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through means of a gravity model: evidence from Italy

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# EXPLORING FLOWS TO TAX HAVENS THROUGH MEANS OF A GRAVITY MODEL: EVIDENCE FROM ITALY

by Alessia Cassetta\*, Claudio Pauselli\*, Lucia Rizzica<sup>♦</sup>, Marco Tonello<sup>♦</sup>

## Abstract

We exploit a gravity model to study the main determinants of cross-border financial flows and to identify those flows that appear to be abnormally above the predicted value. Our data include all Italian cross-border bank transfers that took place between 2007 and 2010. We find that, other things being equal, financial flows to risky destinations are 36 per cent larger than in other countries. Using the residuals from our main econometric specification, we then construct an index of anomaly and find positive and statistically significant correlations between this and the rate of property and drugs-related crimes in the province of origin, and also between the index and other measures of foreign jurisdictions' riskiness and opacity of legislation.

**JEL Classification:** K33, G15, F36.

**Keywords:** offshore financial flows, money laundering, regulation.

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# 1 Introduction<sup>1</sup>

The crackdown on international tax evasion and on countries facilitating it, the so called “tax havens” or “offshore financial centers”, has recently risen on top of the political agenda of the advanced economies where it is widely asserted that the presence of confidential accounts reduces the transparency of financial transactions and facilitates tax evasion, money laundering and other criminal activities, including corruption, terrorism and drug trafficking.

The concern is justified by the fact that offshore financial centers (OFCs) account for a sizable share of total international financial transactions: overall, they attract about a quarter of worldwide foreign portfolio investment (nearly USD 9.5 trillions in 2011).<sup>2</sup> The official figures, moreover, tend to underestimate the actual amount of assets in foreign portfolios because offshore centers typically underreport assets held. According to Pellegrini and Tosti (2011), underreporting is so widespread that 7.3% of the world GDP is missing from the official statistics.

The economic literature on tax havens has mainly focused on their impact on the economies of other countries. In this respect, the traditional view that depicted tax havens as “parasites” whose elimination would lead to increases in tax revenues, savings of the resources spent on tracking financial activities to these countries, and welfare enhancements in non-haven countries (Slemrod and Wilson, 2009; Bucovetsky and Haufler, 2008) has recently been challenged by a number of works which point up some desirable aspects of tax havens that may offset the negative ones. These are essentially of three types (Hebous, 2011): (i) tax havens produce efficiency in the way firms use their capital in investing at home (Hong and Smart, 2007) or in other foreign countries (Desai et al., 2006b; Hines, 2010); (ii) tax havens may alleviate international tax rate competition (Johannesen, 2010; Dharmapala, 2008); (iii) tax havens, or offshore financial centers, can generate positive externalities in neighboring countries by enhancing competition in the banking sector (Rose and Spiegel, 2007).

A smaller body of literature, to which we aim to contribute, focuses instead on the determinants of flows to tax havens. Scholars argue that countries can become tax havens if they have a high quality of governance, with sufficient political stability (Dharmapala and Hines Jr., 2009). Another essential feature of tax havens is small size: in a small country, the tax system may be one of the few available instruments to attract foreign investment (Bucovetsky and Haufler,

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<sup>1</sup>The opinions expressed in this paper are those of the authors and do not necessarily represent those of the institutions they are affiliated with. We are indebted for useful comments to Magda Bianco, Mario Gara, Silvia Giacomelli, Domenico Marchetti and participants at the 2013 Annual Conference of the Italian Society of Law and Economics (Lugano). An earlier version of this work circulated as *Financial flows to tax havens: determinants and anomalies*, Quaderni dell’Antiriciclaggio, Collana Analisi e Studi, N. 1. All errors are ours.

<sup>2</sup>UIF calculation based on IMF CPIS data. The UIF is Italy’s Financial Intelligence Unit and is established at the Bank of Italy. According to a standard international definition, a Financial Intelligence Unit (FIU) is a central, national agency responsible for receiving, (and as permitted, requesting), analyzing and disseminating to the competent authorities, disclosures of financial information (i) concerning suspected proceeds of crime and potential financing of terrorism, or (ii) required by national legislation or regulation, in order to combat money laundering and terrorist financing.

2008; Kanbur and Keen, 1991). Using firm level data, instead, Desai et al. (2006a) showed that firms which are larger, hold more foreign assets, have more intensive intra-firm trade and R&D expenses, are more likely to use tax havens.<sup>3</sup> A number of studies have estimated the determinants of cross-border financial flows using gravity models: Lane and Milesi-Ferretti (2008), for instance, applied a gravity model to data on international equity holdings and found a strong correlation with bilateral imports but also a prominent role of information costs in determining financial flows. Rose and Spiegel (2007) estimated a gravity model on a large sample including 69 source and 222 host countries. Their empirical analysis delivers two main findings: first, geography matters, as distance has a significant negative impact on cross-border flows; second, tax havens attract more flows than other countries, even controlling for all the available economic and institutional variables.

Our paper builds on these contributions, applying a gravity model to the flows of capital between Italian provinces and foreign countries in order to assess the relevance of the main economic and socio-demographic variables and evaluate the differences between offshore and non offshore countries. Secondly, we take a normative step and provide evidence that the analysis of the residuals from the estimated gravity model can reveal patterns of anomaly which well correlate with measures of tax evasion and money laundering activities.

The paper is structured as follows: next section describes the institutional setting and the data used, and provides some descriptive statistics. Section 3 provides the conceptual framework of the study; Section 4 shows the econometric model and reports the empirical evidence on the determinants of cross-border wire transfers and the analysis of the residuals of the model. Section 5 concludes.

## 2 Institutional Setting, Data and Descriptive Statistics

### 2.1 Italy's anti-money-laundering legislation and the S.A.R.A. archive

Italy's anti-money-laundering law (Legislative Decree 231/2007) requires banks and other intermediaries to record all transactions amounting to over 15,000 euros in a specific archive (Single Electronic Archive). Each month intermediaries transmit these data to the UIF in aggregate anti-money-laundering reports (S.A.R.A. from the Italian acronym) by aggregating individual records according to criteria determined by the law.<sup>4</sup> During 2012, the UIF received almost 100 million aggregate records, corresponding to 300 million transactions worth more than 24 trillion euros. Most of the reporting entities are banks, which accounted for more than 96% of the total

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<sup>3</sup>The rationale for this finding is that these are the firms which benefit the most from the possibility of reallocating taxable income away from high-tax jurisdictions and from reducing the burden of home-country taxation.

