# Inter-Industry and Inter-Firm Wage and Hours Differentials in Switzerland

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## 1. INTRODUCTION

In the middle of this century, low-wage male workers worked longer hours than high-wage male workers in developed economies. Figures from the United States show that this backward bend in the wage-hours curve tended to disappear in the 1970s, which was a time of increased globalisation, growing female participation in the labour market and the expansion of non-manufacturing industries. Nowadays, workers at every wage level in the United States work more hours than in the 1980s for the same weekly wage and, more importantly as regards earnings inequalities, the famous backward bend in the wage-hours curve—which resulted mainly from labour supply considerations—has totally disappeared. In other words, high-wage workers tend to work significantly more hours than low-wage workers.[1]

In light of this shift in the wage-hours curve in the United States, there are surprisingly few explanations in the "orthodox" literature—not related to the labour supply—for a similar change in the relation between the distribution of working hours and wages. However, in a recent contribution, Leamer and Thornberg (1998) used 2- and 4-digit manufacturing data to explore the empirical content of an interesting two-sector model developed by Leamer (1996). In this model, it is shown that the high-wage high-hours contract occurs in the capital-intensive rather than in the labour-intensive sector, where the capital cost savings from higher hours are lower. This assumption is borne out by the data.

Assuming that is the effort (per hour) rather than the number of working hours that determines finally the wage a firm will offer, the evidence that there is a relation between wages and working hours in the market means that there must be a relation be-

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1. See Costa (1998), Leamer and Thornberg (1998).

tween working hours and effort. So the core contradiction in the relation between wages and hours that is the subject of our attention here is part of the well-known debate about the nature of inter-industry and, more generally, inter-firm wage differentials.

As in the compensating theory of equalising wage differences, Leamer's model assumes that inter-industry wage differentials result from payment for observable effort instead of premiums above market clearing prices solving monitoring problems, as in the efficiency wage approach. In this case, firms find profitable to use wages to enhance productivity. The resulting efficiency wage can vary not only from one sector to another, but also from a firm to another within a given industry, depending on the technology of the production process.[2] An effort variation in a highly capital-intensive job will have an higher impact on the firm's output than in a less capital-intensive job. The efficiency wage theory therefore predicts a higher return on effort in highly capitalised tasks. In other words, the efficiency wage premium associated with a job should, thus, be positively correlated with its capital intensity.

In the context of the relation between wages and hours, Leamer's model and the efficiency wage approach may both result in a positive relation. To observe such a relation, the hours-elasticity of effort should be positive. And this is exactly what is assumed by LEAMER and THORNBERG (1998) in using the length of the working week as an indicator of the effort intensity of a given job. However, the difference between the two approaches still remains in that one assumes that effort is observable whereas the other does not. In other words, and as is generally assumed in neoclassical models, the relation between effort per hour and the number of working hours is exogenously given to the worker in Leamer's model.[3]

The focus of this paper is thus the empirical examination of the influence of demand factors on individual wage and hours dispersion in the Swiss labour market and of the relationship between these two components of individual earnings. To accomplish this task, we used a large employer-employee survey, the 1996 Swiss Wage Structure Survey. Following the methodology of the literature on the analysis of inter-industry wage differentials[4] and of recent studies on inter-firm wage differentials[5], we examined the effects of industry and firm differences on wages and hours.

The first question we try to answer in this paper concerns the impact of capital intensity on the relationship between inter-industry wage and hours differentials. The other question we are more particularly interested in here is to know whether the influence of the internal organisational structure of firms on wages is partially related to the relationship between wages and working hours. In other words, we wonder whether the change

2. See, for example, RAMASWAMY and ROWTHORN (1991).
3. In hedonic models (LEWIS, 1969, BARZEL, 1973), however, effort per hour diminishes when hours are longer, because of the fatigue effect. So there is an expected negative relation between hours and effort per hour, but in this case such a relation can be considered as exogenously given to the worker.
4. See particularly KRUEGER and SUMMERS (1987, 1988), MURPHY and TOPEL (1987).
5. See, for example, GROSHEN (1991), KRAMARZ et al. (1995)

away from a Taylorist organisation of work toward more flexible structures affects the wage-hours structure offered by firms because, as suggested by LINDBECK and SNOWER (1997), one can reasonably expect that the move toward flatter organisations, resulting in a decentralisation of decision-making and fewer hierarchical levels, will increase the difficulty of evaluating an individual's productivity.[6]

The efficiency wage theory tells us that in such a case the internal organisational structure chosen by firms will positively affect the relation between wages and hours, if there exists a relation between the level of effort per hour and the number of working hours. However, Leamer's model also predicts such a result if the reorganisation of the internal structure of firms involves an increase in their capital intensity. As such, the question of the determinants of demand factors as a source of individual wage differentials remains open. The recent availability of large employee-employer surveys throws valuable light on extend the empirical and theoretical debate at the firm level.

The paper is structured as follows. The next section gives a brief description of our data. In section 3 we present our estimated inter-industry wage and hours differentials. Section 4 examines individual and inter-firm differentials. We then analyse the relation between (a) the estimated firm-specific wage and (b) the firm-specific hours and the establishment-level characteristics. In the last section, some conclusions are drawn.

## 2. DATA

The Swiss Wage Structure Survey (SWSS) was launched in 1994 by the Federal Office of Statistics (OFS). The survey was repeated in 1996 and 1998. The SWSS records individual wages within a sample of establishments of all industries (including the public sector). The sampling has two levels: at the first level, production units are sampled; and at the second level, individuals employed at these sampled units are also sampled. Concerning production units, the universe to be sampled includes all establishments with at least two employees.[7]

The sampling rate is stratified according to the 2-digit sector classification and the size of the largest plant of a given firm. The sampling structure for the employees is as follows: exhaustive in small units (less than 20 employees); half of the employees in firms with 20 to 49 employees and one sixth of the employees in firms with or more than 50 employees. In 1996, 8,258 production units and 552,015 employees were included (al-

6. There is a burgeoning literature on the role of organisational change in rising wage inequality. See for example KREMER and MASKIN (1996), LINDBECK and SNOWER (1996, 1997). The underlying theme being that organisational changes magnify wage inequality not only between skills, but within skills as well.

7. The universe of firms has been changed since the 1996 survey; in 1994, the register of firms and establishments was used but, since 1996, the universe has been a new database of firms. Moreover, individuals cannot be identified in the intervening two years between surveys. Thus, at this stage, we cannot directly identify firms between those two-year periods nor can we identify the individual fixed effects on wage and hour dispersions.

most 450,000 in the private sector). These figures represent almost 7% of the private and public establishments in Switzerland and 20% of the workforce employed.

Annual as well as October remuneration is recorded. Annual remuneration can be broken down into total wage, overtime pay (and others payments for shift-work, night-work, etc.), a 13th and possibly the 14th month's salary and annual bonuses. Information on the method of pay (time-rate, piece-rate, etc.) and the form of pay (monthly or hourly) is available. There is also information on the fraction of the October remuneration paid out for social insurances, but not the contribution paid by the employer. It is thus possible to deduce the net annual remuneration (before tax) for each worker.

Furthermore, we know for each worker whether he or she is Swiss or not and, if not, the type of work permit he or she holds, his or her age, his or her level of seniority in the firm, educational level and marital status and the number of "normal" hours he or she normally puts into the job. There is, however, no direct information on overtime worked in October, or on night- and shift-work time. In addition, the level of demanded by the job (4 positions) and a 24-position variable defining the "activity domain" of the job are given. This last variable is especially useful to distinguish between blue-collar and white-collar workers. Finally, the information about the firm comprises: 2- and 4-digit industry codes, total employment, post code and the existence or not of a branch agreement (referred to below as a collective agreement) or of a firm-level agreement.

