Education Economics

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/cede20

Deeper crisis, higher skills demand? Impact of the European financial crisis on demand for German language skills

Laura Cyron & Rahul Mehrotra

To cite this article: Laura Cyron & Rahul Mehrotra (2022) Deeper crisis, higher skills demand? Impact of the European financial crisis on demand for German language skills, Education Economics, 30:1, 47-65, DOI: 10.1080/09645292.2021.1931036

To link to this article: https://doi.org/10.1080/09645292.2021.1931036

Published online: 24 May 2021.

EDUCATION ECONOMICS
2022, VOL. 30, NO. 1, 47–65
https://doi.org/10.1080/09645292.2021.1931036

Routledge
Taylor & Francis Group

Deeper crisis, higher skills demand? Impact of the European financial crisis on demand for German language skills

Laura Cyron and Rahul Mehrotra

Graduate Institute of International and Development Studies, Geneva, Switzerland

ABSTRACT

We analyze the 2007 European financial crisis' impact on the demand for new language skills. The crisis affected German-speaking regions less. Learning German became relatively more attractive for migration and trade. We construct a sub-national database for German as a foreign language exam (TestDaF) participation rates between 2001–2013 and define regional crisis indicators. Using a multiple-group, multiple-period difference-in-differences framework with propensity score matching, we find that TestDaF participation increased significantly in crisis-affected regions, driven by youth and severely-affected Hellenic and Latin linguistic regions.

ARTICLE HISTORY
Received 30 November 2019
Accepted 11 May 2021

KEYWORDS
Language skills; human capital; European crisis; unemployment

JEL CODES
J24; J60; Z13

1. Introduction

Acquiring new skills enhances human capital which in turn increases economic opportunities. In particular, the acquisition of additional, non-native language skills is associated with higher life-time earnings by facilitating access to better university education and increased employment opportunities and improved trade opportunities (Saiz and Zoido 2002, 2004; Aldashev, Gernandt, and Thomsen 2009; Grin, Sfreddo, and Vaillancourt 2011; Chiswick and Miller 2014; Gazzola and Wickström 2016). Furthermore, acquiring destination-language proficiency among migrants also decreases the cost of migration by facilitating economic and social integration (Pedersen, Pytlikova, and Smith 2008; Chiswick and Miller 2014; Aparicio Fenoll and Kuehn 2016; Adserà and Pytliková 2016; Budria, Colino, and Martinez de Ibarreta 2019). Economic theory shows that acquiring new language skills is associated with costs which vary according to individual ability and linguistic distance from the mother-tongue. Individuals demand new skills when potential benefits exceed costs and this assessment is influenced by prevailing economic conditions (Selten and Pool 1991; Lazear 1999). However, while there is significant research on the impacts of language skills on economic outcomes, there is a paucity of robust empirical evidence on the opposite relationship, i.e. the impact of economic conditions on skill formation.

Can economic shocks shift the demand for new language skills? An adverse shock which impacts output and employment levels could lead to a shift in demand for new skills to boost competitiveness among the affected population. In order to shed light on this research question, we construct a new, regional data-set of demand for German language proficiency in the European Union (EU) proxied by participation in the TestDaF (test of German as a foreign language) examination between 2001–13. Individuals can participate in this examination to certify their advanced

CONTACT Rahul Mehrotra rahul.mehrotra@graduateinstitute.ch Graduate Institute of International and Development Studies, Chemin Eugène-Rigot 2, 1202 Geneva, Switzerland

German language skill levels acquired previously, including during compulsory education, through the private market, or a combination of both. The examination is not linked to any specific language course itself. Indeed, there is significant diversity in foreign language policies during compulsory education across EU countries with German language courses being offered more prominently in some locations (Eurydice 2012).[1]

Next, we exploit the heterogeneous, regional impact of the European financial crisis of 2007-onward to construct new regional crisis indicators. We follow the empirical macroeconomics literature and define a region to be in crisis if the growth rate of per capita gross domestic product (GDP) falls by more than 1 standard deviation from its pre-crisis time trend (Laeven and Valencia 2012).[2] We use these crisis measures to test the hypothesis that demand for German language proficiency increased in regions affected by the crisis using a multiple-group, multiple-period difference-in-differences framework. This framework allows us to compare demand for German language testing between crisis-affected and unaffected regions, before and after the crisis in order to identify a causal estimate. Finally, we conduct further empirical tests to verify the identifying assumption for our estimates and use propensity score matching to address potential biases in our baseline difference-in-differences estimates.

While GDP per capita declined and unemployment rates increased across Europe starting in 2007, we hypothesize that there was an increase in the relative attractiveness of German language proficiency since labor markets in German-speaking regions of Europe were relatively less affected by the financial crisis. For example: between 2007 and 2013, unemployment rates in Germany (8.7% to 5.2%), Austria (4.9% to 5.3%) and Switzerland (3.7% to 4.8%) performed significantly better compared to Greece (8.4% to 27.5%), Italy (6.1% to 12.2%), Spain (8.2% to 26.1%) and Portugal (7.9% to 16.2%) (The World Bank 2021; ESPON 2014). This makes acquisition of German language skills within Europe attractive for two main reasons. First, labor mobility towards regions with excess labor demand is a means to deal with asymmetric economic shocks, especially when wages are sticky. Indeed, freedom of movement for workers is one of the founding principles of the EU. Furthermore, the EU-Swiss Agreement on the Free Movement of Persons permits EU citizens the right to live and work in Switzerland since 2002, subject to their possession of an employment contract from a Swiss employer (State Secretariat of Migration 2020). This policy promotes the immigration prospects of those EU citizens with the required language and professional skills demanded by Swiss employers.[3]

Nevertheless, internal migration levels remained persistently low before the crisis. Only 3% of EU citizens lived in another member country and annual migration flows did not exceed 0.3% before 2007. Linguistic differences between countries' labor markets are a prominent reason which makes acting on the right to free movement difficult (Barslund and Busse 2014).[4] While EU-level agencies like the European Employment Service (EURES) exist since before the financial crisis to foster intra-EU mobility of workers, Germany in particular adopted a direct approach to assist inward migration, especially from Southern European countries, to address domestic labor market requirements after the financial crisis. The 'Make It in Germany' program was launched with federal funding support to connect domestic employers with potential workers abroad who are offered administrative and financial support for language training and moving costs.

Second, common spoken language is an important predictor for increased international trade and capital flows (Konya 2006; Melitz 2008, 2012; Melitz and Toubal 2014). However, research shows that European companies lose a significant amount of intra-EU business as a result of lack of language skills among employees. Firm-level surveys estimate that 11% of exporting small and medium enterprises (SMEs) have lost EU contracts because of communication barriers. Therefore, the acquisition of workers with additional linguistic skills is an important priority for firms (European Commission 2006; Grin, Sfreddo, and Vaillancourt 2011).

Our analysis finds that participation in TestDaF examinations increased by 38% on average in European regions affected by the crisis. We interpret this increase to represent individuals who acquired new language skills in response to the financial crisis as well as others seeking certification

for pre-existing language skills in order to upgrade their professional qualification or migration prospects. In terms of sub-groups, the increase is driven by male test-takers whose participation rates increase by 45% and youth between 15 and 25 years whose participation rates increase by 38%.

Next, we analyze heterogeneous effects by the different linguistic regions of Europe, including Baltic, Finno-Ugric, Germanic, Hellenic, Latin, and Slavic speaking regions.[5] After controlling for region and time fixed effects that account for time-invariant differences in foreign language education policies across EU regions, we find suggestive evidence indicating a large increase in Hellenic linguistic regions affected by the crisis where TestDaF participation rates increased by 190%. There is also an increase of 64% in Latin linguistic regions affected by the crisis.

Finally, we conduct robustness tests to test the validity of our findings. Accordingly, we first limit our analysis to observations over the region of common support, i.e. regions with similar observed characteristics paired using propensity score matching. This reduces the sample size used in the estimations but confirms our main findings. Next, we test a more stringent crisis definition whereby a region is defined to be in crisis if its GDP per capita growth falls by more than 2 standard deviations of its pre-crisis time trend. Once again, our main empirical results remain similar in magnitude and statistically significant.

