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# Energy & Jobs: Adapting to Change

## The Evolution of Swiss Labor Market and Educational Implications in the Era of Energy Transition and Digitalization

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# Summary

The energy transition and the digitalization of energy systems are reshaping Switzerland's energy landscape, from production and storage to distribution and consumption. These developments are altering the labor market, changing both the number of workers required and the skills they need. Occupations in the energy and construction sectors are particularly affected, with rising demand for qualified professionals in areas such as electricity grids, heating and cooling, and smart building technologies. The project "Energy & Jobs: Adapting to Change" responds to this challenge by analyzing the effects of the energy transition on specific professions and by developing recommendations for vocational and continuing training.

The project combines econometric analysis of large-scale datasets with qualitative input from experts and firms. Two main data sources form the empirical foundation: job postings from x28, which provide detailed information on occupations, skills, and vacancy durations, and construction project data from Baublatt, which track energy-related investments such as solar installations, heating system replacements, and building insulation. By linking these datasets at the company level, the project can identify how firms' involvement in energy-related projects influences their labor demand and recruitment difficulties. This quantitative analysis is complemented by a Delphi workshop with industry representatives, a representative survey of firms, and a synthesis workshop to ensure that findings are translated into actionable measures for education and training.

The first stage of the project has focused on data preparation and econometric analysis (WP1). A significant achievement has been the successful structuring and linking of the two extensive datasets, creating a balanced panel at firm level covering the years 2018–2024. This now enables robust statistical analysis of how energy-related activities drive labor demand and skill shortages. Initial results are highly promising and confirm the relevance of job postings as an indicator of labor demand and vacancy duration as an indicator of labor market tightness in energy-related professions. In parallel, preparations for the Delphi workshop (WP2) are underway, with the first survey launched and strong support from industry associations ensuring participation. Overall, the project is progressing according to plan.

# Zusammenfassung

Die Energiewende und die Digitalisierung der Energiesysteme verändern die Schweizer Energielandschaft grundlegend – von der Produktion und Speicherung bis hin zur Verteilung und zum Verbrauch. Diese Entwicklungen wirken sich stark auf den Arbeitsmarkt aus, indem sie sowohl die Anzahl der benötigten Arbeitskräfte als auch die geforderten Qualifikationen verändern. Besonders betroffen sind Berufe im Energie- und Bausektor, wo die Nachfrage nach Fachkräften in Bereichen wie Stromnetze, Heiz- und Kühlsysteme sowie intelligente Gebäudetechnologien deutlich zunimmt. Das Projekt «Energy & Jobs: Adapting to Change» reagiert auf diese Herausforderungen, indem es die Auswirkungen der Energiewende auf spezifische Berufe untersucht und Empfehlungen für die Berufsbildung und Weiterbildung entwickelt.

Das Projekt kombiniert ökonometrische Analysen umfangreicher Datensätze mit qualitativen Beiträgen von Expertinnen, Experten und Unternehmen. Zwei zentrale Datenquellen bilden die empirische Grundlage: Stellenausschreibungen von x28, die detaillierte Informationen zu Berufen, Kompetenzen und Vakanzdauer liefern, sowie Baudaten von Baublatt, die energiebezogene Investitionen wie Solaranlagen, Heizungsersatz oder Gebäudedämmungen erfassen. Durch die Verknüpfung dieser Datensätze auf Unternehmensebene kann analysiert werden, wie sich die Beteiligung von Firmen an energiebezogenen Projekten auf ihre Arbeitskräftenachfrage und Rekrutierungsschwierigkeiten auswirkt. Diese quantitativen Analysen werden durch einen Delphi-Workshop mit Branchenvertretern, eine repräsentative Unternehmensbefragung sowie einen Synthese-Workshop ergänzt, um praxisnahe Handlungsempfehlungen für die Bildung abzuleiten.

In der ersten Projektphase lag der Schwerpunkt auf der Datenaufbereitung und der ökonometrischen Analyse (WP1). Ein wesentlicher Erfolg war die erfolgreiche Strukturierung und Verknüpfung der beiden umfangreichen Datensätze zu einem balancierten Panel für die Jahre 2018–2024. Damit ist nun eine robuste statistische Analyse der Auswirkungen energiebezogener Aktivitäten auf die Arbeitskräftenachfrage und mögliche Engpässe möglich. Erste Ergebnisse sind sehr vielversprechend und bestätigen die Aussagekraft der Vakanzdauer als Indikator für den Fachkräftemangel in energienahen Berufen. Parallel dazu laufen die Vorbereitungen für den Delphi-Workshop (WP2); die erste Umfrage ist gestartet und dank der Unterstützung der Branchenverbände ist eine breite Teilnahme sichergestellt. Insgesamt verläuft das Projekt planmässig.