Our final sample selection was done as follows. We focused only on the private sector of the economy and did not include the energy industry (position 11 in the 2-digit classification) or services as teaching, medical and social services, etc. (codes 81 to 88). As will become clearer, we excluded firms employing less than 5 workers.[8] We also excluded workers under the age of 20 or over the legal retirement age (62 for women and 65 for men). In the end, once the observations for which information was missing on the variables of interest were excluded, our sample contained 3,221 firms and 314,426 workers.

## 3. INTER-INDUSTRY DIFFERENTIALS

Before analysing the role of firm-specific compensation on wages and hours, we first test for the existence of inter-industry differentials following the usual strategy.[9] If $S_m$, $m = 1...M$, is the vector of the industry dummies, the reduced form equations[10] of

8. The reason for the exclusion of industries coded 81 to 88 below are partly because the proportion of firms employing less than 5 workers is high in some of these industries, and partly because the services in question are primarily supplied by non-profit organisations in Switzerland.
9. See KRUEGER and SUMMERS (1988).
10. To estimate the potential relation existing between wages and working hours in a "simultaneous framework" we should have at least one good instrument for working hours. Unfortunately, instrument variables like the family size or the non-labour income of the worker are not given in the SWSS. We therefore choose to turn our empirical investigation towards the reduced form equations of wage and hours to infer the relationship between these two variables using, first, inter-industry differentials and, secondly, inter-firm differentials.

wages and hours can be written

$$w_{im} = Z_i\beta^w + S_m\delta^w + \epsilon_i^w \quad (1)$$

$$h_{im} = Z_i\beta^h + S_m\delta^h + \epsilon_i^h, \quad (2)$$

where $\delta^w$ and $\delta^h$ are the vectors of inter-industry wage and hours differentials respectively, $w_{im}$ is the log-weekly "standardised" wage of worker $i$ in industry $m$ and $h_{im}$ the "standardised" number of weekly hours he or she normally works. The standardisation was done at 40 working hours per week. Thus for both wages and hours, the estimated inter-industry differentials are in percent. The error terms $\epsilon_i^w$ and $\epsilon_i^h$ are assumed to be independent and identically distributed. The matrix $Z_i$ represents the set of measured characteristics of the worker influencing his or her wage level and number of working hours.

The matrix $Z_i$ contains fully the interaction of gender, skill, age and its squared term, and seniority (in years) and its squared term. We chose such a specification mainly because in Switzerland remuneration and working time differ widely between genders.[11] Secondly, as in other western European countries, the distinction between skilled and unskilled and between white-collar and blue-collar is common in collective and firm-level agreements in Switzerland. Moreover, we opt for skill instead of years of education because this information cannot be taken directly from the Swiss Wage Structure Survey.[12] We also prefer age to (potential) experience for the same reason. Finally, the set $Z_i$ also contains a vector of dummies differentiating Swiss workers and the different work-permit holders.

The two-step estimation strategy consists first of testing and measuring the size of wage and hours differentials across the $M$ industries. Then, following KRUEGER and SUMMERS (1988),[13] the estimated wage and hours differentials are normalised as deviations from the corresponding weighted means:

$$\hat{\gamma}_m^k = \hat{\delta}_m^k - \bar{\delta}^k \quad m = 1...M; k = w, h; \quad where \quad \bar{\delta}^k = \sum_{m=1}^{M} \frac{N_m}{N} \hat{\delta}_m^k \quad (3)$$

where $N_m$ and $N$ are, respectively, the employment in industry $m$ and total employment. Expressed in this way, the terms $\hat{\gamma}_m^w$ and $\hat{\gamma}_m^h$ measure the proportional difference in terms

11. See, for example, BOYMOND (1993), FLÜCKIGER and SILBER (1999).
12. In addition, using the educational level of workers to estimate years of education would reduce the sample by almost 50,000 observations.
13. As shown by HAISKEN-DENEW and SCHMIDT (1996), the method proposed by KRUEGER and SUMMERS overestimates the standard deviations of inter-industry differentials. The standard deviations we obtained can be thus considered as upper bounds to those estimated by using restricted least squares. However, generally speaking, the obtained t-values in using the method proposed by Krueger and Summers are large enough, given the quality of the data and the sample size (See Table 1).

of wages and hours, respectively, between the worker in sector $m$ and the "average worker" in the economy.

To measure the amplitude of the dispersion of inter-industry wage and hours differentials, we still follow Krueger and Summers (1988) in computing the weighted standard deviations of the estimated wage and hours differentials as

$$SD(\delta^k) = \sqrt{var(\hat{\delta}^k) - \frac{1}{M}\sum_{m=1}^{M}(\hat{\sigma}_m^k)^2 + \frac{1}{M^2}\sum_{m=1}^{M}\sum_{n=1}^{M}\hat{\sigma}_{mn}^k} \quad k = w, h. \tag{4}$$

Such an adjustment is necessary because the $\hat{\delta}_m^v$ are estimated with error; that is, we have to correct for the fact that $\hat{\delta}_m^k = \delta_m^k + \hat{\epsilon}_m^k$. The $(\hat{\sigma}_m^k)^2$ and $\hat{\sigma}_{mn}^k$ are the variance and covariance of the $\hat{\delta}_m^k$, respectively, where $k = w, h$.[14] The complete results are presented in Table 1. The model's regression points to significant differences across industries, not only in terms of wages but also as concerns hours.

Our regression results for the wage equation confirm the findings of Ferro Luzzi (1994), who used the same methodology but a different database. As in other developed countries, there is some evidence of the existence of noncompetitive rents in the Swiss labour market, even though one can put forward that such rents will partly result from unobserved individual ability. When no controls are included (i. e. without the set $Z_i$), the weighted standard deviation of wage differentials is close to 19 %. When the set of observable individual characteristics is included, the weighted standard deviation of wages falls to 11.7 %, a value closed to that obtained by Ferro Luzzi (1994). Industries like retail trade, restaurants and hotels and personal services paid wages 10 to 20 percent under the average, while in industries like tobacco, chemicals, trade intermediaries, banking and finance, insurance and business services, a worker can earn significantly more than the average.

As expected, the estimated mean working hours in manufacturing and the construction industries are above the weighted mean, while among the non-manufacturing industries there is apparently greater variability. Partly because the SWSS underestimates individual working hours (given that overtime is not surveyed), the estimated weighted standard deviation of inter-industry hours differentials is relatively low, reaching only 3.3 % when controls are added to the hours equation. When the observable individual characteristics are added, the sign of the estimated hours differential changes significantly for some industries, reflecting, as for wages, the important gender segregation existing among industries in Switzerland. This appears to be particularly the case for the restaurant and hotel, retail trade and personal services industries, where the estimated hours differentials increase significantly when the worker's characteristics are added.

14. Krueger and Summers (1988) do not take account of the covariance term in equation (4) because they observe that this term has a marginal effect on $SD(\delta^k)$. We however estimate this weighted standard deviation using the covariance term, even though its impact is effectively marginal.

