Law-of-One-Price deviations Before and After the Euro: the case of Cyprus*

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Abstract

Did Cyprus become more integrated with Europe after adopting the euro? How did this process affect its prices relative to its European partners? Does the degree of integration relative to European Union (EU) economies as implied by Cypriot price differences vary across goods? What can explain this variation in Cypriot price differences? We provide some answers to these questions using a panel of thousands of good-level prices before and after the adoption of the euro. Comparing the densities of law-of-one-price (LOP) deviations for Cyprus relative to other Eurozone (EZ) and non-EZ EU economies before and after it adopted the euro, informs us about the changing degree of integration of Cyprus with other EU economies during this important period. We infer that Cyprus (a) became significantly more integrated with EU economies between 2005 and 2010, and (b) the Cypriot distribution of LOP deviations relative to these economies shifted to the left indicating that Cyprus became relatively cheaper during this period. This leftward shift of the mean price level faced by Cypriot consumers coexists with a large degree of heterogeneity across categories, and a more detailed look reveals many prices of imports falling while domestic production for certain categories was becoming relatively more expensive. Even so, by 2010, the empirical distribution for Cyprus becomes statistically indistinguishable from that of core EZ economies like Germany, implying a fast pace of relative price adjustment for Cyprus during the process of euro adoption and indicative of the high degree of flexibility characterizing the Cypriot economy.

Keywords: Cyprus, integration, euro, law-of-one-price.

JEL Classification: F3, F4

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1 Introduction

On July 10th 2007 the conversion rate between the Cyprus pound and the euro, that would become effective on January 1st 2008, was fixed at 0.585274 pounds per euro (or 1.7086 euro per Cypriot pound). The PPP exchange rate implied by our detailed micro price dataset of goods and services that comprise the harmonized CPI for Cyprus and the rest of the European Union (EU), is very much in agreement with this conversion rate. Our data show that as of 2005 the mean (median) across all goods and services of the ratio of Cypriot prices in pounds relative to the average price in euro in the twelve Eurozone (EZ) economies, was 0.59007 (0.575507) pounds per euro, and the mean (median) across tradeable goods for this ratio was 0.603279 (0.588902). These values suggest that Cyprus entered the Eurozone at more or less the right conversion rate, to the extent that this specific metric should be taken into account. In what follows, we will analyze the behavior of prices in Cyprus before (in 2005) and after this conversion to the euro (in 2010), to answer a number of important questions.

Did Cyprus become more integrated with the EZ core and the broader group of EU economies after adopting the euro? How did this process affect its prices relative to its EU partners? Does the degree of integration relative to the EZ as implied by Cypriot price differences vary across goods? Finally, what can explain this variation in Cypriot price differences? We attempt to provide some answers to these questions in what follows.

Our work is closely linked to the work by Crucini, Telmer and Zachariadis (2005) (CTZ) and Glushenkova and Zachariadis (2014). The last two papers at-

tempt to understand LOP deviations in Europe for the period 1975 to 1990, and the period from 1985 to 2010 respectively.[1] CTZ make the case that the Law-of-One-Price (LOP) and Purchasing Power Parity (PPP) are essentially about the cross-sectional distribution of international relative prices rather than the time-series behavior of changes in these.[2] Our paper focuses on cross-sectional LOP deviations for the case of Cyprus relative to the EU in 2005 and 2010 to understand the role played by the process of monetary unification for this particular economy. For example, the use of micro prices for well defined markets allows us to detect markets for specific goods and services where integration has been slower or where barriers have not been removed.

The literature focusing on the effects of the process of European monetary unification has produced mixed results regarding the effect of this process on price dispersion. Allington et al. (2005) find that the euro led to greater integration evidenced by price convergence for tradeables among EMU members between 1995 and 2002. Imbs et al. (2010) use prices for TV sets across European countries and show that EMU countries display lower price dispersion but not necessarily because of the single currency. Similarly, Engel and Rogers (2004) find no tendency for product prices of 101 narrowly defined traded goods from 18 European cities in eleven Eurozone countries to converge after January 1999, but that there has been a significant reduction in price dispersion throughout the decade of the 1990s suggesting an increase in the integration of

[1] The same data has been used by Inanc and Zachariadis (2012) for 1975 to 1990 across Europe, to study the importance of the direction of trade in estimating the role of distance and trade costs using LOP deviations.

[2] The LOP states that identical goods in different countries at a given point in time should have identical prices once the prices are expressed in common currency units, and PPP states that this should hold on average. Due to data limitations, the literature had until recently been focusing mostly on the *time-series* behavior of these international relative prices.

consumer markets during that period. Along the same lines, Rogers (2007) finds that price dispersion for tradeables prices falls sharply across European cities from 1990 to 2004, but is unrelated to the launch of the euro. Fischer (2012) uses highly comparable washing machine prices across 17 European countries for 1995-2005, and does not find price convergence for EMU countries or that EMU membership is relevant for any small convergence clusters found in the data. Dreger et al. (2007) use comparative price levels for the EU-25 for 1999-2004 and find price convergence that is more pronounced for the EU-10 and for homogeneous products and positively related to tradeability. Guerreiro and Mignon (2013) also use comparative price levels for 12 EZ members at the monthly frequency between January 1970 and July 2011, and find high convergence speeds relative to Germany for core EZ countries (Austria, Belgium, France and the Netherlands) but also for Greece and Portugal albeit mainly due to their loss of competitiveness over time.

In the next section, we discuss our data construction and empirical analysis before presenting our results. The final section briefly concludes.

2 Data Analysis

2.1 Data Construction

Our European prices dataset, sequentially assembled from Eurostat data over the past decade, is described extensively in Glushenkova and Zachariadis (2014). Here, we use a subset of that dataset of local currency prices of individual goods and services, that pertains to Cyprus. In Table 1, we list some examples of item descriptions prices for which are available in our dataset. We constructed our panel dataset from the cross-sections data for 2005 and 2010 by matching

Table 1: Exemplary set of goods from the sample

Rice, long-grain, Parboiled; 400-600g, cooking time < 10min. / WKB	Printer, ink-jet, EPSON, Epson Stylus C42, C44 Plus / SB
Wheat flour, all-purpose flour, 750 - 1000 g / WKB	Desktop pc, HP COMPAQ, DELL, FUJITSU-SIEMENS / SB
Flaked oats, for cooking, 500 - 1000 g / WKB	Disposable camera, FUJI, FUJICOLOR QuickSnap Marine 800 / SB
Bread, "pre-baked" baguettes/rolls, Made of: wheat (white flour), 200-300g / WKB	Novel, A.Christie; national, paperback /
Biscuits salted, "Crackers", BAHLSEN,TUC,VERKADE,RITZ, 100-200g / SB	Daily newspaper, INTERNATIONAL HERALD TRIBUNE / SB
Breakfast cereals, NESTLE, Clusters or cheerios, 250-500g / SB	Cutlery set, IKEA, FORNUFT / SB
Beef, Silverside (F2a), Beef for roasting / —	Frying pan,TEFAL(SEB group trademark) Ambiance Essence Activ/SB
Veal, Leg (prime cut A4), w/o bones / —	Secateurs; exclude GARDENA, / WKB
Pork, Loin chop (B2), with bones / —	Light bulb, PHILIPS, SOFTONE / SB
Chicken, roasting, w/o head and feet / —	Battery,DURACELL,Ultra M3 Alkaline MN 1500 - AA Mignon 1.5/SB
Salami, Country typical variety, Made of: pork and /or beef and bacon fat / —	Car hire - HERTZ
Mackerel (- scomber scombrus), Whole fish with head and tail / —	Taxi - 5 km, working day
Salmon (atlantic sal+A50mon - salmo salar), Fresh / —	Urban rail transport, single ticket - up to 3 km / 15 min.
Milk, unskimmed, Fat content: 2.8 - 4 %, 0.8-1.2l / WKB	Coach, single ticket - approx. 35 km
Fruit Yoghurt, DANONE,YOPLAIT, Fat content: 2 - 4 %, 150-350g/ml / SB	Flight, Domestic - return ticket, 200 km
Cheese, Camembert type, Fat content: 45 - 55 %, 180-330g / WKB	Flight, International - London, return ticket
Ice cream, CARTE D'OR, any flavour, Industrial production, 500-1000g / SB	General practitioner / "private" patient
Carbonated drink, Tonic, SCHWEPPES,KINLEY,SEAGRAMS, 0.2 - 0.5 l/SB	Beef steak, grilled - modest R /
White wine, Californian, PAUL MASSON WHITE, Package: bottle, 0.75-1l / SB	Filter coffee, cup - at the counter /
Spirit, Whiskey - American, JACK DANIEL'S, 0.7 - 1 l / SB	Hotel - Cat.1, Capital, excludes HOLIDAY INN etc - 1 night /
Cigarettes, with filter, CAMEL, (Excl.: light) / SB	Services, Cobbler - men's classic shoes
Men's overcoat / WKB-M	Plumber, hourly charge
Ladies' top coat, 85-90% wool,15-10% cash. / SB	Electrician, hourly charge
Children's parka / WKB-M	Decorator, per m2 (64m2)
Bunk bed, IKEA / SB	Water supply, including sewerage - 200 m3
Floor covering laminated INKU(MELAN),PERGO,TARKETT,ALLOC,QUICK STEP/SB	Electricity: 2,500 kWh
Refrigerator, BOSCH, KTL 16420 "economic" / SB	Gas: 16.75 GJ or 4,652 kWh
Washing machine, AEG, OKO-LAVAMAT 86760, 86800 / Top class / SB	Domestic servant (housework) - registered
Microwave oven, AEG, MICROMAT 153 E / SB	Baby sitting - not registered
Vacuum cleaner, PHILIPS, FC 9126/20 Specialist for carpets / SB	Services, PC technician, replacement of power supply
Fridge-freezer, CANDY, "Biocold" CPDC 381VZ / SB	Driving school
Coffee-maker, MOULINEX, Crystalys with timer AEC 342 / SB	Piano lesson
Motor cars, Diesel engine NISSAN Terrano 2.7 Tdi / SB	Men - scissors cut, dry; suburbs /
Motorcycles YAMAHA DT 50 Supermotard / SB	Ladies - haircut /
Bicycle GIANT X-Sport Mountain bike / SB	Household telephone call, local - off-peak hour
Tyre MICHELIN Energy (E3A, E3B) 175/70 R14 (84)T summer tyre / SB	Monthly total costs, mobile calls to fixed line
Television, SONY, KE-42TS2 / SB	Internet connection - ADSL (digital)
Laptop computer, ACER, TravelMate 800/800LCi / SB	Veterinary service, desexing cat

