

Non-technical summary

There has been much discussion in Germany whether flexible forms of employment should be facilitated in order to reduce rigidities on the labour market. Flexible labour contracts, such as fixed-term contracts (FTCs), temporary work agency (TWA) employment and freelance work (FL) are, on the one hand, seen as important instruments of adjustment for employers. On the other, they may create a segmented labour market, with part of the workforce being permanently employed in unstable and precarious employment relationships. In West Germany, the share of TWA workers has increased strongly over the last decades. The share of FTC workers has risen, too, although to a somewhat more moderate extent. Some, but certainly not all of this development can be attributed to changes in the law.

This paper investigates under which conditions firms employ FTC, TWA or FL workers. The need to use flexible labour contracts arises from the adjustment costs for permanent workers. From the theory of dynamic labour demand, conditions may be derived under which atypical work is a more efficient instrument of adjustment to temporary demand fluctuations than adjustments in the number of regular employees. In addition, by employing atypical workers firms may insulate their regular workforce from changing demand conditions and can therefore reduce firing costs and preserve firm-specific human capital. Using the IAB-establishment panel for West-Germany and a probit model which accounts for firm heterogeneity, we find that positive changes in expected or actual sales are associated with a higher probability of employing atypical work, which suggests that these forms of employment are used as means of adjustment.

Institutionally, adjustment costs for permanent workers are mainly due to individual and collective dismissal protection and the requirements of German co-determination law. One object of the paper is to assess whether these regulations have an impact on firms' employment decisions. Concerning co-determination, one might argue that the presence of works councils, by making separations more costly, increases the demand for atypical work. In our estimations, this hypothesis is strongly confirmed for FTC employment, although not for TWA or FL workers. Concerning dismissal protection, firms which are too small to be covered by the law should have a lower incentive to use atypical work. In our data set, we have exogenous variation in the minimum number of employees beyond which the dismissal protection law applies. Using this as a source for a natural experiment,

we do find that the likelihood of using FTCs decreased for firms which ceased to be covered by the law. Hence, we conclude that legal dismissal protection for regular employees has an impact on the demand for workers on fixed-term contracts.

In our estimations, we control for a number of other factors, such as employees' skill levels. Descriptive evidence shows that, on average, FTC and TWA workers possess lower skills than permanent workers. However, the proportion of employees with university education is also high among FTC workers. We further include measures for the kind of investments undertaken and the incidence of specific personnel problems. A set of industry dummies confirms the notion that FTC and, to an even higher extent, TWA work is concentrated in particular industries.

The Use of Flexible Working Contracts in West Germany: Evidence from an Establishment Panel

Bernhard Boockmann[‡] and *Tobias Hagen*[§]

Centre for European Economic Research (ZEW)

P.O. Box 10 34 43

D- 68034 Mannheim

Abstract:

This paper investigates under which conditions firms use fixed-term contracts, subcontracted and freelance work. Using a probit model which accounts for unobserved heterogeneity, we find that positive changes in expected or actual turnover are associated with a higher probability of employing atypical work, which suggests that these forms of employment are used as means of adjustment. Other important factors are employees' skill levels, investment in information technology, and the existence of collective wage agreements and works councils. Furthermore, a natural experiment is used to evaluate the impact of dismissal protection for permanent workers on the use of flexible working contracts. There is clear evidence that reducing dismissal protection decreases the demand for fixed-term employment.

Key Words: Flexible working contracts, fixed-term employment, labour demand, adjustment costs

JEL classification: C23, J23, J42

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[‡] Phone: +49 / 621 / 1235 -156, Fax: +49 / 621 / 1235 -225, e-mail: boockmann@zew.de

[§] Phone: +49 / 621 / 1235 -288, Fax: +49 / 621 / 1235 -225, e-mail: hagen@zew.de

1 Introduction

There has been much discussion in Germany whether flexible forms of employment (often also called secondary, contingent or atypical employment¹) should be facilitated in order to reduce rigidities on the labour market. Flexible labour contracts, such as fixed-term contracts (FTC), temporary work agency (TWA) employment, freelance work (FL) or marginal part-time work are, on the one hand, seen as important instruments of adjustment for employers. On the other, they may create a segmented labour market, with part of the workforce being permanently employed in unstable and precarious employment relationships. Recent changes in the regulation of atypical employment in Germany have gone both ways. There has been a stepwise deregulation of TWA and FTC employment since the mid-1980s which was, however, partially reversed in the case of FTCs by the new German government after 1998. Likewise, regulations on marginal part-time work and freelance work were tightened in 1999, extending the coverage of the social security system to these workers.

