SPEED OF EURO ADOPTION

by Francesco Columba *

Abstract

This paper estimates the speed and determinants of euro adoption across Italian provinces by exploiting the natural experiment in early 2002 when the euro and lira dually circulated as legal tender. A unique data set with daily observations on the net flows of euro banknotes from the branches of the Bank of Italy, province by province, is built and used. The diffusion of the euro differs across Italy, being faster in the Northern regions and slower in the Southern regions and in the Islands up to the beginning of February. The speed of euro adoption is influenced by the availability of transaction technology and by demographic characteristics, but it is not influenced by literacy and criminality levels.

JEL classification: E41; E51.

Keywords: demand for money, financial innovation, payment economics, speed of euro adoption.

Contents

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1. Introduction[1]

On January 1, 2002 the euro became legal tender and began circulating the European Monetary Union. A period when the old national legacies and the euro dually circulated ranged in length from zero to two months across member countries. In Italy the dual circulation of the lira and of the euro lasted two months until February 28; on March 1 the lira ceased to be legal tender and the euro became the only legal tender[2].

We exploit the natural experiment of the introduction of a new currency in an economic system to analyse the patterns of the speed of adoption in different areas and its relationship with the demographic and economic characteristics. To our knowledge this is the first empirical analysis using census data on this phenomenon[3]. We first derive a measure of the speed of adoption of the euro in each Italian province and then analyze cross-regional determinants.

We expect that standard currency demand variables will affect the speed of euro adoption, with effects of the similar signs found in currency models[4]. The idea is that if a variable positively (negatively) affects the demand for cash, it also accelerates (decelerates) the adoption of the new legal tender because the desire to continue to conduct transactions in cash without inconvenience arising from the acceptability of the notes, induces faster adoption of the new currency. Moreover, the greater is the use of cash, the faster the cash holdings in the old currency are exhausted and the sooner the new currency is adopted. We argue that the spread of the new currency, given the initial amounts of banknotes delivered to post offices and banks (frontloading) and their subsequent distribution by these to commercial chains and retailers (sub-frontloading)[5], was influenced by the economic and

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[2] It is possible to convert Italian lire banknotes in euro banknotes at the branches of Bank of Italy until 28 February 2012. See Bank of Italy (2002a), (2002b) for a description of the transition to euro in Italy.

[3] Other interesting studies on the euro introduction used survey data with a very limited coverage, Cannon and Cipriani (2006), Goodhart and Pappa (2003).

[4] See Boeschoten (1992) and Duca and Van Hoose (2004) for a review of the literature on currecny models.

[5] The banknotes frontloadead and sub-frontloaded were distributed before 1 January 2002.

demographic characteristics of the areas examined. We investigate this hypothesis using an unique data set with daily data on the diffusion of euro in Italian provinces through the branches of Bank of Italy. In section 2 the related literature is briefly reviewed and section 3 describes the methodology and the data. In section 4 the results of the analysis are illustrated. In section 5 the results of the robustness checks are reviewed, while the conclusions are drawn in section 6.

2. Related literature

Lotz and Rocheteau (2002) examine, within a dual currency search-theoretic framework, the different options a policy-maker faces when introducing a new fiat currency. The model they develop offers some policy prescriptions for a currency reform in which a fiat currency is replaced with a new one. To induce the move to the new currency, the government must help agents to co-ordinate in order to achieve a new equilibrium. In particular, it has to introduce measures to stop the use of the old currency, to reduce the conversion cost and finally to define the length of time of dual currency circulation. The authors conclude that their model could be amended to allow for innovation in the payment system, in the form of a new currency (like the euro) that speeds up trades and reduces transaction costs.

