

# Technological change as a contributing factor to the eurozone crisis

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## Abstract

The public debate over the eurozone crisis revolves around three main themes: chronic economic mismanagement in the periphery; mishandling of the crisis by the core countries and the EU institutions; and structural deficiencies of the monetary union. In this paper, we focus on a less discussed factor, namely the rapid technological change which has rendered some of the initial objectives of the monetary union obsolete, in particular, the objective of reducing the costs created by the existence of several currencies inside a common market.

In the first part of the paper we briefly review some relevant technological developments which, by facilitating cross-border transactions and reducing their monetary and non-monetary costs, also reduce the benefit expected from the adoption of a common currency. Our review covers the now ubiquitous online shopping, some recent attempts for cross-border integration of mobile payment systems, and finally, the more controversial cryptocurrencies.

In the second part of the paper we analyse statistical data, mostly from the relevant issues of the Eurobarometer, on cross-border online purchases of goods and services in EU. Several factors encouraging or discouraging cross-border purchases can be identified. For example, high levels of home Internet access facilitate cross-border purchases, while linguistic factors, such as shared mother tongues, may also play a role. On the other hand, the data show that the large domestic markets of countries such as Germany, France, UK and Italy, or the successful domestic e-commerce model of Netherlands, discourage cross-border purchases in these countries. The adoption or not of the single currency does not seem to have a significant influence on the levels of cross-border purchases.

In conclusion, while the higher than anticipated costs of EMU justifiably dominate the debate over the eurozone crisis, the lower than expected gains, due to technological changes that were largely unanticipated at the time when EMU was planned, should also be identified as an underlying, long term and deeply rooted contributing factor. In particular, the effects of past technological shifts such as the rapid expansion of online shopping, ongoing developments such as mobile money, and possible future ones such as the cryptocurrencies, should be taken into consideration when the future of the euro is debated.

## 1. Introduction

The public debate on the eurozone crisis revolves around three main themes, which are also reflected in the relevant academic literature; political mismanagement in the periphery; wrong policies, i.e. fiscal austerity, imposed by the centre; and structural deficiencies of the euro. Comprehensive critiques usually cite combination of these reasons; see for example (Stiglitz, 2014). Further refinement of these categories is possible, as for example in (Mavroudeas, 2015) where the structural explanations are split into weak structural and deep structural or systemic. In that paper, non-mainstream analyses of the crisis are also reviewed. A common theme in the mainstream approaches to the understanding of the crisis, either political or structural, is that the cause of the crisis the higher than anticipated economic cost of the monetary union. In this paper, we explore the opposite idea; the anticipated economic benefit from joining a monetary union was smaller than expected because new technologies facilitating trade between countries with different currencies have emerged.

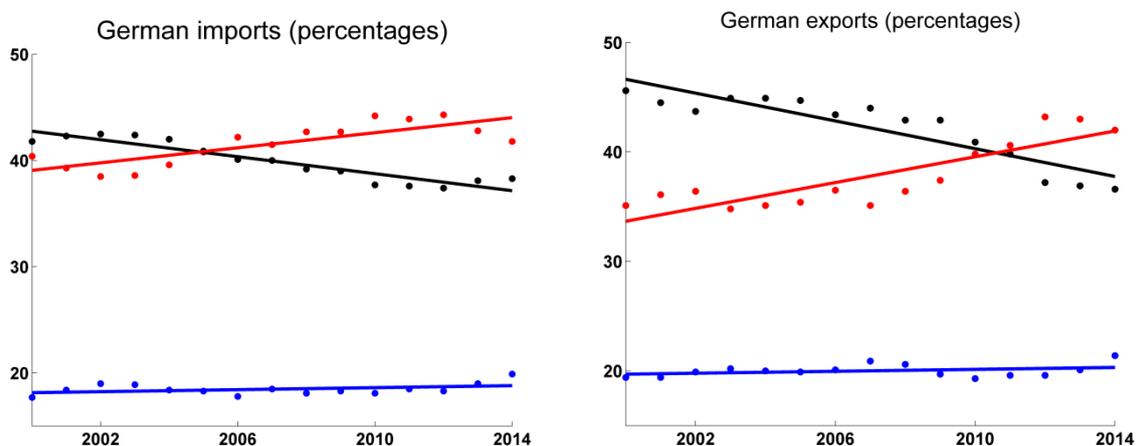
It is now widely accepted that the motives behind the creation of the single currency were political. Critics of the monetary union refer to it as a political project (Dannhauser, 2013), while its proponents, even when they avoid the use of that term, they regularly defend the single currency in political terms, i.e. as being part of a wider push for European integration which is vital for the preservation of the peace and the prosperity of the continent.