goods available in both years. To explain LOP deviations across European countries we use only goods with sufficient cross-country variation. This is taken to be at least thirteen country observations for 2005 and 2010. Furthermore, to alleviate measurement error, we control for outliers by eliminating individual price observations that are at least five times bigger or smaller than the cross-country mean price level for an individual good.

The distributions we present are based on LOP deviations obtained for each good and each time period, omitting good and time subscripts for simplicity of notation, as $q_{i,EU} = \frac{p_i}{\sum_{j=1}^{N} p_{jt}/N} - 1$, where i is the country being compared to the price average. For example, p_i is typically the price in euro of the good in Cyprus at a specific time and N is the number of countries comprising the average relative to which Cyprus is being compared. We consider N to be comprised of all EU countries to obtain $q_{CY,EU}$, and in some cases (which we clearly state in each case) we restrict this to be comprised of the EZ twelve to obtain $q_{CY,EZ}$, or of the non-EZ subset of EU countries (to obtain $q_{CY,NEZ}$). The non-EZ EU sample is comprised of EU countries that were not members of the EZ as of 2005, including recent EZ members: Cyprus, Malta, the Slovak Republic and Slovenia. The remaining non-EZ EU countries are: The Czech Republic, Estonia, Denmark, Hungary, Latvia, Lithuania, Poland, Sweden, the UK, Bulgaria and Romania, with the latter two countries excluded when we focus on non-tradeables, in order to maintain a reasonable and more representative number of non-tradeables in our sample[3]. Our EU sample includes these countries plus the original EZ twelve: Austria, Belgium, Finland, France, Germany, Greece,

[3] Otherwise, about 50% of non-tradeables would have to be excluded as outliers because of extreme price values for certain non-tradeables reported primarily in the case of Romania and to a lesser extent in the case of Bulgaria.

Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain, for a total of twenty-seven countries. For presentational purposes, we also report mean and median log LOP deviations for Cyprus relative to the EU, EZ, and non-EZ average price but also relative to individual EU, EZ and non-EZ economies.

We also utilize additional data for VAT rates and to construct tradeability and non-traded input share indices. VAT rates for Cyprus and the other EU countries were obtained from the European Commission report on VAT Rates Applied in the Member States of the European Union[4] for June 1st 2005 and January 1st 2011. Export and import data were obtained from the OECD STAN Bilateral Trade Database and gross output from the Statistical Service of Cyprus for each industry for 2005 and 2010. Non-traded input shares for each industry in Cyprus were obtained from the Eurostat Supply-Use tables in 2005 and 2009.

2.2 Empirical Analysis

Comparing the distribution of Cypriot LOP deviations (relative to the EU, EZ and non-EZ EU) before and after the euro

In Figure 1, we present the LOP deviations for all goods and services in Cyprus relative to the EU ($q_{CY,EU}$) but also, separately, relative to the EZ ($q_{CY,EZ}$) and relative to non-EZ EU countries ($q_{CY,NEZ}$).

As shown in the first panel of Figure 1, the distribution of LOP deviations for Cyprus relative to the EU moves to the left from 2005 to 2010. This is also shown in the first row of Table 2, where the mean (median) goes from

[4] Available at http://ec.europa.eu/taxation_customs/taxation/vat/how_vat_works/rates/index_en.htm

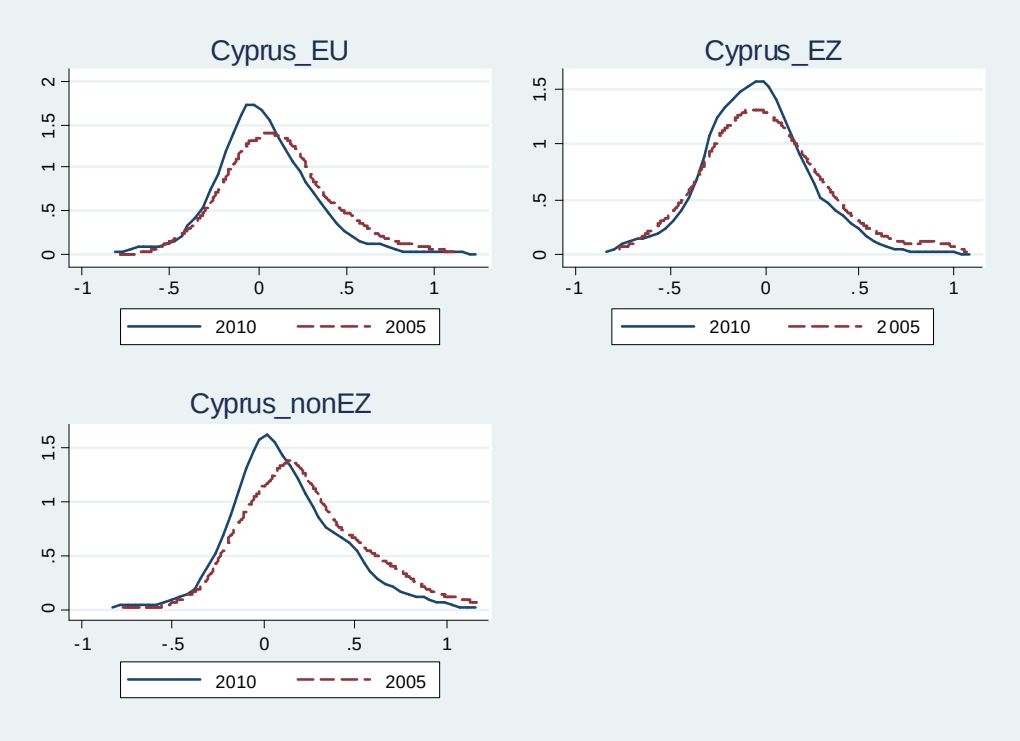

Figure 1: Empirical distributions of Cyprus LOP deviations before and after the Euro

7.1% (9.2%) more expensive in 2005 to near parity with the EU by 2010. This signals that Cyprus did not become relatively more expensive compared to its EU partners as a result of adopting the euro. Quite the contrary. From Figure 1, we can also see that Cyprus apparently becomes more integrated with the EU countries between 2005 and 2010. This is also evident in the first row of Table 2 where we see how the kurtosis value[5] for the distribution of LOP deviations for Cyprus relative to the EU increases from 3.31 in 2005 to 4.5 in 2010. As we can see in the first row of Table 2, using the Kolmogorov-Smirnov (KS) test the null hypothesis that the distribution of LOP deviations of Cyprus relative to the EU for 2010 is the same as the 2005 distribution, is rejected at the one percent level of significance.

