.68%)	15293 (2.25%)

* Total Affiliates is not equal to Total Workers in the sample. See Appendix 1.

We compute the rate of immigration by qualification (number of immigrants to a province i divided by the total number of affiliates in that province) and the rate of emigration (emigrants over affiliates). Workers of qualification 1 exhibit a higher average rate of migration (near double with respect to qualification 3) and a much higher standard deviation (see Table 2).

TABLE 2
Inmigration and emigration rates

Category	Average Inmigration (Standard Deviation)	Average Emigration (Standard Deviation)
Qualification 1	0.048 (0.041)	0.051 (0.055)
Qualification 2	0.032 (0.023)	0.030 (0.022)
Qualification 3	0.027 (0.017)	0.027 (0.019)
Pensioners	0.013 (0.015)	0.012 (0.012)

Figure 1 plots the rate of emigration. It is worth noting that migration is highly pro-cyclical for all groups but pensioners. Figure 2 plots the national unemployment rate.

Low mobility is associated with high unemployment rates: during recessions flows are reduced; on the other hand, internal migration increases during economic recovery[15]. It seems that the recession of the

[15] Same finding in Ródenas (1994a, 1994b). The author shows that the decade 1960-70 was characterized by very high mobility; a reduction of mobility took place in the

FIGURE 1
Migration rate (by Qualification)

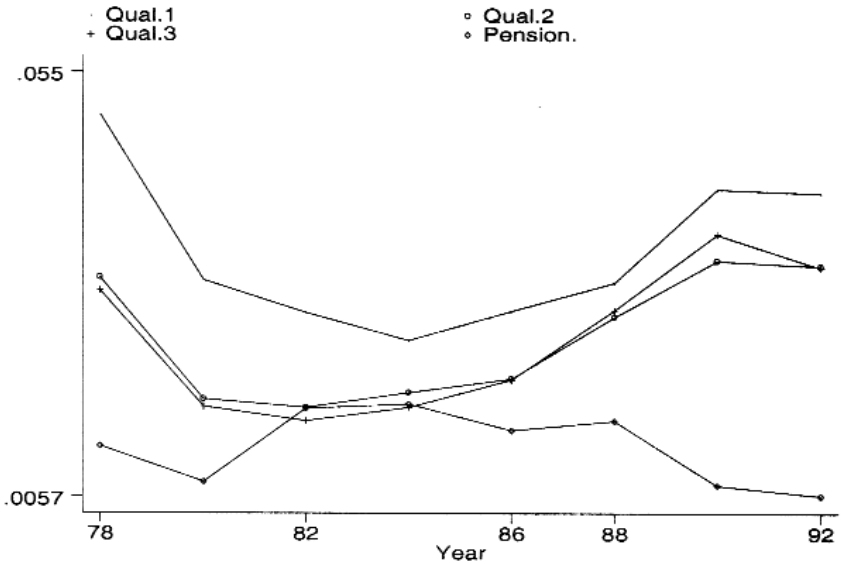
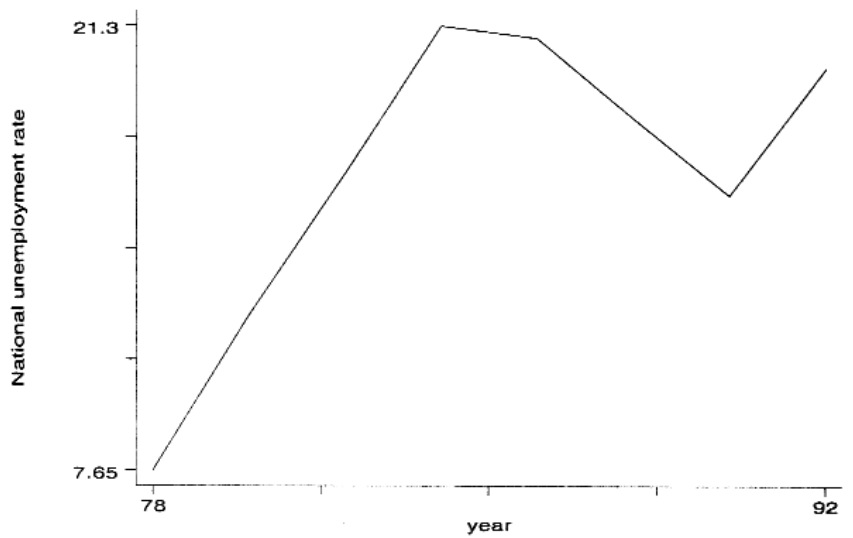


FIGURE 2
National unemployment rate



1970s, especially during the period 1971-75. In between 1986 and 1989 migration was even higher than during the 60's.

early 1990's reduced migration flows. This observation, which has a clear theoretical explanation[16], suggests that the equilibrating role of labor mobility reduces during economic slow-down.