In this paper we will focus on the decision of West German firms to use FTC, TWA and FL employment. In the literature, several reasons have been identified that may render atypical employment profitable. First, the most commonly cited reason is that firms can use atypical employment to adjust more efficiently to temporary demand fluctuations. In particular, if employers are uncertain about whether a rise in demand is temporary or permanent, they will be reluctant to increase the number of regular workers, relying instead on atypical workers until the economic outlook becomes more certain. Second, by employing atypical work, firms may insulate their regular workforce from changing demand conditions. This insulation may help firms to reduce firing costs and save firm-specific human capital. It may also be used to obtain wage and work rule concessions from regular workers in exchange for greater employment security. Third, atypical work may be used in case of temporary absences of regular employees due to illness, holidays or child care leave. Fourth, firms may use flexible working contracts to screen prospective regular employees.² Fifth, the existence of specialised TWA or FL workers may make it cost-effective for small- or medium-sized firms to hire

1 For a definition of flexible work see POLIVKA and NARDONE (1989), ATKINSON (1985) or KELLER and SEIFERT (1995). A definition of TWA employment can be found in BROSE et al. (1990). The distinction between FL and other self-employed workers, on the one hand, and dependent employment, on the other, is discussed in DIETRICH (1999).

2 POLIVKA and NARDONE (1989) report that temporary work agencies in the US charge a penalty when subcontracted workers are retained permanently by the user enterprise. This shows that screening may be an important reason for using temporary employment.

atypical workers for particular tasks instead of hiring regular workers. ABRAHAM and TAYLOR (1996) cite the example of computer support activities inside smaller firms often being carried out by FL workers. Sixth, employers may be forced to use secondary workers if they are not able to fill vacancies at prevailing wages. An explanation for skill shortage as a reason for atypical employment is not easily found since one common assumption in theoretical models is that atypical employees are worse off than regular employees. Nevertheless, firms report to be using TWA or FL workers in case of skill shortage even if the unfilled vacancies are for employees with a university degree.³ And finally, using FL workers instead of permanent employees may be advantageous for firms in order to avoid paying social security contributions.

In our empirical analysis we will focus on the first three points mentioned which we consider the most important ones. Some of these reasons are based on the presence of wage rigidities for permanent workers. If wages of permanent workers were perfectly flexible, firms would be able to adjust to economic fluctuations by changing wages rather than by hiring and firing permanent or atypical workers.

Efforts to build theoretical models of demand for atypical work start from the theory of dual labour markets and the theory of dynamic labour demand.⁴ A common result of these models is that the two types of contracts (high versus low firing costs) increase the relative protection of regular employees and generate a duality within firms.⁵ Since hiring and firing of regular workers is costly due to economic reasons (search, training etc.) as well as institutional reasons (protection against dismissals etc.), hiring secondary workers with lower firing costs can be advantageous for firms, even if regular (or primary) and atypical (or secondary) workers are homogeneous and secondary workers have a higher wage rate (or lower productivity) than primary workers.⁶ In the model of SAINT-PAUL (1996), the primary or core workforce is insulated from demand fluctuations by secondary workers, i.e. the job stability of regular workers increases. A sufficient increase in product demand is a reason for employing secondary workers. Similarly, the theoretical model of ABRAHAM (1988) shows that an increase in the *dispersion* (un

3 For instance, in the IAB-Establishment Panel 2000 for the federal state of Baden-Württemberg, 13 per cent of the establishments which reported skill shortages used TWA workers to deal with this problem.

4 See BENTOLILA and SAINT-PAUL (1992) and SAINT-PAUL (1996). For a review of evidence of existence of dual or segmented labour markets see DICKENS and LANG (1992).

5 For a contrary result see MAURIN (2000).

6 Usually, higher wage rates are motivated by higher supervision costs of secondary workers. They occur since they are less experienced than regular employees and shirk with a higher probability because they are less motivated (SAINT-PAUL 1996, ABRAHAM 1988).

certainty) of demand raises the expected ratio of secondary to regular employment.

Empirical evidence concerning the reasons for firms employing atypical workers is scarce. The empirical analysis of ABRAHAM (1988), based on a survey of U.S. employers in 1985, shows that firms subject to high seasonal or year-to-year variations in demand make greater use of temporary workers than other firms. ABRAHAM and TAYLOR (1996) find that, for the U.S., a firm's decision to use contracted work rather than its own employees is influenced by wage and benefit savings, the volatility of its output demand, and the availability of specialised skills possessed by FL workers. If FL work is employed in low-skilled activities, the decision is motivated mainly by savings in wage costs. Tasks in machine maintenance, engineering and drafting, accounting or computer services are contracted out more frequently in smaller establishments and in locations within metropolitan areas.

AUTOR (2000) assesses empirically whether there is a causal relation between the increase of firing costs (decline of "employment-at-will"⁷) in some federal states in the U.S. and the growth of TWA employment. The empirical analysis indicates that the increase in firing costs explains as much as 20 percent of the growth of TWA employment between 1973 and 1995.

Using a dataset with German firms from the service sector, KAISER and PFEIFFER (2000) investigate under which conditions firms use FTC and FL employment as a means of adjustment. The probability of using FTC employment increases with the size of the firm, the significance of demand changes and the share of low skilled workers. Furthermore, if a firm is bound to a collective wage agreement, the probability of using FTC workers increases as well. Contrary to these results, FL work is used with a lower intensity if the firm applies a collective wage agreement, and increases with the share of high-skilled workers.