According to the literature on currency demand[6] the key factors determining currency demand include a scale variable that accounts for transactions (such as the gross domestic product or consumption), an opportunity cost reflecting interest rate, demographic and social characteristics, the extent of the shadow economy, and the availability of transaction technology. As for the signs of the effects, the demand for currency is positively influenced by the scale variable and negatively by the opportunity cost. The age of the population should be positively related to the use of cash since the most advanced transaction technologies (e.g. debit and credit cards) are less used with increase in age. Aside from behavioural motives, this correlation arises because the elderly have a higher probability of being poor, a condition that limits the scope of available cash alternatives. Conversely, the

[6] See Boeschoten (1992) for a survey of the literature.

use of cash is expected to fall as transaction technology improves and reduces the need for cash. Such improvements can be empirically proxied by the number of ATM (automated teller machines), POS (point of sale terminals), or the use of credit and debit cards.

Snellman, Vesala and Humphrey (2001) study cash transactions patterns for ten European countries over 1987-1996. They argue that the diffusion of POS has made it convenient to use payment cards instead of cash for low value payments at a point of sale, since the finality of the settlement typical of cash is coupled with the ability to earn interest on demand deposits. They suggest that the diffusion of POS is one of the key determinant of the substitution of non-cash payments for cash. The diffusion of ATM has instead an ambiguous effect on the substitution for cash. On the one hand, it becomes easier to withdraw cash, but on the other hand, the use of payment cards is enhanced and the average cash balance held can be reduced. Their results are that, controlling for standard money demand theory influences, the nature of the substitution of card payments for cash is similar across countries and that the stage of development for each country in the substitution process depends crucially on the diffusion of the card payment infrastructure, particularly POS. For an analysis of the spread of ATMs and POS in Italy see Columba (2003).

Drehmann, Goodhart and Krueger (2002) investigate the effects of modern payment technologies, namely POS and ATMs, on the demand for cash. For large banknotes they do not find a strong effect because large notes will probably continue to be the means of payment preferred in the underground economy. Their conclusions are that POS have a significant negative effect on the demand for small banknotes but the advance of ATMs seems to increase the demand for small banknotes. They conclude that technology is not crowding out small banknotes, while the effect on large notes and hence on total notes in circulation is not clear-cut. Rogoff (1998) believes the determinants of cash holdings to be mainly the interest rates, the ratio of taxes to GDP, and a proxy for violent crime. Zizza (2002) finds that crime positively affects the demand for currency using Italian data.

Attanasio, Guiso and Jappelli (2002) find empirical results possibly in line with the interpretation that cash holding is considerably higher in Central and in Southern Italy, where the underground economy and criminal activities are deemed to be more widespread than in Northern Italy.

3. Methodology and data

The branches of the Bank of Italy in the Italian provinces are the points through which the currency is first put in circulation and also finally withdrawn for destruction. To measure the speed of adoption of the new currency we focused on the dynamic pattern of per capita holdings of euro, derived from the cumulated net flows of euro banknotes introduced in the economy through the branches of the Bank of Italy. This measure after the dual circulation period converges in each area to an asymptote and that makes viable a comparison between areas of different size. We assume that in Italy during the dual circulation period and the month of March, in which the euro became the exclusive legal tender, the flows of the new banknotes between the provinces of introduction were negligible[7]. The functional form that best fits the provincial euro per capita patterns is an exponential negative function, with an initial constant to account for the banknotes frontloaded and attributed to the 2nd of January. This is illustrated in figure 1 which reports the stocks resulting from the sum of the net flows of euro banknotes for the five Italian macro-areas, North-Western, North-Eastern, Central, Southern and the Islands. Accordingly we estimated the following equation per each province:

$$E_{it} = c_i - a_i e^{-bit} \quad (1)$$

where E_{it} is the amount of euro per capita; i indexes the provinces and ranges between 1 and 95[8]; and t indexes the days and ranges between 1 and 63[9] that is from January 2 to March 31.

[7] This assumption seems reasonable due to the feeble relevance of flows of banknotes due to trade and tourism in the short period observed, as argumented in section 3. We have of course also to take into account that cash service companies transporting the banknotes from the Bank of Italy to the private banking sector in principle could move across provinces part of the banknotes introduced in the system by the Central Bank. Unfortunately data on these flows are not available but their magnitude shouldn't be large due first, to the short time period after the introduction of the new currency and second, to safety reasons that push to limit cash movements within Italy as much as possible.