One clear feature of the data is that relatively high gross outflows and inflows generate very small net flows. In our sample, the average rate of net immigration (defined for each province as the total number of immigrants minus the total number of emigrants, divided by the number of affiliates) is of the order of 0.002 for workers of qualification 1 and 2 and 0.0007 for workers of qualification 3. In other words, on average provinces with large outflows also have comparable inflows of workers of the same qualification. In the literature this is known as the Lowry effect. In Spain, the Lowry effect emerged only recently[17]. Bentolila and Dolado (1991), analyzing migration flows between 1962 and 1986, claim that the unidirectionality of flows makes gross and net migration behave quite comparably for most of the period. However, they detect a clear pattern only until 1976.

The absence of any strong unidirectionality of workers' flows can also be appreciated by looking at the cross correlations matrix of immigration and emigration rates (Table 3). Indeed, the correlation of inflows and outflows of workers of the same category is relatively high, reaching 0.82 for qualification 3. The exception is the correlation between immigration and emigration rates for pensioners, which is not statistically significant at the 5% level.

TABLE 3
Correlation matrix of immigration and emigration rates

	I1	I2	I3	I4	E1	E2	E3
I1	1.000						
I2	0.177	1.000					
I3	0.235	0.460	1.000				
I4	-0.068*	-0.047	0.111	1.000			
E1	0.523	0.224	0.181	-0.077*	1.000		
E2	0.106	0.432	0.439	0.090*	0.175	1.000	
E3	0.207	0.475	0.825	0.169	0.153	0.396	1.000
E4	0.009*	-0.169	-0.105	0.046*	0.114	-0.018*	-0.160

Note: I*q* and E*q* are immigration and emigration rate for qualification *q*.
* Not significant at 5%.

[16] See Section 3.1.
[17] Olano (1990) was perhaps the first in recording the new pattern of internal migration in Spain.

From Table 3 it can also be appreciated the very low correlation of immigration (and emigration) rates for different types of workers. For instance, the correlation between the immigration rate of workers of qualification 1 and qualification 2 is 0.17. Again, pensioners behave differently: the correlation of their immigration and emigration rate with migration of other categories of workers is either statistically insignificant or negative.

These observations have a direct impact on net flows, which we computed as the total number of immigrants to a province minus total number of emigrants from the same province, distinguished by qualification. The correlation of net migration flows across qualifications, not reported in the paper, is extremely low. This feature does not change by considering net migration during the whole period: the correlation between total net flows (obtained by summing net flows over time) for different qualifications is extremely low or even negative, as it is the case between qualification 3 and qualifications 1 and 2.

As an example, it is illustrative to look at two big cities, Barcelona and Madrid. Both Barcelona and Madrid have negative net flows (see Table 4). However, if we look at the balance for the 4 different groups, they behave quite differently. Barcelona gained 29 workers of qualification 1, while the net-flows are negative for the other three groups. On the other hand, Madrid lost 118 workers of qualification 1 and 2, and this is offset by a net arrival of 110 workers of low qualification 3. The same table characterizes the Lowry effect for Madrid; the pattern of in and out migration is similar for almost all the other provinces.

TABLE 4
Migration flows (1978-92): Barcelona and Madrid

	Barcelona	Madrid		
	Net flows	Net flows	Inflows	Outflows
Qualification 1	29	-27	310	337
Qualification 2	-76	-91	475	566
Qualification 3	-3	110	878	768
Pensioners	-21	-5	191	196
Total	-71	-13	1854	1867

Two main facts emerge from this descriptive section. First, interprovincial migration exhibits a strong Lowry effect. Second, workers' qualifications affect their mobility decisions; we will further explore the issue later in the paper.

