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How does easing liquidity constraints affect aggregate employment?

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Keywords: Liquidity injection; financial constraints; employment; unemployment; Spain.

JEL classification: J64, H11

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1 Introduction

The recent financial crisis has shown that financial shocks can have important macroeconomic effects. Contemporary macroeconomic models now routinely include "financial frictions" and "financial shocks" to explain how economic fluctuations are generated and propagated. This increased focus on financial variables has shown that financial constraints and worsening credit conditions faced by firms during recessions are extremely important to explain aggregate labor market variables, such as employment and unemployment. Two recent examples of this work are Jermann and Quadrini (2012) and Christiano, Eichenbaum, and Trabandt (2015), who use Dynamic Stochastic General Equilibirium (DSGE) models to study the macroeconomic effects of the financial shock that led into the Great Recession in the US, and find that the tightening of financial conditions faced by firms plays the main role in explaining the deterioration of economic activity and of employment.[1]

Complementing the evidence stemming from DSGE models, economic theory provides plausible mechanisms that explain the connection between credit constrained firms, employment, and unemployment. For example, Petrosky-Nadeau (2014) shows how the easing of financing constraints generates job creation in a standard search-and-matching model of equilibrium unemployment in which firms require external financing to post vacancies. Chugh (2013) shows that a model in which firms require working capital to finance their operating costs, when calibrated to the cyclical nature of financial conditions, generates large fluctuations of labor market quantities.[2] In this paper, we complement the existing theoretical literature by empirically measuring how easing credit constraints affects aggregate employment variables in a recessionary environment.

Our specific question is if—and how—a sudden and unexpected liquidity injection to the

[1] The Great Recession gave rise to an explosion in the number of papers studying financial shocks and their effects on economic fluctuations, both within and outside the DSGE tradition. Because of their sheer number we cannot possibly do justice to all of them. A necessarily arbitrary sample of recent papers on this topic includes Bassetto, Cagetti, and De Nardi (2015), Beck, Colciago, and Pfajfar (2014), Christiano, Motto, and Rostagno (2014), Liu and Minford (2014), and Meeks (2012). The main takeaway from these papers is that financial frictions and financial shocks matter for economic fluctuations. Considering a longer time frame, Schularick and Taylor (2012) show that credit growth has been a powerful predictor of financial crises in the period 1870–2008 and that these crises have had sizable output costs.

[2] Wasmer and Weil (2004) prove, in general, that in a model with endogenous search in credit and labor markets, credit frictions amplify macroeconomic volatility through a financial accelerator.

non-financial private sector affects aggregate employment. To answer this question we use Spain in the Great Recession as our laboratory. In early 2012, the Spanish central government announced that it would pay all invoices in arrears owed by sub-national governments at the regional and municipality level. This program was large (it amounted to almost 3% of Spanish GDP), and unexpected: it was first mentioned in the press in January 2012.

Municipalities were exposed to the liquidity shock to a different degree. We therefore identify the effect of the liquidity shock on employment from the cross-sectional variation in municipal employment data by comparing municipalities that received a high liquidity shock to those that received a low liquidity shock and how they fared before and after 2012. We track the evolution of employment over a window of two years prior to and after the shock, i.e., from 2010 to 2014. To take into account potential selection bias due to the heterogeneity of the size of liquidity shocks across municipalities we use a sample where we match on covariates.

2 Relationship with previous literature

Delgado Téllez, Hernández de Cos, Hurtado, and Pérez (2015) studied the impact of the repayment of sub-national debt in arrears in Spain from an aggregate perspective. They use total payments made to cancel commercial debt by municipalities and regional governments and construct a quarterly time series of payments from the public sector to the private sector. In a first exercise they estimate a VAR specification and find that the reduction of commercial arrears is associated with a cumulative GDP growth of 0.55 percentage points over the period 2012–2014. In a second exercise they use the Quarterly Model of Banco de España (MTBE, *Modelo Trimestral del Banco de España*), a large-scale macro-econometric model used for medium term macroeconomic forecasting of the Spanish economy. They find that repayment of commercial debt in arrears could account for growth in GDP on the level of between 0.3 and 0.6 cumulative percentage points over the period 2012–2014, depending on the degree to which the shock was anticipated. GDP growth in the model is explained mainly through a rise in household consumption and private investment. They also report the estimated effect on employment growth and put that figure between 0.4 and 0.7 percentage points (cumulatively over the period 2012–2014).

Other prior research has also shown a connection between financial constraints and the labor market. In a cross-country study, Borsi (2015) finds that private credit contractions have a sizable impact on the unemployment rate in OECD countries, in particular in the first two years after a disruption of credit markets. Kannan (2012) finds that stressed credit conditions constrain the pace of recovery after a recession. For the case of Spain, Bentolila, Jansen, Jiménez, and Ruano (2013) use Spanish firm-level data to argue that the weakest banks during the Great Recession caused a reduction in credit supply, and also on employment. Our paper complements their findings by studying liquidity that is not provided by the financial sector.

In related research, Brückner and Tuladhar (2014) estimate local government spending multipliers using annual data for 47 Japanese prefectures during a financial crisis in the 1990s. They break down government spending into different categories and find that transfers to firms in the form of credit guarantees for small and medium-sized enterprises provide the strongest effect on output. Their findings also suggest a positive effect on the labor market: they find that government transfers to firms also have a significant positive effect on employment and hours worked. Their identification relies on within-prefecture variation in government expenditures and uses a system-GMM estimation with lagged variables to mitigate endogeneity arising from reverse causality. In contrast, our identification strategy exploits the unexpectedness and differential size of the liquidity shock.

Other research related to ours is that of Corbi, Papaioannou, and Surico (2014), who use a 'fuzzy' regression discontinuity design to study the effect of federal transfers on local economic activity in Brazilian municipalities. Using local GDP measures as their outcome variable, they find that transfers from the federal government tend to be more stimulative in regions with a lower penetration of bank branches, which they interpret as a proxy for tighter financial constraints. Although the lifting of financial constraints was not the main focus, several studies have studied a related question of how stimulus spending from the American Recovery and Reinvestment Act (ARRA) affected US employment using subnational geographic regions. Wilson (2012) provides an example of this kind of work.

Turning to firm-level data, Dharmapala, Foley, and Forbes (2011) studied a tax holiday for the repatriation of foreign earnings which they interpreted as an alleviation of financial constraints. In their sample covering multinational companies they did not find any impact on employment.

3 Spain in the Great Recession: context and institutional detail

The Great Recession took a heavy toll on the Spanish labor market and, as argued by Campos and Reggio (2015), the unemployment rate may have fed back into domestic demand through its effect on consumption. According to Pissarides (2013), the rise in unemployment in Spain was an outlier when compared to other OECD countries. It is exceptionally high when compared to the group of similar crisis-hit countries in the periphery of the Eurozone (Ireland, Greece, Portugal, Italy and Spain). The two main explanations that have been put forward for the surge in Spain's unemployment rate are the country's two-tier labor market (Bentolila, Cahuc, Dolado, and Barbanchon, 2012) and the reduction of credit to firms (Bentolila, Jansen, Jiménez, and Ruano, 2013).