# Résumé

La transition énergétique et la numérisation des systèmes énergétiques transforment en profondeur le paysage énergétique suisse, de la production et du stockage à la distribution et à la consommation. Ces évolutions modifient le marché du travail, en changeant à la fois le nombre de travailleurs nécessaires et les compétences requises. Les professions des secteurs de l'énergie et de la construction sont particulièrement concernées, avec une demande croissante de spécialistes qualifiés dans des domaines tels que les réseaux électriques, le chauffage et le refroidissement, ainsi que les technologies de bâtiments intelligents. Le projet «Energy & Jobs: Adapting to Change» répond à ces défis en analysant les effets de la transition énergétique sur certaines professions et en développant des recommandations pour la formation professionnelle initiale et continue.

Le projet combine des analyses économétriques de vastes ensembles de données avec des contributions qualitatives d'experts et d'entreprises. Deux sources principales de données constituent la base empirique : les offres d'emploi de la plateforme x28, qui fournissent des informations détaillées sur les professions, les compétences et la durée des vacances de postes, ainsi que les données de construction de Baublatt, qui recensent les investissements liés à l'énergie tels que l'installation de panneaux solaires, le remplacement de systèmes de chauffage ou l'isolation des bâtiments. En reliant ces données au niveau des entreprises, le projet permet d'identifier comment l'engagement des sociétés dans des projets énergétiques influence leur demande de main-d'œuvre et leurs difficultés de recrutement. Cette analyse quantitative est complétée par un atelier Delphi avec des représentants de l'industrie, une enquête représentative auprès des entreprises et un atelier de synthèse visant à traduire les résultats en recommandations concrètes pour la formation.

La première phase du projet s'est concentrée sur la préparation des données et l'analyse économétrique (WP1). Une étape importante a été franchie avec la structuration et la mise en relation réussies des deux ensembles de données, aboutissant à un panel équilibré pour les années 2018–2024. Cela permet désormais une analyse statistique robuste de l'impact des activités énergétiques sur la demande de main-d'œuvre et les pénuries de compétences. Les premiers résultats sont très encourageants et confirment la pertinence de la durée des vacances de postes comme indicateur de tensions sur le marché du travail dans les professions liées à l'énergie. Parallèlement, les préparatifs de l'atelier Delphi (WP2) sont en cours ; la première enquête a été lancée et, grâce au soutien des associations professionnelles, la participation est largement assurée. Dans l'ensemble, le projet progresse conformément au calendrier.

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# 1 Introduction

## 1.1. Context and motivation

The ongoing energy transition and the digitalization of energy systems are fundamentally reshaping the entire energy landscape, from generation and storage to transmission, distribution, and consumption. Key developments include the diversification of energy sources, the rise of decentralized production, fluctuating renewable generation from wind and solar, and the increasing ability to optimize consumption through smart metering (Gugler & Haxhimusa, 2019)

These transformations have far-reaching consequences for the labor market, affecting both the number of workers required and the skills they need. Job profiles are shifting, with some tasks disappearing, others emerging, and many becoming more complex. Since each occupation consists of multiple tasks, the degree of change varies widely across professions. Understanding these shifts is crucial for ensuring that the workforce can adapt to evolving energy systems.

This project examines how the energy transition affects occupations in Switzerland's energy and construction sectors. Both industries are directly exposed to these changes: electricity grids face new demands at nearly all levels, and buildings are increasingly shaped by smart systems, renewable heating and cooling, and photovoltaic integration. As a result, demand for qualified workers is rising.

The project aims to provide recommendations for vocational and continuing training, developed on the basis of econometric analysis, expert workshops, and a representative company survey. A distinctive feature of this work is the close cooperation between universities, universities of applied sciences, and professional associations responsible for vocational education. This collaboration ensures that research is both scientifically robust and practically relevant, enabling concrete measures for workforce development.