Nevertheless, as a project that was obviously bound to have profound economic implications, there was an economic rationale behind the creation of the single currency. Part of this economic rationale was the reduction of transaction costs associated with multiple currencies, as mentioned several times in the (European Council, 1989), and summarised in (European Commission, 2015a) as: *“It was clear that the full benefits of the internal market would be difficult to achieve with the relatively high business costs created by the existence of several currencies and unstable exchange rates”*. The stimulation of trade inside the euro area is still cited as an obvious advantage of adopting the euro (Mursa, 2014).

When we look at trade trends and patterns in certain key euro area economies a very different picture is revealed. Figure 1 shows the share in Germany’s imports and exports of the euro area countries, the other EU countries and the non EU countries, respectively. Regressions show that the linear trend of the share of euro area in Germany’s trade is negative, and in fact it was negative even before the beginning of the crisis in 2008. This is a striking observation which can be used to question the purpose of the single currency; the most trade oriented major economy of the world entered a monetary union, only to see for the next 15 years its share of trade with its monetary union partners to be steadily eroded.

We can identify two reasons why such statistical trends, even though obvious and well-known, are not indeed used to question the purpose of the single currency. A first reason is that they are too striking; it is illogical to assume a direct negative effect of the adoption of the single currency to the trade with the monetary union partners, as the data would suggest. Thus, for an explanation of the negative trend one might look at the different growth rates of the various regions, or the maturity and the saturation of the trading relationships between euro area countries, compared to the opportunities for establishing new trade links with non-euro EU countries, former Eastern Bloc in

particular, and non EU countries. In this paper, we only argue that a possible positive effect of the euro on trade was smaller than expected.



**Figure 1:** The share of German imports (left) and exports (right) and their linear trends. The euro area is shown in black (downward trend lines at the top of the diagrams); the other EU countries are shown in blue (slightly upward trend lines at the bottom of the diagrams); and the non-EU countries in red (upward trend lines at the top of the diagrams). Source (Destatis, 2015).

A second reason is that aggregates of imports and exports shares, being very general statistics, do not suggest by themselves a mechanism through which the erosion of trade shares with the monetary union partners might have happened. In this paper, in Section 3, we look at a much more specific statistic which suggests technological change as a mechanism; that is consumer attitudes towards cross-border purchases of goods and services in EU, as they have been documented by the Eurobarometer surveys. Our claim is that technological change related to online shopping has facilitated cross-border trade, even between countries with different currencies, to the extent that any effect of adopting or not the single currency has been diluted.

The choice of using the Eurobarometers surveys on online shopping is not an arbitrary one. Recognising the importance of online shopping for the internal EU market, the “Internal Market” Special Eurobarometer (Eurobarometer, 2013c) consists of three chapters, which are on cross-border online shopping, free movement of workers and regulated professionals and the financial crisis, respectively. Moreover, the latest issues of the series of Flash and Special Eurobarometers on consumer attitudes towards cross-border trade and consumer protection are dominated by data on online shopping.

## 1.1 Overview

In Section 2, we briefly present three case studies on technologies that facilitated or could facilitate cross-border trade. The main motivation for including these case studies is to give some context to the analysis and discussion of the data that follow; however, we also want to highlight some issues related to the nature and the effect of such technologies.