As happened to other countries of the Eurozone, Spain suffered a credit crunch during the Great Recession. Access to credit was difficult, in particular for small and medium-sized firms. For example, in the second half of 2011, almost 30% of the firms interviewed in a study by the ECB (2014) reported that access to finance was the most pressing problem.[3] On the fiscal front, the recession eroded tax bases, also at the sub-national level. As regional and local governments saw their fiscal revenues drop, they started to fall behind on payments to suppliers. By December 2011, commercial debt in arrears by regional and local governments had accumulated to 3% of GDP.

Commercial arrears by sub-national governments were financially constraining suppliers. Because a majority of suppliers were local small and medium-sized companies, in policy circles it was thought that financial constraints were negatively affecting the real economy and employment (IMF, 2013). The Spanish central government responded by passing legislation on February 24 and March 9, 2012 to pay the commercial debt in arrears. It set up a new state-owned vehicle, the *Fondo para la Financiación del Pago a Proveedores* (FFPP).

The FFPP was tasked with making payments directly to suppliers who were owed money by sub-national governments. These payments were made over a two-month period in

[3] We plot the evolution of this fraction over the period 2010–2014 in Figure 1.

2012 and amounted to almost 3% of Spanish GDP.[4] Legally, the stock of commercial debt previously owed to suppliers turned into financial debt now owed to the FFPP. Participation was mandatory for municipalities and voluntary for regional governments. Three out of 17 regional governments (Basque Country, Galicia and Navarre) decided not to participate in the program. In order to participate, regional governments had to commit to a fiscal adjustment plan. Because they could not opt out of the repayment scheme, municipalities were not required to commit to a fiscal adjustment plan although they could voluntarily do so. If their adjustment plan was approved by the central government, then they were given more favorable conditions on the debt owed to the FFPP.

Funds used to pay suppliers were guaranteed by the share in national tax receipts of each region and municipality. To repay debt to the FFPP, regions and municipalities without an approved fiscal adjustment plan would have part of their share in national taxes withheld over a 5-year period. On the other hand, if they secured approval of a fiscal adjustment plan, then the money paid on their behalf could be financed at an attractive interest rate with a 10-year loan, with a 2-year interest-only grace period. The interest rate was set at the funding cost of the Spanish Treasury plus 115 basis points, with an intermediation margin of 30 basis points. These were favorable conditions in the context of 2012.

The FFPP obtained funds from a EUR 35bn syndicated loan granted by a pool Spanish banks, including the state-owned ICO, which made the single largest contribution. This syndicated loan was guaranteed by the Spanish government. From a national accounting point of view, the liabilities of the FFPP became part of the stock of outstanding general government debt.

The payment of commercial debt in arrears through the FFPP was unexpected: it was not part of the electoral program of the Partido Popular (PP), which came into power in the November 2011 general election. As such, it provides a quasi-experimental setting to study the effect of relaxing financing constraints on employment variables. The conception, communication, and execution of the program wholly took place in 2012. The first mention of this program in the press is an article in La Vanguardia in

[4]There were three payment dates: on May 28, EUR9.3bn were transferred to suppliers of municipalities; on June 25, EUR17.7bn were transferred to suppliers of the 14 participating regions; finally, on July 30, EUR 0.3bn were transferred to suppliers of municipalities that had been left out in the May payment.

January 2012. The legislation passed into law in February and March 2012. By July 2012, the program had been completed and the last invoices had been paid.

4 Data

4.1 Data Sources

Employment and unemployment data are obtained from the standard sources. Employment is measured as the year-end number of workers by the Spanish Social Security Administration. These data are maintained by the Ministry of Employment and Social Security and contain all workers affiliated to the Social Security System and by municipality and job classification on a monthly basis from 01/2003 onward.

The number of unemployed is the year-end number of people registered as unemployed and counted as such by the Spanish Ministry of Employment and Social Security. It contains the number of registered unemployed by gender, age group, economic sector, and municipality on a monthly basis from 05/2005 onward.

We use per-capita normalizations for employment and unemployment flows. We obtain population counts from the Continuous Census of the National Statistics Institute (INE). This data set contains the number of residents in a municipality broken up by gender and age for all Spanish municipalities on a yearly basis.

Data on the FFPP were obtained from the Instituto de Crédito Oficial (ICO), the state-owned bank that channeled the payments to the suppliers. These data include anonymized information for firms accounting for 48.2% of all suppliers that benefited from this measure (64,879 out of 134,568) and almost 70% of the funds injected by the FFPP (19 out of 27.3 billion euros). The data set includes information on the number and amount of invoices broken down by local government, the amounts seized by the government due to unpaid taxes and social contributions and the dates in which the payments took place. The difference between the amount of unpaid bills and the seized amount equals the cash the firm effectively receives. Interestingly, the data set also matches this information to to the ZIP code of firms that are paid.

The data set does not include information on 46,564 self-employed individuals (34.6% of suppliers and 1.5% of funds), nor on 23,125 firms (17.2% of suppliers and 29% of funds) that were not available at the Iberian Balance Sheet Analysis System (SABI), a database with a coverage of more than 1.25 million firms in Spain which is provided by INFORMA D&B in collaboration with Bureau Van Dijk.

Budget information on municipalities is obtained from the budget database of the Spanish Ministry of Finance and Public Administration. This database contains the annual budget of all Spanish municipalities for the years 2005 through 2014. Debt by municipality is also obtained from the Spanish Ministry of Finance and Public Administration and is available on a yearly basis from 2008 onward. The revenue of the tax on economic activities (IAE) for each municipality is obtained from yearly reports by the Spanish Ministry of Finance and Public Administration. These reports contain economic activities tax revenues on a yearly basis from 2010 onward for all municipalities with the exception of the Basque Country and Navarre.

4.2 Description of the Liquidity Shock

We normalize liquidity received by each municipality i in 2012 by the working-age population of that municipality in 2011. Per-capita liquidity ℓ_i is defined as

$$\ell_i = \frac{\text{Liquidity injection to municipality } i \text{ in 2012}}{\text{Population aged 15–64 in municipality } i \text{ in 2011}}. \tag{1}$$

Figure 2 shows the per-capita size of shock by quartiles measured at the location of the local administration that had the commercial debt. We call this the origin of the liquidity shock. Figure 3 shows the per-capita size of shock by quartiles measured at the location of the legal address of the supplier. We call this the destination of the shock.

At first sight, these figures show that the origin of the shock resembles the destination of the shock. Geographically, there is a diagonal strip that passes North of Madrid where the liquidity shock is weaker or non-existent. This corresponds to municipalities that are very small in size and in population. One of the differences between the two figures shows up when we turn to the destination of the liquidity shock. The destination of the funds is more concentrated in large and populous areas compared to the origin of the shock.

The first two columns in Tables 1 and 2 show the characteristics of municipalities that received liquidity versus those that did not. Because municipalities that do not receive liquidity strongly differ in their characteristics from those that do (e.g., they are smaller and less unpopulated), they are ill-suited for counterfactual experiments. Controlling for the set of characteristics that are observed might be a questionable approach to overcome selection bias because there are likely unobserved factors that cannot be accounted for in this case. For this reason, we exclude municipalities with no exposure to the liquidity shock from the analysis in what follows.