**Table 1: Estimated inter-industry wage and hours differentials**

| Industry | Without controls | | With controls | |
|---|---|---|---|---|
| | Wages | Hours | Wages | Hours |
| Food | .001 (*.ref*) | .002 (*.ref*) | .021 (*.ref*) | .014 (*.ref*) |
| Beverages | .058 (.006) | .010 (.005) | .008 (.006) | .014 (.005) |
| Tobacco | .326 (.005) | .018 (.004) | .306 (.005) | .022 (.004) |
| Textiles | –.072 (.007) | –.001 (.006) | –.037 (.007) | .010 (.006) |
| Apparel | –.296 (.006) | –.007 (.005) | –.126 (.006) | .037 (.005) |
| Timber, furniture | –.033 (.004) | .027 (.003) | –.029 (.004) | .015 (.003) |
| Paper | .071 (.004) | .028 (.003) | .034 (.004) | .021 (.003) |
| Printing, publishing | .108 (.003) | –.066 (.002) | .097 (.003) | –.031 (.002) |
| Leather, footwear | –.262 (.010) | –.013 (.008) | –.098 (.010) | .015 (.008) |
| Chemicals | .326 (.002) | .024 (.002) | .234 (.002) | .019 (.002) |
| Plastics, rubber | .071 (.006) | .020 (.005) | .030 (.006) | .015 (.005) |
| Non–ferrous minerals | .068 (.004) | .028 (.003) | .032 (.004) | .013 (.003) |
| Metals | .041 (.002) | .037 (.002) | .012 (.002) | .025 (.002) |
| Machinery, equipment | .158 (.002) | .030 (.002) | .054 (.002) | .015 (.002) |
| Electrical machinery | .117 (.002) | .015 (.002) | .050 (.002) | .015 (.002) |
| Watches, jewelry | –.023 (.003) | .035 (.002) | .047 (.003) | .052 (.002) |
| Other manufacturing | –.070 (.005) | .003 (.004) | .025 (.005) | .017 (.004) |
| Construction | .080 (.003) | .026 (.002) | .038 (.003) | –.000 (.002) |
| Building installations | .077 (.003) | .033 (.003) | .023 (.003) | .012 (.003) |
| Wholesale trade | .156 (.002) | –.009 (.002) | .078 (.002) | .013 (.002) |
| Trade intermediaries | .542 (.006) | –.008 (.004) | .354 (.006) | –.003 (.004) |
| Retail trade | –.199 (.002) | –.130 (.001) | –.104 (.002) | –.039 (.001) |
| Restaurants and hotel | –.212 (.003) | –.040 (.002) | –.117 (.003) | .035 (.002) |
| Repair services | –.039 (.005) | .024 (.004) | –.064 (.005) | .026 (.004) |
| Railroads | .004 (.007) | .041 (.006) | –.068 (.007) | .034 (.006) |
| Road transport | .063 (.005) | –.004 (.004) | .021 (.005) | –.004 (.004) |
| Navigation | .080 (.003) | –.021 (.002) | .025 (.003) | .014 (.002) |
| Air transport | .179 (.002) | .005 (.002) | .062 (.002) | .004 (.002) |
| Transport intermediaries | –.101 (.002) | –.129 (.002) | –.054 (.002) | –.069 (.002) |
| Communication | .247 (.009) | .000 (.007) | .167 (.009) | .017 (.007) |

| Industry | Without controls | | With controls | |
|---|---|---|---|---|
| | Wages | Hours | Wages | Hours |
| Banking, finance | .261 (.002) | .006 (.002) | .125 (.002) | .014 (.002) |
| Insurance | .242 (.002) | –.040 (.002) | .126 (.002) | –.007 (.002) |
| Real estate | .143 (.006) | –.065 (.005) | .111 (.006) | –.007 (.005) |
| Leasing, personal hiring | .010 (.014) | –.018 (.011) | .019 (.014) | –.008 (.011) |
| Business services | .358 (.002) | –.025 (.002) | .216 (.002) | –.006 (.002) |
| Personal services | –.341 (.004) | –.250 (.003) | –.196 (.004) | –.140 (.003) |
| Weighted SD of industry fixed effects | .189 | .117 | .058 | .033 |
| R-squared | .242 | .119 | .668 | .299 |
| Corr. wage-hours diff. | .398 | | .226 | |

*Source:* Swiss Wage Structure Survey, 1996. Private sector only. Sample size is 314,426.
*Notes:* Standard deviations are in parentheses. Weights are employment share of each industry. The F-test that industry wage or hours differentials jointly equal zero is rejected at the 0.001 level. Individual controls are full interaction terms of gender, skill, age, age square, tenure and tenure square (see Table 2).

Finally, the correlation between the estimated wage and hours differentials in both equations is positive and close to 0.23 when controls are added. Of course, this does not mean that there is a positive causality between the inter-industry wage and hours differentials, because such a correlation may be the result of unobserved individual characteristics and/or of firm-specific characteristics that are not entirely reflected by industry fixed effects.

However, to gain a better idea about the impact of capital intensity on the wage-hours curve, we use the estimated inter-industry differentials and the capital intensity of industries to infer the sign of this curve. We estimate two separate linear regressions, one for (pre)estimated inter-industry wage differentials, $\hat{\gamma}_m^w$, and one for (pre)estimated inter-industry hours differentials, $\hat{\gamma}_m^h$, where $m = 1...M$ is the industry index,

$$\hat{\gamma}_m^w = \alpha_0^w + \alpha_1^w \left(\frac{K}{L}\right)_m + \mu_m^w \tag{5}$$

$$\hat{\gamma}_m^h = \alpha_0^h + \alpha_1^h \left(\frac{K}{L}\right)_m + \mu_m^h. \tag{6}$$

The term $\left(\frac{K}{L}\right)_m$ stands for the capital intensity in the industry $m$.[15] The regression results are presented in Table 2.

**Table 2: Inter-industry wage and hours differentials regressions**

| Variable | $\hat{\gamma}_m^w$ | | $\hat{\gamma}_m^h$ | |
|---|---|---|---|---|
| $\left(\frac{K}{L}\right)_m$ | .366 | (.106) | .178 | (.051) |
| Constant | –.264 | (.074) | –.131 | (.036) |
| R-squared | .261 | | .267 | |

*Source:* Swiss Wage Structure Survey, 1996. Private sector only. The Statistic of Production and Value Added. The (pre)estimated inter-industry differentials are those shown in the last two columns of Table 1.
*Notes:* Weighted standard deviations are in parentheses. Weights are employment per industry.

As can be seen and as expected, capital intensity has a certain impact on the distribution of inter-industry wage and hours differentials. Using the estimated parameters in equations (5) and (6), we simply solve for the "inter-industry wage-hours differentials line" by eliminating the capital intensity variable. This estimated line is

$$\hat{\gamma}_m^w = 0.005 + 2.056\hat{\gamma}_m^h.$$

which is clearly positive. So, as predicted by LEAMER's model (1996) and the efficiency wage approach, capital intensification seems to increase the effort intensity of the offered wage-hours contracts. In other words, our results are conform with the idea that the hours-elasticity of effort is positive in the Swiss labour market. We now continue our empirical examination of this assumption on the basis of inter-firm differentials.