<sup>4</sup>Classification criteria have been enlarged since January 2012; they currently include the client's residence and economic sector, the branch of the intermediary where transaction took place, the type of the transaction, the total amount transacted and the corresponding cash component, plus the number of transactions aggregated in a single record.



number of reported transactions in 2012, but trust companies, asset management companies, securities firms and insurers also transmit reports.

For the purpose of this study, we consider only cross-border wire transfers made by private customers of Italian banks between 2007 and 2011.<sup>5</sup> On a yearly basis, cross-border wire transfers reported to UIF in the S.A.R.A. archive account for about 5.9% of records (corresponding to 3.4% of transactions and to 9.5% of amounts) and are equally partitioned between inward and outward transfers. Over 5 million records related to outgoing cross-border wire transfers were aggregated to exploit the largest available set of explanatory variables in the estimation. The resulting dataset contains more than 55,000 observations aggregated according to the year, the province of origin and the destination country (which identify, respectively, the province where the bank branch of the sender's account is located and the country where the bank of the beneficiary is based).

## 2.2 Data and descriptive statistics

From the S.A.R.A archive we obtain aggregate records which refer to flows from a given Italian province to a given foreign country in a given year.<sup>6</sup> Since not all explanatory variables are available for all countries and provinces of origin, the final sample considered for the analysis contains slightly more than 50,000 records in the most parsimonious econometric specification and shrinks to just under 25,000 records when we consider all the available control variables.

We classify destination countries into *risky* and *not risky*. Lacking a universal definition of risky destinations,<sup>7</sup> we define as "risky" the group of countries that appear in the official list issued by the Ministry of Economy and Finance according to the Consolidated Income Tax Law<sup>8</sup> and add a group of countries that the UIF specifically monitors because of opaque features of their financial, corporate or tax regulations. Considering this classification, it turns out that: 15% of the outgoing cross-border wire transfers sample are to risky countries; these account for about 8% of the overall amount of outward flows (Figure 1). Aggregate flows to risky destinations are smaller on average and consist of fewer transactions (Table 1): the average size of wire transfers to risky countries is less than a half that of those to non-risky countries (about 110,00 euros versus 223,000 euros). Finally, considering the distribution of flows to risky countries by

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<sup>5</sup>The transactions considered are only those originated by domestic households and firms; wires sent by financial intermediaries and general government entities on their own behalf and by foreign customers are not included.

<sup>6</sup>The dataset included a large number of transactions towards non independent territories. While the analysis of these flows would have been very interesting for this study, we had to drop these observations because no data about the economic and socio-demographic characteristics of these territories is available. A list of the territories dropped is included in the Appendix.

<sup>7</sup>Though the phenomenon of international harmful tax practices is generally well understood, in current practice the terms used to identify opaque jurisdictions are arbitrarily applied to a highly heterogeneous group of states and territories offering privileged tax treatment, diversified 'secrecy' services in the financial or corporate sector and providing typically inadequate tax and judicial cooperation at international level.

<sup>8</sup>See Law 917/1986, Article 167, paragraph 1.

final destination (Figure 2), the vast majority go to European countries, indicating a preference for doing business in the nearest locations even for risky activities.

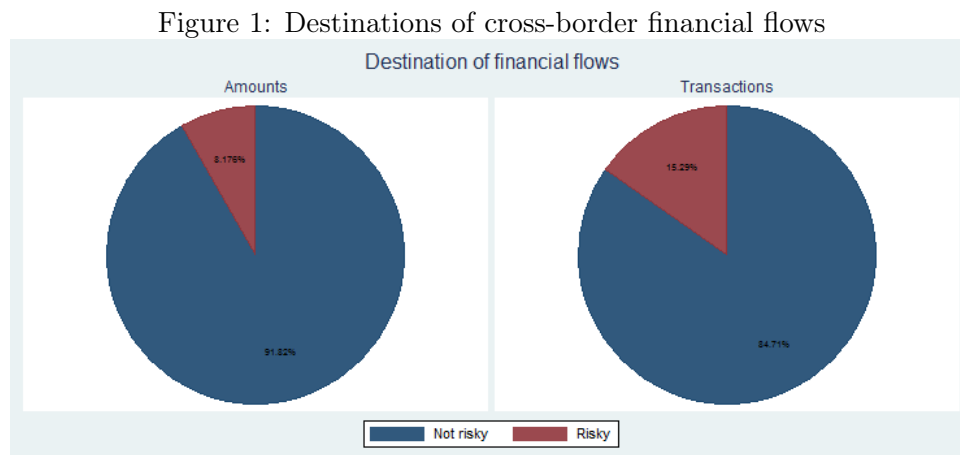


Table 1: Financial flows from Italian provinces to foreign countries, 2007-2011

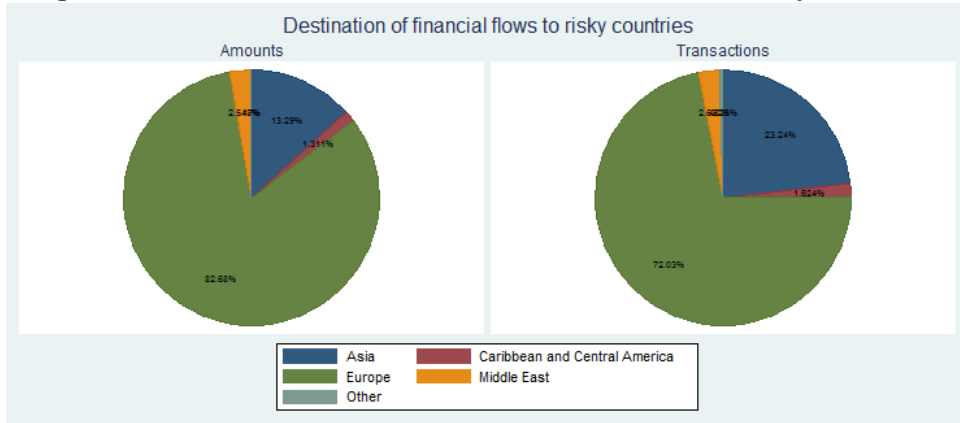
	(1)		
	Not risky	Risky	Total
Transactions <sub>ijt</sub>	385.0 (2996.9)	212.6 (1223.0)	342.6 (2672.7)
Flows <sub>ijt</sub> , million	86.16 (2052.0)	23.48 (257.0)	70.72 (1786.3)
log Flows <sub>ijt</sub>	13.53 (2.756)	13.16 (2.647)	13.44 (2.734)
Observations	55382		

