

Common Currency Zones and Income Levels: The Effects of the Euro on Spanish Incomes**Emily Yeager****Publication Date**

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Common Currency Zones and Income Levels: The Effects of the Euro on Spanish Incomes

Abstract

The creation of the euro as a common currency within the eurozone has led to many studies on optimal currency zones and the economic effects of a common currency. This paper seeks to analyze if there is a relationship between average income increases or decreases and the transition to a common currency in Spain. Panel data from the Organization for Economic Cooperation and Development (OECD) on individual average incomes is used to estimate a difference-in-differences model. The regression models suggest that adopting a common currency does positively impact Spain's income levels.

I. Introduction

Since the formation of the European Union (EU) in 1957 as the European Economic Community (EEC), this political and economic union has become a powerful conglomeration of nations. The Maastricht treaty in 1993 introduced the idea of a common currency and outlined criteria for acceptance into the soon to be common currency zone. Although some western countries in Europe already fulfilled the requirements to join—low inflation, low debt, low interest rate, and a stable exchange rate—Spain, as a newly established democracy, used the next six years to reach these economic levels to match its neighbors. The declaration that Spain would be entering the new eurozone was marked with both positive and negative feedback, with many wondering how a currency transition would affect many aspects of society, such as trade, prices, and immigration. This paper will examine the extent to which the currency transition from the peseta to the euro affected average incomes in Spain and how this varied among different age brackets.

Previous research estimates economic effects of the eurozone on members and joining members, considering positive and negative results. Belke and Setzer (2005) examine non-temporary negative effects in Central and eastern European countries' labor markets following the introduction of the euro. Their findings suggest that exchange rate variability has a significant impact on employment in terms of growth and the underemployment rate, which supports the theory that it is in the best interest of EU member countries to join the euro area because the exchange volatility affects emerging markets the most. Similarly, Andres, Hurtado, Ortega, and Thomas (2010) compare the determinants of Spain's macroeconomic fluctuations with the other eurozone economies since 1999. Their findings indicate that membership in the EU has a significant effect on the volatility of growth and inflation differentials, and they

theorize that Spain would have used monetary policy instead to lower their inflation rates if they had not joined the eurozone. My paper will contribute to this field by examining how individual incomes were affected by this currency transition, expanding the research done on more micro-level effects on countries following the establishment of the eurozone.

In order to measure these economic effects in Spain, a difference-in-differences regression model is utilized to estimate the shock of the currency transition on January 1, 2002. Using data from the years 2000-2017, I estimate regressions for Spain with regional observations as the treatment group and Slovakia with regional observations as the control group, controlling for both fixed regional and fixed time effects. Theoretically, with a difference-in-differences regression, the two countries should show parallel trends in average income until the euro is introduced in 2002 for Spain and in 2009 for Slovakia. The regressions are then estimated again using three different age categories: 0-14 years old, 15-64 years old (working age), and 65+ years old.

The results for both Spain and Slovakia suggest a statistically positive impact on average income following the transition to the euro in 2002 and 2009 respectively. When controlling for fixed time and fixed regional effects, Spain's income increased by €3,933 after the currency transitioned in 2002 relative to Slovakia's income. However, for both countries, the regressions that broke up income by age groups as listed above did not indicate a statistically significant relationship. While these overall results are significant, additional observable variables that might be affecting household income would enhance the robustness of the study.

This paper is organized with Section II exploring the background of both the political and economic situation in Spain and the development of the euro. Section III explores related research in terms of common currency zones, the eurozone, and Spain's economy after adopting

the euro. The following section (Section IV) describes the data used, and Section V details the difference-in-differences approach utilized for this study. Section VI presents the results from the regressions and provides interpretations. Lastly, Section VII concludes the study and suggests potential opportunities for future studies.

II. Background

Modern economies have been structured to operate through a system of trade in which one uses currency to trade for a good or service. Currency allows individuals to establish value for their goods or service and to make exchanges with ease, and it also implies the existence of a central bank. However, using currency as a method of payment becomes challenging when different regions, states, or nations utilize different currency types. An American traveling to Japan would have a difficult time paying for goods with dollars instead of using the Japanese Yen. Creating a currency that can be accepted in a larger regional area allows for greater flexible to make payments, but certain economic features constrict what constitutes an optimal currency zone for its member states.

Mundell (1961) introduces the concept of an Optimal Currency Zone by examining what factors make an area suitable to organize under a single central bank with a single currency. His paper argues that in order to have a successful single currency, there must be a high degree of capital and labor mobility. He argues that currency operates as an “expression of national sovereignty,” which makes it difficult to mobilizes areas into a single currency unless national sovereignty is being sacrificed. Additionally, a common currency should not be expected to increase factor mobility if capital and labor were originally immobile among regions. Should a common currency be adapted with this expectation, Mundell (1961) argues that one would expect to see varying levels of unemployment and inflation in the different regions. Additionally,

concerning unemployment, a currency zone would create a situation where countries with stronger economies should bear the burden of international adjustment through inflation in order to lower unemployment in struggling countries. An optimal currency zone relies upon cooperation among member countries in order for there to be a high degree of ease in factor mobility and economic support.

Although Mundell (1961) argued that the European Union would not be an optimal currency zone because of its limited labor force mobility, after World War II, many European countries began taking steps towards uniting under a common currency. Countries started uniting as early as 1950 under the European Coal and Steel Community in order create unity and peace for the six founding members of Belgium, France, Germany, Italy, Luxembourg, and the Netherlands. Seven years later in 1957 the Treaty of Rome officially established the European Economic Community (EEC), and these countries stopped charging custom duties when trading with each other. They also began collaborating to unify food production so that all citizens under the European Union (EU) had enough to eat through national cooperation. Beginning in 1973, the community expanded as Denmark, Ireland and the United Kingdom joined the EU. As the EU expanded and became more influential, beginning in 1979 citizens were able to directly elect members to the EU Parliament. The EU continued to expand with Greece joining as the tenth member in 1981, and Spain and Portugal joined in 1986. Unity among the member states started to formalize under the Maastricht treaty in 1993, which laid the foundations for how the current EU functions.

