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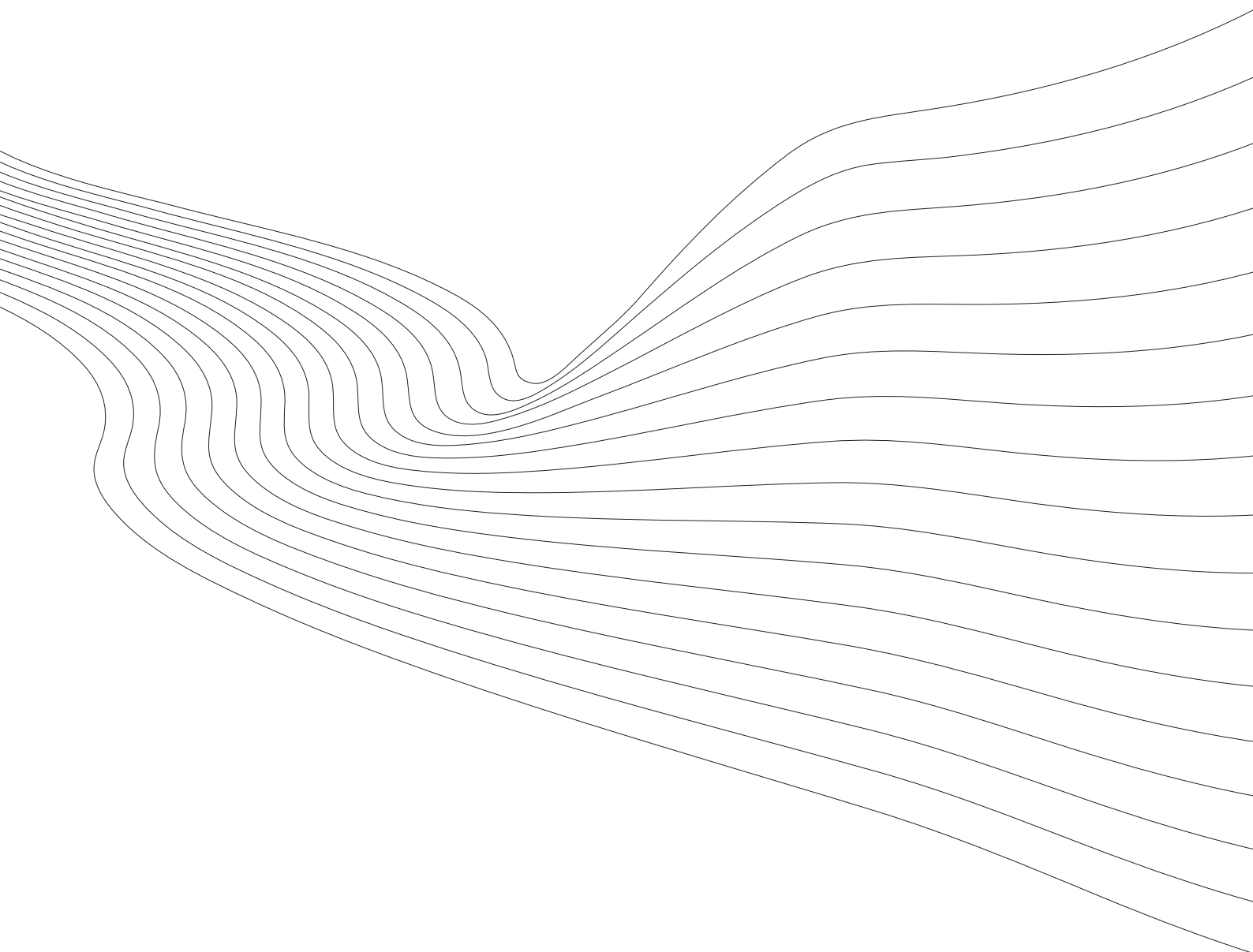
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# The Causal Impact of Common Native Language on International Trade: Evidence from a Spatial Regression Discontinuity Design\*

Peter H. Egger and Andrea Lassmann

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## Abstract

This paper studies the effect of sharing a common native language on international trade. Switzerland hosts three major native language groups which adjoin countries sharing the same native majority languages. In regions close to the internal language border the alternate major language is taught early on in school and not only understood but spoken by the residents. This setting allows for an assessment of the impact of common native rather than spoken language on transaction-level imports from neighbouring countries. Our findings point to an effect of common native language on extensive rather than on intensive margins of trade.

**Keywords:** COMMON NATIVE LANGUAGE; CULTURE; INTERNATIONAL TRADE; REGRESSION DISCONTINUITY DESIGN; QUASI-RANDOMISED EXPERIMENTS **JEL Classification:** C14, C21, F14, R12, Z10

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# 1 Introduction

To which extent does common native language as an expression of common culture affect international trade? This question revolves around three pertinent topics in economics. First, why is consumption so much biased towards domestic goods? Second, why are imports so much biased towards similar countries? Third, what is the economic value of common culture?<sup>1</sup> This paper identifies the impact of common native language on transaction-level trade in a unique setting based on the history and geography of native language use in a multilingual country, Switzerland. In particular, the paper alludes to the differential impact of common native language on different margins of trade.

The overall quantitative effect and even the channels of influence of a common language on trade is well studied in empirical international economics. Trade economists usually estimate the impact of common official language on bilateral trade from gravity model regressions of the following general form:

$$M_{ij} = b_{ij}t_{ij}\mu_i m_j u_{ij} = e^{\lambda_{\text{language}_{ij}}} d_{ij}\mu_i m_j u_{ij}, \quad (1)$$

where  $M_{ij}$  measures bilateral trade (imports) of *country j* from *country i*,  $b_{ij}$  and  $t_{ij}$  capture consumer preferences and trade cost effects, respectively, in  $j$  towards goods in  $i$ ,  $\mu_i$  and  $m_j$  are exporter- and importer-specific factors of influence (such as GDP, price indices, etc.), and  $u_{ij}$  is a country-pair-specific error term. The right-hand-side

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<sup>1</sup>The first question is one of six major puzzles in international macroeconomics (Obstfeld and Rogoff, 2001). The second one is the very root of new trade theory as developed in Krugman (1980). The last question is at the heart of a young literature which aims at quantifying the role of preferences for economic outcomes (see Guiso *et al.*, 2006, for a survey).

of (1) recasts  $b_{ij}t_{ij}$  as a multiplicative function of (official) language effects  $e^{\lambda \text{language}_{ij}}$  where  $\text{language}_{ij}$  is a binary indicator variable which is unity whenever two countries have the same official language and zero else and  $\lambda$  is an unknown but estimable parameter on  $\text{language}_{ij}$ , and  $d_{ij}$  measures the joint impact of other measurable bilateral trade-impeding or trade-enhancing factors (such as bilateral distance or trade agreement membership) on bilateral trade. Commonly,  $e^{\lambda \text{language}_{ij}}$  and all elements in  $d_{ij}$  are interpreted as to reflect (ad-valorem) trade costs in a narrow sense, but the part between the equality signs in (1) makes obvious that consumer preference and pure trade cost effects are isomorphic and not separable. The latter may be particularly important for cultural factors such as common *native* language. The parameter  $\lambda$  should be interpreted as a *direct effect* or *direct semi-elasticity* of common language on bilateral trade.<sup>2</sup> A key problem with such an identification of the language effects from *across country-pairs* is that  $\lambda$  may be biased due to omitted confounding factors in  $u_{ij}$  beyond the usually employed variables in  $d_{ij}$  that are correlated with  $\text{language}_{ij}$  (see Egger and Lassmann, 2012, for a meta-analysis of the common language effect on trade which points to the importance of such confounding factors in related empirical work). Among these are the religious orientation (see Helpman *et al.*, 2008), or common economic, legal, and political institutions (see Greif, 1989, 1993; Casella and Rauch, 2002; Rauch and Trindade, 2002; Guiso *et al.*, 2006). As a consequence,  $\lambda$  cannot be interpreted as a causal direct treatment effect of language on trade. Moreover, Melitz and Toubal (2014) point out that,

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<sup>2</sup>New trade models suggest that  $\lambda$  is not a marginal effect or a *total* semi-elasticity of trade but only a *direct* or *immediate* effect, since  $\mu_i$  and  $m_j$  depend on  $\text{language}_{ij}$  (see Krugman, 1980; Helpman and Krugman, 1987; Eaton and Kortum, 2002; Anderson and van Wincoop, 2003; Melitz, 2003; Helpman *et al.*, 2008, for such models). We leave this issue aside here since we are primarily interested in estimating consistently the immediate effect on common native language.

when using an official language indicator,  $\lambda$  reflects a weighted impact of *spoken language* as a mere vehicle of communication and *native language* as a contextual cultural factor, rendering the interpretation of  $\lambda$  difficult. Technically, this refers to a variable reflecting common spoken acquired (non-native) language by  $CSL_{ij}$  and one reflecting common native language by  $CNL_{ij}$  and replaces  $e^{\lambda_{\text{language}_{ij}}}$  in (1) by  $e^{\lambda_{\text{CNL}}CNL_{ij}}e^{\lambda_{\text{CSL}}CSL_{ij}}$ .

The present paper is devoted to estimating the direct effect of common native language (CNL) rather than spoken language (CSL) or official language (COL) on trade from within country-pairs by utilising a spatial regression discontinuity design. The causal role of a CNL on trade can be identified from exploiting the discontinuity of native language in a small neighbourhood around internal historical language borders in Switzerland together with information on trade between subnational spatial (postcode) units in Switzerland and a country of origin. This strategy obtains an estimate of  $\lambda_{\text{CNL}}$  which may be interpreted as a *local average direct (and causal) treatment effect* of CNL on bilateral (country-to-Swiss-postcode) imports. Our findings point to an effect of CNL on extensive rather than on intensive margins of trade: estimates in this study suggest that sharing a CNL increases the value share of import transactions by 16.5 and the share of numbers of import transactions by 19.6%, respectively, relative to other postcodes' imports from the same country. Nothing of that effect could be explained by COL because all adjacent countries' official languages are also official languages of Switzerland. And little should be explained by spoken acquired languages which in the vicinity of internal language borders of Switzerland are all similar if not the same due to training in school and regular usage in every-day life. Also, we provide evidence that the magnitude of

the effect is not driven by the presence of retailers and wholesalers, by cross-border shopping, or by cross-border working. The native language effects identified in this paper on the import value and the number of import transactions explain one-quarter and 40 percentage points, respectively, of the ones obtained with traditional gravity estimation using (1) and employing COL as the language measure, but using otherwise the same data. The remaining part of the conventional estimates is either due to CSL or to confounding factors.

To which extent the estimated direct effect of CNL reflects pure trade costs (including information-induced ones) or consumer preferences through tastes is difficult if not impossible to determine. However, product-level estimates are consistent with the view that the CNL effect is stronger for more differentiated products as opposed to homogeneous ones, which points to the importance of the preference channel.

The remainder of the paper is organised as follows. The next section relates ours to earlier work on the impact of a common language on bilateral trade. Section 3 provides some institutional background supporting the use of internal native language zone boundaries in Switzerland as instruments for causal inference about language-borne effects on international trade. Section 4 provides details about the data-set and descriptive statistics for core variables of interest. Section 5 outlines briefly the spatial regression discontinuity design for the data at hand, summarises the results, and assesses their robustness. The last section concludes by summarising the key insights.



## 2 Common language as a driver of trade in the literature

The interest in the role of language as a means of interaction and its consequences for outcome has its habitat at the interface of several disciplines within and at the boundaries of the social sciences.<sup>3</sup> Common language – partly as a reflection of cultural proximity – is understood to stimulate interaction in general and cross-border transactions of various kinds in particular.

In the context of international economics, theoretical research identifies a role for common language as a mere means of communication or as a broader substrate on which common culture and externalities flourish (e.g., Kónya, 2006; Janeba, 2007; Melitz, 2012). Empirical research typically models common language as a non-tariff barrier to trade – mostly in the form of an iceberg-type, ad-valorem trade cost element among the numerous variable costs to trade in line with (1) (see Helliwell, 1999; Melitz, 2008; Egger and Lassmann, 2012; Melitz and Toubal, 2014; Fidrmuc and Fidrmuc, 2014). However, the language coefficient in gravity models seems to capture confounding economic, cultural, and institutional determinants in cross-country studies as has been shown by Egger and Lassmann (2012) in a meta-analysis. This is consistent with broader concerns about the endogeneity of common culture in general (see Disdier and Mayer, 2007; Guiso *et al.*, 2009; Felbermayr and Toubal, 2010) and of common spoken language in particular (see Melitz, 2012; Sauter, 2012).

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<sup>3</sup>See Laitin (2000), Hauser *et al.* (2002), Fidrmuc and Ginsburgh (2007), Holman *et al.* (2007), Chiswick (2008), Matser *et al.* (2010), and Falck *et al.* (2012) for recent important contributions on the matter in political science, sociology, socio-linguistics, economics, and psychology.

The parameter on common language indicators tends to be very sensitive to the exclusion of covariates among the determinants of bilateral trade flows – much more so than, e.g., that of bilateral distance (see Table 4 in Head and Mayer, 2013).

Differentiating the various aspects of common language is particularly difficult for these reasons. For an estimation of the impact of native language on trade one would ideally use data which allow for an isolation of the nativeness from the spokenness and officialness of common language (see Falck *et al.*, 2012, for such an approach in the context of dialects). The latter is a strategy pursued in this paper.

### **3 Native languages as cultural traits in Switzerland**

The paper adopts an identification strategy which differs from previous work by exploiting data on native language differences *within* a country, Switzerland, and (transaction-level) data on imports of different language zones in that country with other countries. That said, we should emphasise that Switzerland is not just another country where several languages are spoken (see Melitz and Toubal, 2014, for descriptive evidence on multi-linguality on the globe). Switzerland consists of four native language communities – German, French, Italian, and Romansh (ordered by the number of speakers) – that mainly reside in geographically distinct areas whose internal borders have deep historical roots. See Figure 1 for census maps from the middle and the end of the previous century for the distribution of native speakers in Switzerland. These language borders can actually be traced back to the

post-Roman period and proved to be very persistent over time. Hence, the language borders measure the historical and cultural legacy as embodied in differences in native languages even nowadays. The Swiss Confederation aims to maintain this diversity in various respects, most importantly, by the equal treatment of all four official languages by the Federal State. In general, the notion of *native* language does not just reflect linguistic proficiency but persistent common cultural characteristics and preferences that individuals and regions speaking a common mother tongue share. In particular, a CNL may generate trust, knowledge of cultural habits, and social norms of interaction. Accordingly, the concept of *common native language* overlaps with cultural proximity, going beyond mere language proficiency and ability to speak.<sup>4</sup>

According to the Census of the Swiss Federal Statistical Office from 2000, German is the native language of roughly 4,640,400 speakers, French that of roughly 1,485,100 speakers, Italian that of about 471,000 speakers, and Romansh that of about 35,100 speakers. Except for Romansh, all languages are main national tongues (the official and main native languages) in countries adjacent to Switzerland. The Romansh regions in Switzerland and northern Italy do neither share common borders nor do they share obvious common socio-linguistic or historic roots as the French-, German-, and Italian-speaking regions of Switzerland do with their respective neighbouring countries. Since Romansh was never the official language of a state or country in modern history and there is no large-enough foreign language base so as to identify

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<sup>4</sup>The deep cultural aspect particularly of native language was emphasised in anthropology (e.g., in the work of Franz Boas), linguistics (e.g., in Benjamin Whorf's concept of linguistic relativity) and philosophy (e.g., in the work of Johann Gottfried Herder, Wilhelm von Humboldt, or Ludwig Wittgenstein).

specific language-related trade ties, we will not consider it in our analysis and exclude the corresponding regions and data in the regression analysis.<sup>5</sup>

To ensure the best possible quality of identification, we focus on Swiss trade with neighbouring countries only. This ensures the largest possible homogeneity in characteristics (apart from native language overlap, these are adjacency, membership in the European Union, institutional design, etc.). Among Switzerland's five neighbouring countries, German is the official language in Germany, Austria, and Liechtenstein, French is the official language of France, and Italian the one of Italy such that everyone of the three main languages of Switzerland is the single official language spoken in at least one of the adjacent countries. In fact, none of Switzerland's neighbouring countries has an official (or main native) language beyond the three aforementioned tongues. These languages are important among the 6,909 known languages spoken worldwide at our time. According to Lewis (2009), German ranks 10th among the native languages spoken worldwide (90.3 million speakers), French ranks 16th (67.8 million speakers), and Italian ranks 19th (61.7 million speakers). The Swiss Federation explicitly regularises and promotes multilingualism in the official languages in accordance with the Constitution. For instance, every student in a Swiss school has to learn a second language of the country from third grade onwards and, in some German-speaking cantons, from fifth to seventh grade onwards.<sup>6</sup> Swiss pupils learn a third language from fifth to seventh grade onwards,

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<sup>5</sup>Whether the three languages Swiss (Bündner-)Romansh and the Ladin and Friulian – spoken in the Alps of northern Italy – form three subgroups of a common Rhaeto-Roman language or not is a controversial question in linguistic research (*questione ladina*, see Bossong, 2008; Liver, 2010). In fact, one should distinguish between five main dialects of Romansh (*Bündnerromanisch*) and consider the official Romansh an artificial language.

<sup>6</sup>See figures for the geographic location and for details on languages taught in school in online Appendix A to this paper.

and Swiss citizens are supposed to understand if not speak at least two main tongues. In any case, residents close to internal language borders tend to speak the two main native languages on either side of an internal border particularly well due to specifically intensive training of and exposure to those languages there. All of that leaves the issue at stake in this paper not one of common *official* language in very broad terms, and also not one of *spoken* language as such, but mainly one of *native* language stimulating economic exchange beyond the impact of spoken language in a narrow sense on trade.

The geographical clustering of native speakers with different language background in Switzerland is strong and can best be visualised by way of a map as in Figure 1b. Each of the colors corresponds to one language spoken by the majority (at least 50%) of the inhabitants in a Swiss municipality.<sup>7</sup> Of course, using a majoritarian rule to cut native language zones would be misleading if today's language borders were different from the historical ones or the discontinuity about language usage were rather smooth at the majority-based language borders. It turns out that historical and majority-rule-based language borders are the same (see Figure 1a), and we will illustrate below that there is a clear (though not a sharp in a technical sense of the word) discontinuity about the main native language within relatively narrow spatial intervals around the Swiss internal historical language borders. We will utilise exactly this discontinuity to infer the causal impact of language on measures of international trade transactions of small spatial units.

– Figure 1 about here –

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<sup>7</sup>While we use postcodes in the regression analysis, we employ municipality aggregates of postcodes in some of the graphical analysis for reasons of presentation.

It is worth emphasising that language borders within Switzerland do not always coincide with the ones of *Cantons* – comparable to US *States* and German *Länder* – which have relatively strong economic and political autonomy (e.g., with regard to setting profit tax rates, etc.). As will become clear below, by isolating spatial units of different native language majority *within* cantons we may condition on economic, institutional, and political factors that may change at cantonal borders (certainly, in comparison to country-level studies; see also Brügger *et al.*, 2009; Eugster *et al.*, 2011; Eugster and Parchet, 2013).

The use of transaction-level data with spatial information is essential to our analysis for two reasons. First, it allows us to geo-spatially identify the location of importers within Switzerland. This is essential to determine the majoritarian native language zone an importer resides in as well as her distance to the respective language border within Switzerland. Second, it reveals novel insights into the impact of CNL on alternative margins of trade such as the number of bilateral transactions and the number of products traded as examples of extensive trade margins, versus the value per transaction or the unit value as examples of intensive trade margins.

## 4 Transaction-level import data and spoken languages in Switzerland

### 4.1 Data sources

To identify the direct treatment effect of CNL for alternative margins of bilateral imports, we use data from various sources. First of all, we utilise transaction-level

import data (imports from abroad) of the Swiss Federal Customs Administration (*EDEC*) between January 2006 and June 2011. This data source contains for the universe of import transactions (102,518,645 data points) the following information (inter alia): an identifier for the importing authority (a person, a firm, or a political entity); an identifier of the address of the importing authority; the value per transaction; the quantity imported; the product (Harmonised System 8-digit code; *HS 8*); the time (day and even hour) of entering the country; and the country of origin.<sup>8</sup> Unlike with many firm-level data-sets available nowadays, the present one is untruncated and contains all transactions that cross Swiss international borders officially. Some transactions are as small as one Swiss Franc. More precisely, everything shipped into Switzerland by postal services to firms and households is subject to customs checking (including taxation and, where applying, tariff payments).<sup>9</sup> Moreover, since Switzerland charges a lower value-added tax rate than its neighbouring countries and most products from neighbouring (European Union member) countries are exempted from tariffs, there is an incentive even for individuals to declare foreign-purchased products when entering Switzerland. We collapse this information at the postcode and country-of-origin language zone level across all years and compute the following outcome variables: the aggregate value of imports per country-of-origin language zone relative to all imports of that postcode for all dates and importing authorities covered, *Value share*; the number of transactions per country-of-origin language

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<sup>8</sup>Compared to the import data, the transaction-level export data at our disposal do not cover the universe of transactions (but only about 40%) so that we suppress the corresponding information and results here and focus on imports.

<sup>9</sup>Personally imported goods of a value below 300 Swiss Francs can be imported without declaration, though one would save on taxes when declaring. For alcohol and other sensitive products, there are numerous exceptions from the 300 Swiss Francs rule, and even smaller purchases have to be declared. More details on this matter are available from the authors upon request.

zone relative to all transactions of that postcode for all dates and importing authorities covered, *Transactions share*; the number of HS 8-digit product codes per country-of-origin language zone imported by that postcode, *Number of products (HS8 tariff lines)*; the logarithm of the average unit value by country-of-origin language zone of all imports by that postcode, *Log unit value*; the logarithm of the value per import transaction by country-of-origin language zone of all imports by that postcode, *Log value per transaction*; and the logarithm of the quantity per import transaction by country-of-origin language zone of all imports by that postcode, *Log quantity per transaction*. The outcomes are based on trade with countries adjacent to Switzerland, with Germany and Austria as German-speaking exporters, France as the French-speaking exporter and Italy as the Italian-speaking exporter, where shares are calculated in total imports including the rest of the world.<sup>10</sup>

We match this information with geo-spatial data on the exact location of language borders within Switzerland at 100-meter intervals. Language borders are determined by exploiting postcode-based information from the 1990 Census of the Swiss Federal Statistical Office (*Bundesamt für Statistik*) and Geographical Information Systems data about Swiss postcodes of *Die Post*. Moreover, we use data from *Die Post* to determine road distances from Swiss postcode centroids to the closest point on the language border on a road. These centroids belong in 3,495 postcodes for the sample period of which 3,079 can be used after dropping Romansh, non-trading, and non-matchable (between customs and spatial data) postcodes. In addition, we obtain the distance of each spatial unit in Switzerland from the country’s external border

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<sup>10</sup>Liechtenstein is a German-speaking country but its trade flows are reported within Switzerland’s trade statistics so that the country appears neither as a country of origin nor – due to its large distance to the Swiss language border – as an importing unit within Switzerland.