A growing body of literature investigates the impact of climate policy on labor markets, often focusing on shifts between sectors, firms, occupations, and regions. Many studies distinguish between "green," "white," and "brown" jobs (e.g., European Commission. Directorate General for Economic and Financial Affairs., 2022, OECD, 2023). . However, much of this research is based on the U.S. labor market (e.g., Vona et al., 2019). For Switzerland, (Lobsiger & Rutzer, 2021) estimated the "green potential" of occupations by measuring how different skills contribute to environmentally relevant tasks. Yet, existing work rarely addresses shortages or surpluses at the occupational level, nor the implications for retraining.

Most of these studies rely on the U.S.-based Occupational Information Network (O*NET), which does not align well with Switzerland's vocational training system. Alternative approaches, such as (Bau et al., 2022) use Swiss and German classifications to assess how digital transformation affects specific service-sector professions. Particularly relevant for our project is the methodology of (Kaiser et al., 2023), who employed the highly detailed x28 dataset of online job advertisements. Among other insights, x28 provides "vacancy duration," the time between the posting and removal of a job ad, which is a useful indicator of labor shortages. This dataset has also been used to study the impact of exchange rate changes on skill requirements (Colella, 2022) and to develop scarcity indicators for occupations (Felder & Shelden, 2023).

Existing Swiss studies provide an important foundation for understanding how the energy transition reshapes labor demand and competencies. Analyses of the photovoltaic (PV) sector show that around 7,000 full-time equivalents were employed in 2022, with demand expected to grow to 10,000–20,000 by 2035. Electricians, installers, and building services professions (heating, ventilation, sanitation) are identified as key bottlenecks (EPB, 2024; Koordinationsstelle Solarbildung Schweiz, 2023). Studies of the electrical and building services sectors highlight that electrification, heat pumps, and smart building technologies will strongly increase demand, while training statistics confirm growing numbers of graduates in relevant fields (Haessig & Schälchlie, 2023; von Euw et al., 2021).

The literature also emphasizes changing skill requirements: beyond traditional installation, future workers need competences in system integration (PV, storage, EV charging, heat pumps), digitalization, circular economy, and customer consulting (Interface, 2024; pom+Consulting, 2023).

While previous studies provide valuable insights into how the energy transition reshapes employment structures, they remain limited in scope. Most research has focused on broad categorizations of "green," "white," and "brown" jobs, or on estimating the green potential of occupations. However, they seldom capture occupational shortages, surpluses, or the retraining needs specific to Switzerland's vocational system. Our project directly addresses these gaps. By combining unique datasets on job postings (x28) and construction projects (Baublatt), we can link labor demand and vacancy durations with the intensity of energy-related investments at the firm level. This approach allows us to go beyond descriptive estimates and to identify causal relationships between the energy transition and changing labor market dynamics. Furthermore, the project integrates quantitative analysis with expert assessments and representative company surveys. This multi-method design not only validates the econometric results but also ensures that findings are translated into actionable recommendations for vocational and continuing training. In this way, the project deepens the existing evidence base, moving from general projections toward precise, practice-oriented insights for Switzerland's energy and construction sectors.

## 1.2. Project objectives

The overarching goal of this project is to understand the complex relationship between the energy transition and labor market dynamics in Switzerland. By analyzing these interactions, the project seeks to provide insights that support an efficient and socially responsible labor market transition.

More specifically, the project investigates the effects of the energy transition on jobs in the energy and building sectors, with a focus on the implications for education and training. The main research questions are:

1. Which jobs in the energy and building industries are most affected by the energy transition and the digitalization of energy systems?
    a. In which occupations has the transition created labor shortages or surpluses?
    b. Are entirely new professions emerging, and what tasks and skills do they require?
    c. How are tasks and skills in existing professions evolving?
    d. Are some professions likely to disappear altogether?
2. What developments are expected over the next five to ten years?
3. Which skills should be increasingly prioritized in vocational and continuing education?

# 2 Approach, method, results and discussion

## 2.1. Overview

The project is organized into four main work packages, combining empirical analysis with input from experts and firms:

1. **Econometric analysis** of the impact of the energy transition on labor demand.
2. **Delphi workshop** with industry representatives (e.g., VSE, EIT.Swiss, Swissolar) and selected HR managers.
3. **Representative survey** of HR managers and directors of small and medium-sized enterprises to validate and expand the findings from the econometric analysis and workshop.

