Collective Labour Agreements and Minimum Wages in the Swiss Main Construction Sector

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Abstract

In this work, we estimate the impact of the application of the bilateral agreement of Free Movement of Persons (FZA) between Switzerland and the original EU-15 countries on the growth rate of labour market outcomes in a context of increasing minimum wage levels in the Swiss main construction sector. The included treatment variable, the minimum wage bite, which is the share of employees in construction that earn a wage below the next year’s minimum wage, is compared to the growth of the labour market outcomes. For this aim we use the Swiss labour force survey (SLFS) and data of minimum wages applied in the sector on a cantonal-basis in the period 1999-2016. Totally, we conducted four different specifications of the model singularly for each of the outcomes (average wages and employment) and one joint analysis, controlling for characteristics and spatial spillover effects. The results suppose that the introduction of the FZA reduced the growth rate of the labour market outcomes, compared to the growing minimum wage bites. In case of the joint analysis, outcomes decreased, average wages instead decreased only marginally or stagnated, while employment growth, depending on the specification, showed up ambiguous trends.

Keywords: minimum wage, construction sector, spatial heterogeneity, labour market outcomes, free movement for persons agreement, collective labour agreement, Switzerland

Jel classification: C33, J31, J38, J61.

1. Introduction

The Swiss main construction sector is a highly regulated sector, compared to the remainder of the economy. A collective labour agreement (Landesmantelvertrag LMV) ensures minimum wages and employment conditions for all construction employees. Also, the construction sector recruits a significant part of its low-skilled workforce abroad.

Our paper wants to focus on the effects of the opening of the Swiss labour markets towards the European Union (EU) and its relative impact on the growth of the labour market outcomes (average wages of the sector and employment) compared to the variation of the minimum wage bite, in a context of rising minimum wages over time. The bilateral application of the Free Movement of Persons Agreement (FZA) by the EU and Swiss Confederation and the consequently higher worker mobility changed the way in which minimum wage floors affect the functioning of the Swiss construction labour market. The treatment in this research will be measured in terms of the effects that the minimum wage bite, which is the quota of workers in this period earning below the minimum wage of the upcoming year, has on the labour market outcomes. The source of the changes in the treatment variable derives from the rise of the minimum wage level for unskilled employees.
in the main construction sector. The spatial unit of the research is the cantonal level (NUTS – 3). Further, cantons are used to control for spatial heterogeneity.

Our findings show that as a result of the application of the FZA in June 2002 the growth rate of the labour market outcomes was lower than the minimum wage bite growth. The highest effect of the FZA application can be identified in the specification where both outcomes, employment and average wages were analysed jointly. A lowest impact of the policy change is registered for specification with a focus on the average wages. Considering employment effects instead, the effects of varying minimum wage bites were ambiguous, depending on the chosen specification. All three analyses are conducted in four different variations of the model (base-model and three specifications). The first of them controls for economic structure in a canton. The second variation includes the typology of the analysed cantons, and the third application includes potential spill over-effects of neighbouring cantons.

This paper makes two contributions to the literature. First, using both a panel-data approach and an approach including neighbouring effects, we contribute to the evolving international literature that examines minimum-wage effects on different labour market outcomes. Secondly, we focus on the Swiss context, enriching the ongoing research on the European context, focusing on a specific economic branch with both low-wage and high wages.

We use nationally representative data from the Swiss labour force survey (SLFS), which is conducted every year by the Swiss federal office of statistics (FSO). This basis provides data on the workers’ characteristics as working hours, earned wages, working places as well as the sector of activity. In addition to this database, information on annually valid minimum wage levels for unskilled employees in the construction sector were extracted from the LMVs databases. These are published annually on a cantonal basis by the Swiss constructors’ association (Baumeisterverband SBV).

Our analysis of the impacts of minimum wages in the Swiss main construction sector is structured as follows. Section 2 reviews a general model of labour market equilibrium and the literature concerning minimum wages and economic liberalisation. Section 3 describes the institutional setting, while Section 4 describes data and our measures of minimum wages in Switzerland. Results of our descriptive analysis and regressions showed in Section 5, are discussed in section 6. Finally, Section 7 presents concluding remarks.

2. Theoretical Background

2.1 Minimum Wage Effects

Theory suggests that the impact of minimum wages on economic outputs strongly depends on its level. Starting with low minimum wages and increasing them gradually, then the increases might not be unfavourable to employment. In contrast to this, a relatively high minimum wage can have a negative impact, on employment for example. The practical application of minimum wages policies varies across European Countries. Some of them introduced overall minimum wage levels, in other ones these are varied by industry and can be defined in collective labour agreements rather than by law. In order to better understand the structure of wages in a country, a measure called the Kaitz index (ratio of minimum wage level to average wage level) was introduced. (Cahuc, Carcillo, & Zylberberg, 2014, pp. 786-790)

On a Macro evidence comparison, in the past 40 years in most countries, there was a correlation between high minimum wages and lower unemployment for both the working-age population and the youth. However, this conclusion might be due to a problem of reverse causality in the sense that a country with high employment rate can absorb larger growth of minimum wages. Therefore, this has to be seen as a descriptive combination of the two trends. (Cahuc, Carcillo, & Zylberberg, 2014, pp. 791-792).
In order to highlight some of the dynamics, it is worth to start with a Monopsony model, made of one consumer (employer) and many vendors (employees). The firm is characterized by an increasing and concave production function and constant level of technology. This model sets-up a non-monotonic relationship between the minimum wage and employment and is increasing for low levels of minimum wages and decreasing for high ones. The Monopsony is not a really plausible simulation of economic reality, but the importance of labour supply elasticity is not negligible. A higher elasticity causes a higher impact of minimum wage on employment. Other factors that should be taken into account in order to enrich the Monopsony model would be labour mobility, information costs as well as the interest of refusing inadequate job offers. Including the efficiency wage, defined by all these factors it is possible to achieve an efficient wage level that lies below the marginal costs of production of a firm, and therefore the positive linkage between higher minimum wages and higher employment is plausible. Even the matching model developed by Cahuc et al. (2014) assumes some monopsonic power as employees are paid below marginal productivity and in this case, the model can explain a positive linkage as well. (Cahuc, Carcillo, & Zylberberg, 2014, pp. 793-795)

Some empirical research deals with the impact of minimum wages on employment. In a time series analysis framework, no significant correlation among variations in minimum wages and employment can be made out. One study by the OECD (1998) though found an impact on youth-employment of changing minimum wage policies. This effect emerges as well in Brown et al. (1982) in a general 10% increase in minimum wages that leads to a reduction of youth employment around 1-3%.