(even of the external border of a specific foreign language zone). In general, we focus on spatial units within a radius of 50 kilometers from internal language borders.<sup>11</sup> The geospatial information and the use of distances to internal language borders is elemental for the identification strategy towards a causal effect of CNL on trade. In particular, the chosen approach helps avoiding a bias from omitted confounding factors. As alternative geo-spatial information, we utilise Geographical Information Systems data provided by *Swisstopo (Amtliche Vermessung Schweiz)* to determine the location of Swiss postcode centroids in space and their Haversine distance in kilometers to all points along the internal language border in Switzerland as well as to all points along the national border. This allows for an exact determination of the minimal great-circle distance of each postcode (of which there are 3,079 in the data) from the internal language border as well as from the national border (which will both be included in the analysis later on).<sup>12</sup>

Finally, we augment the data-set by information on the mother tongue spoken in households per municipality from the 2000 Census. This information was kindly provided by the Swiss Federal Statistical Office (*Bundesamt für Statistik*). In conjunction with geo-spatial information, the data on the distribution of actual mother tongue may be used to measure the discontinuity in the majority use of native language as a percentage-point gap in mother tongue spoken of spatial units on one side of the Swiss language border relative to exporting foreign language zones

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<sup>11</sup>Calculating minimal road distances of all postcodes to internal language borders in Switzerland is time-consuming and costly. Since identification of the causal direct effect of CNL is local at the language border by way of the chosen design, it is unproblematic to focus on a band of 50 kilometers around internal language borders anyway.

<sup>12</sup>We conjecture that road distances reflect transaction costs more accurately than great-circle distances and thus report results based on great-circle distance in Appendix A only. Note that the postcode sample is generally somewhat larger when using great-circle distance.

to ones on the other side of the Swiss language border. Later on, this will allow us to express the estimated treatment effect of common language on various import aggregates per percentage point gap in CNL. A summary description of the variables constructed for analysis is available in online Appendix B.

## 4.2 Descriptive statistics

The value of the average transaction in the covered sample is 9,930 Swiss Francs (CHF) and the median value is 376 CHF. Figures 2a–2d summarise for all geographical units the frequency of import transactions per geographical unit with adjacent German-speaking, French-speaking, Italian-speaking, and (non-adjacent) other countries (rest of the world, RoW), respectively.

– Figures 2a–2d about here –

The figures support the following conclusions. First, the share of import transactions from the same language zone is generally higher for units with the same dominant mother tongue in Switzerland than for other regions. Very few spatial units outside the German- or Romansh-speaking parts have a similarly high concentration of imports from Germany or Austria as the ones in those zones (see Figure 2a). The same pattern is true for the French-speaking and the Italian-speaking parts of the country with respect to destinations that share a common language (see Figures 2b and 2c). Figure 2d shows that imports to the rest of the world are much more evenly distributed over the three considered language regions. Unsurprisingly, rural regions exhibit lower shares with the RoW than the densely populated regions in the French-speaking part of the country and the Swiss-German agglomerations, in

particular around Zurich (the largest city of Switzerland) and Berne (the capital of Switzerland). Second, a randomly drawn unit from all over Switzerland accounts for a larger share of import transactions from German-speaking countries than from elsewhere for three reasons: the German-speaking part of Switzerland is relatively large, Germany is larger than France or Italy, and the transport network openness of Switzerland to German-speaking countries is relatively higher than to other language zones due to (relevant, non-mountainous) border length, road accessibility, etc. Altogether, Figures 2a–2d provide clear evidence of a language divide in the concentration of import transactions in Switzerland.

– Tables 1a–1c about here –

Tables 1a–1c provide a more detailed overview of the importing behavior of Swiss regions (postcodes) located within alternative distance brackets from the language border at a maximal distance of 50 km. The tables indicate that Swiss regions import a larger share of import volume or transactions and more products from neighbouring countries with a CNL that is spoken by a majority of the inhabitants than on average. This pattern is similar for units within the same canton (see the lower panel of Tables 1a–1c) – where the language border within Switzerland divides a canton and institutional differences between treated and untreated regions are minimal – and for all units (see the upper panel of Tables 1a–1c) at cross-cantonal or intra-cantonal language borders. In general, language differences appear to affect predominantly extensive transaction margins of trade (such as the share of transactions) but less so intensive transaction margins of trade (such as the value per transaction or the unit value).

Let us just single out a few numbers for a discussion of Tables 1a–1c. According to the bottom row of the top panel of Table 1a, German-speaking regions in Switzerland trade on average 52% and of their import volume and 49% of their transactions with German-speaking countries within 50 km from the language border. These numbers are 52.8% and 50.2% for postcodes which are located on the German side of intra-cantonal Swiss language borders that separate French-speaking and German-speaking regions. They are 59.7% and 52.9% for German-speaking postcodes around the language border between Italian-speaking and German-speaking regions. German-speaking Swiss regions import only 6.1% and 10.8% of their import volume from French- and Italian-speaking countries of origin, respectively. The corresponding shares of transactions from these source countries are 4.2% and 9.7%, respectively. The same qualitative pattern (with some quantitative differences) arises when considering French- and Italian-speaking regions’ common-language versus different-language imports.<sup>13</sup> The same is true for the number of imported products as shown in Table 1b. Clearly, the number of products imported from countries with a CNL spoken by the majority is relatively higher. On the other hand, Tables 1b and 1c do not confirm similar patterns for the log unit value, the log value per transaction, and the log quantity per transaction. These outcomes do not differ between imports from differing language groups. Tables 2–3 summarise further features of the Swiss spatially disaggregated data.

– Tables 2–3 about here –

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<sup>13</sup>The import shares of French-speaking regions from France tend to increase with increasing distance from the respective language border, while import shares of Italian-speaking regions from Italy tend to increase within a distance of about 20 km and then decrease with increasing distance from the language border.

Table 2 indicates the number of postcodes in different language areas and distance brackets from the Swiss internal language borders. For instance, that table demonstrates that the number of German-speaking regions in the data is much bigger than that of French- and Italian-speaking regions. However, Table 2 suggests that the number of postcodes is relatively symmetric on either side of Swiss language borders within symmetric distance bands around those borders. If all postcodes with a native majority of one of the three languages considered were used to infer the average treatment effect of CNL independent of their distance to language borders, transactions from 3,079 postcodes could be utilised. Of those, only 986 postcodes would be used when focusing on intra-cantonal language borders. Of course, the number of postcodes used in estimation declines as one narrows the symmetric distance window around language borders: there are 41 postcodes within a  $\pm 1$ -kilometer band of language borders all over Switzerland of which 36 are located at intra-cantonal language borders; there are 553 postcodes within a  $\pm 20$ -kilometer band of language borders all over Switzerland of which 354 are located at intra-cantonal language borders.

Table 3 indicates that the language border effect is drastic and discontinuous in the sense that, no matter how narrow of a distance band around the internal border we consider, the one language is spoken by a large native majority while the majoritarian language of the adjacent different-language community accounts for a positive but much smaller fraction.

## 5 Spatial RDD estimation of the direct local average treatment effect (LATE) of common native language on trade

This section is organised in three subsections. First, we briefly outline the identification strategy of the LATE as a spatial regression discontinuity design in Subsection 5.1. Then, we summarise the corresponding benchmark results regarding the LATE in Subsection 5.2. Finally, we assess the robustness of the findings and extensions in various regards in Subsection 5.3. In general, what we refer to as LATE here are always direct effects on various import margins.

### 5.1 A spatial regression discontinuity design (RDD) for the LATE of common native language majority

This paper’s empirical approach is based on the following identification strategy. Bilateral imports of geographical unit  $j = 1, \dots, N$  which, in our case, is a Swiss postcode, from country  $i$  are given by the relationship in Equation (1). Let us specify two such bilateral import relationships based on the latter equation. Imports of  $j$  from  $i$  are determined as  $M_{ij} = e^{\lambda_{\text{CNL}} \text{CNL}_{ij}} e^{\lambda_{\text{CSL}} \text{CSL}_{ij}} d_{ij} \mu_i m_j u_{ij}$ , where CNL and CSL reflect common native and common spoken acquired language variables (shares), and ones of  $k$  from  $i$  by  $M_{ik} = e^{\lambda_{\text{CNL}} \text{CNL}_{ik}} e^{\lambda_{\text{CSL}} \text{CSL}_{ik}} d_{ik} \mu_i m_k u_{ik}$ . Suppose that we pick countries and postcodes such that  $\text{CNL}_{ij} \geq 0.5$  while  $\text{CNL}_{ik} < 0.5$ ,  $\text{CSL}_{ij} \approx \text{CSL}_{ik}$ ,

$d_{ij} \approx d_{ik}$ ; and  $m_j \approx m_k$ . Then,

$$\frac{M_{ij}}{M_{ik}} = e^{\lambda_{\text{CNL}}(\text{CNL}_{ij} - \text{CNL}_{ik})} \frac{u_{ij}}{u_{ik}}. \quad (2)$$

Notice that exporter-specific factors such as GDP, preference parameters, and prices subsumed under  $\mu_i$  have cancelled, and that CSL, other trade costs (e.g., distance, institutions), and other importer-specific factors such as price indices are assumed to be approximately the same for  $j$  and  $k$ . Then,  $\lambda_{\text{CNL}}$  can be estimated as a constant to the log-transformed relationship in Equation (2), if (conditional or unconditional) independence of  $(\text{CNL}_{ij} - \text{CNL}_{ik})$  and  $\ln(u_{ij}/u_{ik})$  is achieved. Econometric theory proposes two elementary options to achieve such independence, instrumental variables estimation or – in very broad terms – a control function approach, where we subsume any form of controlling for observable variables (with more or less flexible functional forms) under the latter approach.

The variable  $\text{CNL}_{ij}$  measures the share of speakers in postcode  $j$  with the same CNL as the majority of the population in exporting country  $i$ . Alternatively, we may determine a binary variable  $\text{RULE}_{ij}$  which is unity between  $i$  and  $j$  for, say, historically mainly German-speaking postcodes in Switzerland for their imports from Germany and Austria, and similarly for French-speaking and Italian-speaking postcodes with imports from France or Italy. As said before, the dominant language is the mother tongue of at least 50% of the residents by definition, but not necessarily and even not actually of 100%. In contrast to other studies exploiting language differences within Switzerland, we think of native language borders as to entail a fuzzy identification design. Most (but even not all) individuals have *one* native

language. Yet, spatial aggregates host fractions of individuals of different native language as shown in Table 3.<sup>14</sup> Hence, native language borders do not generate a sharp design: there are German native speakers on either side of the German-French border in Switzerland and the same is true for French native speakers, etc. It has been neglected in earlier work that this calls for suitable identification strategies (such as instrumental variable estimation) in order to render estimated discontinuities at language borders interpretable as (causal) local average treatment effects. In addition, Figure 3 – which is organised in such a way that the treatment (averaged within distance bins of 1 km) is shown in the vertical dimension, and panels on the left-hand side are based on distance from language borders that coincide with cantonal borders and run through cantons as the forcing variable, while panels on the right-hand side are based on distance to intra-cantonal language borders as the forcing variable – visualises the discontinuity of treatment at the language border. It is shown that the discontinuity is pronounced but does not jump from zero to one at the border. The curvature is quite flat and similar on both sides of the language border. The degree of fuzziness may be measured by the difference in the fraction of speakers of a common language to the "right" of the border (in the treatment region) and those to the "left" of the border (in the control region). Based on an optimally chosen bandwidth (18 km) around internal language borders for treatment, this difference amounts to 0.76. An estimate across all three native language usages and regions in Switzerland within 50 km around internal language borders amounts to 0.78. With a sharp design, the parameter would measure the LATE associated

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<sup>14</sup>The geographic pattern is visible from Figures A3-A5 shown in Appendix A as well.



with a jump of the difference in CNL from zero to one-hundred % of all speakers.<sup>15</sup> Accordingly, a larger deviation of that difference from unity is associated with a larger degree of fuzziness.

– Figure 3 about here –

Let us generally refer to an import outcome of any kind for spatial unit  $j$  as  $y_j$ . Recall from Section 4 that we employ six alternative bilateral import outcomes (generally referred to as  $y_{ij}$ ) in the analysis: *Value share*; *Transactions share*; *Number of products (HS8 tariff lines)*; *Log unit value*; *Log value per transaction*; and *Log quantity per transaction*.

We follow the literature on regression discontinuity designs (RDDs; see Imbens and Lemieux, 2008; Angrist and Pischke, 2009; Lee and Lemieux, 2010) and postulate a flexible function about a so-called forcing variable, which may remove the endogeneity bias of the average treatment effect on outcome. For this, let us define the forcing variable for imports from country  $i$  by spatial unit (postcode)  $j$ ,  $x_{ij}$ , as the centered distance to the intra-Swiss language border in kilometers. We code the forcing variable negatively in the non-treatment case ( $x_{ij} < 0$  if  $\text{CNL}_{ij} < 0.5$ ) – then, there is a different language majority between  $j$  and the respective foreign language zone – and positively in the treatment case ( $x_{ij} \geq 0$  if  $\text{CNL}_{ij} \geq 0.5$ ). For convenience, we will sometimes refer to observations with  $x_{ij} < 0$  as to be situated *to the left* of the border and ones with  $x_{ij} \geq 0$  as to be situated *to the right* of the border. We argue that the historical political and main native language borders are an outcome

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<sup>15</sup>Melitz and Toubal (2014) provide evidence that the fraction of native language in virtually all exporting countries with only a single official language is less than 100%. Not surprisingly, this is true as well for Switzerland.

of the political power play for centuries in the distant past (e.g., the Congress of Vienna in 1814/15).<sup>16</sup> While the politico-historical setting of borders is random to a large extent, this does not mean that, unconditional on history, the residence of native speakers is random today. However, it is still conditionally random so that a causal treatment effect can be identified (see Lee and Lemieux, 2010). The forcing variable in this paper is distance to internal historical language borders. Observations are postcodes on either side of the border. There is no difference in the density or emergence of postcodes on either side of any language border in Switzerland by design, and there is also no difference in the density or emergence of individual importers on either side of any language border in Switzerland. Hence, the dominance of one or the other native language is unrelated to the density of trade activity as such.

Next we define the sufficiently smooth (parametric polynomial or nonparametric) continuous functions  $f_0(x_{ij})$  at  $x_{ij} < 0$ ,  $f_1(x_{ij})$  at  $x_{ij} \geq 0$ , and  $f_1^*(x_{ij}) \equiv f_1(x_{ij}) - f_0(x_{ij})$ . With a fuzzy treatment assignment design, the average treatment effect (ATE) in an arbitrary geo-spatial unit and the local average treatment effect (LATE) in a close neighbourhood to a Swiss internal language border of  $CNL_{ij}$  on outcome

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<sup>16</sup>Notice that some regions in Europe had been re-assigned to different countries even as an outcome of the last two World Wars. E.g., South Tyrolia was Austrian prior to 1918 and became Italian formally from 1920, Saarland was French prior to 1957 and became German afterwards, etc.

are defined as

$$\begin{aligned} \text{ATE} &\equiv \frac{E(y_{ij}|x_{ij} \geq 0) - E(y_{ij}|x_{ij} < 0)}{E(\text{CNL}_{ij}|x_{ij} \geq 0) - E(\text{CNL}_{ij}|x_{ij} < 0)} \\ &= \text{LATE} + E \left[ \frac{f_1^*(x_{ij})}{E(\text{CNL}_{ij}|x_{ij} \geq 0) - E(\text{CNL}_{ij}|x_{ij} < 0)} \right]. \end{aligned} \quad (3)$$

$$\begin{aligned} \text{LATE} &\equiv \lim_{\Delta \rightarrow 0} \frac{E(y_{ij}|0 \leq x_{ij} < \Delta) - E(y_{ij}|-\Delta < x_{ij} < 0)}{E(\text{CNL}_{ij}|0 \leq x_{ij} < \Delta) - E(\text{CNL}_{ij}|-\Delta < x_{ij} < 0)} \\ &= \lambda_{\text{CNL}}. \end{aligned} \quad (4)$$

Accordingly, ATE is the adjusted difference in conditional expectations of outcome between treated and untreated units, while LATE is the conditional expectation in outcome between treated and untreated units *in the neighbourhood of*  $x_{ij} = 0$ .<sup>17</sup> Both ATE and LATE are adjusted for the degree of fuzziness in the denominator which is a scalar in the open interval  $(0, 1)$  in case of some finite degree of fuzziness as is the case with the data at hand. If treatment assignment is truly random conditional on  $x_{ij}$  and there is no other discontinuity determining treatment assignment other than about  $x_{ij}$ . Then, the limit of the difference in conditional expectations in Equation (4) is unconfounded by other covariates and there is no need to control for observables beyond  $f_0(x_{ij})$  and  $f_1(x_{ij})$ . Because the cutoff is spatially defined, the assumption of continuity of baseline covariates may be too strong. We will account for this by basing our estimates on a subsample of observations where  $\lambda_{\text{CNL}}$  is only estimated from units to the left and the right of intra-cantonal language borders as is the case in the cantons of Bern (German/French), Valais (German/French),

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<sup>17</sup>Note that in the following we use the term *LATE* in general, except for estimates solely based on parametric specifications.

Fribourg (German/French), and Graubünden (German/Italian), and by additionally controlling for the demeaned distance of postcode  $j$  to the Swiss external language border to a specific language zone. In addition, the validity of this assumption will be subject to a number of sensitivity checks. Note that results based on this conservative approach are qualitatively absolutely robust to utilising all observations within our chosen distance bands.<sup>18</sup>

Empirically, the adjustment through the denominator in (3) and (4) can easily be made when regressing outcome  $y_{ij}$  on  $\widehat{\text{CNL}}_{ij}$  instead of  $\text{CNL}_{ij}$  (apart from the control functions  $f_0(\cdot)$  and  $f_1(\cdot)$ ), where  $\widehat{\text{CNL}}_{ij}$  is the prediction from a regression of  $\text{CNL}_{ij}$  on the indicator variable  $\text{RULE}_{ij}$  which is unity whenever  $x_{ij} \geq 0$  and zero else (and on the control functions  $f_0(\cdot)$  and  $f_1(\cdot)$ ).<sup>19</sup>

Regarding the design of the data-set for identification of the LATE of CNL on import outcomes, we ensure that there is no variation across exporting countries by considering imports from one and the same country into postcode regions in Switzerland. Consequently, each Swiss spatial unit within a certain distance bracket to the left and the right of a Swiss language border up to thrice: once as a treated observation ( $x_{ij} \geq 0$ ) and up to twice (depending on the considered distance window around language borders) as a control observation ( $x_{ij} < 0$ ). This is because, say, a unit  $j$  in the German-speaking part and adjacent to the French-speaking part of Switzerland is considered as *treated* with imports from the German-speaking foreign

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<sup>18</sup>Evidence is provided in Table A1 and Figure A6 in Appendix A.

<sup>19</sup>Of course, as is standard with two-stage least squares, the standard errors have to be adjusted properly for the fact that  $\widehat{\text{CNL}}_{ij}$  is estimated rather than observed. Clustering the standard errors at the postcode level to account for some multiplicity of the presence of postcodes (as treated and untreated units) has a minuscule effect on standard errors and inference.

language zone but as *untreated* (*control*) with imports from the French-speaking or the Italian-speaking foreign language zone, respectively. Given the choice of a certain distance window around language borders, only units which are within the respective window of two different language borders will show up thrice in the data.<sup>20</sup>

## 5.2 Main results

In the empirical analysis, we consider postcodes within a radius of 50 kilometers (defined as the minimum road distance) around internal language borders in Switzerland. Figure 4 visualises the discontinuities in outcomes at the intra-cantonal language border by showing linear predictions for all six outcomes by distance to the language border within a respective optimal bandwidth as well as the actual outcomes averaged within distance bins of 1 km. It suggests that jumps are more pronounced for extensive than for intensive import transaction margins.

We summarise regression results for the LATE of a CNL of residents in a region on the aforementioned outcomes for imports in Table 4. Notice that the adopted instrumental variable strategy entails that the estimated parameter on CNL reflects the LATE associated with a jump from zero (to the conceptual *left* of the border) to one-hundred % (to the conceptual *right* of the border); thus the impact of CNL per percentage point overlap in CNL amounts to  $0.01 \times \text{LATE}$ . Table 4 contains eight numbered columns each, which indicate the functional form of the control functions  $f_0(x_{ij})$  and  $f_1(x_{ij})$ , and Figure 4 illustrates the estimates of the nonparametric

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<sup>20</sup>In the sample at hand, 4 German-speaking postcodes lie within 50 km from both the German-French and the German-Italian language border if we use the road distance as a distance measure. The corresponding number with respect to great-circle distance is 15.

control functions in Column (4) of Table 4. For each outcome considered, we report information with regard to the point estimate of LATE and its standard error with a parametric control function and the correlation coefficient between the model prediction and the data with a nonparametric control function, in line with Fuji *et al.* (2009) and Imbens and Kalyanaraman (2012).<sup>21</sup> Moreover, we report information on the number of cross-sectional units used for estimation, the  $R^2$ , and – for nonparametric estimates – the chosen bandwidth. Table 4 is organised in two panels: the panel on the left contains the results for the LATE of CNL estimated without further baseline covariates beyond the control function based on the forcing variables; the panel on the right conditions on the demeaned distance to Switzerland’s external border with the respective language in addition.<sup>22</sup>

– Figure 4 and Table 4 about here –

The tables suggest the following conclusions. First, the quantitative difference between most of the comparable estimates of LATE on the same outcome in the left and right panels of Table 4 is relatively small. Hence, the results suggest that the RDD about road distance to internal language borders is capable of reducing substantially the possible bias of the LATE of common language majorities on (Switzerland’s) import behavior. Second, model selection among the polynomial models based on the Akaike Information Criterion (AIC) as suggested by Lee and

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<sup>21</sup>The latter estimates the LATE by way of inverse-distance weighted local linear regression based on a triangular kernel within an optimal bandwidth estimated for the fuzzy regression discontinuity design.

<sup>22</sup>Austria and Germany for German imports (relative to others), France for French imports, and Italy for Italian imports. The respective distance is demeaned properly such that the treatment effect is still the LATE of a CNL majority.

