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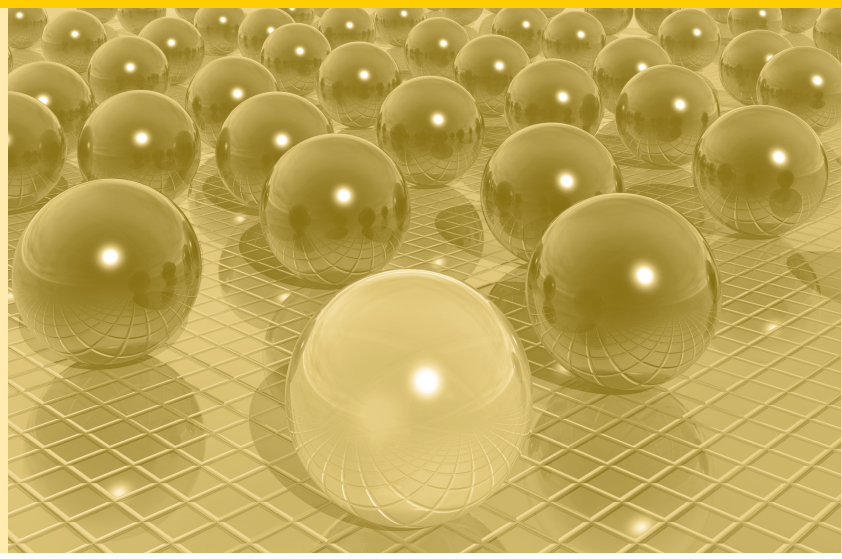

Temporary agency work and firm performance

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Temporary agency work and firm performance[†]

Sebastian Nielen and Alexander Schiersch[‡]

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Abstract:

This paper addresses the relationship between labor productivity and the utilization of temporary agency workers by firms, using a rich, newly built, data set for German manufacturing enterprises. The analysis is conducted by applying different panel data models while taking the inherent selection problem into account. The results indicate an inverse U-shaped relationship between productivity and the extent that temporary agency workers are used by the firms, implying the existence of an optimal share of temporary agency workers on total workforce.

Zusammenfassung:

Gegenstand dieser Arbeit ist die Untersuchung des Zusammenhangs zwischen der Arbeitsproduktivität von Unternehmen und der Nutzung von Zeitarbeit durch Selbige. Basierend auf einen umfangreichen Datensatz deutscher Industrieunternehmen werden verschiedene Paneldatenmodelle unter Berücksichtigung des inhärenten Selektionseffekts geschätzt. Die Ergebnisse deuten auf einen umgekehrt U-förmigen Zusammenhang zwischen dem Ausmaß der Nutzung von Zeitarbeit und der Produktivität hin. Dies impliziert, dass es einen optimalen Anteil von Zeitarbeitern an der Gesamtbelegschaft gibt.

Keywords: temporary agency work, productivity, manufacturing

JEL Classification: D24, L60, J24

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1. Introduction

In Germany, a new form of employment, the temporary agency worker, has exploded onto the scene. This new form of employment became important in the years since 1995, where regulation in most European countries was relaxed. Between 1995 and 2007, the number of temporary agency workers in Germany quadrupled from roughly 175,000 to 700,000 (Brenke and Eichhorst 2008). However it must be noted also that despite this impressive growth, in 2007 the proportion of the working population working as temporary agency employees was only 1.6 percent (Eichhorst et al. 2010a). However, this is by no means a German phenomenon. The importance of temporary agency employment increased throughout the western world. For example, in Japan between 2000 and 2007, the share of temporary agency workers grew in the active population by more than 1.3 percentage points to 2.1 percent. In European countries like Switzerland, Austria, Finland and Italy, the growth in temporary agency work was 0.7 percentage points, about the same as in Germany (Eichhorst et al. 2010a).

This growth suffered a serious setback during the financial and economic crisis. The number of temporary agency workers in Germany dropped about a quarter between January 2008 and July 2009, to just over 500,000. However, starting in July 2009 there was a renewed rise of temporary numbers (Schmidt and Wüllerich 2010). It seems that, as in past crises, temporary agency work is among the first to profit from a rebound in economic activity (Brenke and Eichhorst 2008).