[8] We consider the administrative distribution of Italy existing until 1996 in 95 provinces since the distribution of the 99 branches and subsidiaries of Bank of Italy is coherent with it (in 1996 8 new provinces were created).

[9] From the 2nd of January 2002 to the 31st of March 2002 with the exclusion of the Saturdays and Sundays.

We defined the speed of adoption in each province i in each date t as the derivative of equation (1), whose expression is the following:

(2) $$S_{it} = \frac{\partial E_{it}}{\partial t} = a_i b_i e^{-b_i t}$$

After estimating the parameters of equation (1), we substituted their values in equation (2) and evaluated the speed of adoption of euro S_{it} for all the 95 provinces and the 63 dates, obtaining for each date a vector S_t of 95 provincial speeds S_{it}. Figure 2 plots the speed of adoption for the five Italian main areas over all periods while Table 1 reports the value of the speed of adoption at the end of March for each province. We then ran cross-sections regressions using as dependent variable the speed S_{it} and as regressors variables suggested by the currency demand literature and previous work on banknote migration in the euro-area. The specification used is:

(3) $$S_{it} = b_0 + b_1 \log(GDP)_i + b_2 i_{dd\,i} + b_3 \log(ATM)_i + b_4 \log(POS)_i + b_5 \log(OLD)_i + \varepsilon_t$$

Following standard currency demand models, we regressed the dependent variable, the speed of adoption of the new currency, on gross domestic product per capita (*GDP*), as a scale variable, the interest rate on demand deposits, $i_{dd,}$ as opportunity cost; and the number per capita of *ATM* and *POS* terminals to proxy for transaction technology. We also included to proxy for individuals with a higher demand for cash, a demographic variable, the percentage of elderly people in the population, *old*.

The data set we built is unique because it comprises data on the daily inflows and outflows of lira and euro banknotes through the branches of the Bank of Italy, that act as cash offices. To analyse the dynamic pattern of euro adoption we analyze 5,985 observations, each consisting of the net flow of euro banknotes for one of the 95 provinces and for one of the 63 dates. We cumulated all the euro banknotes put in circulation since January 2 up to March 29 (subtracting the ones withdrawn from circulation), province by province, and we tracked the stocks of euro that increased during the period observed. Our assumption is that, in the period observed, the flows of euro banknotes due to trade between the different provinces were negligible so that the stocks built and, more importantly, the

pattern of their growth, are reliable. This assumption hinges on the long extent of the dual circulation period which led part of the currency needs to be satisfied with the still circulating lire and on the proximity of our study period to the introduction of euro. Moreover in the period observed the flows should not have been altered significantly by tourism that in Italy begins on a large scale at Easter, that in 2002 was the 31st of March. In the analysis moreover we divided the stocks of euro by the population of the province to obtain per capita holdings of euro that can be compared across different provinces. The other variables used in the cross-section regressions are measured as of end 2001 (see Appendix).

