Business Cycles Association in a Small Monetary Union: The Case of Switzerland*

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Abstract

With its German, French, Italian, and Romansch Cantons, the Helvetic Federation is a small-scale version of the cultural, social, religious, and linguistic heterogeneities found in the European Union (EU). Although it is an interesting case study for observing the effects of idiosyncratic shocks within regional economies, few studies have been conducted that address Switzerland and the lessons it might hold for the EU, especially for the members of the European Monetary Union (EMU). We study the connections between the business cycles of Swiss regions. Evidence shows that Swiss cantons are closely related but there are dynamic effects toward more 'independent' business cycles. Despite the economic and cultural heterogeneity, Swiss cantons remain in the same political and monetary union, sharing a common central bank and a coordination/equalization mechanism for managing independent fiscal policies. Switzerland's ability to do these things should be a matter of interest to the EU.

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1 Introduction

1.1 Motivation: Possible Lessons of Swiss Federalism for the EU

With its German, French, Italian, and Romansch Cantons, the Helvetic Federation is a small-scale version of the cultural, social, religious, and linguistic heterogeneities found in the European Union (EU). Although it is an interesting case study for observing the effects of idiosyncratic shocks within regional economies, few studies have been conducted that address Switzerland and the lessons it might hold for the EU, especially for the members of the European Monetary Union (EMU). This is the aim of the current work.

Switzerland became a federal state in 1848, when a new constitution turned a Confederation (an association of sovereign entities, similar to the EU) into a Federation (a group of entities (cantons) sharing a common central authority). This came on the heels of a civil war between groups for and against the proposed Swiss Federation. The constitution abolished trade restrictions between cantons, established a single currency, and authorized federal bodies to enforce policies. The Swiss National Bank was established 59 years later, in 1907.

The situation of the EU today in many ways resembles the old Swiss Confederation of 1815-1848 – more than it does the current Federation – especially in the economic sphere. As did the cantons of the old Confederation, the EU member states retain their own constitutions while also respecting and abiding by common treaties. External trade policy and the setting of common external tariffs are determined at the EU level, just as the old Confederation also exercised these controls on behalf of the Cantons (Church and Dardanelli, 2005).

Swiss Federalism is a three-tiered system: the national state (the Confederation), federated states (the Cantons), and the smallest administrative units at the local level (the Communes). The division of competencies and powers between these three tiers is regulated by constitutional norms, although over time the dividing lines between them have sometimes grown blurry. Each canton has its own constitution, government, and judicial system (although this must be compatible with Federal law and the Federal Constitution), and sustains considerable administrative autonomy and exercises a good deal of independent decision-making. The features vary with the preferences of individual cantons, respecting the diversity of the communities involved.

Swiss federalism is based not on strong federal government, but on cooperation between cantons under the principle of subsidiarity, a principle that is also espoused in the European Union. It is built with a bottom-up perspective,

respecting cantonal and communal autonomy. The cantons have a strong influence on the role of the Federation, since new (or established) competencies of the Federation are decided by a majority vote of the cantons – each canton casting one vote, regardless of its size. The citizenry also has a powerful voice in decisions regarding public services, providing an admirable example of direct democracy. Direct democracy is also present in the power of controlling and auditing public funds and duties.

The federal system in Switzerland initially had a low degree of centralization, but this has been gradually increasing, although it remains one the least centralized federations in the world. The centralization process that unfolded in Switzerland was mainly in terms of legislation and not as much in terms of policy implementation, since there are no federal agencies in the cantons (Church and Dardanelli, 2005). In the European Union, amendments to the Constitutional treaty can be achieved only through unanimity, although, since several states do not require a referendum (as is the case among the Swiss cantons), the prospect of making corrections to this law and the possibility of further integration and centralization of the EU powers should not be excluded. Also, in the EU, unlike the situation in Switzerland, the national and regional levels of government, especially the latter, feel marginalized from the discourse in Brussels. The recent white paper on multilevel governance is an attempt to close this gap (European Union, 2009). The idea of direct democracy, which is specifically promoted in the Constitutional treaty of the European Union, will be hard to implement, as there is as yet no sense of European citizenship or belonging to a supra-national institution, as there is in Switzerland. Similar to the situation for the national states comprising the EU, the constitution that binds the Swiss cantons has no provision for leaving the Federation (Church and Dardanelli, 2005).

The current institutional framework in Switzerland comprises a Federal Assembly, an executive body called the Federal Council, and a Federal Tribunal. The Federal Assembly has two houses: an elected lower house called the National Council, and an upper house called the Council of States. In the upper house each canton has two representatives, (except for the half-cantons, which have one representative each). There is also an administrative body called the Conference of Canton Ministers, which helps to ensure cooperation between the cantons at several levels. Vertical coordination is assured by the federal powers (e.g., the veto power of cantonal constitutions by the Federal Parliament and the judicial review of cantonal laws by the Federal Tribunal), and horizontal coordination is obtained through treaties between cantons. Horizontal coordination is very important in Switzerland, especially for, but not limited

to, tax harmonization purposes, which makes this type of federalism a "cooperative federalism". In terms of administrative and governing bodies, the EU can be compared to any given country. The Council of Ministers works like a second-level legislative body. The European Parliament' members are elected by direct vote, and it functions like the first- level legislative body. The European Commission resembles a government, elected by the European Parliament.

The 26 cantons comprising the Federation vary considerably in size, and have four official languages (German, French, Italian, and Romansch), usually with one language dominating in each canton. Protestantism and Catholicism are the dominant religions of the country.

Each canton has its own fiscal policy and budget, and the freedom to levy and collect taxes as long as these do not encroach on the sovereignty of the other cantons. These multiple fiscal policies emerge largely through orthodoxy, as cantonal constitutions or laws call for almost balanced budgets and most cantons do not allow budget deficits for anything other than capital expenditures (Dafflon, 2005). Despite the extent of the federal administrative institutions, the weight of the state in GNP is lower than in other European countries (Dafflon, 2005).

The vast majority of fiscal resources of the cantons are derived from their own tax revenues, demanding very little in the way of transfer payments from the federal government. Some cantons have set their own rules regarding budget restrictions and debt ceilings, and the only federal law pertaining to deficit financing is the one that prohibits the cantons from borrowing from the Central Bank. Although tax competition between cantons is not unknown, fiscal coordination and harmonization become central issues when there is a common currency. Hence, there is a fiscal equalization mechanism, at both the vertical level (from the Federation to the cantons) and the horizontal level (between the cantons).

In the European Union there are no such equalization mechanisms in the short term, either horizontal or vertical. The most similar instrument that the EU has is the programme of structural funds, but this exists to address long-term issues. In the EU, fiscal issues are left outside the competence of the Union and are mainly reserved to the states. The EU budget is also very small (about 1% of the EU GDP). Each member state has its own national budget and debt, and there is no such thing as European Union debt. In a recent working paper Paul de Grauwe (2011) claims that a European debt would help to solve one of many of the governance problems of the EMU in terms of default risk.