The growing importance of temporary work is of growing interest to economists. So far, there is an extensive discussion on the various aspects of this form of employment. However, the discussion is driven from a labor market perspective. The discussion usually focuses on the question whether temporary work is a stepping stone into permanent jobs or not (Booth et al. 2002b); the overall effects on employment levels (Nunziata and Staffolani 2007); if there are, and, if so, how large are, wage differentials between persons under permanent contract and fixed-term contracts (Brown and Sessions 2005); how satisfaction differs between individuals employed under temporary or permanent contracts (Hall 2006, Forde and Slater 2006); if temporary employees receive less training and hence are not able to increase human capital as necessary (Albert et al. 2005, Arulampalam et al. 2004) etc…. This study tries to shed light on a different aspect of the use of temporary agency work. First, does the use of this instrument increase the productivity of firms? Second, is there a threshold or an optimum above which firms shouldn't increase the number of temporary agency workers since this would result in a decreasing productivity?

So far, there are two published papers, Arvantis (2005) and Kleinknecht et al. (2006), that analyze the effect of temporary agency work on firm performance. Arvantis (2005), based on 1,382 Swiss firms across all sectors, uses a dummy variable to model the utilization of temporary agency work on the

outcome variable sales per capita by running a simple regression. No significant difference between firms using temporary agency work and those not using it is found. Kleinknecht et al. (2006) uses a different measure for temporary agency work. Here the percentage of hours worked by temporary agency workers on total working hours is used. Based on a sample of 590 Dutch firms, simple regression models are used to test for a relationship between the utilization of temporary agency work and firm performance as measured by sales growth and growth in employment. Like Arvantis (2005), no significant effects are found.

We extend the existing literature on the effects of temporary employment on firm performance, by applying panel data models on a rich newly combined representative panel data set of more than 11,300 German manufacturing enterprises. In contrast to the aforementioned studies, we control for the inherent selection problem. This is done, first, by estimating a selection equation and applying the selection term to the subsequent estimations. Then, secondly, by creating subsamples that only contain firms that actually used temporary agency work. Moreover, this study also controls for firm specific effects by using fixed effects regression models.

The remainder of the paper is organized as follows. The next section shows the broad lines of discussion in connection with temporary agency work and fixed-term employment. From this, we develop the hypothesis to be tested. In the third section, the data are presented and discussed. The results of the analysis are the subject of the fourth section and the last section concludes.

2. Theoretical Framework and Hypothesis

In this section we present some theoretical aspects about temporary agency work and use them to explain the relationship between the use of temporary agency work and labor productivity. The literature on the various aspects of temporary employment and temporary work is extensive, from which three main lines of argumentation can be discerned.[1]

The first line develops along the increase of labor market flexibility through temporary employment. Thereafter, the temporary employment or temporary agency work is a form of external flexibility, which allows companies to react quickly to fluctuations in demand with an adjustment of labor input without prohibitive high redundancy payments (Bentolila and Saint-Paul 1992, Pfeifer 2005, Nollen 1996). Hence, this form of employment is actually a result of strict labor market regulation. This argument already seems to be confirmed by the fact that, particularly in countries with high labor market regulation and, thus, high firing costs, the use of temporary employment has increased much more

[1] Although this paper focuses on temporary agency work, which is defined as a triangular relationship between worker, leasing company and client (Burgess and Connell 2005), we do not explicitly distinguish between fixed-term contracts and temporary agency work in this literature review, because the discussed effects are rather similar for both forms of employment. This paper does not discuss the institutional framework and the development of temporary agency work in Germany. For more information on it see Schmidt and Wüllerich (2010), Mitlacher (2008) Antoni and Jahn (2006) and Pfeifer (2005).

than in countries with low levels of labor market regulation (Booth et al. 2002b, Eichhorst et al. 2010a, Eichhorst et al. 2010b) But empirical evidence also suggests a positive correlation between permanent employment protection and temporary employment (Nunziata and Staffolani 2007, Houseman 2001, Shire et al. 2009). The effect on the productivity of firms is double-sided. On the one hand, using temporary employment to increase flexibility might increase also the productivity, due to a more efficient allocation of labor. However, temporary agency work can also be used to substitute for permanent employees (Booth et al. 2002a, Vidal and Tigges 2009). As discussed in management literature, this could demotivate remaining core workers and result in lower performance (DeCuyper et al. 2008). This effect however, is conditional "...upon the proportion of temporary workers and upon permanent workers' assumptions concerning the reasons for hiring temporary workers" (DeCuyper et al. 2008, 39).