4. **Second workshop (synthesis)** to develop recommendations for vocational and continuing training in the professions most affected by the energy transition.

This interim report presents the methods and preliminary findings from the econometric analysis (work package 1). The Delphi workshop is currently being prepared and will take place in October 2025.

## 2.2. Econometric analysis

We investigate the impact of the energy transition on labor demand by analyzing the number and vacancy duration of job postings as measures of labor demand and labor shortages within the Swiss energy and construction industries. The project team has been working on preparing and analyzing two major data sources to understand how Switzerland's energy transition is shaping the labor market. We employ two unique panel datasets containing annually firm-level data. These are: **construction data** on energy-related projects from Baublatt, and **job postings data** from the platform x28. With the help of the company identification number, we can link this data at the company level (see Figure 1).

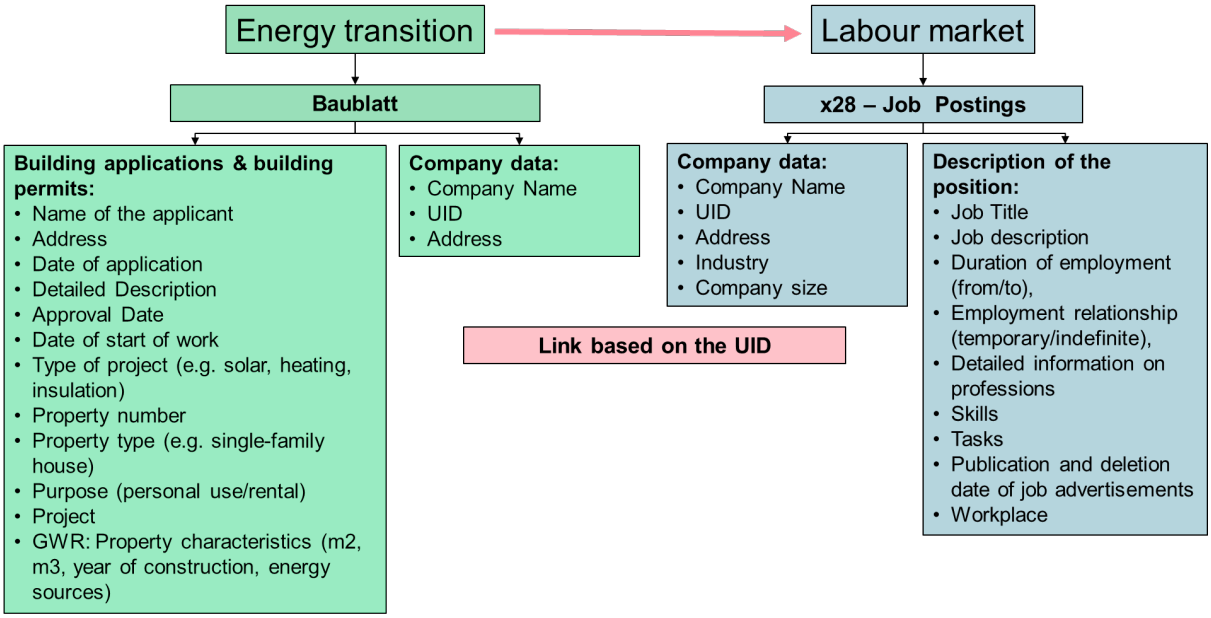


Figure 1: Diagram showing the link between building permit data relating to the energy transition from Baublatt and job advertisements from x28 AG

### 1. Job posting data (x28)

The x28 dataset covers online job advertisements in Switzerland from 2018 to 2024. Each posting contains information about the company, its sector, size, and details of the position (occupation and required skills).

To capture energy-related employment, the team identified occupations and skills relevant to the energy sector. This was done using keyword searches and manual classification. Five clusters of energy-related work were defined, including renewable energy, electricity grids, building and heating systems, and energy engineering. A set of energy-specific skills was also identified, such as heating technology, electricity supply, and renewable energy systems.

For each company and year, the data now shows:

- The number of energy-related job postings,

- The average time vacancies remain open (a signal of skill shortages).

This makes it possible to track trends in demand for energy-related professions over time.