As shown in the second panel of Figure 1, Cyprus also becomes more integrated with EZ countries with the kurtosis values reported in the second row of Table 2 going up from 3.43 in 2005 to 3.78 in 2010. As we can see in the second row of Table 2, using the KS test, the null hypothesis that the distribution of LOP deviations relative to the EZ for 2010 is the same as the 2005 distribution is rejected at the one percent level of significance. Again the mean (median) LOP deviation reported in the second row of Table 2 goes down from -5.3% (-1.8%) in 2005 to -8.7% (-5%) by 2010, suggesting Cyprus becoming relatively cheaper than the EZ over time.

[5] Kurtosis is a measure of peakedness and tailedness of the distribution, with higher kurtosis values indicating peakedness and fatter tails of the distribution, while lower kurtosis values indicate flatness and thinner tails. Higher peak of the distribution suggests that data values are relatively more concentrated around the mean. As a result, Kurtosis can be informative about integration, but more informative about the change of the degree of integration over time, than across different groups (say tradeables versus non-tradeables), to the extent that the latter set of comparisons might involve distributions with very different tail characteristics. In the latter case, it would not be clear whether high kurtosis values are associated with peakedness or fat tails for both groups, or with peakedness for one group and fat tails for another group.

Table 2: Tests for the equality of LOP deviation distributions.

	KS test		Kurtosis		Mean LOP deviation		Median LOP deviation	
	2010	2005	2010	2005	2010	2005	2010	2005
Cyprus(EU)	0.000 !	-	4.500	3.307	-0.005	0.071	0.007	0.092
Cyprus(EZ)	0.007 !	-	3.779	3.427	-0.087	-0.053	-0.050	-0.018
Cyprus(nonEZ)	0.000 !	-	3.550	3.146	0.073	0.158	0.075	0.168
Cyprus(EU) TR	0.000*	0.000*	4.979	3.327	0.021	0.068	0.017	0.088
Cyprus(EU) NT	-	-	2.941	3.057	-0.144	-0.097	-0.077	-0.029
Cyprus(EZ) TR	0.000*	0.000*	4.052	3.497	-0.044	-0.014	-0.025	0.003
Cyprus(EZ) NT	-	-	2.632	3.494	-0.256	-0.205	-0.189	-0.180
Cyprus(non-EZ) TR	0.002*	0.015*	3.735	3.272	0.083	0.150	0.066	0.163
Cyprus(non-EZ) NT	-	-	2.741	2.724	-0.022	0.040	0.067	0.124
Germany(EU)	0.318	0.001	3.961	3.937	0.024	0.040	0.028	0.035
Greece(EU)	0.795	0.000	4.001	3.605	-0.003	-0.026	0.018	-0.015
UK(EU)	0.000	0.027	4.598	3.674	-0.078	0.063	-0.075	0.053
Ireland(EU)	0.000	0.000	2.977	2.941	0.124	0.182	0.132	0.187
Portugal(EU)	0.000	0.000	4.483	3.510	-0.068	-0.012	-0.055	-0.013
Spain(EU)	0.000	0.000	5.640	4.323	-0.062	-0.069	-0.045	-0.051

Notes: We report p-values for the Kolmogorov-Smirnov test of the null of equality of distribution functions. The LOP deviations are constructed relative to the EU, or relative to the EZ. or relative to the non-EZ EU, as indicated in parentheses in the first column of each row. For the last six rows, the tests in the first two columns are based on comparisons of distributions of LOP deviations (relative to the EU) between Cyprus and each of the six countries considered there. We report mean and median log LOP deviations for 2010 and 2005 in the last four columns of the table. For the last six rows, these are the mean and median log LOP deviations of each of the six countries relative to the EU average. ! We compare the distribution of LOP deviations for 2010 to that for 2005. * We compare the distributions of LOP deviations for tradeables versus nontraded goods. EZ - the twelve original Eurozone members: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain. non-EZ EU - includes new Eurozone members: Cyprus, Malta, the Slovak Republic and Slovenia, and other EU countries that were not members of the Eurozone as of 2005: the Czech Republic, Estonia, Denmark, Hungary, Latvia, Lithuania, Poland, Sweden, the UK, Bulgaria and Romania. EU - includes the EZ12 plus non-EZ EU countries. When we focus on nontradeables we exclude Bulgaria and Romania from the EU and non-EU averages, as including these in the calculation of mean price would lead to the exclusion of almost half of our nontradeables sample (e.g. 64 out of 141 for the EU in 2005.) as outliers from our dataset. Our sample for tradeables consists of 555 (551) goods for the EU, 555 (552) goods for the EZ, and 550 (550) for the non-EZ in 2010 (2005), while our sample of non-tradeables consists of 143 (141) items for the EU, 142 (141) items for the EZ, and 143 (140) items for the non-EZ in 2010 (2005).

The third panel of Figure 1 portrays information for the distribution of LOP deviations of Cyprus relative to the non EZ EU economies. As is evident from Figure 1, Cyprus becomes relatively cheaper than non-EZ EU economies and this leftward shift in the distribution for Cyprus is much more evident here than relative to the EZ economies, suggesting that the euro created a less inflationary environment over the period for Cyprus and other EZ as compared to non-EZ economies. As shown in the third row of Table 2, the mean (median) LOP deviation of 7.3% (7.5%) in 2010 was less than half the 2005 value of 15.8% (16.8%). Moreover, Figure 1 is again consistent with a higher degree of integration in 2010 as compared to 2005. As shown in the third row of Table 2, the kurtosis value in this case goes up from 3.15 to 3.55**.** In the third row of Table 2, we see that using the KS test the null hypothesis that the distribution of LOP deviations relative to the EZ for 2010 is the same as the 2005 distribution is rejected at the one percent level of significance.

Distinguishing between traded and non-traded goods and services

In what follows, we will take a separate look at tradeables and non-tradeables in order to better understand the mechanisms behind the changing degree of integration and any shifts in the distribution of LOP deviations for Cyprus relative to the other EU economies.

As we can see in Figure 2 for tradeables and non-tradeables separately, the distribution of LOP deviations for Cyprus relative to the EU countries average moves to the left between 2005 and 2010 implying that Cyprus became relatively cheaper for both tradeables and non-tradeables. This is also evident in Table 3 where we report the average and median LOP deviation for Cyprus relative

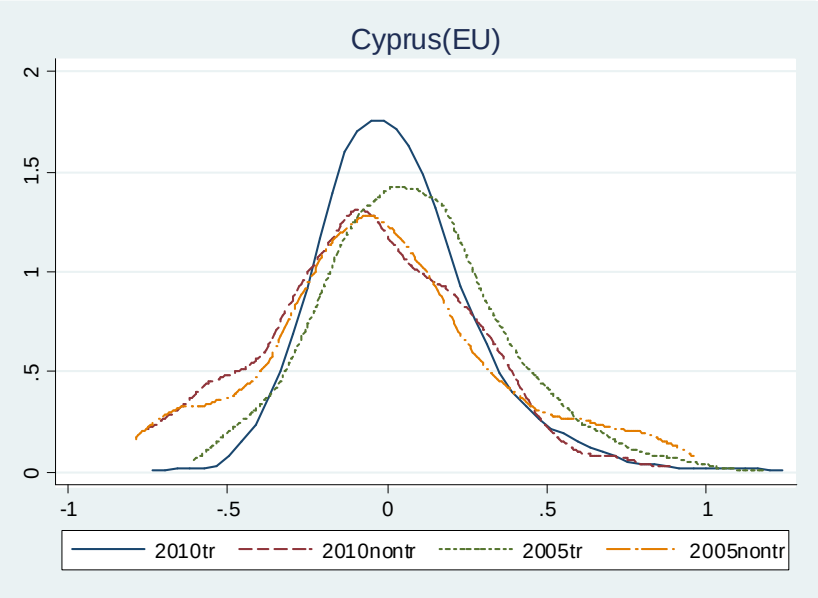

Figure 2: Empirical distributions of Cyprus LOP deviations from the EU countries

to the EU in the first row. There, we see that while Cyprus was 7.2%, on average, more expensive relative to the EU in 2005 for tradeables, it was only 2.5% more expensive by year 2010. The median price for tradeable goods was 9% higher in Cyprus relative to the EU in 2005 and only 1.8% more expensive by 2010. For non-tradeables, while Cyprus was 7.3% cheaper in 2005, it became 13.5% cheaper than the average EU member by year 2010, while the median non-tradeable good was 2.4% cheaper than in the EU in 2005 and 7.5% cheaper by 2010. The above results are, at first glance, consistent with possible gains in price competitiveness relative to the average EU country during the (process towards and the) adoption of the euro that led to lower inflation relative to non EZ countries.