Figure 1

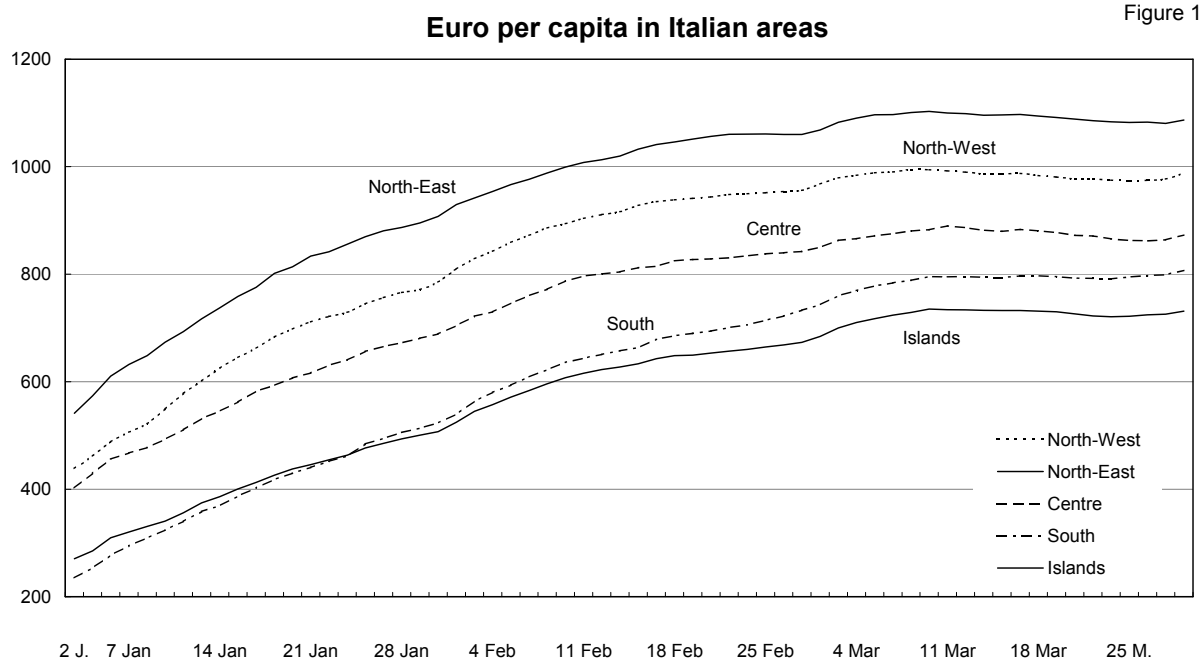

Figure 2

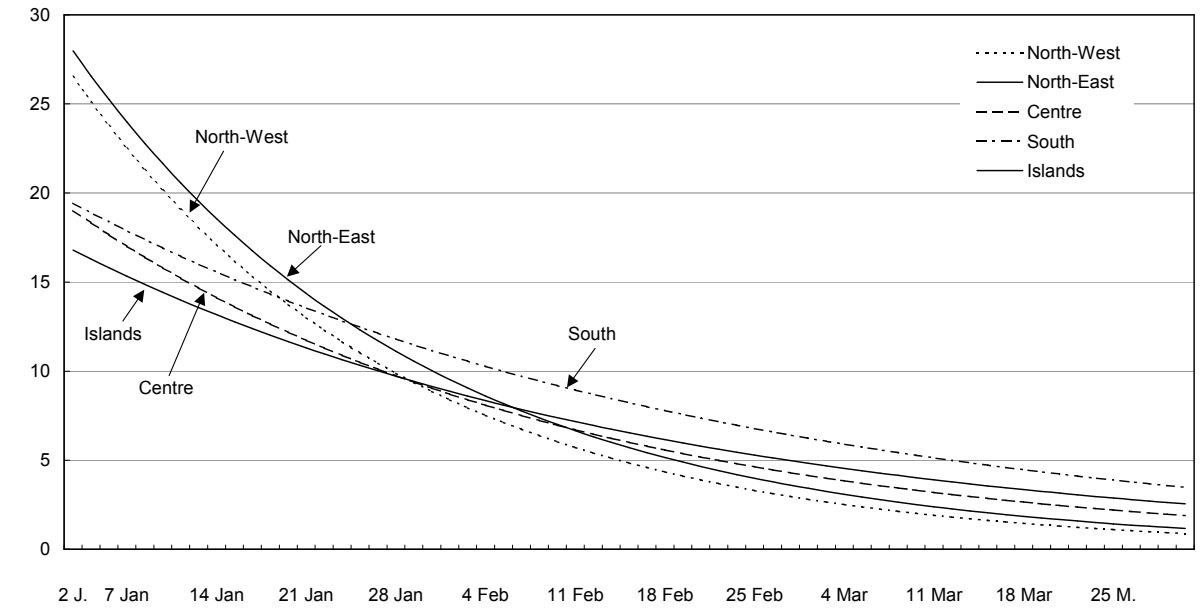

Table 1

Speed of euro adoption

Provinces	January 31	February 28	March 29
North-West	**8.4**	**2.8**	**0.9**
Torino	15.2	5.6	2.0
Vercelli	1.7	0.2	..
Novara	9.3	3.9	1.5
Cuneo	2.5	0.3	..
Asti	7.8	4.2	2.2
Alessandria	9.7	4.4	1.9
Aosta	3.5	1.7	0.8
Milano	11.4	5.1	2.2
Varese	1.5	0.1	0.0
Como	18.4	10.4	5.7
Sondrio	4.8	0.5	..
Bergamo	22.4	6.3	1.7
Brescia	6.5	1.0	0.2
Pavia	2.9	1.1	0.4
Cremona	5.5	2.7	1.3
Mantova	11.2	4.7	1.8
Genova	9.9	2.4	0.6
Imperia	3.0	1.2	0.5
Savona	3.5	0.6	0.1
La Spezia	11.8	6.7	3.8
North-East	**10.0**	**3.4**	**1.2**
Trento	3.5	0.3	..
Bolzano	..	..	..
Venezia	3.9	1.8	0.8
Verona	11.0	3.7	1.2
Vicenza	17.8	7.4	3.0
Belluno	12.2	5.9	2.8
Treviso	13.3	4.4	1.3
Padova	14.1	4.2	1.2
Rovigo	4.2	1.2	0.3
Trieste	11.8	6.3	3.2
Udine	17.9	7.0	2.6
Gorizia	7.6	4.8	3.0
Pordenone	3.8	2.5	1.7
Bologna	16.6	5.7	1.9
Piacenza	14.8	7.0	3.2
Parma	9.3	4.5	2.1
Reggio Emilia	11.1	5.9	3.1
Modena	3.3	0.8	0.2
Ferrara	5.8	2.0	0.7
Ravenna	2.8	0.4	..
Forlì	14.5	5.5	2.0

Table 1 (continued)

Provinces	January 31	February 28	March 29
Centre	**9.0**	**4.1**	**1.9**