## 4. INDIVIDUAL AND INTER-FIRM DIFFERENTIALS

To examine the role of firm-specific differences in wage and hours formation, we must be able to appraise the respective contribution of the worker's characteristics and of firm's characteristics on the dispersion of wages and hours. In equations (1) and (2), the

15. Capital intensity is not available in Switzerland. What we use from the Statistic of the Production and Added Value is a proxy: industry's value added per worker minus the industry's average cost per worker. However, this information is not available for industries like banking and finance, and insurance. Note also that the industry's average cost per worker includes also the employers' payments for the Swiss social security scheme.

specific contribution of firms (within each industry) is embodied in the error term; that is, it is implicitly considered as a pure random effect. Treating the unobservable worker and firm contributions as fixed effects, the reduced form equations of wage and hours can then be written

$$w_{ij} = Z_i\beta^w + F_j\pi^w + u_i^w + \epsilon_i^w \tag{7}$$

$$h_{ij} = Z_i\beta^h + F_j\pi^h + u_i^h + \epsilon_i^h, \tag{8}$$

where $w_{ij}$ and $h_{ij}$ are the wage and the number of hours respectively of worker $i$ in firm $j$. The effects of the unobservable characteristics of the workers are summarised by the terms $u_i^w$ and $u_i^h$. The variable $F_j$ stands for the vector of firm dummies and so $\pi^w$ and $\pi^h$ are the vectors of firm fixed effects on wages and hours, respectively.

In this model, the fixed effect associated with firm $j$ denotes whether workers at this firm $j$ are, at a given point in time, paid more or less than workers at other firms in the economy. Thus in equations (7) and (8), the industry effects correspond to the respective averages of firm effects. From these two equations, we can extract the following matching functions

$$\mu_{ij}^w = F_j\pi^w + u_i^w \tag{9}$$

$$\mu_{ij}^h = F_j\pi^h + u_i^h. \tag{10}$$

To estimate these very interesting functions, we need first to have longitudinal information on the workers to estimate the individual fixed effects and, secondly, to be able to identify the firm employing the worker $i$. The Swiss Wage Structure Survey allows us to accomplish only the last task. However, following KRAMARZ ET AL. (1995), we choose to estimate the following slightly transformed version of the "ideal" equations

$$w_{ij} = Z_i\beta^w + F_j\phi^w + \epsilon_i^w \tag{11}$$

$$h_{ij} = Z_i\beta^h + F_j\phi^h + \epsilon_i^h, \tag{12}$$

where the fixed effects $\phi^w$ and $\phi^h$ for firm $j$ are the sum of the "pure" firm fixed effects and of the mean individual fixed effects of the workers of that firm. Hereafter, we call these firm fixed effects "the global firm fixed effects".[16]

16. As mentioned previously, we exclude from our sample firms employing fewer than 5 workers. The reason is probably clearer now. Given that we cannot separate the individual fixed effect from the global firm fixed effect, the inclusion of very small firms will undoubtedly decrease the importance of the "pure" firm effects in the estimated global fixed effects. This has a certain importance when we analyse the determinants of the inter-firm wage differentials, as we shall see in the next section.

**Table 3: Wage and hours equations with firm fixed effects**

| | Wages | | Hours | |
|---|---|---|---|---|
| Swiss nationality | .0 | .ref | .0 | .ref |
| Seasonal permit | –.088 | (.004) | .040 | (.004) |
| Yearly permit | –.033 | (.001) | .029 | (.001) |
| Settled permit | –.045 | (.001) | .013 | (.000) |
| Cross-border permit | –.039 | (.001) | .028 | (.001) |
| Special permits | –.072 | (.003) | .036 | (.002) |
| | | | | |
| Unskilled blue collar men | .141 | (.024) | .255 | (.022) |
| Age | .021 | (.000) | .001 | (.000) |
| Age square /1000 | –.224 | (.010) | –.019 | (.009) |
| Seniority | .007 | (.000) | .001 | (.000) |
| Seniority square /1000 | –.113 | (.013) | –.026 | (.012) |
| | | | | |
| Unskilled blue collar women | .091 | (.028) | .293 | (.025) |
| Age | .013 | (.001) | –.004 | (.001) |
| Age square /1000 | –.158 | (.015) | .011 | (.013) |
| Seniority | .008 | (.000) | .008 | (.000) |
| Seniority square /1000 | –.103 | (.022) | –.135 | (.020) |
| | | | | |
| Skilled blue collar men | –.100 | (.021) | .289 | (.019) |
| Age | .038 | (.000) | .000 | (.000) |
| Age square /1000 | –.396 | (.007) | –.014 | (.007) |
| Seniority | .004 | (.000) | .000 | (.000) |
| Seniority square /1000 | –.038 | (.008) | –.015 | (.007) |
| Skilled blue collar women | .064 | (.044) | .458 | (.039) |
| Age | .022 | (.002) | –.009 | (.001) |
| Age square /1000 | –.271 | (.026) | .062 | (.024) |
| Seniority | .007 | (.001) | .004 | (.001) |
| Seniority square /1000 | –.027 | (.040) | –.009 | (.036) |
| | | | | |
| Unskilled white collar men | .0 | (.ref) | .0 | (.ref) |
| Age | .025 | (.000) | .010 | (.000) |
| Age square /1000 | –.255 | (.010) | –.147 | (.009) |
| Seniority | .010 | (.000) | .010 | (.000) |
| Seniority square /1000 | –.179 | (.015) | –.172 | (.014) |

| | Wages | | Hours | |
|---|---|---|---|---|
| Unskilled white collar women | .141 | (.021) | .416 | (.019) |
| Age | .015 | (.000) | –.017 | (.000) |
| Age square /1000 | –.170 | (.008) | .140 | (.007) |
| Seniority | .003 | (.000) | .016 | (.000) |
| Seniority square /1000 | .042 | (.017) | –.308 | (.015) |
| | | | | |
| Skilled white collar men | –.494 | (.019) | .258 | (.017) |
| Age | .057 | (.000) | .002 | (.000) |
| Age square /1000 | –.589 | (.006) | –.039 | (.006) |
| Seniority | .001 | (.000) | .002 | (.000) |
| Seniority square /1000 | .070 | (.008) | –.035 | (.007) |
| | | | | |
| Skilled white collar women | –.171 | (.019) | .744 | (.017) |
| Age | .035 | (.000) | –.026 | (.000) |
| Age square /1000 | –.405 | (.006) | .238 | (.005) |
| Seniority | .006 | (.000) | .008 | (.000) |
| Seniority square /1000 | .017 | (.010) | –.097 | (.009) |
| Highly skilled white collar men | –.643 | (.023) | .312 | (.021) |
| Age | .074 | (.000) | .000 | (.000) |
| Age square /1000 | –.700 | (.009) | –.006 | (.008) |
| Seniority | .000 | (.000) | .001 | (.000) |
| Seniority square /1000 | .029 | (.008) | –.032 | (.007) |
| | | | | |
| Highly skilled white collar women | –.540 | (.033) | .636 | (.029) |
| Age | .067 | (.001) | –.017 | (.001) |
| Age square /1000 | –.740 | (.018) | .175 | (.016) |
| Seniority | –.001 | (.000) | .001 | (.000) |
| Seniority square /1000 | .163 | (.021) | .022 | (.019) |
| | | | | |
| Weighted SD of firm fixed effects | .160 | | .067 | |
| R-square | .759 | | .366 | |

*Source:* Swiss Wage Structure Survey, 1996. Private sector only. Sample size is 314,426.
*Notes:* Standard deviations are in parentheses. The F-test that firm fixed effects jointly equal zero is rejected at the 0.001 level. Weights used to estimate the standard deviation of firm fixed effects are the number of worker per firm.