The second argumentation line develops along the screening aspect of temporary agency work and employment under fixed-term contracts. Here, following the principal agent theory, the true quality of job applicants is unknown. Fixed-term contracts are used to increase the period of probation in order to give the employer more time to screen the employees (Booth et al. 2002a, Vidal and Tigges 2009). If the temporary employees can expect that productive behavior and positive work attitude will increase job tenure, or increase the probability of getting a permanent contract, screening helps to separate good and bad agents (Pfeifer 2005, Wang and Weiss 1998). This in turn would have a positive effect on the productivity, both, in the period of screening, as well as afterwards. In the screening period, temporary workers have high incentives, due to the "winner takes it all" situation, to reveal their productivity and hence they are as productive as possible (Engellandt and Riphan 2005). If fixed-term contracts are prolonged or the productive temporary workers get permanent contracts and shift to the core workforce, it will be the productive ones. However, if the firm policy or recent events have proved that fixed-term contracts or temporary agency work is not used to screen for the productive workers, the positive incentives of screening fail to appear. The resulting "…low levels of job satisfaction and morale may exert an adverse influence on productivity levels." (Brown and Sessions 2005, 311)

Finally, the discussion in the literature is about lower human capital among fixed-term employees and temporary agency workers. It is also argued, however, that firms have low incentives to invest in the human capital of temporary employees, since the rent of such an investment comes in the long run. Since it is not planned, or just unknown if a company will or can hold on to temporary employees, such investments, which are only costs in the short run, make no sense for a profit maximizing firm (Booth et al. 2002c). Consequently, the human capital and hence the productivity of persons under fixed-term contract or temporary agency workers will remain below the level of core workers with permanent contracts. Moreover, the productivity of firms is also depending on the firm-specific human capital. The literature argues that this kind of human capital is lower for temporary employed persons

than for permanent employees (Nunziata and Staffolani 2007, Pfeifer 2005). Moreover, as pointed out by Nunziata and Staffolani (2007, 76), the share of temporary employees idirectly affecting firms' productivity, since: "… the productivity of the newly hired temporary employees depends on the number of permanent employees who can dedicate part of their working time to train them to workplace tasks." This implies a transfer of firm specific knowledge from the permanent employees to the temporary employees, for which interaction between both groups are needed. This level of interaction, however, is already low in normal situations (Mitlacher 2008). Hence, the knowledge transfer is restricted and productivity of temporaries is not increasing.

To sum up, there are arguments for an increasing firm performance as a result of using temporary agency work as well as arguments for a decreasing firm performance. In this paper we apply these arguments without, however, to confirm or refute them. Rather, it is assumed that the potential positive or negative effects of temporary employment on the firm performance are justified.[2] Instead, crucial to the firm performance, the scale of temporary agency work is used. We therefore expect to find an inverse U-shaped relationship between productivity and the extent to which temporary agency workers are used by the firms. Hence, the use of temporary agency work may increase labor productivity of a firm, but using too many temporary employees may lead to decreasing productivity.

3. Data

This study uses a newly combined data set of German Manufacturing enterprises. It contains data from the German Cost Structure Census (*Kostenstrukturerhebung*), the German Production Census (*Produktionserhebung*) and the Monthly Reports of German Manufacturing enterprises (*Monatsbericht*). Each dataset was gathered and complied by the German Statistical Office (*Statistisches Bundesamt*). We use the data for the 1999 to 2006 period. Plant and firm level data are merged using a common identifier. This combined dataset covers all large German manufacturing firms with 500 or more employees over the entire time span. Smaller firms with more than 20 employees are included as a random subsample which is held constant for four years.[3] The samples are designed to be representative for each sector.[4]

The most important dataset is that of the Cost Structure Census. It contains information on several input categories, namely expenditures for material inputs, self-provided equipment, external maintenance and repair, tax depreciation of fixed assets, subsidies, rents and leases, insurance costs, sales tax, other taxes and public fees, fringe benefits, payroll, employer contributions to the social security

[2] This is also supported by DeCuyper et al. (2008). In his literature review he finds that there are usually papers that support an argument as well as papers that discard the same argument.
[3] The Subsamples are compiled in 1999 and 2003.
[4] For more information about the Cost Structure Census surveys in Germany, see Fritsch et al. (2004).

system, goods for resale, energy costs, external wage-work, interest on external capital as well as "other" costs such as license fees, bank charges and postage, or expenses. The Production Census contains information on the good produced, based on a nine-digit product classification system (*Güterverzeichnis für Produktionsstatistiken*) of the Federal Statistical Office. It gives us the information about the number of products that are produced by company. The Monthly Reports contains information on domestic sales and foreign sales. This allows us to measure the export intensity of firms.