3. The framework of analysis

Internal migration can be described by means of a square matrix, whose rows and columns are locations within a country. The element (ij) represents the number of migrants from location i to location j, M_{ij} (in this section the indices for year and qualification have been suppressed in order to simplify the notation). In general, the matrix has larger values for migration between large places and/or in correspondence of locations which are geographically closer. Population size can itself influence migration if people care about the dimension of the province (for instance, big cities could be preferred because of the easier access to services). Moreover, the total number of vacancies arising in a province j is proportional to j's population size, because of the natural turnover of its labor force[18], and missing data on vacancies, they are proxied by population size.

The baseline gravity model tries to capture these regularities by modeling M_{ij} as directly proportional to the population size of areas (P_i and P_j) and inversely proportional to the distance (d_{ij}). Assuming multiplicative errors and taking logarithms:

$$\ln(M_{ij}) = \mu_0 + \mu_1 \ln(P_i) + \mu_2 \ln(P_j) + \mu_3 \ln(d_{ij}) + \varepsilon_{ij} \qquad [1]$$

where the μ's are coefficients. Treating $\ln(M_{ij})$ as a continuous variable and assuming errors to be log-normally distributed, the model can be estimated by means of standard econometric tools.

However, a trivial feature of the migration matrix is that the larger the number of locations considered, the greater the proportion of zeros and of very small values, and the dependent variable is clearly discrete in nature. When this occurs, the Poisson regression model improves on the log-linear model. The Poisson regression model specifies the probability of M_{ij} persons moving from origin i to destination j as drawn from a Poisson distribution with parameter λ_{ij}:

$$prob(M_{ij}) = \frac{e^{-\lambda_{ij}} \lambda_{ij}^{M_{ij}}}{M_{ij}!} \qquad M_{ij} = 0, 1, 2, ... \qquad [2]$$

where λ_{ij} is the mean of the distribution. λ_{ij} can be related to a set of regressors X_{ij}:

$$\lambda_{ij} = \exp(\mu X_{ij}) \qquad [3]$$

[18] Vanderkamp (1977) shows that an aggregate migration function of the gravity type emerges from a search model in which migration is seen as a response to information about vacancies in other locations.

where μ is the vector of parameters.

However, one assumption implicit in the Poisson model is that the variance of M_{ij} equals its mean λ_{ij}. In fact, migration flows often show a greater variability than expected under the Poisson model. This situation is denoted in the literature as overdispersion, or extra-Poisson variation. In the presence of extra-Poisson variation, the assumption that data are Poisson affects the estimates and results in wrong (overstated) significance levels of the independent variables.

Many reasons can explain overdispersion in the data[19]. It may be caused because the model does not include all the relevant explanatory variables, or because the covariates, which are typically represented by averages of the areas, might not succeed in capturing the variance of individuals' opportunities. Finally, the Poisson model assumes that migration events are independent over time, over space and between individual movers. Violation of any of these assumption leads to a violation of the Poisson variance assumption. This last problem becomes even more serious when bilateral flows are pooled over time periods[20], as in our study. In fact, we checked whether our migration flows are Poisson distributed, and the comparison of the Chi-squared goodness-of-fit statistic with disposable degrees of freedom indicates the presence of strong overdispersion in the sample.

A common solution to overdispersion is to use the Negative Binomial model. This model introduces an extra-variation in the Poisson model. More precisely, count data of migrants are assumed to be generated by a Poisson process:

$$prob\,(M_{ij}) = \frac{e_{ij}^{-\widetilde{\lambda}_{ij}}\widetilde{\lambda}^{M_{ij}}}{M_{ij}!} \qquad M_{ij} = 0,\, 1,\, 2,\, ... \qquad [4]$$

where:

$$\widetilde{\lambda}_{ij} = \exp\left(\mu X_{ij} + u_{ij}\right) \qquad [5]$$

and u_{ij} is an error term, with:

$$e^{u_{ij}} \sim Gamma\left(\frac{1}{\alpha}, \frac{1}{\alpha}\right) \qquad [6]$$

[19] For an exhaustive review of the topic, see Congdon (1993) and Winkelmann and Zimmermann (1995).
[20] Cfr. Congdon (1993).

The expected value of the migration random variable is $\lambda_{ij} = \mu X_{ij}$, as before, but now the variance is $\lambda_{ij} + \lambda_{ij}^2 \alpha$, where α is known as the overdispersion parameter. The larger α, the greater the overdispersion; if α is zero, than the Negative Binomial model collapses in the Poisson model.