Next, we turn to the size of the liquidity injection. We classify all municipalities that were exposed to a liquidity shock into two groups according to the magnitude of per-capita liquidity they received. We set the threshold at the median, i.e., 50% of municipalities fall into the low and high groups. The last two columns in Tables 1 and 2 compare the characteristics of municipalities that were exposed to a low versus a high per-capita liquidity injection. Gaps in characteristics become smaller, often by an order of magnitude, relative to the prior analysis that compared no-shock versus shock municipalities. However, municipalities in the low and high groups still differ in some dimensions. That is why in our later analysis we use matching on covariates to construct a comparable control group.

Table 1: *Summary Statistics (origin: municipality where funds are paid).*

	No Shock	Shock	Low	High
Per-capita FFPP injection	0.00	527.17	132.31	922.44
	(0.00)	(854.68)	(86.65)	(1068.69)
Population	2650.00	9393.11	10085.54	8699.95
	(27105.27)	(62892.03)	(36406.21)	(81174.62)
Unemployment rate	0.08	0.12	0.12	0.12
	(0.05)	(0.05)	(0.05)	(0.05)
Employment rate	0.42	0.39	0.40	0.38
	(0.35)	(0.19)	(0.18)	(0.19)
Fraction of population aged 15-64	0.60	0.63	0.64	0.63
	(0.09)	(0.07)	(0.06)	(0.07)
Percentage PSOE	0.29	0.35	0.35	0.35
	(0.23)	(0.19)	(0.18)	(0.20)
Percentage PP	0.41	0.38	0.38	0.38
	(0.30)	(0.22)	(0.21)	(0.23)
Percentage IU	0.02	0.04	0.05	0.04
	(0.07)	(0.09)	(0.10)	(0.09)
Per-capita IAE (EUR/N)	73.69	30.37	28.09	32.66
	(365.27)	(192.02)	(89.90)	(256.32)
Per-capita debt (EUR/N)	294.45	513.49	414.79	612.29
	(717.72)	(592.68)	(471.29)	(679.13)
Per-capita revenue (EUR/N)	2560.45	1938.81	1678.11	2200.48
	(3166.87)	(1428.03)	(924.00)	(1758.83)
Per-capita expenditure (EUR/N)	2501.77	1981.47	1701.21	2262.77
	(2435.56)	(1473.06)	(936.25)	(1819.66)
Observations	4326	3784	1892	1892

Table 2: *Summary Statistics (destination: municipality where firms are headquartered).*

	No Shock	Shock	Low	High
Per-capita FFPP injection	0.00	158.26	13.43	303.18
	(0.00)	(678.50)	(10.85)	(937.62)
Population	757.29	12758.99	7618.61	17902.40
	(2566.44)	(72550.32)	(18973.31)	(100599.03)
Unemployment rate	0.08	0.12	0.12	0.12
	(0.05)	(0.04)	(0.04)	(0.05)
Employment rate	0.38	0.44	0.42	0.46
	(0.30)	(0.26)	(0.24)	(0.29)
Fraction of population aged 15-64	0.59	0.65	0.65	0.65
	(0.09)	(0.05)	(0.05)	(0.06)
Percentage PSOE	0.31	0.33	0.33	0.33
	(0.24)	(0.18)	(0.18)	(0.18)
Percentage PP	0.43	0.36	0.35	0.37
	(0.29)	(0.21)	(0.22)	(0.21)
Percentage IU	0.02	0.05	0.04	0.05
	(0.07)	(0.10)	(0.09)	(0.10)
Per-capita IAE (EUR/N)	59.10	43.00	39.53	46.40
	(288.66)	(297.85)	(148.81)	(392.12)
Per-capita debt (EUR/N)	325.88	494.43	458.42	530.45
	(727.72)	(570.10)	(504.28)	(627.19)
Per-capita revenue (EUR/N)	2702.09	1674.52	1635.11	1713.96
	(3155.50)	(933.24)	(796.59)	(1051.13)
Per-capita expenditure (EUR/N)	2673.17	1687.32	1640.15	1734.52
	(2504.43)	(938.40)	(775.39)	(1075.26)
Observations	4705	3405	1703	1702

5 Empirical Strategy

Our unit of observation is a municipality and we use yearly data for the years 2010–2014. This gives us a 2-year window before and after the liquidity shock that occurred in 2012. The effect on employment and unemployment (either through direct hiring or through spillover effects) can be located either in the municipality that owed money to a firm (where the money originates), or in the municipality where the firm has its headquarters (the destination of the money). We therefore explore the effects on employment and unemployment at both the origin and the destination of the funds.

In our main analysis we exclude municipalities that did not receive FFPP funds. The reason is that municipalities that did not receive funds are very different from the rest of the population. These differences fall into two categories. First, non-recipient municipalities are typically small, sparsely populated, and rural. Thus, comparisons between municipalities with positive liquidity shocks and a zero shock do not plausibly lead to an effect that can be argued to be causal. Second, when focusing at the origin of the money, municipalities from the Basque Country and Navarre were excluded from participating in the FFPP because these two regions enjoy a special tax status. Any effect derived from a comparison between municipalities within and outside these regions cannot be disentangled from the special fiscal status.

In Section 4.2 we compare recipient to non-recipient municipalities to show how they differ on certain dimensions, such as population, labor market variables, and fiscal variables. Our results presented in Section 6 rely exclusively on municipalities exposed to a positive liquidity shock. This population is more homogeneous and selection bias is less of an issue. In any case, we go to great lengths to rule out selection bias and other confounding factors.

5.1 Outcome variables

We use two different labor market measures: employment and unemployment. Our first outcome variable consists of employment flows normalized by working-age population in 2011, the same variable we used to normalize the liquidity variable. Employment flows are constructed for each municipality i as

$$\Delta e_{it} \equiv \frac{E_{i,t} - E_{i,t-1}}{N_{i,15-64}} \times 100, \tag{2}$$

where $E_{i,t-1}$ and $E_{i,t}$ are employment counts in two consecutive years and $N_{i,15-64}$ is the working-age population in 2011, defined as the population aged between 15 and 64. Likewise, letting $U_{i,t-1}$ and $U_{i,t}$ denote the stock of unemployed in two consecutive years, unemployment flows in a municipality are defined as

$$\Delta u_{it} \equiv \frac{U_{i,t} - U_{i,t-1}}{N_{i,15-64}} \times 100. \tag{3}$$

As we explain in Section 4.1, employment and unemployment counts are obtained from public sources: two different datasets maintained by the Spanish Ministry of Employment and Social Security. Population data are obtained from the Spanish National Statistics Institute.[5]

5.2 Specification

5.2.1 Benchmark specification

We use i to index municipalities, t to index time, and $y_{it} \in \{\Delta e_{it}, \Delta u_{it}\}$ to refer to any of the outcome variables of interest. Letting ℓ_i stand for the amount of per-capita liquidity

[5] As a robustness exercise, we experimented with a second way of measuring outcome variables through the use of symmetric growth rates. The symmetric growth rate of employment is defined by

$$g_t^E \equiv \frac{E_t - E_{t-1}}{\frac{1}{2}E_t + \frac{1}{2}E_{t-1}} \times 100 \tag{4}$$

and the symmetric growth rate of unemployment is defined by

$$g_t^U \equiv \frac{U_t - U_{t-1}}{\frac{1}{2}U_t + \frac{1}{2}U_{t-1}} \times 100. \tag{5}$$