Another approach is to conduct natural experiments. One of the best known natural experiment was conducted by Card and Krueger (1994) as a comparative case study for the fast-food industry in the States of Pennsylvania and New Jersey. Data were collected by telephone, interviewing the restaurant managers. The treatment variable in this research was the difference between the minimum wage level in the State of New Jersey and in Pennsylvania, where the same was kept fixed. Following this approach, two interviews were conducted. Ignoring all other factors that could bias the outcome and affect employment as well, except for the minimum wage level, results evidence that employment grew faster in New Jersey. It is also interesting to highlight that employment grew faster observing only the restaurants in which the starting wage was initially below 5$ (with a new minimum at 5.05$) compared to the ones that offered already higher starting wages before the introduction of the new minimum. They tested their results, by checking the controls of employment growth, for both restaurants with high and low starting wages in Pennsylvania and still conclude that the minimum wage may have had a positive impact on employment if the starting wage was low.

It is possible to focus in a theoretical way on the effects on labour demand of changing factorial prices for labour as introduced by Franz (1991) and Borjas (2005). He assumes perfect competition as well as the exogenous determination of wages and costs of capital. The firms are assumed to produce according to a linearly homogeneous production function. He divides the analysis in two effects, the substitution effect and the scale-effects. The first of the two focuses on a movement on the isoquant and technically speaking, a growing wage would lead to a substitution towards a more capital-intensive production. This is true if we ignore possibly higher productivity of labour. The scale-effect instead means that the optimal output quantity decreases the implied quantity of labour. This is true even if the firms would be able to forward their higher prices to the consumers. In this case, therefore, the employment of labour is decreasing. The effect changes though if the focus is on the prices for capital instead. For increasing costs of capital, the scale effect needs to overcompensate the substitution effect in order to have a negative impact on employment. For a particular case, namely, if the firm has a high market share and produces a superior good (high elasticity of demand), then the second part of the scale effect of higher wages leads to an increase of consumers’ purchasing power and consequently a higher production which in the end boosts employment growth again. (Franz, 1991, p. 132)
Moving back to the scenario of complete competition on the product market, then only the effect of the growing wages are still relevant. We need to take into account two elasticities, the price-elasticity of demand as well as the elasticity of substitution. Both of them are defined as positive values. If the two elasticities tend to assume higher values, the reaction of the demand for labour will be larger than in response to higher wages. The explanation for this is that the higher the sensibility of the demand for the product is, the lower is the production and with a higher substitution elasticity, additionally, the production mix is changed away from the employment of more labour towards a more capital intensive production. In this case, the reduction effects of higher wages on the labour demand fall out high. If the share of wage costs on the total costs is low, the scale effect is low as labour costs assume marginal importance for the firms. On the other hand, if labour has a higher elasticity in the production process, then the substitution effect is lower, as it is less attractive in this case for a firm to substitute labour with the less productive factor capital. (Franz, 1991, p. 135)

The importance of the elasticities of demand of labour and the price-elasticities for the produced goods area analysed in Blien et al. (2017) in a context of technological progress in the production process. There is the main distinction among the two effects that in technologically leading sectors the growing demand for the products compensates the progressing technology and labour demand rises, while in sectors where mechanisation or progress leads to lower prices, the demand for the product grows only slowly and labour demand falls consequently. For the analysed construction sector, the second of the two effects might rather be true. The basic theorem of technological change weights out the displacement effect of the technological progress, which leads to lower labour demand and the corresponding compensation effect that has the opposite effect. The compensation effect depends widely on the price-elasticity of demand for products and in case of inelastic demand, it exceeds the displacement effect and labour demand increases. This application is important as it helps to understand the changes in the labour market. Technological progress and the possibility to absorb higher wage costs, induced by rising minimum wages, have both impacts on the final labour market equilibrium. In construction, where the mechanisation progressed, and labour productivity grew (explained in detail in a later section), these effects decide on the sensibility of the employment decision in response to growing minimum wages.
2.2 Minimum wage bite

When choosing the measure to analyse the effects of a given wage floor, frequently researchers have to deal with the minimum wage bite. This section is dedicated to the explanations that favour the choice of this measure to evaluate the impacts of defined wage policies.

As explained in detail by Kampelmann et al. (2013) the Kaitz index (relation of minimum wages to overall wage distribution) is not the right measure for all issues, especially not for studying the impact of minimum wage policies. The minimum wage bite for this aim is the better choice. It focuses on a particular part of the wage distribution, namely the employees earning wages at and below the minimum wage threshold. An interesting application of the bite is to focus on the effects of an increased minimum wage in a defined sector. Following the neoclassical models for the labour market, then this would imply that workers in the minimum wage bite would lose their job if they were not able to increase their marginal productivity above the new wage. The variation of the bite is in this framework a measure that helps understand the reaction of the firms. They have still the possibility to pass the higher production costs to the customer or to reduce their actual profits. Alternatively, as previously mentioned, the employees can increase their productivity, for example taking additional courses or applying organisational changes. (Kampelmann, Garnero, & Rycx, 2013, pp. 12-16)

Recent literature states that employment effects of minimum wages are probably small or inexistent for the total employment. Only the weaker part of the workers could be affected, which is justifying the focus on the bite for the research. (Kampelmann, Garnero, & Rycx, 2013, p. 18). Consequently, the minimum wage bite (bite calculated on the next year’s minimum) it is the adequate measure as it captures best the marginal employees that are at highest risk of unemployment.