mean coefficients; sd in parentheses

We add to the S.A.R.A archive a set of socio-economic and demographic variables relating to the province of origin and to the country of destination of the wire transfer (a list of the variables and their sources is reported in the Appendix). For the destination countries, we consider per capita GDP, the average level of corporate taxation, and per capita foreign direct investment. As a proxy of the distance, we add a dummy variable which takes value 1 if the foreign country  $j$  shares a border with the Italian province  $i$ . For the province, economic characteristics are proxied by the employment rate,<sup>9</sup> personal taxable income per tax payer and the value of imports from each country. Socio-demographic characteristics include resident population and the stock of resident immigrants from each country. We also employ, in a second stage of the analysis, a

<sup>9</sup>We would have preferred to use province-level value added, but this is not yet available from the Italian National Bureau of Statistics (ISTAT) for the years covered by the empirical exercise.

Figure 2: Destinations of cross-border financial flows to “risky” countries



classification of criminal activity that distinguishes between crimes more related to profitable activities such as drug trafficking, smuggling and prostitution, i.e. “enterprise syndicate crimes”, and crimes more related to penetration of organized crime, such as extortions, mafia affiliations and murders, i.e. “power syndicate crimes” (Block, 1980). All the crime indicators are taken from the ISD (Intelligence System Database) of the Ministry of the Interior. An index of mafia penetration in each province computed by Transcrime<sup>10</sup> is also used as a measure of presence of criminal activity.

Finally, we consider the number of suspicious transaction reports (STRs) received by the UIF as a proxy for the actual amount of money laundering or tax evasion activity. STRs must be filed by financial intermediaries, professionals and non-financial enterprises “whenever they know, suspect or have reason to suspect that money laundering or terrorist financing is being or has been carried out or attempted”.<sup>11</sup>

Tables 2 and 3 show the descriptive statistics for the variables included in the main econometric specification of Section 4. Table 2 contains the characteristics that are specific to each province/country/year cell in the upper panel and those specific to the destination country  $j$  and year  $t$  in the lower panel. All statistics are split between flows to risky countries (as defined above) and other flows; the last column reports the statistics for the full sample.

The figures reported in the first three lines of Table 2 are consistent with those of Table 1: the average number of transactions in each record of flows to risky countries is smaller than that of flows to non-risky countries and so is the average amount (129,000 euros for risky countries,

<sup>10</sup>Transcrime is an academic center (Catholic University of Milan and University of Trento) for the study and monitoring of criminal activities in Italy.

<sup>11</sup>According to the Legislative Decree 231/2007, Article 41(1): “the suspicion must arise from the characteristics, size or nature of the transaction or from any other circumstance ascertained in connection with the functions carried out and taking account of the economic capacity and the activity engaged in by the person in question, on the basis of information available to the reporters, acquired in the course of their work or following the acceptance of an assignment”.

241,000 euros for non-risky ones).<sup>12</sup> We also have information about the number of immigrants from each country  $j$  residing in province  $i$  in each year  $t$ : clearly the number coming from risky countries is considerably lower than that of those from other countries, because risky countries are less populous. It also appears that the value of the trade flows between Italian provinces and risky countries is lower on average than that with non-risky countries. Looking at country-specific indicators, we observe that risky countries are on average richer than non-risky ones, receive less FDI, and generally apply lower corporate tax rates.

Table 2: Descriptive statistics of regression sample, 2007-2010. Characteristics of flows destination countries

	(1)		
	Not risky	Risky	Total
Transactions $_{ijt}$	541.7 (3570.8)	393.9 (1852.7)	521.6 (3389.6)
Flows $_{ijt}$ , million	130.8 (2661.4)	50.78 (399.3)	119.9 (2478.8)
log Flows $_{ijt}$	14.27 (2.668)	14.16 (2.695)	14.25 (2.672)
log migrants $_{ijt}$	4.042 (2.160)	2.684 (2.091)	3.858 (2.201)
log import $_{ijt}$	14.72 (2.884)	13.51 (2.846)	14.55 (2.908)
log GDP $_{jt}$ , pc	9.078 (1.396)	9.522 (1.202)	9.138 (1.380)
Shared border $_{ij}$	0.00228 (0.0477)	0.00890 (0.0939)	0.00318 (0.0563)
log population $_{jt}$	17.00 (1.537)	15.44 (1.473)	16.79 (1.618)
tax rate $_{jt}$	45.50 (16.25)	36.95 (10.21)	44.34 (15.84)
log FDI $_{jt}$	22.60 (1.945)	21.84 (1.719)	22.49 (1.934)
Observations	24844		

mean coefficients; sd in parentheses

<sup>12</sup>These figures are simply obtained from those in Table 1 by dividing the value of the flows by the number of transactions.

With respect to the province of origin of the financial flows, in Table 3 we observe that flows to risky countries usually come from bigger and richer provinces. In terms of crime indicators, moreover, provinces of origin of financial flows to risky countries have higher property crime rates and lower extortions and white collar crime rates, while other crime rates do not differ according to the destination of the transfers.<sup>13</sup> Considering the indicators built by Transcrime and the number of STRs to the UIF, instead, it appears that flows to risky countries tend to originate from provinces with higher crime rates or number of STRs.