This paper contributes to the literature on human capital and financial crises in several ways. First, it provides novel, intra-national evidence of the impact of economic conditions on human capital acquisition in terms of language skills. A rich literature in language economics has analyzed the economic impacts associated with the acquisition of additional language skills and finds that the benefits can often be substantial. Language skills improve the probability of employment, with higher level of proficiency being more beneficial than basic or intermediate skills. This research also shows that the selection of language that provides positive benefits also depends on the location being considered. For example – while English language skills may generally have positive benefits worldwide, other widely spoken languages like French or German may be more valuable for individuals working in Europe. Individuals are incentivized to acquire additional languages in order to access more potential trading partners (Lazear 1999; Gazzola and Wickström 2016; Gazzola, Wickström, and Templin 2019).

Research on language skills and migration has shown that proficiency in host country's local language is an important factor for easier assimilation and received higher returns to human capital through improved employment opportunities. Host language proficiency also affects non-economic outcomes including social integration within networks, political participation, civic engagement, further education and health outcomes. Overall, this literature shows that language skills reduce both financial and psychological costs of migration while improving access to information (Pedersen, Pytlikova, and Smith 2008; Chiswick and Miller 2014; Adserà and Pytliková 2016; Melitz 2016; Budria, Colino, and Martinez de Ibarreta 2019).

Theoretical research in international economics identifies common language as a means of communication and measure of common culture (Konya 2006; Janeba 2007; Melitz 2012). On the other hand, empirical research models lack of common language as a non-tariff barrier to trade, in the form of an iceberg-type, ad valorem trade cost element. Gravity model estimations show that trading partners who speak the same language experience a significant decline in transaction costs in trade (Melitz 2008; Oh, Selmier, and Lien 2011; Melitz and Toubal 2014). Finally, language proficiency is associated with increased individual income as well as labor market participation rates among migrants (Aldashev, Gernandt, and Thomsen 2009; Chiswick and Miller 2014). However, to the best of our knowledge, we provide the first empirical evidence on the role of economic conditions influencing dynamic changes in the demand for language skills.

Second, we contribute new evidence of skill formation in response to financial crises. The existing crisis literature has predominantly focused on the drivers of crises and impact on the real and financial sector, in terms of direct fiscal costs to support the financial system, increase in public debt and real output losses. The European financial crisis, in particular, led to persistent negative impacts on total and youth unemployment in countries of Southern Europe (Claessens et al. 2011;

Lane 2012). Some researchers have also analyzed the unequal impacts of the European financial crisis on labor market and migration outcomes. Calvo, Coricelli, and Ottonello (2012) document an increase in average unemployment rates from 7% to 11% in the EU-17 countries between 2007 and 2011 and show that financial crises tend to be followed by jobless recoveries and significantly lower real wage recoveries. Persistent shocks in the presence of jobless recoveries can lead to an increase in both long-term and structural unemployment. Using Eurostat data, Ghoshray, Ordonez, and Sala (2016) document that youth unemployment rates worsened significantly during the crisis increasing from 15.5% in 2007 to 23.5% in 2013 and being generally more than twice as high as the adult unemployment rates. Moreover, youth unemployment statistics can underestimate the true measure of the problem since young workers can opt to continue their education or live with their families, reducing the pressure to re-enter formal employment. Finally, Bertoli, Brucker, and Moraga (2013) analyze migration to Germany from EU-28 countries between 2006 and 2012 and find that an increase in local unemployment rates by 1% leads to an increase in migration to Germany by approximately 0.4%. The magnitude of these estimates are comparable to our findings of an increase in TestDaF participation rates in crisis-affected European regions. Migration data from the German Statistical Office shows that total immigration to Germany increased sharply, especially after the financial crisis from Greece, Italy, Portugal and Spain (Barslund and Busse 2014).

Finally, our findings provide supporting evidence for the European Commission's Framework Strategy for Multilingualism (European Commission 2005). This policy initiative aims to promote multilingualism in Europe in order to enhance economic competitiveness. Accordingly, this objective has been incorporated into the educational policies of all EU member countries.

2. Data and descriptive statistics

We use data from two sources in this paper. First, German language testing data is provided by the TestDaF Institut. This organization is responsible for the development, implementation and evaluation of the test of German as a foreign language (TestDaF) examination since 2000. The TestDaF is recognized by all German universities and professional institutions as proof of language proficiency. There are 501 test centers located in 99 countries where approximately 350,000 individual examinations have taken place (TestDaF Institut 2016). Our empirical analysis focuses on test centers within the EU. We aggregate anonymized data on individual test takers in each sub-national region for the time period 2001–2013.[6]

Second, the economic variables are sourced from the European Commission's Eurostat regional database. The sub-national regions are defined based on the EU's *Nomenclature of Units for Territorial Statistics* (NUTS), a geocode standard for subdivisions of countries which allow comparisons for statistical purposes. NUTS 2 regions are defined to have between 800,000 and 3 million inhabitants, and correspond to the level at which regional policies are applied (Eurostat 2015). We use gross domestic product per capita in order to define the crisis variables. Gross fixed capital formation, adult unemployment, and youth unemployment are included as measures of economic activity which help us control for time-varying observable economic characteristics of the regions in our analysis. These variables are also crucial for our implementation of the matching methodology to define the region of common support.[7] Finally, we include secondary and tertiary education attainment and enrollment rates in our analysis to account for the educational characteristics of the population.

Summary statistics for TestDaF participation rates and selected covariates are presented in Table 1 for both the full sample of 55 NUTS 2 regions for the time period 2001–2013, as well as the common support sample whereby crisis-affected and non-affected regions with similar observed characteristics are matched using propensity scores. This sample is used to test the robustness of our empirical results. The regions are further classified based on the dominant spoken language family, specifically Latin (47% of sample) and Slavic linguisitic regions (27%) comprising the largest shares. In our study sample, the linguistic regions incorporate the following countries: Baltic (Latvia and Lithuania),

Finno-Ugric (Estonia, Finland, and Hungary), Germanic (Ireland, Luxembourg, Netherlands, Sweden, United Kingdom), Hellenic (Cyprus and Greece), Latin (France, Italy, Luxembourg, Spain, Portugal, and Romania), and Slavic (Czech Republic, Poland, Slovakia).

An average of 12.3 individuals participated annually in the TestDaF per NUTS 2 region in our full sample, with significant variance between the range of zero and 195. At the country-level, the average annual number of test participants was 56, while the total participation numbers ranged between zero and 290. The test participation certifies an advanced, professional proficiency in the German language therefore this statistic only captures those individuals who have advanced beyond beginner and intermediate training. As such, it is a predictor of overall demand for German language skills. Furthermore, it is observed that on average the TestDaF participation rates are higher for women than for men, and for youth between 15 and 25 years compared to

Table 1. Summary statistics.

	Full sample		Common support	
	N (1)	Mean (Std. Dev.) (2)	*N* (3)	Mean (Std. Dev.) (4)
Gross Domestic Product (per capita, thousand EUR)	715	20.50 (14.71)	624	22.44 (14.77)
Youth Unemployment Rate (age 15–25 years)	715	24.41 (11.69)	624	23.20 (11.41)
Adult Unemployment Rate (age 26–65 years)	715	8.64 (5.25)	624	8.09 (5.04)
Population with Secondary Education (%)	715	47.46 (18.36)	624	44.29 (17.50)
Population with Tertiary Education (%)	715	22.46 (9.86)	624	23.29 (10.17)
Gross Fixed Capital Formation (billion EUR)	594	15.07 (20.19)	503	9.18 (1.08)
Enrollment Rate in Secondary Education (age 15–24 years, %)	617	36.16 (9.30)	533	35.87 (9.92)
Enrollment Rate in Tertiary Education (age 20–24 years, %)	617	62.56 (26.39)	533	63.76 (27.69)
Germanic linguistic region	715	0.11 (0.31)	624	0.13 (0.33)
Latin linguistic region	715	0.47 (0.50)	624	0.54 (0.50)
Slavic linguistic region	715	0.27 (0.45)	624	0.17 (0.37)
Greek linguistic region	715	0.073 (0.26)	624	0.08 (0.28)
Baltic linguistic region	715	0.04 (0.19)	624	0.04 (0.20)
Finno-Ugric linguistic region	715	0.06 (0.23)	624	0.06 (0.24)
TestDaf Participants (Total)	715	12.31 (20.06)	624	13.11 (21.16)
TestDaf Participants (Male)	715	4.62 (8.47)	624	4.98 (8.94)
TestDaf Participants (Female)	715	7.69 (12.16)	624	8.13 (12.79)
TestDaf Participants (age 15–25 years)	715	10.86 (17.86)	624	11.53 (18.83)
TestDaf Participants (age 26–65 years)	715	1.42 (2.72)	624	1.55 (2.87)
TestDaf Participants (Foreign)	715	1.20 (2.75)	624	1.36 (2.91)
TestDaf Participants (Domestic)	715	11.10 (18.50)	624	11.75 (19.52)
Number of NUTS 2 regions	55		38	

Note: Data Sources: TestDaF Institut, Eurostat, OECD Statistics.

individuals above 25 years old. Figure A1 in the Appendix denotes the annual average TestDaF participants during our sample period 2001–2013.