It can be shown from the definition that the symmetric growth rate is bounded in the range $[-200, 200]$. The symmetric growth rate is used mainly in the literature using establishment-level employment microdata (see, e.g., Davis, Haltiwanger, and Schuh, 1998). It is a second-order approximation of the log difference growth rate around zero. The symmetric growth rate's main advantage over the usual growth rate is that it is robust to the presence of outliers, which may pose problems in micro datasets. All our results held for outcome variables measured in this way.

received in 2012 under the FFPP program in municipality i, we estimate the parameter λ in the regression:

$$y_{it} = \alpha_i + \lambda \ell_i \times I_{\{t>2012\}} + \delta_t + X_{it}\beta + \varepsilon_{it}, \quad t \neq 2012. \tag{6}$$

The interaction term $\lambda \ell_i \times I_{\{t>2012\}}$ captures the effect of interest. Time dummy variables δ_t allow for arbitrary common time variation. X_{it} is a vector of time-varying control variables that aim to capture heterogeneity in the evolution of employment and unemployment across municipalities. In our main estimation we allow for municipality-specific fixed effects α_i and estimate this equation using the standard fixed-effects within-estimator. We also experiment with a pooled-OLS estimation, i.e., one that imposes $\alpha_i = \alpha$ for all i. In this case, we add a term $\gamma \ell_i$ to the right hand side of (6) and also increase the number of variables in X_{it}, which can contain variables that are constant by municipality. In all estimations, we use panel-robust standard errors.

Our standard set of control variables consists of population, budget variables at the municipality level (per-capita income, per-capita expenditure and per-capita debt), and the political landscape, measured as the number of assembly members (*concejales*) in the local elections in 2007 and 2011 belonging to the three main political parties at the time (PP, PSOE, IU). We also add an economic activity indicator, defined as per-capita revenue of the economic activity tax (IAE) collected by municipalities. This variable is commonly used as an indicator of economic activity at the municipal level, for example in the influential yearly report by *La Caixa*.[6]

We include interaction terms between time dummies and dummies for regions (CCAA). These interaction terms will capture any time-varying effects that are common by CCAA. The reason for including these terms is that at the same time of the FFPP plan to municipalities, there was similar plan designed for CCAA. In addition, because the liquidity injection occurred during 2012 it is unclear whether this year is already affected by the liquidity injection. We decided to exclude this year from our estimations in the benchmark equation. However, as we show below, the year 2012 can be included in a

[6] In this report, La Caixa reports data only for the largest 3,245 municipalities out of a total of roughly 8,100 municipalities in Spain. We therefore obtain IAE tax revenue by municipality directly from yearly reports by the Spanish Ministry of Finance and Public Administration, as explained in our section on data sources.

more flexible model.

5.2.2 Flexible specification

Because we have two periods prior to the liquidity injection and two periods after it, we can estimate a more flexible specification. As argued by Mora and Reggio (2012) and Mora and Reggio (2015), there are advantages to replacing the dummy variable indicating the period before and after the occurrence of the shock with a more flexible specification. Their argument is made for binary treatment variables but the intuition carries over to a our continuous variable measuring liquidity.

In the flexible specification the single interaction term $\lambda \ell_i \times I_{\{t>2012\}}$ in (6) is replaced with four yearly interaction terms, so that the equation to be estimated becomes

$$y_{it} = \alpha_i + \sum_{\tau=2011}^{2014} \lambda^\tau \ell_i \times I_{\{t=\tau\}} + \delta_t + X_{it}\beta + \varepsilon_{it}. \tag{7}$$

Otherwise, we include the same controls as those of our benchmark specification.

Our interest in this specification lies in the estimation of the coefficients λ^{2011}, λ^{2012}, λ^{2013}, and λ^{2014} (the year 2010 is the excluded category). This flexible specification has a number of advantages over the standard specification in (6). As argued by Mora and Reggio (2012), our specification does not directly impose a common-trend assumption on labor market variables before 2012. In fact, the flexible specification allows to test whether the years 2010 and 2011 differ in terms of the evolution of labor market variables by performing a simple t-test on the coefficient estimated for λ^{2011}.

There are two additional advantages from the flexible model. The first advantage is that the year 2012 can be included without having to decide whether it is affected by the shock. The data are allowed to speak for themselves. The second advantage is that the effect of the liquidity injection is not constrained to be constant over the whole treatment period, i.e., this flexible model allows for the possibility that $\lambda^{2013} \neq \lambda^{2014}$.

5.2.3 Binary specification

In addition to the continuous variable ℓ_i, we also estimate specifications of the form

$$y_{it} = \alpha_i + \lambda_H I_{\{\ell_i \in L_H\}} \times I_{\{t>2012\}} + \delta_t + X_{it}\beta + \varepsilon_{it}, \quad t \neq 2012, \tag{8}$$

and

$$y_{it} = \alpha_i + \sum_{\tau=2011}^{2014} \lambda_H^{\tau} I_{\{\ell_i \in L_H\}} \times I_{\{t=\tau\}} + \delta_t + X_{it}\beta + \varepsilon_{it}, \tag{9}$$

where $I_{\{\ell_i \in L_H\}}$ is an indicator of whether liquidity ℓ in municipality i belongs to a group of high liquidity recipients. We considered different definitions of the group L_H, such as the top half of the sample, the top quartile, etc.

The drawback of this approach is that by transforming our variable of interest into a discrete variable with broad categories the estimation may be losing precision. The advantage of the approach is that we can use standard tools derived for binary treatment variables to study whether heterogeneity in the covariate distribution is biasing the estimated effect of the liquidity shock.

5.2.4 Matching on covariates

As highlighted by Imbens (2004), the estimation of average treatment effects is sensitive to differences in the covariate distribution. The specifications of the form (8) and (9) allow us to perform matching on covariates. We use propensity score matching to select a single match for each of the municipalities in the high group L_H. According to Imbens and Wooldridge (2009), this leads to credible inference with the least bias, at the cost of sacrificing some precision. Matching is done with replacement, so that the same municipality outside of the high group L_H can perform as a match for more than one observation in the L_H group. We match on covariates for the year 2010. As a general rule, we use variables in levels and add their squares only if they improve the results of the the matching algorithm

For our matching variables we used the logarithm of the population, budget variables, and the per-capita tax on economic activity. In addition to these variables we also included the geographical location of each municipality represented as the centroid of the 2-dimensional coordinates of each municipality on a map in geospatial vector data format. As argued by Heckman, Ichimura, Smith, and Todd (1998) geographically-matched controls greatly reduce the potential selection bias, especially in the presence of heterogeneous effects. We found that matching for the destination of funds was greatly improved by also adding the employment rate measured in 2010. The results of the matching procedure can be seen in Section 8.5. Despite the reduced set of variables that were used in the matching procedure, we observe that the match is very good for the year 2010, and also for the year 2011.

We estimate the specification for the binary treatment variable in (8) and (9) for the original sample and for the sample matched on covariates. Our estimations include the same controls as those of our continuous variable specification.

6 Results

Our results using the empirical strategy laid out in Section 5 suggest that liquidity provision had significant effects on unemployment and employment both at the origin of the liquidity injection and at the destination of of liquidity. Our results are presented in a series of tables shown in the Appendix. The main conclusion is that the effect on unemployment is stronger at the origin than at the destination whereas the effect on employment is stronger at the destination. Moreover, there is evidence indicating that the effect on employment carries over into 2014 at the destination.