Table 3: Descriptive statistics of regression sample, 2007-2010. Characteristics of flows source provinces

	(1)		
	Not risky	Risky	Total
Employment rate <sub>it</sub>	60.14 (8.951)	61.03 (8.682)	60.26 (8.920)
log population <sub>it</sub>	13.01 (0.800)	13.15 (0.797)	13.03 (0.801)
log taxable income <sub>it</sub> , pc	9.996 (0.0919)	10.01 (0.0928)	9.997 (0.0922)
log property crimes <sub>it</sub>	28.18 (10.65)	29.62 (10.99)	28.37 (10.71)
log violent crimes <sub>it</sub>	3.358 (2.199)	3.286 (2.206)	3.348 (2.200)
log organized crime <sub>it</sub>	0.0120 (0.0152)	0.0119 (0.0148)	0.0120 (0.0151)
log extortions <sub>it</sub>	0.0700 (0.0568)	0.0672 (0.0549)	0.0696 (0.0565)
log white-collar crimes <sub>it</sub>	0.0389 (0.0423)	0.0353 (0.0376)	0.0384 (0.0417)
log enterprise syndicate crimes <sub>it</sub>	2.074 (1.437)	2.055 (1.467)	2.072 (1.441)
log power syndicate crimes <sub>it</sub>	8.394 (5.830)	8.383 (6.009)	8.392 (5.855)
Transcrime Index of Mafia Penetration <sub>i</sub>	7.572 (16.44)	7.947 (17.51)	7.623 (16.59)
Firms confiscated for Mafia <sub>i</sub> , per 10,000 firms	7.346 (8.347)	7.904 (9.372)	7.426 (8.504)
UIF STR <sub>i</sub>	148.3 (288.9)	175.1 (323.6)	151.9 (294.0)
Observations	24844		

mean coefficients; sd in parentheses

<sup>13</sup>These differences are all statistically significant at 1% level according to standard t-tests; the difference on the rate of extortion crimes is instead significant at 5% level.

### 3 Conceptual Framework

Our empirical analysis relies on a specification based on a “gravity model” (Tinbergen, 1962) This type of models are typically used in the field of international trade to predict the flows of goods from a country  $i$  to a country  $j$ . In this model it is assumed that the flows of goods between countries are regulated by a law similar to Newton’s gravity, so that:

$$F_{ijt} = G \times \frac{M_{it}M_{jt}}{D_{ij}} \quad (1)$$

where  $F_{ijt}$  are the flows from a country  $i$  to a country  $j$  in the specified unit of time  $t$ ,  $G$  is then a constant, similar to Newton’s gravity constant,  $M_{it}$  and  $M_{jt}$  represent the economic “mass” of respectively country  $i$  and country  $j$ , and  $D_{ij}$  is the physical distance between the two countries. The econometric translation of the model takes the natural logarithms of equation 1 to obtain a simple linear specification of the type:

$$\log F_{ijt} = g + \beta_1 \log M_{it} + \beta_2 \log M_{jt} - \beta_3 \log D_{ij} + \epsilon_{ijt} \quad (2)$$

Following Lane and Milesi-Ferretti (2008), Portes and Rey (2005), Rose and Spiegel (2007), we apply this model to the flows of capital (rather than goods) between Italian provinces and foreign countries between 2007 and 2011. Estimating a regression like that in equation 2 allows us to assess the relevance of the main economic variables for the amount of capital that flows from Italy to foreign countries and provides an estimate of the share of the observed flows which can be explained by standard economic variables. It is of special interest to us to understand how much of the observed flows of capital from Italy is *not* explained by the main economic and socio-demographic characteristics of the two countries involved, and what other factors are instead relevant, in order to derive some policy implications for effective financial control and tax compliance.

### 4 Empirical Analysis

In this Section we bring the model to the data. The dependent variable is the natural logarithm of the financial flows from province  $i$  to country  $j$  in year  $t$ . The first set of control variables includes the observable characteristics of each Italian province. In principle, we want to add as many observable characteristics as possible, so as to describe the (time variant) economic features of each province that might explain the financial flows from province  $i$  to each foreign country  $j$ . We thus use the available socio-demographic characteristics of the source provinces and a set of relevant economic characteristics of each destination country  $j$  (as detailed in Section 2) which might explain financial and economic flows from Italian provinces. Finally, in some specifications we also include a dummy which takes value 1 if the foreign country is a risky one ( $risky_j$ ) according to the classification described in Section 2.

We estimate several versions of the model using OLS regressions with robust standard errors

clustered at the provincial level, progressively adding the complete set of control variables. In some specifications we also include province and year fixed effects to control, respectively, for time invariant unobserved heterogeneity in each province and time trends. The estimated coefficients can be interpreted as elasticities, as the control and dependent variables are expressed in logarithms.

#### 4.1 Cross-border flows determinants

Our baseline results are presented in Table 4. We include flows from *all* Italian provinces to *all* foreign destination countries. In columns (1), (2) and (3) we add the set of control variables that are available for all countries and provinces, while in columns (4), (5), (6) and (7) we add the complete set of control variables, year and province fixed effects. The sample shrinks considerably passing from the first set to the second set of specifications. To make sure that our results are not driven by sample selection, we repeat the regression of column (3) on the smaller sample. The results are in column (8) and show no significant differences with respect to those in column (3). The explicative power of the model also increases. Thus, we focus our comments on columns (4)-(7), which are the specifications that will be used in the analysis of the residuals (see Section 4.2).

Focusing on column (4), all the correlations with the characteristics of the foreign country have the expected sign. Financial flows are positively correlated with the foreign GDP and population, with FDI and with proximity to the Italian provinces. Conversely, they are negatively correlated with the firm-level tax rate. The characteristics of the local economies (i.e. the set of control variables at the provincial level) are also significantly correlated with cross-border financial flows. Cross-border flows are positively correlated with the provincial average personal taxable income, with the stock of immigrants (of the receiving foreign country), with the amount of goods imported from each foreign country, and with the general economic conditions of the province (as proxied by the employment rate).

Including year and province fixed effects - columns (5) and (6) - does not substantially change the sign and magnitude of the correlations, except for the provincial employment rate and population, which are no longer statistically different from 0.<sup>14</sup> In column (7) we add the dummy *risky*, which shows a positive and statistically significant coefficient. Its size implies that, other things being equal, financial flows to a risky destination are about 36 per cent larger than those to other countries.