Lemieux (2010) leads to the choice of first-order to third-order polynomial control functions: higher-order polynomials are rejected in comparison due to efficiency loss. The AIC is minimised for the linear control function for the value share and the transactions share. A second-order polynomial control function is selected for the number of products as outcome and the log quantity per transaction. A third-order polynomial is selected for the log unit value. And a fifth-order polynomial is selected for the log value per transaction.<sup>23</sup> Table 4 indicates that there is some sensitivity of the point estimates to the functional form of the control function. The reason for this might be that within a band of 50 kilometers around the internal language borders the functional form of the control function still matters. Therefore, it may be preferable to consider a nonparametric rather than a parametric control function. The point estimates indicate that the first-order polynomial parametric control functions tend to generate ATE parameters which tend to be closer to the nonparametric counterparts than the ones based on higher-order polynomials, on average. Finally, we identify effects mainly at extensive import margins in the upper part of each panel in the vertical dimension but not on intensive import margins. Irrespective of the additional channel through preferences motivated by (1), the latter arguably points to CNL as a factor that reduces *fixed* market access costs rather than *variable trade costs* as is commonly assumed (see Egger and Lassmann, 2012). Evidence of CNL as a fixed trade cost factor may potentially influence the specification of structural trade models which distinguish between fixed and variable trade costs (see Helpman *et al.*, 2008).

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<sup>23</sup>In general, also the Bayesian Information Criterion selects first-order to third-order control functions. For the sake of brevity, we report ATEs involving either first-order to third-order parametric control functions or nonparametric control functions in the tables.

Table 4 suggests a significant ATE of CNL of 0.155 for the import volume share and 0.179 for the import transactions share, according to Column (1). The ATE of CNL for the number of transactions amounts to 182. Estimates based on a nonparametric control function suggest similar point estimates of the LATE in Column (4): 0.165 for the import volume share, 0.196 for the import transactions share, and 136 for the number of transactions. This means that the import value share from a given country is about 16.5% higher, and the transaction share is 19.6% higher for a postcode with a CNL exporter than those shares are for a comparable postcode with a different native language exporter. Regions import 136 additional products from a neighbouring country sharing a CNL compared to different native language exporters. There is no robust evidence regarding effects of CNL on other considered trade outcomes. Akin to the parametric evidence, results based on the nonparametric control function point to a dominance of effects of CNL on the extensive transaction margin of trade rather than at intensive margins.<sup>24</sup> The analysis of three additional outcomes regarding intensive *product* (rather than *transaction*) margins (the log value per HS 8-digit product line, the log unit value per product line, and the log quantity per product line) confirms this interpretation (see Table A3).

In order to obtain a quantitative idea about the bias associated with conventional estimates, we convert the estimates of direct CNL effects into semi-elasticities and compare them to the estimates of the semi-elasticities of COL. The semi-elasticities are 0.248 for the log import value and 0.307 for the log number of transactions. We

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<sup>24</sup>The quantitative difference between the results shown in Tables 4 and A1 in Appendix A (using all language borders) is low. The nonparametric LATE in the latter table amounts to 0.180 for the import value share, to 0.197 for the transaction share, and to 103 for the number of products. Utilising the great-circle distance instead of road distance in Table A2, the results are robust compared to Table 4. The robustness of these findings is also evident from Figures A8–A9.



compare these to a gravity estimate of COL for Swiss postcodes in the data at hand based on Poisson pseudo-maximum-likelihood regressions of positive import flows ( $M_{ij} > 0$ ) and, alternatively, of the number of import transactions on the following covariates in line with (1): common language which is coded as one whenever a foreign country uses the majoritarian native language of a Swiss postcode as an official language and zero else; log geographical distance between a Swiss postcode and the capital of the foreign export country of origin of Swiss imports; and a full set of fixed postcode effects and fixed exporting country of origin effects. The estimates amount to 0.99 for the import value and to 0.81 for the number of import transactions with all countries, and to 1.21 for import value and 0.68 for the number of transactions with adjacent exporter countries only.<sup>25</sup> Estimates based on the sample of observations used for causal identification in this section amount to 0.97 for import value and to 0.75 for the number of import transactions. We conclude that about one-fifth to one-quarter of the direct effect of common (official) language for import value and more than one-third to almost one-half of the one for the number of import transactions is due to the economic effect of sharing a CNL. The rest of the estimates of official language effect may be attributed either to endogeneity that results from omitting important confounding variables in estimating the COL effect, or to proficiency-related aspects linked to CSL. Similar conclusions may be drawn regarding evidence on the effect of COL and CNL on trade found in the literature. For instance, Egger and Lassmann (2012) find a coefficient of 0.44 for COL in a

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<sup>25</sup>There are 3,079 postcodes and 220 countries of origin. The total number of postcode by country observations with positive bilateral imports in those regressions is 153,256. Notice that those regressions may be viewed as one part of two-part models which distinguish between the margin referring to whether there are any imports at all and other margins which we focus on (see Egger *et al.*, 2011).

meta-analysis, and Melitz and Toubal (2014), in Columns 1 and 3 of their Table 3, find coefficients of 0.514 for COL and 0.856 for CNL, respectively, all of which exceed the semi-elasticities for CNL found in this paper.

### 5.3 Sensitivity analysis and extensions

The aim of this section is to illustrate the qualitative insensitivity of the aforementioned results along various lines and to provide further results based on components of imports (in terms of product and size categories) rather than total imports.

#### 5.3.1 The nonparametric native language LATE for alternative bandwidths

In a first step, we analyze the sensitivity of the nonparametric regressions to different bandwidth choices based on fixed (lower than optimal) bandwidths. The corresponding findings shown in Table A4 suggest that the results are fairly insensitive to choosing bandwidths between 20 and 30 kilometers, and bandwidths at 10 kilometers produce insignificant LATE parameters. In general, bandwidths that are smaller than the optimal bandwidth lead to an efficiency loss, while bandwidths larger than the optimal one lead to larger bias.<sup>26</sup>

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<sup>26</sup>The optimal bandwidth estimated in line with Imbens and Kalyanaraman (2012) for the fuzzy regression discontinuity design is about 40 kilometers for the extensive margins of interest, which is in line with bandwidths for outcomes chosen by the cross-validation criterion (these amount to 37 km for the value and the transactions share, to 39 km for the number of products, to 49 km for the log unit value, to 40 km for the log value per transaction, and to 50 km for the log quantity per transaction with all language borders). Since the bandwidth is in general lower for treatment, we use fixed bandwidths of 10, 20 and 30 as alternatives.

### 5.3.2 Geographical placebo effects of the native language LATE

In addition, we undertake two types of placebo analysis to see whether discontinuities of trade margins at internal language borders are spurious artifacts or not. For the first one, we test whether we observe discontinuities at points other than the majoritarian native language borders by splitting the sample in subsamples with forcing variables of  $x_{ij} < 0$  or  $x_{ij} \geq 0$ . Then, we test for discontinuities at the median level of the forcing variable in those subsamples. The upper panel of Table 5 suggests that such discontinuities do not appear at the median. Furthermore, Figure 4 suggests that a discontinuity might exist at a distance to the internal language border of about 15 kilometers. The lower panel of Table 5 provides an assessment of this issue. It turns out that no systematic statistically significant discontinuities are detected.

– Table 5 about here –

For the second placebo analysis, we consider the local average treatment effect of CNL on import outcomes from the rest of the world. The reason for this analysis is to check whether the pattern of trade around internal language borders indeed reflects a cultural relationship to the surrounding languages rather than spurious discontinuities which could occur for other languages and cultural contexts as well. For this, we utilise a sharp RDD and define language to be unity for all Roman languages. This analysis is summarised in Table A5, and it suggests that there is no systematic effect of intra-Swiss language differences on imports from the rest of the world at the internal language borders.

### 5.3.3 Lack of a RDD for fixed postcode-specific effects at internal language borders

Since the underlying data are double-indexed (by Swiss postcode and foreign country), we may assess whether the importer-specific characteristics differ jointly between postcodes on the two sides of an internal language border. We illustrate graphically that postcode omitted variables are powerfully controlled for by the chosen design in Figure 5. For this, we estimate gravity models of the form of equation (1). While the modeling of the trade cost function is quite standard across new trade models, the structural interpretation of  $\mu_i$  and  $m_j$  depends on the underlying theoretical model.

– Figure 5 about here –

Figure 5 suggests that there is no discontinuity of postcode characteristics (regarding their size and consumer price index) at Swiss internal CNL borders. As a result, considering regional units close to the language borders within Switzerland powerfully eliminates important sources of heterogeneity across exporters and importers and confirms that assumption  $m_j \approx m_k$  is credible. Moreover, by the normalisation of outcomes – i.e., using import value or transaction shares from the same language zone of origin, etc. – any possible source of bias from a heterogeneity of foreign language zones is eliminated anyway as illustrated in (2).

### 5.3.4 The native language LATE for specific internal language borders and native languages

Next, we assess the possibly varying magnitude of the LATE of interest for specific internal language borders: the French-German and the German-Italian border within

Switzerland. The corresponding results are reported in Table 6. Columns (1)–(4) refer to the French-German border and Columns (5)–(8) refer to the Italian-German border.

– Table 6 about here –

We observe that the LATE is much higher for the latter, amounting to 0.287 regarding the value share and to 0.285 regarding the transactions share as shown in Column (8). It is 0.149 and 0.181, respectively, for the former sample in Column (4). Hence, CNL is nearly twice as important for the German-Italian border than for the French-German one. One explanation for this may be seen in the relative importance of geographical barriers (by way of the mountains)<sup>27</sup> towards shaping nowadays’ linguistic and cultural barriers.

Beyond those border-specific results, we estimated the LATE for the internal language border in the canton of Fribourg only. The reason for this exercise was to eliminate any role of mountain barriers for the treatment effect of CNL. Doing so led to LATE estimates of 0.249 for the value share (with a standard error of 0.067), and to 0.225 for the transactions share (with a standard error of 0.056). These results exhibit a slightly higher magnitude than the ones which are pooled across language treatments and language borders. Apart from that, the topographical barriers should not pose major problems to our identification strategy in the sense that they would spuriously confound the LATE of CNL. Transport routes such as tunnels are nowadays well accessible (for instance, it takes only 20 minutes to cross the Gotthardpass, which is the most important geographical barrier in the sample),

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<sup>27</sup>These alpine barriers are the *Gotthardpass* – a main transit route – and *Berninapass*.

barriers are powerfully taken into account by means of a flexible control function of distance, and most parts of the language border do not involve mountainous barriers anyway.

Beyond differences in the native language LATE across language barriers, there might be a difference with regard to specific native languages (or language treatments). One reason for this could be a greater general acceptance of or taste for goods from a specific language zone across all customers. Notice that part of the effect in Table 6 might be due to such heterogeneity already. Akin to the descriptive statistics about the transactions share shown in Figures 2a–2c, we summarise the relative magnitude of the LATE across the languages French, German, and Italian in Table A6. The relative magnitude of the LATE for imports from France is comparable to the pooled estimates. The estimates for imports from Austria and Germany are somewhat smaller than the pooled ones. With intra-cantonal language borders only the LATE for imports from Italy cannot be estimated at high-enough precision to reject the null hypothesis. When considering intra- and extra-cantonal language borders within Switzerland, there is evidence of the LATE to be strongest for imports from Italy.<sup>28</sup>

### 5.3.5 The native language LATE in the size distribution of importers

With the analysis at stake, it is worthwhile to consider different effects of native language on large versus small importers. The reason is that large importers might (i) more easily hire native workers from another language district (inducing worker commuting or migration) and (ii) engage in retailing. This would create fuzziness

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<sup>28</sup>In general, a distinction across the three native languages leads to a loss of degrees of freedom so that the LATE cannot be estimated at the same precision as the pooled estimates.

about the LATE.

– Table 7 about here –

To address this point in part, we augment the sensitivity analysis in Table 7 by reporting results for each of the four quartiles of the distribution of respective outcomes as used in Table 4. For the sake of brevity, we only report estimates including the demeaned distance to respective national borders as a covariate. The nonparametric estimates in Table 7 suggest that the LATE is highest at the third quartile and lowest at the fourth quartile (of value shares and numbers of transactions).

Altogether, the findings in the previous subsection do not appear to be driven by large importers in particular. The quartile-specific results again point to the relevance of CNL for extensive rather than intensive margins of trade, however, for the smallest quartile of transaction sizes, the LATE is not only higher for extensive margins of trade than in the highest quartile, but it is even positive and significantly different from zero for log unit value and log value per transaction.

### **5.3.6 The native language LATE when excluding trading hubs**

The effect of CNL may be biased by the fact that all postcodes, including major trading hubs, are used. It may be interesting to exclude the following postcodes in which customs offices that handle trade in goods according to the Swiss Federal Customs Administration are located: Aarau, Basel, Birsfelden, Bern, Brig-Glis, Chavornay, Le Noirmont, Möhlin, and Pratteln. These trading hubs naturally coincide with the location of large warehouses and logistic centers. When excluding the corresponding postcodes, the LATE amounts to 0.165 (0.033) regarding the

value share, to 0.195 (0.027) regarding the transactions share, and to 147 (55.779) regarding the number of products. These figures are similar to the ones reported in Table 4.

### **5.3.7 The native language LATE when accounting for cross-border shopping**

One would want to see how the LATE of CNL changes as one excludes regional observations in the immediate proximity to the internal border. The latter would address the possibility of (internal language-)cross-border shopping as a consumer side counterpart to the supplier side argument related to hiring of non-local-native language commuters. Again, commuting or cross-border shopping would induce measurement error about the LATE of CNL.

– Tables 8 about here –

To shed light on this matter, we leave out all observations within 2, 5, 10, and 15 kilometers around internal language borders and estimate the LATE from a discontinuity at a distance of 4, 10, 20, and 30 kilometer, respectively, in the forcing variable in order to avoid measurement error in outcome by way of sales of goods at one side of the internal language border to customers at some distance on the other side of the border. Compared to the nonparametric estimates in Table 4, Table 8 shows that the nonparametric estimates of value and transactions shares increase to more than 0.2 if we leave out observations within 2, 5, 10 and 15 kilometers from the language border. The estimates are quite robust across these three alternative



truncation choices.<sup>29</sup> The pattern is the same – although less pronounced – for the parametric estimates.

### 5.3.8 The native language LATE for individual product categories

Finally, there may be a genuine interest in the relative magnitude of the LATE across alternative product categories for two reasons. First of all, preferences (and the specific role of culture) might differ across products or product types and, second, the relative importance of variable and fixed trade costs might vary across products.

In Table 9 we report the LATE estimates across three goods categories – *homogeneous*, *reference-priced*, and *differentiated* goods – according to the so-called liberal classification by Rauch (1999). The corresponding results may be summarised as follows.

– Table 9 about here –

Table 9 reveals that the impact of CNL is more pronounced for *reference-priced* and *differentiated* goods than for *homogeneous* goods. In particular, there is a positive impact of CNL in those goods categories for both *reference-priced* and *differentiated* good import value and transaction shares and for *differentiated* good number of products. These results are broadly in line with the findings in Melitz and Toubal (2014) who argue that cultural traits such as ethnic ties and trust are expected to be more important for differentiated than for homogeneous goods because trade in

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<sup>29</sup>The LATE for the value share amounts to 0.212, 0.255, 0.245, and 0.254, respectively. It is 0.203, 0.222, 0.221, and 0.253, respectively, for the transactions share. And it amounts to 172, 159, 139, and 218 for the number of products, respectively. In addition, the LATE becomes significant if we leave out observations within 5 and 10 kilometers for the log unit value.

the former requires a larger amount of information. The evidence provided here suggests that differentiated goods depend more strongly on CNL than homogeneous goods. Although it is not possible to distinguish between the pure trade cost versus the consumer preference channels quantitatively this offers some implicit support for a role of native language for consumer preferences rather than only for trade costs. In addition, we illustrate estimates of the ATE point estimates across all HS 2-digit product lines (of which there are 97) by way of kernel density plots in Figure A10. It suggests that the dispersion of the ATE is fairly high for all outcomes. Another concern is that CNL might be more important for consumer goods than for intermediate goods. To shed light on this, we singled out consumer goods according to the Swiss Federal Customs Office to estimate the LATE of CNL only on those goods. The results are summarised in Table A7 which suggests that there is no significant difference – neither qualitatively nor quantitatively – in the sensitivity of *all goods* in Table 4 versus *consumer goods only* to CNL.

## 6 Conclusions

This paper combines three sources of information to isolate the impact of CNL on international trade: geographical information about language zones in Switzerland; transaction-level data on international trade by geographical site in Switzerland; and the distance of importers to internal language borders within Switzerland as well as to national borders. These data let us infer the causal impact of CNL on different margins of international trade from neighbouring countries sharing a common language to language zones corresponding to the ones around the internal

language border in Switzerland. We choose a fuzzy regression discontinuity design that eliminates the endogeneity of conventional estimates of common language to identify the discontinuity of importing behavior at the internal language borders. This strategy suggests direct effects on trade of the following magnitude. The value share and the transactions share of a geographical unit from an import destination are 16.5 and 19.6% higher, respectively, if CNL is the same. The effect is about 136 for the number of products imported. We find no significant effect with respect to the unit value, the value per transaction, and the quantity per transaction. We conclude that speaking a CNL matters for extensive margins rather than intensive margins of trade. In addition, the local average treatment effect differs among transaction size classes and substantially so across industries, where it seems to be more important for differentiated goods categories rather than homogeneous products. Since Swiss citizens quite proficiently speak the respective other (non-native) main languages of the country, especially within regions in close proximity to internal language borders, this effect may capture the effect of cultural proximity inherent in the notion of CNL, rather than the one of CSL.

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Additional Supporting Information may be found in the online version of this article.

Appendix A: Additional figures and tables

Appendix B: Description of spatial data about transaction-level imports and languages in Switzerland

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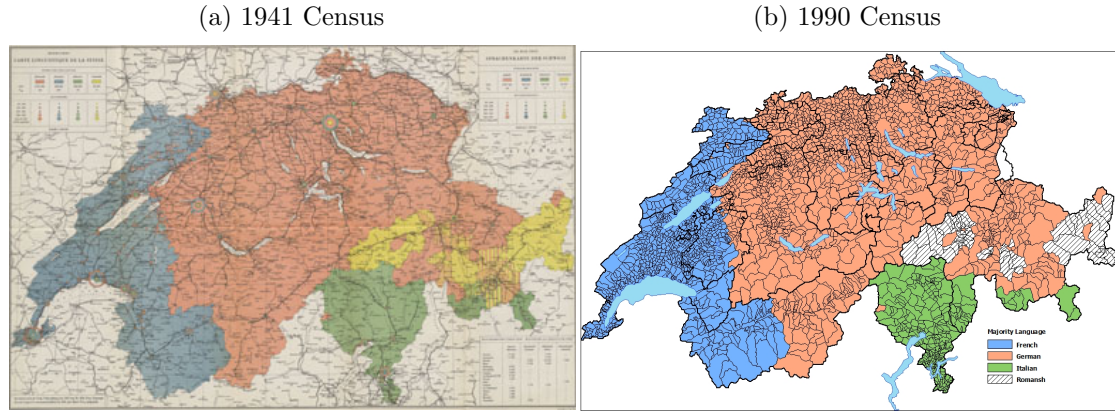
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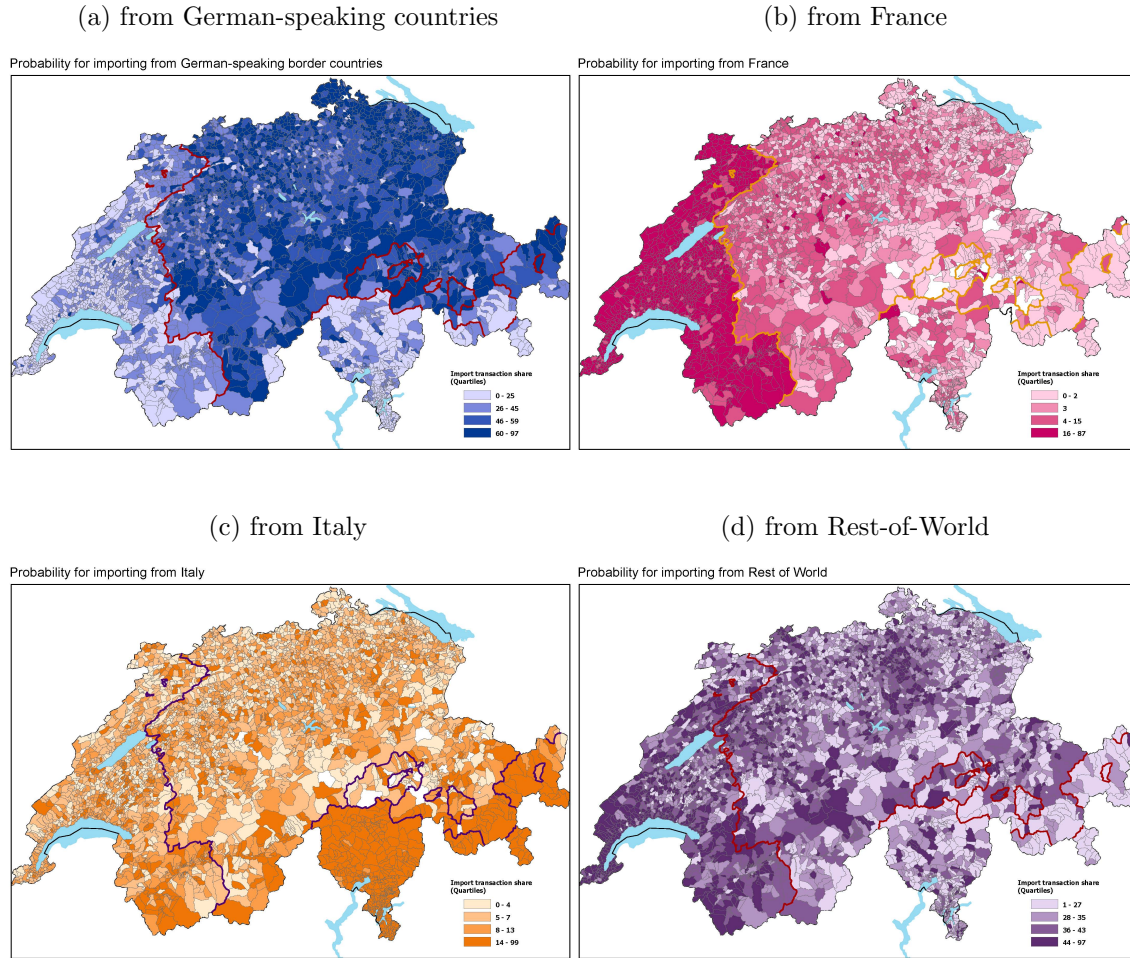
## Figures and Tables

Figure 1: *Swiss Language Regions by Native Language Majority*



*Data sources:* (a) 1941 Census (Dr. Hch. Frey); (b) 1990 Census, Swiss Federal Statistical Office. Thin lines represent municipality borders, bold lines indicate cantonal and national borders. Official 50% majority cutoff. Those borders are the same as the historical language borders associated with the political formation of Switzerland. The Swiss Federation consists of 26 cantons which joined the country sequentially between 1291 (the foundation of inner Switzerland by the four German-speaking so-called *Urkantone*) and 1815 (when the Congress of Vienna established independence of the Swiss Federation and when the French-speaking cantons Genève, Valais, and Neuchâtel joined the Federation, consisting of 22 cantons by then). In 1979, the French-speaking canton Jura separated from the canton of Berne and constituted the 26th canton (with six half-cantons that became full cantons as of the Constitution of 1999: *Appenzell-Ausserrhoden*, *Appenzell-Innerrhoden*, *Basel-Stadt*, *Basel-Landschaft*, *Nidwalden*, and *Obwalden*).