In addition, as we can see in Figure 2, Cyprus apparently becomes more integrated with the EU countries between 2005 and 2010 for tradeables. This is evident in the fourth row of Table 2 where we see that the kurtosis value for the distribution of LOP deviations for Cyprus relative to the EU increases from 3.33 in 2005 to 4.98 in 2010. For non-tradeables, the kurtosis value reported in the fifth row of Table 2 falls slightly from 3.06 in 2005 to 2.94 in 2010. Looking at Figure 2, we can also see that the tradeables distribution is more highly peaked than the non-tradeables one for 2010 so that the higher kurtosis values for the former as compared to the latter distribution are consistent with higher integration for tradeables, as one would expect from a higher degree of integration in markets linked by trade as compared to markets linked mostly by labor flows within a fragmented EU. Using the KS test, we reject at the one percent significance level the null that the tradeables and non-tradeables distributions are identical.

As compared to its Eurozone (EZ) monetary union partners, we see in Figure 3 that Cyprus moved slightly to the left in terms of the distribution of relative prices for tradeables. In the second row of Table 3, we see that the average tradeable good in Cyprus was 0.9% cheaper than the average EZ country in 2005 but became 4% cheaper than average by year 2010. The median price for tradeable goods was 0.7% higher in Cyprus relative to the EZ in 2005 but became 2.4% cheaper by 2010. For non-tradeables, we can see from Table 3 that the average (median) non-tradeable good in Cyprus was 19.6% (17.9%) cheaper than in the average EZ country in 2005 and 24% (18.5%) cheaper than average by year 2010. The latter alludes to the fact that non-tradeables have been on average considerably more expensive in the richer EZ economies as compared to

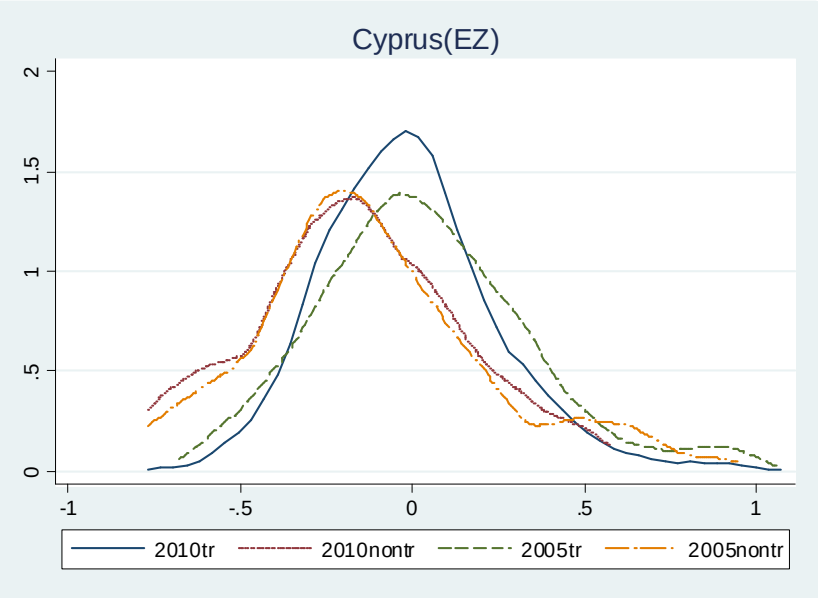

Figure 3: Empirical distributions of Cyprus LOP deviations from the original EZ countries

Cyprus. Table 4 also reveals that this positive gap in the mean (and median) price of non-tradeables between Cyprus and the EZ shrinks once we remove the effect of income, but with Cyprus still looking cheaper by 14.2% on average in 2010 as compared to the average EZ country while it was, on average, 7.9% cheaper than average as of 2005.

Moreover, as we can see in Figure 3, Cyprus became more integrated with the core EZ countries by 2010 as compared to 2005 for traded goods. As shown in the sixth row of Table 2, the kurtosis value increases from 3.497 in 2005 to 4.05 by 2010. This increase in integration with the EZ is not evident for non-tradeables in Figure 3 or in Table 2 (where we report the kurtosis value for the distribution of LOP deviations for non-tradeables to be 3.494 in 2005 and

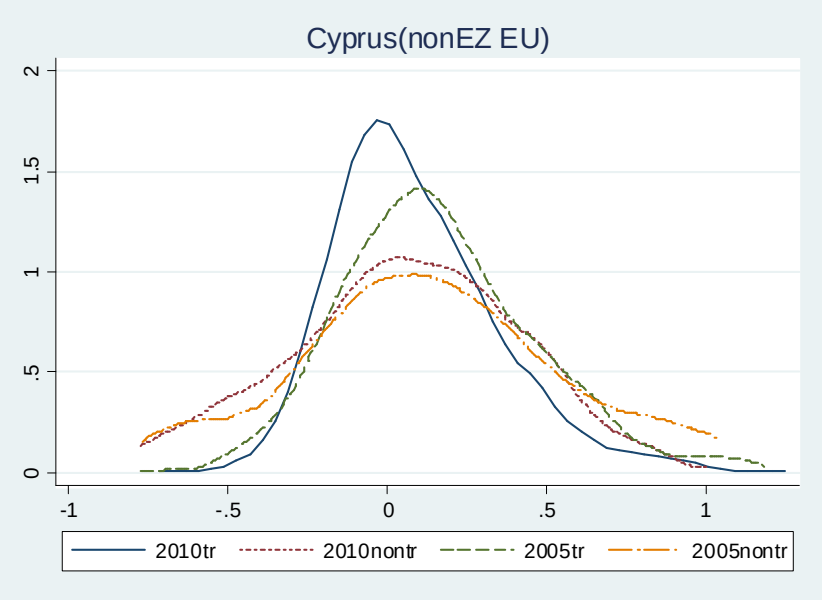

Figure 4: Empirical distributions of Cyprus LOP deviations from the nonEZ12 countries

2.632 in 2010), suggesting that a channel driving increased integration is via increasing trade in final goods not accompanied by a similar degree of openness for services and factors of production such us labor. Finally, we can see in Figure 3 and again from Table 2 that tradeables in Cyprus relative to the core EZ countries were clearly more integrated than non-tradeables in 2010. This is also indicated by the evident difference in peakedness of these distributions in 2010 in Figure 3. The KS test null that the distributions of LOP deviations of Cyprus relative to the EZ for tradeables is identical to that for non-tradeables in 2010, is rejected beyond the one percent level of statistical significance as shown in Table 2.