Firenze	2.1	0.2	..
Massa Carrara	8.4	6.0	4.2
Lucca	8.9	3.7	1.4
Pistoia	10.0	5.9	3.4
Livorno	9.5	5.4	3.0
Pisa	8.9	4.4	2.1
Arezzo	11.0	5.3	2.5
Siena	10.3	7.5	5.3
Grosseto	10.9	6.0	3.3
Perugia	10.4	4.3	1.7
Terni	5.9	2.6	1.1
Ancona	7.9	2.3	0.6
Pesaro e Urbino	8.6	3.1	1.0
Macerata	9.6	4.9	2.4
Ascoli	5.3	3.9	2.9
Roma	12.8	5.1	1.9
Viterbo	5.4	2.5	1.1
Rieti	11.0	6.4	3.7
Latina	5.8	1.9	0.6
Frosinone	8.2	4.9	2.9
South	**11.2**	**6.2**	**3.5**
L'Aquila	10.4	6.2	3.6
Teramo	9.4	5.0	2.6
Pescara	8.0	2.1	0.5
Chieti	8.9	5.5	3.3
Campobasso	14.9	8.1	4.3
Isernia	13.3	9.7	6.9
Napoli	15.1	8.0	4.1
Caserta	10.1	5.9	3.3
Benevento	10.5	7.9	5.8
Avellino	9.8	6.6	4.3
Salerno	13.6	7.7	4.3
Bari	9.0	3.3	1.2
Foggia	10.4	5.8	3.2
Taranto	8.7	5.8	3.9
Brindisi	6.2	3.4	1.8
Lecce	10.9	5.4	2.6
Potenza	16.3	10.5	6.6
Matera	6.5	4.1	2.5
Reggio Calabria	13.4	8.0	4.6
Catanzaro	11.7	7.0	4.1
Cosenza	8.9	5.6	3.5
Islands	**9.1**	**4.8**	**2.5**
Palermo	13.9	7.1	3.5
Trapani	8.3	5.3	3.3
Messina	11.9	7.2	4.3
Agrigento	9.7	5.8	3.3
Caltanissetta	9.6	5.4	3.0
Enna	9.5	6.3	4.0
Catania	7.4	2.9	1.1
Ragusa	2.7	2.0	1.5
Siracusa	6.5	6.1	5.8
Cagliari	8.0	2.9	1.0
Sassari	8.3	2.9	1.0
Nuoro	8.9	4.8	2.5
Oristano	9.4	4.2	1.8