#### 4.2 Analysis of the residuals

The empirical analysis carried out to this point has allowed us to highlight the role played by the major economic variables in explaining the flows of capital from Italian provinces to foreign countries. A crucial question remains that of understanding what other, non-economic variables determine the variation in the amount of flows that we observe.

<sup>14</sup>This is probably due to the low temporal variability of these two measures in the observed period.

Table 4: OLS Estimates on full sample.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Employment rate <sub>it</sub>	0.064*** (0.001)	0.080*** (0.001)	0.080*** (0.001)	0.041*** (0.002)	0.040*** (0.002)	0.000 (0.009)	-0.000 (0.009)	0.089*** (0.001)
log GDP <sub>jt</sub> , pc	0.807*** (0.007)	1.191*** (0.006)	1.193*** (0.007)	0.838*** (0.012)	0.852*** (0.013)	0.872*** (0.013)	0.866*** (0.013)	1.318*** (0.009)
Shared border <sub>ij</sub>	3.364*** (0.233)	3.676*** (0.188)	3.680*** (0.188)	1.308*** (0.165)	1.303*** (0.165)	1.202*** (0.162)	1.095*** (0.161)	3.240*** (0.208)
log population <sub>it</sub>		1.252*** (0.011)	1.252*** (0.011)	0.571*** (0.017)	0.561*** (0.017)	0.336 (0.610)	0.329 (0.608)	1.333*** (0.015)
log population <sub>jt</sub>		0.632*** (0.005)	0.630*** (0.005)	0.087*** (0.010)	0.096*** (0.010)	0.101*** (0.010)	0.118*** (0.010)	0.591*** (0.008)
log taxable income <sub>it</sub> , pc				1.781*** (0.171)	1.954*** (0.177)	5.217*** (2.009)	5.285*** (2.002)	
log migrants <sub>ijt</sub>				0.253*** (0.005)	0.255*** (0.005)	0.264*** (0.005)	0.270*** (0.005)	
tax rate <sub>jt</sub>				-0.007*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)	-0.007*** (0.001)	
log import <sub>ijt</sub>				0.400*** (0.004)	0.399*** (0.004)	0.394*** (0.004)	0.397*** (0.004)	
log FDI <sub>jt</sub>				0.057*** (0.009)	0.046*** (0.009)	0.047*** (0.009)	0.047*** (0.009)	
risky <sub>j</sub>			-0.032 (0.025)				0.361*** (0.028)	-0.053 (0.036)
Observations	50510	50510	50510	24844	24844	24844	24844	24844
R <sup>2</sup>	0.214	0.485	0.485	0.704	0.704	0.723	0.725	0.524
Year FE					yes	yes	yes	
Province FE						yes	yes	

Standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

We thus focus our attention on the residuals of the regression which has the highest predictive power among those estimated in the previous section.<sup>15</sup> The model considered is that of column (6) of Table 4. The  $R^2$  of this regression reveals that about 28% of the observed variation in the amount of log flows from Italy to foreign countries remains unexplained by the main economic variables that we included in the regression. In order to understand what other forces drive the financial flows, we take the studentized residuals<sup>16</sup> of the regression and normalize them on a 0-1 scale. This allows us to identify and rank the most unpredicted flows and to build an anomaly index which will be highest for the flows most *above* the amount predicted by the estimation of equation 2 and lowest for those most *below* the predicted amount. Table 5 reports the top 20 flows according to our index together with the corresponding amount of capital transferred and

<sup>15</sup>This is a prudential choice that minimizes the probability of classifying as “anomalous” flows which can instead be explained by a slightly richer econometric specification.

<sup>16</sup>These are the regression residuals divided by their standard deviation. This normalization makes the residuals of a regression comparable and is needed for the detection of outliers.



the number of transactions involved.<sup>17</sup>

Table 5: Top 20 outliers flows

<i>Year</i>	<i>From</i>	<i>To</i>	<i>million €</i>	<i>Operations</i>	<i>Index</i>
2010	Umbria 1	Cyprus	194.5	104	1
2007	Emilia Romagna 1	Mozambique	5.8	26	.9779373
2007	Sardinia 1	Switzerland	44.7	26	.9566107
2007	Emilia Romagna 2	Panama	14.6	36	.9463907
2008	Piedmont 1	Algeria	220.2	18	.927729
2008	Lazio 1	Malta	0.5	16	.9102542
2007	Emilia Romagna 3	Luxembourg	5594.5	3274	.907112
2010	Veneto 1	Cyprus	253.4	253	.8934924
2010	Umbria 1	Honduras	5.0	27	.893119
2008	Piedmont 2	Kenya	1.9	57	.8860027
2009	Tuscany 1	Zimbabwe	6.8	27	.8740342
2010	Tuscany 1	Zimbabwe	6.9	35	.8723251
2008	Umbria 1	Malta	1.4	21	.8695132
2007	Liguria 1	Malta	121.5	554	.8687478
2007	Liguria 2	Nigeria	4.8	2	.8566697
2007	Tuscany 1	Zimbabwe	7.2	31	.8542836
2010	Liguria 3	Panama	8.5	48	.851546
2010	Lazio 2	Latvia	5.4	37	.8458577
2008	Lazio 3	Sierra Leone	4.9	42	.8452809
2010	Campania 1	Malta	3.6	61	.8452042

The index is, by definition, a measure of all that is not explained by the variables included in the empirical specification: this is likely to include money laundering activities and tax evasion, but it will also synthesize such other aspects as the presence, in some foreign countries, of NGOs and humanitarian organizations that receive financial aid from Italy. Still, Table 6 shows that our index of anomaly is significantly higher in the countries that UIF classifies as risky but not in those that currently appear in the FATF list.<sup>18</sup>

Table 6: Correlation between anomaly index and definitions of “risky country”

	All values			Index > .5		
	Index	Risky <sub>j</sub>	FATF <sub>j</sub>	Index	Risky <sub>j</sub>	FATF <sub>j</sub>
Index	1			1		
Risky <sub>j</sub>	0.0760***	1		0.130***	1	
FATF <sub>j</sub>	-0.0359***	-0.0451***	1	0.0103	-0.128***	1