1.2 Swiss Business Cycles: A Revision of the Literature

In this work we examine the cantons' business cycles between 1978 and 2005, seeking policy lessons for the EMU from a much older monetary union. Regional business cycles in monetary unions is a subject that has received a great deal of scholarly attention, but it is usually focused on the USA, Canada, or the European Union. Tootell (1990), Carlino and Sill (1997, 2000), and Partridge and Rickman (2005) are good examples of such study for the USA, while Beine and Coulombe (2003) provide comparisons between Canadian Provinces and USA States. Recent studies on business cycle synchronization between regions of the EU include Belke and Heine (2006) and Montoya and De Haan (2008). Ferreira-Lopes and Pina (2011) compare business cycle synchronization between USA States, Canadian Provinces, and regions of EU member countries. To our knowledge, literature on regional business cycle synchronization for Switzerland does not exist. Previous studies on business cycles in Switzerland have been made at the national level and include Danthine and Girardin (1989), Danthine and Neftci (1990), Zimmerman (1997), Cuche and Hess (1999), Detken (2002), Perruchoud (2008), and Konstantakopoulou et al. (2009).

Using rolling windows and cluster analysis techniques, we analyse the co-movements of the output gaps for the cantons of Switzerland. The rolling windows technique enables us to examine the evolution of business cycle co-movements and volatility. By using cluster analysis, we also seek to detect a core-periphery pattern concerning cyclical association in this monetary union.

The paper has the following structure: In Section 2 we present the data, Section 3 is dedicated to cyclical association, Section 4 discusses business cycle synchronization, and Section 5 unites the results of the two previous sections and analyses business cycle convergence. Section 6 concludes.

2 Data

The variable used below is the annual output gap, calculated by subtracting the value for the log of potential output from the log of real output for each of the 26 cantons, i.e., we de-trend the data, removing each series trend to obtain the business cycle frequency. To calculate potential output we have used two widely known methods, both with standard parameter values: the Hodrick-Prescott (HP) filter with λ=100, and the Baxter and King (BK) band-pass filter with L=2, H=8, and K=3. For conciseness, results presented in the main text are for the HP filter, whereas those obtained with the BK filter are available upon request.

Ideally, to fully assess the behaviour of business cycles following and/or resulting from the transition to a federal state, data from before the event is needed. However, a common source of regional data for cantons is not available for the years before 1978. Cantonal data for Switzerland were obtained from the Swiss Federal Statistics Office, and refer to the Net National Income (NNI) at factors cost and current prices, in millions of Swiss francs, for all 26 cantons.[1] These data have three breaks: 1978-1995, 1990-2001, and 1998-2005.[2] Between these breaks some methodological and conceptual changes have been made, namely the substitution of the European System of National Accounts for the traditional method of national accounting, the system of 1979, and the system of 1995, respectively. Thus, a careful interpretation of the results is required. Breaks were dealt with by applying the growth rates of the old accounting system to the levels of the ESA 95 data. Deflators at the cantonal level were not available, so the deflator at the national level was used for the Gross National Income at market prices, base year 2000, taken from AMECO (Annual Macro Economic Database, from the European Commission). Earlier studies facing the same problem have used this same method (e.g., Sala-i-Martin, 1996).

3 Cyclical Association

Switzerland is both a political and monetary union and although fiscal policy is decided by each canton, monetary policy is decided at the Federal level. This can give rise to coordination problems between the two policies. The impact of the common monetary policy for each canton can potentially be different as well, although the fiscal equalization mechanisms help to alleviate this problem. With this context as the starting point, an important issue to analyse regarding business cycles is the degree of cyclical association of each canton with Switzerland.[3]

[1] In Appendix B we show the list of Swiss cantons, including the abbreviation of the name for each canton, its relative weight in Switzerland's total output, the official language(s) of each canton, and the predominant religion in each canton. The base year for the calculation of the relative weight of each canton is 2005.

[2] In calculating the cantonal income, revenues of inter-cantonal commuters are attributed to the canton where the worker lives, but production accounts for the canton where he/she works. For small cantons which have a high proportion of commuters, the cantonal income can be greatly influenced. Additionally, corporate income from capital companies is recorded in the canton where the capital companies have their headquarters, which has a positive impact on cantons with large numbers of these companies. The construction of this regional variable was interrupted after 2005. Until this date no other regional variable was officially constructed for all cantons to replace the old definition (for a long time period). Some cantons have estimations of Gross Cantonal Product but existing data have a very short time span.

[3] In all the sections that follow we provide tentative explanations for our findings using economic specialization, religion, language, geographical location, and economic size as possible

Before addressing this issue, we describe some data on volatility and persistence of business cycles. Volatility is calculated using the standard-deviation, and persistence is the autocorrelation coefficient of order 1 of each series. In particular, volatility is usually below 3% and persistence below 0.5%. Evidence is shown in Table A.1 in Appendix A. However, the cantons show a high degree of heterogeneity, especially in terms of volatility. This can represent a problem in terms of macroeconomic policy coordination. Volatility does not seem to be associated with the size, geographical location, language, or religion of the canton. However, amongst the most volatile cantons are some of the richest (Zoug and Nidwalden, for example), the most dynamic (Basel-Stadt, for example), and some of the most attractive in terms of tax systems (for instance, Nidwalden, Zoug, and Schwyz). Results for the BK filter confirm these observations, although volatility and persistence are lower.

3.1 Pearson Correlation, Concordance, and Spearman's Rank Correlation

To analyse the degree of cyclical association for the 1978-2005 period between each canton and Switzerland we recur to three statistics - the Pearson correlation coefficient, the concordance statistic, and the Spearman's rank correlation.[4] Results are presented in Table 1 below.

causes. Our main providers of information were the Swiss Statistical Office and the Statistical Office of each canton. Data are available upon request.

[4] The Pearson correlation coefficient is usually designated simply by correlation coefficient.

Table 1 - Pearson Correlation, Concordance, and Spearman's Rank Correlations

Cantons	*Correlation*	*Concordance*	*Spearman's Rank*
Aargau (AG)	0.44**	0.44	0.36*
Appenzell Innerrhoden (AI)	0.53***	0.34	0.52***
Appenzell Ausserrhoden (AR)	0.43**	0.32	0.43**
Basel-Landschaft (BL)	0.38**	0.37	0.37*
Basel-Stadt (BS)	0.54**	0.22	0.54***
Bern (BE)	0.43**	0.42	0.41**
Fribourg (FR)	0.57***	0.54	0.54**
Geneva (GE)	0.81***	0.60	0.81***
Glarus (GL)	0.52***	0.28	0.48**
Graubünden (GR)	0.60***	0.58	0.62***
Jura (JU)	0.68***	0.56	0.71***
Luzern (LU)	0.39**	0.39	0.28
Neuchâtel (NEU)	0.70***	0.45	0.74***
Nidwalden (NW)	0.79***	0.58	0.78***
Obwalden (OW)	0.39**	0.35	0.48**
St.-Gallen (SG)	0.38**	0.38	0.35*
Schaffhausen (SH)	0.53***	0.52	0.65***
Schwyz (SZ)	0.49***	0.35	0.51***
Solothurn (SO)	0.66***	0.63	0.61***
Thurgau (TG)	0.54***	0.54	0.54***
Ticino (TI)	0.81***	0.78	0.77***
Uri (UR)	0.01	0.01	-0.01
Vaud (VD)	0.93***	0.93	0.93***
Valais (VS)	0.63***	0.62	0.59***
Zurich (ZH)	0.96***	0.91	0.97***
Zug (ZG)	0.45**	0.33	0.37*

Note: (*), (**), and (***) denote significance at 10%, 5%, and 1% levels, respectively.