Figure 2: *Import Transactions Share by Postcode and Origin*



*Data sources:* Swiss Federal Customs Administration 2006–2011 and 1990 Census, Swiss Federal Statistical Office. The figures represent the share of import transactions with German-speaking countries, France, Italy, and the rest of the world in total import transactions (averaged over all import transactions between the years 2006 and 2011) by postcode and country of origin in %. Bold red lines represent language borders, thin lines indicate postcode regions. German-speaking countries refers to Germany and Austria.

Table 1a: *Descriptive Statistics About Imports by Native Language Region*

Characteristics of regions at the German-French language border within Switzerland												
Swiss officially German-speaking regions												
Distance to language border in kilometers	% imports from			% transactions from			% imports from			% transactions from		
	German-speaking countries	French-speaking countries	German-speaking countries	German-speaking countries	French-speaking countries	German-speaking countries	German-speaking countries	French-speaking countries	German-speaking countries	French-speaking countries	German-speaking countries	
All regional units												
0-1	39.0	11.9	37.4	5.6	35.4	13.9	29.5	15.0	15.0	15.0	15.0	
1-2	34.4	8.5	39.1	8.2	39.7	22.0	33.8	22.0	33.8	16.4	16.4	
2-5	44.0	6.8	41.4	5.0	32.9	24.8	28.8	24.8	28.8	22.7	22.7	
5-10	47.8	8.0	45.4	5.8	28.5	23.0	28.9	23.0	28.9	20.5	20.5	
10-20	51.7	6.5	49.9	4.2	30.6	28.8	27.2	28.8	27.2	24.2	24.2	
20-50	52.8	5.8	50.2	4.2	25.4	32.3	23.4	32.3	23.4	25.0	25.0	
All	52.0	6.1	49.0	4.2	27.8	29.6	25.4	29.6	25.4	23.8	23.8	
Regional units within cantons through which intranational FR/DE language border runs												
0-1	40.2	12.0	39.1	4.3	36.6	15.0	29.5	15.0	29.5	16.0	16.0	
1-2	30.2	10.5	32.3	9.9	44.0	25.8	30.4	25.8	30.4	19.3	19.3	
2-5	41.8	7.1	38.2	5.4	31.0	25.2	26.3	25.2	26.3	23.4	23.4	
5-10	47.2	7.4	44.0	5.4	27.5	22.3	26.3	22.3	26.3	21.2	21.2	
10-20	50.4	6.5	48.5	4.3	31.8	28.0	27.7	28.0	27.7	24.1	24.1	
20-50	53.4	6.3	49.0	4.2	27.1	27.1	23.9	27.1	23.9	22.6	22.6	
All	50.6	6.8	47.1	4.5	29.8	26.0	26.0	26.0	26.0	22.5	22.5	
Characteristics of regions at the German-Italian language border within Switzerland												
Swiss officially Italian-speaking regions												
Distance to language border in kilometers	% imports from			% transactions from			% imports from			% transactions from		
	German-speaking countries	Italian-speaking countries	German-speaking countries	German-speaking countries	Italian-speaking countries	German-speaking countries	German-speaking countries	Italian-speaking countries	German-speaking countries	Italian-speaking countries	German-speaking countries	
All regional units												
0-1	36.8	55.1	24.6	58.0	21.6	68.1	12.8	68.1	12.8	63.4	63.4	
1-2	8.9	50.9	28.6	42.9	42.6	49.8	17.1	49.8	17.1	66.9	66.9	
2-5	42.5	44.2	36.0	39.6	26.6	67.9	20.0	67.9	20.0	67.7	67.7	
5-10	61.1	28.8	45.3	24.1	16.8	68.1	13.8	68.1	13.8	67.9	67.9	
10-20	51.6	25.3	42.3	27.3	17.6	67.9	16.2	67.9	16.2	62.2	62.2	
20-50	59.7	14.9	52.9	11.7	25.8	57.3	21.8	57.3	21.8	51.7	51.7	
All	52.0	10.8	49.0	9.7	24.2	60.9	19.5	60.9	19.5	57.0	57.0	
Regional units within cantons through which intranational IT/DE language border runs												
0-1	36.8	55.1	24.6	58.0	8.8	77.8	9.7	77.8	9.7	62.6	62.6	
1-2	8.9	50.9	28.6	42.9	41.0	50.5	20.7	50.5	20.7	71.2	71.2	
2-5	37.1	48.7	34.5	43.8	34.2	61.9	23.3	61.9	23.3	63.6	63.6	
5-10	55.9	36.9	44.6	31.0	13.6	84.0	6.6	84.0	6.6	88.8	88.8	
10-20	51.4	30.3	38.1	32.8	9.3	80.3	12.6	80.3	12.6	75.7	75.7	
20-50	57.9	15.4	51.7	12.1	12.8	67.1	18.9	67.1	18.9	57.9	57.9	
All	54.9	21.7	48.0	18.8	15.7	70.2	16.5	70.2	16.5	65.2	65.2	

*Data source:* Swiss Federal Customs Administration 2006–2011 (EDEC). Figures are reported in various distance intervals around internal Swiss language borders. Distance measured by road distance to the language border.

Table 1b: *Descriptive Statistics About Imports by Native Language Region (Continued)*

Characteristics of regions at the German-French language border within Switzerland											
Swiss officially German-speaking regions						Swiss officially French-speaking regions					
Distance to language border in kilometers	# products (HS 8) from German-speaking countries	# products (HS 8) from French-speaking countries	Log unit value from German-speaking countries	Log unit value from French-speaking countries	All regional units	# products (HS 8) from German-speaking countries	# products (HS 8) from French-speaking countries	Log unit value from German-speaking countries	Log unit value from French-speaking countries	Log unit value from German-speaking countries	Log unit value from French-speaking countries
0-1	271	68	5.2	5.1	223	139	5.4	5.1	4.9		
1-2	298	83	5.0	5.1	450	316	5.2	5.1	5.1		
2-5	679	192	5.4	5.1	336	223	5.1	5.1	4.9		
5-10	499	105	5.3	5.1	353	239	5.2	5.1	5.3		
10-20	487	74	5.1	4.5	209	168	5.1	5.1	5.2		
20-50	653	117	5.0	4.7	214	196	5.2	5.1	5.1		
All	542	99	5.0	4.7	238	196	5.2	5.1	5.1		
Regional units within cantons through which intranational FR/DE language border runs											
0-1	299	75	5.3	5.1	236	152	5.5	5.0	5.0		
1-2	238	89	5.0	5.0	517	362	4.9	5.0	5.0		
2-5	650	189	5.4	5.0	359	242	5.1	5.1	4.9		
5-10	495	116	5.4	5.1	292	198	5.2	5.2	5.4		
10-20	442	72	5.1	4.6	214	166	5.0	5.0	4.9		
20-50	485	78	5.0	4.6	204	182	5.1	5.1	5.0		
All	475	87	5.1	4.7	239	187	5.1	5.1	5.0		
Characteristics of regions at the German-Italian language border within Switzerland											
Swiss officially German-speaking regions						Swiss officially Italian-speaking regions					
Distance to language border in kilometers	# products (HS 8) from German-speaking countries	# products (HS 8) from Italian-speaking countries	Log unit value from German-speaking countries	Log unit value from Italian-speaking countries	All regional units	# products (HS 8) from German-speaking countries	# products (HS 8) from Italian-speaking countries	Log unit value from German-speaking countries	Log unit value from Italian-speaking countries	Log unit value from German-speaking countries	Log unit value from Italian-speaking countries
0-1	140	154	4.6	3.0	47	186	5.8	4.5	4.5		
1-2	11	11	4.6	5.8	29	58	4.7	3.1	3.1		
2-5	42	23	4.4	4.0	122	222	4.6	4.4	4.4		
5-10	271	190	4.9	3.7	91	174	4.9	4.2	4.2		
10-20	353	291	5.3	3.2	89	219	4.8	4.2	4.2		
20-50	226	62	4.8	4.3	178	344	5.0	4.2	4.2		
All	542	136	5.0	4.5	140	282	4.9	4.2	4.2		
Regional units within cantons through which intranational IT/DE language border runs											
0-1	140	154	4.6	3.0	43	200	6.3	4.5	4.5		
1-2	11	11	4.6	5.8	42	80	5.5	3.0	3.0		
2-5	42	25	4.4	3.7	93	162	4.7	4.6	4.6		
5-10	294	241	4.7	3.3	97	249	4.6	3.5	3.5		
10-20	408	355	5.5	3.4	153	419	5.0	4.1	4.1		
20-50	186	58	4.8	4.4	82	266	5.2	4.1	4.1		
All	201	99	4.8	4.2	91	266	5.2	4.1	4.1		

*Data source:* Swiss Federal Customs Administration 2006-2011 (EDEC). Figures are reported in various distance intervals around internal Swiss language borders. Distance measured by road distance to the language border.

Table 1c: *Descriptive Statistics About Imports by Native Language Region (Continued)*

Characteristics of regions at the German-French language border within Switzerland											
Swiss officially German-speaking regions						Swiss officially French-speaking regions					
Distance to language border in kilometers	Log value/transaction from German-speaking countries	Log value/transaction from French-speaking countries	Log quantity/transaction from German-speaking countries	Log quantity/transaction from French-speaking countries	Log value/transaction from German-speaking countries	Log value/transaction from French-speaking countries	Log quantity/transaction from German-speaking countries	Log quantity/transaction from French-speaking countries	Log value/transaction from German-speaking countries	Log value/transaction from French-speaking countries	Log quantity/transaction from German-speaking countries
0-1	8.0	8.5	6.3	7.0	8.4	8.1	6.8	6.6	8.1	8.4	6.6
1-2	8.3	8.2	6.3	6.5	8.1	8.4	6.5	7.4	8.4	8.4	7.4
2-5	8.2	8.3	6.5	6.6	8.5	8.4	6.9	6.9	8.4	8.4	6.9
5-10	8.5	8.5	6.9	6.9	8.3	8.4	6.8	6.8	8.4	8.4	6.8
10-20	8.2	8.3	6.7	7.0	8.1	8.3	6.7	7.0	8.3	8.3	7.0
20-50	8.3	8.3	6.8	7.1	8.2	8.4	6.5	7.3	8.4	8.4	7.3
All	8.3	8.2	6.8	6.7	8.2	8.4	6.6	7.1	8.4	8.4	7.1
Regional units within cantons through which intranational FR/DE language border runs											
0-1	7.9	8.6	6.3	6.8	8.4	8.2	6.8	6.4	8.2	8.2	6.4
1-2	8.2	8.2	6.1	6.0	8.2	8.1	7.0	7.6	8.1	8.1	7.6
2-5	8.2	8.2	6.6	6.4	8.4	8.3	6.5	6.6	8.3	8.3	6.6
5-10	8.4	8.5	6.7	6.8	8.4	8.4	6.9	7.0	8.4	8.4	7.0
10-20	8.2	8.4	6.7	7.1	8.1	8.2	6.7	7.0	8.2	8.2	7.0
20-50	8.2	8.1	6.6	7.0	8.2	8.3	6.6	7.2	8.3	8.3	7.2
All	8.2	8.2	6.6	6.9	8.2	8.3	6.7	7.0	8.3	8.3	7.0
Characteristics of regions at the German-Italian language border within Switzerland											
Swiss officially German-speaking regions						Swiss officially Italian-speaking regions					
Distance to language border in kilometers	Log value/transaction from German-speaking countries	Log value/transaction from Italian-speaking countries	Log quantity/transaction from German-speaking countries	Log quantity/transaction from Italian-speaking countries	Log value/transaction from German-speaking countries	Log value/transaction from Italian-speaking countries	Log quantity/transaction from German-speaking countries	Log quantity/transaction from Italian-speaking countries	Log value/transaction from German-speaking countries	Log value/transaction from Italian-speaking countries	Log quantity/transaction from German-speaking countries
0-1	8.6	7.4	5.9	6.8	8.2	7.8	5.7	6.6	8.2	7.8	6.6
1-2	6.2	7.5	7.2	8.8	9.4	8.1	7.1	8.4	9.4	8.1	8.4
2-5	8.2	8.6	6.0	7.6	8.6	8.5	7.3	7.2	8.6	8.5	7.3
5-10	8.6	7.7	7.0	6.3	8.2	8.1	6.2	7.1	8.2	8.1	7.1
10-20	8.6	8.4	6.7	7.9	8.0	8.3	6.7	8.2	8.0	8.3	6.7
20-50	8.2	8.0	6.9	6.0	8.3	8.3	6.4	7.4	8.3	8.3	6.4
All	8.3	8.0	6.8	5.9	8.3	8.3	6.5	7.5	8.3	8.3	6.5
Regional units within cantons through which intranational IT/DE language border runs											
0-1	8.6	7.4	5.9	6.8	7.6	7.6	4.4	6.3	7.6	7.6	6.3
1-2	6.2	7.5	7.2	8.8	9.0	8.0	6.8	8.3	9.0	8.0	8.3
2-5	8.0	8.6	5.8	7.3	8.6	8.2	6.7	6.3	8.6	8.2	6.7
5-10	8.6	8.3	7.2	7.7	8.7	7.9	7.2	6.7	8.7	7.9	7.2
10-20	8.5	8.2	6.5	7.8	8.2	8.6	6.5	8.5	8.2	8.6	6.5
20-50	8.1	8.0	6.9	5.9	7.4	8.1	5.2	7.4	7.4	8.1	5.2
All	8.1	8.0	6.7	6.3	7.9	8.1	5.8	7.4	7.9	8.1	5.8

*Data source:* Swiss Federal Customs Administration 2006–2011 (EDEC). Figures are reported in various distance intervals around internal Swiss language borders. Distance measured by road distance to the language border.

Table 2: *Number of Postcodes by Native Language Region*

Number of postcodes in French-German part	Official language		Number of postcodes in German-Italian part	Official language		
	French	German		German	Italian	Unique sum
All cantons						
Within 1km of FR/DE intranational border	16	18	Within 1km of DE/IT intranational border	3	4	41
Within 5km of FR/DE intranational border	61	59	Within 5km of DE/IT intranational border	11	12	143
Within 10km of FR/DE intranational border	109	121	Within 10km of DE/IT intranational border	19	18	267
Within 20km of FR/DE intranational border	232	259	Within 20km of DE/IT intranational border	30	32	553
Within 50km of FR/DE intranational border	561	726	Within 50km of DE/IT intranational border	120	79	1482
All	808	1993	All	1993	278	3079
Cantons through which intranational language border runs						
Within 1km of FR/DE intranational border	14	16	Within 1km of DE/IT intranational border	3	3	36
Within 5km of FR/DE intranational border	43	50	Within 5km of DE/IT intranational border	10	8	111
Within 10km of FR/DE intranational border	69	94	Within 10km of DE/IT intranational border	16	10	189
Within 20km of FR/DE intranational border	144	169	Within 20km of DE/IT intranational border	25	16	354
Within 50km of FR/DE intranational border	258	434	Within 50km of DE/IT intranational border	101	31	820
All	281	517	All	151	37	986

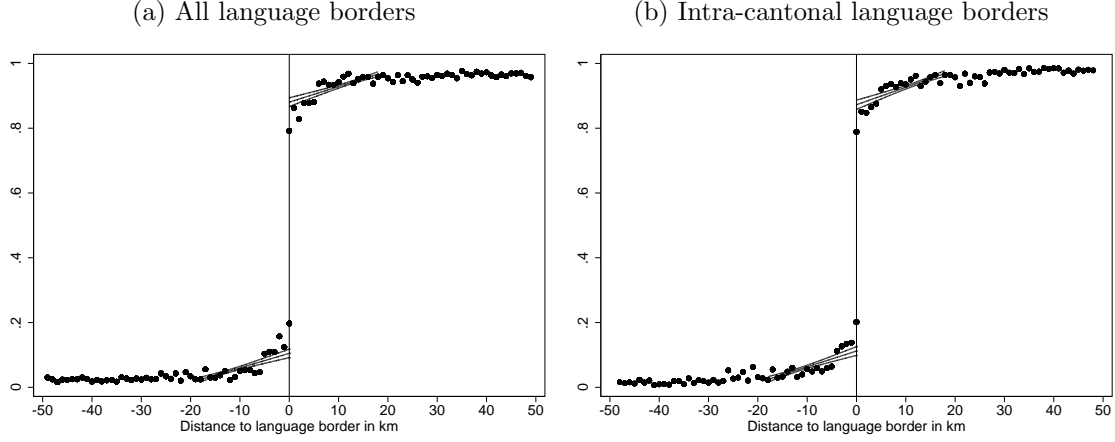
*Data source:* 1990 Census, Swiss Federal Statistical Office. Figures are reported in various distance intervals around internal Swiss language borders. Distance measured by road distance to the language border.

Table 3: *Population Shares by Native Language Region in %*

Distance bins from language border	German-French speaking language border regions				German-Italian speaking language border regions			
	German speakers		French speakers		German speakers		Italian speakers	
	DE regions	FR regions	DE regions	FR regions	DE regions	IT regions	DE regions	IT regions
Within 1km of language border	83.8	26.9	15.4	71.7	75.9	16.9	22.9	83.1
Within 5km of language border	89.3	19.6	9.5	78.9	84.9	15.1	14.4	84.4
Within 10km of language border	91.9	14.6	6.9	83.8	87.7	12.8	11.5	86.6
Within 20km of language border	95.1	9.9	3.8	88.7	88.9	9.9	10.3	89.4
Within 50km of language border	96.7	6.9	2.0	91.9	95.4	8.0	4.0	91.2
All	96.7	6.9	2.0	91.9	95.4	8.0	4.0	91.2
Within 1km of language border	87.7	29.1	11.5	69.5	75.9	21.9	22.9	78.1
Within 5km of language border	89.7	21.1	9.2	77.4	83.4	20.8	15.8	79.2
Within 10km of language border	92.3	15.9	6.6	82.4	85.5	19.9	13.6	80.0
Within 20km of language border	94.9	10.7	4.2	88.0	86.8	14.7	12.2	85.0
Within 50km of language border	96.7	7.9	2.4	91.0	94.8	12.9	4.6	86.6
Through which language border runs	96.7	7.9	2.4	91.0	94.8	12.9	4.6	86.6

*Data source:* 2000 Census, Swiss Federal Statistical Office. Figures are reported in various distance intervals around internal Swiss language borders. Distance measured by road distance to the language border.

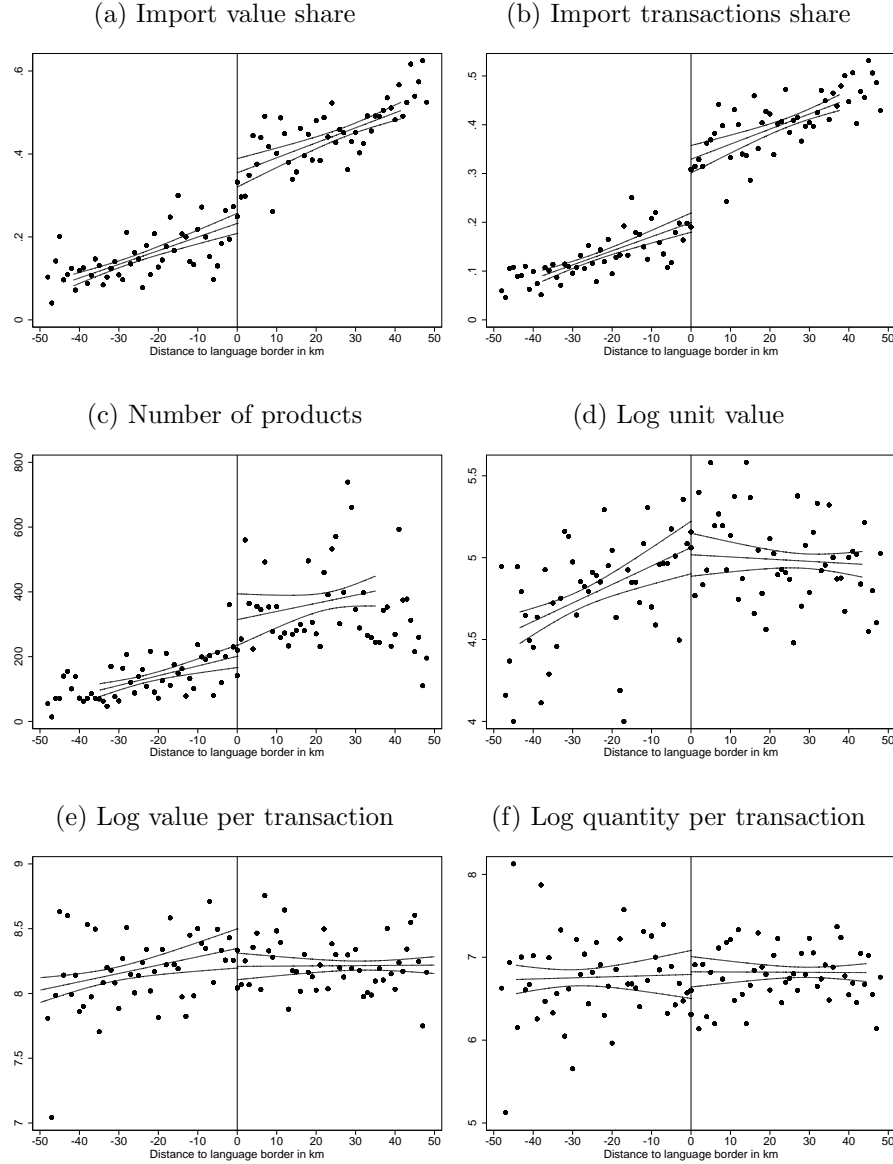
Figure 3: *Treatment Probability by Road Distance to Language Border*



*Notes:* Treatment probability for all language borders that both coincide with cantonal borders and run through cantons in left-hand side panel and intra-cantonal language borders in right-hand side panel. Shares of native language use (averaged within bins of 1 km) on the y-axis. Treated observations (common native language) to the right side of the language border (positive distance) and control observations (non-common native language) to the left side of the language border (negative distance) in all figures. The figures represent a linear prediction and a 95% confidence interval based on a triangular kernel within an optimal bandwidth for the share of native language use (18 km) estimated from all observations according to Imbens and Kalyanaraman (2012).



Figure 4: *Outcomes by Road Distance to Intra-cantonal Language Borders*



*Notes:* Outcomes (averaged within bins of 1 km) on the y-axis. Treated observations (common native language) to the right side of the language border (positive distance) and control observations (non-common native language) to the left side of the language border (negative distance) in all figures. The figures represent a linear prediction and a 95% confidence interval based on a triangular kernel within optimal bandwidths for the fuzzy RDD estimated from all observations according to Imbens and Kalyanaraman (2012). Number of products measured by HS 8 tariff lines.