The Maastricht treaty formalized the idea of the euro as a single common currency and outlined the criteria for how a country can join the eurozone. Under this treaty the European Central Bank (ECB) was established and given the objective of maintaining price stability for the

euro. In order to maintain price stability in the region, the Maastricht criteria (or the convergence criteria) created economic requirements for countries so that their joining would not alter the price stability. Firstly, a country's average inflation rate over a one-year period should not exceed the inflation rate of the three best-performing EU member states by more than 1.5%. Secondly, the country's overall government debt should not exceed 60% of its gross domestic product (GDP), and its annual fiscal deficit should not exceed 3% of its GDP. Thirdly, its interest rate must not exceed the interest rate of the three best-performing member states by more than 2% over a one-year period. Lastly, the country must maintain a stable exchange rate as outlined by the fluctuation margins from the exchange rate mechanism (ERM II) for at least the previous two years. Only once these four criteria are met is a country deemed stable enough to join the eurozone. The Maastricht Treaty established the economic framework needed to unify the current EU member nations under a single currency.

The inclusion of Spain into the EU marked a significant moment in Spanish history as it opened its economy as a recently formed democracy. When Spain first joined the EU, its inflation rate had lowered considerably from its initial 26% in the late 1970s to about 8% upon its incorporation into the community; however, adoption into the eurozone required a considerably lower inflation rate that would promote stability among the region. Finally, in 1997, Spain reached an inflation level of 2%, which fulfilled the convergence requirements needed to join the common currency zone. Within the next year, Spain fulfilled all the Maastricht criteria, and it joined the Eurozone on January 1, 1999. Spain became one of the original countries organized under the Central European Bank and the eleven National Central Banks, and it would become one of the original countries to adopt the euro. On this same date, the eleven National Central Banks converted their accounts to euros and financial institutions converted the account

balances of their clients to euros. Additionally, financial markets such as the Public Debt and the Stock Exchange began to operate in euros instead. In book-keeping terms, the euro became the new currency, but the timeline to physically manufacture the coins and banknotes necessitated a postponement of the euro into circulation until January 1, 2002. During this three-year transitional period, the national currency of each country as well as the euro represented legal currency that would be accepted as payment for exchanges. For some countries, both their national currency and the euro were accepted as payment options, but other countries used one day to officially exchange out their currency for the new euro. Spain utilized the longer transition option and accepted the peseta and the euro until the official switch in 2002. In Spain, this long transition sparked optimism for economic growth, but it also sparked apprehension as the traditional peseta was transitioned out for the newborn euro.

In particular, this currency transition into a single currency raised concerns about exchange rates for trade. Suárez (1998) expresses the fear that Spain, as well as other founding countries, held as there was uncertainty about which nations would be included in the eurozone and what the exchange rate would be. Depending on which nations would be part of the first transitional phase, there would be differing levels of competitiveness. Increased competitiveness presents a challenge for domestic companies and factories as the market opens with frictionless trade. Consumers then had cheaper options for goods and services than were present before this economic zone was formed. Domestic price discrimination is eliminated as other countries accept the same exchange rate. Suárez (1998) also identifies the difficulties of a currency transition for consumers, and in particular the elderly. Citizens have to learn new values for goods and services, as everything is now valued at a different rate according to the euro—this would be particularly challenging for the elderly as they have lived their whole life with values

represented by the peseta. As one ages, learning new ways of living becomes more challenging, and people typically are less welcome to significant changes, such as a currency change. In the short term, the disadvantages of the currency transition will be felt more by those who keep their assets in liquid cash that would need to be exchanged for euros. An article from the Guardian (2001) reflects this uncertainty in Spain, quoting a bank teller, "I'm not sure that the government has done the right thing by introducing the euro over two months - allowing it to be used alongside the peseta. I think that will be very confusing."

This transition period greatly affected individuals, prompting confusion about this new economic endeavor. By allowing both the peseta and the euro to be in circulation both as legal currencies, citizens had to juggle understanding the values of goods and services in two different currencies. Once the switch from the peseta to the euro became official on January 1, 2002, Spain officially was a part of the eurozone, sharing a common currency alongside its fellow European Union members. A single common currency allows for greater factor mobility among member nations, but its effects on regional producers and consumers left many Spaniards with doubts and apprehensions about trade and the exchange rate for the new currency.

Presently, Spain represents a strong economy as part of the EU. Their GDP per capita for 2019 was \$29,600, and their GDP growth was 2%. Also, in 2019, the inflation rate was 0.7% and unemployment was 13.96%. The euro has now been in circulation for 19 years and is regarded as the official currency of Spain and is accepted by many other nations in Europe as a formal method of payment. On a macroscale, it can be observed that Spain has adapted well to the currency transition, but on a microscale, individuals in Spain accepted the effects, positive and negative, of the euro that can often be more difficult to observe.

III. Literature Review

As one of the largest and most well-known common currency zones, considerable economic literature regarding the eurozone has been written that examines the consequences to each European nation following the introduction of the Euro in January 2002. Additionally, some papers focus on Spain and how its specific economy changed when it joined the conglomeration of European countries that introduced the Euro in an effort to create a stable economy through a common currency. My paper will study how income in particular was affected by this currency transition. Although much research has been conducted concerning the benefits and drawbacks of the Euro creating a common currency zone, my paper will contribute on a micro-scale how individual Spaniards' incomes were affected.

Various pieces of economic literature have examined how European Union (EU) economies have fared after the common currency of the Euro was introduced in Europe. While typically one considers the traditional Eurozone to be the first 11 countries which joined, Tizón, Santos, and García (2012) identify the differences in economic reactions to a common currency between the center of the EU and the periphery, which includes the nations of Ireland, Greece, Portugal, and Spain. Using macroeconomic data from EuroStat, this paper determines whether the Eurozone represented an optimal currency zone based on certain economic indicators such as inflation, GDP, and the real exchange rate before the Euro was introduced. Their findings suggest that the higher inflation levels and imbalances in public accounts are concentrated within the periphery countries rather than within the Eurozone as a whole. Tizón, Santos, and García's (2012) findings point to a need for the Eurozone to take measures to move inflation rates in these peripheral areas closer to the mean in order to establish a more optimal currency zone for all members. This analysis indicates that economic effects following the transition to the Euro may