In Section 3, we analyse the Eurobarometer data. This is a challenging task since there is a multitude of factors affecting the popularity of intra-EU cross border purchases in each country. The size of the 17<sup>th</sup> annual conference of the Association for Heterodox Economics, July 2015

domestic economy and prevalence of home Internet access are easily identified as two of the most important, while language, geography and price levels may also play a role. The analysis of data in search of the impact of the single currency is further complicated by the fact that there are only ten countries outside the euro area, most of which can be considered as being in a trajectory towards joining eventually the euro. To overcome these challenges, the chosen methodology groups together countries with similar characteristics and looks at the corresponding data inside each group. This peer grouping was a natural choice for the additional reason that if a country is to assess the impact the adoption or rejection of the single currency had its economy, will naturally compare its situation with countries it sees as its peers, e.g. the UK would probably compare itself against Germany, France or Italy, while Finland with Sweden, Norway or Denmark. In this paper, we considered four groups; the G7 economies (Germany, France, UK and Italy), the Nordic countries (Sweden, Norway, Denmark and Finland), the mid-sized Central Eastern European countries (Czech Republic, Hungary and Slovakia) and the Baltic countries (Lithuania, Latvia and Estonia).

In Section 4, we summarise the main results and discuss the limitations of our approach.

## **2. Technologies affecting cross-border trade activity - three case studies**

We present three brief case studies of technologies related to cross-border trade; online shopping, as an example of an already mature technological change; mobile money, as an example of technological change that is currently under way; and cryptocurrencies as an example of technological change that might get traction in the future.

Online shopping is reviewed as relevant to the data that will be analysed in Section 3. In the review of mobile banking we make the point that the even technologies that can be termed as low-end or even obsolete can have transformative effects, depending on the environment and the processes through which they are adopted. Finally, the third case study is a reminder of the unpredictable and often controversial nature of technological change and its effects. That means that continuous analysis and constant reassessment of the findings is often the only way we have for understanding the effects of technological change.

### **2.1. Online shopping**

Due to its widespread adoption, large volumes and steep upward trend, online shopping is considered the backbone of the digital economy. In 2014, online sales represented the 7% of the total retail sales in EU (European Commission, 2015a), with an expected average annual growth rate for the 2013-2016 period of above 10% (European Commission, 2013). Several of the technologies associated with online shopping can be considered mature, even though they still obviously evolve.

The evolution of online shopping has not been smooth; the dotcom bubble and the subsequent bust around the year 2000 is cited as a typical false start with several parallels to other speculative technology driven frenzies such as the railroad, telegraph, automobile, radio or television (Stewart & Zhao, 2000). In the immediate aftermath of the burst of the bubble, the phenomenon was rightly attributed to investors and businesses getting well ahead of customers and markets (Stewart & Zhao, 2000). In the 17<sup>th</sup> annual conference of the Association for Heterodox Economics, July 2015

Pavlou, 2002) and not fully understanding the complex cost-benefit trade-offs between online and traditional shopping, as for example the cost for the customer of revealing personal information that might otherwise not have to provide to a traditional seller. About 15 years later, it is clear that the rapid growth of online shopping should be more attributed to consumers accepting and adapting to the technology, rather than the evolution of the technology itself. For example, trust to online retailers is increasing and people are becoming more willing to share their personal information online, reducing or eliminating what (Stewart & Pavlou, 2002) describes as a hidden cost of online shopping.

In another more specific example, also highlighting the need for constant reassessment of the impact of the technology, (Hirabuko & Friedman, 2002), citing (Neuborne, 2000), raised the possibility of online shopping being inherently incapable of displacing certain sectors of traditional retailing, such as fashion clothing which in (Neuborne, 2000) is described as a “social experience”. Today, fashion is one of the fastest growing areas of online shopping, not so much for cost considerations, according to (Craik, 2015), as for people wanting to be fashion forward. Such a development would have been inconceivable before the post bubble growth of the online social networks.

## **2.2. Mobile money**

Mobile money has a transformative effect on the banking systems of several developing countries, mostly in Africa, while, on the other hand, several failures to gain traction have also been documented (Evans & Pirchio, 2015). The most well-known example of mobile money is Kenya’s m-Pesa. While mobile money is essentially a system for making financial transactions through mobile phones, m-Pesa has also been described as a distinct commodity, called e-money or e-float, measured nevertheless in the same units as money (Jack & Suri, 2011). Mobile money reduces drastically the costs of several financial services that are usually associated with traditional banking, allowing access to people that were otherwise excluded; m-Pesa is now used by two thirds of Kenyan adults (Cook & McKay, 2015).