Dolton et al. (2012) in their analysis of the impact of minimum wages on employment and inequality relied on the minimum wage bite as a variable of analysis. The methodology and identification strategy is relevant for defending the choice of our approach. The authors illustrate their reasoning and justification for the adoption of the minimum wage bite in the analysis completely. Their explanations, using a structural econometric model, consisting of two equations, were already suggested in the previous literature by Card (1992) and Stewart (2002). The first of the two equations takes up the concept of labour demand. It puts in a relationship the movement of the employment rate ($\Delta E_j$) along the labour curve with the set wage level. In other words, employment is defined as a function of the wage. In the second equation, a form of identity, the wage variation is a function of the proportion of the low paid workers ($P_j$). Substituting the second equation in the labour demand equation, we obtain the following formulation: (Dolton, 2012, p. 518)

\[
\Delta E_j = \gamma_0 + \eta \alpha_1 + \beta P_j + \epsilon_j
\]

Equation 1 – Structural econometric model

where $\beta = \eta \lambda$, with $\lambda$ assumed positive, implying that $\beta$ has the same sign as $\eta$ and according to economic theory they are negative. In other words, a higher proportion of low-paid worker, in our case, a higher bite, would result in a negative variation of the employment. (Dolton, 2012, p. 518)

Steward (2002) sets the precondition for identification of this model as the proportion of the low paid worker ($P_j$), is a predetermined instrument for the endogenous wage change. We discuss in the later section 3.1, this precondition that implies that an endogenous variation of the bite through variation of the workforce composition can be neglected. In our research the bite is consequently defined to be affected by changing minimum wage policy and economic conditions, but not through over proportional growth of the low-wage workforce. This is evidence for the validity for the chosen identification strategy in this work.
2.3 Effects of labour market liberalisation

Data from the years preceding 2011 give pieces of evidence about the changes in the education level of immigrants in Switzerland. Due to the labour market liberalisation between Switzerland and the European Union, even highly skilled workers started to be attracted. In fact, this is emerging as well in the wage distribution, where the immigrants lately were overrepresented in the low and high wage classes. (Favre, 2011, p. 2)

Favre (2011) follows the approach of analysing the competition among workers along the entire wage distribution as proposed by Dustmann et al. (2008) and evidences the competition between natives and immigrants at the two tails of the wage distribution. This approach is in contrast to the earlier literature in the field that puts in evidence the correlation of the mean wage variation in response to the market liberalisation across the spatial units. Our analysis, focusing on the correlation between average wages and employment with minimum wage bite growth, follows the traditional literature. Nevertheless, the insights gained from the work of Favre (2011) are useful for the understanding and interpretation of the results. A further distortion is that not each region is similarly attractive for immigrants, but they tend to allocate in areas with already high presence of other immigrants of their nationality. This might attract more immigrants from countries that are not speaking one of the Swiss national languages. Also, a second issue is the inter-regional mobility of workers that can cause employees to move from one place to another one, which is not facing competition on earnings as strong as in the first one. The results show that there is a decrease in wage in those parts of the wage distribution where immigrants are overrepresented and increase of wages in the other ones. This regarding quantiles in the wage distribution and not on a regional basis.

A work published by Gilpin et al. (2006) focuses on the effects of the European free movement of workers agreement on the UK labour market. The policy took place in a time of rising unemployment in 2005 and therefore was dealt as one of the contributors to it. The research finds no statistical evidence for the agreement to be a contributor to the higher unemployment.

Focusing on the wage effects, the research takes into consideration the growth rate of the Average Earnings Index. For this comparison, there is low evidence of a fall in nominal wage growth in reaction to the market liberalisation as well. No discontinuity in the wage growth rate was made out, and even for the missing counterfactual, it is not probable the find a significant effect of immigration on the wages. (Gilpin, Henty, Lemos, Portes, & Bullen, 2006, p. 29)

3. Institutional setting

3.1 The Swiss construction sector

This section aims to introduce some key points of the construction sector. Background knowledge of the dynamics and trends of the industry help to interpret in a good way the results of the research. The first part explains some economic data, with a particular focus on the productivity of labour in the construction sector. A second part then focuses on the sectorial labour market outcomes, in particular on employment as well as on the trends in the wage levels.

Looking at the most recent data from 2016, then it emerges that the construction sector achieved overall a net product of 33.71bn CHF. Compared to the nominal Swiss GDP of 650.11bn CHF, this corresponds to a 5.15% of the product. Regarding achieved revenues in 2016, the civil engineering slightly exceeded with 10.17bn CHF the building construction that reached revenues of 9.80bn CHF. The whole construction sector employed 80’700 workers in September 2016 out of which 65’400 were workers on the construction ground, 10’800 technical and service employees and 4’600 trainees. The labour force was composed of 56% of foreigners (45’300 employees), compared to 35’400 indigenous workers. The
The average wage achieved across the entire construction sector amounted up to 5’765 CHF per month across all wage classes. (Baumeisterverband, 2016, p. 5)

A focus worth is the evolution of the construction activity compared to the potential of the Swiss economy. In terms of percentage of GDP, the expenses for construction were decreasing over the years, reaching a minimum in 2008, in consequence of the financial crisis, and registered a smooth increase since then. The net nominal product of the sector instead was increasing in the long run, except for an expected slight reduction for the last year (2016). (Baumeisterverband, 2016, p. 8)

It is important to understand how the share of expenses on construction change in Switzerland. One point to focus on is certainly the productivity of the workforce. Increasing productivity means that the output costs can be reduced, workers’ wages can be increased, or firm’s profits fall out higher. In a competitive sector as the main construction, the first two alternatives are the most plausible. Looking at the historical data (figure 3), it emerges that labour productivity (real) in the construction sector was increasing in the eighties and then, starting with the nineties no significant increments were registered anymore. This is true even if the automation evolved during this period, which further could enforce labour productivity growth. Explanations for this trend can be the higher costs for production inputs and decreasing margins that consume earnings. (Baumeisterverband, 2016, p. 9)

![Figure 1 - Labor productivity (real in full-time equivalents) in the Swiss construction sector](source.png)

Recalling in mind the three alternative effects of increasing productivity, then it is worth to focus on the second point as well. The point is that growing productivity of the workforce can be the main driver for wage growth. Pointing out the trend of the past couple of years, then it emerges that wages of employees in the construction industries were constantly growing over time. In real terms, compared to the inflation index they grew even significantly (as exposed in figure 4 below). Since 2008, the wages of construction site employees (that are covered by the national collective wage agreement “Landesmantelvertrag” (LMV)), which will be the focus of this work, on average grew by 8.5% in real terms. Only supervisors’ real wages grew even more. (Baumeisterverband, 2016, p. 38)
A further possibility to face the higher labor costs for the firm is to forward the additional expenses directly to the consumer market. Giupponi et al. (2018) therefore checked for this possibility in their study on minimum wages in the care home industry. The following figure 5 compares the indexed growth of the prices of the construction industry and the indexed growth of the minimum wages in the sector. We can divide the period in two parts, the first one including the years preceding 2008, with a relative important growth of minimum wages, which is linked to a growth of construction prices. In addition, a second period of the last years, in which the construction prices stagnated on a stable level and therefore with a limited capacity to absorb higher wage costs, forwarding them on to the consumer. The evidence from this data comparison suggests a partial absorption of the wage effect on employment and a reduced effect in the results for the employment effect as it would have been in absence of this possibility.