The remainder of this paper is structured as follows. The following section describes dismissal protection legislation and the regulation of atypical employment in Germany. Section 3 presents some stylised facts. Section 4 refers to the dynamic theory of labour demand to discuss the conditions under which atypical employment is used in order to cope with demand and supply changes. Section 5 introduces the data set and describes the specification. Section 6 contains the empirical results. Section 7 concludes.

7 The common law doctrine of employment-at-will, which has been recognized throughout the U.S. since 1953, held that employers and employees have unlimited discretion to terminate their employment relationships at any time for any reason unless explicitly contracted otherwise (AUTOR 2000).

2 *Institutional Background*

In order to explain the use of flexible working contracts, one has to consider the institutional factors which raise the adjustment costs of regular employment. In Germany, these are primarily the legal protection against dismissal, the employment protection regulations contained in collective agreements and the role of the works councils.

German **dismissal protection** is based on legal regulations as well as decisions of labour courts. Furthermore, collective agreements sometimes contain additional clauses in favour of employees. These regulations makes individual or collective dismissals costly either in terms of time, money or procedural complexity (HUNT 2000). Dismissals are associated with periods of notice which depend on age and job tenure. In the absence of individual or collective agreements, the notice period is one month for two years of job tenure and increases up to 20 months for 20 years of job tenure (§ 622 of the German Civil Code, BGB). In addition, the Protection Against Dismissal Law (KSchG) stipulates conditions under which a dismissal is socially unjustified. A worker who has been dismissed unfairly is entitled to severance payments. These depend on age, job tenure and earnings and amount to a maximum of 12 monthly wages (§ 10 KSchG) or up to 18 monthly wages if the dismissed employee is at least 55 years old and has been employed in the firm at least for 20 years.

Before the changes introduced by the second Improvement of Employment Opportunity Act (Beschäftigungsförderungsgesetz, BeschFG) in October 1996, all permanent employees with a duration of employment of at least 6 months in establishments with 6 or more employees covered by social security (threshold level) were within the scope of the dismissal protection law. The new Improvement of Employment Opportunities Act of 1996 raised the threshold level for the application of the dismissal protection law to 11 employees. However, employees which had been covered by the dismissal protection law in September 1996 retained their coverage under the old regulation for three years (until September 1999). In December 1998, the new German government lowered the threshold level to 6 employees. Since our dataset extends over most of the 1990s, we have exogenous variation (“natural experiment”) in dismissal protection legislation which will allow us to assess the effect of employment protection on the use of flexible working contracts.

According to the Works Constitution Act (Betriebsverfassungsgesetz, BetrVG), the **works council** (Betriebsrat) must be consulted before an employee can be laid

off. Works councils are elected every 4 years in establishments employing more than 5 workers. If the works council disagrees, the worker may appeal to the labour court. In case of mass dismissal the consultation with the works council is more extensive and the regional employment office (Landesarbeitsamt) must be informed. The employment office can decide that the employer has to wait for up to 2 months (normally 1 month) before proceeding with redundancies. Firms with at least 20 employees have to negotiate a “social plan” with the works council, which includes redundancy payment and payment of re-training measures.

In establishments with at least 20 employees, works councils also have to agree to the recruitment of new employees (§ 99 BetrVG). The works council can refuse to agree if the recruitment leads to dismissals or is otherwise detrimental for the current staff. In this case, the employer can appeal to a labour court for an approval of the recruitment. Thus, although works councils cannot ultimately prevent the employer from hiring new workers, they can increase the procedural complexities and the costs of hiring. Apart from these general provisions, the Works Constitution Act does not provide works councils with a mandate to negotiate with employers over the use of atypical employment.

The most important restrictions on the use of **atypical employment** are the “objective reasons” which must be given for FTC employment, the maximum number of successive TWA employment contracts or the maximum number of renewals of FTCs, and finally, the maximum cumulated duration of these contracts with one employer.

The use of **FTCs** was liberalised by the Improvement of Employment Opportunities Act in May 1985. Before this act came into force, German employers always had to justify the use of FTCs by “objective reasons”. From 1985, employers were free to hire new employees on FTCs without “objective reasons” for a duration of up to 18 months. In start-up businesses, the maximum duration was extended to 24 months. However, under the Act an FTC had to be converted into a permanent contract if, on expiry of the contract, the worker was to be retained. To prevent the opposite conversion from permanent into temporary employment contracts, FTCs were not permitted if the worker had been employed by the same employer (on either type of contract) during a period of four months before conclusion of the FTC.

Even before 1985, FTCs with a maximum duration of 6 months had been possible in accordance with the Civil Code (“Bürgerliches Gesetzbuch”, BGB), but again there was the judicial requirement that a reason must be given for conclusion of an FTC. Accepted reasons were (and still are) seasonal fluctuations, tem

porarily high volumes of work, deputising a person, carrying out special tasks, on-the-job-training, public employment measures and probationary periods.