2.1. Regional crisis definition

In the empirical macroeconomics literature, financial crisis indicators are defined at the national level. The widely used (Laeven and Valencia 2012) database on systemic banking and financial crises defines crisis onset by the joint occurrence of significant financial distress in the banking sector and significant government intervention following large losses in the banking sector. Based on this definition 14 EU countries were in crisis by 2008. Government interventions tend to be at the national level, therefore cannot be used to distinguish potential sub-national heterogeneity in the impact of an economic downturn. Similarly, financial sector information is not consistently available at the sub-national level. Therefore, we construct new regional crisis indicators for our analysis. Our measures are defined based on the severity of the economic downturn and not by any specific financial sector rescue policy.

First, we define the pre-crisis time trend for Gross Domestic Product per capita (GDP p.c.) by estimating the following equation for each region:

$$\ln(Z_t) = \alpha_t + \beta \cdot year_t + \varepsilon_t \tag{1}$$

where α is the constant term, Z_t is GDP p.c. in period t, $year_t$ is a continuous variable between 2001 to 2006, and ε_t is the error term. The estimated coefficient β_t is the slope of the pre-crisis trend of GDP p.c.

We define a binary crisis variable which equals 1 if the deviation of actual GDP per capita from its pre-2007 time trend exceeds 1 standard deviation.[8] Our methodology is data-driven, in such that it allows the data to define the onset period of the crisis which can be different for each affected region. One notable limitation of this methodology is that we can not identify regions which may have experienced a 'double-dip recession', i.e. two crisis events separated by a recovery period in between, since we can only detect the first crisis event. However, while we acknowledge that financial crises are not a homogeneous event across regions, the main objective of our analysis is to simply identify crisis-affected regions for the purpose of our difference-in-differences analysis.

3. Empirical methodology

3.1. Identification and estimation methods

Our objective is to identify the average effect of the European financial crisis on TestDaF participation rates in regions affected by the crisis. Accordingly, we are interested in comparing TestDaF participation rates when a region experiences an adverse economic shock to the counterfactual, i.e. TestDaF participation rates if there was no economic shock. Since this counterfactual is never observed, we use quasi-experimental methods that mimic random assignment of the treatment (=crisis) under reasonable assumptions to estimate the average treatment effect.

The major concern for us is that the regions which experience the financial crisis may be different from unaffected regions and these differences are correlated with demand for German language skills. In principle, several observable and unobservable regional characteristics which can confound identification are those that vary across regions but are fixed over time. Our method of controlling for such time-invariant heterogeneity is to use panel data and estimate a multiple-group, multiple-period difference-in-differences model. Therefore, even without the benefit of a randomized treatment, we can estimate the average treatment effect by comparing the change in outcomes (=TestDaF participation) in the treatment group (=crisis affected regions) before and after the treatment (=crisis) to the change in outcomes in the control group (=unaffected regions). By comparing differences, we control for observed and unobserved time-invariant regional characteristics that

might be correlated with the crisis onset, as well as with demand for German language skills. The change in the control group is assumed to be the estimate of the true counterfactual. Finally, our methodology allows the treatment to start in different years for each region.[9]

Formally, our difference-in-differences model is specified by the following panel, two-way fixed-effects linear regression model which we estimate using ordinary least squares:

$$\ln(Y_{rt}) = \alpha + \beta_{DID} D_{rt} + \gamma_t + \lambda_r + \delta X'_{rt} + \varepsilon_{rt} \tag{2}$$

The dependent variable $\ln(Y)_{rt}$ is the log of TestDaF participation in region r in year t, α is the constant term, D_{rt} is a dummy variable which equals 1 if region r is in crisis in year t and 0 otherwise. The coefficient of interest is the difference-in-differences estimate β_{DID}, which represents the causal impact of the crisis on TestDaF participation. X'_{rt} indicates the vector of covariates, which includes the variables listed in Table 1. Covariates include measures of education and local economic conditions. λ_r is a fixed effect unique to region r and γ_t is the time effect common to all regions in period t.

ε_{rt} is the region and time-varying error-term assumed to be distributed independently of all λ_r and and γ_t. However, in practice the error term might be correlated across time and space. For example, regional demand for German language education may be persistent and therefore induce time-series correlation. Error correlation could also be present in the cross-section dimension of the panels due to common cultural factors influencing neighboring regions. Therefore, we allow for an arbitrary covariance structure within regions over time by computing bootstrapped standard errors with 500 repetitions clustered at the NUTS 2 regional level.[10] We use a log(n+1) transformation to address the zero values of TestDaF participation in our analysis. Our results are robust to using an alternative approach based on inverse hyperbolic sine transformation of TestDaF participation variable, as per Bellemare and Wichman (2020).[11]

3.2. Identifying assumption

The key identifying assumption for our interpretation of the difference-in-differences estimate is that the change in TestDaF participation in non-crisis regions is an unbiased estimate of the counterfactual. This assumption can not be directly tested, however we can test whether the secular time trends of TestDaF participation rates in crisis and non-crisis regions were significantly different before the crisis onset. If the time trends are the same in the pre-crisis period, then it is likely that they would have been the same absent the crisis.

To test this assumption, we are unable to use the standard methodology of estimating our baseline difference-in-differences model on pre-crisis observations since we allow the crisis to start in different years for each region. Therefore, we apply Autor (2003)'s approach for multiple treatment groups and multiple periods by including leads and lags of the 'treatment', i.e. crisis variable, and estimating the following modified version of our baseline estimation model:

$$\ln(Y)_{rt} = \alpha + \sum_{t=-m}^{q} \beta_{DID} D_{rt} + \gamma_t + \lambda_r + \delta X'_{rt} + \varepsilon_{rt} \tag{3}$$

where $D_{r,t=0}$ denotes the crisis start year, $D_{r,-m<t<0}$ denote the lagged indicators, and $D_{r,1<t<q}$ denote the lead indicators of the crisis. The remaining variables are defined the same as before in Equation (2). If the identifying assumption of parallel trends is to be satisfied, then it implies that $\beta_{DID,t} = 0, \forall t < 0$, i.e. the coefficients for the lagged indicators should not be significantly different from 0.

3.3. Potential biases and matching methods

An additional concern for our methodology is that the impact of the financial crisis may not have been homogeneous across the regions in our sample, but instead may vary as a function of some

regional characteristics. For example, the impact of the financial crisis may be higher in regions where local firms and businesses are more dependent on the financial sector. In this case, difference-in-differences estimates may suffer from two additional sources of bias (Heckman, Ichimura, and Todd 1998). Firstly, there may be some crisis-affected regions for which there are no comparable unaffected regions in our sample, and vice versa. Second, a bias may arise from different distributions of the vector of observable regional characteristics which influence demand for German language skills between the two groups. Heckman, Ichimura, and Todd (1997) suggest that the first of these two sources of bias is likely to be the most severe in empirical applications, therefore we use matching methods to address this concern. We attempt to account for the different distributions of regional characteristics by including covariates which measure economic, labor market, and educational characteristics of each region.

Matching allows us to pair crisis-affected regions with non-crisis regions that have similar observed characteristics in order to define the region of common support in the distribution of regional characteristics. Estimating our baseline model using observations in the common support region allows us to eliminate the potential source of bias. This method assumes that, conditional on the observed regional characteristics, the counterfactual distribution of TestDaF participation for the treatment group (crisis regions) is the same as the observed distribution of the control group (non-crisis regions). It also assumes that there is no selection into treatment on the basis of unobservable characteristics.

Matching treated and control regions on the basis of the vector of observed characteristics (denoted by X in our estimation equation) is equivalent to matching them using a balancing score (Rosenbaum and Rubin 1983). Accordingly, we calculate propensity scores to give us the conditional probability of receiving treatment, i.e. being affected by the crisis (denoted by D=1 in our estimation equation), given the pre-treatment values of the vector X. Alternatively, we can denote the propensity score as: $P(X) = Pr(D = 1 \mid X)$. The propensity scores are estimated using a logit model of the probability that a region experienced the crisis as a function of its pre-crisis characteristics.