In the baseline gravity model $\mu X_{ij} = \mu_0 + \mu_1 \ln(P_i) + \mu_2 \ln(P_j) + \mu_3 \ln(d_{ij})$. However, the model can be extended to include other variables expected to affect the decision to move. The next section develops a simple human capital model of migration in order to illustrate this point.

3.1 A simple human capital model of migration

Define V_i the value function of an individual living in location i, which can either move to location j or remain:

$$V_i = Max \left\{ u(y_i) + \frac{1}{R} E\left[V_i'\right] ; u(y_i - c) + \frac{1}{R} E\left[V_j'\right] \right\} \qquad [7]$$

where $u(\cdot)$ is the individual's utility function, y_i is income, R is the discount factor, c is the monetary cost of migration and the prime refers to next period value function. Migration is optimal as long as the difference between the discounted expected value function of being in location j and that of staying at home is greater then the loss in utility caused by migration:

$$u(y_i) - u(y_i - c) \leq \frac{1}{R} \left\{ E[V_j'] - E[V_i'] \right\} \qquad [8]$$

The empirical strategy is to assume that the comparison between the value function of leaving and the value function of staying is done in terms of observable characteristics of locations X_j and X_i. If one assumes a linear utility function, then migration is optimal if the associated cost is less or equal to the discounted expected gains: $c \leq \frac{1}{R} \{ f_j(X_j) - f_i(X_i) \}$, where $f_j(\cdot)$ and $f_i(\cdot)$ denote generic functions of the local characteristics. With a more general concave utility function migration is decided if $u(y_i) - u(y_i - c) \leq \frac{1}{R} \{ f_j(X_j) - f_i(X_i) \}$, and the utility loss due to the cost of migration would be inversely related to income y_i, making migration pro-cyclical. In both cases, the probability of migrating is going to be a function of observable characteristics of locations X_i and X_j, and the cost of migration, which might vary with the distance between locations.

The human capital model of migration provides testable conditions under which it is optimal to migrate. However, as already stressed, we only observe migration when the migrant finds a new job in the province of destination. Following Jackman and Savouri (1992), here migration can be viewed as the consequence of a successful job search for (re-)employment, rather than as a pre-condition for it.

3.2 Regression specification

We finally run a Generalized Negative Binomial regression, which performs a maximum likelihood estimation of [4] − [6], and where the logarithm of the overdispersion parameter α is allowed to vary across observations as a linear combination of a set of covariates z_{ij}:

$$\ln \alpha = \delta z_{ij} \qquad [9]$$

Standard errors are computed using the White robust estimator of variance.

The dependent variable of our econometric exercise is M^q_{ijt}, the number of workers[21] of qualification q moving at time t from province i to province j, where, $q = 1, ...3$, $t =$ 1978, 1980, ..., 1992 and $i, j = 1, ..., 50$. The data base for our analysis is constructed by crossing this information coming from records from the Spanish Social Security with provincial data provided by Fundación BBV, as explained in Appendix 1. We use provincial information with a lag; that is, we cross the 1977 provincial data with 1978 migration flows[22], 1979 provincial data with 1980 flows, and so on. All regressors are in logarithms, thus allowing for a direct interpretation of the results in terms of elasticity.

The sample has been split into two sub-samples. The first sub-sample pools together 4 cross-sections, from 1978 to 1984; the second, the remaining 4 cross-sections, from 1986 to 1992. The likelihood ratio test for equal distribution of the two periods allows us to reject the hypothesis of identical distributions at any level of significance.

X^q_{ijt}, the set of regressors for the mean of the distribution, includes the gravity-model variables, in logs. They are: the distance between provinces and the size of origin and destination, measured by the total number of registered workers in the provinces, lagged one period.

[21] Pensioners are excluded from the regression.

[22] We remind that our migration variable includes flows for two years -i.e. migration flows in 1978 include both 1977 and 1978 moves.

The choice of the variables measuring the relative attractiveness of locations has been strongly constrained by data availability at the provincial level. In the final specification X^q_{ijt} includes the logarithm of the ratio[23] (origin/destination) of: the share of employment in the services sector, and the wage rate, the unemployment rate and percentage change of employment, by qualification[24]. The share of employment in the services sector is intended to control for the sectorial composition of the economy; previous studies find that it is a significant determinant of migration[25]. The coefficient of the unemployment rate is allowed to vary across categories of workers. We expect higher employment growth and higher wages in the province of origin to lower out-migration. On the contrary, a higher unemployment rate should increase out-migration. Since the descriptive analysis highlights a different propensity to migrate across groups, in the regression we include dummies for qualifications.