Figure 2 – Wages in the main construction sector and inflation
Source: Data: Swiss federal office of statistics (SFO)

Figure 3 – Minimum wage index in the construction sector and construction price index (month of October)
Source: Data from Swiss federal office of statistics (SFO) – construction price index and minimum wage data from the collective labour agreements of the Swiss constructors’ association (Baumeisterverband)
Stepping back to the labour market outcomes, hypothetically higher productivity of the workforce could be translated into a reduced requirement for the workforce to produce the same amount of output. For this reason, the next focus is put on the number of employees in construction over time. Figure 6 below highlights the variability of the workforce in the Swiss main construction sector. The sector registered a drop in employment in consequence of the real-estate bubble in the nineties and grew afterwards until 2014. In the last couple of years, employment fell again. Most of the growth was registered in the finishing construction segment, a part of the sector that does not apply minimum wages as proposed in the LMV. The main construction sector instead grew by less. (Baumeisterverband, 2016, p. 40)

![Figure 6](image.png)

**Figure 6** – Employment (full-time equivalents) in the construction sector (in the third quarter of the year)

Source: Data from Swiss federal office of statistics (SFO) – Job Statistics

An important point to focus on is the growth of the share of workers in the two parts of the wage distribution. This is relevant for the research in order to discuss out a potential endogeneity problem that might could appear from the application of the minimum wage bite as a treatment variable. We want the minimum wage variation to be a result of higher pressure on the labour market, and of differing minimum wage policies. We need to limit the effect of a heterogeneous growth of the workforce in the sector that endogenously could affect the variation of the minimum wage bite. For this reason, we choose to analyse in each of the Swiss greater regions (NUTS-2) the growth of low wage and high wage workforce, compared to the total growth of workers in the construction sector. The following figure 7 evidences these trends for aggregated Switzerland. Over the observed years, total employment in the construction sector grew. In the same time, data highlights that this growth mainly is due to the evolution in the high-earning share of the workforce, while the number of low-wage employees remained stable in the same period. This trend is valid for each of the greater regions that were analysed. We can exclude from this point of view a rising minimum wage bite as a consequence of a more than proportional growth of the employment in the lower part of the wage distribution. Variations in the minimum wage bite, in this case, need to be the result of the exogenous variation of the minimum wage level, and of the changing economic environment and conditions.
A last key factor is the educational level of the employees in the main construction sector. This is important as for the research the lowest possible minimum wage applied to unskilled workers is the point of reference. Therefore, unskilled workers are potentially most affected by varying minimum wages, this in particular if the focus is on the lowest wage group. The increasing number of skilled workers in the labour force is due to the increasing complexity on construction sides. Many tasks require special skills in order to keep up with the technological progress. Moreover, in general, the quota of unskilled workers on the Swiss labour market is decreasing. Only the share of supervisors is nearly unchanged over the years. The exclusion of them in the general trend towards higher-skilled workers is mainly because they execute jobs that are of a different character than the two other groups of workers (office work rather than jobs on the construction site). (Baumeisterverband, 2016, p. 41)
3.2 Free Movement of Persons Agreement (FZA) Switzerland - EU

In 1999, Switzerland signed the bilateral agreements I with the European authorities and cantons and population approved this act in May 2000. According to the bilateral agreement on Free Movement of Persons (FZA), all citizens of European countries have the right to freely choose their location of residence within the zone of all contractual partners. An additional component of the agreement is the coordination of the national social security systems as well as the mutual recognition of foreign professional diplomas.

The agreement was adopted gradually, during a transition phase, and instruments such as priority to indigenous and contingency systems can still be applied unilaterally. These measures also are known as “valve-clause” ensure a gradual and controlled merger of labour markets. For the original 15 EU nations, Malta and Cyprus the agreement was applied starting with June 1st, 2002 and entered in full-application in 2007, after which it was not possible to apply “valve-clause” anymore. (EDA, 2017)

In 2007, the border-zones of Switzerland were abolished and through this, a further limitation to labour mobility was removed. (Verein-Grenzgänger, 2013) Starting with this even citizen from not neighbouring countries can work in Switzerland with a cross-border commuter permit. This further policy change caused a second wave (after 2001/2002) of strong relative growth of the number of cross-border commuters in Switzerland.

In order to reduce violations against Swiss wage and labour conditions, in 2004 supporting measures were applied. In this way, it is possible to ensure that employers meet the conditions that are foreseen in collective labour agreements and that foreign service providers maintain guidelines contained in the employee secondment law. Tripartite commissions are in charge to control and check the application of these measures. The commissions are made of representatives from public authorities, employers and labour unions. Their main task is to check for compliance of normal and collective labour agreements’ norms. The employment secondment law has been adapted continuously in order to meet the requirements of a changing environment and growing space of application of Free Movement of Persons Agreement’s zone. In this way, the last refinements were taken in the inclusion phase of Romania and Bulgaria into the agreement. (EDA, 2017).

4. Dataset

4.1 Data construction

This research is based on data from the Swiss Labour force survey (SLFS) and supplementary and specific data about minimum wage levels for main construction workers in Switzerland; in addition to these, data from the Swiss federal office of statistics (SFO) was used to define spatial parameters and regional peculiarities.