have been different for certain nations, such as Spain, because of their economic situation before 2002. Belke and Setzer (2005) also examine negative effects following the introduction of the Euro by examining why Central and eastern European countries experienced negative developments in their labor markets that were not temporary. Their analysis focuses on exchange rate volatility and its relation to employment rates. Belke and Setzer's (2005) findings indicate that exchange rate variability has a significant impact on employment in terms of growth and the underemployment rate. This supports the theory that it is in the best interest of EU member countries to join the euro area because the exchange volatility affects emerging markets most. Hegerty (2020) studies how joining the eurozone has further affected five recent inductees as they relinquish their nation's individual control of monetary policy. This paper uses data from the International Financial Statistics of the IMF to analyze percentage changes in CPI from 2000 to 2017 for the countries of Estonia, Latvia, Lithuania, Slovakia, and Slovenia, which all joined the eurozone after 2002. The analysis of this data shows that the mean inflation tended to decrease after controlling for the 2008 financial crisis. Additionally, the results of this study suggest that inflation rates of the Central and Eastern European (CEE) region have begun converging and lowering. However, this may be independent from whether a nation has adopted the euro or not as the converging and lowering of inflation rates began before the Euro was adopted—countries in this region can still reap the benefits of a common currency region. This study closely resembles my area of focuses with its analysis on purchasing power, but it examines countries that joined the eurozone post-2002 when the Euro was already circulating in the region. It focuses instead more on how the region's economy collectively changed following the introduction of the Euro. Because the European economies are so closely connected in terms

of their macroeconomies, introducing a common currency created ripple effects in inflation and capital flows that altered the economies of all eurozone nations.

As a foundation for analyzing an individual market, literature on the eurozone also analyzes the economic changes for each country when there are economic fluctuations. Reis (2013) analyzes the Portuguese economy from 2000-2012, searching for reasons why the Portuguese economy fared even worse when compared to how the US economy fared during the Great Depression. There were similar events in both Spain and Portugal during these years, such as the introduction of the Euro; however, Portugal experienced a significant economic slump and stagnation during a time when its neighbor experienced growth. Their analysis uses an open economy model that reacts to a shock that relaxes the financing constraint on foreign capital, representing the Euro. Reis's (2013) findings suggest that capital inflows in Portugal went towards unproductive firms that did not produce tradeable goods, which led to the fall of economy-wide production and the rise of real-exchange rates. These results highlight the importance of analyzing economies on a micro-scale in order to understand how macro and micro economic changes affect individual markets. The introduction of a common currency can only positively alter an economy to a certain extent because it also depends on other factors, such as the policy decisions made by a nation's leadership.

Given its position as one of the first 11 countries to join the eurozone, significant economic literature has focused on Spain and analyzed its economic changes due to currency change. Andres, Hurtado, Ortega, and Thomas (2010) compare the determinants of Spain's macroeconomic fluctuations with the other eurozone economies since the inception of the euro in 1999. Relying on the Banco de España DSGE model of Spain and the rest of the Eurosystem (BEMOD), the paper uses a forecasting tool for analysis on possible economic policies. Their

analysis compares the effects of economic shocks in Spain with the rest of the EU member nations. Their findings suggest that membership in the EMU has a significant effect on the volatility of growth and inflation differentials. Based on this information, this paper theorizes that Spain would have used monetary policy to lower their inflation rates had they instead excluded themselves from joining the Euro currency zone. Garcia (2008) also investigates inflation in Spain and compares its trends with aggregated trends in the EU. This paper uses two structural self-regulating vectors with structural constraints in order to identify what types of shocks or disturbances in an economy affect inflation in both Spain and in Europe. Their analysis focuses mainly on the measurement tools used to measure inflation rates and the limitations of these many methods. Garcia's (2008) paper's conclusion highlights that for both Spain and Europe, inflation was underestimated compared to the inflation theoretically important during the time period leading up to the introduction of the Euro. Because inflation depends on many significant factors, it can be challenging to measure accurately, especially when additional shocks are introduced to a model. While much literature examines how the Spanish inflation rate has been affected in the last thirty years, debates about measurement techniques and its effect on the rest of the euro zone imply that continued research must be conducted in order to create a fuller understanding of the relationship the Euro has created among economic markets and factors.

Most similar to my paper in terms of methodology, Pilar Beneito and Carlos Cháfer (2020) find evidence that the introduction of the Euro has significantly increased the negative impacts of capital inflows on costs. Using a difference-in-differences approach, they use 12 Euro countries and 12 non-Euro countries (control group) from a 1993 to 2007 period with a treatment year of 2002—the year the Euro was introduced. In order to control for productivity, the control

variables used are real GDP growth, unemployment rate increase, and union density. They analyzed their data into different market sectors, those being industry, construction, market services, trade-transport-communications, financial and business services. The data used for this regression came from the OECD database and the IMF WEO database. Their findings suggest implications regarding the competitiveness of supply markets in the eurozone given changed capital flows following the euro transition. The authors, however, only examine the effects in capital inflow by aggregating the 12 markets. My research question also examines the impact of the Euro but looks specifically at Spain to identify the particular effects on income.

IV. Data and Summary Statistics

Spain is organized into 17 autonomous communities (*comunidades autónomas*) that serve to give limited autonomy to regions of Spain within the whole decentralized unitary state. The data used for this paper captures the uniqueness of each autonomous community by having an observation for each autonomous community for every year included in the data. In order to examine the impact on income at a regional level, I will utilize panel data from the years 2000-2017 for the Autonomous Communities of Asturias, Andalusia, Aragon, Balearic Islands, Basque Country, Canary Islands, Cantabria, Castille and León, Castille-La Mancha, Catalonia, Ceuta, Extremadura, Galicia, La Rioja, Madrid, Melilla, Murcia, Navarra, and Valencia. Using a balanced panel data set will allow me to observe and track each region over an 18-year period. The data was collected from the Organization for Economic Cooperation and Development (OECD), which provides extensive global data for public access. The goal of the OECD is to establish evidence-based global standards and solutions to international social, economic, or environmental challenges. The OECD long-term strategy is to collect data and metadata through

statistical data and metadata eXchange (SDMX), which standardizes and modernizes the process for exchanging statistical data and metadata internationally.

The variables used in order to measure income change are meant to analyze which demographics in specific regions were most impacted by the shock of a currency transition. The demographic used to segment each region is ages, beginning with ages 0-14, then 15-19 continuing with 5-year additions, and ending with 65+. There are a total of 342 observations. Isolating the observations based on region as well as age group will allow me to observe if specific age groups experienced a more significant impact on their income following the currency transition.

The data on primary income of private households for both Spain and Slovakia is measured in Millions USD. It also has constant prices and a constant purchasing power parity (PPP) with a base year of 2015. Because the PPP is held constant, it eliminates the differences in price levels between countries to equalize the purchasing power of different currencies. A constant PPP also allows me to analyze the data in US dollars when typically, Spaniards are paying for goods and services in the peseta (until 2002) and then the euro (post-2002). However, with a constant PPP, some factors such as transport costs, tax differences, government intervention, non-traded services, and market competition are harder to include in calculations. Despite these limitations, this income data will be able to show me how the absolute value of income was affected over this 18-year period during which the currency changed.