In our implementation, we have used the pre-crisis values from year 2001 (i.e. first year in our sample) of the most complete set of economic variables that is available at our desired NUTS2 region-level from the Eurostat database. These variables are reported in Table 1: Summary Statistics and include GDP per capita, Youth Unemployment Rate, Adult Unemployment Rate, Population with Secondary Education, Population with Tertiary Education, Enrolment Rate in Secondary Education, Enrolment Rate in Tertiary Education. We use the *pscore* package in Stata to estimate the propensity score of the treatment (crisis indicators) using a logit model.[12]

Next, we exclude all control observations whose propensity scores are less than the propensity score of the treatment region at the 1st percentile of the treatment propensity score distribution. We also exclude all treatment observations whose propensity score is greater than the propensity score of the control observation at the 99th percentile of the control distribution. The remaining control and treatment observations are defined as our common support regions, i.e. regions that are comparable to each other along the observed economic and educational characteristics used in the matching algorithm. We re-estimate our difference-in-differences model on this restricted sample and use bootstrapped standard errors with 500 repetitions clustered at the regional level, similarly as for our baseline difference-in-difference estimations described in Section 3.1.

4. Estimation results

4.1. Main results

Table 2 reports the results for the difference-in-differences model given in Equation (2). Column (1) reports the results for the baseline model without covariates, while column (2) includes covariates.

Next, in column (3) we report the results from estimating the model using observations in the region of common support.

In the baseline estimation, we find that TestDaF participation increases by 47% in crisis-affected regions, compared to unaffected regions. After controlling for regional measures of economic activity, employment and education, we find that TestDaF participation remains statistically significant but decreased to 38% in crisis-affected regions. Finally, when we limit the estimation sample to observations in the region of common support the estimated impact of the financial crisis on TestDaF participation increases. The estimated difference-in-differences coefficient indicates that German language testing increases to 48% in crisis-affected regions on the common support. All estimated coefficients of interest are statistically significant at 95% confidence level.

This estimated coefficient indicates that TestDaF participation increased from 13.1 to 19.4 persons per year in the average crisis-affected region included in the common support sample. Our interpretation of this increase is that it represents individuals who acquired new language skills in response to the financial crisis as well as those seeking certification for pre-existing language skills with the objective of improving their professional qualifications and migration prospects. We argue that this effect is economically significant since it represents a large percentage increase in demand of an advanced, professional certification that is very valuable and hard to acquire. While the time taken to acquire language skills varies by training intensity, method of instruction and distance to mother tongue, the TestDaF exam requires an advanced B2 – C1 level as per the Common European Framework for Languages corresponding to approximately 800–1000 h of guided study. Second, the advanced TestDaF examination is a proxy for general interest in acquiring German language skills at all levels in non-German speaking Europe. Finally, advanced German language certification is only one of many professional skills trainings which affected populations could select in response to local economic shocks.

Table 2. Impact of financial crisis on TestDaF participation.

	Dependent variable: Log Participation in TestDaF		
	Full sample		Common support
	(1)	(2)	(3)
Regional Crisis Indicator	0.471**	0.381**	0.483**
	(0.197)	(0.193)	(0.209)
Log Gross Fixed Capital Formation		0.386	0.520
		(0.470)	(0.490)
Youth Unemployment		0.024	0.028
		(0.017)	(0.021)
Adult Unemployment		0.016	0.035
		(0.050)	(0.063)
Secondary Education		−0.037	−0.038
		(0.042)	(0.044)
Tertiary Education		−0.044	−0.039
		(0.046)	(0.050)
Enrollment in Secondary Education		−0.001	−0.000
		(0.018)	(0.022)
Enrollment in Tertiary Education		−0.001	−0.002
		(0.008)	(0.008)
Observations	715	501	417
R^2	0.379	0.431	0.474
Number of NUTS 2 Regions	55	45	38
Year & Region FEs	Yes	Yes	Yes

Notes: Dependent variable: Log participation in TestDaF – test of German as a foreign language. TestDaF is an international language examination to certify an advanced knowledge of German, corresponding to competence levels B2 to C1 of the Common European Framework of Reference for Languages. Regional Crisis Indicator is a dummy variable equal to 1 for region *i* experiencing a crisis in year *t*, and equal to 0 otherwise. Column (1) reports the baseline estimation without covariates, which are included in column (2). Column (3) reports the estimation results using observations over the region of common support, i.e. treated and control regions with similar observed characteristics paired using propensity score matching. Bootstrapped standard errors with 500 repetitions are clustered at region-level and reported in parentheses. *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

As discussed in Section 3.2, the results presented in Table 2 can only be interpreted as average treatment effects if the identifying assumption is satisfied. To test this assumption, we estimate Equation (3). If there are no significant differences in the time trends of TestDaF participation between crisis and non-crisis regions, the coefficients for lagged periods before the crisis hit will not be statistically significant. The results are reported in Table 3. Column (1) reports the results for the baseline model, while covariates are included in column (2). In column (3), we report the results using the restricted common support sample. The coefficients for the two lagged periods are not statistically different from zero in each specification which indicates that our identifying assumption of parallel pre-trends in TestDaF participation rates is satisfied.

4.2. Sub-group results

Next, we divide our sample into sub-groups according to available demographic characteristics in order to examine which groups are driving the observed average increase in TestDaF participation in crisis regions. The results are presented in Table 4, where Panel A includes the results for the full sample and Panel B includes the results for the common support observations. Columns (1)–(6) present the results for male, female, youth (15–25 years old), adult (26–65 years old), domestic, and foreign participants. All columns include the full vector of covariates as included in Table 2 columns (2) and (3).

The estimated coefficients in Panels A and B indicate that both men and women increase their demand for German language skills in crisis affected regions, with the increase for men being larger and more robust than the corresponding increase for women. TestDaF participation for men increases significantly by 45%, while the increase for women is smaller in magnitude and less robust.

Table 3. Empirical test for parallel pre-trends.

	Dependent variable: Log Participation in TestDaF		
	Full sample		Common support
	(1)	(2)	(3)
Regional Crisis Indicator: Leads and Lags			
$Crisis_{t-2}$	0.034	0.270	0.365
	(0.186)	(0.283)	(0.302)
$Crisis_{t-1}$	0.295	0.230	0.312
	(0.180)	(0.333)	(0.354)
$Crisis_{t}$	0.516**	0.580*	0.689*
	(0.208)	(0.323)	(0.390)
$Crisis_{t+1}$	0.496**	0.402	0.580
	(0.222)	(0.342)	(0.418)
$Crisis_{t+2}$	0.650**	0.550	0.783*
	(0.264)	(0.371)	(0.453)
$Crisis_{t+3}$	0.545*	0.436	0.669
	(0.310)	(0.445)	(0.545)
$Crisis_{t+4\ onward}$	0.321	0.151	0.382
	(0.313)	(0.582)	(0.714)
Observations	715	501	417
R^2	0.381	0.437	0.481
Number of Regions	55	45	38
Covariates	No	Yes	Yes
Year & Region FEs	Yes	Yes	Yes

Notes: Dependent variable: Log participation in TestDaF – test of German as a foreign language. TestDaF is an international language examination to certify an advanced knowledge of German, corresponding to competence levels B2 to C1 of the Common European Framework of Reference for Languages. Regional Crisis Indicator is a dummy variable equal to 1 for region *i* experiencing a crisis in year *t*, and equal to 0 otherwise. Column (1) reports the baseline estimation without covariates, which are included in column (2). Column (3) reports the estimation results using observations over the region of common support, i.e. treated and control regions with similar observed characteristics paired using propensity score matching. Cluster-bootstrapped standard errors are clustered at region-level and reported in parentheses. *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

Table 4. Impact of financial crisis on TestDaF participation, by sub-groups.