The regression results of equations (11) and (12) are presented in Table 3. As we can see, the use of firm dummies instead of industry dummies significantly increases the proportion of the variance explained by the model. The weighted standard deviation of inter-firm differentials is 16.0% for wages and 6.7% for hours. Compared with the estimated standard deviation of hours from the equation with industry fixed effects and individual controls, the increase is relatively important. So there is undoubtedly a certain hours variability between firms within industries.

Concerning the observable individual effects, our estimates confirm what we already knew about wage differentials between Swiss and foreign workers. However, it is interesting to note that, whatever type of permit they hold, foreign workers not only earn *ceteris paribus* less than Swiss workers, but also work relatively more hours per week. As one can observe, the higher the probability of return migration, the greater is the number of hours the person works.[17] Although we have no means of knowing if workers are satisfied or not with the length of their working week, given their wages, we can, however, suspect that there is a certain form of "exploitation", which may be due to to the lower bargaining power of non-settled workers. What seems to be clear, in any case, is that seasonal workers, for example, have to work significantly longer hours on average than Swiss in order to reach the same standard of living.

The estimated age and seniority profiles are very different between skills. Some estimates of seniority effects on wages are quite surprising. For skilled white-collar workers, whatever their gender, the wage increases steadily with the number of years spent in the same firm. The same applies for highly skilled white-collar males, but not to women having similar skills. Generally speaking, and given their relatively lower level of general human capital, the wage of blue-collar workers seems more seniority-based than age-based. The estimated age profiles for skilled and highly skilled white-collar males are steeper than those of other skill-gender groups. If we focus on hours, differences between genders as concerns the age profile are striking. For every skill type, the estimated number of normal hours worked by women decreases from the time they enter the labour market (fixed arbitrarily at age 20 here).

Before analysing the determinants of estimated wage global firm fixed effects, we can take a look at the composition of the sample and the degree of firm-specific wage and hours dispersion within each industry. The first two columns of the table in annex present the number of workers (i. e. individual observations) and of firms per industry. For the food industry, for example, we estimated 74 wage global firm fixed effects attached to 11,511 individual observations.

The third and fourth columns of the table in annex show the estimated weighted standard deviation of the global firm fixed effects by industry for wages and hours, respectively. As suggested by GROSHEN (1991) and KRAMARZ ET AL. (1995), we used the number of observations per firm as weights. It can be seen that differences among industries

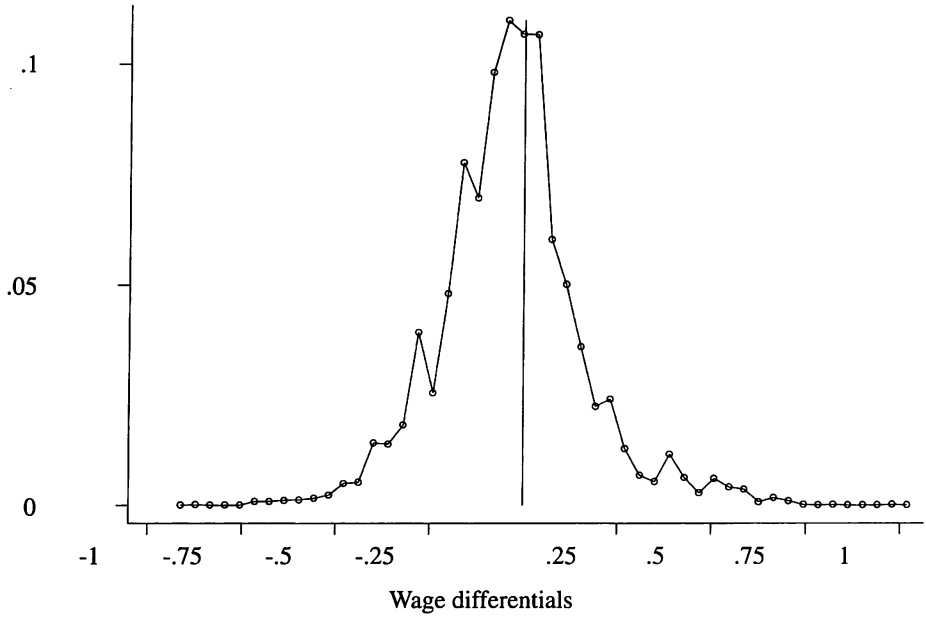
17. See, for example, GALOR and STARK (1991) who explain such a result in an intertemporal framework.

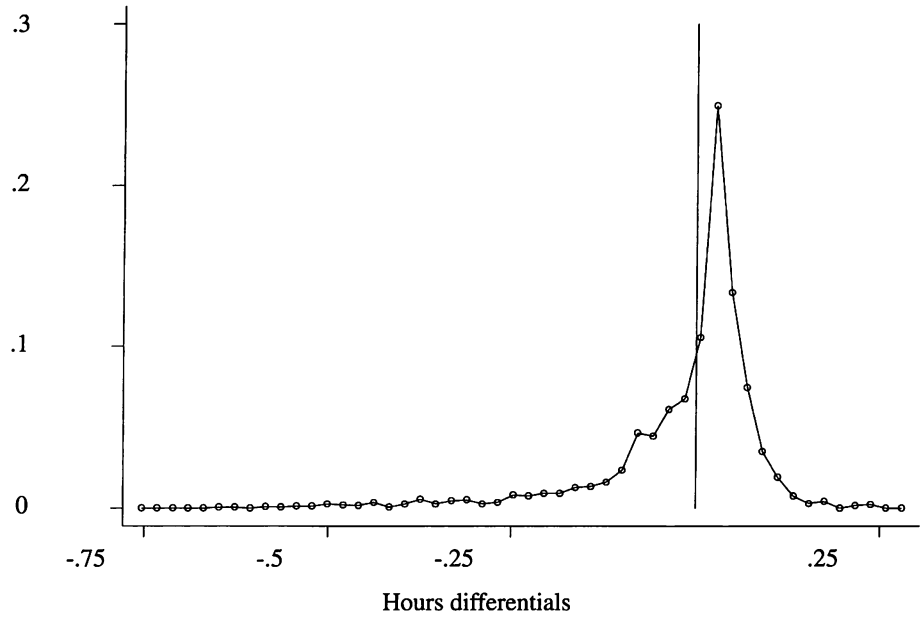
can be relatively great. As one would expect, the potential earnings inequality appears to be larger in non-manufacturing industries. In personal services, for example, the estimated (weighted) standard deviation is 17.1 % for wages and 22.6 % for hours. At the other extreme, that is in the air transport industry, the respective figures are 3 % and 1.1 %.

To gain a better representation of the differences existing between industries regarding inter-firm differentials, we computed weighted Kernel densities using the global firm fixed effects. Figure 1 below shows how these 3,221 estimated firm-entry wages and hours are distributed. These figures confirm the lower variability of the global firm fixed effects of (normal) working hours compared to the firm-entry wages. Similar figures have been computed for some industries in Figures A1 and A2 in annex. As can be seen, in the construction industries, potential inter-firm differentials in earnings appear to be smaller than in the selected non-manufacturing industries. The potential inter-firm differentials in earnings can also be deduced by comparing the estimated weighted correlations between the global firm fixed effects on wages and hours by industry shown in the last column of the table in annex. The correlation coefficient between inter-firm wage and hours differentials by industry is 0.52.

So in accordance with this last correlation and the estimated set of correlations between inter-firm wage and hours differentials within industry, there is more evidence of a positive wage-hours offer curve in the Swiss labour market, given observable workers' characteristics. The remaining question to be answered concerns the impact of the internal organisational structure of firms on the wage-hours curve.