The Pearson correlation coefficient measures the degree of linear association between the business cycle of each canton and Switzerland. Correlations are all positive and all except one, the canton of Uri, are significant. Some of the cantons reveal high correlations with Switzerland, mostly those with larger economies. This correlation is also related to the economic specialization of each canton and the co-movements, in terms of business cycles of the sectors each canton is specialized in, and the Swiss average. The canton of Uri does not show the traditional specialization pattern that is present in most of the other cantons (security & defence engineering and construction are among the sectors that employ most people in this canton).

Since the correlation coefficient is a measure of linear association, we use

two statistics that allow for the existence of a non-linear association between two variables - the concordance statistic and the Spearman's Rank Correlation. The first is a non-parametric statistic that measures the proportion of time that the cycles of two variables spend in the same cycle phase, and varies between 0 and 1. A positive association between two variables implies a concordance statistic above 0.5. Of the 26 cantons, 12 have a positive association between the canton and Switzerland. These cantons are specialized in goods and services in which, on average, Switzerland is specialized: finance and insurance, chemicals, pharmaceutical and health related products, energy, and the watch industry. Overall, the concordance statistic's results corroborate those of the Pearson correlation coefficient.

For any given two variables, the Spearman's Rank is a non-parametric measure of statistical dependence. It measures how well the relationship between two variables can be described by a monotonic function. In contrast with the Pearson Correlation Coefficient, this statistic does not imply a linear function between two series, only a monotonic function. The Spearman's rank correlation is the correlation coefficient of the ranks of two series. The rank is calculated as the ordered values (in descending order) of the cycle for each State. Results are similar to the two previous statistics, especially the correlation coefficient, confirming the existence of a linear association. Results using the BK filter confirm those presented above. Overall, there is significant evidence of a positive correlation of business cycles between the cantons and the union (Switzerland), despite the results of the Concordance statistic, which are low on average. Findings to this point indicate an overall association of business cycles, with evidence of some non-synchronization in some cantons (due to the concordance statistic), a feature that can also be observed in the EU (see, e.g., Darvas and Szapáry, 2008).

3.2 Multiple Correlation

The existence of lags and leads between a region and the country is important, especially regarding the impact of macroeconomic policies at the regional level. Up to this point we have analysed the degree of cyclical association ignoring the issue of lags and leads in business cycles between the cantons. One way of assessing the degree of cyclical association in the presence of non-contemporaneous relationships between two series is to estimate the following equation:

$$y\_cic_t^i = \beta_1 y\_cic_{t-2}^{Swiss} + \beta_2 y\_cic_{t-1}^{Swiss} + \beta_3 y\_cic_t^{Swiss} + \beta_4 y\_cic_{t+1}^{Swiss} + \beta_5 y\_cic_{t+2}^{Swiss} + \varepsilon_{it} \quad (1)$$

where y_cic^i is the cyclical component of canton i and $y\_cic^{Swiss}_{t+j}$ is the cyclical component of Switzerland with lags and leads. If R^2 is the coefficient of determination in equation (1), the square root of this coefficient (R) is the correlation coefficient between X^i and $\hat{X}^i$, where $\hat{X}^i$ are the fitted values of X^i. Because of this, R can be interpreted as the multiple correlation coefficient between canton i and Switzerland.

Table 2 - Multiple Correlation between each Canton and Switzerland

Cantons	$1978 - 2005$
Aargau (AG)	0.66
Appenzell Innerrhoden (AI)	0.65
Appenzell Ausserrhoden (AR)	0.81
Basel-Landschaft (BL)	0.60
Basel-Stadt (BS)	0.72
Bern (BE)	0.45
Fribourg (FR)	0.72
Geneva (GE)	0.85
Glarus (GL)	0.62
Graubünden (GR)	0.80
Jura (JU)	0.80
Luzern (LU)	0.43
Neuchâtel (NEU)	0.77
Nidwalden (NW)	0.81
Obwalden (OW)	0.43
St.-Gallen (SG)	0.64
Schaffhausen (SH)	0.73
Schwyz (SZ)	0.59
Solothurn (SO)	0.77
Thurgau (TG)	0.73
Ticino (TI)	0.81
Uri (UR)	0.62
Vaud (VD)	0.94
Valais (VS)	0.79
Zurich (ZH)	0.98
Zug (ZG)	0.49

Results, which clearly confirm the previous statistical results, are shown in Table 2. The values are higher than those obtained for correlation statistics, suggesting some degree of cyclical convergence, but with an absence of synchronization between the cantons. Cantons that maintain a lower correlation, even after the estimation of the above equation are: Bern, Luzern, Obwalden, and Zoug. These cantons are all geographically close (in the centre of Switzerland) and share agriculture as a specialization sector. Dafflon (2005: 9) states that the

equalization mechanisms in Switzerland have been very successful in reducing regional disparities. Results for the BK filter confirm those above. The results in this section also confirm the notion introduced at the end of the previous section.

3.3 Idiosyncratic Component of the Cycle

Another exercise to test if cyclical association is strong is to calculate the specific or idiosyncratic component of the cycle in each canton, i.e., the part of the canton cycle that is not explained by Switzerland's overall business cycle or by the past behaviour of the canton cycle. If this component reveals elevated values, cyclical association between each canton and Switzerland will be weak. For this purpose we estimate the following equation:

$$y\_cic_t^i = \beta_1 y\_cic_{t-1}^i + \beta_2 y\_cic_{t-2}^i + \beta_3 y\_cic_t^{Swiss} + \beta_4 y\_cic_{t-1}^{Swiss} + \beta_5 y\_cic_{t-2}^{Swiss} + \varepsilon_{it} \quad (2)$$

where ε_{it} can be regarded as the idiosyncratic component of each canton's fluctuations. For each canton we attempt several estimations in order to achieve the best possible fit. This means that whenever variables are not statistically significant, they are dropped from equation (2).

Our purpose with these calculations is to assess the proportion of the business cycle explained by idiosyncratic shocks in each of the cantons. This proportion is calculated in the following way: $\frac{\sigma_{\varepsilon_t}}{\sigma_{y\_cic_t}}$, where σ_{ε_t} is the standard deviation of the idiosyncratic component of the cycle and $\sigma_{y\_cic_t}$ is the total standard deviation of the cycle in the canton. Thus, the larger the value of this ratio, the greater is the proportion of the business cycle due to specific canton shocks. Table 3 shows the results for each canton for the period between 1978 and 2005. The majority of the cantons present a greater proportion of business cycle idiosyncrasy, meaning that most of the variations in its business cycle are not due to variations in Switzerland's business cycle. The canton with the lowest proportion of idiosyncrasy in its business cycle is Zurich, which is the largest canton in Switzerland, accounts for approximately 22% of Switzerland's GDP, and is the country's principal economic and financial city. The cantons with the specific component below 50% are: Vaud, Geneva, and Neuchâtel. The canton of Geneva is the headquarters of many multinational companies and these cantons share a few sectors that are very dynamic in terms of growth in Switzerland: biotechnologies, micro- and nano-technologies, information and communication technologies (ICT), and computer engineering. The substantial degree of fiscal and political independence of the cantons might also be an

explanation. These three cantons are all geographically close and share French as their official language and Protestantism as their main religion. Results for the BK filter corroborate these findings.