A limitation to this data is that observations on income were not found before 2000. Already in 2000, Spain was accepted into the eurozone and the country was being prepared and paved to accept the euro in two years. The idea and imminent change were already being circulated in Spanish minds, so the change might not be as evident with data beginning in 2000.

Using data from before 2000 would provide a more complete picture of the income situation from before the euro was the currency or even being prepared for as the next currency.

The data for Slovakia was also pulled from the OECD and serves as a control group for my analysis of Spain. The euro was introduced on January 1, 2009, so the global events were different when Spain transitioned versus when Slovakia transitioned. The age brackets used for Slovakia are 0-14, 15-64, and 65+ to separate the population into children, working age, and retired ages. There are only four large regions in Slovakia, so there are only 72 total observations. A limitation to using Slovakia as a control group is that the transition to the euro occurred right after the 2008 Global Recession began. This will affect the income effects caused by the currency transition as the recession significantly affected incomes as well. It will be difficult to isolate the effects on income due to the currency transition versus the global recession. Additionally, the country has not completely transitioned to the euro, as the koruna is still accepted in small villages in place of the euro. The incomes will not be accurately represented because the koruna is still unofficially circulating. Despite these limitations, having Slovakia as a control group will increase robustness of the regression and analysis of Spain.

Table 1 shows the average primary income in units of \$ in 1,000s of private households by year and autonomous community for 2000-2006. Upon first observation, the table shows the significant wealth disparity by autonomous community. The autonomous communities of Madrid and Catalonia (which includes the city of Barcelona) have significantly higher average income than many of the other more rural regions. This trend is consistent for all years. For example, in 2000, the average primary income of private households in Madrid was \$150,900, but in La Rioja (a small northern community) it was only \$6,531.

Primary Income of Private Households (\$ in 1000s)							
	Year						
Autonomous Community	2000	2001	2002	2003	2004	2005	2006
Galicia	44.75	46.62	47.69	48.86	50.06	51.74	53.463
Asturias	18.88	19.83	20.17	20.62	20.94	21.75	22.627
Cantabria	10.64	11.24	11.59	11.85	12.08	12.6	12.966
Basque Country	54.27	56.67	57.42	58.64	59.3	60.67	62.435
Navarra	15.05	15.66	15.96	16.38	16.73	17.19	17.604
La Rioja	6.531	6.847	6.945	7.212	7.275	7.437	7.6853
Aragon	27.34	28.43	29.45	30.21	30.59	31.52	32.819
Madrid	150.9	159.9	164	169	174.8	181.7	189.14
Castile and León	47.38	49.25	50.07	50.99	51.7	52.93	54.393
Castile-La Mancha	29.16	30.99	32.51	33.8	34.77	36.07	37.245
Extremadura	14.78	15.46	15.78	16.19	16.41	16.96	17.472
Catalonia	159.9	166.8	171.4	178.4	183.4	190.1	196.4
Valencia	83.33	87.58	90.32	93.01	95.32	98.14	101.33
Balearic Islands	21.82	22.95	23.43	23.68	24.53	25.28	26.112
Andalusia	113.3	119.1	123.1	128.7	133	138	142.89
Murcia	20.11	21.43	22.61	23.59	24.35	25.64	26.437
Ceuta	1.356	1.392	1.411	1.479	1.508	1.562	1.5848
Melilla	1.262	1.297	1.299	1.328	1.38	1.406	1.4343
Canary Islands	34.44	36.09	37.27	38.36	38.81	39.64	40.157

Table 1—Primary Income of Private Households by Year and Autonomous Community in Spain

Chart 1 shows similarly the extreme differences in income among communities, with Madrid, Catalonia, Andalusia, and Galicia having noticeably higher incomes than the other communities. Their trend lines of these four communities show an observable increase in average income over time until the 2008 global recession. The other communities with lower average income, though, do not have as observable of an increase in their average primary income. This initial observation makes me believe that effects of the introduction of the euro will be felt more in the higher income communities that are more metropolitan than in the rural communities.