The first of the two main data sources, the SLFS, is annually conducted by the SFO and interviewed up to 105.000 subjects since 1991. Questionnaires include several features around the topics of employment, unemployment as well as the educational and professional background of the interviewed. Further questions cover geographic and sociodemographic issues. Social security, education and migration topics complete the survey. For this research, the variables that identify the sector and industry of activity of an employee, as well as the identification of the geographical unit (Switzerland’s 26 cantons), are of particular interest. The core element for the aim of this research is the wages associated with the share of workers employed in the main construction sector. Those wages though are not revealed uniquely and therefore need to be standardised in order to guarantee the comparability. All wages are counted up to become annual net wages, to draw comparable employees with salaries on hourly base and part-time employees to full-time wage earners.

The process of wage standardisation follows two principles. The first is the assumption required to deal with wages on different temporal references and foresees that every week of work consists of 40 working hours. Each month is made of
4.33 weeks and annual earnings include the wages of 12 months without bonuses. A bigger issue to deal with is the computation of net wages in the second step if for an observation gross wages are registered. In order to develop the standardisation of net wages, a differentiation in time is required, as social security contributions vary across years. The first deductions, including Old age insurances (AHV), Disability insurance (IV) as well as Income compensation (EO), are equal to 5.05% of gross wages in years precedent to 2011, 5.15% starting with 2011 and 5.125% after 2015. These contributions are independent of the age (starting with 18 years) and follow a linear path for the range of earnings included. The contributions of unemployment insurance (ALV) also add a complexity that has to be addressed. The rates vary not only across the observed years, but they are also linear only up to a certain maximum wage level. Higher wages exceeding the level of 126,000 CHF for annual gross wage did not pay a contribution for the income share exceeding the maximum. For early years in the database, a contribution equal to 0.01% of gross wages was taken into account. Starting with 2011 the base rate for annual gross wages up to 126,000 CHF increased slightly to 0.011% and an additional, lower rate for the income share exceeding this wage level, was introduced and amounts up to 0.005%. In 2015, the maximum annual gross wage level up to which the higher rate applies was raised to 148,200 CHF.

The third issue to deal with in wage standardisation is the pension fund contributions that vary within several age groups and are applied only to coordinated wages. Coordinated wages are the annual gross wages between 23,940 – 82,080 CHF until 2010 and from 24,675 – 84,600 afterwards. Different levels of employee contributions are applied to this coordinated wages, which are up to 3.5% for ages 25-35; 5% for employees’ ages leading from 35-45 years, 7.5% for 45-55 years old and 9% for ages 55-65. To all other groups, with age lower than 25 or older than 65 years, no mandatory contributions are charged.

Moreover, taking in consideration the minimum wage for the main construction sector in accordance to the collective wage agreement (LMV), it is possible to draw a regional minimum wage that formulates the reference independently of qualifications. These wages are divided into three different categories that take into account spatial heterogeneity. For cantons that are split up in two different wage categories (Bern, Schwyz, St. Gallen, Solothurn), following a precautionary principle, the lower of the two included levels was considered as reference. The provided minimum wages are standardised according to the personal characteristics on an annual net level, following the same principles described above on a personal characteristics basis, determinant in this case for the spatial association is the canton of activity.

Finally, the merge of the two databases, including observations from years 1999-2016, allows constructing a panel dataset including the determinants of all 26 Swiss cantons over a timeline of 17 years. The main variables for this panel define the economic structure, the importance of the construction sector in a certain region, as well as the workplace distribution among different economic sectors. Main independent variable includes a reflection of the wage structure prevailing in the main construction sector. Two variables capture the effects of changing wage policies in the labour market, which are changing levels of employment and in changing wage structures. This issue is discussed with a particular focus in the theoretical part of this work. The first of these two variables considers the main construction sector’s changing wage structure and employment effect and is captured as a sum of the variation of the average wages in construction in the considered canton and the relative change of employment in the construction sector, both included on a logarithmic scale. The second of these two variables, including all others than the main construction sector is constructed similarly and is then included as a further independent variable in the model.
4.2 Data description

On average across all observed years, a 10% of employees are employed on a marginal wage basis – this means today they earn salaries that would be below the minimum wage applying starting with the upcoming year (definition of the minimum wage bite). This distribution is not homogeneous across the 26 cantons and not persistent in time.

In the following three graphs, we want to compare the trends of four variables of interest in three structurally different cantons. The first one (figure 8), the canton of Vaud, is an example of the regions applying the highest possible level of minimum wages (the minimum wage data will be explained in the following part). Considering the average wage in construction, we notice that it grows similarly as the sector’s minimum wages. Focusing on the average wages of the remaining part of the economy instead, we figure out a higher variability across the observed years. In particular, some drops correspond to the peaks of the minimum wage bite (blue line, measured on the right axis). During conditions of economic downturns, the bite tends to rise, so we observe contemporary pressure on the average wages of the economy and the low wages in the construction sector.

![Figure 6 – Canton Vaud (an example of high minimum wage threshold)](image)

Description: Dynamics in the canton of Vaud as an example of the highest possible minimum wage. Comparison of minimum wages (red), minimum wage bite (blue – right axis) and average wages in construction (yellow) and in other economic sectors (green).

Source: Authors’ calculations based on wage and employment data from the Swiss labour force survey (SLFS) and minimum wage data from the collective labour agreements of the Swiss constructors’ association (Baumeisterverband)

The second example, the canton of Zürich (figure 9), is one of those adopting the middle level of minimum wages in the construction sector and it differs in a few points from the first one. Like in the first example, the average wages in the construction sector are above the ones of the remainder of the economy. Average wages instead fluctuate less than in the previous example of Vaud. The most significant variation is that the minimum wage bite is low and stable over the years. The evident point is that the general wage level in this canton is higher than in the first example. This point is valid for both, the construction industry and the other sectors of the economy of Zürich.
Figure 7 – Canton Zürich (an example of medium minimum wage threshold)

Description: Dynamics in the canton of Zürich as an example of the medium minimum wage. Comparison of minimum wages (red), minimum wage bite (blue – right axis) and average wages in construction (yellow) and in other economic sectors (green).