Table 3 - % of the Variability of the Idiosyncratic Component in the Total Variability of the Cycle

Cantons	$1978-2005$
Aargau (AG)	64%
Appenzell Innerrhoden (AI)	73%
Appenzell Ausserrhoden (AR)	86%
Basel-Landschaft (BL)	93%
Basel-Stadt (BS)	51%
Bern (BE)	75%
Fribourg (FR)	68%
Geneva (GE)	45%
Glarus (GL)	60%
Graubünden (GR)	72%
Jura (JU)	71%
Luzern (LU)	75%
Neuchâtel (NEU)	48%
Nidwalden (NW)	62%
Obwalden (OW)	91%
St.-Gallen (SG)	71%
Schaffhausen (SH)	71%
Schwyz (SZ)	74%
Solothurn (SO)	75%
Thurgau (TG)	72%
Ticino (TI)	58%
Uri (UR)	84%
Vaud (VD)	33%
Valais (VS)	70%
Zurich (ZH)	19%
Zug (ZG)	79%

The evidence presented in this section reveals that the majority of the cantons' business cycles are not explained by the Swiss business cycle. In this case, a single monetary policy does not have homogenous results across the cantons. This could pose a potential problem, but since there is coordination of fiscal policies between the cantons and with the Federal Government, the existing monetary union in Switzerland is manageable. Contrary to this, in the EMU there are no such coordination mechanisms for fiscal policies of member states.

We also analysed the evolution of the idiosyncratic component of the cycle for each canton and found that in most cantons the volatility of the specific

component of the cycle seems to be increasing in the last decade of the sample.[5]

4 Business Cycle Synchronization

In this section we assess the degree of business cycle synchronization between each canton and Switzerland. The synchronization will be measured by defining the number of lagging or leading periods (in our case, years) at which we have the maximum value for the correlation coefficient. For a given canton X^i and Switzerland, $\rho_{\pm N}\left(x^i_{t\pm N}, Switzerland_t\right)$ is the correlation coefficient between X^i and Switzerland at any given period N ($N \in \mathbb{N}$). The maximum value for $\rho_{\pm N}$ is the maximum correlation coefficient. Synchronization is obtained when the maximum value for the correlation coefficient is at period 0.

Table 4 - Maximum Correlation between each Canton and Switzerland

Cantons	$1978-2005$
Aargau (AG)	0.56 (+1)
Appenzell Innerrhoden (AI)	0.53 (0)
Appenzell Ausserrhoden (AR)	0.68 (+1)
Basel-Landschaft (BL)	0.38 (0)
Basel-Stadt (BS)	0.54 (0)
Bern (BE)	0.43 (0)
Fribourg (FR)	0.57 (0)
Geneva (GE)	0.80 (0)
Glarus (GL)	0.52 (0)
Graubünden (GR)	0.60 (0)
Jura (JU)	0.68 (0)
Luzern (LU)	0.39 (0)
Neuchâtel (NEU)	0.70 (0)
Nidwalden (NW)	0.79 (0)
Obwalden (OW)	-0.43 (-4)
Saint - Gallen (SG)	0.51 (+1)
Schaffhausen (SH)	0.53 (0)
Schwyz (SZ)	0.48 (0)
Solothurn (SO)	0.66 (0)
Thurgau (TG)	0.60 (+1)
Ticino (TI)	0.81 (0)
Uri (UR)	-0.42 (-1)
Vaud (VD)	0.93 (0)
Valais (VS)	0.63 (0)
Zurich (ZH)	0.96 (0)
Zug (ZG)	0.45 (0)

[5] Results are available upon request.

Results in Table 4 show that business cycles for the cantons are synchronized with Switzerland's business cycle, except for the cantons of Aargau, Appenzell Ausserrhoden, Obwalden, Saint-Gallen, Thurgau, and Uri. The cantons of Obwalden and Uri, which show a maximum correlation with Switzerland that is negative and lagged are both German, Catholic, geographically close to each other, and share tourism as a specialization sector. The cantons of Aargau, Appenzell Ausserrhoden, Saint-Gallen, and Thurgau are all German speaking, and the last three are geographically close. In common they have textiles and clothing, railway and metallurgical companies. Although this means that business cycle synchronization exists for the majority of the cantons, one should note that correlations are still low. Hence, the timing of monetary policy stills matters, as we saw in the previous section. In the EU we find similar results, i.e., different sectors drive the business cycles in different countries (e.g., Afonso and Furceri, 2009). Results for the BK filter are very similar to those presented above.

5 Cyclical Convergence

In this section we assess the dynamic behaviour of Swiss business cycles. This determines whether the Swiss cantons' business cycles are converging or diverging over time. In fact, one may expect that as regions become more integrated, business cycles would become ever more similar. In order to obtain an increase in cyclical convergence, both cyclical association and synchronization must show signs of improvement over time. To assess if cyclical convergence has increased (or not) in the time period analysed we need to perform a dynamic analysis. The following exercises will assess the behaviour of cyclical convergence for Swiss cantons. A general picture of the bilateral correlations for the cantons between 1979 and 2005 is shown in Table A.2 in Appendix A. Bilateral correlations are mostly positive and significant, although not very high. Some of the cantons have negative bilateral correlations with other cantons, especially Basel - Landschaft, Glarus, and Uri. Results for the BK filter strongly corroborate these results.

5.1 Rolling Windows

We analysed the dynamics of the correlation coefficients for the output gap between Swiss cantons using rolling windows analysis. Since results in Table 1 point to the existence of a linear association between the variables, we analyse, in terms of the dynamic evolution, only the Pearson correlation coefficient. Rolling

window analysis works like a moving sample, where a specified number of observations are dropped from each window and others are added in; with each window always having the same length.

To perform rolling windows analysis, we specified a window length of ten years, which is the average duration of a complete business cycle.[6] The window advances by an increment of one year. We begin with the first ten observations of the data, then use observations 2 to 11, and so on.[7]

In each window we calculate the bilateral correlation matrix between the cantons. Thus, given that there are 26 cantons, in each window we calculate $\frac{26*25}{2} = 325$ bilateral correlations, and compute their average and standard deviation. In the figures below, we call these values "bilateral average" and "standard deviation (bilateral)", respectively.

We also calculate a vector (26×1) of correlations of the cantons with Switzerland and obtain the average and standard deviations of these correlations. In the figures below we designate these values as "national average" and "national standard-deviation", respectively.

The figures in the text are for the rolling windows analysis of ten-year length. Because there is no consensus in the literature on the choice of the optimal period of time for a rolling window, we perform another calculation, using a period of 15 years, but the main conclusions hold.[8]

[6] Sorensen and Whitta-Jacobsen (2005) and the seminal work of Burns and Mitchell (1946) are good references for business cycle length.

[7] Notice, however, that computation of the output gap was performed only once, using the full sample.

[8] Results are available upon request.