When the second Improvement of Employment Opportunities Act came into force in October 1996, the maximum duration of FTCs was extended to 24 months, and a maximum of three contract renewals were allowed. In January 2001, a new law of part-time and fixed-term employment relationship (“Gesetz über Teilzeitarbeit und befristete Arbeitsverträge”) came into effect which replaced the Improvement of Employment Opportunities Act. Fixed-term contracts without objective reasons are now only allowed in case of hiring new employees (i.e. employees who have never before worked for the employer). The law explicitly states that the maximum duration of fixed-term contracts and the number of renewals can be regulated by collective agreements, even in the case they should be less restrictive than the law. Fixed-term contracts, however, have so far not been subject to collective bargaining.

Until 1967, the supply of **temporary workers by TWA** was forbidden, because the Federal Employment Service (Bundesanstalt für Arbeit) had a monopoly on job placement. In 1967 a judgement of the Federal Constitutional Court repealed this regulation in view of the constitutional right of freedom of occupation. The supply of workers by private agencies was subsequently regulated by the Temporary Employment Agencies Act (Arbeitnehmerüberlassungsgesetz, AÜG) of 1972. The main thrust of the law is still valid today: the TWA has all the duties of an employer. With this provision, the legislator aimed at bringing the relation between the TWA and its temporary workers onto the same level as the relation between a regular employer and its employee.

To prevent the TWA from working as a job placement agency, additional conditions were included in the law. First, the employment contract between the TWA and the temporary worker has to be of unlimited duration. This stipulation was later given more concrete meaning by the Federal Employment Service. It required the contract between the worker and the TWA to be at least 25 per cent or one day longer than the duration of the first commission to a user enterprise. A second legal condition for TWAs is the limit to the duration a worker is allowed to be commissioned to a user company. In the original law, the maximum duration had been 3 months. With the Improvement of Employment Opportunities Act of 1985, the maximum duration was extended to 6 months. In 1994, this limitation was increased to 9 months. In addition, the Federal Employment Service’s monopoly of job placement was repealed in this year. Since then, TWAs have had the possibility both to supply temporary workers and to provide job placement serv

ices. Finally, the maximum cumulated duration was increased to 12 months by the Temporary Employment Agencies Act of 1997. The works council of the user establishment has to agree to the employment of TWA workers (§ 14 AÜG) in the same way as in the case of recruitment of permanent workers (§ 99 BetrVG).

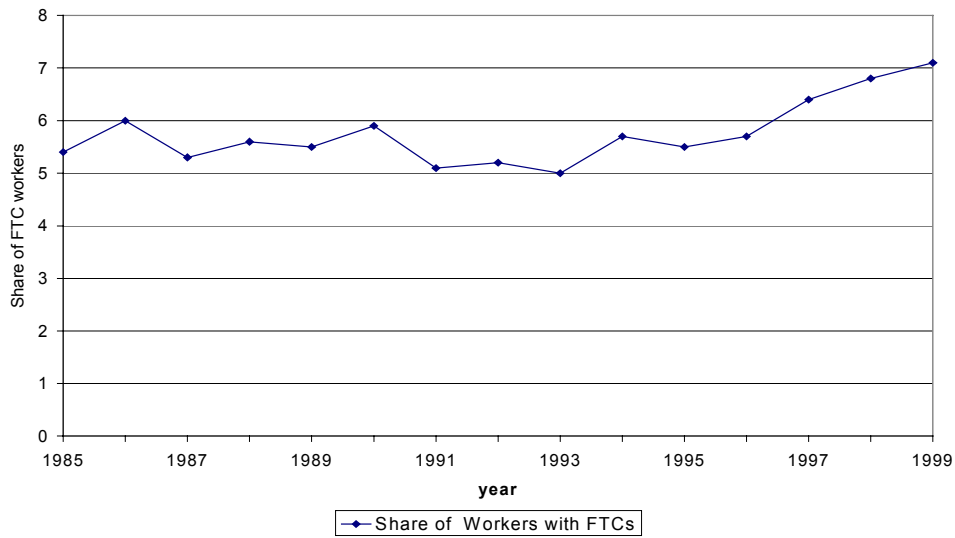
Following an intense public discussion on the subject of fictitious self-employment (or “Scheinselbständigkeit”, such that the self-employed person works for a major client without having access to the benefits of dependent employment), contracting **FL workers** was restricted in 1999. Self-employment is usually regarded as fictitious if this form of employment primarily serves to reduce social security contributions. To limit the tendency of wage workers to become fictitiously self-employed, the German government imposed more stringent requirements on the classification of workers as self-employed. According to the new regulations laid down in Vol. IV, § 7 of the German Social Welfare Code (Sozialgesetzbuch), a person counts as an employee if at least three of the following five conditions are fulfilled: (1) The person does not employ other workers; (2) the person depends strongly on one employer over a long period of time; (3) the person carries out tasks for which the employer usually employs permanent workers; (4) the person does not act as an entrepreneur; (5) the person is employed with the same tasks by the same employer for whom she previously worked as a permanent employee. Since, we observe FL workers only until 1998 in our data, we cannot analyse the effect of these new regulations.