Next, we turn to the non-EZ EU countries. In Figure 4, we can see that the

Table 3: Average and median LOP deviations of Cyprus relative to other countries

	traded goods				nontraded goods			
	2005		2010		2005		2010	
country	average	median	average	median	average	median	average	median
Cyprus(EU)	0.072	0.090	0.025	0.018	-0.073	-0.024	-0.135	-0.075
Cyprus(EZ)	-0.009	0.007	-0.040	-0.024	-0.196	-0.179	-0.240	-0.185
Cyprus(nonEZ)	0.160	0.164	0.094	0.071	0.070	0.131	-0.012	0.072
Austria	0.015	0.028	-0.036	-0.021	-0.287	-0.259	-0.243	-0.157
Belgium	0.001	-0.001	-0.060	-0.053	-0.167	-0.177	-0.225	-0.230
Finland	-0.103	-0.061	-0.144	-0.106	-0.388	-0.376	-0.429	-0.403
France	0.033	0.047	-0.018	-0.004	-0.199	-0.173	-0.174	-0.186
Germany	0.030	0.050	0.001	0.013	-0.136	-0.091	-0.121	-0.089
Greece	0.099	0.089	0.003	0.009	0.009	0.081	-0.017	0.032
Ireland	-0.101	-0.060	-0.088	-0.051	-0.265	-0.280	-0.351	-0.328
Italy	-0.030	-0.032	-0.021	-0.022	-0.094	-0.035	-0.169	-0.153
Luxembourg	0.000	0.021	-0.042	-0.020	-0.213	-0.204	-0.235	-0.198
Netherlands	0.073	0.091	0.024	0.031	-0.255	-0.286	-0.195	-0.171
Portugal	0.060	0.056	0.053	0.034	0.060	0.089	0.032	0.112
Spain	0.134	0.134	0.084	0.075	0.029	0.054	-0.058	-0.011
Malta	0.142	0.124	0.087	0.069	0.329	0.317	0.312	0.388
Slovak Republic	0.332	0.328	0.127	0.105	0.523	0.609	0.149	0.278
Slovenia	0.146	0.164	0.071	0.042	0.155	0.184	-0.010	0.019
Bulgaria	0.483	0.444	0.320	0.281	0.648	0.828	0.565	0.687
Czech Republic	0.304	0.267	0.180	0.152	0.507	0.580	0.245	0.402
Denmark	-0.188	-0.132	-0.243	-0.222	-0.542	-0.506	-0.539	-0.560
Estonia	0.295	0.274	0.155	0.103	0.337	0.398	0.185	0.220
Hungary	0.301	0.289	0.227	0.190	0.395	0.435	0.427	0.450
Latvia	0.343	0.307	0.141	0.105	0.540	0.643	0.247	0.258
Lithuania	0.356	0.341	0.197	0.154	0.505	0.505	0.341	0.404
Poland	0.410	0.404	0.294	0.251	0.345	0.419	0.382	0.460
Romania	0.480	0.442	0.272	0.241	1.013	1.072	0.717	0.758
Sweden	-0.128	-0.128	-0.088	-0.103	-0.346	-0.322	-0.391	-0.405
United Kingdom	0.024	0.031	0.119	0.148	-0.233	-0.289	-0.137	-0.083
Iceland	-0.321	-0.324	-0.133	-0.151	-0.619	-0.647	-0.248	-0.314
Norway	-0.274	-0.244	-0.307	-0.298	-0.610	-0.570	-0.667	-0.644
Switzerland	-0.149	-0.104	-0.151	-0.130	-0.354	-0.371	-0.446	-0.443
Turkey	0.253	0.261	0.235	0.233	0.358	0.341	0.333	0.368

Notes: We report mean and median log LOP deviations for Cyprus relative to each EU economy and to the non-EU economies of Iceland, Norway, Switzerland andTurkey that are excluded from the analysis elsewhere. We calculate log LOP deviations as the log price of good j in Cyprus minus the log average price of good j across the relevant group of countries or country, and then take the mean or median over goods of these LOP deviations. In the first three rows, Cypriot LOP deviations are relative to the EU, the EZ, and the non-EZ EU respectively. To maintain a high degree of comparability, we use exactly the same set of goods and services for each of the three regions in these first three rows, so we end up with 554 tradeables and 142 non-tradeables in each case. In the last four columns where we focus on nontradeables, we exclude Bulgaria and Romania from the EU and non-EU averages as including the latter two countris in the calculation of mean price leads to the exclusion of almost half of our nontradeables sample (65 out of 142 items) as outliers.

Table 4: Average and median LOP deviations after income correction

	traded goods				nontraded goods			
	2005		2010		2005		2010	
	average	median	average	median	average	median	average	median
Cyprus(EU)	0.043	0.060	0.000	-0.007	-0.069	-0.021	-0.133	-0.072
Cyprus(EZ)	0.109	0.124	0.059	0.074	-0.079	-0.061	-0.142	-0.087
Cyprus(nonEZ)	0.038	0.042	-0.009	-0.032	-0.019	0.041	-0.089	-0.005
Austria	0.151	0.163	0.092	0.108	-0.152	-0.124	-0.115	-0.028
Belgium	0.129	0.127	0.056	0.064	-0.039	-0.049	-0.108	-0.113
Finland	0.034	0.076	-0.022	0.016	-0.251	-0.239	-0.307	-0.281
France	0.144	0.157	0.073	0.088	-0.088	-0.062	-0.082	-0.095
Germany	0.139	0.159	0.099	0.111	-0.027	0.018	-0.022	0.009
Greece	0.089	0.079	-0.018	-0.011	-0.001	0.071	-0.037	0.012
Ireland	0.108	0.149	0.047	0.084	-0.055	-0.071	-0.216	-0.193
Italy	0.053	0.051	0.031	0.029	-0.011	0.048	-0.117	-0.102
Luxembourg	0.346	0.367	0.312	0.333	0.133	0.142	0.119	0.156
Netherlands	0.223	0.241	0.163	0.170	-0.105	-0.136	-0.056	-0.033
Portugal	0.004	-0.001	-0.018	-0.038	0.004	0.033	-0.040	0.040
Spain	0.175	0.174	0.103	0.094	0.070	0.095	-0.038	0.008
Malta	0.030	0.012	-0.008	-0.026	0.217	0.205	0.217	0.293
Slovak Republic	0.149	0.145	-0.022	-0.043	0.341	0.426	0.001	0.129
Slovenia	0.085	0.102	0.019	-0.010	0.094	0.122	-0.062	-0.034
Bulgaria	-0.001	-0.040	-0.079	-0.119	0.165	0.344	0.165	0.287
Czech Republic	0.151	0.113	0.074	0.047	0.354	0.427	0.140	0.297
Denmark	0.014	0.070	-0.052	-0.032	-0.340	-0.303	-0.349	-0.370
Estonia	0.086	0.065	-0.030	-0.082	0.128	0.189	0.000	0.035
Hungary	0.108	0.095	0.017	-0.020	0.202	0.241	0.217	0.239
Latvia	0.028	-0.008	-0.116	-0.153	0.225	0.328	-0.010	0.000
Lithuania	0.064	0.050	-0.050	-0.093	0.214	0.213	0.094	0.157
Poland	0.130	0.125	0.073	0.030	0.066	0.140	0.161	0.240
Romania	0.051	0.013	-0.075	-0.107	0.585	0.643	0.370	0.410
Sweden	0.035	0.035	0.066	0.051	-0.183	-0.159	-0.237	-0.251
United Kingdom	0.167	0.174	0.189	0.218	-0.090	-0.146	-0.066	-0.012
Iceland	-0.080	-0.083	-0.039	-0.057	-0.377	-0.405	-0.154	-0.220
Norway	0.016	0.046	-0.003	0.006	-0.320	-0.280	-0.363	-0.340
Switzerland	0.077	0.121	0.099	0.120	-0.128	-0.145	-0.196	-0.193
Turkey	-0.056	-0.048	-0.038	-0.040	0.049	0.032	0.060	0.096

Notes: We report mean and median log LOP deviations for Cyprus relative to each EU economy and to the non-EU economies of Iceland, Norway, Switzerland andTurkey that are excluded from the analysis elsewhere. We calculate log LOP deviations as the log price of good j in Cyprus minus the log average price of good j across the relevant group of countries or country, and then take the mean or median over goods of these LOP deviations. In order to remove the income effect, we regress log LOP deviations on the difference in log income of Cyprus relative to the relevant group of countries or country being compared. We then utilize the residuals i.e. that component of LOP deviations that excludes the effect of income. In the first three rows, Cypriot LOP deviations are relative to the EU, the EZ, and the non-EZ EU respectively. To maintain a high degree of comparability, we use exactly the same set of goods and services for each of the three regions in these first three rows, so we end up with 554 tradeables and 142 non-tradeables in each case. In the last four columns where we focus on nontradeables, we exclude Bulgaria and Romania from the EU and non-EU averages as including the latter two countris in the calculation of mean price leads to the exclusion of almost half of our nontradeables sample (65 out of 142 items).

distributions of LOP deviations for Cyprus relative to non-EZ EU moves starkly to the left between 2005 and 2010 for both tradeables and non-tradeables. This is also evident in Table 3 where we report the average and median LOP deviation for Cyprus relative to non-EZ EU economies in the third row. Cyprus was 16%, on average, more expensive relative to the average non-EZ EU country in 2005 for tradeables, and down to 9.4% more expensive by year 2010. Similarly, the median price for tradeable goods was 16.4% higher in Cyprus relative to the EU in 2005 and down to 7.1% more expensive by 2010. For non tradeables, Cyprus was on average 7% more expensive in 2005, but became 1.2% cheaper than the average non-EZ EU country by 2010. The latter is not the case for the median non-tradeable good which was still 7.2% more expensive in Cyprus in 2010, down from 13.1% more expensive in 2005. The above results suggest that the process towards and the adoption of the euro constrained inflation in Cyprus relative to non EZ countries. This led to a smaller price gap between Cyprus and these countries for both tradeables and non-tradeables by the end of our sample.