Source: Authors’ calculations based on wage and employment data from the Swiss labour force survey (SLFS) and minimum wage data from the collective labour agreements of the Swiss constructors’ association (Baumeisterverband)

The third example is St. Gallen (figure 10), a canton in the eastern part of Switzerland that has the lowest of the three possible minimum wage thresholds. An eye-catcher was the drop in the average wages in 2002, and the lower wages in the following years. Even construction average wages fall by little less than 1000 CHF within some years. Minimum wage bite instead is more stable than in the case of Vaud. Similar as in the case of Vaud, in some years with low average wages, the minimum wage bite grows, but this common trend is not as evident as in the first example.
Figure 8 – Canton St. Gallen (an example of low minimum wage threshold)

Description: Dynamics in the canton of St. Gallen as an example of the lowest possible minimum wage. Comparison of minimum wages (red), minimum wage bite (blue – right axis) and average wages in construction (yellow) and in other economic sectors (green).

Source: Authors’ calculations based on wage and employment data from the Swiss labour force survey (SLFS) and minimum wage data from the collective labour agreements of the Swiss constructors’ association (Baumeisterverband)

One factor to explain the differences in minimum wage bites across cantons are the peculiarities of the regional labour markets. Not all of the cantons are affected in the same way by changing conditions and policies, and further have different characteristics (some of them are border cantons with cross-border labour markets). To mention one example, the change of the federal constitution in March 2012, limiting the construction of secondary residences. Such a policy, for example, affects stronger touristic regions rather than construction in urban agglomerations. The second important point is that the level of the minimum wage for each canton varies in the collective labour agreement. Four cantons (Bern, Schwyz, St. Gallen and Solothurn) have two different minimum wage levels in different parts of the canton. For precautionary reasons in these four cantons, the lower of the two levels has been applied, and the bite might show up slightly lower than it would be considering distinct wage levels within the cantons. For the remaining 22 cantons, instead, a unique level is valid for the entire canton, and only one of the three possible minimum wage levels is applied. The picture of the affection of the cantons to the three distinct minimum wage levels looks as follows (figure 11):
Each of the 26 cantons is grouped in one of the three “regions” that define the level of wages that apply to all employees of the sector. The highest levels are applied in the two cantons of Geneva and Vaud in the Western part as well as the two cantons of Basel-Stadt and Basel-Landschaft. The lowest levels instead can be made out among the cantons situated in the South-eastern part of Switzerland, Schaffhausen and Bern.

The evolution of the minimum wage levels in absolute terms for the three above mentioned regions would look as exposed in the following graph (figure 12) for the entire period of analysis. The colours correspond to the ones in the graph above, with the darkest zones applying the highest minimum wage level, the fairest one applying the lowest possible level in the region.
Stepping back in the explanation of the peculiarities of the regional labour market we can focus on the key data for the sector. Average annual net wages of employees in the main construction sector in Switzerland are at 72,086 CHF and 95,560 CHF for the other sectors. The share of employees in the main construction sector is on average 3.5% of total employment. This values change across cantons as well. In a first step, we focused on the average wages paid in the construction sector, the remainder of the economy, as well as the minimum wage, bite three sample cantons.

A factor that might influence the wage differentials across cantons could be the different relative importance of the construction sector in the regions. A higher concentration of the construction sector can be explained in the less densely populated regions, as there is a relatively high requirement of civil engineering to maintain traffic and public infrastructure. Further also regions with low presence of workplaces in other industries and regions without any large centre offering services show up a higher share of the construction sector in the regional economy. The following picture gives evidence of the relative importance of the construction sector regarding workplaces in 2010:

![Figure 11 – Share of workplaces in construction in the regional labour market in 2010](image)

Description: Dark coloured cantons register the highest share of workplaces in the construction sector, compared to the total number of workplaces in the regional economy

Source: Authors’ calculations based on employment data from the Swiss labour force survey (SLFS)

To provide a basis for comparison, a map illustrates the density of residence regarding inhabitants by square km in 2004. This map provides useful background information, not at least also to explain the distribution of economic strengths among the 26 cantons. Regions in dark colour show the highest density of residents:
5. The model

5.1 Formal explanation of the strategy

The basis for the construction of the model is the approach proposed by vom Berge & Frings (2017) who focused on the introduction of a minimum wage in Germany and the effects on the labour markets, distinctly for Western and Eastern Germany. They combine the panel approach of Neumark and Wascher (1992) with the approach of applying minimum wage bites as in Card (1992). According to vom Berge & Frings (2017) the post-treatment effects are separated in this research as well from the period preceding the exogenous shock. In their paper, they use the introduction of the minimum wage in 1997 in Germany. The cut-off for this research instead will be the application of the Free Movement of Persons Agreement in Switzerland in 2002 with the original 15 EU countries. Differential trends of the minimum wage effects are captured analogously in the pre-treatment period following Dolton, Bondibene and Wadsworth (2010) in their study in the UK.

For the first estimation, we followed the indications taken by vom Berge & Frings (2017), in the basis, but varying and adapting the specifications in order to explain the various effects of the policy adaptation on the minimum wage effects.
5.2 Basic model
The initial model can be written in the following way:

\[
\Delta \ln y_{it+1} = b_i \alpha + (d \times b_i) \beta + \Delta \ln x_{it} \gamma + \mu + \tau_t + \epsilon_{it}
\]

Equation 2 – Initial specification of the model

Vom Berge & Frings (2017) in their specification define \(y_{it+1}\) as the wage or employment growth in district i in the time from t to t+1, d is the indicator for the post-treatment effect (in their case the introduction of the minimum wage). \(\beta\) captures the treatment effect on the minimum wage. In their specification \(y_{it+1}\) is expressed for the main construction sector relatively to finishing trades. \(x_{it}\) instead would be the mean employment or wage growth in the other industries, except for all species of construction sectors. \(\mu\) and \(\tau_t\) instead represent district and time fixed effects.

In our study, we chose to vary this formulation. We analyse three different formulations of the problem. We initially assume that a relative growth of minimum wage could affect the general wage level in the construction sector. In a first specification, we try to analyse how the growing minimum wages after the introduction of the FZA would change the mean wage level of the construction sector. In this way, we can gain insights if the firms chose to redistribute their wage mass in a different way than previously (lower wages for workers who are in higher positions to equilibrate higher minimum wage).

A second formulation focuses on the employment effects and the reduction of workplaces in response to higher minimum wages, this again using the pre-FZA period for calibration and the post-treatment period to focus on this problem.