3 *Some stylised facts on atypical employment in Germany*

This section presents stylised facts on the development and structure of atypical employment in Germany. For reasons of data availability, we will mainly be looking at the *stock* of atypical workers recorded on a reference day, rather than on the total number of employment contracts in force during a particular interval. The stock of workers depends on the number of contracts as well as on their duration.

Judged by figure 1, the **share of FTC workers** has remained fairly constant over most of the last 15 years, staying in the 5 to 6 per cent interval up to 1997. Overall, FTC employment does not seem to evolve more cyclically than total employment. However, there was a decline to 5.0 percent after the post-unification boom ended in 1993, and a subsequent increase in the proportion of FTC workers reaching up to 7.1 per cent in 1999.

Figure 1: Share of FTC Workers in West Germany



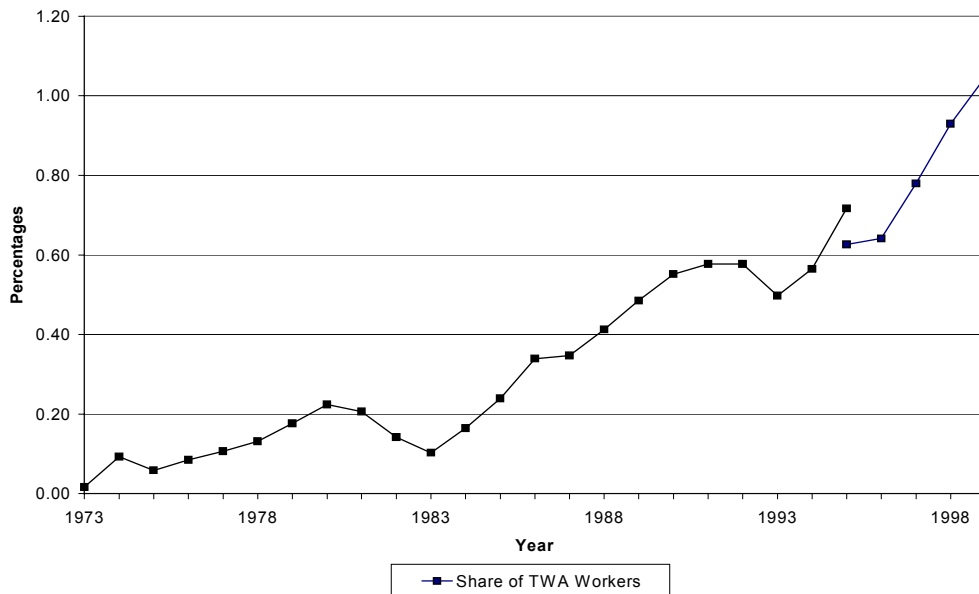
Note: Measured as of April of each year. Includes only blue-collar and white-collar workers without persons in vocational training.

Sources: German Microcensus, RUDOLPH (1996), RUDOLPH (2000).

By comparison, figure 2 shows that **TWA employment** increased much more dramatically over the last 15 to 20 years. In West Germany, the absolute number of TWA workers rose by 683 per cent over the period from 1983 to 1995, with the share of TWA workers in all employees covered by social security increasing to 0.75 per cent. In all Germany, the increase in the proportion of TWA workers accelerated during the second half of the 1990s. In general, TWA employment shows a markedly procyclical pattern, with the proportion of TWA workers exhibiting strong growth after each of the recessions in 1975, 1982 and 1993.

Data on FL workers are more difficult to obtain than for the other two forms of employment. Based on projections from the IAB Establishment Panel, DIETRICH (1999) reports that FL employment rose from 554,100 in 1994 to 610,500 in 1997. Thus, there seems to have been an increase in the number of FL workers, too, although perhaps a more moderate one than for TWA workers.

**Figure 2: Share of TWA Workers in Overall Employment in West Germany
(all Germany after 1995)**



Notes: Employment stocks (thousands) covered by social security at the end of June. Data for West Germany are unavailable for years later than 1995.

Sources: Bundesanstalt für Arbeit, Bundesministerium für Arbeit und Sozialordnung.

The **skill composition** of atypical workers differs from that of regular workers in a number of ways. Table 1 summarises information from the German Microcensus provided by the Federal Statistical Office as well as from the employment statistics provided by the Federal Employment Office. The first source refers to all blue- and white collar workers, while the latter contains only employees covered by the social security system. Therefore, the numbers are not directly comparable. In both cases, information is given for West Germany only and limited to the private sector. Among FTC workers, we find a higher share of employees without vocational qualification than among workers with a permanent contract. However, the proportion of employees with university education is also higher among FTC workers. This still holds even though the academic sector, in which the use of FTC contracts is particularly wide-spread, is excluded from the statistics. We did not find any apparent differences between the skill composition of female and male FTC workers. Overall, the share of female FTC workers is only slightly above the share of male FTC workers (4.6 per cent for women as opposed to 4.4 per cent for men).