	Dependent variable: Log Participation in TestDaF					
	Males (1)	Females (2)	Youth (15–25 years) (3)	Adult (26–65 years) (4)	Domestic Citizens (5)	Foreign Citizens (6)
Panel A: Full sample						
Regional crisis indicator	0.453***	0.209	0.377**	0.138	0.363*	0.121
	(0.142)	(0.172)	(0.191)	(0.100)	(0.191)	(0.097)
Observations	501	501	501	501	501	501
R^2	0.357	0.432	0.434	0.257	0.409	0.304
Number of Regions	45	45	45	45	45	45
Panel B: Common support observations only						
Regional crisis indicator	0.440***	0.328*	0.480**	0.161	0.466**	0.096
	(0.146)	(0.190)	(0.203)	(0.112)	(0.206)	(0.105)
Observations	417	417	417	417	417	417
R^2	0.405	0.473	0.481	0.269	0.452	0.321
Number of Regions	38	38	38	38	38	38
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Year & Region FEs	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variable: Log participation in TestDaF – test of German as a foreign language. Regional Crisis Indicator is a dummy variable equal to 1 for region *i* experiencing a crisis in year *t*, and equal to 0 otherwise. Columns 1–6 report estimation results for sub-groups of men, women, youth (15–25 years old), adults (26–65 years old), domestic citizens, and foreign nationals respectively. All estimations include covariates: Youth Unemployment Rate, Adult Unemployment Rate, Log Gross Fixed Capital Formation, Enrollment Rate in ISCED 3-4, Enrollment Rate in ISCED 5-6, Secondary Education Rate, and Tertiary Education Rate. Cluster-bootstrapped standard errors are clustered at region-level and reported in parentheses. *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

The results also show that there is a large and statistically significant increase of 38% in demand for German language skills among the youth (increase by 48% in the common support regions). This finding can be explained by the disproportionate impact of the European financial crisis on youth employment and professional opportunities. The increase in TestDaF participation of adults is smaller and statistically indistinguishable from zero. Finally, there is some evidence indicating that the increase is driven predominantly by domestic citizens, rather than foreign test takers traveling to TestDaF centers.

4.3. Heterogeneous effects by linguistic regions

In order to analyze heterogeneous effects of the financial crisis on TestDaF participation in the different linguistic regions of Europe, we assign our sample to one of the following language families: Baltic (Latvia and Lithuania), Finno-Ugric (Estonia, Finland, and Hungary), Germanic (Ireland, Luxembourg, Netherlands, Sweden, United Kingdom), Hellenic (Cyprus and Greece), Latin (France, Italy, Luxembourg, Spain, Portugal, and Romania), and Slavic (Czech Republic, Poland, Slovakia).[13]

We re-estimate the difference-in-differences model including an interaction term between the regional crisis indicator and the linguistic region. The results are reported in Table 5, where Panel A includes the results for the full sample and Panel B includes the results for the common support observations. The table includes the estimated coefficients for the interaction terms with the main linguistic regions of interest: Hellenic, Latin, and Baltic-Slavic. The corresponding comparison group includes the Germanic and Finno-Ugric speaking regions. Columns (1)–(7) present the results for total, male, female, youth (15–25 years old), adult (26–65 years old), domestic, and foreign participants respectively. All estimations include the full set of covariates and fixed effects to control for region-specific and year-specific unobservables, including time-invariant differences in foreign language education policies across the different linguistic regions.

The results in Panel A indicate weak evidence that there is an increase in Hellenic linguistic regions (in Cyprus and Greece) affected by the crisis where TestDaF participation rates increased by 190% compared to Germanic and Finno-Ugric regions. There is also weak evidence of an increase of 64% in Latin linguistic regions (France, Italy, Luxembourg, Spain, Portugal, and Romania) affected

Table 5. Impact of financial crisis on TestDaF participation, by linguistic regions.

	Dependent variable: Log Participation in TestDaF						
	Total Participants (1)	Males Participants (2)	Females Participants (3)	Youth (15–25 years) (4)	Adult (26–65 years) (5)	Domestic Citizens (6)	Foreign Citizens (7)
Panel A: Full sample							
Regional Crisis Indicator	−0.009	0.222	−0.053	0.054	0.080	−0.018	0.225
	(0.325)	(0.238)	(0.304)	(0.307)	(0.220)	(0.290)	(0.261)
Regional Crisis Indicator	1.901*	1.348	1.718*	1.880*	0.806	1.947*	0.241
x Hellenic Linguistic Regions	(1.142)	(1.077)	(0.908)	(1.073)	(0.649)	(1.151)	(0.607)
Regional Crisis Indicator	0.643*	0.373	0.459	0.561*	0.068	0.639**	−0.182
x Latin Linguistic Regions	(0.347)	(0.271)	(0.318)	(0.322)	(0.251)	(0.308)	(0.297)
Regional Crisis Indicator	−0.086	−0.032	−0.157	−0.174	0.059	−0.118	0.034
x Baltic-Slavic Linguistic Regions	(0.372)	(0.287)	(0.349)	(0.345)	(0.284)	(0.337)	(0.313)
Observations	501	501	501	501	501	501	501
R^2	0.465	0.384	0.465	0.470	0.271	0.447	0.313
Number of Regions	45	45	45	45	45	45	45
Panel B: Common support observations only							
Regional Crisis Indicator	0.012	0.153	−0.013	0.074	0.065	0.006	0.167
	(0.370)	(0.270)	(0.341)	(0.343)	(0.250)	(0.326)	(0.294)
Regional Crisis Indicator	1.782	1.259	1.611*	1.760*	0.812	1.807	0.290
x Hellenic Linguistic Regions	(1.106)	(1.017)	(0.902)	(1.043)	(0.664)	(1.110)	(0.633)
Regional Crisis Indicator	0.714*	0.425	0.524	0.633*	0.097	0.706**	−0.147
x Latin Linguistic Regions	(0.371)	(0.293)	(0.336)	(0.341)	(0.270)	(0.321)	(0.315)
Regional Crisis Indicator	−0.070	−0.040	−0.130	−0.154	0.071	−0.101	0.046
x Baltic-Slavic Linguistic Regions	(0.401)	(0.306)	(0.374)	(0.370)	(0.304)	(0.354)	(0.355)
Observations	417	417	417	417	417	417	417
R^2	0.512	0.435	0.509	0.520	0.284	0.494	0.329
Number of Regions	38	38	38	38	38	38	38
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year & Region FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variable: Log participation in TestDaF – test of German as a foreign language. Columns 1–7 report estimation results for sub-groups of men, women, youth (15–25 years old), adults (26–65 years old), domestic citizens, foreign nationals, and total participants respectively. All estimations include covariates: Youth Unemployment Rate, Adult Unemployment Rate, Log Gross Fixed Capital Formation, Enrollment Rate in Secondary Education, Enrollment Rate in Tertiary Education, Secondary Education Rate, and Tertiary Education Rate. Cluster-bootstrapped standard errors are clustered at region-level and reported in parentheses. *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

Table 6. Robustness test: crisis defined using 2 standard deviation decrease from GDP growth time trend.

	Dependent variable: Log Participation in TestDaF		
	Full sample		Common support
	(1)	(2)	(3)
Regional Crisis Indicator	0.429**	0.325*	0.400**
	(0.195)	(0.187)	(0.194)
Log Gross Fixed Capital Formation		0.392	0.523
		(0.470)	(0.491)
Youth Unemployment Rate		0.023	0.028
		(0.017)	(0.021)
Adult Unemployment Rate		0.019	0.038
		(0.049)	(0.063)
Secondary Education Rate		−0.039	−0.040
		(0.042)	(0.044)
Tertiary Education Rate		−0.047	−0.043
		(0.047)	(0.051)
Enrollment in ISCED 3-4		−0.002	−0.001
		(0.019)	(0.023)
Enrollment in ISCED 5-6		−0.001	−0.001
		(0.008)	(0.008)
Observations	715	501	417
R^2	0.377	0.430	0.471
Number of Regions	55	45	38
Year & Region FEs	Yes	Yes	Yes

Notes: Dependent variable: Log participation in TestDaF – test of German as a foreign language. TestDaF is an international language examination to certify an advanced knowledge of German, corresponding to competence levels B2 to C1 of the Common European Framework of Reference for Languages. Regional Crisis Indicator is a dummy variable equal to 1 for region *i* experiencing a crisis in year *t*, and equal to 0 otherwise. Column (1) reports the baseline estimation without covariates, which are included in column (2). Column (3) reports the estimation results using observations over the region of common support, i.e. regions with similar observed characteristics paired using propensity score matching. Cluster-bootstrapped standard errors are clustered at region-level and reported in parentheses. *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

by the crisis. In both cases, the increases appear to be driven by female and youth participation in the TestDaF. These results also correspond to the countries whose labor markets were most severely affected during the financial crisis. However, the estimated coefficients are only significant at 90% confidence level and the estimations are under-powered to detect significant treatment effects, therefore we interpret this as suggestive, rather than robust causal evidence of regional heterogeneity along linguistic lines.