6.1 The fully flexible specification

The effect on unemployment is reported in two tables. Table 3 measures the liquidity shock at the location where suppliers were owed the money, i.e., at municipalities that had their invoices in arrears repaid through the FFPP program. Table 4 measures the location at the destination of funds, the municipality where suppliers had their legal address. Coefficients in columns 1 and 2 are multiplied by 1,000. Therefore, they measure changes in the number of unemployed individuals per EUR 1,000 that flow into a municipality.

We are most interested in the results of the continuous flexible specification (Column 2) and the binary specification with the matched sample (Column 6). According to the continuous specification there is a significant effect on unemployment only at the origin of funds. In fact, this effect is negative and significantly different from zero only in 2013. At the destination there does not seem to be any effect in the continuous specification.

Things change in the binary specification (Column 4). These results for the whole sample show a significantly negative effect on unemployment in 2013 and 2014, if the location of the origin is considered. When we use the sample that is matched on covariates (Column 6), the significance is reduced although point estimates remain virtually unchanged.

The first look at unemployment in the fully flexible model suggests that the effect is clearer at the origin of funds.

Notably, the coefficients on λ^{2011} are not significantly different from zero. We therefore later fit a reduced model that imposes $\lambda^{2010} = \lambda^{2011}$.

Before doing so, we turn to employment. Table 5 focuses on the origin and Table 6 on the destination of funds.

The continuous specification (Column 2) shows significant positive effects on employment in 2013 at the origin and in 2013 and 2014 at the destination. The estimation at the origin also shows a large point estimate for 2012 which is not significantly different from zero. The effect measured at the destination seems to be stronger and more persistent than at the origin.

This overall result is maintained when we turn to the binary specification, although significance is reduced. Focusing on the matched sample (Column 6), we find that at the destination the matching procedure has eliminated the large and significant coefficient on λ^{2011}. Again, this is evidence in favor of a more parsimonious model in which $\lambda^{2010} = \lambda^{2011}$.

We now turn to a reduced model that imposes $\lambda^{2010} = \lambda^{2011}$.

6.2 A flexible specification with $\lambda^{2010} = \lambda^{2011}$

Results of imposing $\lambda^{2010} = \lambda^{2011}$ are shown in Tables 7 through Tables 10. This specification yields results that are qualitatively similar to those for the fully flexible model. However, the precision with which the coefficients are estimated is larger.

There are two main conclusions from these results. First, the evidence for a reduction of unemployment is stronger at the origin whereas the evidence for an increase of employment is stronger at the destination. Second, there are differences in timing. Effects do not persist into 2014 in the same way at the origin and at the destination.

6.3 Robustness checks

We conducted several robustness checks. In addition to the fixed-effects specification, we estimated all our equations using a pooled-OLS estimator (clustering standard errors by municipality). We obtained results that were qualitatively similar although, in general, with smaller estimated standard errors, and therefore higher statistical significance. In this sense, our fixed-effects results are the more conservative choice.

We conducted several robustness checks on our matching procedure, as well. We changed the caliper from our preferred value of 0.005 to smaller and larger values and obtained overall similar results. We also explored using other variables in the matching procedure but the use of groups of variables that delivered a fit comparable with our preferred case delivered similar results.

7 Concluding Remarks

We find that the liquidity injection had effects both at originating and destination municipalities. However, the size and timing of the effects are different. At the origin, there was a strong reduction in 2013 that persists until 2014. At the destination, the effect is weaker and concentrated in 2013. In comparison, the effect on employment was stronger and more persistent at the destination.

Our preliminary findings suggest that the liquidity injection in 2012, and the elimination of financial constraints it implied, had a plausibly causal effect on labor market outcomes. Our results are a first step in attempting to study the effect of the FFPP program on employment and unemployment. The objective is to obtain estimates that can be argued to be of a causal nature. For this, further work is needed in order to weed out potential selection bias.

More generally, our findings address the effect of “financial frictions” and “financial shocks” on employment that were brought to the highlight by the recent financial crisis, and which are now routinely used in economic models. We do so by using micro data at the municipality level. Our preliminary findings suggest that the strong effects on the real economy predicted by economic theory are validated once the geographical origin and destination of funds is considered.

8 Figures and Tables

Figure 1: *Fraction of small and medium-sized firms in Spain mentioning access to finance as the most pressing problem over the period 2010–2014 (constructed from the ECB series SAFE.H.ES.SME.A.0.0.0.Q0.ZZZZ.P3.AL.WP)*

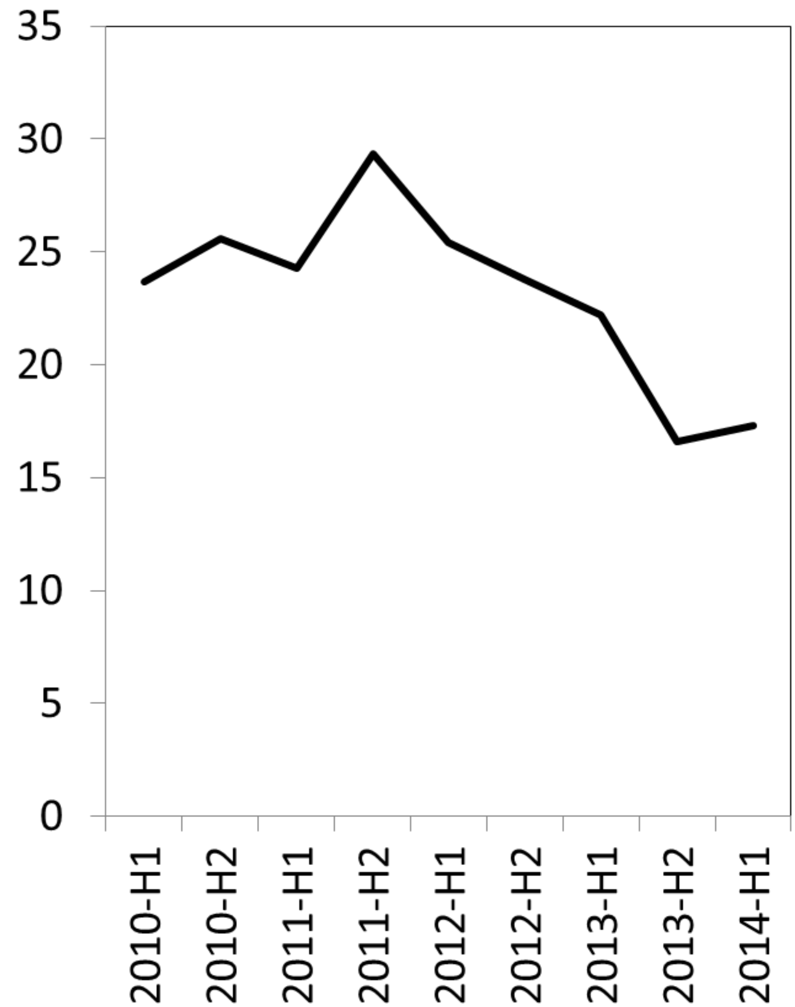


Figure 2: *Per-capita size of shock by quartiles measured at the location of the local administration that had the commercial debt (Origin). Canary Islands are not included to preserve the scale.*