We also include per-capita income of the province of origin and destination. A dummy variable for each year was included (but not reported in the tables of results), in order to control for the heterogeneity caused by pooling together different periods. Overall, they are found to be statistically significant.

Since variables affecting the general attractiveness of each location may have been omitted[26], we follow the common practice[27] of including one dummy variable for each province of origin (not reported in the results), which are found to be statistically significant[28].

[23] By taking the logarithms of the ratios, we are constraining the effect of economic variables to be the same at the origin and destination. This specification allows for an immediate interpretation in terms of the equilibrating role of migration.

[24] Appendix 1 explains the construction of figures by qualification.

[25] Ródenas (1994b) find that the employment share of services is a significant determinant of interregional migration in Spain; Arellano and Bover (2001) and Bover and Velilla (1999) point out the importance of the regional employment in the services sector in driving migration within Spanish regions.

[26] Actually, the number of factors which have been found significant in explaining migration is extremely large; from climate conditions to local public goods, etc. See Ghatak *et al.* (1996) for a recent and exhaustive survey of the literature.

[27] Cfr. Flowerdew (1991).

[28] This specification fits better the data than the alternative of using dummy variables for destinations, which we also explored. We also run the regression without including provincial dummies, getting similar estimates, but lower statistical significance of the regressors related to the local labor market conditions. Finally, we also tried to include dummies for provinces belonging to regions with a coofficial

Finally, the covariates z_{ij} of the (logarithm of the) overdispersion parameter α are a constant, the distance, and the population size of origin and destination, lagged of one period. We also include dummy variables for qualification 1 and 2, in order to allow for different unexplained variability across categories.

4. Results

The regression results are reported in Table 5. For both regressions we test the hypothesis that data are Poisson distributed and the likelihood ratio test allows to rejects the null that α is equal to zero, so that the Negative Binomial model is the appropriate one. Moreover, all the explanatory variables of the overdispersion parameter α are statistically significant. In particular, the unexplained variability increases with distance and decreases with the population size at origin and destination: everything else constant, migration flows are more erratic between small and distant provinces. As the dummies for qualifications are concerned, the estimated coefficients indicate that extra-Poisson variation decreases with workers' qualification.

Let us focus on the period 1986-1992 (the second column of Table 5). Our results suggest that job opportunities are an important determinant of migration. Workers move to locations with more developed services sectors, higher wages and higher growth of employment. The sign of the coefficient of per-capita income in the province of destination is positive, as expected; per-capita income in the province of origin (for which we have no theoretical a-priori) is not statistically significant. The effect of unemployment rate differentials varies across qualifications. For highly qualified workers (qualification 1), a higher unemployment rate prompts people to change province, while it has no statistically significant effect on workers of qualification 2 and has a perverse effect on low qualified workers (qualification 3).

The effect of unemployment rate differentials on migration is controversial; in general, it has been found to be extremely sensitive to the model specification[29].

language, like Catalunya, Galicia or the Basque Country, but they turned out to be insignificant.

[29] See Hergoz *et al.* (1993). For the UK, Hughes and McCormick (1994) found a perverse effect of unemployment rate differentials and a standard role for wages differentials.

TABLE 5
Generalized Negative Binomial Regression for Workers
Dependent variable is M^{q}_{ijt}, the number of workers of qualification q moving at time t from province i to province j