**Figure 1: Distribution of inter-firm differentials in wages and hours**



## 5. EXPLAINING INTER-FIRM WAGE DIFFERENTIALS

In order to explain the estimated wage global firm fixed effects, and the potential relation between these and hours global firm fixed effects, we perform a regression using firm-level variables. Following GROSHEN (1991) and KRAMARZ ET AL. (1995), the firm-level variables included are the logarithm of the firm size, the proportion of wage earners,[18] the proportion of female workers and a dummy variable which indicates the use of incentive payments. We also include two dummies to take account of the existence of a collective or firm-level agreement.

Finally, we do not introduce directly the hours global firm fixed effects as regressor. To test (indirectly) if the internal organisational structure of firms has an impact on the relation between wages and hours, we cross-multiply each proportion of the five skill-groups with the hours global fixed effects.[19] The estimated equation is the following

$$\hat{\phi}_j^w = FC_j\gamma + \sum_{k=1}^{5}(\alpha_{0k} + \alpha_{1k}\hat{\phi}_j^h)SG_{jk} + S_j\delta + \epsilon_j \tag{13}$$

where $\hat{\phi}_j^w$, $\hat{\phi}_j^h$ are the global fixed firm effects estimated previously for wages and hours, respectively. The vector $FC_j$ stands for firm-level characteristics and the vector $S_j$ is the vector of industry dummies. The parameters attached to the proportion of each skill-group inside the firm, $SG_{jk}$, allow us to take account of possible spillover effects of the skill composition of the workforce within each firm.[20] Moreover, adding the terms cross-multiplying the proportion of each skill-group with the hours global firm fixed effects will tell us if the internal organisational structure also matters in what concerns the relationship between wages and working hours. Assuming, as suggested by LINDBECK and SNOWER (1996, 1997), that firms having a relatively more flexible organisation of work employ relatively more people having a good level of general human capital (i. e. more "versatile" workers), we can expect a positive (negative) impact of the proportion of skilled (unskilled) workers on the relation between wage and hours global fixed effects. The regression results are given in Table 4.

18. Proportions at the firm-level estimated were simply computed using the ratio between the number of observations per firm for the given workers' group and the total number of observations per firm.
19. It can be argued that the use of such regressors may introduce a simultaneous bias. However, as noted before, we do not have a good instrument for global firm fixed effects in hours. Moreover, given that these effects are estimated from reduced forms, the potential simultaneity bias should not so great.
20. See KREMER and MASKIN (1994).

**Table 4: Determinants of the wage global firm fixed effects**

| Variable | Without industry dummies | | With industry dummies | |
|---|---|---|---|---|
| Firm-level agreement | .0048 | (.0066) | –.0075 | (.0053) |
| Collective agreement | –.0072 | (.0056) | –.0098 | (.0060) |
| Log(firm size) | .0020 | (.0015) | .0020 | (.0016) |
| Incentive payments | .0250 | (.0124) | .0536 | (.0111) |
| Wage earners | –.1810 | (.0209) | –.1453 | (.0192) |
| Women | –.1401 | (.0161) | –.0589 | (.0170) |
| Unskilled blue-collar | .0216 | (.0163) | –.0088 | (.0174) |
| Skilled blue-collar | –.0592 | (.0181) | –.0680 | (.0184) |
| Unskilled white-collar | –.0968 | (.0181) | –.0220 | (.0167) |
| Highly skilled white-collar | .1789 | (.0169) | .0183 | (.0164) |
| Unskilled blue-collar $*\phi^h$ | .0922 | (.2107) | –.0161 | (.1834) |
| Skilled blue-collar $*\phi^h$ | –.9439 | (.2765) | –.5596 | (.2444) |
| Unskilled white-collar $*\phi^h$ | –.5550 | (.0654) | –.3582 | (.0583) |
| Skilled white-collar $*\phi^h$ | .5856 | (.1184) | .2008 | (.1059) |
| Highly skilled white-collar $*\phi^h$ | 1.5729 | (.1652) | 1.5069 | (.1449) |
| Constant | .0445 | (.0160) | .0271 | (.0196) |
| R-squared | .3356 | | .5162 | |

*Source:* Swiss Wage Structure Survey, 1996. Private sector only. Sample size is 3,221 firms.
*Notes:* Weighted standard deviations are in parentheses. Weights are number of workers (observations) per firm. The proportion of skilled white-collar workers in a firm employed exclusively on individual contracts is the identification constraint.

In the first column, we did not control for inter-industry differences. The inclusion of industry dummies clearly increases the proportion of explained variance. By and large, a comparison between the estimates with and without industry dummies clearly suggests the existence of inter-firm differentials within industries in Switzerland.

The strong apparent spillover effect of the proportion of highly skilled white-collar workers is significantly reduced when industry dummies are included. As can be seen from the estimates attached to variables cross-multiplying the proportion of each skill-group and the hours global fixed effects, the internal organisation of work chosen by firms seems to have some impact on the distribution of firm-entry wages through the

wage-hours curve. This remains true when industry dummies are included in the regression. The relation between work intensity and hours thus seems to be negatively related to the proportion of blue-collar workers, particularly skilled blue-collar workers. Conversely, when the internal production process involves more skilled white-collar workers, the hours-elasticity of effort becomes positive. Moreover, as can be seen from the impact of the proportion of unskilled white-collar workers on the relation between wage and hours global fixed effects, it is not so much the service-based nature of the production process which affects positively the hours-elasticity of effort. It is the proportion of skilled (and highly skilled) white-collar workers which clearly increases this elasticity; that is, people who are more "versatile", having a relatively higher level of general human capital.

The observed difference between the impact of the proportion of blue- and white-collar workers on the wage-hours relationship translate probably a different hours-elasticity of effort between these two forms of occupation. Among blue-collar occupations, the fatigue effect, for example, should be more important that among white-collar occupations. By and large, our regression results suggest that the internal organisational structure of firms has a certain impact on the effort-intensity related to offered wage-hours contracts in the Swiss labour market, independently of industry differences. These results rather contradict Leamer's model, because the compensating wage differentials' argument should still raise wages for each skill-groups in the firm.

Concerning the other firm-specific variables, we can see that the firm size has no notable effect on inter-firm wage differentials in Switzerland. Collective and firm-level agreements do not have the expected effect on the firm-entry wages in the Swiss labour market. Firms using incentive payments offer a relatively higher firm-specific wage. The significant change of the effect of the proportion of women when industry dummies are included confirms what we already know about the important gender segregation between industries in Switzerland.[21] In addition, we can see that the wage global fixed effect is quite lower when the proportion of blue-collar workers is larger.

The firms employing a larger proportion of wage earners offer a relatively lower entry-wage. Wage earners in Switzerland are mainly (more than 80 %) women working part-time. In fact, for more than nine wage earners out of ten, neither the wage earner nor the employer have to pay the contribution to the second "pilar" of the Swiss social security scheme, which is compulsory only when gross annual remuneration is above CHF 23,880. The benefit for the employer is that the non-labour cost per worker is significantly lower than for a salaried worker, a plus for a more flexible employment policy. In light of estimated parameter attached to this variable, and given that we have already taking into account the proportion of women employed by the firm, a large proportion of wage earners in firms cry out to us "secondary" labour market.