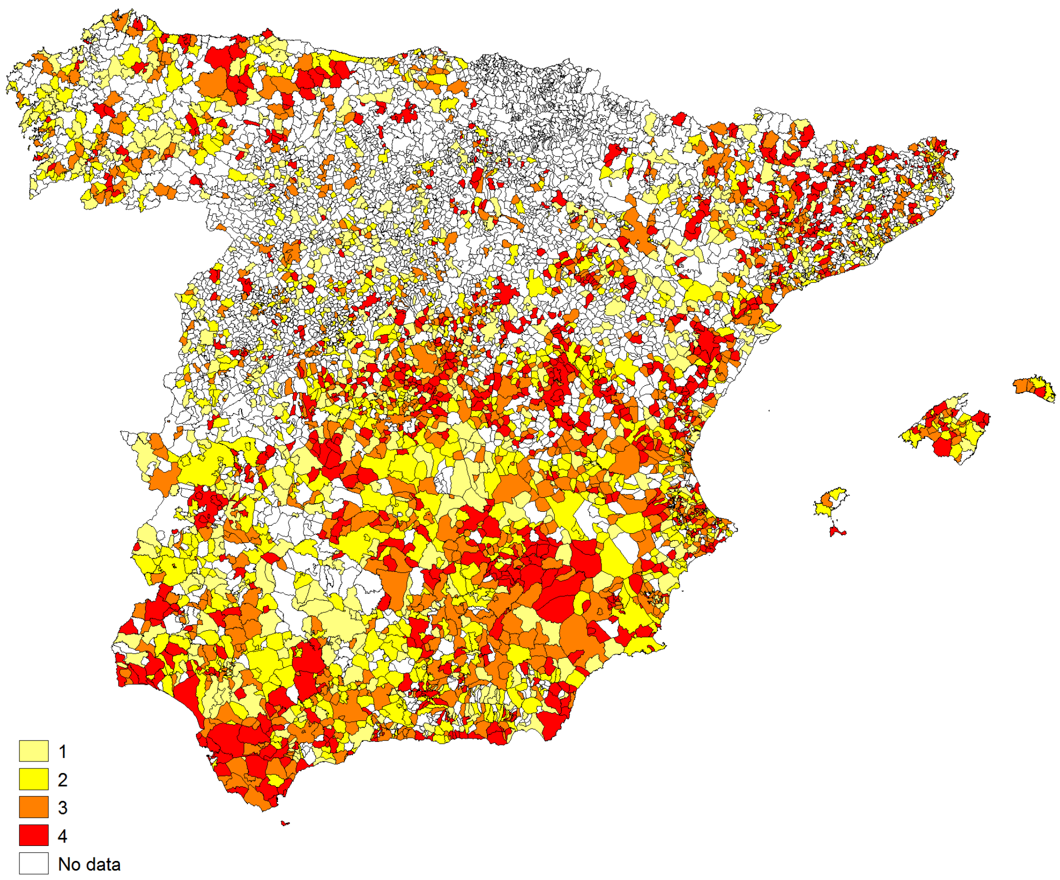
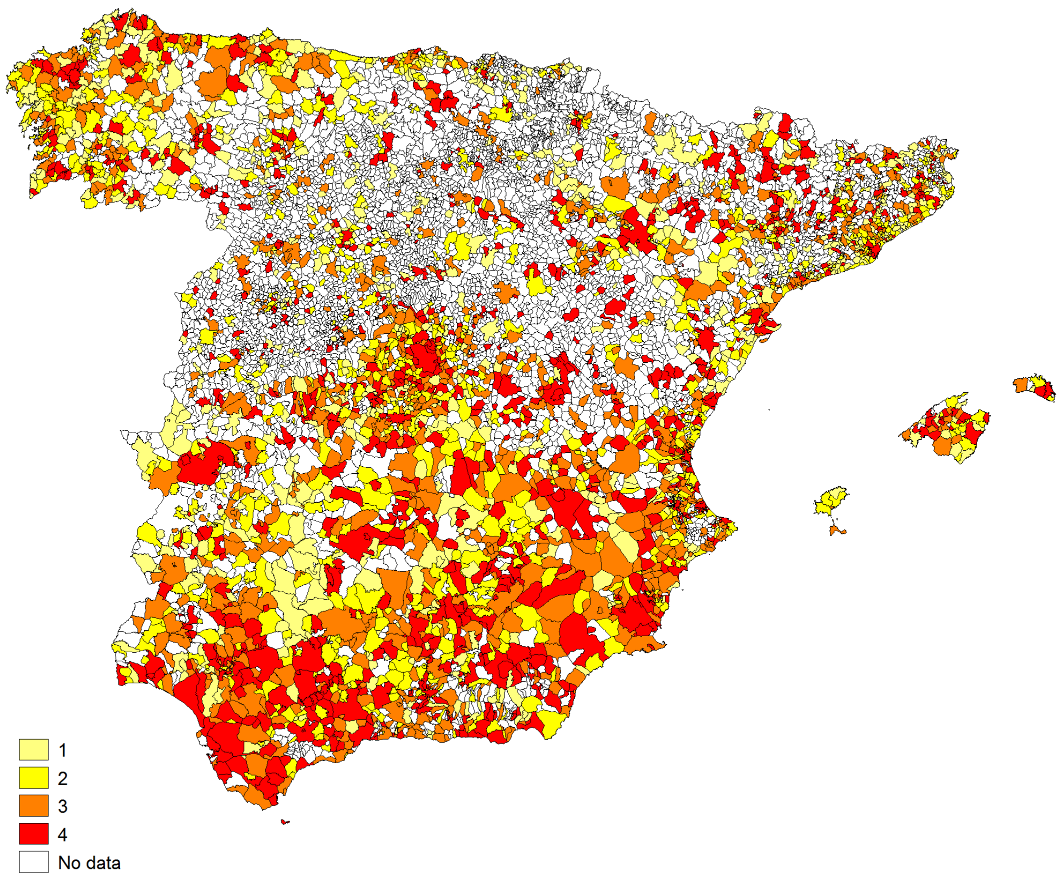


Figure 3: *Per-capita size of shock by quartiles measured at the location of the legal address of the supplier (Destination). Canary Islands are not included to preserve the scale.*



8.1 Results for Unemployment (Fixed Effects)

Table 3: *Effect on* Δu *(Origin).*

VARIABLES	(1) Benchmark	(2) Flexible	(3) Binary	(4) Binary Flex	(5) Matched	(6) Matched Flex
$\lambda^{\geq 2013}$	-0.104*					
	(0.059)					
λ^{2011}		-0.076				
		(0.098)				
λ^{2012}		-0.099				
		(0.082)				
λ^{2013}		-0.193**				
		(0.088)				
λ^{2014}		-0.103				
		(0.104)				
$\lambda_H^{\geq 2013}$			-0.182***		-0.210**	
			(0.058)		(0.084)	
λ_H^{2011}				-0.129		-0.072
				(0.107)		(0.161)
λ_H^{2012}				-0.134		-0.105
				(0.097)		(0.140)
λ_H^{2013}				-0.264***		-0.260*
				(0.096)		(0.148)
λ_H^{2014}				-0.240**		-0.233
				(0.097)		(0.145)
Observations	14,671	18,339	14,671	18,339	13,995	17,494
R-squared	0.207	0.219	0.207	0.219	0.197	0.210
Number of id	3,668	3,668	3,668	3,668	2,685	2,685