	Period 1978-1984		Period 1986-1992	
Variable	Coefficient	Std. Error[1]	Coefficient	Std. Error[1]
$ln\ Distance_{i,j}$	-1.102	0.037	-1.162	0.028
$ln\ Population_i$	0.253	0.086	0.802	0.072
$ln\ Population_j$	0.712	0.031	0.721	0.021
$ln\ Income_i$	-1.291*	0.680	-0.181**	0.527
$ln\ Income_j$	-0.040**	0.171	0.581	0.118
$ln\ \frac{Share\ of\ Services_i}{Share\ of\ Services_j}$	-0.190	0.057	-0.309	0.063
$ln\ \frac{\%\Delta\ Employment_i}{\%\Delta\ Employment_j}$	-0.617**	0.413	-1.207	0.324
$ln\ \frac{Wage_i}{Wage_j}$	-0.305	0.102	0.209	0.071
$ln\ \left(\frac{Unemployment_i}{Unemployment_j}\right)^{q=1}$	0.245	0.102	0.209	0.071
$ln\ \left(\frac{Unemployment_i}{Unemployment_j}\right)^{q=2}$	-0.010**	0.111	-0.066**	0.072
$ln\ \left(\frac{Unemployment_i}{Unemployment_j}\right)^{q=3}$	-0.268	0.048	-0.200	0.047
Qualification 1	0.699	0.190	1.235	0.136
Qualification 2	0.143**	0.119	0.638	0.086
Constant	17.651*	9.551	-9.756**	7.738
Regression for $ln\ (\alpha)$				
$ln\ Distance_{i,j}$	0.811	0.100	0.662	0.047
$ln\ Population_i$	-0.282	0.080	-0.447	0.046
$ln\ Population_j$	-0.634	0.110	-0.597	0.051
Qualification 1	-1.811	0.408	-1.734	0.198
Qualification 2	-1.429	0.341	-1.496	0.153
Constant	1.809*	0.932	4.060	0.465
Log Likelihood	-7037.879		-14257.682	
Number of obs.	22050		29400	
Model chi2	4862.37		9499.79	
Prob > chi2	0.000		0.000	
Pseudo R2	0.1874	0.1884		

[1] Standard errors are computed using the White robust estimator of the variance.

** Coefficient not significant at 5%.

* Coefficient not significant at 10%.

For Spain, Bentolila and Dolado (1991) find that the effect of unemployment and wages on interregional migration flows is right signed (but small). On the contrary, Antolín and Bover (1997), analyzing the Spanish labor force survey (EPA), report a perverse effect of unemployment (and wages) on migration, and argue that this is mainly due to the anomaly of registered workers at INEM. Ródenas (1994b), finally, finds that after the economic recovery of 1986-1989, these variables are no longer significant.

Actually, our findings need to be qualified. As the effect of wages is concerned, we acknowledge that our analysis suffers from the low quality of disposable provincial data and from the fact that we cannot control for differences in living costs and house prices[30]. Regarding the effect of the unemployment rate differentials, we stress that the SSR data set does not say anything about migrants which do not find a new job. It follows that our findings are still compatible with those obtained by Antolín and Bover (1997), as long "wrong" migration (migration to locations with higher unemployment rates) does not result in re-employment. We also remind that the results are correct *coeteris paribus*. In particular, dummy variables for the provinces of origin are found to be statistically significant and to improve the explanatory power of the model.

Our analysis confirms that higher qualified workers are more mobile. The dummy variables for qualification 1 and 2 are significant and positive. This finding, joint with the above result on the wrong signed elasticity of low qualified workers' migration with respect to the unemployment rate, suggests that the labor market for highly qualified workers is much more integrated. The higher internal mobility of more educated workers is a very well known feature in developed countries and, as argued by Devillanova (1998), this may have perverse effects on the stabilization role of migration.

Note, finally, that the gravity model variables have the expected sign: moves are larger between neighboring provinces, and more populated places attract new workers.

Some remarkable differences characterize the first pooled regression (1978-1984) with respect to the second one (1986-1992), suggesting

[30] In a previous version of this paper we also included housing prices, proxied by renting and real estate income over provincial GNP. However, due to very low quality of the variable, we finally decided to drop it.

that the equilibrating role of migration has been lower during the period 1978-1984. Indeed, until 1984 per-capita income of the province of destination and the change of employment are not statistically significant. Still, sectorial composition affects migration, but the elasticity is lower than in the second period. The interpretation of this result is not obvious. It may be due to the change of the business-cycle conditions (in 1984 the national unemployment rate reached its maximum value of 21.3%). A second possible explanation relies on the temporary contracts labor market reform, in 1984. The reform might have increased internal mobility in Spain[31].

A final remark can be made on the role of return migration. The conventional wisdom is that migrations from the north of Spain to the poorer Southern regions can be explained by return migration of retired workers. Already Antolín and Bover (1997) find that those perverse migration flows are not particularly affected by people near retirement age. Our analysis confirms that pensioners are a relatively small sub-sample of migrants.

5. Conclusions

How do migration flows respond to local economic conditions? Do workers move away from depressed labor markets (relatively high unemployment rates and low wages), thus reducing the geographical mismatch between local labor demand and supply? Do skilled workers behave differently from unskilled workers?