## 2. Construction project data (Baublatt)

The Baublatt dataset records all construction projects in Switzerland that applied for or received planning permission. The analysis focused on projects that received approval, as these are the ones that move forward.

Each project lists different types of activities (e.g., solar installation, heating replacement, insulation upgrades). Using keyword analysis, projects were classified as “energy-related” if they included relevant activities. Variables were then created to measure the share of energy-related work within each project and the associated costs.

At the company-year level, the dataset now shows:

- The number and type of energy-related activities,
- The share of energy-related components within projects,
- The distribution of costs across different energy technologies.

## 3. Dashboard for data visualization

To support analysis and communication of results, we have developed a PowerBI-based dashboard. The tool provides interactive visualizations of:

- Building applications and permits, categorized by project stage and type, with a distinction between energy-related and other projects, available for Switzerland and for each canton.
- Job postings, showing both the number and average vacancy duration, differentiated by energy-related occupations, occupational groups, and skills, again for Switzerland overall and by canton.

Access to the dashboard is limited to members of the project consortium and the project’s advisory board. The tool is intended for internal use to facilitate data analysis, visualization, and the joint interpretation of results within the project.

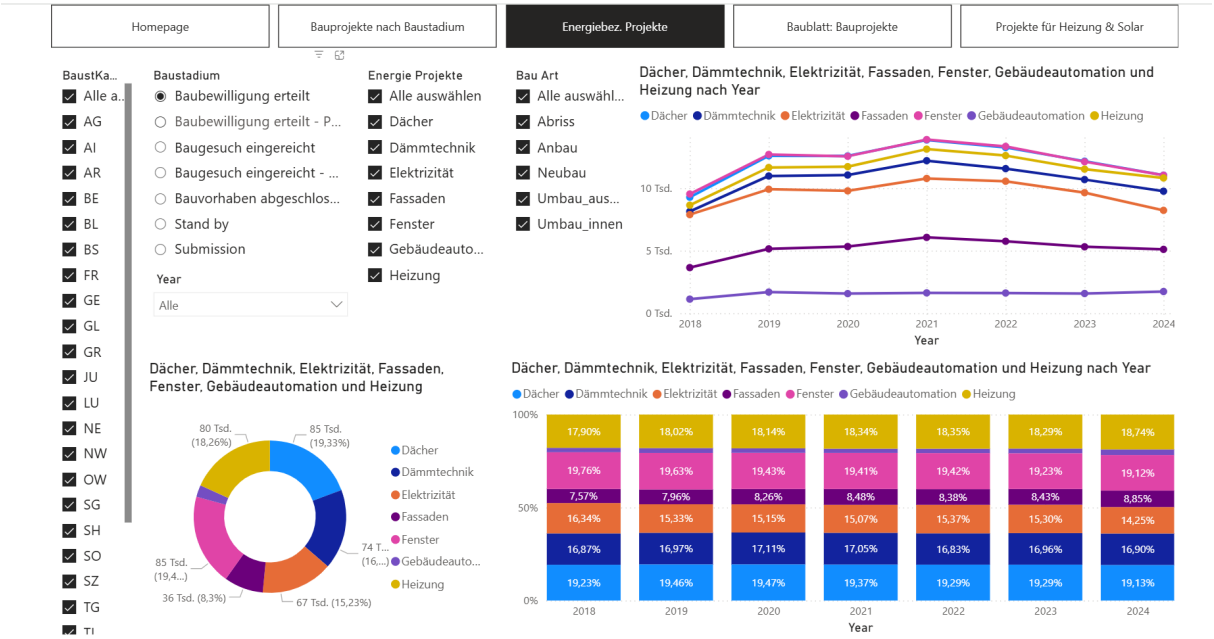


Figure 2: Excerpt from the Baublatt data dashboard

## 4. Linking the two data sources

The main innovation of this project is linking job postings (x28) with construction projects (Baublatt) at the company level. This enables the team to study how a company's involvement in energy-related projects influences its demand for workers and how long vacancies remain unfilled.

Because the datasets cover slightly different years, they were transformed into a balanced structure for 2018–2024. This ensures that each company has a record for every year, even when no data was reported, making comparisons over time consistent.

## 5. Analytical approach

### Identification strategy

We employ a difference-in-differences (DiD) event-study design to investigate the effect of energy-related construction project costs on the number of job postings requiring energy-related skills or corresponding to energy-related occupations. The analysis is based on a firm-year panel dataset constructed by matching job posting data (x28) with construction project data (Baublatt).