Table 1: Skill Composition of FTC and TWA Workers in West Germany (percentages)

	Blue-collar and white-collar workers, 1997		Workers covered by social security, 1998	
	FTC workers	Permanent workers	Workers employed in the TWA industry	All workers
No Vocational Qualification	23.1	18.1	36.0	20.5
Vocational Training	59.5	71.3	60.5	71.5
University or College Degree	17.4	10.6	3.5	8.1

Notes: Private sector only. FTC workers do not include employees in vocational training. Workers with A-levels (Abitur) but no vocational training are included in the middle category.

Sources: FTC workers: German Microcensus 1997, Federal Statistical Office. TWA workers: Employment Statistic 1998, Federal Employment Office.

TWA workers are identified by their employer's industry affiliation. If the employer belongs to the temporary work agencies industry (code: 745), his or her employees are counted among TWA workers. Since we cannot distinguish between TWA workers and TWA agencies' regular administrative staff, the proportions may be slightly biased. There is clear evidence, however, that TWA workers possess, on average, lower skills than permanent workers. The share of women among TWA workers is fairly constant over time and amounts to about 20 per cent (Bundesanstalt für Arbeit, 2000).

Comparable data for the skill composition of FL workers are not available. However, the German Microcensus does contain information on self-employed persons who do not themselves employ other workers. For 1997, we found that the average skill level in this group is higher than among blue-collar or white-collar dependent workers. However, this finding needs to be interpreted with care since many persons in this category cannot be counted as FL workers.

The **duration** of FTCs and TWA contracts in West Germany is described in tables A1 and A2 of the appendix. Again, care must be exercised in interpreting these numbers. Information concerning the duration of FTCs is taken from stock data, i.e. the number of contracts in force at a particular moment in time. Compared to the total number of contracts concluded during a particular time span, the number of contracts with short duration is under-sampled in stock data. Even taking into account the length-bias (SALANT, 1977), temporary contracts with a duration of more than 12 months are no rare phenomena in West Germany. There are

some differences regarding contract duration between young and old employees as well as between unskilled and skilled workers.

While no information is available on the duration of TWA employment spells within the user enterprise, there is data on the duration of the employment relationship of temporary workers with their TWA (see table A2 in the appendix). The duration of employment within the commissioning firm can be interpreted as an upper limit to the time a worker is commissioned to a user enterprise. Employment relationships of temporary workers with TWAs appear to be often very short-term. In 1998, 64.3 percent of all terminated relationships were shorter than three months. In spite of the increase of the maximum duration a worker can be commissioned to a user enterprise in 1994, the length of employment of temporary workers provided by TWAs seems to decline. The short average duration of TWA employment in combination with high and increasing stocks of TWA workers implies a large and increasing number of inflows and outflows.

So far, we have looked at atypical work from the perspective of the worker. Table 2 displays the **proportions of firms** using atypical workers. It is based on the Establishment Panel of the IAB, the same data source which is also used in our econometric investigation. From the table, we observe an increase in the share of establishments using atypical work for all types of flexible contracts from 1996 to 1998. The increase in the use of FTC workers could be due to the effect of the new Improvement of Employment Opportunities Act of 1996. However, the increase is even stronger in proportional terms for the other two types of contracts, though no changes in the regulation of these employment relationships occurred in 1996.

Table 2: Share of Establishments Using Flexible Working Contracts (Percentages)

	1994	1995	1996	1997	1998	total
FTC workers			6.7	7.8	8.4	7.6
TWA workers	2.1	2.3	1.4	1.9	2.3	2.1
FL workers	4.4	4.8	3.6	4.4	4.7	4.4

Notes: Weighted and extrapolated data for West Germany. As in the estimation sample, establishments which did not report their turnover as revenues (financial institutions, insurance companies, non-profit organisations, the government sector, public social security institutions and agricultural enterprises) were excluded.

Source: IAB Establishment Panel waves 2 - 6 for West Germany.

The weak increase in the share of firms using TWA employment is unexpected, given the strong rise in the number of TWA workers during this period (see figure 2). Moreover, the decrease in the use of TWA labour after 1995 is surprising, given the liberalisation of the Temporary Employment Agencies Law in 1994 and the strong increase in the share of TWA workers during this period (see figure 2). Apparently, the rise in the number of TWA workers is due to increased demand by firms already employing this kind of workers, not by an increase in numbers of these firms.