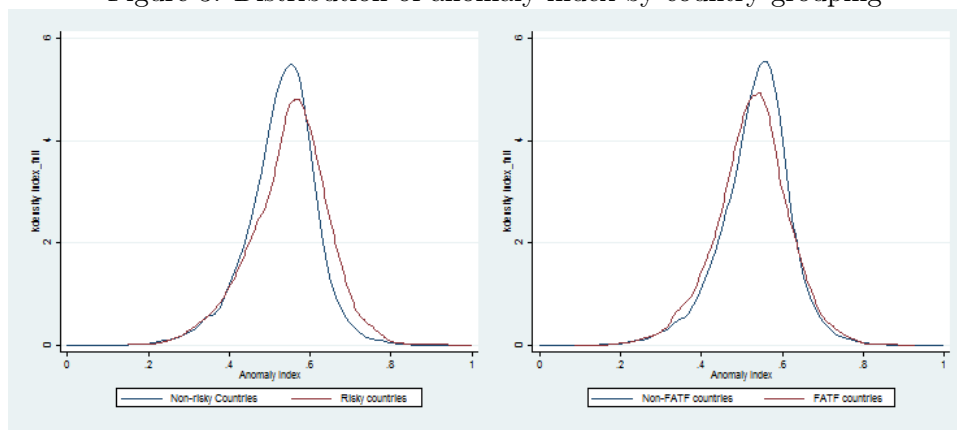
\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

<sup>17</sup>The names of the provinces are not disclosed for confidentiality reasons.

<sup>18</sup>We also tested whether the probability of having an anomalous residual is higher for observations related to risky countries. We define as “anomalous” the residuals with studentized values above 2 (Iglewicz and Hoaglin, 1993; Velleman and Welsch, 1981). We find that the percentage of anomalous observations for risky countries (3.62) is more than double that for non risky countries (1.59), the difference being significant at the 1% level.

Further evidence on this is provided by Figure 3, which shows that the distribution of our index for the risky countries is shifted to the right, i.e. risky countries have higher scores on our anomaly index. On the other hand, a similar correlation is not seen for the countries belonging to the list created by the Financial Action Task Force (FATF).<sup>19</sup> This result was predictable, because the FATF list currently contains only 14 countries<sup>20</sup> that are monitored because they still are deficient in their compliance with the standards set for purposes of combating money laundering and the financing of terrorism. As shown in Table 6 and Figure 3, the flows towards the FATF countries are generally *below* the amounts predicted by our econometric model. This suggests that the list of “risky” countries employed by the UIF permits a more effective detection of anomalous financial flows.

Figure 3: Distribution of anomaly index by country grouping



### 4.3 Correlations between the anomaly index and provincial level crime indicators

A second step of the analysis consists in comparing the degree of riskiness measured by our anomaly index with the characteristics of the country of destination and of the province of origin of the financial flows. We begin with the countries of destination and assign a single value of the index to each country by collapsing it at the country level; in doing so we use the *sum* of the values rather than the mean to maintain the variation generated by the regression and assign a larger weight to those countries that have more unexplained variability in the financial flows received from Italy. The sum of the index values is then normalized between 0-1.

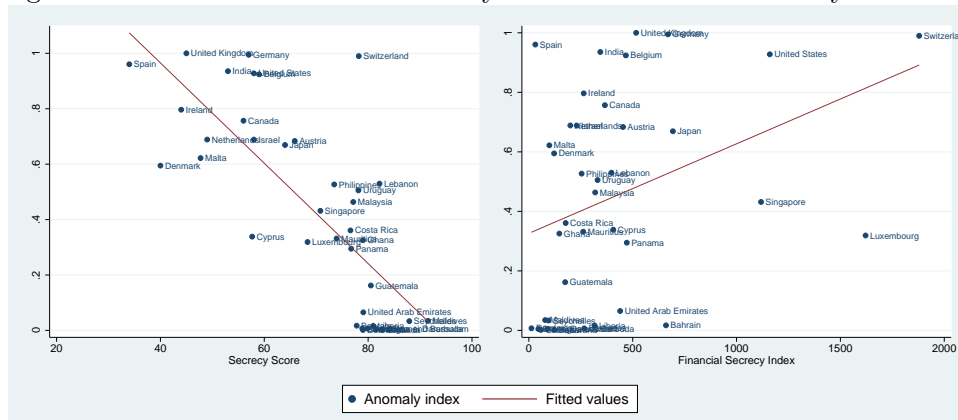
Having assigned a level of riskiness to each single country, we compare this ranking with that generated by the Financial Secrecy Index of the Tax Justice Network, a UK-based research

<sup>19</sup>The FATF is an inter-governmental body established in 1989 within the Organization of Economic Development and Cooperation. Its objectives are to set standards and promote effective implementation of legal, regulatory and operational measures for combating money laundering, terrorist financing and other related threats to the integrity of the international financial system.

<sup>20</sup>At the time of the analysis, these were: Democratic People’s Republic of Korea (DPRK), Ecuador, Ethiopia, Indonesia, Iran, Kenya, Myanmar, Pakistan, Sao Tomé and Príncipe, Syria, Tanzania, Turkey, Vietnam, Yemen.

center that focuses on the impacts of tax avoidance, tax competition and tax havens. The Financial Secrecy Index is based on a secrecy score, which is a *qualitative* measure that assesses how secretive a jurisdiction is in terms of laws, regulations, adherence to international treaties, and so on. The secrecy score is then *weighted* by the jurisdiction’s size and overall importance to the global financial markets so as to create a final measure of financial secrecy that takes into account not only the degree of opacity of the country’s regulations but also its relevance on the financial markets: while the Maldives has the highest secrecy score in the sample, it ranks just 60th in terms of the Financial Secrecy Index, where Switzerland is first. Figure 4 compares our index with the secrecy score (left panel) and the Financial Secrecy Index (right panel): our index is negatively related to the secrecy score (the correlation coefficient in this case is -0.761, significant at the 1% level) while it correlates positively and significantly with the Financial Secrecy Index (the correlation coefficient is 0.357, significant at the 5% level).<sup>21</sup> The reason of such divergent paths is that our index, as the Financial Secrecy one, takes into account the number of transactions involved so as to give a larger weight to countries which receive the largest amounts of flows; on the other hand, the countries with the highest degrees of opacity of regulation, and thus with the highest levels of secrecy score, are generally the very small ones and therefore this score is negatively correlated with our index.