The underlying technology of m-Pesa and other mobile money is far from cutting edge. To keep the specifications and thus the cost of the required hardware as low as possible, the service is based on the USSD and SMS protocols and the financial transactions take place by the exchange of SMS messages. The use of low-end technology is recognised as a limitation of the service and a move to smartphones and Internet based protocols that will allow, for example, the use of graphical interfaces is predicted as the next logical step in the development of the service (Donovan, 2015).

The first cross-border mobile money remittance system was launched in 2014 by Tigo, allowing mobile money payments between Tanzania and Rwanda (Reuters, 2014). In 2015, Vodafone and MTN announced a cross-border mobile money payment system covering seven African countries, in a move described by Vodafone’s Director of Mobile Money as an agreement to “connect our mobile wallets” (Vodafone, 2015). Whether these developments, by reducing the costs of cross-border financial transactions, will compete against and make less attractive existing or planned monetary unions in the African continent is an open question.

### 2.3. Cryptocurrencies

Even though there are several cryptocurrencies in existence, Bitcoin, as the most well-known and traded by far, is almost a synonym for cryptocurrency. The two characteristics of Bitcoin that drew the most attention are the enhanced privacy of the transactions, which has been abused for criminal purposes, and its deflationary nature which has contributed to the instability of its exchange rate. It should be noted however that these are not intrinsic characteristics. Cryptocurrencies with reduced privacy are possible (Peng, 2014), while the extreme deflationary characteristics of the Bitcoin are the result of the parameters of the managing protocol that is currently used by the Bitcoin Foundation (Barber et al., 2012).

The defining characteristic of cryptocurrencies is their decentralised nature, that is, a transaction takes place between a sender and a receiver, without the mediation of a third trusted party such as a broker or a bank. The removal of the intermediate party is cutting the transactions costs to virtually zero making cryptocurrencies appealing, especially for cross-border transactions, but also poses certain technical challenges, most notably the possibility of someone making multiple purchases using the same bitcoin. That challenge, which obviously would not exist if a physical commodity such as gold was used, was mostly dealt with in (Nakamoto, 2008) where the use of technologies such as digital signatures and hashed based proof of work was proposed.

While the initial reception of cryptocurrencies from the financial authorities and institutions was indifferent or hostile, the promise of the underlying technology is now widely recognised. A recent paper from Goldman Sachs, which is investing in the technology, recognises that *“the way we pay is changing”* and that *“the plumbing connecting banks, merchants, networks and consumers is being reconsidered”* (Schneider & Borra, 2015). In another recent paper, the Bank of England states that *“while existing private digital currencies have economic flaws which make them volatile, the distributed ledger technology that their payment systems rely on may have considerable promise”* (Bank of England, 2015).

### 3. Cross-border online shopping in EU

Several Flash and Special Eurobarometer issues contain market research data on online shopping behaviour. (Eurobarometer, 2013a) on “Consumer attitudes towards cross-border trade and consumer protection” is the latest in a long series of comparable online shopping data (Eurobarometer, 2013a), (Eurobarometer, 2012a), (Eurobarometer, 2011b), (Eurobarometer, 2010), (Eurobarometer, 2008) and (Eurobarometer, 2006). (Eurobarometer, 2013c) on “Internal Market” and (Eurobarometer, 2013b), on “European small claims procedure” contain similar but not directly comparable data due to methodological issues. (Eurobarometer, 2013b) and (Eurobarometer, 2013c) also contain data from Norway and Iceland. In all these surveys, the respondents were asked whether in the last 12 months made an online purchase of goods or services, either from a seller based in their country, or in another EU country, or in the rest of the world.

Our main references will be the two latest issues (Eurobarometer, 2013a) and (Eurobarometer, 2013c), while the preceding issues are used as a check for the consistency of the data. We found that while there are fluctuations, as one would expect in any series of consumer surveys, they do not affect our analysis, apart from one possible exception that we will discuss later.

(Eurobarometer, 2012b) on “Retail Financial Services” contains a consumer survey on purchases of financial services from other EU countries. The data do not contradict our analysis and will not be discussed here as they are very sparse, i.e., in 24 out of 27 countries less than ten percent of the respondents had made such purchases. Thus, it is quite probable that the data are heavily influenced by human mobility factors, for example, people opening current accounts when temporarily moving to another EU country.