4.4. Robustness

Lastly, we test a more stringent definition which defines a region to be in crisis if its GDP growth reduces by more than 2 standard deviations from the pre-crisis time trend. This alternate definition is used to re-estimate the difference-in-differences model on the full sample and common support observations. The results are reported in Table 6. We find that the estimated coefficients for the full sample remain similar in magnitude and statistically significant. The estimated coefficient using the common support observations is smaller in magnitude compared to the previous crisis definition (indicating a 40% increase in TestDaF participation compared to a 48% increase earlier), however it remains statistically significant. We interpret this finding to imply the robustness of our main results and the decrease in magnitude can be explained by the change in composition of our treatment and control groups, as compared to our baseline definition.

5. Concluding remarks and policy implications

In this paper, our objective is to analyze whether the European financial crisis and the associated economic downturn had a causal impact on demand for German language skills. We focus on the

German language since Germany and other German-speaking countries did not experience the severe banking and sovereign debt crises, economic downturn, and increase in unemployment rates experienced in other European countries. Given the legal commitment to free trade and labor movement within the European Union, we hypothesize that German language skills become increasing valuable after the crisis to enable trade and migration flows.

In order to test our study hypothesis we construct a new sub-national data-set of TestDaF participation rates and financial crisis indicators. Our empirical methodology uses difference-in-differences estimations combined with propensity score matching to identify the causal impact of the crisis on demand for German language proficiency proxied by TestDaF participation. We find that regions which were affected by large deviations from the pre-crisis time trends of GDP growth exhibited significantly increased TestDaF participation rates. In particular, the demand of TestDaF certification increased considerably among youth between 15 and 25 years of age. Our findings indicate that there is an increased demand for new skills following the crisis, especially in regions where opportunities for young adults were reduced.

This research contributes further evidence in support of European language and educational policy promoting multilingualism. As part of its efforts to promote cultural links, labor mobility, and internal trade, the European Union has designated multilingualism as an important priority. The EU's language policy objective is to enable every European citizen to master two other languages in addition to their mother tongue.[14] Accordingly, the EU funds a number of programs dedicated to helping member countries develop new educational policies aiming to increase language skills among both school-going youth and adults already in the labor market. These policies are backed by a commitment to gathering data to monitor progress in language teaching and learning. Our findings contribute to this effort by providing regional evidence of determinants for language demand and a first economic analysis of skill formation in response to economic crises.

Notes

1. TestDaF test incorporates four parts: reading, listening, writing, and oral comprehension. Results are assigned to one of three levels, which are equivalent to competence levels B2 to C1 of the Common European Framework of Reference for Languages.
2. As a robustness test, we also use a more stringent definition which defines a region to be in crisis if the fall in GDP per capita growth exceeds 2 standard deviations.
3. EU immigrants who can demonstrate evidence of adequate financial means exceeding the eligibility threshold for Swiss social security payments can also be permitted to live in Switzerland. In contrast to non-EU citizens, there are no quotas regarding the number of permits per origin country for people in employment or with sufficient financial means.
4. Recent evidence shows that in the post-crisis period, south-north migration flows increased significantly, especially towards Germany and the United Kingdom (Barslund and Busse 2014).
5. In our study sample, the linguistic regions incorporate the following countries: Baltic (Latvia and Lithuania), Finno-Ugric (Estonia, Finland, and Hungary), Germanic (Ireland, Luxembourg, Netherlands, Sweden, United Kingdom), Hellenic (Cyprus and Greece), Latin (France, Italy, Luxembourg, Spain, Portugal, and Romania), and Slavic (Czech Republic, Poland, Slovakia).
6. The 55 regions in our full sample are also presented in Figure A2 in the Appendix. Each panel corresponds to a particular year between 2007–10 in order to graphically illustrate the advance of the Euro-crisis in our sample. Our study sample does not include Austria, Germany, Switzerland, Malta and Slovenia. The first three are excluded to focus our analysis on non-German speaking countries. The latter two because no testing took place in the relevant time period. Belgium is also excluded from our sample due to poor availability of sub-national economic data. The complete list of regions is included in Table A1 in the Appendix.
7. Gross fixed capital formation, also known as Investments, consists of resident producers' net acquisitions of fixed assets intended for use in processes of economic production, for example: buildings, structures, machinery and equipment (Eurostat 2021).
8. As mentioned earlier, we also use a crisis definition based on 2 standard deviations as a robustness check.
9. See Imbens and Wooldridge (2009) for a theoretical exposition and Galiani, Gertler, and Schargrodsky (2005) for an empirical application.
10. As per Bertrand, Duflo, and Mullainathan (2004).

11. Results are available upon request.
12. The complete algorithm is described in Becker and Ichino (2002) and our implementation is similar to Galiani, Gertler, and Schargrodsky (2005).
13. See Lewis, Simons, and Fennig (2009) and Ruhlen (1991).
14. See here: https://ec.europa.eu/education/policy/multilingualism_en.

Acknowledgements

We are grateful to Uschi Backes-Gellner, Stefan Kloner, Edward Lazear, Ugo Panizza and Martina Viarengo for their guidance and useful discussions. Thanks to participants at the Swiss Society of Economics and Statistics Annual Conference (Lausanne), Development Therapy Workshop (Geneva), Swiss Leading House PhD Workshop on Personnel Economics and Economics of Education (Zurich), and European Association of Labour Economics Conference (St.Gallen) for their feedback. Thank you to the TestDaF Institute for sharing data for this research.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Rahul Mehrotra http://orcid.org/0000-0003-1214-9921

References

Adserà, A., and M. Pytliková. 2016. *Language and Migration*, 342–372. London: Palgrave Macmillan UK.

Aldashev, A., J. Gernandt, and S. L. Thomsen. 2009. "Language Usage, Participation, Employment and Earnings: Evidence for Foreigners in West Germany with Multiple Sources of Selection." *Labour Economics* 16 (3): 330–341. doi:10.1016/j.labeco.2008.11.004.

Aparicio Fenoll, A., and Z. Kuehn. 2016. "Does Foreign Language Proficiency Foster Migration of Young Individuals Within the European Union?" In *The Economics of Language Policy*, edited by B.-A. Wickstroem and M. Gazzola, 331–355. Cambridge, MA: MIT Press.

Autor, D. H. 2003. "Outsourcing At Will: The Contribution of Unjust Dismissal Doctrine to the Growth of Employment Outsourcing." *Journal of Labor Economics* 21 (1): 1–42. doi:10.1086/344122.

Barslund, M., and M. Busse. 2014. "Making the Most of EU Labour Mobility." CEPS Task Force Reports.

Becker, S. O., and A. Ichino. 2002. "Estimation of Average Treatment Effects Based on Propensity Scores." *The Stata Journal* 2 (4): 358–377. doi:10.1177/1536867X0200200403.

Bellemare, M. F., and C. J. Wichman. 2020. "Elasticities and The Inverse Hyperbolic Sine Transformation." *Oxford Bulletin of Economics and Statistics* 82 (1): 50–61. doi:10.1111/obes.v82.1.

Bertoli, S., H. Brucker, and J. F.-H. Moraga. 2013. "The European Crisis and Migration to Germany: Expectations and the Diversion of Migration Flows." IZA Institute of Labor Economics, (IZA DP No. 7170).

Bertrand, M., E. Duflo, and S. Mullainathan. 2004. "How Much Should We Trust Differences-In-Differences Estimates?" *The Quarterly Journal of Economics* 119 (1): 249–275. doi:10.1162/003355304772839588.

Budria, S., A. Colino, and C. Martinez de Ibarreta. 2019. "The Impact of Host Language Proficiency on Employment Outcomes Among Immigrants in Spain." *Empirica* 46: 625–652. doi:10.1007/s10663-018-9414-x.

Calvo, G. A., F. Coricelli, and P. Ottonello. 2012. "Labor Market, Financial Crises and Inflation: Jobless and Wageless Recoveries." Working Paper 18480, National Bureau of Economic Research.

Chiswick, B. R., and P. W. Miller. 2014. "International Migration and the Economics of Language." In *Handbook of the Economics of International Migration*, Vol. 1A The Immigrants, 211–270. Oxford: North-Holland.