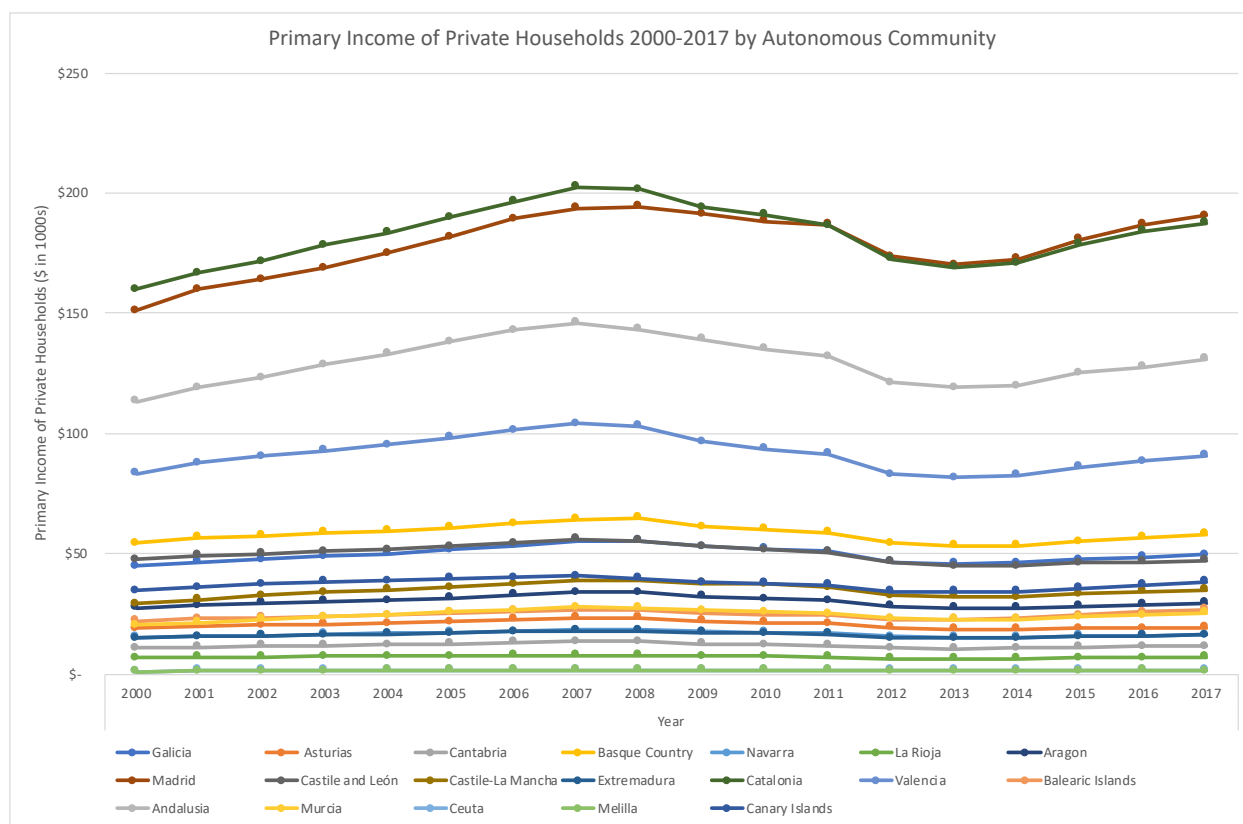


Chart 1—Primary Income of Private Households over time by Autonomous Community in Spain

Similarly, Chart 2—Primary Income of Private Households over time by Region in Slovakia isolates the Bratislava Region as experiencing the most change in its income over time. The Bratislava Region contains the city of Bratislava, which is the largest city in Slovakia. This matches the trend observed in Spain that the more metropolitan regions have higher incomes and experienced more change in income than the more rural areas.

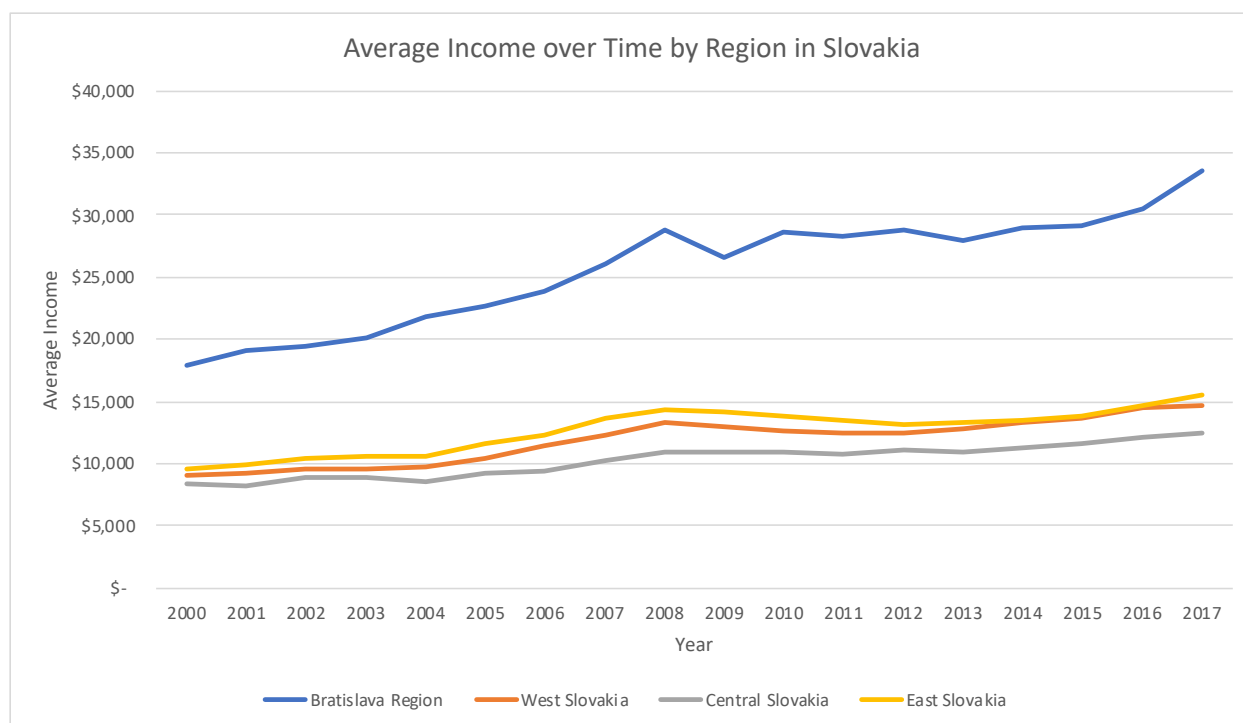


Chart 2—Primary Income of Private Households over time by Region in Slovakia

A key assumption of difference-in-differences regressions is that there are parallel trends between the control and the treatment groups. This assumption implies that Slovakia's income level trends reflect what would have happened to Spain's income levels had Spain not transitioned from the peseta to the euro (and likewise with Slovakia and its currency transition in 2009). One simple way to observe pre-treatment trends is by graphing my y-variable of average income by year for both Spain and Slovakia. Chart 3 shows the average incomes with the top trend line representing incomes in Spain and the bottom trend line representing the trend line in Slovakia. Both in 2000 and 2001, incomes follow a similar trend in both countries in that incomes increase slightly. For Spain, the parallel trends assumption is considered valid. The trend is slightly more difficult to discern for Slovakia and its treatment year of 2009 because of the financial crisis of 2008. Until 2008, it appears that both countries experienced similar

increases in income (parallel trends), but Spain saw a decrease in income in the year 2008

whereas Slovakia continued its positive increasing trend. The parallel trends assumption cannot hold for Slovakia's difference-in-differences regressions.