(Eurobarometer, 2011a) on “Building the Digital Single Market - Cross border Demand for Content Services” contains survey data on the access of digital content from other EU countries. Again, the data do not contradict our analysis and will not be discussed here as it is not clear if the accessed digital content was paid for or if it was free.

### **3.1 Factors affecting consumer behaviour**

In the analysis accompanying the presented data, (Eurobarometer, 2013a) states that “EU consumers are more likely to purchase via the Internet both domestically and cross-border if they have Internet access at home.” Since home Internet access can vary considerably from country to country this can be a significant factor skewing the data. To gauge its influence, apart from raw percentages of respondents buying goods or services from other EU countries, we will also look at ratio RoEU between the respondents who made an online purchase from another EU country and those who made an online purchase in general. Taking such ratios can also reduce the possible influence of country specific cultural factors, such as the levels of confidence with online shopping. A table with raw percentages and RoEU ratios from issues (Eurobarometer, 2013a) and (Eurobarometer, 2013c) can be found in the Appendix at the end of the paper.

Another obvious factor affecting the levels of cross-border purchases from other EU countries, both in raw percentages and RoEU ratios, is the size of the domestic economy. Consumers living in small countries are more likely to search abroad to satisfy their demands. By comparing the RoEU ratios from (Eurobarometer, 2013a) with the GDP of the countries in 2012, which is the year the field work of the survey took place, we find a correlation coefficient of 0.955, suggestive of a very high positive correlation.

Apart from home Internet access and domestic economy size, which almost certainly affect the frequency of cross-border online purchases, a multitude of other possible factors can be identified. Their number highlights both the challenge of isolating evidence regarding the effect of the common currency, and also some inadequacies of the data set we use.

**Language:** Looking at the data in the Appendix, we notice that Austria and Ireland have high RoEU ratios, indicating a high preference for cross-border purchases from other EU countries. They are surpassed only by three much smaller countries, Luxemburg, Malta and Cyprus. A possible

explanation is the shared language with large neighbouring countries. In (Eurobarometer, 2013a), language is recognised as a factor affecting cross-border online shopping and thus, the respondents are explicitly asked how willing they are to use a different language for their online purchases. In Ireland, only 28 percent of the respondents said that they agree or tend to agree with the statement “You are prepared to purchase goods and services using another EU language, while 48 percent of the respondents have nevertheless made a purchase from another EU country. That means that they either used UK based vendors or English language online shops in other EU countries. In either case, the high percentage of respondents that made a purchase from another EU country shows the influence of linguistic factors.

**Geography:** The Eurobarometer surveys include the online purchases of goods and, moreover, the purchased services are dominated by categories involving some form of human movement. Indeed, across the whole of EU, the three most popular services for online shoppers are travel tickets (e.g. trains, flights) at 30 percent, accommodation bookings (e.g. hotels) at 24 percent and tickets for events (e.g. concerts) at 23 percent, (Eurobarometer, 2013c). Thus, we would expect people in countries landlocked inside EU, such as Luxembourg, to have a preference for purchases from other EU countries rather than outside EU. Indeed, only 8 percent of the respondents from Luxembourg made a purchase from outside EU, compared to 15 percent in Cyprus and 24 percent in Malta.

**Successful domestic digital economy:** The Netherlands have the highest proportion of respondents making domestic purchases, at 72 percent, while the percentage of those purchasing from other EU countries is at a relatively low 19 percent. In contrast, in Belgium, domestic purchases are at 30 percent, while purchases from other EU countries, at 26 percent, are more popular than at the Netherlands. That means that the success of the Dutch digital economy, which arguably is the most developed in EU, deters the residents of that country from using retailers based in other EU countries, but that does not mean that the Dutch digital economy is less outward facing than the Belgian.

Indeed, the above observation highlights the main limitation of the data set we use, namely, for the cross-border EU transactions we only have data for the country of the buyer not the country of the seller, or in other words, the per country data we have are for imports only not for exports.

**Price levels:** Finally, we can reasonably assume that high price levels in a country encourage purchases from retailers based in other countries. Thus, in the Nordic countries, which have the highest price levels in EU (World Bank, 2015), shoppers should be more likely to make cross-border purchases than shoppers from the countries of the former Eastern Bloc, where the price levels are well below the EU average.