Figure 1 - Average Bilateral Correlations for Swiss Cantons

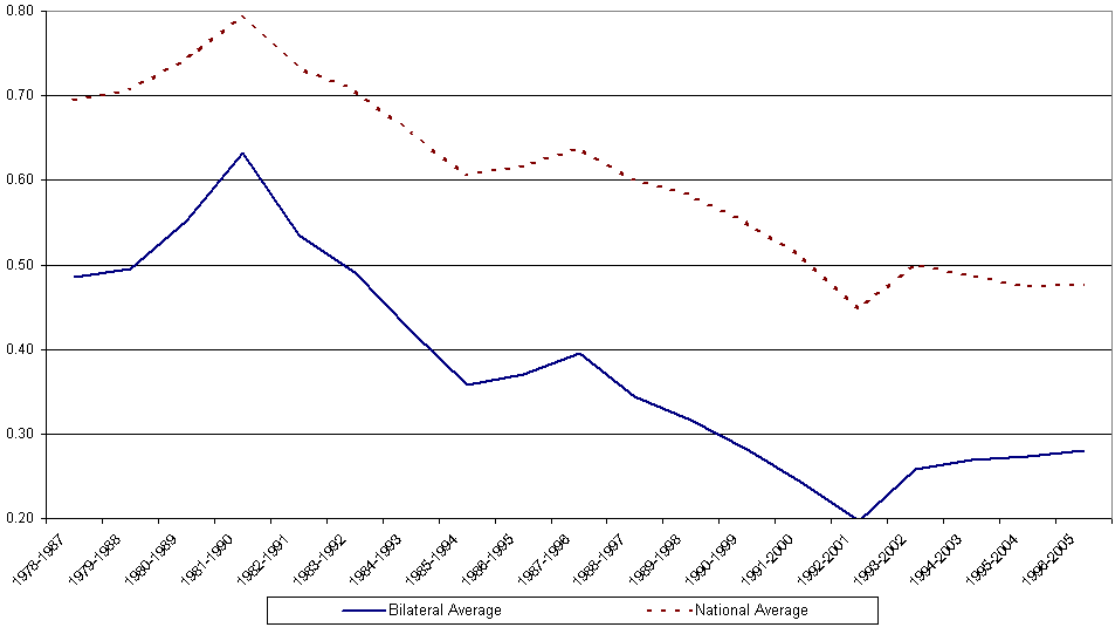

Figure 2 - Standard Deviation of Bilateral Correlations for Swiss Cantons

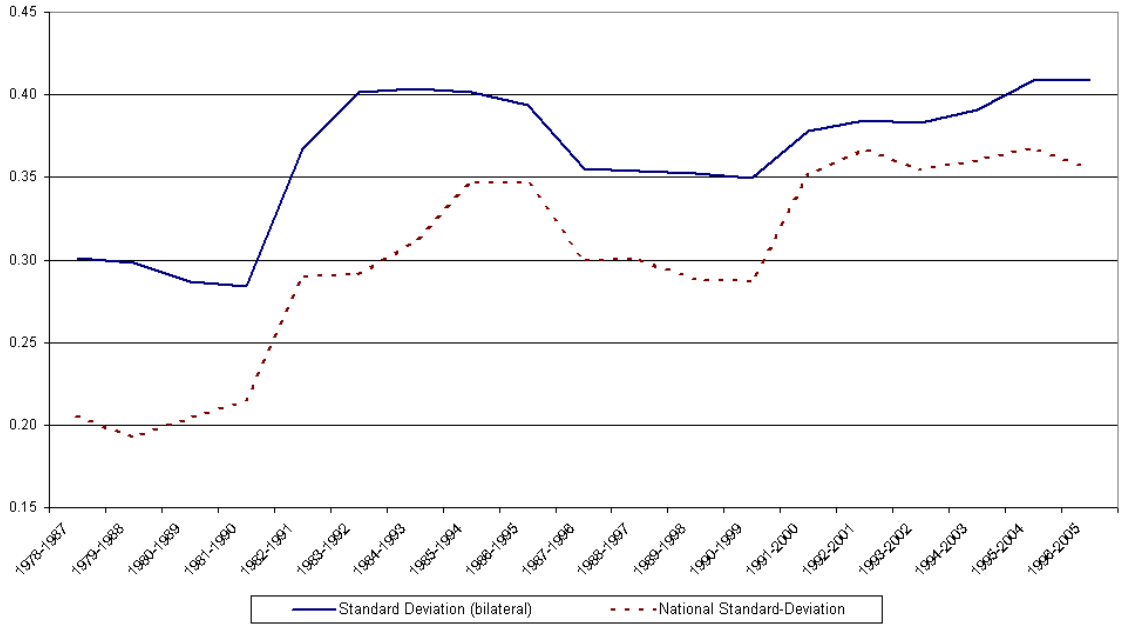

Figure 1 shows that the initial value for bilateral and national average correlations was high but has been decreasing over time, although national average correlations are higher than bilateral ones. This fact is evident in all time periods used for the calculations of rolling windows. On the other hand, the standard deviations of the correlations have been increasing, even though this evidence is clearer in the ten-year period rolling windows, as seen in Figure 2. The standard deviations for the bilateral correlations are higher than those for the national average. This may be evidence of some loss of convergence between the cantons. These results corroborate the evidence we have found that the volatility of the specific component of the cycle of each canton was increasing in the last decade of the sample. Ferreira-Lopes and Pina (2011) found the same evidence for the EU.

We will assess the statistical significance of the trends suggested by the rolling windows analysis as regards differences between cantons and also differences between periods. As in earlier studies (e.g. Wynne and Koo (2000), Clark and van Wincoop (2001), and Beine and Coulombe (2003)) we estimate the variance-covariance matrix of the bilateral correlation coefficients using the

generalized method of moments (GMM). More specifically, we compute Newey-West standard errors and covariances.[9]

Table 5 gives us significance results for the period 1978-2005 for average bilateral correlations between all cantons, for German and French speaking cantons, and also for Catholic and Protestant cantons.[10] The division of the cantons by languages is inspired by gravity models of international trade, where the sharing of a common language is assumed to be useful in facilitating commercial transactions (e.g. Melitz, 2008). The division between Catholic and Protestant cantons is based on the literature initiated by Weber (1930), in which the author found a positive relationship between Protestantism and economic development, and other works have found a negative correlation between Catholicism and economic development.[11] There is a clear difference in average bilateral correlations between French speaking cantons and German speaking cantons. German speaking cantons have a more similar value for average bilateral correlations than the one presented for the whole country, which is quite normal since they represent more than 60% of Switzerland's GDP. French cantons, however, present a much higher value for the bilateral correlations, indicating that these cantons' business cycle comovements are much more evident than amongst the German cantons. They are all geographically close to each other and share a similar economic specialization, reported above, in Section 3.3. Results for the BK filter confirm those presented below. The division between Catholic and Protestant cantons does not show any significant difference. Results for the BK filter show greater difference between religions.

Table 5 - Significance of Average Bilateral Correlations 1979-2005

All Cantons	*German*	*French*	*Catholic*	*Protestant*
0.33***	0.29***	0.64***	0.32***	0.34***
(0.05)	(0.05)	(0.07)	(0.07)	(0.05)

Note: (***) denotes significance at 1% level. Numbers in parentheses are Newey-West standard errors.

[9] The GMM method is used when ones suspects problems of endogeneity between explanatory variables. The correlation coefficient implies a relationship, positive or negative, between two variables, so by definition of this statistic, there is endogeneity between these two variables. We use the GMM to estimate this statistic and also the associated standard error.

[10] In this sense, we classify a canton as German or French speaking only if the most important language of the canton is one of these, as can be seen in Table B.1 of Appendix B. We cannot calculate average bilateral correlations for Italian speaking cantons because there is only one - Ticino. Hence, we have removed five cantons from this analysis, representing 21.7% of Switzerland's GDP. Regarding religion, when there are two, the canton is classified according to the greater percentage. We have removed three cantons from the analysis (representing 14.3% of Switzerland's GDP), as no prevailing religious faith can be identified in them. In the column "All Cantons", results are for the 26 cantons.

[11] Grier (1997) is a more recent reference on this topic.

We also checked if there is a significant difference in average bilateral correlations between German and French speaking cantons and between Catholic and Protestant cantons - what Clark and van Wincoop (2001) called the border effect in their Europe versus USA comparison. The difference in average bilateral correlations between French speaking and German speaking cantons between 1979 and 2005 is statistically significant, as seen in Table 6. This finding may suggest the existence of two very distinct and separate groups (or clusters) in Switzerland, separated by language differences. Results regarding religion differences are not statistically significant. Results are equivalent for the BK filter for language, but differ for religions, where the difference between religions is statistically significant, but by very little.