Additionally, as we can see in Figure 4, Cyprus became more integrated with non-EZ EU countries for tradeables between 2005 and 2010. In the eighth row of Table 2, we see that the kurtosis value for the distribution of LOP deviations for Cyprus relative to the EU increased from 3.27 in 2005 to 3.74 in 2010. For non-tradeables, the kurtosis value reported in the ninth row of Table 2 increases only slightly from 2.72 in 2005 to 2.74 in 2010. From these values and Figure 4, we can also see that the tradeables distriubution is more highly peaked than the non-tradeables one for both 2005 and 2010, with the KS test null that the tradeables and non-tradeables distributions are identical rejected at the five

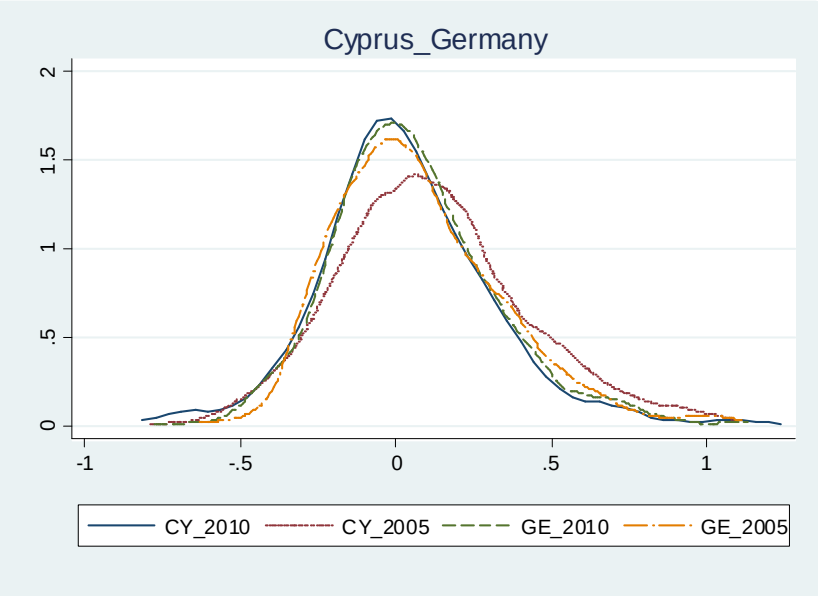

Figure 5: LOP deviations distributions for Cyprus and Germany

percent and one percent level of statistical significance respectively for 2005 and 2010.

Comparing the distribution of Cypriot LOP deviations (relative to the EU) with individual economies

In Figure 5, we compare Cyprus to Germany for 2005 and for 2010. The striking fact that emerges is that by 2010 the distribution of prices for Cyprus moves all the way to the left to meet the German distribution. From the information reported in Table 3, we can see that this leftward shift in the distribution of LOP deviations for Cyprus as compared to that of Germany, is due to tradeables becoming relatively cheaper for Cyprus over time. The average (median) LOP deviation in Cyprus relative to Germany for tradeables is reported in the

eighth row of Table 3 to be 3% (5%) higher in Cyprus relative to Germany in 2005, but very close to parity with a mean (median) LOP deviation relative to Germany of 0.1% (1.3%) in 2010. However, when we control for the fact that income is higher in Germany, prices for traded goods net of the income effect appear to be distinctly higher in Cyprus. The mean (median) LOP deviation for tradeables controlling for income was 13.9% (15.9%) in 2005 and 9.9% (11%) by 2010. The fact that, controlling for income, Cyprus was about ten percent more expensive for tradeables than Germany as of 2010, might be explained by the greater geographic distance from potential trade partners as well as the small economic size characterizing the Cypriot market, in the presence of transport costs that increase with distance and the positive relation of size with the degree of potential competition[6] respectively.

The high degree of integration of Cyprus relative to Germany in 2010 as compared to 2005 is striking. These changes render the Cypriot distribution statistically indistinguishable from the German one in 2010, and apparently more similar to the German distribution in 2005 or 2010 than to the Cypriot distribution of LOP deviations in 2005! The KS test implies that the null that the distributions for Cyprus and Germany are identical in 2010 cannot be rejected even at the ten percent significance level, with a p-value of 0.318 as we report in Table 2. The statistical coincidence of the German and Cypriot distributions for year 2010 occurs via the movement of Cyprus to the left and the increased degree of integration for Cyprus relative to the EU without appar-

[6] Given a fixed cost of producing, size would imply a lower number of potential domestic producers, while given a fixed cost of entering a market, size would imply a smaller number of exporters to that market, both factors reducing the degree of potential competition in a small economy, especially so if this economy is relatively distant and faces higher transportation costs for exporting (amplifying the first factor) or importing (likely amplifying the second factor.)

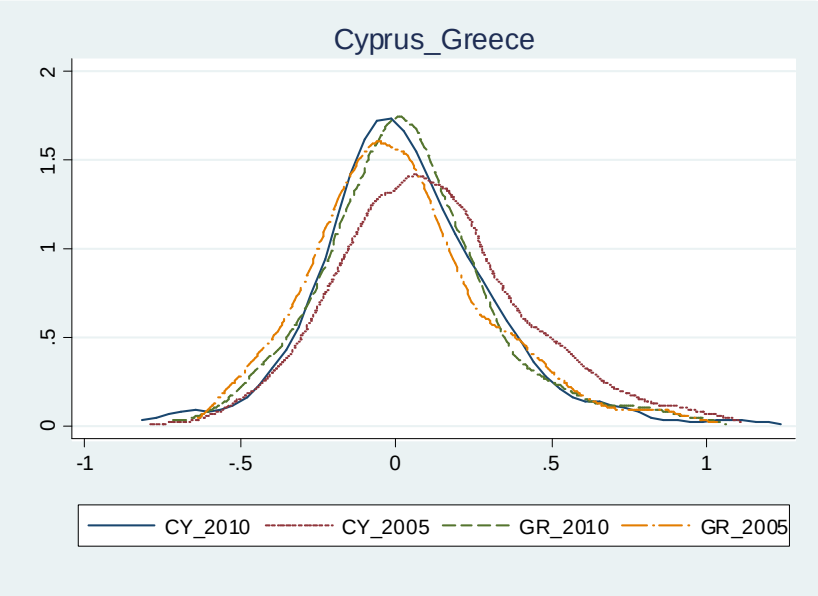

Figure 6: LOP deviations distributions for Cyprus and Greece

ent changes in the German distribution of LOP deviations relative to the EU between 2005 and 2010.

To the contrary, as we show in Figure 6, the statistical coincidence of the Greek and Cypriot distributions in 2010 occurs both via the shift of the Cypriot distribution to the left as well as the shift of the Greek distribution to the right[7], and because both distributions exhibit a higher and similar degree of integration relative to the EU by year 2010. In the ninth row of Table 3, we show that the average (median) tradeable good in Cyprus was 9.9% (8.9%) more expensive than in Greece in 2005 but very close to parity by 2010, with the mean (median) LOP deviation relative to Greece at 0.3% (0.9%). Moreover, the average non-tradeable was 0.9% more expensive in 2005 and 1.7% cheaper

[7] The mean (median) LOP deviation in Greece relative to the EU is shown in Table 2 to be -2.6% (-1.5%) in 2005 and -0.3% (1.8%) by 2010.

in 2010, while the median non-tradeable was 8.1% more expensive in Cyprus than in Greece in 2005 and 3.2% more expensive in 2010. It is useful to note here that Guerreiro and Mignon (2013) use comparative price levels for twelve EZ members at the monthly frequency between January 1970 and July 2011 and find that Greece (as well as Portugal) exhibit fast convergence but mainly due to their loss of competitiveness over time. Glushenkova and Zachariadis (2014) show that between 1990 and 2005, Portugal, Greece, and Ireland become more integrated relative to Europe but also relatively more expensive over time with their distributions of LOP deviations shifting to the right. This is not the case for Cyprus that, apparently, experienced lower prices relative to other EZ and non-EZ EU economies during its process of monetary unification between 2005 and 2010.[8]

Also evident in Figure 6 is that the change in the degree of integration between 2005 and 2010 is greater for Cyprus than Greece, (the kurtosis values reported in Table 2 equal 4.5 for Cyprus in 2010 as compared to 3.3 in 2005, and 4.0 for Greece in 2010 as compared to 3.6 in 2005) perhaps due to the process of monetary unification that takes place for Cyprus during this period. While we reject the KS test null that the distribution of LOP deviations of Cyprus relative to the EU is identical to that of Greece in 2005, by 2010 we cannot reject the null that the distributions for Cyprus and Greece even at the ten percent level of significance, with an astonishingly high p-value equal to 0.795 as we report in Table 2.