Given these datasets, the explanatory variables are: the size of a company (Size) measured by the number of employees; the number of products (NoProducts); The average labor costs (AvageLaborCosts), which are used as proxy for the knowledge intensity of the production; the share of outsourced activities like repair and costs for contract work performed by other companies on gross value added (External); the material intensity of production as share of material costs and energy on sales (IntermediateIntensity); the export intensity as share of foreign sales on total sales (ExportIntensity). Further we use Dummy variables for the legal form (LegalForm) of the company; dummy variables for the years (Year Dummies) and the industries (Industry Dummies) as well as dummy variables for the establishment profile (EstablishmentProfile). Finally the inverse mills ration (InversMillsRatio) is calculated and used as explanatory variable to account for the selection bias.

The output variable is an approximation of labor productivity (LabProd). The usual way to construct labor productivity, by dividing the gross value added by the number of employees or the hours worked, does not work in this context. The reason is that the given numbers of employees or the hours worked in the data sets are always that of permanent or fixed-term workers, but not temporary agency workers. Hence, just using these figures would result unreliable estimates for a simple reason. Assume two equal companies with one using temporary agency workers and the other not. Since the former will have fewer permanent workers, it will have higher labor productivity. We overcome this problem by using the costs of labor. Hence, the variation in the output variable depends not only on the productivity but also on wages. However, since wages in Germany are highly regulated by wage agreements in industries, the dispersion in wages among similar industries is reduced. The quotient is therefore highly correlated to labor productivity. Moreover, by using the labor costs we also can easily account for the input of temporary agency workers since companies pay a fee for the duration the hired a temporary agent.

This, of course, leads to the question if costs for temporary agency workers and permanent workers can be aggregated. As many studies show, the wage of temporary agency workers is considerably below that of their permanent employed colleagues (Antoni and Jahn 2006, Brown and Sessions 2005, Jahn and Rudolph 2002). Jahn and Rudolp (2002) find that wages of temporary agency employees in Germany are roughly one third below that of permanent employees. However, as pointed

out by Nollen (1996), the cost saving goals are sometimes not met. This "… disappointing experience appear to occur in Europe as well as in the U.S." (Nollen 1996, 578). One reason is that the client company does not pay the low wages directly. Instead, the client company pays a fee that includes the gross wage of the temporary worker and additional fees, depending on the contract, to the agency. The overhead fees are sometimes quite high, as pointed out by Houseman (2001). According to Rangnitz (2008), only two-thirds of the fee paid by the client company to the agency is the actual wage of the temporary worker and the rest are costs and profit of the agency (Kleinknecht et al. 2006). This means, in turn, that actual costs for a temporary agency worker, compared to a similar worker under a permanent contract, are at least the same or higher. This is also confirmed in an empirical study by Kleinknecht et al. (2006, 176) that found "…evidence that flexible contracts lead to significant savings on firm's wage bill. This holds for people on truly temporary contracts and for self-employed ('free lance') people. It does not, however, hold for people hired from manpower agencies."

Hence, by following these findings and arguments, we sum up the labor costs for temporary employees and the costs for temporary agency workers, paid by the company to the agency, and divide the gross value added by this sum to create the outcome variable: labor productivity (LabProd). According to the comparable costs of temporary agency workers and permanent workers with the same productivity, we measure the share of temporary agency workers on the total employment in a firm, by dividing the costs for temporary agency workers with the sum of labor costs for permanent employees and costs for temporary agency workers (Share). Since we expect the relationship between productivity and the share of temporary agency workers on the total workforce to be negatively U-shaped, we also include the squared form of the variable (Share2). Finally all variables are used as logarithms except the dummy variables.

The descriptive statistics of the explanatory variables are shown in Table A1 in the Appendix, while Table A2 shows the intensity temporary agency workers are used per industry.