### 3.1 Groups of peers

While there is no definitive method for clustering countries in groups of peers, and indeed, one can readily create their own by just choosing rows from Table 5 in the Appendix, our aim here is to eliminate as source of variance as many of the above factors as possible. Thus, we are looking for groups of countries consisting of economies of similar size, similar levels of development, geographic

proximity and if possible countries with parallel historical courses; at least as far as their recent history is concerned. Moreover, each group must contain eurozone and non-eurozone countries.

The first group we look at is that of the major EU economies, here the members of G7. This is the most important group we examine, since it represents more than half of EU's population and GDP. Looking at the data at Table 1, it is remarkable that UK is the only country not using the single currency, and also the country with the greatest proportion of consumers purchasing goods and services from other EU countries. To find evidence in this set of data for a positive impact of the euro adoption in cross-border online shopping, we have to look at the RoEU ratios which are higher in France and Italy. However, any positive impact from the adoption of euro on the cross-border online shopping indicated by the ratio data is secondary to the impact from the level of development of the digital economy, and perhaps linguistic and cultural factors.

**Table 1:** EU/G7 members. Euro area countries are shown in green.

	eb2013a		eb2013c	
	EU	ratio	EU	ratio
<b>UK</b>	20	0.29	13	0.20
<b>France</b>	19	0.33	13	0.23
<b>Germany</b>	13	0.21	11	0.18
<b>Italy</b>	11	0.31	6	0.17

The second group consists of the Nordic countries, excluding the smaller island economies. Again it is a group of particular importance since the Nordic countries regularly top the various tables of development indexes. From Table 2 we notice that the country with the most cross-border purchases from other EU countries is not in the eurozone. The only eurozone country of the group is in second place in (Eurobarometer, 2013a) and last third in (Eurobarometer, 2013c).

**Table 2:** Nordic countries. Euro area countries are shown in green.

	eb2013a		eb2013c	
	EU	ratio	EU	ratio
<b>Denmark</b>	33	0.46	36	0.47
<b>Finland</b>	26	0.45	22	0.36
<b>Norway (EEA)</b>	24	0.38	-	-
<b>Sweden</b>	17	0.27	25	0.32

The next two groups may provide some evidence of the positive effect of the single currency on cross-border trade. Table 3 shows the mid-size Central Eastern European countries of the 2004 accession and Table 4 the Baltic countries.

**Table 3:** Mid-size Central Eastern European countries. Euro area countries are shown in green.

	eb2013a		eb2013c	
	EU	ratio	EU	ratio
Slovakia	18	0.32	14	0.33
Czech Rep.	7	0.11	5	0.11
Hungary	7	0.19	3	0.12

**Table 4:** Baltic countries. Euro area countries are shown in green.

	eb2013a		eb2013c	
	EU	ratio	EU	ratio
Estonia	17	0.40	15	0.30
Latvia	15	0.35	13	0.33
Lithuania	11	0.28	9	0.27

In both tables, the country with the highest score on cross-border purchases from other EU countries is the only eurozone country of the respective group. In the case of Slovakia in Table 3 in particular, we also notice that the percentage of cross-border purchases from other EU countries jumped from 2 percent in 2008 (Eurobarometer, 2008) to 13 percent in 2009 (Eurobarometer, 2010), providing further evidence that Slovakia's adoption of euro in January 2009 may had a positive impact on its cross-border trade. On the other hand, Tables 3 and 4 refer to economies that are still to some extent in a period of transition and the weight of any evidence should only be judged after country specific considerations.

Finally, we notice that some other groups could have been considered. A group of South Eastern European countries consisting of Bulgaria, Greece and Romania was a possibility. However, the late EU accession of Bulgaria and Romania means that they are not yet fully integrated into the EU frameworks, for example, in 2012 when the field work for (Eurobarometer, 2013a) was done, complete freedom of movement of persons had not yet been fully established. Another possibility was a group of small island countries at the EU's geographical periphery, consisting of Cyprus, Iceland and Malta; however, the only non-eurozone country of this group is not an EU member.