Comparing Cyprus to the UK, one of its main trade partners outside the

[8] Glushenkova and Zachariadis (2014) show that the distribution of LOP deviations for Spain relative to the EZ also shifts to the left between 1990 and 2005 during the process of monetary unification.

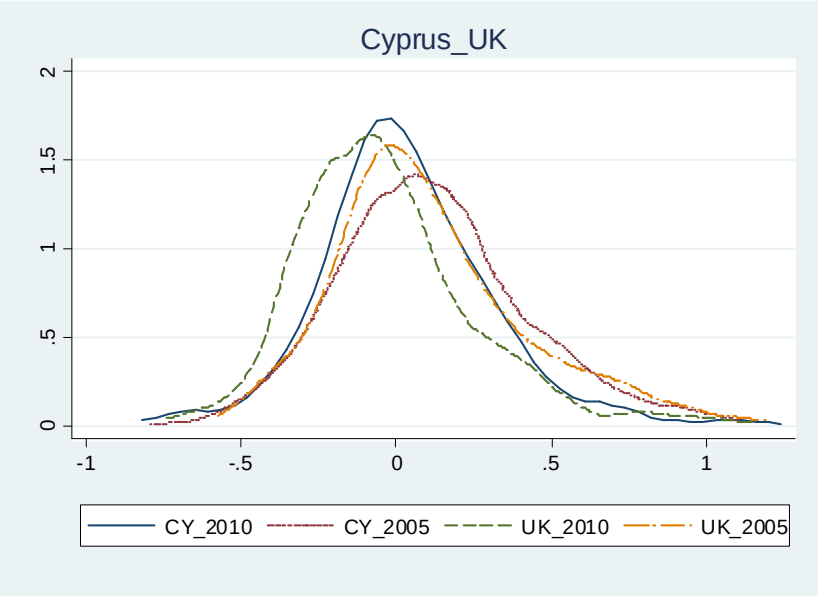

Figure 7: LOP deviations distributions for Cyprus and UK

EZ, the findings are somewhat different than above. Both the UK and Cyprus distributions move leftward relative to the average EU country as shown in Figure 7, becoming relatively cheaper over the period 2005-2010. As shown in Table 2, the UK mean (median) LOP deviation relative to the EU was 6.3% (5.3%) in 2005 but way down to -7.8% (-7.5%) by 2010. In Table 3, we can see that as a result, the average (median) tradeable good in Cyprus was 2.4% (3.1%) more expensive in Cyprus in 2005 but up to 11.9% (14.8%) more expensive by 2010, while on the other hand the average (median) non-traded good was 23.3% (28.9%) cheaper in Cyprus than in the UK in 2005 and 13.7% (8.3%) cheaper by 2010. All this suggests Cyprus was likely becoming less competitive during the period relative to one of its main trading partners.

Importantly, there are no visible signs in Figure 7 of Cyprus becoming more

integrated with the UK during this period as compared to the integration taking place between Cyprus and individual EZ countries like Germany and Greece during this period. Unlike the comparisons with Germany and Greece, the KS test reported in Table 2 implies that the null that the distributions for Cyprus and the UK are identical can be rejected at the one percent significance level in 2010 whereas the p-value for 2005 was 0.027 so that we could not have rejected the null at the one percent level (but just at the five percent level) back in 2005. This suggests that Cyprus became somewhat less integrated with one of its main trading partners outside the EZ during the process of monetary unification from 2005 to 2010.

A perhaps surprising fact is that despite the general tendency for Cyprus to become cheaper over time relative to the EU or EZ average for both tradeables and non-tradeables, the average tradeable good in Cyprus remained somewhat more expensive than in EU economies like the Netherlands, Spain and the UK for 2005 and 2010 as shown in Table 3. This is the case even after we remove the effect of income differences between Cyprus and these countries, as shown in Table 4. Greater geographic distance from potential trade partners along with the small economic size characterizing the Cypriot market are two candidate explanations for this fact. Given a fixed cost of production, size would imply a lower number of potential domestic producers, while given a fixed cost of entering a market, size would imply a smaller number of exporters to that market. Both of these factors would then reduce the degree of potential competition in a small economy, especially so if this economy is relatively distant and faces higher transportation costs for exporting (that would amplify the first factor) or importing (that would likely amplify the second factor.) Given these char-

acteristics Cyprus shares to some extent with Malta, it is then instructive to note that by 2010 the average (median) tradeable good was 8.7% (6.9%) more expensive in Cyprus down from 14.2% (12.4%) in 2005 as shown in Table 3, and that once we correct for income differences between Cyprus and Malta the average (median) tradeable good is shown in Table 4 to be 0.8% (2.6%) cheaper in Cyprus as compared to Malta by 2010.[9]

Comparing categories

So far, we have considered the distributions of Cypriot LOP deviations before and after the euro and compared these to the distributions for other EU economies, to understand the changes that occurred after euro adoption. We have also looked at the mean and median LOP deviation for Cyprus relative to other countries in our sample for tradeable as well as for non-tradeable goods and services to understand whether the movements over time differ across these two important categories. In the current subsection, we consider Cypriot LOP deviations for a number of smaller sub-categories of goods and services to understand how these have changed between 2005 and 2010. To do so, we consider the group mean over all individual LOP deviations in each group for the goods or services belonging in each category. The results of this exercise are reported in Table 5 for twenty distinct categories of goods and services.

As we can see in Table 5, there are important differences in how the mean LOP deviation changed between 2005 and 2010 for different types of goods and services. We see some spectacular changes in the average and median

[9] However, Cyprus remained significantly more expensive than Malta for non-tradeable services during this period.

Table 5: LOP deviations in Cyprus for different industries

		petrol	water	electr.	cars	pub.trans.	taxi	pharm.	doctors	tobacco	alcohol
2005:											
mean	CY-EU	-0.197	-0.305	-0.107	0.126	0.212	-0.143	0.083	0.119	0.222	0.301
	CY-EZ	-0.258	-0.406	-0.231	0.128	-0.075	-0.300	-0.014	-0.170	0.109	0.415
	CY-nonEZ	-0.138	-0.211	0.011	0.137	0.521	0.089	0.195	0.386	0.355	0.196
2010:											
mean	CY-EU	-0.169	-0.314	0.134	-0.036	-0.027	-0.192	0.115	-0.140	0.022	0.007
	CY-EZ	-0.198	-0.355	0.096	-0.054	-0.183	-0.353	0.046	-0.406	-0.105	0.060
	CY-nonEZ	-0.141	-0.276	0.167	-0.002	0.118	0.045	0.191	0.103	0.173	-0.044

		drinks	cell tel.	teleph.	food	restaur.	hotels	coffee	car rental	flights	internet
2005:											
mean	CY-EU	0.300	-1.109	-0.880	0.063	0.192	-0.117	0.585	-0.008	0.482	0.189
	CY-EZ	0.292	-1.240	-0.829	-0.042	0.077	-0.156	0.481	0.014	0.549	0.108
	CY-nonEZ	0.299	-0.958	-0.922	0.197	0.341	-0.065	0.680	0.013	0.428	0.256
2010:											
mean	CY-EU	0.223	-0.965	-1.003	0.041	0.063	0.049	0.493	-0.129	0.234	0.073
	CY-EZ	0.197	-1.104	-0.945	-0.043	-0.025	-0.037	0.415	-0.197	0.269	0.077
	CY-nonEZ	0.234	-0.790	-1.056	0.144	0.176	0.142	0.560	-0.012	0.209	0.081

Notes: We calculate log LOP deviations as the log price of good j in Cyprus minus the log average price of good j across the relevant group of countries, and then take the mean over goods of these LOP deviations for each category. EZ - the twelve original Eurozone members: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain. non-EZ EU - includes new Eurozone members: Cyprus, Malta, the Slovak Republic and Slovenia, as well as other EU countries that were not members of the Eurozone as of 2005: the Czech Republic, Estonia, Denmark, Hungary, Latvia, Lithuania, Poland, Sweden, and the UK. This excludes the non-EZ EU members Bulgaria and Romania, as excluding these from the average allows us to include information about Cypriot LOP deviations relative to the EU and nonEZ EU countries in 2005 for six more categories. EU - includes the EZ12 plus non-EZ EU countries.To maintain a high degree of comparability, we present results of Cyprus comparison with the three regional categories (EU, EZ and nonEZ EU) for exactly the same set of goods or services within each category.