This paper tries to address these questions by using information from the records of Spanish Social Security. We estimate an extended gravity model by performing a Generalized Negative Binomial regression on gross migration flows between Spanish provinces. Four biannual cross-sections are pooled together, from 1978 to 1984 and from 1986 to 1992.

For the period 1986-1992 we find that job opportunities are an important determinant of migration. Workers move to locations with more developed services sectors. Lower local wages, as well as a lower growth of employment, prompt people to change province. On the other hand, the equilibrating role of migration seems to have been lower during the

[31] Lacking a subsample that can act as a control data set, that is a set of migrants affected by the business cycle but not by the labor reforms, we cannot identify these two effects separately.

period 1978-1984, when employment opportunities are found to have no significant effect on labor mobility. We also find that the market of highly qualified workers is more geographically integrated: less educated workers have a lower propensity to migrate and their response to unemployment rate differentials is wrong signed.

A direct comparison of these results with the existing literature on internal migration in Spain is not intuitive, both because of the peculiarity of the information contained in the Social Security records and because we choose to look at migration between provinces, while previous studies analyze regional migration out-flows. Future research should repeat a similar exercise for aggregate regional migration flows. A further line of research, which we are pursuing at the moment, is to look directly at the individual data.

Appendix A1. The data

The data base for this analysis was constructed by crossing information coming from the Spanish Social Security, provincial data from Fundación BBV and distance data computed from maps provided by SAS Institute.

A1.1 Social Security Data

The original data is a random sample of Social Security Records - *Fichero Técnico de Afiliados, Instituto Nacional de la Seguridad Social* provided by *Centro de Estudios Avanzados en Economía, Universidad Carlos III*, see Cardelús-Farré (1993). It has information about 700,000 workers and contains the work history of affiliated workers till July 1993, when the information was downloaded. The total number of records is 4,156,003, and includes information about periods of employment, periods of illness and out-of-employment when INEM (*Instituto Nacional de Empleo*) is paying to the Social Security and information about pensioners. The data provided includes information about age of the workers, Spanish province where the worker is affiliate to the Social Security, professional category of the contribution of the worker to the Social Security, dates when the employment spell starts and ends and type of Social Security system for the worker (*Régimen General, Régimen Agrario*, etc.).

We follow a cleaning strategy similar to García-Fontes and Hopenhayn (1995a and 1995b) and García-Perez (1997). After eliminating incomplete records and keeping only workers affiliated to the General

System (*Régimen General*, we eliminate special systems like Agriculture, Fisheries, and so on; almost all workers, independently of the economic sector where they work, are affiliated to the *Régimen General*), we keep only spells after 1978. From the remaining records we extract a random sample of 682375 records, corresponding to 140100 workers. Based on these records, and by checking changes in location within the working history of each worker, we construct matrices of migration flows by year and qualification as follows. For year $t\,(t = 78, 80, ..., 92)$ we compute the total number of affiliates for each qualification in our sample and the total number of corresponding migration events. The ratio between migration events and total affiliates is our migration rate. We define four qualification groups, based on the Social Security tariff of workers, according to the following table:

TABLE A1.1
Qualification groups

Qualification	Tariff	Definition
1	1	Ingenieros, licenciados y asimilados
	2	Ingenieros técnicos, peritos, ayudantes titulados y asimilados
	3	Jefes administrativos y de taller y asimilados
2	4	Ayudantes no titulados y asimilados
	5	Oficiales administrativos y asimilados
	6	Subalternos y asimilados
	7	Auxiliares administrativos y asimilados
3	8	Oficiales primera y segunda asimilados
	9	Oficiales tercera y especialistas y asimilados
	10	Peones y asimilados
	11	Trabajadores de 17 años
	12	Trabajadores menores de 17 años
4	13	Pensionistas

From this original data we construct a panel of gross migration flows. It has 80,000 observations (8 biannual dates from 78 to 92, by 4 qualification groups, by 50 multiplied by 50 province pairs, including the diagonal, which we later ignore. Each observation has the following variables:

M**:** The actual gross flow from province of origin to province of destination. This is our main dependent variable.

i**:** Province of origin.

j**:** Province of destination.

q**:** Qualification of flows at province of origin.

$Population_i$**:** Total number of affiliate workers to the Social Security at the province of origin.

$Population_j$**:** Total number of affiliate workers at the Social Security in the province of destination.

t**:** Time variable, with values 78, 80, 82, 84, 86, 88, 90 and 92.

t, i, j, and q indexes each observation M_{ijt}^q.