Table 6 - Language and Religion as Border Effects (1979-2005)

	German Cantons
French Cantons	0.35***
	(0.08)
	Protestant Cantons
Catholic Cantons	-0.02
	(0.07)

Note: (***) denotes significance at 1% level. The entries are the difference in average pairwise correlations between French speaking cantons in row and German speaking cantons in column and Catholic cantons in rows and Protestant cantons in columns. Numbers in parentheses are Newey-West standard errors.

Finally, we divide the sample into two sub-samples and calculate the changes in average bilateral correlations between the two periods, and report the results in Table 7. Our aim was to assess, if, in dynamic terms, average bilateral correlations have changed.

Table 7- Significance of Average Bilateral Correlations

	All	*German*	*French*	*Catholic*	*Protestant*
$1980-1992$					
	0.49***	0.50***	0.57***	0.58***	0.33***
	(0.07)	(0.07)	(0.16)	(0.09)	(0.07)
$1993-2005$					
	0.25***	0.21***	0.64***	0.20***	0.34***
	(0.04)	(0.05)	(0.08)	(0.04)	(0.04)
Change	-0.24***	-0.29***	0.07	-0.38***	0.01
	(0.09)	(0.09)	(0.20)	(0.09)	(0.08)

Note: (***) denotes significance at 1% level. Numbers in parentheses are Newey-West standard errors.

As seen from Table 7, changes in German cantons and in the whole country are significant. Average bilateral correlations decreased between these two periods. Contrary to this trend, average bilateral correlations between French cantons increased, although the change is not enough to be considered significant. Even so, there seems to be a difference, in terms of business cycle correlations, between German speaking and French speaking cantons. These differences might reflect the uneven distribution of multinational headquarters and trends in commuting. Multinational headquarters are located mainly in the French cantons. Trends in commuting have brought the French cantons closer, especially in the last decades (the commuting area has expanded among French cantons), while some cantons of the German Region remain with limited commuting. Changes are also significant in Catholic cantons, but not in Protestant ones. This last group represents about 64% of Switzerland's GDP. The difference between periods that we see in Catholic cantons can be associated with the differences in German cantons, since most are German (also includes the Italian canton, Ticino). Differences between Protestant and Catholic cantons narrowed from the first period to the second. Results for the BK filter are similar to those presented above.

5.2 Core-Periphery Patterns

We perform cluster analysis to investigate the evolution of convergence between the cantons and Switzerland, checking the output gaps, with a ten-year span for each cluster analysis. This time span is also used in the rolling windows analysis, and for comparison reasons is used here as well. We also perform a sensitivity analysis with a fifteen-year span, just as in the rolling-windows analysis, and find that all the main conclusions hold.[12]

The hierarchical agglomerative cluster method was used, i.e., a method that begins with each individual region being a single cluster and ends with all the regions in the same cluster, if not stopped earlier. In order to use this method an aggregation (or desegregation) criterion must also be chosen, and in this case the complete linkage (or furthest neighbour) method was chosen. With this method the distance between two groups is defined as the distance between its least similar members. Given two groups (l, j) and (k), the distance (d) between them is the greatest distance between their members:

$$d_{(l,j)k} = \max\{d_{lk}; d_{jk}\}$$

[12] Results are available upon request.

The Pearson correlation coefficient was chosen as a distance measure so that it would be possible to compare these results to those of the other sections. The first cluster that is formed tends to be the most homogeneous, i.e., the one that has the highest correlations between its members.

We stop cluster formation before the correlation coefficient goes below the average bilateral correlations of the cantons. These values were obtained in the previous section. With this method, the number of clusters in each period can be obtained. We perform sensitivity analysis on the hypothesis for cluster formation, in order to check if the results change substantially with the change in the criterion. Thus, in this last exercise we stop cluster formation before the correlation coefficient goes below the value for average bilateral correlations plus half a standard deviation of those bilateral correlations.[13]

Cluster analysis for Switzerland does not reveal a distinct division between a core and periphery, as shown in Table 8. Although clusters seem to be formed according to some degree of geographical proximity, the cantons that take part in that specific cluster are not the same across the time periods analysed, although there are some exceptions. The cantons of Zurich and Vaud always belong to cluster 1, which is the cluster that has the highest correlation between its members. These two cantons are geographically distant but their cyclical association is high and their economic weight in Switzerland is high, especially in the case of Zurich.

Productive specialization in each canton can provide some explanations for cluster formation. The sectors of energy and pharmaceuticals (medical sciences) always belong to cluster 1, and in the last two periods, the sectors of biotechnologies and finance and insurance join this cluster. The tourism and agriculture sectors are always in the same clusters. The sectors of micro- and nano-technologies, computer engineering, and information and communication technologies (ICT) always belong to the same cluster and appear in cluster formation in the two last periods. Although in terms of productive specialization there seems to be a pattern in cluster formation, the cantons in the clusters change over time, as seen in Table 8. This is because several cantons have the same (or very similar) productive specialization. This analysis therefore does not clearly reveal a core-periphery type of situation in the Swiss Federation.

The sensitivity exercise does not reveal any significant change from the conclusions stated above, although some cantons that are shown in Table 8 come out of cluster formation in the several periods, but they are not always the same ones. Sometimes cantons that are joined in the same cluster under the previous

[13] Results are available upon request.

criteria are separated under sensitivity analysis, but this does not follow a common trend. Thus, the existence of a core-periphery in the case of Switzerland does not seem plausible, even though some cantons, as mentioned above, seem to share a high degree of business cycle synchronization during the time period analysed. Results for the BK filter are similar.

Table 8 - Cluster Evolution for Switzerland

	1979-88	**1989-98**	**1996-2005**
Cluster 1	NEU, ZH, FR, SO, JU, SH, VD, VS	GE, ZH, VD, TG	GE, TI, ZH, VD, NEU BS, GL, ZG, NW
Cluster 2	AG, NW, OW, SZ, BE TG, AR, GR, UR, BL	BS, SH, SZ, AI, BL	AR, TG, AG, SG, UR GR, VS, JU
Cluster 3	LU, SG,GL, AI	JU, VS, TI, NEU, NW	BE, OW, LU, FR
Cluster 4	BS, GE, TI	BE, OW, LU, FR, SO	SH, SZ, BL, AI, SO
Cluster 5		AG, SG, ZG	
Cluster 6		AR, GR, UR	
Cantons not included in cluster	ZG	GL	-
Average for the bilateral correlat.	0.49	0.32	0.28
Value for correlat. when cluster stops	0.50	0.40	0.29
Value for correlat. after cluster stops	0.42	0.30	0.06

6 Conclusions

This paper analyses the business cycle patterns between Swiss Cantons and their relationship with the national business cycle. To our knowledge, regional business cycle literature for this country is nonexistent, and our work is a vanguard contribution.

We show evidence that Swiss Cantons are relatively synchronized despite the relative importance of the idiosyncratic component of the cantons' business cycles. Bilateral correlations have been decreasing over time, and volatility of those bilateral correlations seems to be increasing, meaning that synchronization may be weakening. This means that the unified monetary union may face problems in the timing and transmission of monetary policy, although in this federal country there is horizontal and vertical coordination of fiscal policy to mitigate the possible asymmetric results of monetary policy.