Table 4: *LATE Estimates of the Impact of Common Native Language on Imports*

Common native language effect with parametric polynomial or nonparametric control function of distance	1st order	Baseline regression			Including distance to external border			
		2nd order	3rd order	Nonparam.	1st order	2nd order	3rd order	Nonparam.
		All regions to left and right of language border within the same canton						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Value share</b>								
Treatment	0.155	0.173	0.151	0.165	0.163	0.162	0.135	0.160
	(0.025)***	(0.039)***	(0.053)***	(0.032)***	(0.024)***	(0.038)***	(0.051)***	(0.032)***
Obs.	1644	1644	1644	1438	1644	1644	1644	1438
Cent. R-squ./Opt. Bandw.	0.357	0.359	0.358	42	0.397	0.397	0.397	42
<b>Transactions share</b>								
Treatment	0.179	0.196	0.229	0.196	0.186	0.186	0.215	0.190
	(0.019)***	(0.030)***	(0.041)***	(0.027)***	(0.018)***	(0.029)***	(0.039)***	(0.027)***
Obs.	1644	1644	1644	1322	1644	1644	1644	1322
Cent. R-squ./Opt. Bandw.	0.448	0.450	0.454	38	0.495	0.495	0.498	38
<b>Number of products (HS8 tariff lines)</b>								
Treatment	182.187	112.103	150.932	136.453	185.741	100.764	137.233	128.814
	(44.454)***	(69.678)	(94.138)	(61.592)**	(44.043)***	(69.314)	(93.813)	(61.431)**
Obs.	1644	1644	1644	1226	1644	1644	1644	1226
Cent. R-squ./Opt. Bandw.	0.079	0.081	0.081	35	0.091	0.095	0.094	35
<b>Log unit value</b>								
Treatment	0.051	0.172	-0.018	0.111	0.060	0.136	-0.060	0.101
	(0.136)	(0.214)	(0.289)	(0.198)	(0.135)	(0.212)	(0.287)	(0.196)
Obs.	1633	1633	1633	1478	1633	1633	1633	1478
Cent. R-squ./Opt. Bandw.	0.021	0.023	0.024	43	0.038	0.038	0.040	43
<b>Log intensive margin (value per transaction)</b>								
Treatment	-0.168	-0.177	-0.417	-0.172	-0.179	-0.170	-0.406	-0.173
	(0.115)	(0.181)	(0.245)*	(0.126)	(0.115)	(0.181)	(0.245)*	(0.126)
Obs.	1633	1633	1633	1633	1633	1633	1633	1633
Cent. R-squ./Opt. Bandw.	0.006	0.006	0.009	50	0.009	0.009	0.011	50
<b>Log quantity per transaction</b>								
Treatment	-0.095	-0.231	-0.178	-0.169	-0.144	-0.197	-0.124	-0.164
	(0.210)	(0.329)	(0.444)	(0.232)	(0.207)	(0.327)	(0.442)	(0.230)
Obs.	1633	1633	1633	1517	1633	1633	1633	1517
Cent. R-squ./Opt. Bandw.	0.001	0.002	0.004	44	0.018	0.018	0.020	44

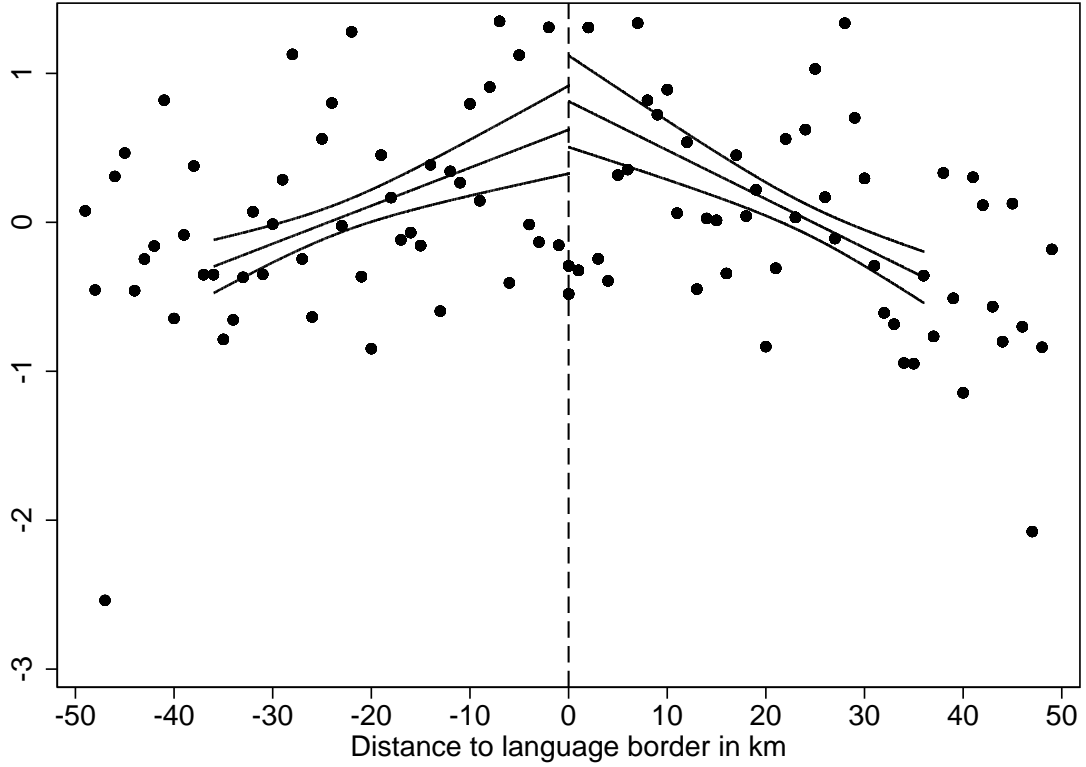
Notes: Treatment effect from instrumental variables regression. \*\*\* indicates statistical significance of parameters at 1% \*\* 5% \* 10%. The optimal bandwidth in nonparametric regressions is estimated according to Imbens and Kalyanaraman (2012). Parametric specifications are chosen according to BIC among specifications including first-order to fifth-order polynomials of road distance to intra-cantonal language borders. Imports from common language speaking bordering countries to Switzerland.

Table 5: *Testing for Jumps at Non-discontinuity Points*

Common native language effect with parametric polynomial or nonparametric control function of distance	1st order	Common language=0 2nd order	3rd order	Nonparam.	1st order	Common language=1 2nd order	3rd order	Nonparam.
		At the median of the forcing variable (road distance to language border)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Value share</b>								
Treatment	-0.538 (0.831)	1.857 (3.839)	3.814 (6.740)	-0.727 (1.236)	0.936 (0.792)	34.647 (1084.958)	-1.421 (7.145)	0.413 (2.113)
Obs.	824	824	824	802	820	820	820	717
Cent. R-squ./Opt. Bandw.	-0.060	0.071	-1.094	25	0.099	-90.227	-0.109	21
<b>Transactions share</b>								
Treatment	-0.710 (0.693)	-0.038 (2.821)	1.739 (3.424)	-0.601 (0.793)	0.179 (-0.613)	21.483 (670.756)	-2.323 (7.052)	0.175 (0.887)
Obs.	824	824	824	816	820	820	820	820
Cent. R-squ./Opt. Bandw.	-0.245	0.154	0.089	27	0.140	-54.635	-0.724	29
<b>Number of products (HS8 tariff lines)</b>								
Treatment	-125.286 (1041.900)	6.216 (5105.457)	-3953.626 (9989.780)	-75.916 (1284.763)	-2911.211 (1658.731)	374147.256 (11803281.679)*	-7082.877 (17414.828)	-10766.138 (13188.810)
Obs.	824	824	824	824	820	820	820	551
Cent. R-squ./Opt. Bandw.	0.060	0.074	-1.593	34	-0.087	-2969.228	-0.813	17
<b>Log unit value</b>								
Treatment	8.815 (5.812)	-0.076 (24.812)	-28.862 (76.148)	12.521 (21.750)	-1.167 (3.386)	74.657 (2430.823)	10.336 (34.917)	-0.820 (5.039)
Obs.	813	813	813	685	820	820	820	813
Cent. R-squ./Opt. Bandw.	-0.094	0.046	-2.9470	21	0.016	-26.386	-0.584	26
<b>Log intensive margin (value per transaction)</b>								
Treatment	2.394 (4.876)	-14.714 (30.084)	28.243 (69.527)	13.249 (21.570)	3.184 (2.849)	230.942 (7290.570)	19.339 (43.142)	-0.907 (9.630)
Obs.	813	813	813	672	820	820	820	630
Cent. R-squ./Opt. Bandw.	-0.023	-0.864	-3.374	21	-0.075	-379.169	-2.732	19
<b>Log quantity per transaction</b>								
Treatment	-3.631 (8.934)	-42.342 (71.636)	88.415 (201.568)	40.274 (75.577)	7.518 (4.906)	-578.728 (18245.809)	82.108 (157.828)	17.872 (17.815)
Obs.	813	813	813	598	820	820	820	695
Cent. R-squ./Opt. Bandw.	0.001	-2.074	-9.693	18	-0.068	-796.345	-15.726	21
At a road distance of 15 km from the language border								
<b>Value share</b>								
Treatment	0.886 (0.769)	-1.321 (3.479)	-1.371 (1.950)	2.142 (2.241)	1.188 (0.939)	-6.153 (27.491)	2.588 (3.287)	0.712 (1.485)
Obs.	824	824	824	627	820	820	820	644
Cent. R-squ./Opt. Bandw.	0.228	-0.447	-0.479	21	0.080	-3.117	-0.237	22
<b>Transactions share</b>								
Treatment	-0.135 (0.635)	-0.150 (2.099)	-0.328 (1.221)	1.208 (4.076)	0.303 (0.715)	-3.362 (17.148)	1.522 (2.348)	0.064 (1.482)
Obs.	824	824	824	542	820	820	820	595
Cent. R-squ./Opt. Bandw.	0.111	0.111	0.022	16	0.148	-1.556	-0.007	19
<b>Number of products (HS8 tariff lines)</b>								
Treatment	301.643 (1109.753)	-5032.300 (7217.410)	-994.719 (2236.684)	-12158.152 (55368.949)	-1960.754 (1877.175)	-30463.403 (113746.229)	139.997 (-5598.573)	5470.882 (11395.793)
Obs.	824	824	824	476	820	820	820	339
Cent. R-squ./Opt. Bandw.	0.093	-2.512	-0.097	14	-0.011	-18.387	0.012	10
<b>Log unit value</b>								
Treatment	2.138 (5.882)	18.408 (26.896)	6.600 (10.782)	-11.017 (10.434)	5.187 (4.316)	41.433 (168.426)	-2.733 (11.987)	8.877 (14.897)
Obs.	813	813	813	603	820	820	820	544
Cent. R-squ./Opt. Bandw.	0.055	-0.773	0.000	20	-0.162	-8.241	0.016	16
<b>Log intensive margin (value per transaction)</b>								
Treatment	1.512 (5.260)	-21.774 (30.004)	-16.012 (13.319)	-23.053 (31.202)	7.751 (3.878)**	-25.093 (102.153)	5.430 (10.711)	9.389 (7.653)
Obs.	813	813	813	382	820	820	820	603
Cent. R-squ./Opt. Bandw.	-0.005	-1.933	-1.029	11	-0.448	-4.246	-0.213	19
<b>Log quantity per transaction</b>								
Treatment	-7.758 (9.961)	-12.626 (34.927)	-19.263 (20.483)	-2.255 (14.152)	3.911 (5.503)	-76.164 (295.829)	21.778 (23.845)	0.853 (11.716)
Obs.	813	813	813	646	820	820	820	589
Cent. R-squ./Opt. Bandw.	-0.048	-0.156	-0.396	22	0.024	-13.732	-1.013	18

Notes: Treatment effect from instrumental variables regression. \*\*\* indicates statistical significance of parameters at 1% \*\* 5% \* 10%. Regressions include distance to external border. The optimal bandwidth in nonparametric regressions is estimated according to Imbens and Kalyanaraman (2012). Parametric specifications include first-order to third-order polynomials of road distance. Artificial breakpoint at median of forcing variable: 23 km from true language border. The sample is based on regions to the left and right of the language border within the same canton.

Figure 5: *Average Swiss Postcode Fixed Effects*



*Notes:* Mean-normalised fixed effects averaged within road distance bins of 1 km within 50 km from the language border from PPML gravity regressions of import value on fixed postcode and country of origin effects, log bilateral distance and common native language. Sample from intra-cantonal language borders (821 postcodes and 4 neighbouring countries of origin). Treated observations (common native language) to the right-hand side of the language border (positive distance) and control observations (non-common native language) to the left-hand side of the language border (negative distance) in all figures. The figure represents a linear prediction and a 95% confidence interval based on a triangular kernel within an optimal bandwidth for mean-normalised fixed effects (36 km) estimated from all observations according to Imbens and Kalyanaraman (2012).

Table 6: *LATE Estimates by Language Border Region*

CNL effect with parametric polynomial or nonparametric control function of distance	French-German speaking regions only				Italian-German speaking regions only			
	1st order (1)	2nd order (2)	3rd order (3)	Nonparam. (4)	1st order (5)	2nd order (6)	3rd order (7)	Nonparam. (8)
<b>Value share</b>								
Treatment	0.161 (0.023)***	0.142 (0.037)***	0.099 (0.051)**	0.149 (0.028)***	0.370 (0.096)***	0.298 (0.135)**	0.303 (0.161)*	0.287 (0.115)**
Obs.	1388	1388	1388	1186	268	268	268	246
Cent. R-squ./Opt. Bandw.	0.444	0.443	0.445	39	0.488	0.486	0.487	47
<b>Transactions share</b>								
Treatment	0.185 (0.017)***	0.169 (0.027)***	0.191 (0.037)***	0.181 (0.022)***	0.300 (0.075)***	0.223 (0.106)**	0.270 (0.125)**	0.285 (0.085)***
Obs.	1388	1388	1388	1110	268	268	268	232
Cent. R-squ./Opt. Bandw.	0.579	0.580	0.583	36	0.556	0.548	0.558	45
<b>Number of products (HS8 tariff lines)</b>								
Treatment	190.772 (49.006)***	97.843 (76.982)	188.671 (106.299)*	139.502 (68.616)**	73.569 (107.391)	81.550 (151.500)	-0.206 (172.632)	105.884 (107.370)
Obs.	1388	1388	1388	1072	268	268	268	268
Cent. R-squ./Opt. Bandw.	0.097	0.101	0.103	34	0.079	0.080	0.153	50
<b>Log unit value</b>								
Treatment	0.014 (0.142)	0.180 (0.223)	0.121 (0.308)	0.123 (0.214)	-0.335 (0.497)	-0.141 (0.702)	-1.184 (0.826)	-0.023 (0.621)
Obs.	1385	1385	1385	1158	260	260	260	260
Cent. R-squ./Opt. Bandw.	0.034	0.036	0.038	39	0.088	0.095	0.118	50
<b>Log intensive margin (value per transaction)</b>								
Treatment	-0.189 (0.119)	-0.122 (0.188)	-0.454 (0.259)*	-0.165 (0.129)	0.181 (0.473)	-0.047 (0.667)	-0.086 (0.786)	-0.132 (0.471)
Obs.	1385	1385	1385	1377	260	260	260	260
Cent. R-squ./Opt. Bandw.	0.011	0.012	0.014	49	0.009	0.021	0.045	50
<b>Log quantity per transaction</b>								
Treatment	0.004 (0.215)	-0.007 (0.339)	-0.218 (0.468)	-0.023 (0.235)	0.005 (0.808)	-1.362 (1.134)	0.082 (1.311)	-0.677 (1.002)
Obs.	1385	1385	1385	1310	260	260	260	133
Cent. R-squ./Opt. Bandw.	0.027	0.027	0.028	45	0.076	0.093	0.148	34

Notes: Treatment effect from instrumental variables regression. \*\*\* indicates statistical significance of parameters at 1% \*\* 5% \* 10%. Regressions include distance to external border. The optimal bandwidth in nonparametric regressions is estimated according to Imbens and Kalyanaraman (2012). Parametric specifications include first-order to third-order polynomials of road distance. The sample is based on regions to the left and right of the language border within the same canton.

Table 7: *LATE Estimates in Different Quartiles of the Distribution of the Dependent Variables*

CNL effect with parametric polynomial or nonparametric control function of distance	Effects across quartiles of the respective dependent variable							
	1st order	2nd order	3rd order	Nonparam.	1st order	2nd order	3rd order	Nonparam.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1st Quartile				2nd Quartile			
<b>Value share</b>								
Treatment	0.316	0.308	0.343	0.317	0.284	0.302	0.360	0.313
Obs.	(0.025)***	(0.040)***	(0.055)***	(0.038)***	(0.026)***	(0.042)***	(0.057)***	(0.042)***
Cent. R-squ./Opt. Bandw.	1592	1592	1592	1186	1594	1594	1594	1084
	0.604	0.604	0.606	34	0.595	0.596	0.600	31
<b>Transactions share</b>								
Treatment	0.307	0.279	0.319	0.295	0.283	0.286	0.332	0.295
Obs.	(0.024)***	(0.038)***	(0.052)***	(0.034)***	(0.026)***	(0.042)***	(0.057)***	(0.040)***
Cent. R-squ./Opt. Bandw.	1592	1592	1592	1292	1594	1594	1594	1158
	0.617	0.616	0.619	38	0.597	0.597	0.600	33
<b>Number of products (HS8 tariff lines)</b>								
Treatment	47.866	10.504	32.734	27.309	100.570	44.177	66.375	62.869
Obs.	(14.221)***	(22.442)	(30.969)	(20.687)	(25.303)***	(40.066)	(54.714)	(36.218)*
Cent. R-squ./Opt. Bandw.	1592	1592	1592	1051	1594	1594	1594	1148
	0.062	0.069	0.069	30	0.078	0.084	0.083	33
<b>Log unit value</b>								
Treatment	0.247	0.140	0.175	0.199	0.060	0.132	0.237	0.093
Obs.	(0.092)***	(0.146)	(0.202)	(0.110)*	(0.087)	(0.138)	(0.189)	(0.124)
Cent. R-squ./Opt. Bandw.	1581	1581	1581	1427	1583	1583	1583	1534
	0.049	0.048	0.049	43	0.002	0.004	0.004	47
<b>Log intensive margin (value per transaction)</b>								
Treatment	0.156	0.175	0.233	0.180	-0.024	0.023	0.036	0.016
Obs.	(0.050)***	(0.079)**	(0.109)**	(0.055)***	(0.022)	(0.035)	(0.048)	(0.029)
Cent. R-squ./Opt. Bandw.	1581	1581	1581	1324	1583	1583	1583	1099
	0.097	0.098	0.101	39	0.013	0.015	0.015	32
<b>Log quantity per transaction</b>								
Treatment	-0.079	0.056	0.091	0.008	-0.023	-0.374	-0.277	-0.253
Obs.	(0.121)	(0.190)	(0.263)	(0.170)	(0.166)	(0.264)	(0.360)	(0.233)
Cent. R-squ./Opt. Bandw.	1581	1581	1581	1311	1583	1583	1583	1041
	0.022	0.027	0.028	39	0.045	0.046	0.047	30
	3rd Quartile				4th Quartile			
<b>Value share</b>								
Treatment	0.329	0.334	0.401	0.344	0.248	0.232	0.198	0.238
Obs.	(0.027)***	(0.043)***	(0.058)***	(0.042)***	(0.029)***	(0.046)***	(0.062)***	(0.038)***
Cent. R-squ./Opt. Bandw.	1594	1594	1594	1213	1603	1603	1603	1453
	0.553	0.553	0.558	36	0.467	0.466	0.465	43
<b>Transactions share</b>								
Treatment	0.326	0.329	0.398	0.340	0.284	0.276	0.282	0.280
Obs.	(0.027)***	(0.042)***	(0.057)***	(0.042)***	(0.026)***	(0.042)***	(0.057)***	(0.037)***
Cent. R-squ./Opt. Bandw.	1594	1594	1594	1213	1603	1603	1603	1356
	0.562	0.562	0.567	36	0.494	0.494	0.495	40
<b>Number of products (HS8 tariff lines)</b>								
Treatment	105.042	55.472	76.566	72.361	74.995	37.282	51.753	50.289
Obs.	(27.966)***	(44.094)	(59.814)	(38.324)*	(21.914)***	(34.615)	(46.063)	(29.459)*
Cent. R-squ./Opt. Bandw.	1594	1594	1594	1206	1603	1603	1603	1201
	0.066	0.069	0.069	35	0.052	0.056	0.055	35
<b>Log unit value</b>								
Treatment	0.147	0.214	0.152	0.202	-0.058	-0.165	-0.281	-0.092
Obs.	(0.151)	(0.238)	(0.323)	(0.187)	(0.233)	(0.368)	(0.500)	(0.284)
Cent. R-squ./Opt. Bandw.	1583	1583	1583	1352	1590	1590	1590	1590
	0.055	0.057	0.057	40	0.061	0.061	0.062	50
<b>Log intensive margin (value per transaction)</b>								
Treatment	-0.013	0.004	0.015	-0.006	-0.088	-0.133	-0.234	-0.104
Obs.	(0.024)	(0.038)	(0.051)	(0.024)	(0.076)	(0.121)	(0.164)	(0.084)
Cent. R-squ./Opt. Bandw.	1583	1583	1583	1583	1592	1592	1592	1592
	0.039	0.043	0.044	50	0.037	0.037	0.036	50
<b>Log quantity per transaction</b>								
Treatment	0.304	0.203	0.348	0.247	-0.034	-0.113	0.087	-0.066
Obs.	(0.208)	(0.329)	(0.446)	(0.258)	(0.160)	(0.253)	(0.344)	(0.181)
Cent. R-squ./Opt. Bandw.	1583	1583	1583	1291	1590	1590	1590	1502
	0.051	0.051	0.053	38	0.004	0.005	0.008	45

Notes: Treatment effect from instrumental variables regression. \*\*\* indicates statistical significance of parameters at 1% \*\* 5% \* 10%. Regressions include distance to external border. The optimal bandwidth in nonparametric regressions is estimated according to Imbens and Kalyanaraman (2012). Parametric specifications include first-order to third-order polynomials of road distance. The sample is based on regions to the left and right of the language border within the same canton.