A breakdown of firms using atypical work by establishment size and by industry is provided in table A3 in the appendix. As expected, the proportion of establishments employing atypical workers increases with the total number of employees. However, the size effect is stronger for FTC and TWA employees than for FL work. The reason could be that small and medium-sized firms use FL workers for very specialised tasks of intermittent nature for which hiring regular or temporary employees does not pay. The table also shows that TWA employment is used predominantly in the supply of energy and water, as well as in basic and investment goods industries. FTCs are frequent in the same industries, but also in some of the service sectors. FL work, by contrast, is concentrated in industries which are providing human capital intensive services, such as education and business related services.

The role of flexible working contracts can also be gathered from assessments of the establishments' management. In the 1996 survey of the IAB Establishment Panel, establishments were asked whether they had experienced expected or unexpected fluctuations in demand and production during the year and which instruments of adjustment they had used. The results can be seen from table A4 in the appendix. FTCs are much more frequently mentioned than TWA employment, in particular among companies affected by expected demand changes. Only three per cent of these companies used TWA employment as a means of adjustment, while TWAs were used by six per cent of the establishments affected by unforeseen demand changes. This difference can be explained by lower search costs, but higher overall labour costs for TWA workers in comparison to FTC workers. A firm which needs to react quickly to an unexpected positive shock in the very short run may have no time to search for new employees on the labour market, while a firm which has more time for adjustment may engage in search activities in order to avoid TWA charges.

4 *Atypical work as a means of adjustment*

If the wages of permanent workers were perfectly flexible, quantitative adjustments in firms' workforces, such as the employment of atypical workers, would not be necessary as a response to changing demand and supply conditions. In reality, wage rigidities are prevalent in Germany, as a number of studies confirm (FITZENBERGER and FRANZ, 2000). One explanation for wage rigidities at the firm level is the presence of industry-wide collective agreements. Apart from this institutional reason, economic theory provides several explanations why it may be rational for employers and workers not to adjust wages to changing economic conditions. For instance, new empirical evidence for Germany suggests that the presence of implicit contracts and the concern to retain their investments in human capital prevent employers from downward adjustments of wages (FRANZ and PFEIFFER, 2001).

The advantages and disadvantages of employing atypical labour rather than using other quantitative adjustment instruments depend on economic and institutional factors. Alternative instruments of adjustment are, in particular, adapting the number of employees or the number of working hours, or making use of inventories. An economic factor which impacts on the choice of adjustment instruments is whether the firm's product can be kept on stock. In the service sector, for instance, stock-keeping is often impossible, implying that other adjustment instruments, like atypical employment, may need to be used. Institutional reasons may be employment protection legislation, collective agreements and works councils:

- Companies which are exempt from employment protection (such as small enterprises) will have a lower incentive to employ atypical labour, because their costs of adjusting the number of regular employees are lower.
- Since many collective wage agreements restrict the amount of overtime work or fix overtime premia, companies which apply collective agreements may have higher costs of changing working hours. They may also have greater difficulties adjusting the number of permanent employees, since collective wage agreements often contain clauses regarding employment protection rules, in particular clauses which protect specific groups of workers, such as senior employees (KAISER and PFEIFFER, 2000). They may thus have a higher probability of using atypical labour.
- Similarly, since works councils have to agree to the introduction of overtime, companies with works councils may be prevented from using overtime as an instrument of adjustment. In addition, works councils can increase the firing

costs of permanent workers by increasing the procedural complexity in the case of individual dismissals or of mass redundancies. Firms which have works councils may thus exhibit a higher propensity to adjust with employing atypical workers.

- On the other hand, collective agreements and works councils may also provide an obstacle for the employment of atypical workers. KAISER and PFEIFFER (2000) argue that, since unions mobilise against the use of contract workers, the likelihood of TWA and FL work is lower in firms which adhere to collective agreements. ABRAHAM (1988) gives a similar argument for the demand for TWA workers in the United States. As for Germany, one might also presume that the probability of using atypical workers is lower in firms with works councils, since hiring of any kind of workers falls within the scope of co-determination (see section 2).

Firms will normally make use of more than one instrument of adjustment. In the following, we will only consider the simultaneous adjustment in the number of regular and atypical workers, leaving aside inventories and the adjustment of working hours. We will assume that atypical and regular workers are distinguished by the amount of hiring and firing costs.

It is well-known from the theory of dynamic labour demand that, under certain assumptions concerning the structure of adjustment costs, the nature of the shocks and firms' expectations, after experiencing a shock to the demand for their products firms do not instantly adjust the number of permanent employees to the level which would be optimal in the long run. The first set of assumptions under which a slow adjustment process is obtained consists of marginal costs of hiring or firing increasing with the number of hirings or separations. A leading example is the case of quadratic costs of adjustment. In this case, it is optimal to smooth the dynamic time path of employment over time, no matter how expectations are formed. This result differs sharply from the one obtained by assuming linear adjustment costs where the firm adjusts instantly (NICKELL, 1986). Under the second set of assumptions, expectations are static and adjustment costs are lumpy (i.e., costs of adjustment do not depend on the number of workers hired or fired). In this case, the lag in employment adjustment is due to the time it takes the firm to realise the transitory or permanent nature of the shock. Once the shock is perceived as permanent, however, the firm instantly adjusts to the equilibrium level (HAMERMESH, 1993: 213ff.) .