21. See, for example, FLÜCKIGER and SILBER (1999).

## 6. CONCLUDING REMARKS

The present paper has attempted to analyse the existence of inter-industry and inter-firm wage and hours differentials in the Swiss labour market. Unsurprisingly, the results suggest the probable existence of noncompetitive rents in this market. A worker can obtain a better wage not only by moving from one industry to another, but also by transferring to another firm in the same industry. Despite the fact that the data set we used underestimates the effective number of working hours, particularly among male workers because it does not cover overtime, our results show that demand factors significantly affect also individual differences in (normal) hours.

In accordance with simple correlations between estimated inter-industry wage and hours differentials, and between inter-firm wage and hours differentials within industries, we observe that there is some preliminary evidence of a positive wage-hours curve in Switzerland. Then, using estimated inter-industry differentials and information on capital intensity by industry, we infer a positive "inter-industry wage-hours differentials line" which confirms simple correlations. So, as suggested by LEAMER (1996) and by the efficiency wage approach, the wage-hours contracts in capital-intensive industries are more effort-intensive than in labour-intensive industries.

Furthermore, in light of the estimates of a regression of firm-specific wages on firm-level characteristics, the positive wage-hours curve seems, at least partially, related to the internal organisation of firms in Switzerland. In other words, given industry and observable workers' characteristics, more flexible structures exhibit a higher return on working hours. According to the efficiency wage approach, this result translates the existence of a wage premium to solve the problem of supervision, because a move toward more flexible structures presumably increases the difficulty of evaluating the individual's productivity. Conversely, in the compensating wage approach used by LEAMER and THORNBERG (1998), the observed positive correlation between inter-firm wage and hours differentials may on the contrary reflect the payment for observable effort. However, the positive wage-hours curve we observed could not be explained by pointing to compensating differentials.

Irrespective of the debate about the observability of effort, the present paper has highlighted the importance of demand factors in the Swiss labour market, not only on the wage distribution but in the earnings distribution as well, given the observed effect of such factors on the offered wages-hours packages. In light of our empirical examination, it appears that the reorganisation of firms into more flexible structures should increase the hours-elasticity of effort, even though such a reorganisation does not modify the capital intensity of firms.

To resume and conclude, our empirical examination of the Swiss labour market suggests that the hours-elasticity of effort is positive and that both capital intensification and higher flexibility of production processes increase earnings inequality. A result to be confirmed by supplementary empirical work on Swiss data and also by using similar employee-employer surveys from other countries.

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## ANNEX

**Dispersion of global firm fixed effects on wages and hours by industry**

| Industry | Sample | | Standard deviation | | Correlation |
|---|---|---|---|---|---|
| | N Firms | N Workers | Wages ($\phi^w$) | Hours ($\phi^h$) | $\phi^w - \phi^h$ |
| Food | 74 | 11,511 | .160 | .031 | .263 |
| Beverages | 17 | 1,326 | .104 | .041 | .525 |
| Tobacco | 8 | 1,619 | .162 | .020 | –.497 |
| Textiles | 33 | 868 | .128 | .064 | .345 |
| Apparel | 39 | 1,197 | .148 | .072 | .311 |
| Timber and Furniture | 88 | 3,102 | .072 | .033 | –.034 |
| Paper | 42 | 3,019 | .073 | .024 | .251 |
| Printing and publishing | 76 | 6,811 | .145 | .059 | .076 |
| Leather and footwear | 11 | 495 | .244 | .087 | –.563 |
| Chemicals | 57 | 14,990 | .087 | .013 | .125 |
| Plastics and rubber | 29 | 1,294 | .081 | .046 | .081 |
| Non-ferrous minerals | 70 | 3,135 | .090 | .037 | .122 |
| Metals | 140 | 13,604 | .097 | .024 | .015 |
| Machinery and equipment | 159 | 17,775 | .126 | .021 | .151 |
| Electrical machinery | 160 | 20,919 | .083 | .028 | .146 |
| Watches and jewelry | 50 | 6,690 | .071 | .024 | .272 |
| Other manufacturing | 23 | 1,773 | .121 | .032 | –.027 |
| Construction | 183 | 7,066 | .107 | .055 | .279 |
| Building installations | 170 | 5,247 | .087 | .044 | .069 |
| Wholesale trade | 264 | 19,972 | .193 | .044 | .272 |
| Trade intermediaries | 29 | 1,540 | .132 | .086 | .171 |
| Retail trade | 320 | 66,939 | .093 | .052 | .085 |
| Restaurants and hotel | 215 | 7,825 | .135 | .101 | .021 |
| Repair services | 89 | 2,254 | .090 | .034 | .219 |

| Industry | Sample | | Standard deviation | | Correlation |
|---|---|---|---|---|---|
| | N Firms | N Workers | Wages ($\phi^w$) | Hours ($\phi^h$) | $\phi^w - \phi^h$ |
| Railroads | 26 | 871 | .135 | .027 | –.475 |
| Road transport | 56 | 2,367 | .170 | .097 | .133 |
| Navigation | 25 | 588 | .146 | .060 | .501 |
| Air transport | 23 | 11,992 | .030 | .011 | .365 |
| Transport intermediaries | 68 | 14,548 | .089 | .098 | –.184 |
| Communi-cation | 10 | 578 | .134 | .086 | .117 |
| Banking and finance | 97 | 27,794 | .114 | .033 | .589 |
| Insurance | 68 | 15,761 | .080 | .059 | .440 |
| Real estate | 53 | 1,305 | .141 | .119 | .476 |
| Leasing and personal hiring | 16 | 245 | .165 | .146 | .460 |
| Business services | 341 | 14,555 | .189 | .114 | .033 |
| Personal services | 92 | 2,851 | .171 | .226 | .288 |
| Total | 3,221 | 314,426 | .160 | .067 | .264 |

*Source:* Swiss Wage Structure Survey, 1996.
*Notes:* Inter-firm wage and hours differentials are the global firm fixed effects previously estimated (see Table 2). Weights for standard deviations and correlations are the number of individual observations per firm.