Table 8: *Sensitivity of LATE Estimates Eliminating Different Choices of Distance Windows Around Language Borders*

Table 8: Sensitivity of LATE estimates of the impact of common native language on imports eliminating different choices of distance windows around language borders

CNL effect with parametric polynomial or nonparametric control function of distance	At 2 km from baseline threshold				At 5 km from baseline threshold			
	1st order (1)	2nd order (2)	3rd order (3)	Nonparam. (4)	1st order (5)	2nd order (6)	3rd order (7)	Nonparam. (8)
<b>Value share</b>								
Treatment	0.197 (0.024)***	0.218 (0.037)***	0.216 (0.050)***	0.212 (0.032)***	0.223 (0.024)***	0.258 (0.036)***	0.286 (0.046)***	0.255 (0.033)***
Obs.	1532	1532	1532	1150	1422	1422	1422	988
Cent. R-squ./Opt. Bandw.	0.420	0.421	0.422	34	0.435	0.437	0.440	29
<b>Transactions share</b>								
Treatment	0.201 (0.018)***	0.202 (0.029)***	0.239 (0.038)***	0.203 (0.023)***	0.220 (0.018)***	0.222 (0.027)***	0.268 (0.035)***	0.222 (0.027)***
Obs.	1532	1532	1532	1392	1422	1422	1422	1316
Cent. R-squ./Opt. Bandw.	0.516	0.516	0.520	42	0.534	0.534	0.539	40
<b>Number of products (HS8 tariff lines)</b>								
Treatment	214.427 (44.586)***	143.449 (69.864)**	200.119 (94.414)**	171.996 (64.648)***	219.754 (43.336)***	136.604 (65.867)**	163.858 (85.414)*	159.414 (51.504)***
Obs.	1532	1532	1532	1212	1422	1422	1422	1032
Cent. R-squ./Opt. Bandw.	0.095	0.098	0.099	36	0.101	0.104	0.104	31
<b>Log unit value</b>								
Treatment	0.159 (0.132)	0.370 (0.207)*	0.327 (0.280)	0.323 (0.205)	0.179 (0.131)	0.421 (0.199)**	0.468 (0.257)*	0.385 (0.227)*
Obs.	1521	1521	1521	1137	1412	1412	1412	1030
Cent. R-squ./Opt. Bandw.	0.039	0.041	0.044	34	0.040	0.042	0.048	31
<b>Log intensive margin (value per transaction)</b>								
Treatment	-0.109 (0.115)	-0.018 (0.181)	-0.189 (0.245)	-0.067 (0.126)	-0.071 (0.115)	0.075 (0.175)	-0.014 (0.227)	0.005 (0.133)
Obs.	1521	1521	1521	1433	1412	1412	1412	1199
Cent. R-squ./Opt. Bandw.	0.009	0.011	0.012	44	0.010	0.013	0.015	36
<b>Log quantity per transaction</b>								
Treatment	-0.140 (0.208)	-0.208 (0.327)	-0.127 (0.442)	-0.168 (0.217)	-0.132 (0.209)	-0.201 (0.318)	-0.123 (0.412)	-0.168 (0.212)
Obs.	1521	1521	1521	1409	1412	1412	1412	1324
Cent. R-squ./Opt. Bandw.	0.017	0.017	0.019	43	0.019	0.020	0.020	41
Value share	At 10 km from baseline threshold				At 15 km from baseline threshold			
	1st order	2nd order	3rd order	Nonparam.	1st order	2nd order	3rd order	Nonparam.
Treatment	0.238 (0.024)***	0.253 (0.036)***	0.266 (0.046)***	0.245 (0.028)***	0.255 (0.025)***	0.245 (0.038)***	0.227 (0.048)***	0.254 (0.028)***
Obs.	1266	1266	1266	1224	1110	1110	1110	1110
Cent. R-squ./Opt. Bandw.	0.450	0.453	0.453	38	0.469	0.471	0.471	38
<b>Transactions share</b>								
Treatment	0.232 (0.018)***	0.206 (0.027)***	0.218 (0.034)***	0.221 (0.024)***	0.266 (0.019)***	0.235 (0.028)***	0.237 (0.036)***	0.253 (0.026)***
Obs.	1266	1266	1266	1076	1110	1110	1110	864
Cent. R-squ./Opt. Bandw.	0.555	0.555	0.556	32	0.581	0.580	0.581	26
<b>Number of products (HS8 tariff lines)</b>								
Treatment	232.906 (45.376)***	127.466 (68.007)*	94.276 (85.461)	138.602 (56.012)**	281.909 (48.093)***	198.910 (72.514)***	125.670 (92.170)	218.204 (67.227)***
Obs.	1266	1266	1266	866	1110	1110	1110	854
Cent. R-squ./Opt. Bandw.	0.100	0.106	0.107	26	0.106	0.110	0.113	25
<b>Log unit value</b>								
Treatment	0.139 (0.129)	0.348 (0.195)*	0.453 (0.245)*	0.311 (0.175)*	0.124 (0.133)	0.321 (0.200)	0.583 (0.254)**	0.278 (0.168)
Obs.	1256	1256	1256	957	1101	1101	1101	871
Cent. R-squ./Opt. Bandw.	0.039	0.043	0.047	29	0.038	0.047	0.049	26
<b>Log intensive margin (value per transaction)</b>								
Treatment	-0.076 (0.120)	0.088 (0.181)	0.044 (0.228)	-0.003 (0.145)	-0.141 (0.123)	-0.081 (0.186)	-0.232 (0.236)	-0.118 (0.119)
Obs.	1256	1256	1256	999	1101	1101	1101	1060
Cent. R-squ./Opt. Bandw.	0.008	0.010	0.011	30	0.007	0.007	0.008	33
<b>Log quantity per transaction</b>								
Treatment	-0.144 (0.219)	-0.274 (0.330)	-0.303 (0.415)	-0.227 (0.224)	-0.062 (0.228)	-0.184 (0.344)	-0.305 (0.437)	-0.118 (0.224)
Obs.	1256	1256	1256	1198	1101	1101	1101	1092
Cent. R-squ./Opt. Bandw.	0.022	0.023	0.023	37	0.019	0.020	0.020	35

Notes: Treatment effect from instrumental variables regression. \*\*\* indicates statistical significance of parameters at 1% \*\* 5% \* 10%. The optimal bandwidth in nonparametric regressions is estimated according to Imbens and Kalyanaraman (2012). Parametric specifications include first-order to third-order polynomials of road distance. The sample is based on regions to the left and right of the language border within the same canton. All estimates include distance to the external border as a covariate.

Table 9: *LATE Estimates according to Rauch Goods Classification*

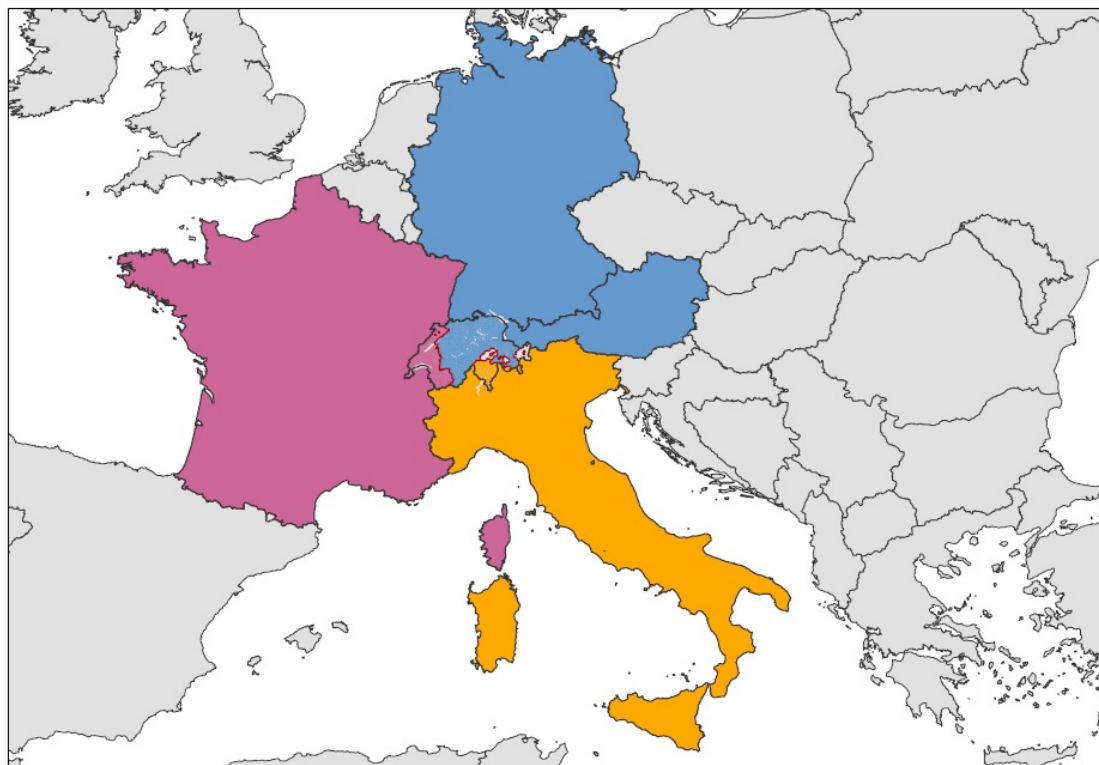
Common native language effect with parametric polynomial control function of distance	Effects across Rauch classified goods categories								
	homogenous goods			reference priced goods			differentiated goods		
	1st order (1)	2nd order (2)	3rd order (3)	1st order (4)	2nd order (5)	3rd order (6)	1st order (7)	2nd order (8)	3rd order (9)
<b>Value share</b>									
Treatment	0.094 (0.062)	0.109 (0.100)	0.075 (0.140)	0.153 (0.034)***	0.149 (0.053)***	0.150 (0.071)**	0.165 (0.025)***	0.156 (0.040)***	0.141 (0.054)***
Obs.	869	869	869	1529	1529	1529	1629	1629	1629
Cent. R-squ./Opt. Bandw.	0.098	0.099	0.098	0.190	0.191	0.191	0.400	0.400	0.399
<b>Transactions share</b>									
Treatment	0.136 (0.055)**	0.122 (0.089)	0.094 (0.124)	0.143 (0.026)***	0.144 (0.042)***	0.156 (0.056)***	0.200 (0.020)***	0.219 (0.031)***	0.251 (0.042)***
Obs.	869	869	869	1529	1529	1529	1629	1629	1629
Cent. R-squ./Opt. Bandw.	0.150	0.151	0.149	0.212	0.213	0.213	0.482	0.483	0.487
<b>Number of products (HS8 tariff lines)</b>									
Treatment	2.065 (1.906)	-0.499 (3.073)	0.630 (4.309)	20.773 (7.139)***	9.354 (11.215)	12.645 (15.190)	121.627 (27.872)***	68.631 (43.803)	94.035 (59.257)
Obs.	869	869	869	1529	1529	1529	1629	1629	1629
Cent. R-squ./Opt. Bandw.	0.029	0.034	0.034	0.046	0.049	0.049	0.093	0.097	0.096
<b>Log unit value</b>									
Treatment	-0.001 (0.423)	-0.673 (0.684)	-1.283 (0.958)	0.256 (0.220)	0.536 (0.345)	0.813 (0.467)*	-0.013 (0.121)	0.030 (0.190)	-0.074 (0.257)
Obs.	855	855	855	1517	1517	1517	1618	1618	1618
Cent. R-squ./Opt. Bandw.	0.082	0.084	0.087	0.094	0.096	0.098	0.014	0.015	0.015
<b>Log intensive margin (value per transaction)</b>									
Treatment	-0.249 (0.305)	-0.307 (0.492)	-0.566 (0.690)	0.007 (0.169)	0.202 (0.266)	0.064 (0.360)	-0.140 (0.122)	-0.242 (0.191)	-0.344 (0.259)
Obs.	858	858	858	1518	1518	1518	1618	1618	1618
Cent. R-squ./Opt. Bandw.	0.011	0.013	0.014	0.012	0.012	0.014	0.019	0.019	0.020
<b>Log intensive margin (value per transaction)</b>									
Treatment	-0.136 (0.535)	0.048 (0.863)	0.634 (1.212)	0.358 (0.311)	0.149 (0.489)	-0.115 (0.662)	0.035 (0.218)	-0.085 (0.344)	0.430 (0.464)
Obs.	855	855	855	1517	1517	1517	1618	1618	1618
Cent. R-squ./Opt. Bandw.	0.026	0.028	0.027	0.049	0.051	0.052	0.038	0.038	0.043

Notes: Treatment effect from instrumental variables regression. \*\*\* indicates statistical significance of parameters at 1% \*\* 5% \* 10%. Regressions include distance to external border. Liberal Rauch Goods Classification (matching data source: <http://www.freit.org/Resources.html>). Homogeneous goods refer to goods traded on an organized exchange. Parametric specifications include first-order to third-order polynomials of road distance. The sample is based on regions to the left and right of the language border within the same canton.



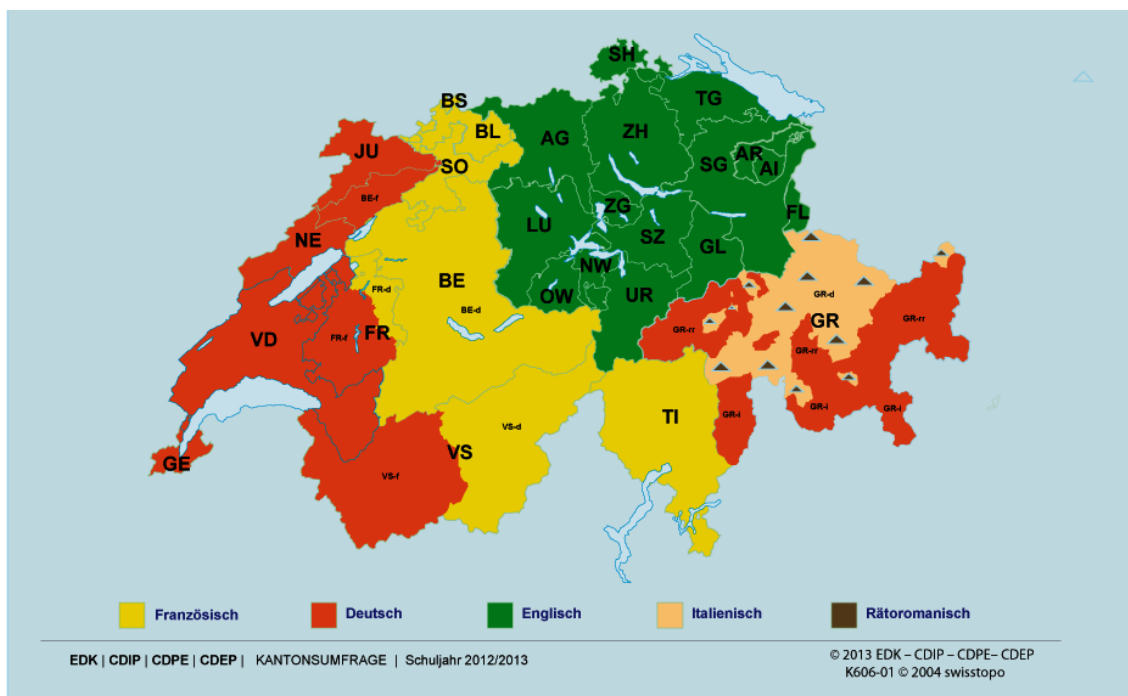
## Appendix A: Additional figures and tables

Figure A1: *Language Regions in Switzerland and Neighbouring Countries by Native Language Majority*



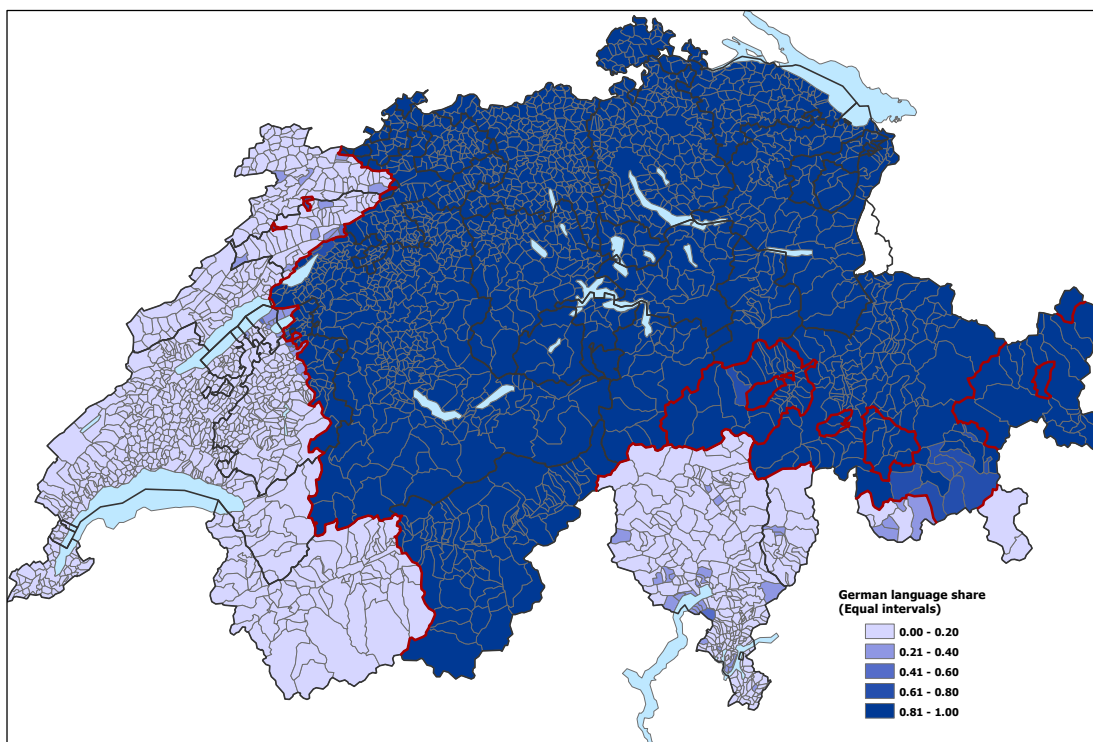
*Data sources:* Wikipedia; 1990 Census, Swiss Federal Statistical Office.

Figure A2: *Languages Taught in School in Switzerland*



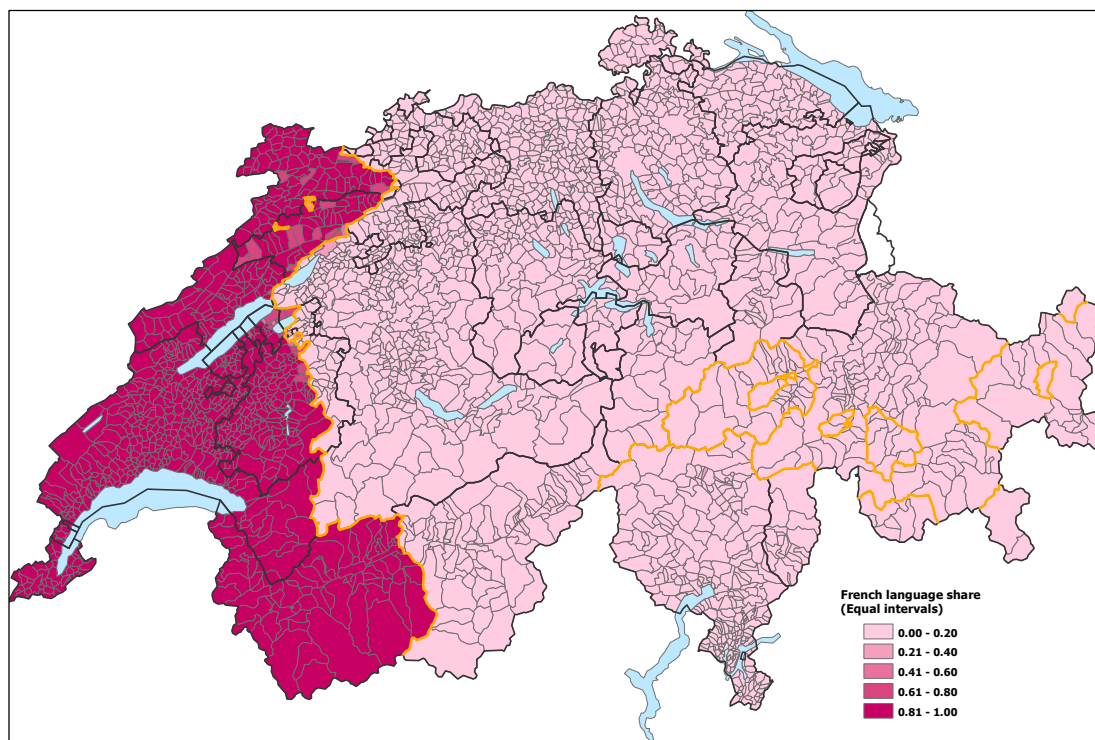
*Data source:* EDK Swiss Conference of Cantonal Ministers of Education. The map refers to the second language – the first language being the native language of the local majority – taught in school. French-speaking region teach German (red) as the second language, Ticino teaches French (yellow) as the second language, Graubünden teaches one of the three languages – German, Italian (peach), or Romansh (brown) – as the second language, and the following six of the 21 (mostly) German-speaking cantons teach French as the second language: Bern, Basel-Landschaft, Basel Stadt, Fribourg, Solothurn, and Valais. The other cantons teach English (green) as the second language.

Figure A3: *Share of German-speaking Population and Swiss Language Borders*



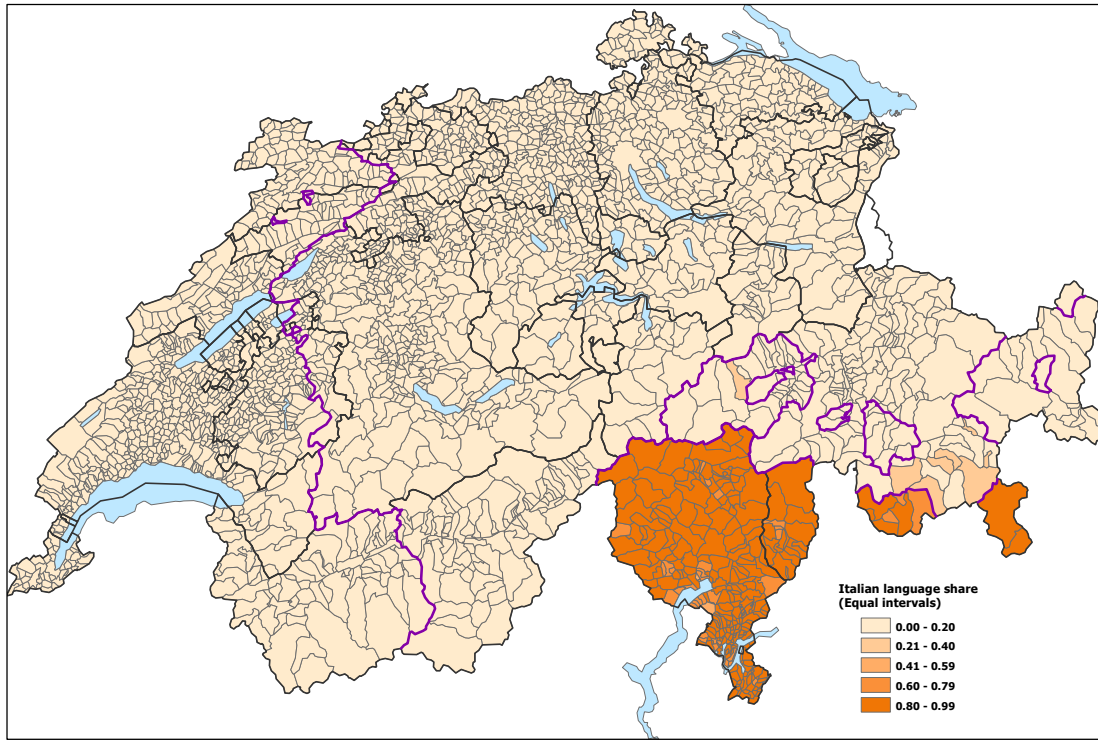
*Data source:* 2000 Census, Swiss Federal Statistical Office (cantonal survey for school year 2012/2013). Thin lines represent municipality borders, bold lines indicate cantonal and national borders and yellow lines indicate language borders according to the official 50% rule. The figure shows the share of German-speaking population in the total of the German, French, and Italian speaking population.