4. Empirical Investigation

As noted before, previous studies do not account for the fact that some firms have never used temporary agency work and that this causes a selection bias. In our data set, there are companies that have made use temporary workers and those that have never used it. Overall, about 65 percent of all companies used temporary agency worker at least once. It follows, however, that the analysis is also subject to a selection problem. Therefore we first estimate a probit selection equation where the dependent variable is a binary one with take the value one if a firm use temporary agency work in a year and

zero otherwise. The results of this equation are reported in the first column of Table 1.[5] Then we calculate the inverse mills ratio, based on the selection model proposed by Heckman (1979). For details of this approach see Briggs (2004). The calculated inverse mills ratio is included in the subsequent estimations as an additional variable to control for possible selection effects.

The actual investigation begins with estimating a simple OLS model in order to gain an impression of the relationship is between the variables of interest, share and share squared, and labor productivity, as defined here. The coefficient for the variable share is positive and significant. As pointed out in the third section, the variable approximates the share of temporary agency worker out of the total workforce used by firms. Hence, the result indicates that labor productivity increases with the share temporary agency worker on total workforce. The coefficient of the squared term, however, is negative and significant. This suggests an inverse U-shaped relationship between labor productivity and the proportion of temporary agency workers in a company.

The remaining control variables are significant and mostly in line with our expectations. We find a positive relationship between the size of a company and labor productivity. The average labor costs, used as a proxy for the knowledge intensity of the production, are also positive and significant. Hence, the labor productivity is higher in companies with more knowledge intense production. Outsourcing certain activities, like repair, also increases labor productivity. This goes along with the expectation that firms concentrating on their core activities are more productive in these activities. The effect of foreign operations is also positive. This result is in line with expectation of higher productivity among exporters. However, the question of whether only productive companies become exporters or if companies become more productive if facing strong global competition cannot be answered with this result. The intermediate input is used as a proxy for vertical integration in a production process. The higher a company is settled in the production chain, the more valuable should be its production. Therefore a positive coefficient for the variable is expected. The results confirm this expectation. With respect to number of products, we would expect to find positive coefficients. However, the results indicate that labor productivity is the lower, the more products a company produces. Finally, the negative coefficient of the inverse Mills ratio suggests that ignoring the selectivity issue results in biased estimates.

Although we use all variables in the OLS approach, the pooling model neglects firm specific effects. By applying a fixed effect model we account for these effects. In the first step, we use all variables except the dummy variables. The results are listed in column three of Table 1. The results support the previous findings. First, the coefficient of share is still positive and significant. Secondly, the coefficient of the squared share variable is again negative and significant. Hence, the expected inverse U-

[5] We do not make use of all available variables in the selection equation because variables in the selection model and in the regression models shouldn't be totally the same in order to avoid multicollinearity between the mills ratio and the other exogenous variables (Briggs 2004).

shaped relationship between the extent of the use of temporary agency work and labor productivity is also found when controlling for firm specific effects. However, our result differs from the pooled model with respect to the coefficient of the average labor costs, which is now negative and significant. This is surprising, but, as shown later, might be driven by the fact that variation is more between the firms than within firms. In addition, the coefficient of size becomes negative, but remains significant. The reason for this is the elimination of level information in the fixed effect model through subtracting the mean.

Table 1: *Estimation results controlling for the selection effect via the inverse mills ration*