Cypriot LOP deviations for some categories of goods between 2005 and 2010. For example, electricity becomes 9.6% more expensive than the EZ average in 2010 while it was 23.1% cheaper than the EZ average in 2005. Relative to the EU, Cyprus is 13.4% more expensive in 2010 as compared to 10.7% cheaper than the EU average in 2005. As this is an important input into the production of most goods and services, this increase in cost placed a serious burden on other industries. Based on the Eurostat Supply-Use Tables for Cyprus for 2007, about ten percent of the input cost of Retail trade and Other Service activities is directly due to electricity use, and the same goes for the manufacturing industry of rubber and plastic products. This is followed by the electricity input intensity of nine percent into the manufacture of non-metallic mineral products and 7.4% for Hotels and Restaurants, while a number of other manufacturing and service industries have a direct electricity use intensity that exceeds five percent of the total input costs into production.[10] These values underestimate the total (direct plus indirect) impact of electricity on the cost of production, to the extent that these industries use inputs from other industries which are also affected by the cost of electricity.

In contrast to higher electricity prices, automobiles and a number of other imports become cheaper over the same period. For automobiles, on average, Cyprus was 12.8% more expensive in 2005 relative to the EZ but became 5.4% cheaper by 2010. Alcohol and Tobacco also become significantly cheaper between 2005 and 2010 and the same goes for the important tourism-related categories of restaurants (on average, 7.7% more expensive in 2005 but 2.5% cheaper

[10] Similar numbers for the share of input costs attributed directly to electricity use for each industry, were obtained using the OECD Input-Output Tables in the mid 2000's.

relative to the EZ by 2010, and 19.2% more expensive relative to the EU in 2005 but down to just 6.3% more expensive by 2010), international flights (on average, 54.9% more expensive relative to the EZ in 2005 but down to 26.9% more expensive by 2010) and car rentals (on average, 1.4% more expensive relative to the EZ in 2005 but 19.7% cheaper by 2010).

On the other hand, the important tourism-related category of hotels becomes more expensive during this period (respectively, 15.6% and 11.7% cheaper in Cyprus relatively to the EZ and the EU in 2005, but just 3.7% cheaper than the EZ and 4.9% more expensive than the average EU country by 2010.) The latter findings might suggest that Cyprus was not able to keep up with productivity gains in hotel services experienced in other EZ and EU economies, and as a result became less competitive in this most important tourism-related category.

Finally, there are some persistently strikingly cheap or expensive categories in Cyprus relative to other EU and EZ economies. For example, phone calls are much cheaper than the EZ or EU average (both via cellular and ground lines) for 2005 and, similarly, for 2010. On the other hand, non-alcoholic drinks and coffee served at coffee shops are persistently and significantly more expensive in Cyprus relative to other EZ and EU economies during this period, even though both categories become somewhat less expensive in 2010 as compared to 2005.

Explaining absolute Cypriot LOP deviations relative to the EU

In this subsection, we consider the determinants of absolute LOP deviations for Cyprus relative to the EU for a short panel comprised of observations for individual goods in 2005 and 2010. We estimate a panel regression of Cypriot LOP deviations over countries, goods and time with Cypriot industry-level data

on tradeability and the share of non-traded inputs required for production.

More specifically, we set out to explain absolute LOP deviations ($|q_{ijs}|$) for Cyprus relative to each EU country i for good j at time s with tradeability, $t_{hs} = \frac{(X_{hs}+M_{hs})}{Y_{hs}}$, defined as imports ($M_{hs}$) plus exports ($X_{hs}$) of Cyprus over gross output (Y_{hs}) of industry h (in which good j belongs to) in Cyprus in period s, the share of non-traded inputs required to produce goods in industry h in Cyprus at time s, α_{hs}, the absolute value of differences between log vat rates for industry h in Cyprus and each country i, v_{his}, an alcohol and cigarettes dummy variable, $D_{ALC\&CIG}$, and a time dummy for year 2010, D_s. According to the model of retail price determination proposed in CTZ, the estimated parameter $\hat{\beta}_1$will capture the role of tradeables in production, while $\hat{\beta}_2$ will be informative about the role of non-traded inputs in determining LOP deviations.

Thus, we estimate the following regression equation over 47246 observations for 1057 goods and services for Cyprus relative to the other twenty-six EU countries[11] and obtain the following results:

$$
\begin{array}{lccccccccccccc}
|q_{ijs}| = & \beta_0 & + & \beta_1 & \ln t_{hs} + & \beta_2 & \ln \alpha_{hs} + & \beta_3 & v_{his} + & \beta_4 & D_{ALC\&CIG} + & \beta_5 & D_s \\
 & 0.494 & & -.073 & & 0.179 & & .046 & & .077 & & -.102 & \\
 & (.030) & & (.012) & & (.063) & & (.011) & & (.021) & & (.014) &
\end{array}
$$

Importantly, the negative estimated coefficient for tradeability and positive for non-tradedness (both significant at the one percent level), are in line with the retail price determination proposed in CTZ. The importance of tradeability in explaining (reducing) absolute LOP deviations in Cyprus relative to other

[11] These are: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Malta, the Slovak Republic, Slovenia, Bulgaria, the Czech Republic, Estonia, Denmark, Hungary, Latvia, Lithuania, Poland, Romania, Sweden, and the UK.

EU countries suggests that explanations based on trade costs can be important in order to understand Cypriot price differences, with higher trade costs (lower tradeability values) being associated with greater price differences. Moreover, the importance of non-traded inputs implies a role for wages and other local input costs in determining these, with a higher non-traded input content share being associated with greater price differences. In addition, vat differences also explain some of the price differences observed in Cyprus and so do special taxes related to alcohol and cigarettes. Both of these variables enter significantly at the one percent level.

3 Conclusion

We have compared the densities of LOP deviations for Cyprus relative to other EZ and non-EZ EU economies before and after it adopted the euro. This has informed us about the changing degree of integration of Cyprus with other EU economies during this important period. More specifically, we infer that Cyprus became more integrated between 2005 and 2010 especially relative to EZ economies, and that the Cypriot distribution of LOP deviations shifted to the left with Cyprus becoming relatively cheaper over the period, especially relative to non-EZ EU economies.

However, we also document important differences in the price behavior for specific goods and services within that distribution. For example, while a number of imported goods became significantly cheaper over the period from 2005 to 2010, the important tourism-related category of hotels becomes significantly more expensive over this period. Moreover, importantly for the price competitiveness of domestically produced goods and services, there was also a dramatic

increase in the cost of electricity during this period as compared to other EZ and EU economies. The above tendencies for the relative price of imports as compared to domestically produced goods and services likely exacerbated Balance of Trade problems for Cyprus over this period, even as the overall price level faced by Cypriot consumers was actually going down relative to the EZ and EU average.

Finally, we show that price differences for Cyprus relative to other EU countries can be adequately explained by the share of non-traded inputs into production, by tradeability, and by differences in taxation. The importance of non-traded inputs in particular, implies a key role for local input costs in determining price differences between Cyprus and other European economies. It follows that policies which encourage liberalization in the labor market and the broader service sector could be important in enhancing the price competitiveness of the Cypriot economy.

While previous work finds that Greece, Portugal and Ireland become more integrated relative to Europe during the process of monetary unification by becoming more expensive over time as their LOP deviation distributions shift to the right, we find that Cyprus becomes more integrated by experiencing lower prices relative to other EZ and non-EZ EU economies during its process of monetary unification between 2005 and 2010.[12] The empirical distribution

[12] It should be noted that factors other than the adoption of the euro could have been partly responsible for this behavior of prices e.g. if the Cypriot economy grew more slowly than other EZ&EU economies during 2006-2010, the cumulated effect of the relative business cycle would have rendered prices relatively lower in Cyprus over time. In fact, Cyprus did not grow more slowly than either the EZ nor the EU during this period. Growth rates in the EZ and the EU had been lower than the Cypriot one for each year during 2006-2010 except in 2010 for which the growth rate was about 2% for the EU and EZ and at 1.3% for Cyprus (Source: WDI 2013). Given the above, it is less likely that the relative shift to the left of the Cypriot distribution of LOP deviations could be attributed to relatively lower growth rates for Cyprus over 2006-2010, even though Cyprus went from a positive growth rate of just below 4% in

of Cyprus becomes statistically indistinguishable to that of core EZ economies like Germany by 2010, implying a fast pace of relative price adjustment for Cyprus during the process of Euro adoption and indicative of the high degree of flexibility characterizing the Cypriot economy. The latter can be important in order to understand the response of the Cypriot economy within the Troika program during the past year and the anticipated nominal versus real response in the years to come.

2005 to a growth rate of just above 1% in 2010 after high positive growth rates for 2006-2008 and a recession in 2009.

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