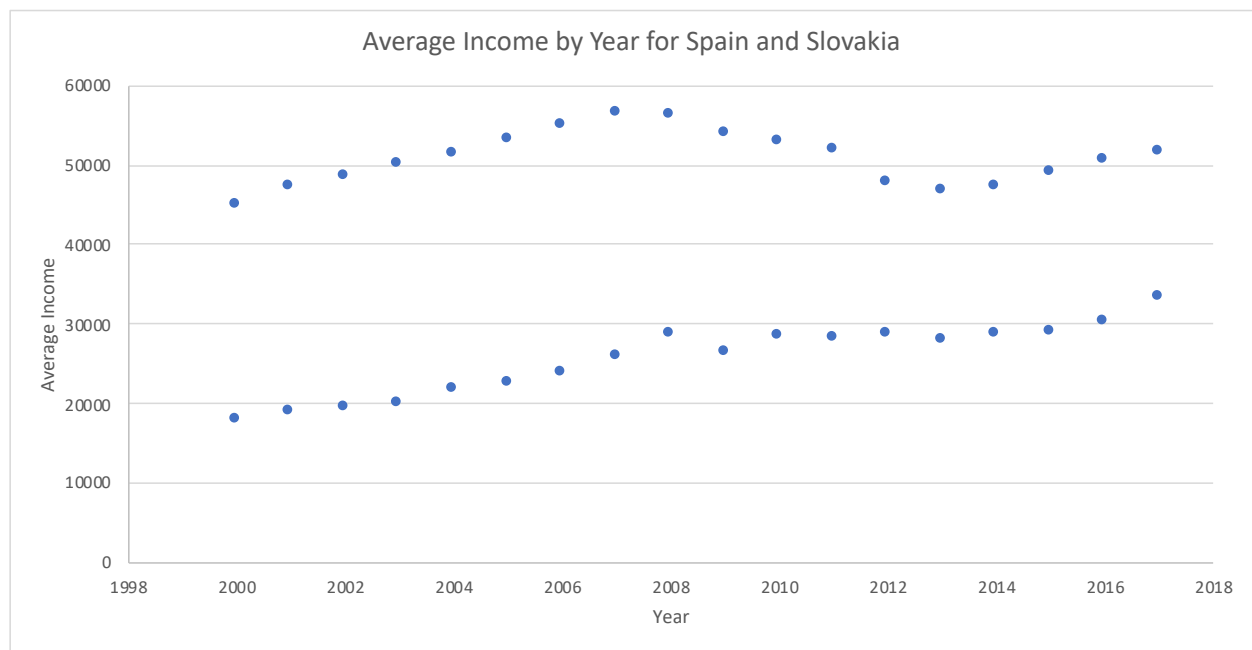


Chart 3—Average Income by Year in Spain and Slovakia

Autonomous Community	Primary Income of Private Households Summary Statistics					
	Mean	Median	Standard Deviation	Minimum Value	Maximum Value	No. of Observations
Asturias	\$ 20,511	\$ 20,394	1608.499947	\$ 18,482	\$ 23,293	18
Andalusia	\$ 129,869	\$ 129,842	9643.710165	\$ 113,293	\$ 146,139	18
Aragon	\$ 30,093	\$ 29,855	2163.986298	\$ 27,336	\$ 33,901	18
Balearic Islands	\$ 24,490	\$ 24,503	1520.41162	\$ 21,817	\$ 26,766	18
Basque Country	\$ 58,286	\$ 58,354	3506.546679	\$ 53,372	\$ 64,876	18
Canary Islands	\$ 37,315	\$ 37,402	2127.830663	\$ 34,086	\$ 40,737	18
Cantabria	\$ 11,779	\$ 11,722	912.6437266	\$ 10,552	\$ 13,366	18
Castile and León	\$ 49,960	\$ 50,285	3589.660848	\$ 44,822	\$ 56,160	18
Castile-La Mancha	\$ 34,578	\$ 34,460	2801.514793	\$ 29,161	\$ 39,044	18
Catalonia	\$ 182,479	\$ 183,733	12311.52824	\$ 159,906	\$ 202,413	18
Ceuta	\$ 1,494	\$ 1,491	74.54601802	\$ 1,356	\$ 1,586	18
Extremadura	\$ 16,171	\$ 16,170	1023.484371	\$ 14,778	\$ 17,930	18
Galicia	\$ 49,671	\$ 49,135	3273.680499	\$ 44,754	\$ 55,413	18
La Rioja	\$ 7,026	\$ 7,014	479.4191084	\$ 6,328	\$ 7,823	18
Madrid	\$ 178,789	\$ 181,219	12609.16517	\$ 150,943	\$ 194,305	18
Melilla	\$ 1,354	\$ 1,369	57.36063119	\$ 1,262	\$ 1,438	18
Murcia	\$ 24,348	\$ 24,428	2042.426054	\$ 20,111	\$ 27,615	18
Navarra	\$ 16,458	\$ 16,327	1036.316682	\$ 15,054	\$ 18,226	18
Valencia	\$ 91,678	\$ 91,198	7065.497883	\$ 81,453	\$ 103,937	18

Table 2—Summary Statistics of Primary Income of Private Households by Autonomous Community from 2000-2017 in Spain

Average Primary Income of Private Households by Year and Age Bracket			
	Average Age Bracket in %		
Year	Ages 0-14	Ages 15-64	Ages 65+
2000	19%	69%	11%
2001	19%	70%	11%
2002	18%	70%	11%
2003	18%	71%	12%
2004	17%	71%	12%
2005	17%	72%	12%
2006	16%	72%	12%
2007	16%	72%	12%
2008	16%	72%	12%
2009	15%	72%	12%
2010	15%	72%	13%
2011	15%	72%	13%
2012	15%	72%	13%
2013	15%	71%	13%
2014	15%	71%	14%
2015	15%	71%	14%
2016	15%	70%	15%
2017	16%	69%	15%

Table 3—Average Primary Income of Private Households by Year and Age Bracket in Percentages for all Regions in Spain

	Average Income by Year and Region			
	Region			
Year	Bratislava Region	West Slovakia	Central Slovakia	East Slovakia
2000	\$ 17,985	\$ 9,026	\$ 8,366	\$ 9,487
2001	\$ 19,054	\$ 9,149	\$ 8,197	\$ 9,898
2002	\$ 19,483	\$ 9,610	\$ 8,862	\$ 10,414
2003	\$ 20,111	\$ 9,581	\$ 8,864	\$ 10,669
2004	\$ 21,893	\$ 9,811	\$ 8,611	\$ 10,659
2005	\$ 22,646	\$ 10,448	\$ 9,230	\$ 11,627
2006	\$ 23,891	\$ 11,486	\$ 9,391	\$ 12,292
2007	\$ 26,077	\$ 12,249	\$ 10,309	\$ 13,627
2008	\$ 28,766	\$ 13,226	\$ 10,938	\$ 14,246
2009	\$ 26,554	\$ 12,913	\$ 10,862	\$ 14,181
2010	\$ 28,644	\$ 12,553	\$ 10,947	\$ 13,762
2011	\$ 28,281	\$ 12,452	\$ 10,694	\$ 13,414
2012	\$ 28,715	\$ 12,452	\$ 11,055	\$ 13,118
2013	\$ 27,927	\$ 12,823	\$ 10,941	\$ 13,286
2014	\$ 28,881	\$ 13,365	\$ 11,217	\$ 13,479
2015	\$ 29,055	\$ 13,727	\$ 11,523	\$ 13,841
2016	\$ 30,427	\$ 14,435	\$ 12,115	\$ 14,722
2017	\$ 33,532	\$ 14,696	\$ 12,467	\$ 15,493