VARIABLES	Probit	OLS	Fixed Effect	Fixed Effect	Between
Endogenous variable	Dummy for tempo-rary agency work	Labor productivity	Labor productivity	Labor productivity	Labor productivity
Share		0.563***	0.875***	0.550***	0.493***
		(0.0794)	(0.0755)	(0.0716)	(0.144)
Share2		-1.520**	-6.567***	-5.493***	-0.259
		(0.735)	(0.665)	(0.618)	(1.066)
Size	0.303***	0.00261	-0.111***	-0.136***	-0.000226
	(0.00557)	(0.00169)	(0.0103)	(0.00985)	(0.00328)
NoProducts	-0.0384***	-0.0317***	-0.0276***	-0.00806*	-0.0372***
	(0.00627)	(0.00179)	(0.00425)	(0.00418)	(0.00373)
AvageLaborCosts	0.705***	0.143***	-0.192***	-0.287***	0.161***
	(0.0148)	(0.00522)	(0.00981)	(0.0107)	(0.00895)
External	1.140***	1.363***	0.553***	0.501***	1.518***
	(0.0875)	(0.0320)	(0.0445)	(0.0437)	(0.0551)
IntermediateIntensity	0.202***	0.432***	0.139***	0.121***	0.454***
	(0.00896)	(0.00446)	(0.00717)	(0.00727)	(0.00505)
ExportIntensity	0.1000***	0.214***	0.285***	0.210***	0.212***
	(0.0281)	(0.00846)	(0.0227)	(0.0232)	(0.0173)
InversMillsRatio		0.0944***	0.343***	0.241***	0.114***
		(0.0130)	(0.0218)	(0.0226)	(0.0267)
EstablishmentProfile2	-0.162***	-0.0864***		-0.822***	-0.0963***
	(0.0219)	(0.00653)		(0.249)	(0.0133)
EstablishmentProfile3	0.0304*	0.0241***		-0.827***	0.0277**
	(0.0179)	(0.00533)		(0.250)	(0.0109)
LegalForm2	0.0123				
	(0.00948)				
LegalForm3	-0.367***				
	(0.0768)				
Year Dummies	yes	yes	no	yes	yes
Industry Dummies	yes	yes	no	yes	yes
Constant	-9.508***	0.0510	3.286***	4.562***	-0.330*
	(0.200)	(0.0739)	(0.138)	(0.152)	(0.175)
Observations	87,933	87,933	87,933	87,933	87,933
R-squared/ Pseudo R-squared	0.1428	0.438	0.100	0.159	0.468
Number of ID			18,582	18,582	18,582

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In a second step we include the dummy variables as additional control variables. The results are listed in column four of Table 1. It might be surprising that we include the dummy variables for industries, but as the results show, there is variation in it, meaning that enough firms change industry classification over time. Hence, including these dummy variables is appropriate, even if we estimate a fixed effect model. The same holds true for the legal form of companies and the establishment profile. With respect to the variables of interest, that is share and squared share, the coefficients remain positive and negative. Hence, the inverted U-shaped relationship between labor productivity and the share of temporary agency workers in total employment remains. But, as the results also show, the level coefficients is lower than in the previous model. This shows that the inclusion of additional control variables, most are insignificant, is necessary. Accordingly, column four in Table 1 describes our preferred model.

However, even in our preferred model the coefficient for the average labor costs is negative and significant, implying that labor productivity is higher, the lower the knowledge intensity of production is. This is counterintuitive. The simplest explanation for this is that our proxy for the knowledge intensity of production might simply be not a good one. It might measure something else related to human capital. The variation in the variable also speaks for this. As shown in Table A1, the between variation is more than three times higher than the within variation. To confirm this finding, we also estimate a between model. As the results in the last column in Table 1 show, we find the expected positive and significant coefficient for average labor costs. Hence, the variation in this variable is rather between companies than within companies.

As pointed out before, the selection problem should be taken into account. This is done by using the inverse Mills ratio. As the results in Table 1 reveal, the coefficient of the variable is always significant. This shows that the selection problem occurred, but was controlled for in our estimations. To check for the selection effect, we also estimate the same model but without the inverse Mills ratio. The results are reported in Table A3. First, all variables have the same sign and are all significant. Hence, variables retain their sign and are still significant, even if we not control for the selection effect. But, as the results with respect to the variables of interest show in the favored model, they have higher coefficients. This reveals the effect of the lack of selection control. Finally, we also estimate all models using only the companies that used temporary agency work at least once as another way to control for the selection problem. Again, the variables of interest have lower values than in the model without controlling for the selection bias, but keep their sign and are still significant. Accordingly, the results in Table A4 support our findings while also showing that one needs to take the selection problem into account.

5. Conclusion

In this study the relationship between labor productivity and the intensity of using temporary agency work is investigated. We find theoretical arguments for a positive relationship between the use of temporary agency work as well as negative ones. Therefore theory let us expect a nonlinear, perhaps inverse U-shaped relationship between the share of temporary agency work on total labor force and labor productivity.

Our main hypothesis of a nonlinear dependency is confirmed by regressing labor productivity on the share of temporary agency work on total employment and the quadratic share as well as several controls. By making use of fixed effects regression models we also control for firm specific effects. We control for a potential selection into the use of this form of employment by firstly making use of a selection equation and secondly restricting the sample to firms actually used of temporary agency work at least once. The results are stable regardless of the applied variant. We find an inverse U-shaped relationship between the intense of using temporary agency work and labor productivity. This allows us to calculate the optimal shares of temporary agency work for different models. The optimal shares are about 15 percentage points for fixed effects models and about 11 percentage points for fixed effects regression models using several dummy variables as additional controls. However the optimal shares should be interpreted carefully because there are differences between the industries: Moreover, labor productivity and the share of temporary agency workers in a firm is calculated by using monetary information.