The third variation instead combines the two possible effects and sums them up in a unique combined variable, constructed from the sum of the two logarithmic variations in employment and average wage level. This third specification was chosen in order to capture the two possible effects together and to have a global overview of the effects of the opening of the labour market on the strength of the minimum wage effects.

In other words the content of the two variables \(y_{it+1}\) and \(x_{it}\) alter throughout the three distinct analyses. This procedure will be maintained throughout the different variations of the initial specification that have been conducted in this work.

5.3 Model with control for economic structure

The basic model has been adapted in order to include differences of the economic structure across the 26 cantons of Switzerland. Not in every canton, the importance of the industrial sector is the same compared to the service sector regarding workplaces. This can cause a variety of possibilities to absorb external shocks and smoothen them for the construction sector for example.

In this specification, the three proposed variables are analysed. Formally, the base-model has been adapted, adding simply a variable q with the ratio of secondary sector workplaces, compared to third sector workplaces.

\[
\Delta \ln y_{it+1} = b_i \alpha + (d \times b_i) \beta + \Delta \ln x_{it} \gamma + q_{it} \delta + \mu_i + \tau_t + \epsilon_{it}
\]

Equation 3 – Base-model with control for economic structure
5.4 Model with canton types

In this second specification, starting again with the base-model, the focus is on demographic differences across the analysed cantons. The model in this way includes canton-type specific trends in a dummy variable. The adapted base model looks as follows:

\[
\Delta \ln y_{it+1} = b_{it} \alpha + (d \times b_{it}) \beta + \Delta \ln x_{it} \gamma + \mu_i + \tau_t + \lambda_i \eta_i t + \epsilon_{it}
\]

**Equation 4 – Model with region-type-specific time trends**

Where in the case developed for Switzerland $I_r$ stays for the four possible categories of region-types. We strictly followed the indications of categorization of the German Federal Institute for Research on Building, Urban Affairs and Spatial Development BBSR (2017). This proposal categorises each area depending on its residential density and characteristics in one of four categories. Reaching from Cantons that are mainly made of a big city up to the low density rural and mountain cantons. This variable multiplied by the time variable provides the canton-specific time trend that will be used as control dummy in the regression.

5.5 Model with neighbour-canton trends

The third specification follows again the proposed model of vom Berge & Frings (2017) working with the three variable variations with employment effects, wage effects and combined effect. Cantons cannot be seen as independent units. Borders among cantons are open and depending on the geographic position; mobility is rather high among some of them. It could be therefore a problem to analyse the effects keeping the cantons as separate units without taking into account trends of the surroundings. This specification includes additionally to the already included variables average values of the independent variables from the surrounding cantons as well:

\[
\Delta \ln y_{it+1} = b_{it} \alpha^D + (d \times b_{it}) \beta^D + \Delta \ln x_{it} \gamma^D + \bar{b}_{it} \alpha^I + \left( d \times \bar{b}_{it} \right) \beta^I + \Delta \ln \bar{x}_{it} \gamma^I + \mu_i + \tau_t + \lambda_i \eta_i t + \epsilon_{it}
\]

**Equation 5 – Model with neighbour-canton time trends**

In this specification, we distinguish the direct effects (D), or the variable characterising the trend and situation in the analysed canton and the indirect effects (I) who capture the impact of the average of the variables of all cantons having common borders with the analysed one. The two variables, $b_{it}$ and $x_{it}$, are averaged for all the neighboring cantons ($N$) as a simple mean and included in this way in the regression. Canton-type-specific trends are maintained as well in this specification, as well as canton and year fixed effects.
6. Results

6.1 Effects on average wages in the construction sector

The first of the three analysed effects are the wage effects. In this case, we focus only on the variation of average wages in the main construction sector (where the LMV minimum wages apply) in response to the introduction of the FZA. In this way, it is possible to understand how the construction firm reviews their retribution policies in a framework of raising minimum wages and in particular with an opening of the labour markets between Switzerland and the first UE member countries.

For this first analysis, we could not identify any effect of the increased minimum wage bite on the employment growth. The analysed treatment effect, the impact of a rise in minimum wage bite (which is the consequence of a higher minimum wage) causes a slight reduction of the average wages in construction (in logarithmic notation). This goes from a -5% reduction in the base-model up to a -17% in the neighbour-cantons model for a doubling of the minimum wage bite. Further, the effects of wage differentials in the remainder of the economic sectors do have hardly any impact on the average wage in main construction.

In the second specification, which includes economic structure, we notice that a higher presence of secondary sectors workplaces, compared to service sector workplaces, has a slightly negative impact on the average wages in main construction. The third specification with controls for the various cantons (District types) shows up with a higher treatment effect variable, which is higher only in the fourth specification that includes average bites and main construction wage and their trends from all neighbouring cantons as well.

To sum up, before the application of the free movement of persons agreement an increasing minimum wage bite was connected to a higher average wage in the construction industry. Two things can cause a higher minimum wage bite: at first, if at constant wages the minimum wage level is increased, or secondarily if wages of low earners are reduced. Wage flexibility is higher for high-wage earners but might be less common among low-wage workers. Following this path, then it is possible to state that there was, in general, a positive growth trend of average wages in the moments when minimum wages grew. This changed starting with the introduction of the new policy. From this point on, an increased minimum wage bite did not imply anymore a positive correlation with the average wages, and it becomes, depending on the specification, a negative or a zero one. Thinking about this in a framework of growing minimum wage in the sector, then it could be slight evidence for wage redistribution from the higher or middle wage earners in favour to the workers earning wages near the minimum.
## Minimum Wage Effects in Main Construction - Effects on Sector average Wages

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Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 1 – Effects of FZA on average wages in the main construction sector
Source: Authors’ calculations based on wage and employment data from the Swiss labour force survey (SLFS) and minimum wage data from the collective labour agreements of the Swiss constructors’ association (Baumeisterverband)
6.2 Employment effects in the construction sector

The second variation of the model analyses the employment effects. This means that the focus lies no more in the logarithmic variation of average wages, but on the logarithmic employment differential in the cantonal main construction sector. For this case, we obtain significant results in the base-model: a strong negative effect of the impact of a high minimum wage bite in the treatment variable on the main construction employment. The correlation of the variation in the employment of the non-main-construction industries is positive. The economic cycle and the environment in this case influences in the same way both the different employments.