Figure A4: *Share of French-speaking Population and Swiss Language Borders*



*Data source:* 2000 Census, Swiss Federal Statistical Office. Thin lines represent municipality borders, bold lines indicate cantonal and national borders and yellow lines indicate language borders according to the official 50% rule. The figure shows the share of French-speaking population in the total of the German, French, and Italian speaking population.

Figure A5: *Share of Italian-speaking Population and Swiss Language Borders*



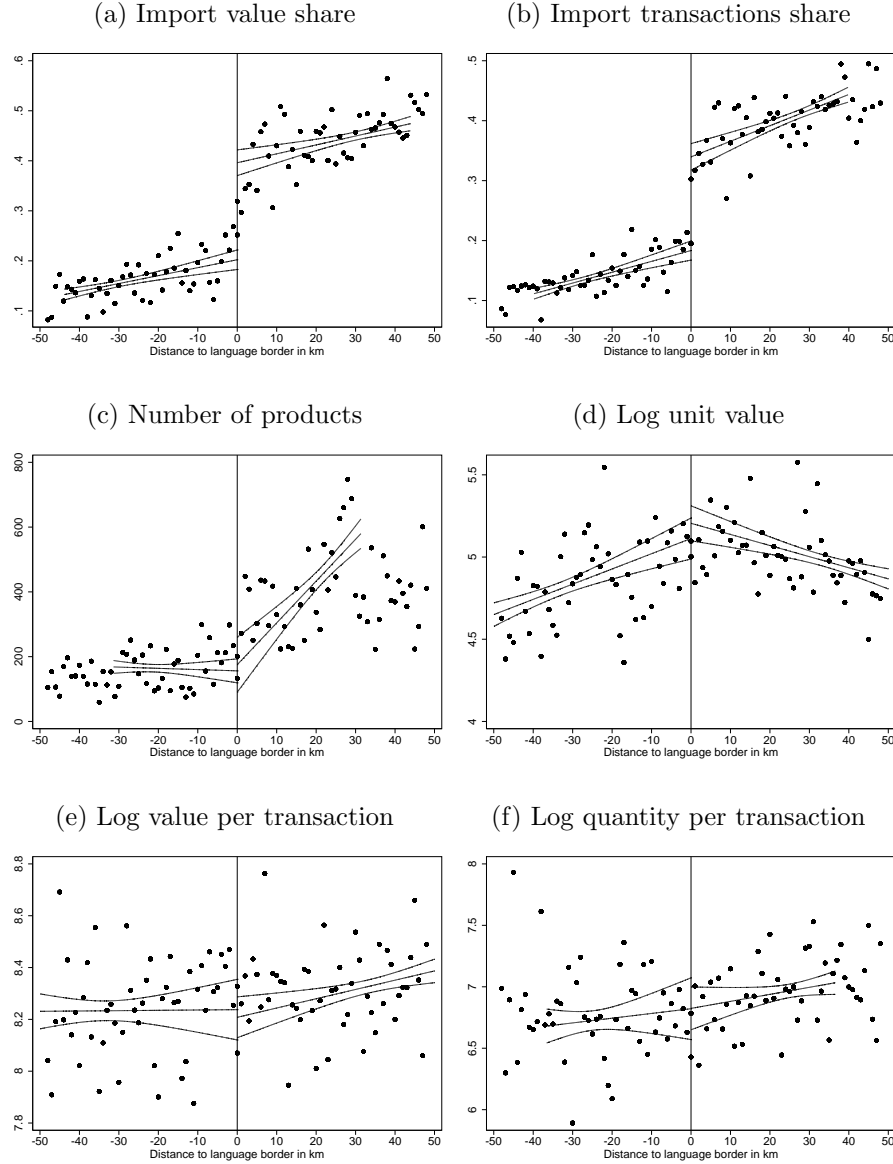
*Data source:* 2000 Census, Swiss Federal Statistical Office. Thin lines represent municipality borders, bold lines indicate cantonal and national borders and purple lines indicate language borders according to the official 50% rule. The figure shows the share of Italian-speaking population in the total of the German, French, and Italian speaking population.

Table A1: *LATE Estimates of the Impact of Common Native Language on Imports (All Language Borders)*

Common native language effect with parametric polynomial or nonparametric control function of distance	Baseline regression				Including distance to external border			
	1st order	2nd order	3rd order	Nonparam.	1st order	2nd order	3rd order	Nonparam.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Value share</b>								
Treatment	0.187	0.177	0.126	0.180	0.194	0.182	0.128	0.186
	(0.019)***	(0.032)***	(0.045)***	(0.025)***	(0.019)***	(0.031)***	(0.044)***	(0.025)***
Obs.	2968	2968	2968	2630	2968	2968	2968	2630
Cent. R-squ./Opt. Bandw.	0.339	0.338	0.334	44	0.383	0.382	0.379	44
<b>Transactions share</b>								
Treatment	0.202	0.195	0.181	0.197	0.209	0.200	0.184	0.202
	(0.015)***	(0.025)***	(0.036)***	(0.022)***	(0.014)***	(0.024)***	(0.034)***	(0.022)***
Obs.	2968	2968	2968	2358	2968	2968	2968	2358
Cent. R-squ./Opt. Bandw.	0.413	0.413	0.412	40	0.466	0.465	0.464	40
<b>Number of products (HS8 tariff lines)</b>								
Treatment	186.403	77.115	78.159	103.170	184.450	84.690	89.714	108.336
	(40.598)***	(67.161)	(94.809)	(53.849)*	(40.404)***	(67.034)	(94.828)	(52.905)**
Obs.	2968	2968	2968	1856	2968	2968	2968	1856
Cent. R-squ./Opt. Bandw.	0.074	0.078	0.078	31	0.079	0.083	0.083	31
<b>Log unit value</b>								
Treatment	0.086	0.061	-0.144	0.077	0.089	0.087	-0.109	0.089
	(0.109)	(0.181)	(0.255)	(0.140)	(0.108)	(0.180)	(0.255)	(0.140)
Obs.	2954	2954	2954	2954	2954	2954	2954	2954
Cent. R-squ./Opt. Bandw.	0.010	0.011	0.011	50	0.020	0.021	0.021	50
<b>Log intensive margin (value per transaction)</b>								
Treatment	-0.052	-0.079	-0.229	-0.063	-0.066	-0.081	-0.223	-0.069
	(0.089)	(0.148)	(0.208)	(0.100)	(0.089)	(0.147)	(0.208)	(0.100)
Obs.	2954	2954	2954	2954	2954	2954	2954	2954
Cent. R-squ./Opt. Bandw.	0.002	0.003	0.004	50	0.009	0.010	0.011	50
<b>Log quantity per transaction</b>								
Treatment	0.018	-0.249	-0.273	-0.171	-0.022	-0.254	-0.257	-0.177
	(0.160)	(0.266)	(0.375)	(0.208)	(0.159)	(0.264)	(0.373)	(0.208)
Obs.	2954	2954	2954	2173	2954	2954	2954	2173
Cent. R-squ./Opt. Bandw.	0.004	0.006	0.006	37	0.022	0.022	0.022	37

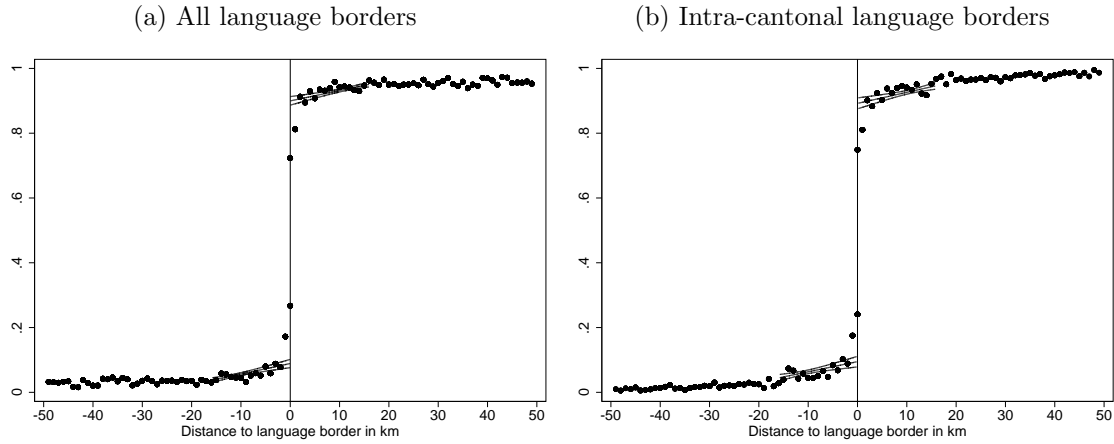
Notes: Treatment effect from instrumental variables regression. \*\*\* indicates statistical significance of parameters at 1% \*\* 5% \* 10%. The optimal bandwidth in nonparametric regressions is estimated according to Imbens and Kalyanaraman (2012). Parametric specifications are chosen according to BIC among specifications including first-order to fifth-order polynomials of road distance to all language borders. All language borders refers to language borders that both coincide with cantonal borders and run through cantons. Imports from common language speaking bordering countries to Switzerland.

Figure A6: *Outcomes by Road Distance to All Language Borders*



*Notes:* Outcomes (averaged within bins of 1 km) on the y-axis. Treated observations (common native language) to the right side of the language border (positive distance) and control observations (non-common native language) to the left side of the language border (negative distance) in all figures. All language borders refers to language borders that both coincide with cantonal borders and run through cantons. The figures represent a linear prediction and a 95% confidence interval based on a triangular kernel within optimal bandwidths for the fuzzy RDD estimated from all observations according to Imbens and Kalyanaraman (2012). Number of products measured by HS 8 tariff lines.

Figure A7: *Treatment Probability by Great-circle Distance to Language Border*



*Notes:* Shares of native language use (averaged within bins of 1 km) on the y-axis. Treated observations (common native language) to the right side of the language border (positive distance) and control observations (non-common native language) to the left side of the language border (negative distance) in all figures. All language borders refers to language borders that both coincide with cantonal borders and run through cantons. The figures represent a linear prediction and a 95% confidence interval based on a triangular kernel within an optimal bandwidth for the share of native language use (15.8 km) estimated from all observations according to Imbens and Kalyanaraman (2012).

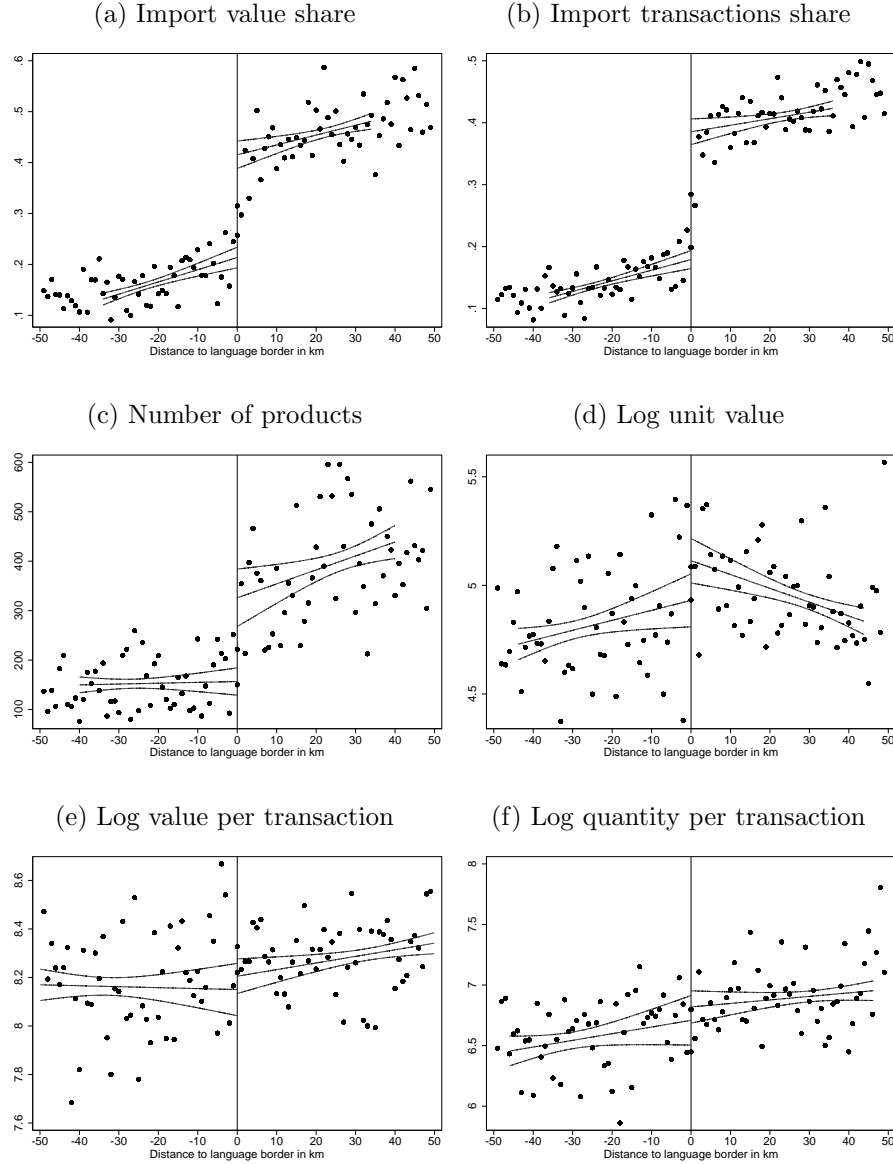


Table A2: *LATE Estimates of the Impact of Common Native Language on Imports (Using Great-circle Distance to the Language Border)*

CNL effect with parametric polynomial or nonparametric control function of distance	Baseline regression			Including distance to external border				Nonparam.
	1st order	2nd order	3rd order	Nonparam.	1st order	2nd order	3rd order	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Value share</b>								
Treatment	0.222 (0.018)***	0.176 (0.029)***	0.146 (0.044)***	0.183 (0.026)***	0.231 (0.017)***	0.173 (0.029)***	0.131 (0.043)***	0.183 (0.025)***
Obs.	3414	3414	3414	2448	3414	3414	3414	2448
Cent. R-squ./Opt. Bandw.	0.348	0.345	0.344	35	0.378	0.377	0.375	35
<b>Transactions share</b>								
Treatment	0.218 (0.014)***	0.193 (0.023)***	0.178 (0.034)***	0.202 (0.020)***	0.227 (0.013)***	0.191 (0.022)***	0.163 (0.033)***	0.202 (0.020)***
Obs.	3414	3414	3414	2566	3414	3414	3414	2566
Cent. R-squ./Opt. Bandw.	0.435	0.432	0.431	36	0.475	0.474	0.472	36
<b>Number of products (HS8 tariff lines)</b>								
Treatment	173.506 (35.337)***	132.149 (58.958)**	129.602 (88.878)	146.891 (40.348)***	168.979 (35.148)***	123.868 (58.744)**	118.001 (89.071)	143.700 (40.270)***
Obs.	3414	3414	3414	2856	3414	3414	3414	2856
Cent. R-squ./Opt. Bandw.	0.074	0.075	0.075	41	0.078	0.079	0.079	41
<b>Log unit value</b>								
Treatment	0.137 (0.097)	0.105 (0.162)	-0.139 (0.244)	0.124 (0.119)	0.148 (0.096)	0.085 (0.161)	-0.194 (0.244)	0.127 (0.117)
Obs.	3395	3395	3395	3403	3395	3395	3395	3403
Cent. R-squ./Opt. Bandw.	0.007	0.007	0.005	50	0.020	0.020	0.020	50
<b>Log intensive margin (value per transaction)</b>								
Treatment	0.021 (0.082)	-0.055 (0.137)	-0.054 (0.206)	-0.014 (0.092)	-0.004 (0.081)	-0.060 (0.136)	-0.037 (0.206)	-0.028 (0.092)
Obs.	3395	3395	3395	3118	3395	3395	3395	3118
Cent. R-squ./Opt. Bandw.	0.003	0.005	0.006	45	0.009	0.011	0.011	45
<b>Log quantity per transaction</b>								
Treatment	0.050 (0.147)	-0.065 (0.246)	-0.357 (0.370)	0.004 (0.152)	-0.026 (0.146)	-0.085 (0.244)	-0.310 (0.369)	-0.046 (0.151)
Obs.	3395	3395	3395	3389	3395	3395	3395	3389
Cent. R-squ./Opt. Bandw.	0.008	0.009	0.012	50	0.024	0.024	0.026	50
<b>All regions to left and right of language border within the same canton</b>								
<b>Value share</b>								
Treatment	0.194 (0.023)***	0.140 (0.038)***	0.114 (0.054)**	0.150 (0.033)***	0.202 (0.023)***	0.126 (0.037)***	0.096 (0.053)*	0.141 (0.032)***
Obs.	1872	1872	1872	1376	1872	1872	1872	1376
Cent. R-squ./Opt. Bandw.	0.356	0.353	0.352	32	0.389	0.388	0.387	32
<b>Transactions share</b>								
Treatment	0.202 (0.018)***	0.169 (0.029)***	0.161 (0.042)***	0.179 (0.026)***	0.209 (0.017)***	0.157 (0.028)***	0.145 (0.040)***	0.172 (0.025)***
Obs.	1872	1872	1872	1414	1872	1872	1872	1414
Cent. R-squ./Opt. Bandw.	0.456	0.454	0.455	33	0.493	0.492	0.493	33
<b>Number of products (HS8 tariff lines)</b>								
Treatment	143.079 (40.761)***	127.849 (65.539)*	221.246 (94.255)**	136.910 (48.823)***	148.622 (40.434)***	114.623 (65.309)*	202.998 (93.940)**	133.713 (48.553)***
Obs.	1872	1872	1872	1788	1872	1872	1872	1788
Cent. R-squ./Opt. Bandw.	0.079	0.079	0.081	44	0.089	0.091	0.092	44
<b>Log unit value</b>								
Treatment	0.073 (0.128)	0.162 (0.205)	-0.160 (0.295)	0.097 (0.173)	0.092 (0.126)	0.099 (0.203)	-0.256 (0.292)	0.082 (0.170)
Obs.	1858	1858	1858	1755	1858	1858	1858	1755
Cent. R-squ./Opt. Bandw.	0.015	0.019	0.020	43	0.036	0.041	0.042	43
<b>Log intensive margin (value per transaction)</b>								
Treatment	-0.111 (0.110)	-0.182 (0.177)	-0.294 (0.254)	-0.136 (0.112)	-0.120 (0.110)	-0.171 (0.177)	-0.279 (0.255)	-0.138 (0.112)
Obs.	1858	1858	1858	1862	1858	1858	1858	1862
Cent. R-squ./Opt. Bandw.	0.008	0.008	0.009	50	0.010	0.010	0.011	50
<b>Log quantity per transaction</b>								
Treatment	-0.058 (0.201)	-0.322 (0.323)	-0.314 (0.465)	-0.228 (0.227)	-0.098 (0.199)	-0.279 (0.322)	-0.256 (0.463)	-0.217 (0.226)
Obs.	1858	1858	1858	1534	1858	1858	1858	1534
Cent. R-squ./Opt. Bandw.	0.002	0.004	0.004	37	0.014	0.015	0.015	37

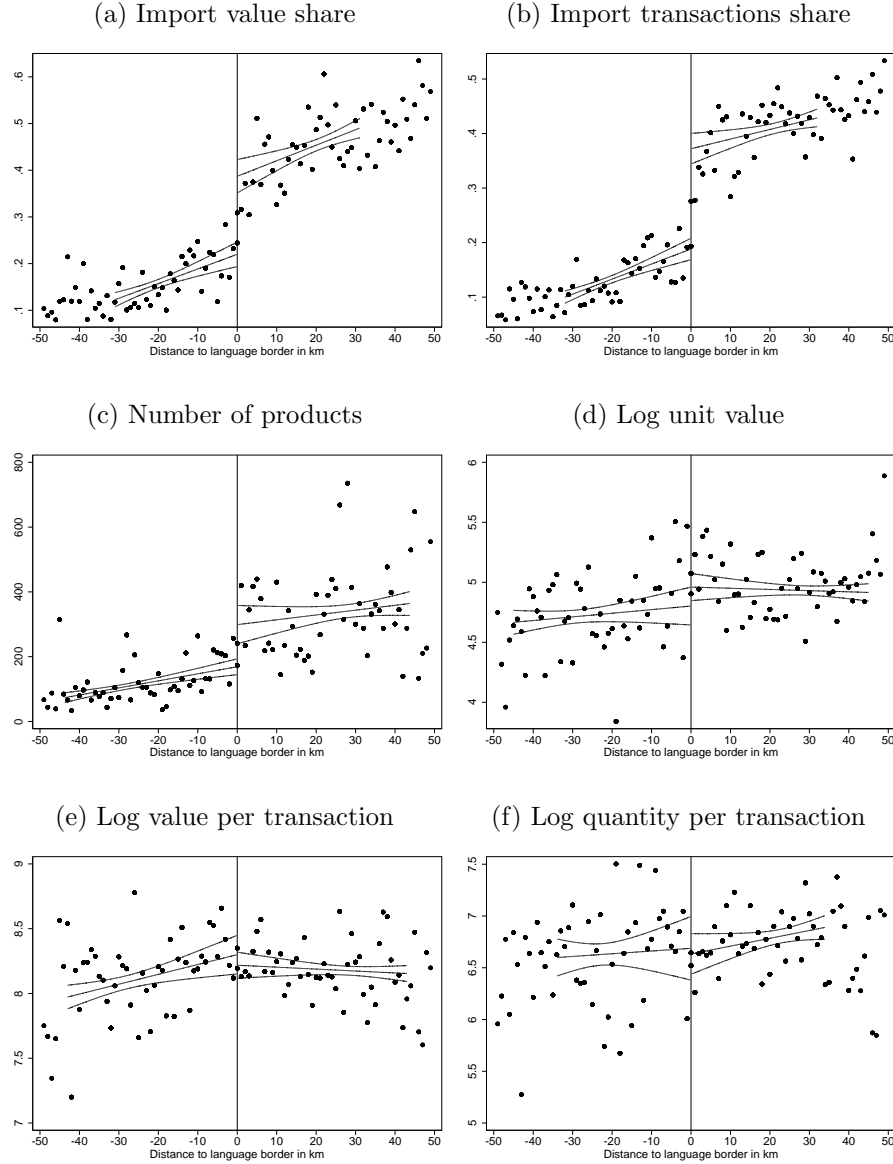
Notes: Treatment effect from instrumental variables regression. \*\*\* indicates statistical significance of parameters at 1% \*\* 5% \* 10%. The optimal bandwidth in nonparametric regressions is estimated according to Imbens and Kalyanaraman (2012). Parametric specifications are chosen according to BIC among specifications including first-order to fifth-order polynomials of great-circle distance to all language borders. Imports from common language speaking bordering countries to Switzerland.