Since every firm in the matched dataset is involved in at least one construction project, the sample does not include a conventional untreated control group.. Instead, we exploit within-sample variation in the annual total value of construction projects undertaken by each firm. Firms are categorized into treatment groups based on the aggregate project costs per year, under the assumption that a higher overall project volume represents a demand shock likely to increase labor demand for energy-related skills or occupations.

Treatment is defined through a binning strategy that assigns firms to cost-based categories. Multiple binning schemes are employed to test the robustness of results across different thresholds: one version uses narrower bins (e.g., starting at CHF 2 million, with widths of CHF 5 and CHF 10 million up to CHF

30 million), while another applies broader bins (e.g., starting at CHF 1 million, with increasing widths of CHF 20, 30, and 40 million, up to CHF 100 million and above).

Treatment indicators capture entry into these bins in the current year, as well as in lead periods (t+1, t+2, and t+3) and a lag period (t–1), allowing for the estimation of dynamic effects. Additionally, we include interaction terms between treatment indicators and cost levels to test for heterogeneity in treatment intensity (Callaway & Sant'Anna, 2021).

The models are estimated separately for job postings requiring energy-related skills and those targeting energy-related occupations, with specifications both including and excluding interaction terms.

**Estimation strategy**

To estimate the relationship between energy-related construction project costs and the number of energy-related job postings, we implement two complementary estimation approaches: a traditional DiD model with fixed effects (FE) and a Poisson pseudo-maximum likelihood estimator with high-dimensional fixed effects (PPMLHDFE).

**(1) DiD with fixed effects (FE)**

We first estimate a linear DiD specification using ordinary least squares (OLS), controlling for firm and year fixed effects. This approach models the number of energy-related job postings as a function of treatment timing and allows us to estimate dynamic effects through an event-study design. While widely used, this linear framework assumes constant variance and a continuous dependent variable, making it less appropriate for modelling non-negative count outcomes, such as the number of job postings, which are discrete, often zero-inflated, and heteroskedastic by nature (Wooldridge, 2010).

**(2) PPMLHDFE estimator**

To address these limitations, we also estimate the model using the Poisson pseudo-maximum likelihood (PPML) estimator, incorporating high-dimensional fixed effects (Correia et al., 2020). This method is well-suited for count data, particularly when the dependent variable contains many zeros or is highly skewed. PPML avoids the need for log transformation and produces consistent estimates under weaker distributional assumptions than OLS (Silva & Tenreyro, 2006).

Moreover, PPMLHDFE efficiently handles large datasets with multiple fixed effects (e.g., firm and year), which is essential given the structure of our panel. It is robust to heteroskedasticity and accommodates zero-valued outcomes—relevant in our context, as some firms may not post any energy-related jobs in certain years.

The primary outcomes of interest are the number of job postings and vacancy duration, the latter serving as a proxy for labor market tightness and the matching frictions firms face in filling energy-related positions. While the current stage of the analysis focuses on the extensive margin of labor demand (i.e., the posting of vacancies), the next stage will address vacancy duration to capture dynamics at the intensive margin specifically, how energy-related construction activities influence firms' recruitment difficulties and the speed of job matching in the labor market.

# 3 Conclusions and outlook

**Econometric analysis**

The datasets have now been processed and prepared for analysis. We successfully structured and linked the two data sources at the company and year level, which represents an important achievement. This integration provides a solid foundation for empirical analysis. We are currently conducting intensive empirical work and comparing preliminary findings across various identification strategies (see section above). The initial results are highly promising.

**Delphi workshop**

In parallel, preparations for the Delphi workshop are progressing. The initial survey with participants is currently being conducted ahead of the workshop, which will take place on 1 October. Recruiting suitable participants required considerable effort, but thanks to the strong support of our project partners from the industry associations, the necessary participation has been secured.

# 4 National and international cooperation

So far, the project team has been working together very closely. In the econometric analysis, the collaboration between the team at the University of Applied Sciences of the Grisons and Michael Siegenthaler from KOF has been particularly important. For data preparation, the cooperation with the data providers x28 AG and Baublatt has also proven highly productive.

# 5 Publications and other communications

No publications yet.

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