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Appendix

Table A1: *Descriptive Statistics*

Variable		Mean	Std, Dev,	Observations	
LabProd	overall	4,1575	3,8294	N =	87933
	between		3,4948	n =	18582
	within		0,9568	T-bar =	4,73216
Share	overall	0,0200	0,0479	N =	87933
	between		0,0421	n =	18582
	within		0,0236	T-bar =	4,73216
Share2	overall	0,0027	0,0173	N =	87933
	between		0,0146	n =	18582
	within		0,0096	T-bar =	4,73216
Size	overall	282,7061	2268,417	N =	87933
	between		1919,281	n =	18582
	within		149,8198	T-bar =	4,73216
NoProducts	overall	3,8290	8,4713	N =	87933
	between		7,6566	n =	18582
	within		1,3996	T-bar =	4,73216
AvageLaborCosts	overall	37109,21	12625,25	N =	87933
	between		11983,78	n =	18582
	within		3672,08	T-bar =	4,73216
External	overall	0,0528	0,0674	N =	87933
	between		0,0621	n =	18582
	within		0,0278	T-bar =	4,73216
IntermediateIntensity	overall	0,4103	0,1995	N =	87933
	between		0,1767	n =	18582
	within		0,0887	T-bar =	4,73216
ExportIntensity	overall	0,2291	0,2501	N =	87933
	between		0,2396	n =	18582
	within		0,0547	T-bar =	4,73216
EstablishmentProfile1	overall	0,8565	0,3506	N =	87933
	between		0,3347	n =	18582
	within		0,0053	T-bar =	4,73216
EstablishmentProfile2	overall	0,0483	0,2144	N =	87933
	between		0,2073	n =	18582
	within		0,0404	T-bar =	4,73216
EstablishmentProfile3	overall	0,0952	0,2934	N =	87933
	between		0,2723	n =	18582
	within		0,0403	T-bar =	4,73216
LegalForm1	overall	0,3726	0,4835	N =	87933
	between		0,4732	n =	18582
	within		0,1026	T-bar =	4,73216
LegalForm2	overall	0,6236	0,4845	N =	87933
	between		0,4744	n =	18582
	within		0,1010	T-bar =	4,73216
LegalForm3	overall	0,0038	0,0611	N =	87933
	between		0,0550	n =	18582
	within		0,0220	T-bar =	4,73216

Table A2: *Share per industry*

Industrie (ISIC Rev.3)	Number of Obs.	Mean	Std, Dev,
Mining of coal and lignite; extraction of peat	145	0.0101	0.0286
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying	67	0.0599	0.0790
Other mining and quarrying	542	0.0059	0.0164
Manufacture of food products and beverages	10254	0.0206	0.0579
Manufacture of tobacco products	67	0.0277	0.0513
Manufacture of textiles	3282	0.0073	0.0255
Manufacture of wearing apparel; dressing and dyeing of fur	896	0.0045	0.0435
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	693	0.0111	0.0318
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	2297	0.0151	0.0333
Manufacture of paper and paper products	2504	0.0107	0.0217
Publishing, printing and reproduction of recorded media	5257	0.0075	0.0317
Manufacture of coke, refined petroleum products and nuclear fuel	180	0.0088	0.0162
Manufacture of chemicals and chemical products	5258	0.0157	0.0323
Manufacture of rubber and plastics products	5105	0.0199	0.0391
Manufacture of other non-metallic mineral products	4231	0.0160	0.0417
Manufacture of basic metals	3591	0.0217	0.0414
Manufacture of fabricated metal products, except machinery and equipmen	10290	0.0295	0.0620
Manufacture of machinery and equipment n.e.c.	13682	0.0232	0.0481
Manufacture of office, accounting and computing machinery	709	0.0219	0.0571
Manufacture of electrical machinery and apparatus n.e.c.	4844	0.0222	0.0496
Manufacture of radio, television and communication equipment and apparatus	1474	0.0196	0.0430
Manufacture of medical, precision and optical instruments, watches and clocks	3345	0.0126	0.0360
Manufacture of motor vehicles, trailers and semi-trailers	3243	0.0364	0.0635
Manufacture of other transport equipment	1423	0.0477	0.0786
Manufacture of furniture; manufacturing n.e.c.	4182	0.0140	0.0364
Recycling	372	0.0217	0.0435