Table 2

SUMMARY STATISTICS [(1)]

	2001
Population	
Mean	0.59
Standard deviation	0.62
Real GDP	
Mean	5.30
Standard deviation	7.18
Euro holdings	
Mean	820
Standard deviation	475
ATM	
Mean	362
Standard deviation	419
POS	
Mean	7873
Standard deviation	10121
Prices*	
Mean	108.97
Standard deviation	1.59
$\mathbf{i_{dd}}$	
Mean	1.37
Standard deviation	0.26
Speed *	
Mean	2.3
Standard deviation	1.63
No. obs.	95

Sources: Bank of Italy, ISTAT, Istituto Guglielmo Tagliacarne and author's calculations.
(1)Data refer to Italian provinces. Population is expressed in millions, real GDP in billions euro. ATM and POS are absolute numbers. i_{dd} stands for interest rate on overnight deposits, expressed as percentage.
* Velocity to end March 2002.

4. Results

Estimates of the speed of adoption of euro in the Italian provinces are obtained for all the dates observed and the provinces. From these the speed of adoption S is calculated for the five major areas of Italy, North-West, North-East, Centre, South and Islands (fig. 1) which is plotted in Figure 2 to illustrate a comprehensive picture of how the euro spread in

Italy. At the very beginning of the three months observed, the speed in the Northern area was higher than in the Southern regions, but then around mid January, this pattern reversed with the Southern areas displaying a faster speed to catch to the Northern regions.

To assess the determinants of how quickly the new currency was adopted Table 3 reports the results of the cross-section regressions performed at three significant dates; the end of January, the end of February (coinciding with the end of the dual circulation period), and the end of March (the first month with the euro being the only legal tender).

Among the r.h.s. variables tested, the numbers of ATM and POS terminals and the percentage of elderly people are significant. The effect of ATM on the speed of adoption is negative, as expected, and it is equal to -2 per cent at the end of the dual circulation period and to -3.4 per cent at the end of March. We find that following a 1 per cent increase in the number of POS the speed of adoption decreases, as expected, increasingly with time. At the end of January the negative effect on the speed of adoption was -1.07 per cent, increasing to -2.08 per cent at the end of February and -3.4 per cent at the end of March. The share of elderly people in a region's population has a positive effect on the speed of adoption at the end of January equal to 1.99 per cent increasing to 5.06 at the end of February and at the end of our sample to 8.29. In contrast, the scale variable and the opportunity cost term are not statistically significant.

Our results are consistent with what we expected for the effect of ATM and POS availability, which, *ceteris paribus,* should reduce the demand for cash and consequently also the urgency of switching to the new fiat currency. This hypothesis is also supported by the evidence that the use of payment cards rose at the beginning of 2002 and then abated, which might have reflected a desire to avoid cash transactions when the euro was first introduced, to avoid possible initial confusion regarding the use of the new currency.

We expected to find demographic variables linked to less use of sophisticated means of payment could proxy for factors associated with and presumably lead to a higher use of cash than the average of the population. The variable we used to proxy for a high proclivity to use cash is the percentage of elderly people in a region's population.