Contrary to the expected result of integration, the regional business cycles' linkages are decreasing over time and between the majority of the German

cantons. Despite the importance of idiosyncratic cycles and the decreasing relationship between the cantons' business cycles, which is also the case in the EU (Ferreira-Lopes and Pina, 2011), Switzerland is not questioning its monetary union. Moreover, even though we show the existence of significant differences between the two main groups of linguistic regions, also differentiated due to religious beliefs, the Swiss union is not at risk. In fact, the EU may learn from Switzerland some of the mechanisms that seem to be the strength of this monetary union, namely the mechanisms of equalization and redistribution of the fiscal system, enforced vertically and horizontally, and the fact that Swiss cantons are allowed to compete on the tax base (with important effects also on economic growth, as shown by Feld et al. (2004) and with negligable effects on migration movements due to tax reasons, as stated by Dafflon (2005)). At a time of uncertainty about the desired level of integration in the EU, the example of Switzerland, and in particular the means it uses to soften the impact of a common monetary policy and avoid uncontrolled deficits on a heterogeneous group of states, may be a matter of reflection for policy-makers in the EU. The means include equalization and redistribution mechanisms, limited tax competition, and tight budgetary rules within the cantons. Indeed, the equalization mechanisms currently existing in the Swiss Federation are set in order not to jeopardize the goals of budget responsibility and fiscal autonomy of the cantons. The very recent intention of some European politicians to introduce deficit limits in the states' constitutions are in this line of thought. However, current mainstream thinking within Europe seems to go against any type of tax competition between states or even any type of equalization or redistribution scheme. Like Switzerland, the EU is composed of heterogeneous states that fear losing even more sovereignty, just as it happened with the more conservative cantons in the $19^{\mathbf{th}}$ century, before the establishment of the Swiss Federation. However, the Swiss type of federalism, in which states work in cooperation, respecting each others' differences is, in our opinion, a small loss compared to the greater gain in stabilization and efficiency. The EU (and especially the EMU) could take great benefit from the Swiss lesson.

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7 Appendix A - Business Cycles Statistics

Table A.1 - Business Cycle Statistics for Swiss Cantons

Cantons	*Volatility (%)*	*Persistence*
Aargau (AG)	1.95	0.48
Appenzell Innerrhoden (AI)	4.87	0.40
Appenzell Ausserrhoden (AR)	3.83	0.63
Basel-Landschaft (BL)	2.05	0.20
Basel-Stadt (BS)	7.98	0.43
Bern (BE)	1.34	0.35
Fribourg (FR)	2.43	0.54
Geneva (GE)	3.82	0.48
Glarus (GL)	5.87	0.42
Graubünden (GR)	2.27	0.28
Jura (JU)	3.29	0.42
Luzern (LU)	1.89	0.32
Neuchâtel (NEU)	4.68	0.44
Nidwalden (NW)	3.90	0.31
Obwalden (OW)	2.77	0.16
Saint - Gallen (SG)	1.79	0.43
Schaffhausen (SH)	2.06	0.30
Schwyz (SZ)	3.97	0.54
Solothurn (SO)	2.34	0.43
Thurgau (TG)	1.92	0.36
Ticino (TI)	2.26	0.28
Uri (UR)	1.92	0.42
Vaud (VD)	1.69	0.44
Valais (VS)	2.20	0.45
Zurich (ZH)	2.43	0.49
Zug (ZG)	3.92	0.41
Switzerland	1.72	0.44