Figure A8: *Outcomes by Great-circle Distance to All Language Borders*



*Notes:* Outcomes (averaged within bins of 1 km) on the y-axis. Treated observations (common native language) to the right side of the language border (positive distance) and control observations (non-common native language) to the left side of the language border (negative distance) in all figures. The figures represent a linear prediction and a 95% confidence interval based on a triangular kernel within optimal bandwidths for the fuzzy RDD estimated from all observations according to Imbens and Kalyanaraman (2012). Number of products measured by HS 8 tariff lines.

Figure A9: *Outcomes by Great-circle Distance to Intra-cantonal Language Borders*



*Notes:* Outcomes (averaged within bins of 1 km) on the y-axis. Treated observations (common native language) to the right side of the language border (positive distance) and control observations (non-common native language) to the left side of the language border (negative distance) in all figures. The figures represent a linear prediction and a 95% confidence interval based on a triangular kernel within optimal bandwidths for the fuzzy RDD estimated from all observations according to Imbens and Kalyanaraman (2012). Number of products measured by HS 8 tariff lines.

Table A3: *LATE Estimates for Product Intensive Margins*

CNL with parametric polynomial or nonparametric control function of distance	1st order	Baseline regression 2nd order	3rd order	Nonparam.	1st order	Including distance to external border 2nd order	3rd order	Nonparam.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Log value per product (HS8 tariff lines)</b>								
Treatment	-0.046 (0.080)**	-0.075 (0.126)	-0.118 (0.170)	-0.057 (0.089)	-0.063 (0.079)	-0.048 (0.124)	-0.083 (0.168)	-0.057 (0.087)
Obs.	1633	1633	1633	1633	1633	1633	1633	1633
Cent. R-squ./Opt. Bandw.	0.004	0.006	0.008	50	0.038	0.039	0.040	50
<b>Log unit value per product</b>								
Treatment	0.177 (0.088)**	0.383 (0.137)***	0.302 (0.185)	0.299 (0.130)**	0.183 (0.086)**	0.353 (0.135)***	0.269 (0.183)	0.279 (0.127)**
Obs.	1633	1633	1633	1069	1633	1633	1633	1069
Cent. R-squ./Opt. Bandw.	0.022	0.030	0.030	30	0.049	0.055	0.055	30
<b>Log quantity per product</b>								
Treatment	-0.187 (0.133)	-0.417 (0.208)**	-0.374 (0.281)	-0.341 (0.175)*	-0.211 (0.129)	-0.363 (0.204)*	-0.308 (0.276)	-0.305 (0.169)*
Obs.	1633	1633	1633	1168	1633	1633	1633	1168
Cent. R-squ./Opt. Bandw.	0.008	0.015	0.016	33	0.052	0.056	0.057	33

Notes: Treatment effect from instrumental variables regression. \*\*\* indicates statistical significance of parameters at 1% \*\* 5% \* 10%. The optimal bandwidth in nonparametric regressions is estimated according to Imbens and Kalyanaraman (2012). Parametric specifications include first-order to third-order polynomials of road distance. The sample is based on regions to the left and right of the language border within the same canton.

Table A4: *Sensitivity of Nonparametric LATE Estimates to Bandwidth Choice*

CNL effect with nonparametric control function of road distance	Opt. bandwidth	Baseline regression Fixed bandwidth			Including distance to external border Opt. bandwidth	Fixed bandwidth		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Value share</b>								
Treatment	0.165 (0.032)***	0.060 (0.072)	0.146 (0.049)***	0.163 (0.038)***	0.160 (0.032)***	0.062 (0.071)	0.137 (0.049)***	0.155 (0.038)***
Obs.	1438	378	708	1064	1438	378	708	1064
Bandwidth	42	10	20	30	42	10	20	30
<b>Transactions share</b>								
Treatment	0.196 (0.027)***	0.171 (0.058)***	0.213 (0.039)***	0.202 (0.030)***	0.190 (0.027)***	0.172 (0.057)***	0.206 (0.039)***	0.196 (0.030)***
Obs.	1322	378	708	1064	1322	378	708	1064
Bandwidth	38	10	20	30	38	10	20	30
<b>Number of products (HS8 tariff lines)</b>								
Treatment	136.453 (61.592)**	105.185 (100.782)	163.798 (82.780)**	144.746 (66.521)**	128.814 (61.431)**	108.941 (98.464)	152.540 (83.338)*	136.767 (66.440)**
Obs.	1226	378	708	1064	1226	378	708	1064
Bandwidth	35	10	20	30	35	10	20	30
<b>Log unit value</b>								
Treatment	0.111 (0.198)	-0.260 (0.469)	-0.069 (0.315)	0.091 (0.245)	0.101 (0.196)	-0.246 (0.464)	-0.107 (0.313)	0.068 (0.243)
Obs.	1478	377	706	1061	1478	377	706	1061
Bandwidth	43	10	20	30	43	10	20	30
<b>Log intensive margin (value per transaction)</b>								
Treatment	-0.172 (0.126)	-0.502 (0.310)	-0.350 (0.211)*	-0.242 (0.164)	-0.173 (0.126)	-0.499 (0.309)	-0.356 (0.212)	-0.236 (0.165)
Obs.	1633	377	706	1061	1633	377	706	1061
Bandwidth	50	10	20	30	50	10	20	30
<b>Log quantity per transaction</b>								
Treatment	-0.169 (0.232)	-0.213 (0.535)	-0.149 (0.367)	-0.156 (0.285)	-0.164 (0.230)	-0.221 (0.531)	-0.137 (0.367)	-0.123 (0.285)
Obs.	1517	377	706	1061	1517	377	706	1061
Bandwidth	44	10	20	30	44	10	20	30

Notes: \*\*\* indicates statistical significance of parameters at 1% \*\* 5% \* 10%. The optimal bandwidth in nonparametric regressions is estimated according to Imbens and Kalyanaraman (2012). The sample is based on regions to the left and right of the language border within the same canton.

Table A5: *Sharp LATE Estimates on Imports from the Rest of the World to Switzerland*

Sharp treatment effect with parametric polynomial or nonparametric control function	Treatment=Roman language			
	1st order (1)	2nd order (2)	3rd order (3)	Nonparam. (4)
<b>Value share</b>				
Treatment	-0.063 (0.027)**	-0.027 (0.037)	-0.020 (0.047)	-0.034 (0.681)
Obs.	821	821	821	621
Adj. R-squ./Opt. Bandw.	0.006	0.006	0.005	35
<b>Transactions share</b>				
Treatment	-0.025 (0.019)	-0.008 (0.026)	-0.003 (0.032)	-0.011 (0.054)
Obs.	821	821	821	694
Adj. R-squ./Opt. Bandw.	0.004	0.003	0.001	40
<b>Number of products (HS8 tariff lines)</b>				
Treatment	-121.434 (56.477)**	80.925 -78.144	90.086 -97.821	24.886 (92.470)
Obs.	821	821	821	421
Adj. R-squ./Opt. Bandw.	0.007	0.022	0.019	24
<b>Log unit value</b>				
Treatment	0.020 (0.136)	-0.015 (0.189)	0.096 (0.237)	0.007 (0.217)
Obs.	821	821	821	821
Adj. R-squ./Opt. Bandw.	0.007	0.006	0.004	50
<b>Log intensive margin (value per transaction)</b>				
Treatment	-0.106 (0.161)	0.044 (0.224)	0.174 (0.280)	0.001 (0.375)
Obs.	821	821	821	706
Adj. R-squ./Opt. Bandw.	0.000	0.000	-0.002	41
<b>Log quantity per transaction</b>				
Treatment	0.157 (0.261)	0.402 (0.364)	0.693 (0.454)	0.347 (0.607)
Obs.	821	821	821	696
Adj. R-squ./Opt. Bandw.	0.002	0.003	0.005	40

Notes: Treatment effect from OLS regression. \*\*\* indicates statistical significance of parameters at 1% \*\* 5% \* 10%. Regressions without distance to external border. The optimal bandwidth in nonparametric regressions is estimated according to Imbens and Kalyanaraman (2012). Parametric specifications include first-order to third-order polynomials or road distance. The sample is based on regions to the left and right of the language border within the same canton.

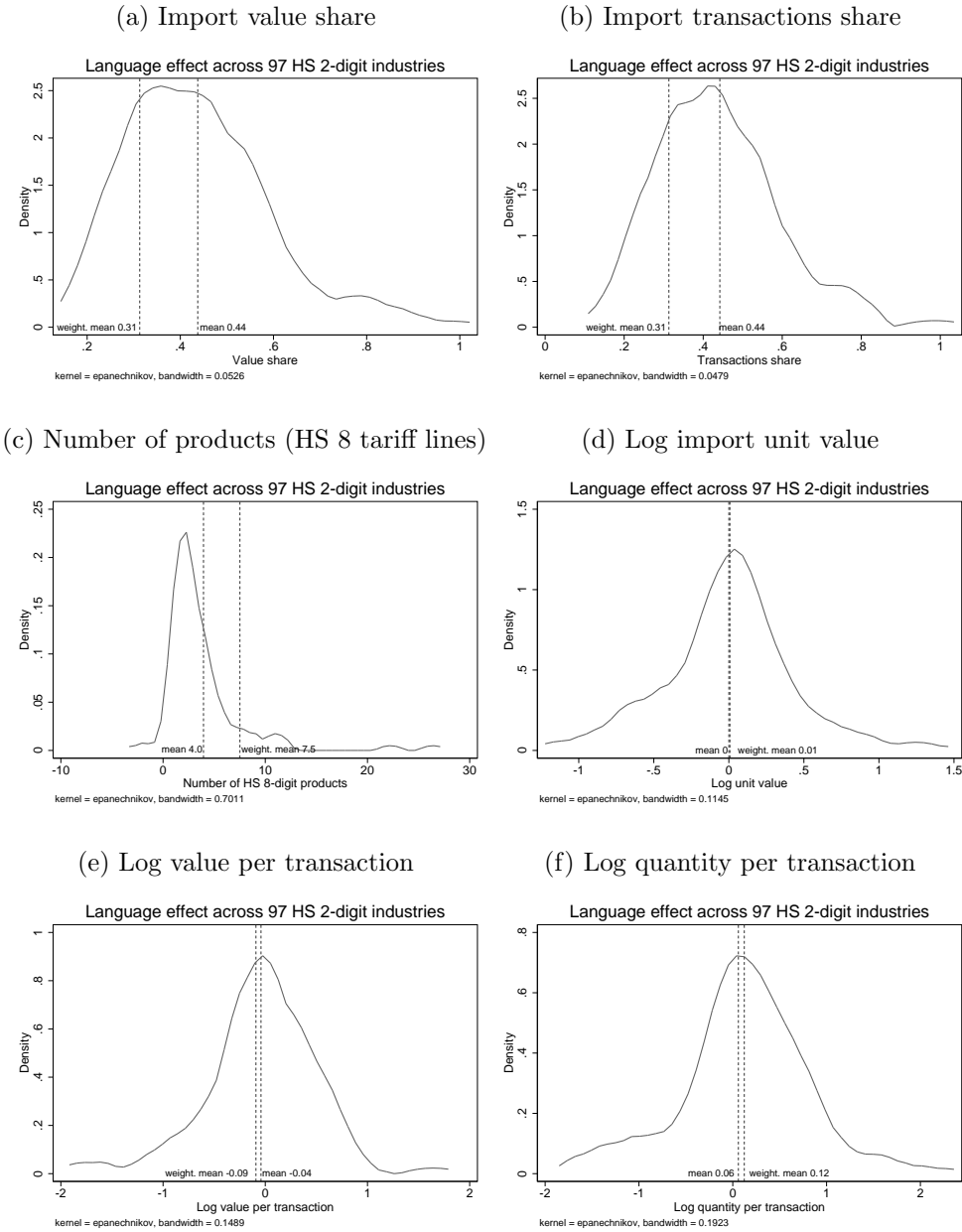
Table A6: *LATE Estimates for Specific Native Languages*

CNL effect with parametric polynomial or nonparametric control function of distance	Imports from France			Imports from Italy			Imports from Austria and Germany		
	1st order (1)	2nd order (2)	3rd order (3)	1st order (4)	2nd order (5)	3rd order (6)	1st order (7)	2nd order (8)	3rd order (9)
<b>Value share</b>									
Treatment	0.218 (0.025)***	0.185 (0.038)***	0.135 (0.052)***	-0.281 (0.584)	-0.165 (0.539)	-0.334 (0.681)	0.113 (0.035)***	0.121 (0.056)**	0.041 (0.076)
Obs.	692	692	692	132	132	132	820	820	820
Cent. R-squ./Opt. Bandw.	0.358	0.359	0.362	0.528	0.560	0.539	0.272	0.273	0.274
<b>Transactions share</b>									
Treatment	0.212 (0.016)***	0.202 (0.025)***	0.193 (0.033)***	-0.437 (0.513)	-0.312 (0.464)	-0.812 (0.637)	0.164 (0.024)***	0.154 (0.037)***	0.152 (0.050)***
Obs.	692	692	692	132	132	132	820	820	820
Cent. R-squ./Opt. Bandw.	0.537	0.537	0.538	0.569	0.612	0.521	0.420	0.424	0.426
<b>Number of products (HS8 tariff lines)</b>									
Treatment	59.112 (40.959)	215.839 (61.984)***	173.236 (84.558)**	-355.601 (647.433)	10.494 (581.169)	-120.730 (702.797)	280.279 (80.796)***	38.820 (126.219)	25.839 (170.576)
Obs.	692	692	692	132	132	132	820	820	820
Cent. R-squ./Opt. Bandw.	0.064	0.094	0.094	0.033	0.147	0.181	0.048	0.071	0.072
<b>Log unit value</b>									
Treatment	-0.168 (0.250)	-0.027 (0.383)	-0.069 (0.523)	2.183 (3.694)	2.575 (3.484)	3.297 (4.238)	0.034 (0.151)	-0.047 (0.238)	-0.364 (0.320)
Obs.	689	689	689	124	124	124	820	820	820
Cent. R-squ./Opt. Bandw.	0.033	0.035	0.035	0.048	0.078	0.115	0.020	0.023	0.035
<b>Log intensive margin (value per transaction)</b>									
Treatment	-0.165 (0.200)	-0.056 (0.307)	-0.286 (0.418)	0.706 (3.166)	0.664 (2.990)	0.495 (3.658)	-0.181 (0.148)	-0.162 (0.234)	-0.646 (0.315)**
Obs.	689	689	689	124	124	124	820	820	820
Cent. R-squ./Opt. Bandw.	0.019	0.020	0.021	0.015	0.043	0.072	0.013	0.014	0.025
<b>Log quantity per transaction</b>									
Treatment	0.493 (0.385)	0.163 (0.591)	0.165 (0.806)	-3.516 (5.932)	-2.948 (5.456)	-2.444 (6.534)	-0.460 (0.233)**	-0.236 (0.368)	-0.452 (0.497)
Obs.	689	689	689	124	124	124	820	820	820
Cent. R-squ./Opt. Bandw.	0.029	0.032	0.033	0.067	0.140	0.201	0.022	0.024	0.025
Notes: Treatment effect from instrumental variables regression. Non-common language speaking regions to the left and common language speaking regions to the right side of the language border. *** indicates statistical significance of parameters at 1% ** 5% * 10%. Parametric specifications include first-order to third-order polynomials of road distance. The sample is based on regions to the left and right of the language border within the same canton.									

Table A7: *LATE Estimates for Consumer Goods Only*

CNL effect with parametric polynomial or nonparametric control function of distance	Baseline regression				Including distance to external border			
	1st order (1)	2nd order (2)	3rd order (3)	Nonparam. (4)	1st order (5)	2nd order (6)	3rd order (7)	Nonparam. (8)
<b>Value share</b>								
Treatment	0.153 (0.025)***	0.174 (0.039)***	0.159 (0.052)***	0.162 (0.032)***	0.158 (0.024)***	0.161 (0.038)***	0.141 (0.052)***	0.160 (0.032)***
Obs.	1644	1644	1644	1450	1644	1644	1644	1450
Cent. R-squ./Opt. Bandw.	0.355	0.357	0.357	42	0.393	0.393	0.393	42
<b>Transactions share</b>								
Treatment	0.173 (0.020)***	0.191 (0.032)***	0.228 (0.042)***	0.186 (0.028)***	0.179 (0.020)***	0.179 (0.031)***	0.214 (0.041)***	0.183 (0.027)***
Obs.	1644	1644	1644	1380	1644	1644	1644	1380
Cent. R-squ./Opt. Bandw.	0.415	0.417	0.422	40	0.458	0.458	0.462	40
<b>Number of products (HS8 tariff lines)</b>								
Treatment	188.804 (45.825)***	117.088 (71.663)	156.900 (96.326)	139.448 (64.264)**	198.871 (45.827)***	110.760 (72.055)	148.644 (97.062)	133.478 (64.062)**
Obs.	1644	1644	1644	1206	1644	1644	1644	1206
Cent. R-squ./Opt. Bandw.	0.080	0.082	0.082	34	0.092	0.096	0.096	34
<b>Log unit value</b>								
Treatment	0.008 (0.139)	0.105 (0.218)	-0.154 (0.294)	0.052 (0.194)	0.043 (0.139)	0.100 (0.219)	-0.165 (0.296)	0.045 (0.191)
Obs.	1632	1632	1632	1549	1632	1632	1632	1549
Cent. R-squ./Opt. Bandw.	0.017	0.019	0.020	46	0.031	0.032	0.034	46
<b>Log intensive margin (value per transaction)</b>								
Treatment	-0.192 (0.112)*	-0.210 (0.175)	-0.444 (0.236)*	-0.197 (0.119)*	-0.193 (0.112)*	-0.185 (0.177)	-0.416 (0.239)*	-0.201 (0.119)*
Obs.	1632	1632	1632	1632	1632	1632	1632	1632
Cent. R-squ./Opt. Bandw.	0.006	0.006	0.010	50	0.011	0.011	0.014	50
<b>Log quantity per transaction</b>								
Treatment	-0.095 (0.206)	-0.257 (0.323)	-0.180 (0.434)	-0.192 (0.240)	-0.092 (0.205)	-0.161 (0.324)	-0.059 (0.436)	-0.179 (0.238)
Obs.	1632	1632	1632	1413	1632	1632	1632	1413
Cent. R-squ./Opt. Bandw.	0.001	0.002	0.006	41	0.021	0.021	0.025	41
Notes: Treatment effect from instrumental variables regression. *** indicates statistical significance of parameters at 1% ** 5% * 10%. The optimal bandwidth in nonparametric regressions is estimated according to Imbens and Kalyanaraman (2012). Parametric specifications include first-order to third-order polynomials of road distance. The sample is based on regions to the left and right of the language border within the same canton.								

Figure A10: *Kernel Density of ATE Estimates by HS 2-digit Industry*



*Notes:* Parametric linear regressions including external border distance with all regional units within the two respective language districts to left and right of language border in all figures. We weight the mean across all 2-digit industries by the industry share in terms of import value in CHF.



## Appendix B: Spatial data about transaction-level imports and languages in Switzerland

Three main data sources are used for the construction of the variables of interest: (1) and Geographical Information Systems data about Swiss postcodes of *Die Post* and 1990 Census data of the Swiss Federal Statistical Office to determine the location of postcode centroids, language borders, and national borders, and the according minimal great-circle distances from all centroids to the internal language and national borders. In addition, we purchased road distance data from *Die Post*; (2) Swiss Federal Customs Administration (EDEC) for transaction-level import data; These data include the universe of Swiss goods import transactions from external exporters that were declared at Swiss customs offices between 2006 and June 2011. (3) 2000 Census data of the Swiss Federal Statistical Office for data on CNL. The variables are defined and constructed as follows.

*CNL*. The share of native language speakers of each of the three languages considered, French, German, and Italian, in the total native language population of all three languages by Swiss postcode region. The Census is based on the universe of the population in Switzerland.

*COL*. A binary indicator that equals 1 if the majority native language (CNL) in a Swiss postcode is the same language as an official language in one of the importer countries, and 0 else. Data on COL were obtained from Melitz and Toubal (2014).

*Distance to language borders by postcode region*. We determine the spatial location of internal language borders using majority languages from the 1990 Census (based

on the universe of the population in Switzerland) obtained from aggregating all individuals by Swiss postcodes according to native language. The exact location of language borders is thus coincident with postcode borders. Next, we determine points along internal language borders at 100-meter intervals and calculate Haversine distance in kilometers to all points. Then we obtain the distance to the internal language border as the minimal distance to the (closest) language border point. As an alternative distance measure, road distance calculated analogously was bought from *Die Post*.

*Distance to national borders by postcode region.* We determine points along the national borders considered at 100-meter intervals and calculate Haversine distance in kilometers to all points for each of the language zones (France, Germany and Austria, Italy). Then we obtain the distance to the national border as the minimal distance to the respective (closest) border point. As an alternative distance measure, road distance calculated analogously was bought from *Die Post*.

*Log quantity per transaction.* The logarithm of the quantity per import transaction by adjacent country-of-origin language zone (France, Germany and Austria, Italy) of all imports aggregated by Swiss postcodes.

*Log value per transaction.* The logarithm of the value per import transaction by adjacent country-of-origin language zone (France, Germany and Austria, Italy) of all imports aggregated by Swiss postcodes.

*Log unit value.* The logarithm of the average unit value by adjacent country-of-origin language zone (France, Germany and Austria, Italy) of all imports by a Swiss post-code.

*Number of products (HS8 tariff lines).* The number of HS 8-digit product codes

per adjacent country-of-origin language zone (France, Germany and Austria, Italy) imported by a Swiss postcode.

*Transactions share.* The share of transactions per adjacent country-of-origin language zone (France, Germany and Austria, Italy) relative to all transactions of a Swiss postcode.

*Value share.* The share of transactions per adjacent country-of-origin language zone (France, Germany and Austria, Italy) relative to all transactions (including imports from the rest of the world) of a Swiss postcode.

*Log quantity per product.* The logarithm of the value per import transaction per HS8 product tariff line aggregated by Swiss postcodes.

*Log unit value per product.* The logarithm of the average unit value per HS8 product tariff line imported by a Swiss postcode.

*Log value per product.* The logarithm of the value per import transaction per HS8 product tariff line aggregated by Swiss postcodes.