Table 4: *Effect on Δu (Destination).*

VARIABLES	(1) Benchmark	(2) Flexible	(3) Binary	(4) Binary Flex	(5) Matched	(6) Matched Flex
$\lambda^{\geq 2013}$	-0.043					
	(0.053)					
λ^{2011}		0.049				
		(0.086)				
λ^{2012}		0.077				
		(0.139)				
λ^{2013}		-0.118				
		(0.098)				
λ^{2014}		0.073				
		(0.115)				
$\lambda_H^{\geq 2013}$			-0.078*		-0.138**	
			(0.047)		(0.061)	
λ_H^{2011}				0.023		0.073
				(0.084)		(0.105)
λ_H^{2012}				-0.004		0.056
				(0.077)		(0.126)
λ_H^{2013}				-0.025		-0.135
				(0.076)		(0.101)
λ_H^{2014}				-0.109		-0.073
				(0.074)		(0.099)
Observations	13,087	16,359	13,087	16,359	12,824	16,030
R-squared	0.307	0.327	0.307	0.327	0.302	0.312
Number of id	3,272	3,272	3,272	3,272	2,453	2,453

8.2 Results for Employment (Fixed Effects)

Table 5: *Effect on* Δe *(Origin).*

VARIABLES	(1) Benchmark	(2) Flexible	(3) Binary	(4) Binary Flex	(5) Matched	(6) Matched Flex
$\lambda^{\geq 2013}$	0.102					
	(0.093)					
λ^{2011}		0.180				
		(0.123)				
λ^{2012}		0.171				
		(0.116)				
λ^{2013}		0.232*				
		(0.126)				
λ^{2014}		0.161				
		(0.137)				
$\lambda_H^{\geq 2013}$			0.166		0.208	
			(0.128)		(0.173)	
λ_H^{2011}				-0.096		-0.098
				(0.212)		(0.277)
λ_H^{2012}				0.314		0.307
				(0.206)		(0.280)
λ_H^{2013}				0.331*		0.342
				(0.196)		(0.248)
λ_H^{2014}				-0.080		-0.015
				(0.183)		(0.229)
Observations	14,605	18,257	14,605	18,257	13,915	17,401
R-squared	0.053	0.079	0.053	0.080	0.060	0.085
Number of id	3,660	3,661	3,660	3,661	2,680	2,681

Table 6: *Effect on Δe (Destination).*

VARIABLES	(1) Benchmark	(2) Flexible	(3) Binary	(4) Binary Flex	(5) Matched	(6) Matched Flex
$\lambda^{\geq 2013}$	0.511**					
	(0.242)					
λ^{2011}		-0.044				
		(0.373)				
λ^{2012}		-0.232				
		(0.209)				
λ^{2013}		0.458**				
		(0.212)				
λ^{2014}		0.520**				
		(0.246)				
$\lambda_H^{\geq 2013}$			0.357***		0.460**	
			(0.126)		(0.199)	
λ_H^{2011}				-0.494**		-0.174
				(0.206)		(0.248)
λ_H^{2012}				-0.199		0.176
				(0.225)		(0.294)
λ_H^{2013}				-0.166		0.334
				(0.199)		(0.264)
λ_H^{2014}				0.386**		0.412*
				(0.190)		(0.249)
Observations	13,065	16,330	13,065	16,330	12,821	16,026
R-squared	0.074	0.101	0.073	0.100	0.084	0.116
Number of id	3,270	3,270	3,270	3,270	2,453	2,453

8.3 Results for Unemployment (Fixed Effects, $\lambda^{2010} = \lambda^{2011}$)

Table 7: *Effect on Δu (Origin).*

VARIABLES	(1) Benchmark	(2) Flexible	(3) Matched	(4) Matched Flex
$\lambda^{\geq 2013}$	-0.104*			
	(0.059)			
λ^{2012}		-0.061		
		(0.058)		
λ^{2013}		-0.155**		
		(0.062)		
λ^{2014}		-0.064		
		(0.074)		
$\lambda_H^{\geq 2013}$			-0.210**	
			(0.084)	
λ_H^{2012}				-0.069
				(0.112)
λ_H^{2013}				-0.224*
				(0.117)
λ_H^{2014}				-0.198*
				(0.111)
Observations	14,671	18,339	13,995	17,494
R-squared	0.207	0.219	0.197	0.210
Number of id	3,668	3,668	2,685	2,685

Table 8: *Effect on Δu (Destination).*

VARIABLES	(1) Benchmark	(2) Flexible	(3) Matched	(4) Matched Flex
$\lambda^{\geq 2013}$	-0.043			
	(0.053)			
λ^{2012}		0.053		
		(0.122)		
λ^{2013}		-0.142		
		(0.097)		
λ^{2014}		0.049		
		(0.085)		
$\lambda_H^{\geq 2013}$			-0.138**	
			(0.061)	
λ_H^{2012}				0.020
				(0.118)
λ_H^{2013}				-0.171**
				(0.085)
λ_H^{2014}				-0.109
				(0.090)
Observations	13,087	16,359	12,824	16,030
R-squared	0.307	0.327	0.302	0.312
Number of id	3,272	3,272	2,453	2,453

8.4 Results for Employment (Fixed Effects, $\lambda^{2010} = \lambda^{2011}$)

Table 9: *Effect on* Δe *(Origin).*

VARIABLES	(1) Benchmark	(2) Flexible	(3) Matched	(4) Matched Flex
$\lambda^{\geq 2013}$	0.102			
	(0.093)			
λ^{2012}		0.081		
		(0.099)		
λ^{2013}		0.142		
		(0.107)		
λ^{2014}		0.071		
		(0.111)		
$\lambda_H^{\geq 2013}$			0.208	
			(0.173)	
λ_H^{2012}				0.356
				(0.250)
λ_H^{2013}				0.391*
				(0.218)
λ_H^{2014}				0.034
				(0.198)
Observations	14,605	18,257	13,915	17,401
R-squared	0.053	0.079	0.060	0.085
Number of id	3,660	3,661	2,680	2,681

Table 10: *Effect on Δe (Destination).*

VARIABLES	(1) Benchmark	(2) Flexible	(3) Matched	(4) Matched Flex
$\lambda^{\geq 2013}$	0.511**			
	(0.242)			
λ^{2012}		-0.210		
		(0.236)		
λ^{2013}		0.481**		
		(0.200)		
λ^{2014}		0.542*		
		(0.325)		
$\lambda_H^{\geq 2013}$			0.460**	
			(0.199)	
λ_H^{2012}				0.263
				(0.256)
λ_H^{2013}				0.421*
				(0.238)
λ_H^{2014}				0.499**
				(0.217)
Observations	13,065	16,330	12,821	16,026
R-squared	0.074	0.101	0.084	0.116
Number of id	3,270	3,270	2,453	2,453