**Figure A1: Inter-firm wage differentials in some industries**

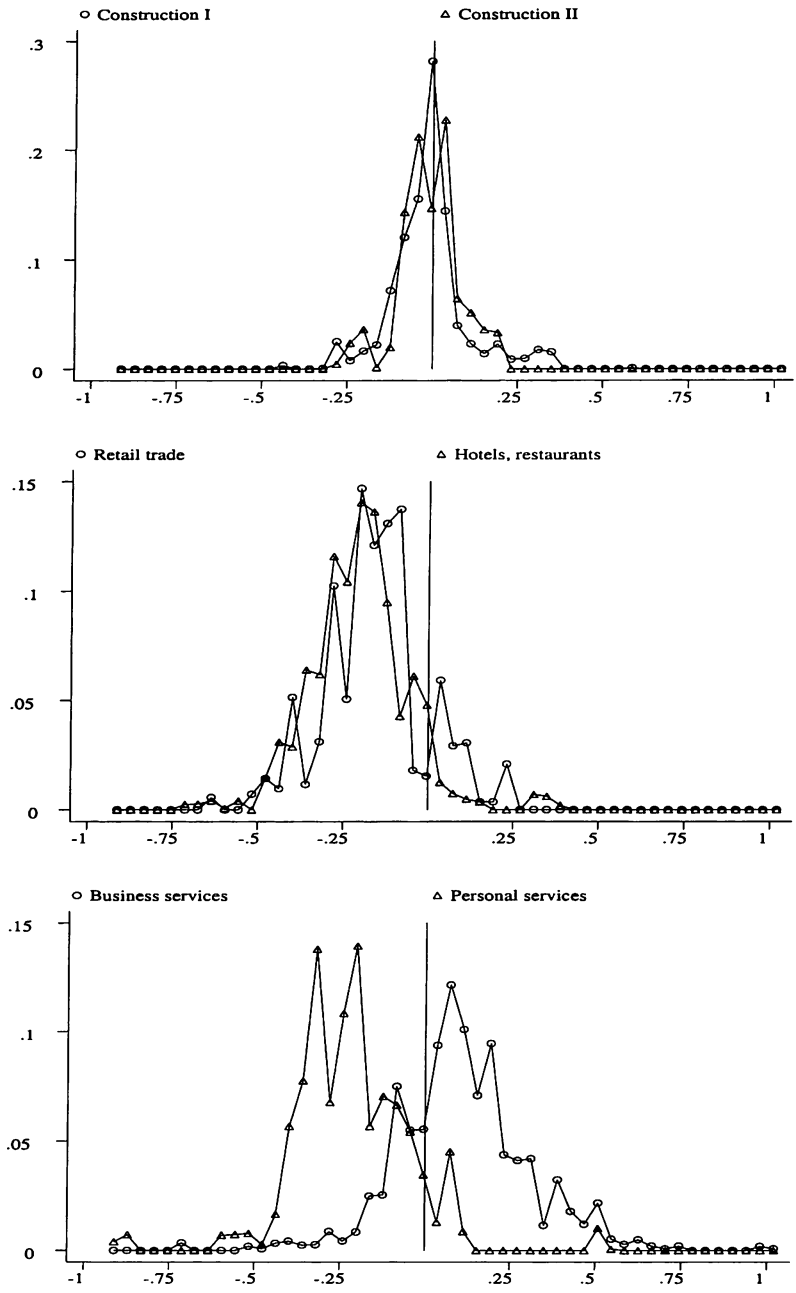
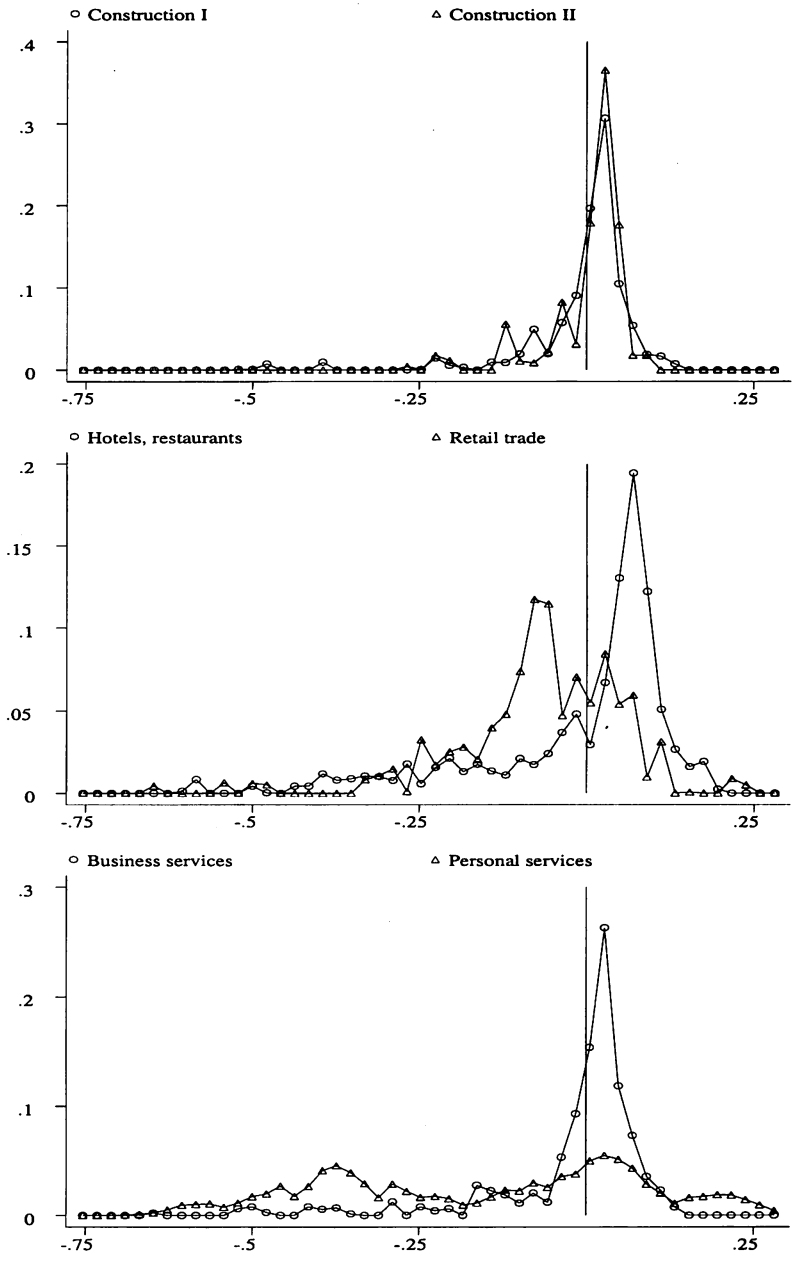


**Figure A2: Inter-firm hours differentials in some industries**



## SUMMARY

In the present paper, we analyse the role of demand factors on wages and hours in Switzerland. To accomplish this task, we used the 1996 Swiss Wage Structure Survey, a large employee-employer survey. Results indicate that capital intensity appears to have a certain impact on the relation between wages and hours: the "inter-industry wage-hours differentials line" we inferred is clearly positive. Further, an analysis of the determinants of inter-firm wage differentials shows that the internal organisational structure of firms clearly affects the relation between inter-firm wage differentials and inter-firm hours differentials. A change away from a Taylorist organisation of work towards more flexible structures seems to imply an increase in the hours-elasticity of effort, as does capital intensification.

## ZUSAMMENFASSUNG

Dieser Artikel analysiert die Rolle der Nachfragefaktoren auf Löhne und Arbeitsstunden in der Schweiz. Um diese Aufgabe zu vollenden, verwendeten wir die Schweizer Lohnstruktur-Erhebung (LSE) 1996. Das Ergebnis der Untersuchung zeigt, dass die Kapitalintensität eine bestimmte Auswirkung auf die Relation zwischen Löhnen und Arbeitstunden hat: Die Linie der "inter-industry wage-hours differentials" ist eindeutig positiv. Die Analyse der Determinanten der "inter-firm wage differentials" zeigt eindeutig, dass die interne Organisation der Unternehmen die Beziehung zwischen den Löhnen und Arbeitsstunden beeinflusst. Der Wechsel von einer Taylorschen Arbeitsorganisation zu einer flexibleren Struktur scheint eine grössere Bereitschaft zu Arbeitsstunden-Elastizität zu bedeuten, so wie bei einer Kapitalsteigerung.

## RESUME

Cet article analyse l'influence des facteurs liés à la demande de travail sur les salaires et les heures de travail en Suisse. Pour accomplir cette tâche, nous utilisons l'Enquête sur la structure des salaires de 1996. Les résultats obtenus montrent que l'intensité capitalistique a un certain impact sur la relation entre salaire et heures de travail: "la droite des différentiels inter-sectoriels" est clairement positive. L'analyse des déterminants des différentiels inter-entreprises montre clairement que l'organisation interne des entreprises affecte la relation entre salaire et heures de travail. A l'instar d'une intensification capitalistique, une réorganisation des enterprises en structures plus flexibles semble ainsi accroître l'élasticité de l'effort par rapport aux heures de travail.