Table A3: *Estimation results without controlling for the selection effect*

VARIABLES	OLS	Fixed Effect	Fixed Effect	Between
Endogenous variable	Labor productivity	Labor productivity	Labor productivity	Labor productivity
Share	0.555***	0.940***	0.576***	0.487***
	(0.0796)	(0.0773)	(0.0722)	(0.144)
Share2	-1.498**	-6.759***	-5.567***	-0.249
	(0.738)	(0.683)	(0.623)	(1.067)
Size	0.00585***	-0.108***	-0.134***	0.00309
	(0.00161)	(0.0103)	(0.00990)	(0.00319)
NoProducts	-0.0307***	-0.0293***	-0.00809*	-0.0361***
	(0.00179)	(0.00436)	(0.00424)	(0.00372)
AvageLaborCosts	0.132***	-0.207***	-0.305***	0.146***
	(0.00516)	(0.00969)	(0.0105)	(0.00827)
External	1.346***	0.533***	0.486***	1.494***
	(0.0319)	(0.0448)	(0.0438)	(0.0549)
IntermediateIntensity	0.428***	0.134***	0.117***	0.449***
	(0.00449)	(0.00744)	(0.00743)	(0.00491)
ExportIntensity	0.220***	0.312***	0.222***	0.219***
	(0.00849)	(0.0228)	(0.0233)	(0.0172)
EstablishmentProfile2	-0.0877***		-0.832***	-0.0973***
	(0.00652)		(0.242)	(0.0133)
EstablishmentProfile3	0.0285***		-0.827***	0.0327***
	(0.00526)		(0.243)	(0.0109)
Year Dummies	yes	no	yes	yes
Industry Dummies	yes	no	yes	yes
Constant	0.316***	3.994***	4.995***	0.00810
	(0.0674)	(0.132)	(0.165)	(0.157)
Observations	87,933	87,933	87,933	87,933
R-squared/ Pseudo R-squared	0.437	0.090	0.154	0.468
Number of ID		18,582	18,582	18,582

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A4: *Estimation results controlling for the selection effect via a dummy variable for the use of temporary agency work*

VARIABLES	OLS	Fixed Effect	Fixed Effect	Between
Endogenous variable	Labor productivity	Labor productivity	Labor productivity	Labor productivity
Share	0.429***	0.901***	0.512***	0.418***
	(0.0823)	(0.0771)	(0.0719)	(0.150)
Share2	-1.034	-6.556***	-5.296***	0.0714
	(0.722)	(0.686)	(0.619)	(1.063)
Size	0.00332*	-0.0972***	-0.120***	0.00219
	(0.00183)	(0.0130)	(0.0123)	(0.00378)
NoProducts	-0.0351***	-0.0296***	-0.00907*	-0.0396***
	(0.00213)	(0.00527)	(0.00511)	(0.00443)
AvageLaborCosts	0.0781***	-0.195***	-0.312***	0.0942***
	(0.00652)	(0.0120)	(0.0133)	(0.0120)
External	0.976***	0.558***	0.502***	1.083***
	(0.0399)	(0.0607)	(0.0591)	(0.0699)
IntermediateIntensity	0.476***	0.172***	0.150***	0.501***
	(0.00596)	(0.0108)	(0.0109)	(0.00659)
ExportIntensity	0.207***	0.300***	0.198***	0.206***
	(0.00992)	(0.0265)	(0.0272)	(0.0201)
EstablishmentProfile2	-0.0244***		-0.842***	-0.0255
	(0.00771)		(0.241)	(0.0167)
EstablishmentProfile3	0.0363***		-0.830***	0.0380***
	(0.00567)		(0.243)	(0.0120)
Year Dummies	yes	no	yes	yes
Industry Dummies	yes	no	yes	yes
Constant	0.814***	3.912***	5.242***	0.578***
	(0.0893)	(0.167)	(0.184)	(0.197)
Observations	57,997	57,997	57,997	57,997
R-squared	0.469	0.104	0.173	0.504
Number of ID		11,827	11,827	11,827

Robust standard errors in parentheses

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

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