Claessens, S., M. Dobler, L. Laeven, O. M. Nedelescu, C. Pazarbasioglu, K. Seal, and F. Valencia. 2011. *Crisis Management and Resolution: Early Lessons from the Financial Crisis*. IMF Staff Discussion Note No. 11/05, International Monetary Fund.

ESPON. 2014. "Economic Crisis: Resilience of Regions."

European Commission. 2005. "A New Framework Strategy for Multilingualism."

European Commission. 2006. "ELAN: Effects on the European Economy of Shortages of Foreign Language Skills in Enterprise."

Eurostat. 2015. "Regions in the European Union – Nomenclature of Territorial Units for Statistics NUTS 2013/EU-28." Tech. Rep.

Eurostat. 2021. "General and Regional Statistics." Tech. Rep.

Eurydice. 2012. "Key Data on Teaching Languages at School in Europe: 2012 Edition." Education, Audiovisual and Culture Executive Agency, Eurydice and Policy Support.
Galiani, S., P. Gertler, and E. Schargrodsky. 2005. "Water for Life: The Impact of the Privatization of Water Services on Child Mortality." *Journal of Political Economy* 113 (1): 83–120. doi:10.1086/426041.
Gazzola, M., and B.-A. Wickström, eds. 2016. *The Economics of Language Policy*. Cambridge, MA: MIT Press.
Gazzola, M., B. Wickström, and T. Templin. 2019. "Language Skills, the Labour Market, and Socioeconomic Integration." *Empirica* 46: 617–623. doi:10.1007/s10663-019-09463-4.
Ghoshray, A., J. Ordonez, and H. Sala. 2016. "Euro, Crisis and Unemployment: Youth Patterns, Youth Policies." *Economic Modelling* 58: 442–453. doi:10.1016/j.econmod.2016.05.017.
Grin, F., C. Sfreddo, and F. Vaillancourt. 2011. *The Economics of the Multilingual Workplace*. New York: Routledge.
Heckman, J. J., H. Ichimura, and P. E. Todd. 1997. "Matching As An Econometric Evaluation Estimator: Evidence From Evaluating a Job Training Programme." *The Review of Economic Studies* 64 (4): 605–654. doi:10.2307/2971733.
Heckman, J. J., H. Ichimura, and P. E. Todd. 1998. "Matching As An Econometric Evaluation Estimator." *The Review of Economic Studies* 65 (2): 261–94. doi:10.1111/roes.1998.65.issue-2.
Imbens, G. W., and J. M. Wooldridge. 2009. "Recent Developments in the Econometrics of Program Evaluation." *Journal of Economic Literature* 47 (1): 5–86. doi:10.1257/jel.47.1.5.
Janeba, E. 2007. "International Trade and Consumption Network Externalities." *European Economic Review* 51 (4): 781–803. doi:10.1016/j.euroecorev.2006.07.002.
Konya, I. 2006. "Modeling Cultural Barriers in International Trade." *Review of International Economics* 14 (3): 494–507. doi:10.1111/roie.2006.14.issue-3.
Laeven, L., and F. Valencia. 2012. "Systemic Banking Crises Database: An Update." IMF Working Paper 12/163, International Monetary Fund.
Lane, P. R. 2012. "The European Sovereign Debt Crisis." *The Journal of Economic Perspectives* 26 (3): 49–67. doi:10.1257/jep.26.3.49.
Lazear, E. P. 1999. "Culture and Language." *Journal of Political Economy* 107 (S6): S95–S126. doi:10.1086/250105.
Lewis, M. P., G. F. Simons, and C. D. Fennig. 2009. *Ethnologue: Languages of the World*. Vol. 16. Dallas: SIL International.
Melitz, J. 2008. "Language and Foreign Trade." *European Economic Review* 52 (4): 667–699. doi:10.1016/j.euroecorev.2007.05.002.
Melitz, J. 2012. "A Framework for Analyzing Language and Welfare." CEPR Discussion Papers 9091, Center for Economic and Policy Research.
Melitz, J. 2016. *English As a Global Language*, 583–615. London: Palgrave Macmillan UK.
Melitz, J., and F. Toubal. 2014. "Native Language, Spoken Language, Translation and Trade." *Journal of International Economics* 93 (2): 351–363. doi:10.1016/j.jinteco.2014.04.004.
Oh, C. H., W. T. Selmier, and D. Lien. 2011. "International Trade, Foreign Direct Investment, and Transaction Costs in Languages." *The Journal of Socio-Economics* 40 (6): 732–735. doi:10.1016/j.socec.2011.08.003.
Pedersen, P. J., M. Pytlikova, and N. Smith. 2008. "Selection and Network Effect – Migration Flows Into OECD Countries 1990–2000." *European Economic Review* 52 (7): 1160–1186. doi:10.1016/j.euroecorev.2007.12.002.
Rosenbaum, P. R., and D. B. Rubin. 1983. "The Central Role of the Propensity Score in Observational Studies for Causal Effects." *Biometrika* 70 (1): 41–55. doi:10.1093/biomet/70.1.41.
Ruhlen, M. 1991. *A Guide to the World's Languages: Classification*. Vol. 1. Stanford, CA: Stanford University Press.
Saiz, A., and E. Zoido. 2002. "The Returns to Speaking a Second Language." Working Papers 02-16, Federal Reserve Bank of Philadelphia.
Saiz, A., and E. Zoido. 2004. "Curriculum Mandates and Skills in Adulthood: The Case of Foreign Languages." *Economics Letters* 84 (1): 1–8. doi:10.1016/j.econlet.2003.11.008.
Selten, R., and J. Pool. 1991. "The Distribution of Foreign Language Skills as a Game Equilibrium." In *Game Equilibrium Models IV: Social and Political Interaction*, 64–87. Berlin: Springer.
State Secretariat of Migration. 2020. "Free Movement of Persons Switzerland – EU/EFTA." State Secretariat of Migration SEM.
TestDaF Institut. 2016. "Informationen Zum TestDaF." http://www.testdaf.de/fuer-teilnehmende/informationen-zum-testdaf.
The World Bank. 2021. *World Development Indicators*. Washington, DC: The World Bank.

Appendix

Figure A1 denotes the time series of average TestDaF participants per year using a local polynomial regression. The smoothed line chart can be interpreted as the annual average values of TestDaF participants with 95% confidence intervals across all 55 NUTS-2 regions in our sample.

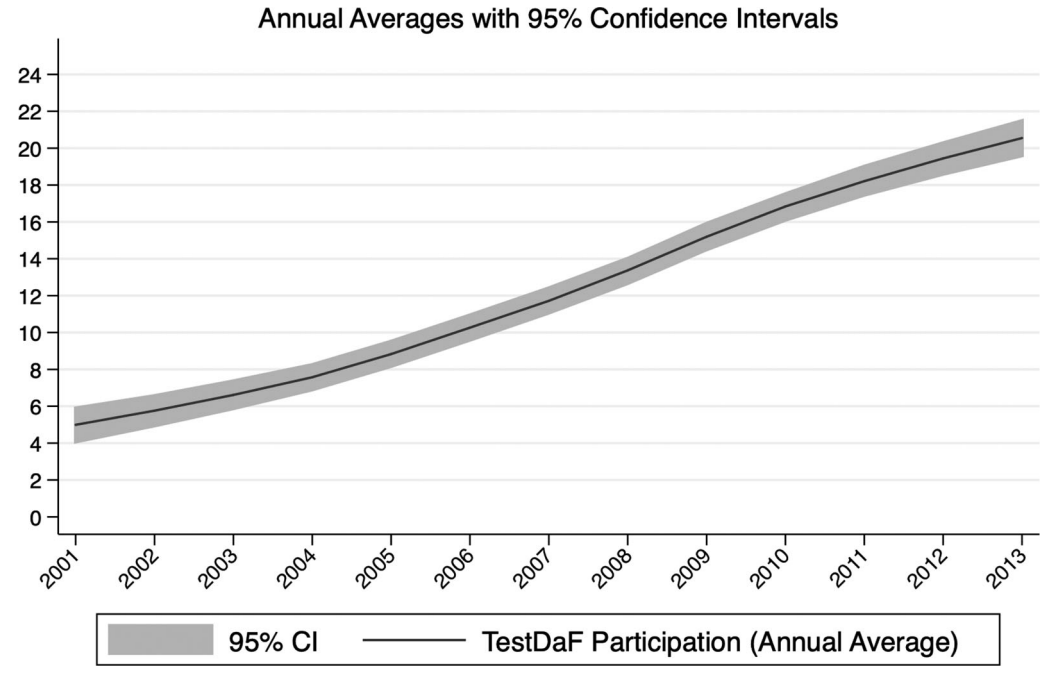

Figure A1. TestDaF Participants (2001–13).