Table A2 - Business Cycle Correlations for Swiss Cantons Between 1979 and 2005

	AIR	AAR	AG	BL	BS	BE	FR	GE	GL	GR	JU	LU	NEU	NW	OW	SH	SZ	SG	SO	TI	TG	UR	VS	VD	ZG	ZH
AIR																										
AAR	0.50***																									
	(0.22)																									
AG	0.42***	0.75***																								
	(0.15)	(0.08)																								
BL	0.74***	0.45**	0.51***																							
	(0.07)	(0.21)	(0.17)																							
BS	0.22*	-0.23	-0.39***	0.10																						
	(0.12)	(0.16)	(0.13)	(0.19)																						
BE	0.06	0.01	0.28	-0.06	-0.04																					
	(0.14)	(0.24)	(0.19)	(0.12)	(0.20)																					
FR	0.22*	0.31***	0.48***	0.07	-0.18	0.71***																				
	(0.12)	(0.14)	(0.12)	(0.14)	(0.12)	(0.09)																				
GE	0.43***	0.12	-0.02	0.16	0.76***	0.19	0.26*																			
	(0.10)	(0.21)	(0.21)	(0.14)	(0.11)	(0.21)	(0.15)																			
GL	0.00	-0.15	-0.27	-0.09	0.68***	0.35***	0.15	0.46*																		
	(0.17)	(0.19)	(0.19)	(0.20)	(0.20)	(0.10)	(0.13)	(0.27)																		
GR	0.28	0.51***	0.39***	0.26	0.22	0.26	0.46***	0.32**	0.48***																	
	(0.19)	(0.12)	(0.11)	(0.22)	(0.17)	(0.23)	(0.14)	(0.15)	(0.08)																	
JU	0.37***	0.61***	0.41***	0.00	0.09	0.35*	0.59***	0.51***	0.11	0.44***																
	(0.14)	(0.07)	(0.12)	(0.22)	(0.08)	(0.19)	(0.09)	(0.13)	(0.09)	(0.12)																
LU	0.33***	0.23	0.64***	0.41***	-0.30***	0.73***	0.69***	-0.06	0.02	0.30	0.18															
	(0.11)	(0.25)	(0.15)	(0.11)	(0.10)	(0.09)	(0.09)	(0.18)	(0.15)	(0.21)	(0.20)															
NEU	0.24**	0.12	0.07	-0.10	0.38**	0.49***	0.66***	0.57***	0.43**	0.31*	0.72***	0.22														
	(0.11)	(0.19)	(0.20)	(0.21)	(0.17)	(0.10)	(0.08)	(0.11)	(0.20)	(0.17)	(0.14)	(0.17)														
NW	0.64***	0.30*	0.20	0.35**	0.58***	0.44***	0.38***	0.59***	0.59***	0.52***	0.51***	0.31***	0.66***													
	(0.10)	(0.18)	(0.17)	(0.17)	(0.12)	(0.12)	(0.10)	(0.15)	(0.13)	(0.15)	(0.10)	(0.11)	(0.06)													
OW	0.21	0.07	0.34	0.16	-0.18	0.84***	0.67***	0.05	0.23**	0.10	0.28	0.72***	0.49***	0.43***												
	(0.17)	(0.24)	(0.21)	(0.17)	(0.16)	(0.05)	(0.07)	(0.20)	(0.11)	(0.22)	(0.21)	(0.09)	(0.14)	(0.14)												
SH	0.51***	0.20	0.18	0.59***	0.59***	-0.15	-0.15	0.53***	0.12	0.13	0.26	-0.01	0.22	0.43***	-0.08											
	(0.06)	(0.15)	(0.13)	(0.10)	(0.09)	(0.18)	(0.26)	(0.11)	(0.19)	(0.30)	(0.18)	(0.16)	(0.219	(0.15)	(0.18)											
SZ	0.69***	0.65***	0.50***	0.74***	0.11	-0.13	0.22*	0.33	-0.22	0.35**	0.44***	0.18	0.19	0.38***	0.01	0.62***										
	(0.05)	(0.12)	(0.15)	(0.06)	(0.29)	(0.18)	(0.12)	(0.24)	(0.18)	(0.17)	(0.11)	(0.20)	(0.15)	(0.13)	(0.21)	(0.13)										
SG	0.37**	0.79***	0.89***	0.48**	-0.41***	0.20	0.40**	0.00	-0.18	0.48***	0.42**	0.54**	-0.07	0.08	0.22	0.16	0.44**									
	(0.20)	(0.08)	(0.05)	(0.20)	(0.12)	(0.20)	(0.16)	(0.20)	(0.20)	(0.10)	(0.17)	(0.21)	(0.22)	(0.17)	(0.22)	(0.14)	(0.18)									
SO	0.39***	0.29**	0.55***	0.19	-0.02	0.55***	0.70***	0.41**	-0.03	0.22*	0.63***	0.59***	0.63***	0.36***	0.55***	0.31***	0.40***	0.43**								
	(0.07)	(0.13)	(0.14)	(0.18)	(0.08)	(0.11)	(0.09)	(0.17)	(0.15)	(0.12)	(0.11)	(0.15)	(0.11)	(0.08)	(0.10)	(0.12)	(0.06)	(0.20)								
TI	0.39***	0.25	0.01	0.10	0.74***	0.28	0.27*	0.82***	0.63***	0.53***	0.58***	0.02	0.64***	0.73***	0.10	0.51***	0.31	0.01	0.36**							
	(0.10)	(0.19)	(0.22)	(0.19)	(0.12)	(0.21)	(0.15)	(0.10)	(0.16)	(0.11)	(0.11)	(0.21)	(0.08)	(0.10)	(0.20)	(0.13)	(0.21)	(0.20)	(0.16)							
TG	0.47***	0.70***	0.78***	0.58***	-0.10	0.26	0.38***	0.19	-0.09	0.37**	0.43***	0.53***	0.17	0.44***	0.34**	0.32**	0.64***	0.67***	0.46***	0.17						
	(0.13)	(0.08)	(0.04)	(0.10)	(0.14)	(0.17)	(0.13)	(0.16)	(0.14)	(0.15)	(0.12)	(0.14)	(0.13)	(0.11)	(0.15)	(0.14)	(0.06)	(0.09)	(0.11)	(0.15)						
UR	0.11	0.62***	0.54***	0.25	-0.31**	-0.14	-0.06	-0.34**	-0.05	0.48***	0.09	0.20	-0.36**	0.00	-0.18	0.05	0.27	0.65***	-0.06	-0.03	0.42**					
	(0.28)	(0.16)	(0.19)	(0.23)	(0.13)	(0.19)	(0.22)	(0.16)	(0.25)	(0.12)	(0.24)	(0.25)	(0.18)	(0.20)	(0.23)	(0.12)	(0.24)	(0.12)	(0.26)	(0.15)	(0.17)					
VS	0.32***	0.59***	0.60***	0.15	-0.05	0.40**	0.64***	0.39*	0.00	0.48***	0.76***	0.38*	0.53***	0.35***	0.35	0.34***	0.49***	0.59***	0.76***	0.49**	0.44***	0.25				
	(0.08)	(0.06)	(0.12)	(0.18)	(0.14)	(0.21)	(0.10)	(0.20)	(0.13)	(0.10)	(0.09)	(0.21)	(0.18)	(0.12)	(0.22)	(0.12)	(0.07)	(0.14)	(0.09)	(0.20)	(0.14)	(0.22)				
VD	0.49***	0.52***	0.49***	0.29**	0.37**	0.48**	0.56***	0.75***	0.42***	0.49***	0.67***	0.34	0.60***	0.66***	0.41**	0.40**	0.40***	0.46***	0.63***	0.74***	0.52***	0.05	0.71***			
	(0.11)	(0.14)	(0.18)	(0.13)	(0.16)	(0.20)	(0.14)	(0.06)	(0.14)	(0.12)	(0.10)	(0.22)	(0.09)	(0.10)	(0.18)	(0.17)	(0.15)	(0.17)	(0.13)	(0.07)	(0.11)	(0.16)	(0.14)			
ZG	0.01	-0.16	0.07	0.03	0.36	0.31	0.26	0.33	0.56***	0.24*	-0.09	0.31	0.12	0.23	0.10	0.05	-0.19	0.11	0.17	0.30	0.05	0.04	0.08	0.41		
	(0.12)	(0.20)	(0.28)	(0.18)	(0.27)	(0.21)	(0.24)	(0.28)	(0.20)	(0.12)	(0.28)	(0.21)	(0.36)	(0.24)	(0.21)	(0.14)	(0.14)	(0.27)	(0.30)	(0.32)	(0.19)	(0.21)	(0.31)	(0.26)		
ZH	0.46***	0.41**	0.35	0.24	0.54***	0.36	0.55**	0.81***	0.52***	0.55***	0.71***	0.22	0.74***	0.74***	0.29	0.46**	0.45**	0.29	0.60***	0.78***	0.46***	-0.04	0.60***	0.91***	0.43	
	(0.09)	(0.20)	(0.24)	(0.15)	(0.17)	(0.23)	(0.14)	(0.09)	(0.18)	(0.09)	(0.09)	(0.23)	(0.08)	(0.08)	(0.23)	(0.19)	(0.20)	(0.23)	(0.15)	(0.09)	(0.14)	(0.20)	(0.18)	(0.03)	(0.26)	

Note: (*), (**), and (***) denote significance at 10%, 5%, and 1% levels, respectively. Numbers in parentheses are Newey-West standard errors.

8 Appendix B - Some Information on Cantons

Table B.1 - Cantons of Switzerland

Swiss Cantons	Year joining the (Con)Federation	% of NNI (2005)	Language	Religion
Aargau (AG)	1803	6.9%	German	Mixed
Appenzell Innerrhoden (AI)	1513	0.2%	German	Catholic
Appenzell Ausserrhoden (AR)	1513	0.6%	German	Protestant
Basel-Landschaft (BL)	1501	3.5%	German	Protestant
Basel-Stadt (BS)	1501	5.4%	German	Protestant
Bern (BE)	1353	10.9%	German/French	Protestant
Fribourg (FR)	1481	2.5%	French/German	Catholic
Geneva (GE)	1815	6.8%	French	Protestant
Glarus (GL)	1352	0.7%	German	Protestant
Graubünden (GR)	1803	2.3%	Germ./Rom./Ital.	1/2 Cat., 1/2 Prot.
Jura (JU)	1979	0.6%	French	Catholic
Luzern (LU)	1332	3.9%	German	Catholic
Neuchâtel (NEU)	1815	2.1%	French	Protestant
Nidwalden (NW)	1291	0.7%	German	Catholic
Obwalden (OW)	1291	0.3%	German	Catholic
Saint - Gallen (SG)	1803	5.1%	German	Mixed
Schaffhausen (SH)	1501	1.0%	German	Protestant
Schwyz (SZ)	1291	1.7%	German	Catholic
Solothurn (SO)	1481	2.9%	German	Catholic
Thurgau (TG)	1803	2.6%	German	Protestant
Ticino (TI)	1803	3.3%	Italian	Catholic
Uri (UR)	1291	0.4%	German	Catholic
Vaud (VD)	1803	8.7%	French	Protestant
Valais (VS)	1815	2.7%	French/German	Catholic
Zurich (ZH)	1351	21.9%	German	Protestant
Zug (ZG)	1352	2.5%	German	Catholic