#### 4. Conclusions and future work

In the (European Commission, 2015b) brochure, the cost benefits from the adoption of the single currency are explained in layman's terms with the example of someone who travelled across 15 European states with 1,000 Deutschmarks in their pocket, changing money at each border, to return back with less than 500 marks without buying anything<sup>1</sup>. The same example has been used in older

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<sup>1</sup> "The costs of exchanging money at borders, so-called transaction costs, have disappeared in the euro area. This reduces the costs for travellers, whether for business, study or vacation. Previously, an individual with 1,000 Deutschmarks in his or her pocket, who travelled through 15 EU countries, changing money in each one, would have less than 500 marks left on returning home – without having made a single purchase".

editions of the brochure (European Commission, 2006). In a summary of our paper in similar layman's terms, we observe that due to technological change travelling with large amounts of money in the pocket and changing at the borders, rather than electronically at the time of purchase, is fast becoming a practice of the past. Moreover, we argue that this change is transformative rather than superficial and should be taken into account when the future of euro is discussed.

If technological change has indeed a disruptive effect on the single currency, it does so by acting competitively to it. That is, by cutting the monetary and, perhaps most importantly, the non-monetary costs of cross-border financial transactions, it undermines part of the economic rationale for a monetary union. This can be seen as part of a more general trend. Technology, information technology in particular, through monetary cost reduction and through enablement often disrupts models which aim at cost reduction through centralisation or standardisation, even though, paradoxically, it is also well-known for the creation of monopolistic situations characterised by unparalleled levels of uniformity and central control.

There are several possible directions for extending the work in this paper, most of them corresponding to easily identifiable limitations of our current approach. One such direction is the collection and analysis of more data on cross-border online shopping in EU. While the statistical analysis of the data in a single issue of the Eurobarometer does not seem meaningful, analysis of a series of issues, including forthcoming ones, could provide some hard statistical evidence on the effect of the euro on online cross-border purchases. A perhaps more promising research direction is the in-depth study of cross-border online shopping in individual countries and then the comparison of the findings. A third possible research direction is the analysis of data on cross-border online shopping in developed non-EU countries, and the comparison with the Eurobarometer data. Corroboration of any findings on cross-border online shopping using with more general trade statistics on imports and exports could also be interesting. Finally, deviating from economics but still on the issue European integration, we can try to test a similar hypothesis on the free movement of persons; namely that as recent advances in biometric security, such as face and iris recognition, bring the cost of human identification down, part of the economic rationale for the abolition of internal border controls inside the Schengen area could be undermined.

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## APPENDIX

**Table 5:** Percentage of respondents who purchased online goods or services from another EU country in the last 12 months and their ratio to those who made an online purchase from any country, including their own.

	eb2013a		eb2013c	
	EU	ratio	EU	ratio
<b>BE</b>	26	0.59	21	0.48
<b>BG</b>	10	0.29	5	0.24
<b>CZ</b>	7	0.11	5	0.11
<b>DK</b>	33	0.46	36	0.47
<b>DE</b>	13	0.21	11	0.18
<b>EE</b>	17	0.40	15	0.30
<b>IE</b>	48	0.73	34	0.53
<b>EL</b>	15	0.44	7	0.29
<b>ES</b>	12	0.28	9	0.29
<b>FR</b>	19	0.33	13	0.23
<b>IT</b>	11	0.31	6	0.17
<b>CY</b>	31	0.76	21	0.68
<b>LV</b>	15	0.35	13	0.33
<b>LT</b>	11	0.28	9	0.27
<b>LU</b>	41	0.82	50	0.88
<b>HU</b>	7	0.19	3	0.12
<b>MT</b>	42	0.88	36	0.84
<b>NL</b>	19	0.26	17	0.22
<b>AT</b>	37	0.62	31	0.66
<b>PL</b>	5	0.09	2	0.07
<b>PT</b>	10	0.38	4	0.22
<b>RO</b>	5	0.16	2	0.08
<b>SI</b>	14	0.32	14	0.39
<b>SK</b>	18	0.32	14	0.33
<b>FI</b>	26	0.45	22	0.36
<b>SE</b>	17	0.27	25	0.32
<b>UK</b>	20	0.29	13	0.20
<b>NO</b>	24	0.38	-	-
<b>IS</b>	20	0.37	-	-