A1.2 Provincial Data

We use the panel constructed by Fundación BBV. This series comes biannually (odd years). The variables used in our analysis are the following:

$\frac{share\,of\,Services_i}{share\,of\,Services_j}$**:** Ratio between employment in the services sector in province of origin to employment in the services sector in province of destination.

$Income_i$**:** Per capita income of province of origin.

$\frac{\%\Delta\,Employment_i}{\%\Delta Employment_j}$**:** Ratio between employment growth between province of origin and province of destination.

$\frac{Wage_i^q}{Wage_j^q}$**:** Ratio between wage rate in province of origin to province of destination. Wage rate is computed as total income from workers over number of employed at the provincial level. Since for the sample period there is no available information on wages by qualification at the provincial level, we constructed the variable used in the regression by multiplying the wage rate described above with a wage premium for qualification level. The information on the wage premium by qualification comes from the earnings information provided by the Households Surveys (Encuesta de Presupuestos Familiares) of 1981 and 1991. For years before 1981 we use the 1981 premium, while for years after 1991 we use the 1991 premium. For years between 1981 and 1991, we

use a weighted average of 1981 and 1991 (the weights are 0.1 for 1982, 0.3 for 1984, 0.5 for 1985, 0.7 for 1987 and 0.9 for 1989 for the 1981 wages, and the same sequence but in a decreasing order for the 1991 wages).

$\frac{Unemployment_i}{Unemployment_j}$**:** Ratio between unemployment rate of province of origin to province of destination.

The following two tables provide a description of these data:

TABLE A1.2
Provincial Data: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Income	588418.3	342722.1	121501	1887307
$\frac{Share\ of\ Services_i}{Share\ of\ Services_j}$	1.418	6.375	.005	177.4
$\frac{Unemployment_i}{Unemployment_j}$	1.384	3.488	.005	188.500
$\frac{\%\Delta\ Employment_i}{\%\Delta\ Employment_j}$	1.001	.055	.783	1.277
$\frac{Wage_i}{Wage_j}$	1.045	.324	.235	4.244

TABLE A1.3
Provincial Data: Correlation Matrix

	$\frac{Share\ of\ Services_i}{Share\ of\ Services_j}$	$Income_i$	$Income_j$	$\frac{\%\Delta\ Employment_i}{\%\Delta\ Employment_j}$	$\frac{Wage_i}{Wage_j}$
$\frac{Share\ of\ Services_i}{Share\ of\ Services_j}$	1				
$Income_i$	-0.0217	1			
$Income_j$	0.0063	0.8101	1		
$\frac{\%\Delta\ Employment_i}{\%\Delta\ Employment_j}$	-0.0320	0.0253	-0.0250	1	
$\frac{Wage_i}{Wage_j}$	-0.0263	0.1639	-0.1768	0.0633	1
$\frac{Unemployment_i}{Unemployment_j}$	-0.0015	-0.0776	-0.0339	-0.0363	-0.0466

Notice that these variables vary with t, i and j but not with the qualification level.

As commented in the text, we use this provincial information with a lag. So the years corresponding to this variables are 1977, 1979, 1981, 1983, 1985, 1987, 1989 and 1991.

A1.3 Distance data

The distance between provinces is computed using coordinates from data maps from SAS Institute from approximated centers of the province. This variable varies obviously only with i and j.

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Resumen

Este artículo utiliza los registros de la Seguridad Social para estudiar la migración interna en España. Este es el primer artículo que utiliza esta fuente de datos, que tiene algunas ventajas respecto a otras fuentes existentes: incluye únicamente migrantes en busca de empleo y permite identificar la migración temporal. En el marco de un modelo extendido de gravedad, estimamos una regresión binomial negativa generalizada que utiliza como variable dependiente los flujos brutos de migración entre provincias. Cuantificamos el efecto que tiene sobre la movilidad de los trabajadores el desequilibrio de los mercados laborales locales y discutimos el rol equilibrador de la migración interna en España. Nuestros resultados sugieren que el efecto de las oportunidades de empleo se ha incrementado durante el período muestral: después de 1984 los migrantes parecen más sensibles a las condiciones económicas. En consistencia con estudios previos sobre el mercado de trabajo español, nuestro análisis confirma también que los trabajadores de alta cualificación presentan una mayor movilidad interna.

Palabras clave: Movilidad geográfica del trabajo, trabajadores inmigrantes, migración regional.

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