Table 4—Average Primary Income of Private Households by Year and Region in Slovakia

	Primary Income of Private Households Summary Statistics					
Region	Mean	Median	Standard Deviation	Minimum Value	Maximum Value	No. of Observations
Bratislava Region	\$ 25,662	\$ 27,241	4507.22	\$ 17,985	\$ 33,532	18
Central Slovakia	\$ 11,889	\$ 12,452	1840.93	\$ 9,026	\$ 14,696	18
East Slovakia	\$ 10,255	\$ 10,778	1321.42	\$ 8,197	\$ 12,467	18
West Slovakia	\$ 12,679	\$ 13,350	1788.81	\$ 9,487	\$ 15,493	18

Table 5—Summary Statistics of Primary Income of Private Households by Region from 2000-2017 in Slovakia

	Average Primary Income of Private Households by Year and Age Bracket		
	Average Age Bracket in %		
Year	Ages 0-14	Ages 15-64	Ages 65+
2000	19.37%	69.17%	11.46%
2001	18.91%	69.70%	11.39%
2002	18.24%	70.31%	11.45%
2003	17.65%	70.81%	11.54%
2004	17.10%	71.26%	11.64%
2005	16.64%	71.60%	11.76%
2006	16.22%	71.88%	11.90%
2007	15.83%	72.11%	12.06%
2008	15.52%	72.28%	12.21%
2009	15.27%	72.37%	12.36%
2010	15.22%	72.22%	12.56%
2011	15.19%	72.09%	12.72%
2012	15.24%	71.84%	12.92%
2013	15.26%	71.48%	13.26%
2014	15.30%	71.03%	13.67%
2015	15.36%	70.55%	14.09%
2016	15.44%	70.00%	14.56%
2017	15.61%	69.29%	15.09%

Table 6—Average Primary Income of Private Households by Year and Age Bracket in

Percentages for all Regions in Slovakia

V. Methodology

To estimate the causal impact of the transition from the euro to the peseta in Spain, I focus on two central difference-in-differences regressions in order to examine a control group (Slovakia) and a treatment group (Spain) when the “shock” or intervention of the currency transition occurs in 2002 for Spain and in 2009 for Slovakia. The key assumption when using a difference-in-differences approach for this estimation is that the group-specific trends in the outcome of income would be identical in both Spain and Slovakia in the absence of the euro. Theoretically, the income trends for both countries should move in parallel had the euro not been implemented in the economies. Both difference-in-differences regressions follow the standard model of:

$$Y_{it} = \beta_0 + T_{it}\beta_1 + A_{it}\beta_2 + T_{it}A_{it}\beta_3 + \varepsilon_{it}$$

Where i = country, t = year, $T_{it} = 1$ if Spain (0 otherwise), and $A_{it} = 1$ if the time is 2002 or later (when the euro was introduced in Spain) and 0 if before or $A_{it} = 0$ if the time is 2009 or later (when the euro was introduced in Slovakia) and 0 if before. A_{it} captures the “shock” of the euro being introduced and separates the control from the treatment.

My first difference-in-differences regression focuses on Spain and only uses data from the years 2000-2006. Constricting the observations to these years concentrates the effects of the currency transition as well as eliminates any effects that occurred from the 2008 financial crisis (which began in 2007) and Slovakia’s transition to the euro in 2009. This regression is as follows:

$$Income = \beta_0 + \beta_1 * Spain + \beta_2 * Post2002 + \beta_3 * Spain * Post2002 + \varepsilon_{it} .$$

The interaction term result of β_3 shows how Spain’s level of income performed after 2002 relative to Slovakia’s level of income (which had not adopted the euro yet). Spain and Post2002 are both dummy variables that replace T_{it} and A_{it} from the model regression, respectively.

My second difference-in-differences regression reverses the control and the treatment groups and includes the years 2006-2013. Spain had already adopted the euro by 2006 and serves as the control group. This regression shows the impact of Slovakia making the transition relative to Spain. The variable A_{it} for this regression only is equal to 1 when the year becomes 2009 because that is when Slovakia adopted the euro (January 1, 2009). Additionally, the post-2007 observations used capture the effect of the 2008 financial crisis on both countries, helping to control for this global event. The second regression with Spain as a control group is as follows:

$$Income = \beta_0 + \beta_1 * Slovakia + \beta_2 * Post2009 + \beta_3 * Slovakia * Post2009 + \varepsilon_{it} .$$

The interaction term result of β_3 shows how Slovakia's level of income performed after 2009 relative to Spain's level of income, which had been paid through euros for the previous seven years.

Additionally, for both regressions I will be accounting for yearly and regional fixed effects. Controlling for regional fixed effects means controlling for region-specific time-invariant characteristics. Similarly, controlling for year fixed effects controls year specific shocks (for example, the financial crisis of 2008 or other shocks that occurred in other years). To account for heteroskedasticity, I also calculate robust standard errors that do not assume the variance of the error term is constant and helps mitigate biased standard errors.

To continue to analyze the situation I will interpret numerous difference-in-differences regressions that focus on demographics. Breaking down each country's characteristics will help to explain where income changes were the most concentrated. For example, to examine the impact of the post-transitional period for regions in Spain that have a certain percentage more elderly, I will run the following regression:

$$Income = \beta_0 + \beta_1 * \%Old + \beta_2 * Post2002 + \beta_3 * \%Old * Post2002 + \varepsilon_{it}$$

In this example, β_3 is the impact of the post-transition period for those who are a certain percentage point(s) older. The marginal effect is a one unit change in "percentage old", so if you are 1% older, then β_3 measures the impact on that region compared to another region.

Continuing the analysis by examining demographics such as age will provide evidence for whether certain characteristics were related to effect on income.

Difference-in-differences regressions rely on many assumptions. One assumption, mentioned previously, is that there are parallel trends in the control group (Slovakia) and the treatment group (Spain). The time trends in average income before the introduction of the euro in

2002 should be parallel. Another key assumption is that there is no endogeneity. This means that the predictor variables should not be correlated with the error term in the models. Finally, the difference-in-differences regression assumes that there are simultaneous shocks for the treatment group and the control group. Any time-varying shock to average income in 2002 should occur in both Spain and Slovakia. The parallel trends assumption was tested for above in Section IV, but no endogeneity was assumed and simultaneous shocks are difficult to test for.