In the second specification, the same is valid, the additional control for secondary sector workplace quota evidences that in cantons and years in which the secondary sector is more prevalent, the reduction of employment in main construction is stronger than in cantons where the service sector has high importance.

The third specification with District-type controls puts less significant results out than the second specification. Insignificant results are obtained in the fourth specification as well. Including the controls for all neighbouring effects might over identifies the problem.

This means that in the period preceding the introduction of the free movement of persons agreement, there was a positive connection between higher minimum wage bites and employment growth. This could mean that the growth of employment took place in the same moments when the relative number of employees working at wages near the minimum was growing as well. The workforce expansion took place, especially in the lower wage groups. In a second moment, after the policy application, this relationship is relaxed. In other words, rising minimum wage bites are not connected to periods with rising employment anymore as in the preceding period.
<table>
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Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 2 – Effects of FZA on employment in main construction sector
Source: Authors’ calculations based on wage and employment data from the Swiss labor force survey (SLFS) and minimum wage data from the collective labor agreements of the Swiss constructors’ association (Baumeisterverband)
6.3 Combined effects on employment differential and wage differences

The third variation of the model combines the two possible effects of changes analysed in the previous sections. The dependent variable adds up the variation in average wage differential for construction and the variation of employment for the sector, both in logarithmic terms. The same procedure is valid for $x_{it}$, combining the respective variable of wages and employment for the remainder of the industries ad exclusion of main-construction.

In this model arrangement, it is possible to identify a stronger negative effect of the treatment effect than in the previous variations of the model. Except for the effect of the non-construction wage and employment effect on the dependent variable, the coefficients are significant at least at the 5% level. The second specification with the inclusion of the economic structure shows up with a higher significance level for the constant variable. This is not true in the third specification with the district-type specific controls. In this combined effect setup, the fourth specification, including trends in the neighbouring cantons, for the first time, some of the coefficients are significant. We get a negative effect on the treatment variable with a 10% significance level, contesting the negative impact of the raising minimum wage bite on the labour market (wages and employment) in the main construction sector with the opening of the labour market towards the EU-15 countries.

For this specification, the results evidence the negative impact of the labour market opening on the relationship of the minimum wage bite on the outcomes. In case of increasing pressure on the firms’ profits, in response of an economic downturn or maybe a stronger increasing minimum wage level, then a consequently possible increase in minimum wage bite, would lead to a lower general average wage level in the sector and in the meantime to a reduction of employees.
### Minimum Wage Effects in Main Construction - Combined Effect

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<td>-0.87**</td>
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<td>0.05**</td>
<td>0.38***</td>
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<td>[0.12]</td>
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Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

**Table 3 – Effects of FZA on employment and wages (combined) in the main construction sector**

Source: Authors’ calculations based on wage and employment data from the Swiss labour force survey (SLFS) and minimum wage data from the collective labour agreements of the Swiss constructors’ association (Baumeisterverband)
7. Conclusion

This research aims to understand the effects of the introduction of the Free Movement of Persons Agreement (FZA) on the labour market dynamics of the Swiss main construction industry. The liberalisation creates an additional functionality of the Swiss labour market, which can enforce downward pressure of the general wage level as a consequence of the possibility to substitute differently remunerated workforce in the same sector with each other. In a sector with rising minimum wage levels, this labour-labour substitution effect gains in importance; moreover, some sector-internal wage compensation effects can arise. The second of the two mentioned issues is mainly important for the construction sector as this specific industry registered stagnating productivity growth in the latest period, and therefore the possibility of absorption of higher minimum wages in a more efficient production process is not a possible solution.

Specifically, in this research, three different analysis on labour market outcomes have been conducted, to identify the effects of the application of the Free Movement of Persons Agreement (FZA) in Switzerland. The first one studies the sectorial average wages, the second one the employment and the third a joint variable of the two mentioned outcomes. Looking at the results and in particular on how the interaction of the minimum wage growth and the variation of the labour market outcomes varied after the policy application, we can state the following points. Focusing on the employment effects in the sector, the results evidence that after the policy application it is no longer true that the employment of the sector grows regardless the growing minimum wage bite. The employment growth stagnates in the post-treatment period and is no longer affected by the variation of the minimum wage bite. The precedent positive relationship between the bite and the employment growth is cancelled out in this sense.

Focusing on the average wages in the construction sector instead, we only obtained statistically not significant results and a very low impact of the policy implementation; this means that in this particular sector the firms chose to adapt employment in order to face the rising number of workers employed at the lowest possible wage level. One explanation could be that, as a consequence of the rising minimum wages, firms could choose to cut their low-wage employees or to review their employees across all hierarchical levels, in order to react on the new political conditions. This point is not analysed in detail in the research, and it is left for future proceedings, as the number of employees in our dataset is registered at an aggregate level, without distinction of their specific previous earnings and skills. The case of diverging employment effects for high- or low-wage workers implies a redistribution of wages to the favour of low-wage workers at the cost of medium-high earners in the sector.

The third specification, including in a unique variable both outcomes, underlines the impact of the raising minimum wage bite after the opening of the labour market on the economic outcomes for the industry. This combined indicator is positively related with the minimum wage bite. Concretely, a growing minimum wage bite did not impede the labour market outcome to grow. With the policy application, this is no longer true. In a liberalised labour market, the market outcomes fall in situations with a higher minimum wage bite. In other words, it imposes a negative relationship of the bite, indicating that the number of low-wage worker in the sector and the growth of the labour market outcomes are related.

These results need to be interpreted carefully and keeping in mind that the cantons of Switzerland show up different economic structures and potentials. Internal migration could be a limiting issue as much as the effects of the international borders present in some of the 26 Swiss cantons. Such peculiarities influence on the tuner-over as much as on the workforce composition and characterise additionally spatial heterogeneity.

Summarizing, the policy had a negative impact in the economic sense on the advance of the observed dependent variables, enforcing the pressure of growing minimum wages on the labour market outcomes. Taking into account all mentioned factors, then the liberalisation reduced the growth rate of the labour market outcome variables (employment, wages and
combined scenario). The effective consequence of the rising minimum wage bite in the context of an open labour market acts as a break for the growth of the outcomes, which is a sign of the tighten conditions on the liberalised labour market.

References