Table 3

BASELINE MODEL OF THE SPEED OF EURO ADOPTION[1]

Explanatory variable	January, 31	February, 28	March, 29
Real GDP	0.87	1.64	2.45
	0.76	*1.50*	*2.28*
Opportunity cost	0.43	0.62	0.81
	0.46	*0.90*	*1.37*
ATM	-0.66	-2.00 *	-3.40 *
	0.59	*1.15*	*1.76*
POS	-1.07 **	-2.08 **	-3.12 ***
	0.44	*0.86*	*1.31*
Old	1.99 **	5.06 ***	8.29 ***
	0.82	*1.60*	*2.44*
R^2:	0.16	0.22	0.24
No. of observations:	95	95	95

[1] Speed of euro adoption, real GDP, ATM, POS and Old variables are per capita amount and in log form. Standard errors in italics.

*** significant at 1% level; ** significant at 5% level; * significant at 10% level.

5. Robustness checks

We performed some robustness checks both on the data set and on the specification employed.

With regard to the data set we calculated the stocks of euro per capita excluding the frontloaded and sub-frontloaded euro banknotes, accounted for in the first inflow of banknotes in the economy dated January 2, this was done to check for a possible outlier effect or for a mechanic predetermination of the starting point of the curves of the cumulated stocks. This however did not change the shape or pattern of the curves. As for the measure of the speed of adoption, we replaced the measure in (2) with simple differences between the

cumulated stocks at the end and the beginning of the sample. Once again, the results did not significantly change.

We also checked if other variables, that might be linked to individual preferences for cash, could help to explain the heterogeneity in the spread of euro through Italy. In our search we used the percentage of graduates in the population, the percentage of people with only the primary school degree, and the level of unemployment. We also tried to see if the speed of euro adoption was influenced positively by an index of criminality, following the literature on the demand for currency, but this variable was statistically insignificant and its inclusion did not alter the qualitative results. We also considered a variable reflecting the level of danger of holding large amounts of cash, the number of cases of pickpocketing, to check if it negatively affected the speed of euro adoption. The coefficient, which was negative as expected, was not statistically significant. We also checked if the amount of banknotes frontloaded and sub-frontloaded (that is the banknotes available in each province already on the first day of introduction of the euro) had an impact. All the variables above were not statistically significant, and their inclusion did not alter the results we had for the variables of the final specification (see Table 4).

Table 4

ALTERNATIVE MODELS OF THE SPEED OF EURO ADOPTION[1]

Explanatory variable	Eq. 1	Eq. 2	Eq. 3	Eq. 4	Eq. 5	Eq. 6
Real GDP	1.27	1.35	1.61	1.30	2.47	2.45
	0.67	*2.65*	*2.53*	*2.38*	*2.30*	*2.28*
i_{dd}	0.76	0.69	0.78	0.87	0.85	0.81
	1.45	*1.44*	*1.41*	*1.38*	*1.40*	*1.37*
ATM	-1.25	-1.15	-1.22	-1.82	-3.35*	-3.40*
	2.61	*2.59*	*2.57*	*2.00*	*1.80*	*1.76*
POS	-3.91***	-3.86***	-3.84***	-3.80***	-3.11**	-3.12**
	1.41	*1.40*	*1.39*	*1.38*	*1.33*	*1.31*
Old	6.86**	7.81***	8.16***	8.25***	8.18***	8.29***
	3.20	*2.72*	*2.51*	*2.49*	*2.51*	*2.44*
Frontloading	-0.32	-0.27	-0.22	-0.21	-0.11	
	0.53	*0.52*	*0.49*	*0.49*	*0.49*	
Criminality	1.83	1.94	2.04	2.14*		
	1.38	*1.36*	*1.32*	*1.28*		
Unemployment	0.42	0.37	0.46			
	1.29	*1.28*	*1.24*			
Graduate	1.21	0.62				
	2.13	*1.87*				
Primary	2.78					
	4.85					
R^2	0.27	0.27	0.27	0.27	0.25	0.24
No. of observations	95	95	95	95	95	95

[1] Speed of euro adoption, real GDP, ATM, POS, frontloading are per capita amount and in log form. Old, criminality, unemployment, graduate, primary variables are in log form. Standard errors in italics.