Figure 4: Correlation between anomaly index and financial secrecy indicators



We proceed with our analysis of the anomaly index by comparing it with some characteristics of the province of origin. As for the countries of destination, we collapse our original index according to province of origin by summing its values and then normalizing them on a 0-1 scale.

Table 7 reports the correlation coefficients for all the crime indices. The first panel provides evidence of a strong positive correlation of our anomaly index with the UIF STRs, which are based on the detection of anomalous behavior. The second panel contains the coefficients of cor-

<sup>21</sup>We also computed the mean of the Financial Secrecy Index and of the secrecy score for the anomalous observations (i.e., those with studentized residuals  $\geq 2$ ) and found that for both indexes the mean is higher with respect to that computed for the other observations, at the 5% significance level.

Table 7: Correlation between anomaly index and provincial crime indicators

	Anomaly Index <sub><i>i</i></sub>
UIF STR per 100,000 people	0.660**
Property crimes <sub><i>i</i></sub>	0.705**
Violent crimes <sub><i>i</i></sub>	0.451
Organized crime <sub><i>i</i></sub>	-0.315
Money laundering crimes <sub><i>i</i></sub>	0.112
Drugs crimes <sub><i>i</i></sub>	0.644**
White-collar crime <sub><i>i</i></sub>	-0.545*
Power syndicate crimes <sub><i>i</i></sub>	0.455
Enterprise syndicate crimes <sub><i>i</i></sub>	0.575*
Firms confiscated for Mafia <sub><i>i</i></sub> , per 10,000 firms	-0.126
Transcrime index of Mafia penetration <sub><i>i</i></sub>	0.0493

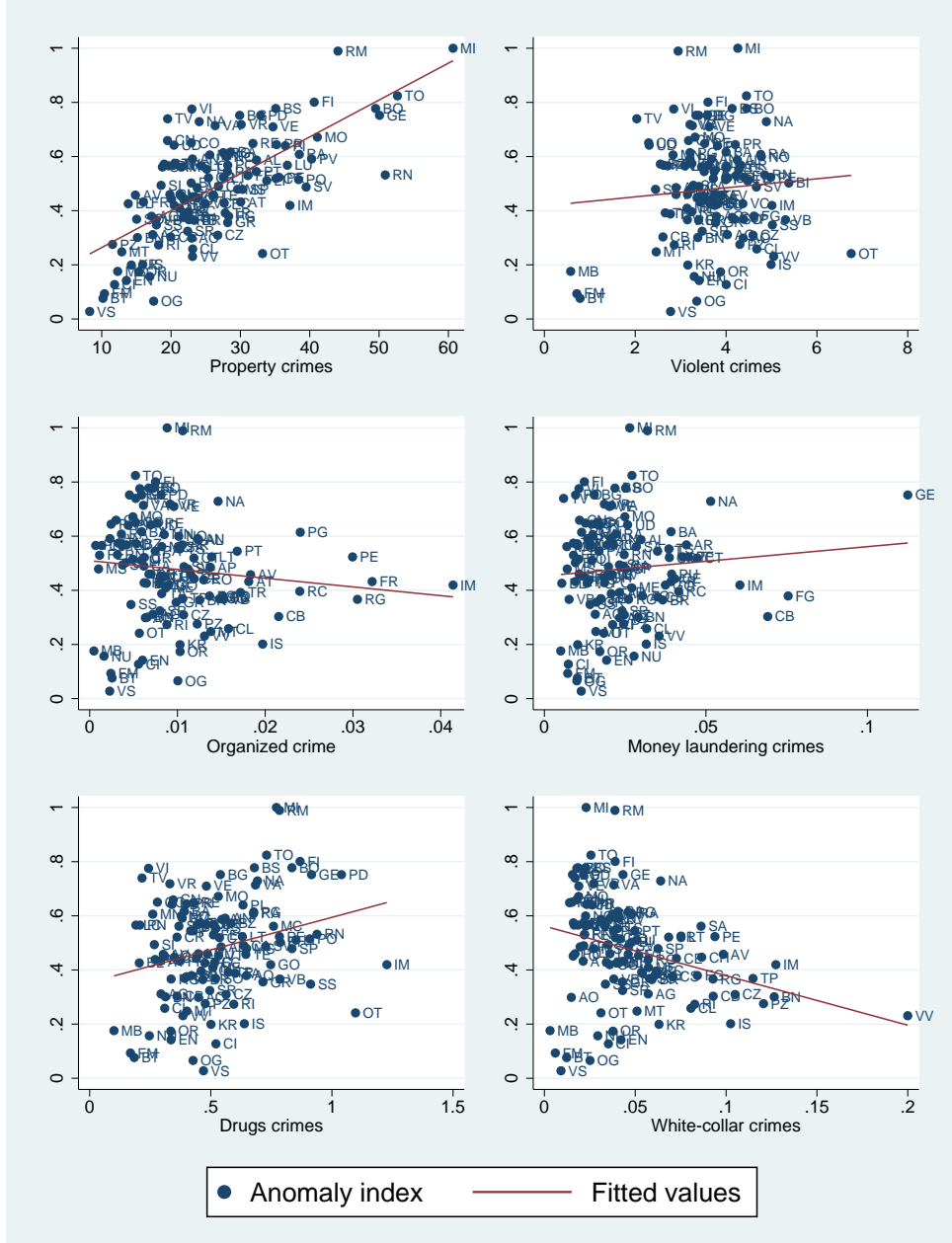
\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

relation between our index and the crime rates derived from the data provided by the Ministry of the Interior: it turns out that our index depicts the same patterns as the crime indicators, exhibiting a positive correlation with most of them. As further confirmed by Figure 5, these positive correlations are particularly strong for property and drugs-related crimes, which generally generate significant flows of (illegal) money.<sup>22</sup>

Finally the last panel of Table 7 reports the correlation between our index and two further measures of the penetration of organized crime: the first is the number of firms confiscated for alleged criminal connections in the province, the second is the Index of Mafia penetration built by Transcrime. These measures show a poor correlation with our index mainly because they tend to overweight the provinces located in the southern regions where the Mafia presence has traditionally been greatest; our index, instead, tends to put more weight on provinces which are financially and commercially more prominent, i.e. those in the North.