VI. Results

Table 7 displays the results of the first difference-in-differences regression, which estimates the effect of the introduction of the euro on Spain's income. The four regressions use a combination of time fixed effects and regional fixed effects, and regardless of the fixed effects presence or absence, the interaction term of Spain*Post2002 is significant. This implies that Spain's level of income increased after 2002 relative to Slovakia's level of income. For the fourth (regional fixed effects) and the third (time and regional fixed effects) regressions, Spain's income increased by €3,933 after the currency transitioned in 2002 relative to Slovakia's income.

Table 7 –Difference-in-Differences for Spanish Income

	Dummy Variable on Income in Spain			
	(1)	(2)	(3)	(4)
Post2002	-27,107*** (6,876)	-32,119 (13,242)	1,584 (465)	-3,428 (1,416)
Spain*Post2002	38,664*** (5,742)	38,664*** (3,212)	3,933* (1,577)	3,933* (1,582)
Time Fixed Effects	No	Yes	No	Yes
Regional Fixed Effects	No	No	Yes	Yes
_cons	40,086*** (6,777)	-2,824,421 (6,425,720)	40,086*** (891)	-2,824,421** (787,196)

N	161	161	161	161
R-sq	0.0634	0.0646	0.0262	0.0234

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 8 displays the results of the difference-in-differences regressions that estimate the impact of the transition to the euro on three age groups in Spain. All three regressions show that for a 1 percentage point increase in population size of any of the three age groups, there was not a significant impact on income relative to other age groups for income in Spain. Each age group within Spain relative to other age groups within Spain is not statistically significant. It appears that regions with a higher percentage of 65+ aged Spaniards are in general more poor and have the worst trend post 2002 (compared to those under 15 and working age individuals), but these are not statistically significant results.

Table 8 – Difference-in-Differences for Spanish Income by Age

	Dummy Variable on Income in Spain		
	(1)	(2)	(3)
Ages 0-14	189,408 (423,149)		
Ages 0-14*Post2002	-10,131 (33,081)		
Ages 15-64		147,279 (154,851)	
Ages 15-64*Post2002		137,454 (74,275)	
Ages 65+			-334,906 (249,168)
Ages 65+*Post2002			-24,004 (34,504)

Time Fixed Effects	Yes	Yes	Yes
Regional Fixed Effects	Yes	Yes	Yes
_cons	17,584 (64,170)	-54,235 (105,776)	102,349*** (23,602)
N	133	133	133
R-sq	0.0133	0.12	0.0064

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

The next four regressions in *Table 9* focus on Slovakia's adoption of the euro in 2009 with Spain as a control group. The interaction term, Slovakia*Post2009, had the strongest significance when both time fixed effects and regional fixed effects were controlled. This suggests that when controlling for time and regional fixed effects, Slovakia saw an increase in income of about €4,955 relative to Spain during this time period. *Table 10* displays the results from regressions that focus on age groups in Slovakia that mirror those from *Table 8* with Spain. Similarly, these regressions fail to show any statistically significant effect by age group on income due to the transition to the euro in 2009 in Slovakia.

Table 9 –Difference-in-Differences for Slovakian Incomes

	Dummy Variable on Income in Slovakia			
	(1)	(2)	(3)	(4)
Post2009	2,807 (9,347)	6,163 (17,591)	-4,209*** (966)	-853 (546)
Slovakia*Post2009	-35,388** (6,654)	-35,388** (6,678)	4,955** (1,019)	4,955*** (1023)
Time Fixed Effects	No	Yes	No	Yes
Regional Fixed Effects	No	No	Yes	Yes
_cons	48,868***	1,973,351	48,868***	1,973,351***

	(6,790)	(8,270,283)	(457)	(575,393)
N	161	161	161	161
R-sq	0.0364	0.0367	0.0098	0.007

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 10–Difference-in-Differences for Slovakian Income by Age

	Dummy Variable on Income in Slovakia		
	(1)	(2)	(3)
Ages 0-14	14,093 (56,167)		
Ages 0-14*Post2002	-3,916 (7,729)		
Ages 15-64		-61,688 (52,421)	
Ages 15-64*Post2002		-13,333 (6,093)	
Ages 65+			298,554 (179,744)
Ages 65+*Post2002			-50,841 (11,479)
Time Fixed Effects	Yes	Yes	Yes
Regional Fixed Effects	Yes	Yes	Yes
_cons	13,307 (9,059)	60,012 (37,698)	-20,455 (13,307)
N	28	28	28
R-sq	0.1285	0.402	0.4476

Standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

VII. Conclusion

This paper aimed to examine the impact that the currency transition from the peseta to the euro in 2002 in Spain had on income. The change in currency led many Spaniards to speculate on their new purchasing power as they joined a common currency zone. Using a difference-in-differences regression, the results indicate that in Spain there was a significant overall increase in income after 2002. However, there was not a significant relationship between income levels and the currency transition for Spain when analyzing age demographics of the Spanish population. When controlling for regional and time fixed effects, the impact of the currency transition on income in Spain is smaller but still significant. Similarly, in Slovakia, the main difference-in-differences regression shows a significant overall increase in income after 2009. When analyzing demographics such as was done with Spain, no significant relationship was observed. The models found that adopting a common currency positively impacts Spain's average income levels. No significance was found when segmenting the data into age categories.

This research contributes to ongoing investigations into the costs and benefits of adopting a common currency, such as in the European Union with the euro. With the departure of Britain from the EU, there has been newfound demand in better understanding how common currency zones function and how a common currency affects member states. Many eastern Europe countries have more recently joined the eurozone and many are recognized as official candidates. Understanding how changing from a national currency to a common currency will affect the joining nation remains a crucial aspect of the decision-making process for governments discerning membership. While macro effects such as trade and mobility among member nations continues to be important factors to consider, micro effects in terms of income and purchasing power also remain important.

A primary limitation of this study is the number of observations. Using data points from before 2000 would better represent incomes before the euro was announced and exchange rates were beginning to be calculated. Additionally, using a limited amount of data for each year limits the accuracy of observable trends. It could be that in general most incomes did not change significantly, but certain income brackets may have been affected significantly, forcing the average to represent an overall increase. Further research should be done to understand which income brackets were most affected by the currency transition and if a common currency leads to more or less income inequality. Studies that focus on income effects and inequality help identify useful and efficient ways for nations to alleviate poverty.

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