*** significant at 1% level; ** significant at 5% level; * significant at 10% level.

6. Conclusions

The natural experiment of the euro's introduction in the first months of 2002 was an extraordinary one. The changeover from twelve national legacies to a single new currency happened in an institutional framework which accommodates the existence of twelve national countries. This notwithstanding the changeover was a success and the operations were conducted smoothly thanks also to the positive reaction of the public to the introduction of the new fiat currency. In Italy a gradualist approach was adopted to minimise the inconvenience for consumers and businesses. Specifically the period of dual circulation was extended until 28 February 2002, the latest date allowed by the Ecofin Council.

The length of the dual circulation period in Italy gives researchers the opportunity to build an unprecedented daily measure of the speed of adoption of the euro under reasonable assumptions subject, of course, to some caveats. Two factors support the validity of this measure. The first is the shortness of the period considered. The second is the circumstance that until 28 February the euro was a legal tender with a competitor, the Italian lira, that prevented euro from being the only mean of payment in cash transactions and that possibly did not lead to relevant flows of euro banknotes migration contrary to lira banknotes. Moreover the period considered does not include Easter, March 31, 2002, that represented the first relevant episode of tourism following the introduction of euro and which avoids including in the sample period banknote migration. One possible caveat is the possible existence of flows of banknotes within Italy arising from the activity of the cash service companies and for which data are not available. Nevertheless, because we are interested to the comparison of the patterns of the speed of adoption of the euro across areas, the phenomenon of interest, the relative patterns across areas, should not be significantly biased. For these reasons, new insights on the pattern of diffusion of a new currency can be gleaned from analysing these high frequency cross-section data.

After deriving a measure of the velocity of the spread of the new money in Italy, we test some hypotheses about the determinants of the speed of euro adoption. We find empirical evidence consistent with currency demand theory and empirical models that the availability of transaction technology and the share of the elderly significantly account for cross-regional patterns of the speed of euro adoption. In particular, the negative effect of the

number of ATMs and POS on the speed of adoption of the euro is consistent with the role that these financial innovations have had in lowering currency demand.

These results strongly suggest that financial technology needs to be taken into account not only in modelling continuous time series data on money demand but also in analyzing unusual transitions involving the adoption of new currencies. Hopefully, more research on the interplay between financial technology and currency area questions will be conducted.

Appendix
The data set

The data set refers to 95 [10] Italian provinces.

Automated tellers machines: number of ATMs located in the provinces examined at the end of each year; the source is the banking statistics data set collected by Bank of Italy (Matrice dei conti).

Criminality: number of total crimes; Ministry of Internal Affairs and Istat data reworked.

Elderly people: percentage of people over 65; Istat (National Institute of Statistics) data reworked.

Euro capita holdings: cumulated net inflows of euro banknotes in the economy through the branches of Bank of Italy, daily frequency (working days); the source is a banknote statistics data set of Bank of Italy.

Gross domestic product: gross nominal value added per province, annual frequency: source Istituto Guglielmo Tagliacarne.

Interest rate on demand deposits: the interest rate is calculated on the basis of the data for demand deposits of over than 20 million lira, the only one for which data are available with provincial detail, the frequency is quarterly; the source is a special data set collected by the Bank of Italy (Centrale dei rischi).

Pickpocketing: number of cases of pickpocketing; Ministry of Internal Affairs and Istat data reworked.

Points of sale: number of POS located in the provinces examined at the end of each year; the source is the banking statistics data set collected by the Bank of Italy (Matrice dei conti).

Population: number of residents at the end of each year; the source is Istat (National Institute of Statistics).

Prices: the index of prices used is the consumer price index and it is calculated only for the administrative centre of each region and attributed also to the other provinces of the region because of lack of data, annual frequency; source, Istat data reworked.

[10] We aggregated the data of the eight new provinces created in 1996 with the data of the provinces of which they were part before 1996.

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