<sup>22</sup>For each variable listed in Table 7, we computed the mean among anomalous observations (studentized residuals  $\geq 2$ ) and tested whether this was higher than the corresponding mean computed on all other observations. The results are consistent with those reported in Table 7, as we found that the mean among anomalous observations is significantly higher for all variables that Table 7 shows to be correlated with the anomaly index (and also for the number of firms confiscated for Mafia). Moreover, by using the residuals of the model estimated without provincial fixed effects, we find that the mean of money laundering crimes and that of the Transcrime Index of Mafia Penetration, computed on anomalous observations, are significantly higher, too.

Figure 5: Correlation between anomaly index and provincial crime indicators



## 5 Concluding Remarks

Offshore financial centers and tax havens are currently at the heart of an intense policy debate because they are held to originate undesirable spillovers by decreasing tax intakes in other countries and reducing the transparency of financial transactions, thus facilitating criminal activities, including tax evasion, corruption, terrorism and drug trafficking. Concerns are further justified by the great volume of financial transactions that involve these centers and by the share of global investments that they attract. These facts are particularly relevant for the case of Italy, where the underground economy is vast and connections between flows to financial havens and businesses under the control of organized crime have been often discovered by the judicial authorities. For example, consider that between 2007 and 2011, our period of observation, almost 15% of the cross-border transfers from Italy went to risky countries, accounting for almost 8% of the overall amount of outward flows. The economic literature has not yet found a clear consensus on the effects of financial havens on global markets. Recent contributions have prevalently focused on the effects of tax havens on the economies of other countries; little has been done on the study of the determinants of financial flows to and from tax havens.

Our work aims to contribute to the latter strand of the literature. We apply a gravity model to study the determinants of the flows of capital between Italian provinces and foreign countries in order to assess the relevance of the main economic and socio-demographic variables and evaluate in which ways flows to offshore and non-offshore countries are different. To this end, we construct a rich dataset which combines information on bank wire transfers to and from all Italian provinces with several data sources containing information on the economic and socio-demographic characteristics of Italian provinces and destination countries. From the empirical point of view, we estimate a gravity model using OLS regressions and test the sensitivity of our findings across several specifications that account for unobserved (time invariant) territorial characteristics and yearly time trends.

We find that financial flows are positively correlated with foreign GDP and population, with FDI and with the proximity between the country of destination and the Italian province of origin. Conversely, they are negatively correlated with the corporate tax rate. The characteristics of the local economies are also significantly correlated with cross-border financial flows: these are positively correlated with the provincial average personal taxable income, with the stock of immigrants, with the amount of goods imported from each foreign country, and with the employment rate. We also find that, all else being equal, financial flows to a risky destination are substantially larger than those to other countries; this is neither explained by the socio-economic characteristics of the province where the financial flow originates nor by those of the destination country.

We then exploit the residuals from the estimated gravity model to identify and rank the most unpredicted flows, and to build an anomaly index which is higher for flows most above the

amount predicted by the estimation of the baseline equation and lower for those most below the predicted amount. We find positive, statistically significant correlations of our anomaly index with property and drug-related crimes at the provincial level and with indexes of opacity and riskiness of the legislation of the destination countries.

Our findings are also interesting from a policy perspective. Investigations by national and international financial and law enforcement authorities could be greatly assisted by knowledge of the characteristics and the dynamics of suspect flows to offshore countries. For instance, we find that flows to risky destinations are those least explained by the volume of trade and financial investment between the Italian provinces and the destination countries. Moreover, the fact that our anomaly index strongly correlates with several indicators of criminal activity in the province of origin suggests that the results of our econometric analysis could be useful for the anti-money-laundering authorities and the police forces. This is further confirmed by the correlation between the anomaly index and the flows of STRs at province level.

## A Appendices

Table A.1: Data sources

Variable	Source
Operations $_{ijt}$ , Flows $_{ijt}$	UIF S.Ar.A.
Migrants $_{ijt}$ ,	Demo Istat
Imports $_{ijt}$ , Employment Rate $_{it}$	Istat
GDP $_{jt}$ , Population $_{jt}$ , FDI $_{jt}$	World Bank
Tax Rate $_{jt}$	Doing Business
Population $_{it}$ , Taxable Income $_{it}$	FINLOC
Crime rates $_{it}$	SDI, Ministry of Interior
Transcrime Index of Mafia Penetration $_i$ , Firms confiscated for mafia $_i$	Transcrime
UIF STR $_i$	UIF
Secrecy Score $_j$ , Financial Secrecy Index $_j$	Tax Justice Network



Table A.2: Countries and territories not included in the analysis

Country	Total Amount	Operations
Aland Islands	115,851	4
Anguilla	4,053,335	134
Antarctica	2,284,375	84
Dutch Antilles	157,784,112	1564
Azores Islands	3,120,129	78
Bouvet Island	272,276	22
Canary Islands	32,108,492	472
Chafarinas Islands	7,360,128	115
Chagos Islands	4,310,352	57
Christmas Island	156,936	8
Vatican City	12,168,469	176
Clipperton	674,148	26
Cook Islands	174,737	18
Falkland Islands	291,945	8
Gibraltar	206,564,000	1614
Gough	14,166	1
Guadalupa	99,631,304	820
French Guyana	27,247,860	346
Guernsey	173,168,240	1429
Heard and McDonald Island	586,732	8
American Pacific Islands	233,924	7
Jersey	1,974,071,680	3791
Madeira	56,123,092	787
Martinica	6,001,378	112
Mayotte	2,007,821	32
Melilla	13,203	1
Midway Islands	246,436	4
Montserrat	3,210,584	100
Nauru	3,653,265	3
Norfolk Island	20,000	1
Penon de Alhucemas	10,531,626	372
Pitcairn	279,482	7
Reunion	13,089,096	418
Saint Helena	127,654	7
South Georgia and South Sadwich	36,170	4
Taiwan	8,337,577,472	168737
British Indian Ocean Territory	11,305	1
Tokelau	4,939,763	89
Tristan da Cunha	1,909,411	31
British Virgin Islands	21,095,060	170
Wallis and Futuna	96,339	2

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