8.5 Quality of the matching procedure

Table 11: *Quality of the match in 2010 (Origin)*

	Low (U)	High (U)	Low (M)	High (M)
X coordinate	0.46	0.52	0.54	0.52
	(0.32)	(0.28)	(0.33)	(0.28)
Y coordinate	4.43	4.42	4.41	4.42
	(0.28)	(0.24)	(0.27)	(0.24)
Population	10054.49	9186.97	10842.75	9333.35
	(36420.56)	(83762.62)	(38656.84)	(84563.89)
Unemployment rate	0.10	0.10	0.10	0.10
	(0.04)	(0.04)	(0.04)	(0.04)
Employment rate	0.38	0.37	0.39	0.37
	(0.17)	(0.18)	(0.16)	(0.18)
Fraction of population aged 15-64	0.69	0.69	0.70	0.69
	(0.07)	(0.07)	(0.07)	(0.07)
Percentage PSOE	0.35	0.35	0.36	0.35
	(0.18)	(0.19)	(0.18)	(0.19)
Percentage PP	0.38	0.37	0.35	0.37
	(0.21)	(0.22)	(0.21)	(0.22)
Percentage IU	0.05	0.04	0.04	0.04
	(0.10)	(0.10)	(0.09)	(0.10)
Per-capita IAE (EUR/N)	24.85	30.44	30.67	27.42
	(76.46)	(233.33)	(90.91)	(212.54)
Per-capita debt (EUR/N)	386.99	581.12	538.24	546.21
	(458.65)	(621.33)	(534.77)	(545.14)
Per-capita revenue (EUR/N)	1870.70	2249.49	2164.13	2191.76
	(1176.63)	(1478.85)	(1447.96)	(1350.39)
Per-capita expenditure (EUR/N)	1848.50	2229.28	2135.79	2177.64
	(1143.76)	(1409.99)	(1405.68)	(1309.01)
Observations	1892	1784	936	1750

Table 12: *Quality of the match in 2011 (Origin)*

	Low (U)	High (U)	Low (M)	High (M)
X coordinate	0.46	0.52	0.54	0.52
	(0.32)	(0.28)	(0.33)	(0.28)
Y coordinate	4.43	4.42	4.41	4.42
	(0.28)	(0.24)	(0.27)	(0.24)
Population	10085.54	9218.34	10891.67	9364.78
	(36406.21)	(83546.39)	(38663.79)	(84345.44)
Unemployment rate	0.12	0.12	0.12	0.12
	(0.05)	(0.05)	(0.05)	(0.05)
Employment rate	0.40	0.39	0.41	0.39
	(0.18)	(0.19)	(0.17)	(0.19)
Fraction of population aged 15-64	0.64	0.63	0.64	0.63
	(0.06)	(0.06)	(0.06)	(0.06)
Percentage PSOE	0.35	0.35	0.36	0.35
	(0.18)	(0.19)	(0.18)	(0.19)
Percentage PP	0.38	0.37	0.35	0.37
	(0.21)	(0.22)	(0.21)	(0.22)
Percentage IU	0.05	0.04	0.04	0.04
	(0.10)	(0.10)	(0.09)	(0.10)
Per-capita IAE (EUR/N)	28.09	34.28	33.89	31.24
	(89.90)	(263.78)	(102.59)	(245.31)
Per-capita debt (EUR/N)	414.79	622.12	568.97	587.81
	(471.29)	(645.67)	(537.78)	(571.68)
Per-capita revenue (EUR/N)	1678.11	2022.59	1827.10	1989.77
	(924.00)	(1277.59)	(961.62)	(1236.53)
Per-capita expenditure (EUR/N)	1701.21	2068.49	1858.45	2028.51
	(936.25)	(1292.66)	(994.25)	(1233.49)
Observations	1893	1784	936	1750

Table 13: *Quality of the match in 2010 (Destination)*

	Low (U)	High (U)	Low (M)	High (M)
X coordinate	0.48	0.48	0.49	0.48
	(0.34)	(0.31)	(0.39)	(0.31)
Y coordinate	4.47	4.41	4.41	4.41
	(0.28)	(0.28)	(0.33)	(0.28)
Population	7585.60	18128.60	11653.83	10142.93
	(18933.18)	(101587.07)	(25638.01)	(21029.69)
Unemployment rate	0.10	0.11	0.11	0.11
	(0.04)	(0.04)	(0.04)	(0.04)
Employment rate	0.40	0.44	0.42	0.42
	(0.22)	(0.28)	(0.19)	(0.20)
Fraction of population aged 15-64	0.71	0.71	0.71	0.71
	(0.06)	(0.06)	(0.06)	(0.06)
Percentage PSOE	0.33	0.34	0.33	0.34
	(0.18)	(0.18)	(0.17)	(0.18)
Percentage PP	0.35	0.37	0.35	0.37
	(0.22)	(0.20)	(0.22)	(0.20)
Percentage IU	0.04	0.05	0.04	0.05
	(0.09)	(0.10)	(0.09)	(0.10)
Per-capita IAE (EUR/N)	34.61	39.82	28.40	30.21
	(138.11)	(359.90)	(53.88)	(93.19)
Per-capita debt (EUR/N)	429.78	501.32	436.17	490.19
	(469.10)	(605.67)	(435.17)	(598.74)
Per-capita revenue (EUR/N)	1791.45	1861.00	1826.57	1859.84
	(906.36)	(1141.90)	(1021.59)	(1143.65)
Per-capita expenditure (EUR/N)	1759.01	1853.52	1783.38	1853.84
	(865.34)	(1101.19)	(990.05)	(1105.94)
Observations	1703	1676	851	1605

Table 14: *Quality of the match in 2011 (Destination)*

	Low (U)	High (U)	Low (M)	High (M)
X coordinate	0.48	0.48	0.49	0.48
	(0.34)	(0.31)	(0.39)	(0.31)
Y coordinate	4.47	4.41	4.41	4.41
	(0.28)	(0.28)	(0.33)	(0.28)
Population	7618.61	18179.21	11722.78	10204.00
	(18973.31)	(101352.04)	(25756.65)	(21109.32)
Unemployment rate	0.12	0.12	0.12	0.12
	(0.04)	(0.05)	(0.04)	(0.05)
Employment rate	0.42	0.46	0.44	0.44
	(0.24)	(0.29)	(0.21)	(0.21)
Fraction of population aged 15-64	0.65	0.65	0.65	0.65
	(0.05)	(0.05)	(0.05)	(0.05)
Percentage PSOE	0.33	0.34	0.33	0.34
	(0.18)	(0.18)	(0.17)	(0.18)
Percentage PP	0.35	0.37	0.35	0.37
	(0.22)	(0.20)	(0.22)	(0.20)
Percentage IU	0.04	0.05	0.04	0.05
	(0.09)	(0.10)	(0.09)	(0.10)
Per-capita IAE (EUR/N)	39.53	46.31	33.46	36.36
	(148.81)	(394.28)	(81.33)	(152.50)
Per-capita debt (EUR/N)	458.42	537.39	466.15	526.67
	(504.28)	(628.61)	(462.50)	(622.23)
Per-capita revenue (EUR/N)	1635.11	1687.43	1655.26	1686.30
	(796.59)	(968.81)	(782.98)	(972.89)
Per-capita expenditure (EUR/N)	1640.15	1701.24	1660.46	1696.27
	(775.39)	(937.32)	(751.41)	(933.42)
Observations	1703	1676	851	1605

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