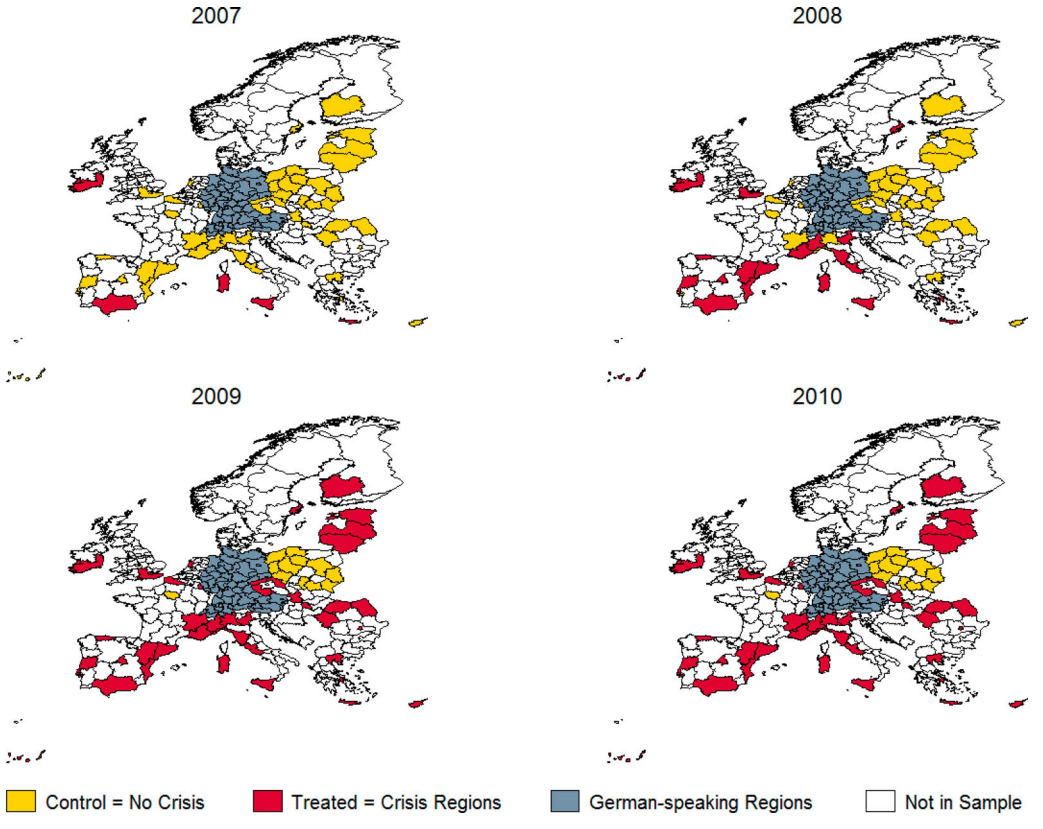

Figure A2. Progression of Euro-crisis in Sample Regions. Source: EuroGeographics for administrative borders. Crisis regions defined using authors' calculation.

Table A1. Treatment and control groups.

	Crisis = 1 Std. Dev. Decrease			Crisis = 2 Std. Dev. Decrease		
Region (NUTS Code)	Control Periods (1)	Treatment Periods (2)	Total Periods (3)	Control Periods (4)	Treatment Periods (5)	Total Periods (6)
Kypros, Cyprus (CY00)	8	5	13	8	5	13
Jihozapad, Czech Republic (CZ03)	8	5	13	8	5	13
Severozapad, Czech Republic (CZ04)	8	5	13	9	4	13
Severovychod, Czech Republic (CZ05)	8	5	13	11	2	13
Eesti, Estonia (EE00)	8	5	13	8	5	13
Attiki, Greece (EL30)	7	6	13	7	6	13
Kriti, Greece (EL43)	6	7	13	8	5	13
Kentriki Makedonia, Greece (EL52)	8	5	13	8	5	13
Principado de Asturias, Spain (ES12)	7	6	13	8	5	13
Aragon, Spain (ES24)	7	6	13	7	6	13
Comunidad de Madrid, Spain (ES30)	7	6	13	8	5	13
Cataluana, Spain (ES51)	7	6	13	7	6	13
Comunidad Valenciana, Spain (ES52)	7	6	13	7	6	13
Andalucia, Spain (ES61)	6	7	13	6	7	13
Canarias, Spain (ES70)	7	6	13	7	6	13

(*Continued*)

Table A1. Continued.

Region (NUTS Code)	Crisis = 1 Std. Dev. Decrease			Crisis = 2 Std. Dev. Decrease		
	Control Periods (1)	Treatment Periods (2)	Total Periods (3)	Control Periods (4)	Treatment Periods (5)	Total Periods (6)
Lansi-Suomi, Finland (FI19)	8	5	13	8	5	13
Ile-de-France, France (FR10)	13	0	13	13	0	13
Nord – Pas-de-Calais, France (FR30)	8	5	13	8	5	13
Rhone-Alpes, France (FR71)	8	5	13	8	5	13
Provence-Alpes-Cote d'Azur, France (FR82)	7	6	13	7	6	13
Kozep-Magyarorszag, Hungary (HU10)	8	5	13	8	5	13
Southern and Eastern, Ireland (IE02)	6	7	13	6	7	13
Piemonte, Italy (ITC1)	7	6	13	7	6	13
Liguria, Italy (ITC3)	8	5	13	8	5	13
Lombardia, Italy (ITC4)	8	5	13	8	5	13
Sicilia, Italy (ITG1)	6	7	13	6	7	13
Sardegna, Italy (ITG2)	6	7	13	8	5	13
Veneto, Italy (ITH3)	7	6	13	7	6	13
Toscana, Italy (ITI1)	7	6	13	7	6	13
Lazio, Italy (ITI4)	7	6	13	7	6	13
Lietuva, Lithuania (LT00)	8	5	13	8	5	13
Luxembourg, Luxembourg (LU00)	8	5	13	8	5	13
Latvija, Latvia (LV00)	8	5	13	9	4	13
Noord-Holland, Netherlands (NL32)	8	5	13	8	5	13
Mazowieckie, Poland (PL12)	13	0	13	13	0	13
Malopolskie, Poland (PL21)	13	0	13	13	0	13
Slaskie, Poland (PL22)	13	0	13	13	0	13
Lubelskie, Poland (PL31)	13	0	13	13	0	13
Podkarpackie, Poland (PL32)	13	0	13	13	0	13
Wielkopolskie, Poland (PL41)	13	0	13	13	0	13
Zachodniopomorskie, Poland (PL42)	13	0	13	13	0	13
Lubuskie, Poland (PL43)	13	0	13	13	0	13
Dolnoslaskie, Poland (PL51)	13	0	13	13	0	13
Kujawsko-Pomorskie, Poland (PL61)	13	0	13	13	0	13
Pomorskie, Poland (PL63)	13	0	13	13	0	13
Centro, Portugal (PT16)	7	6	13	7	6	13
Lisboa, Portugal (PT17)	8	5	13	8	5	13
Nord-Vest, Romania (RO11)	8	5	13	8	5	13
Nord-Est, Romania (RO21)	8	5	13	9	4	13
Bucuresti – Ilfov, Romania (RO32)	8	5	13	10	3	13
Vest, Romania (RO42)	8	5	13	8	5	13
Stockholm, Sweden (SE11)	7	6	13	7	6	13
Zapadnw Slovensko, Slovenia (SK02)	8	5	13	8	5	13
London, England (UKI)	7	6	13	7	6	13
South-East, England (UKJ)	7	6	13	7	6	13
Total Observations	474	241	715	488	227	715

Note: This table lists all 55 regions in the study sample. Control Periods indicate the number of years without financial crisis and Treatment Periods indicate the number of years after the financial crisis affects the region. Columns 1–3 include the number of Control and Treatment Periods under the baseline definition of financial crisis, defined as a 1 standard deviation decrease in GDP per capita. Columns 4–6 include the number of Control and Treatment Periods under the alternative definition of financial crisis, defined as a 2 standard deviation decrease in GDP per capita. Data Sources: Authors' calculations using Eurostat data.