If atypical and regular workers can be substituted, there is scope for the employment of atypical workers under both sets of assumptions even if their costs are

higher in the long run than the costs of permanent employees.⁸ If, in the first case, temporary workers have lower hiring and firing costs, employing atypical labour is profitable for the firm during the process of adjustment to the long-run equilibrium number of permanent workers. In the second case, since atypical workers can be shed more easily (by not renewing their contracts) if a positive shock turns out to be transitory, the firm will choose to hire secondary workers first. If the firm discovers that the positive shock is permanent, it can either replace atypical by permanent workers or convert temporary employment contracts into permanent ones. In both cases, atypical employment will be observed during the transition to a new equilibrium. Analytically, the adjustment process is similar to the simultaneous adjustment of working hours and employment first considered in NADIRI and ROSEN (1969).

The model presented by SAINT-PAUL (1991, 1996) is in a similar framework but yields qualitatively different results. Regular workers are assumed to be associated with linear firing costs. The adjustment of temporary workers does not generate any costs at all. Firms are assumed to face stochastic i.i.d. demand shocks and have rational expectations. In this model, the firm can be in two regimes. If demand is high, the firm will employ regular and temporary workers. If it is low, only permanent employees will be on the firm's payroll. Since the firm expects a positive shock to be reversed, it employs workers with low firing costs as a precaution.⁹ As long as the positive shock prevails, however, the firm remains in the dual regime. The empirical implication of the model is that it is the level of the demand shock which matters for the employment of atypical work rather than changes in demand conditions. Clearly, this pattern strongly depends on the assumptions of i.i.d. shocks and linear adjustment costs, as well as on rational as opposed to static expectations.

In all of these frameworks, an important assumption is that changing the number of atypical workers causes the firm lower adjustment costs than in the case of permanent workers. In reality, one would expect this to apply differently to different types of atypical work. FTC and FL workers are likely to differ from permanent workers with respect to firing costs at the time of contract expiry. By contrast, TWA workers (and perhaps also FL workers) will also differ with respect to

8 Higher labour costs for temporary workers are often thought to be caused by higher costs of supervision. Additional reasons may be the profit margin of the temporary work agency or the compensating differential for higher unemployment risk of atypical workers.

9 An interesting further result by SAINT-PAUL (1996) is that an increase in the volatility of demand (i.e., the variance of the shocks) implies a substitution of primary by atypical workers.

hiring costs, since the firm does not need to engage in search activities and some of the bureaucratic costs of personnel recruitment can be avoided.

Furthermore, we have assumed so far that regular and atypical workers are substitutes in production, which is the case only if they have comparable skills. Clearly, the notion that atypical workers are employed during an upswing and are subsequently replaced by regular employees (if the shock is permanent) strongly depends on this assumption. If both groups have different skill levels and are thus complementary, the dynamic properties of the model are significantly altered. Given that TWA and FTC workers tend to have lower skills (see section 3), only firms with low skilled permanent workers can adjust their workforce by employing TWA and FTC workers easily. On the other hand, severance payments depend on earnings, thus firing costs for permanent employees increase with the skill level of workers. The same will also be true for hiring costs. If this aspect dominates, the profitability of using atypical labour will rise with the average skill level of employees in the firm.

5 *Data, model specification and estimation technique*

Our empirical analysis is based on seven waves of the IAB-Establishment Panel from 1993 until 1999 for West Germany which contains over 4000 usable interviews each year.¹⁰ The unit of observation of the data is not the company, but the establishment. By ‘establishment’ we mean “*the local unit in which the activities of a company, that is, the production of goods or services, are actually carried out.*” (KÖLLING, 2000: 293). Since German dismissal protection requirements differ according to establishment (not company) size, this principle of data collection is well suited for our analysis. The population of the panel consists of establishments with at least one employee covered by social security. Therefore, establishments with no employees covered by social security are excluded, in particular those establishments with only self-employed persons in the definition of the social security system (farmers, artists, publicists) as well as public sector offices exclusively employing civil servants.

The IAB establishment panel is a stratified random sample of establishments. Larger establishments have a far higher probability of being selected into the sample than smaller ones. In addition, the probability of being selected into the sample

¹⁰ Due to data confidentiality laws in Germany, it is not possible for researchers outside the Federal Labour Service to access the data directly. For that reason, all data operations were carried out with the help of the IAB-Establishment Panel Data Service at the Federal Labour Service Offices.

differs across industries (KÖLLING 2000). In each year, the establishments taking part in the survey are interviewed on the number and structure of their employees as of June 30th. Except for 1995, the interviews contained questions regarding the number of FTC workers; however, we can only use information for the years from 1996 to 1998 for the analysis of FTC work due to further data limitations. Information on TWA and FL workers is available for the years from 1994 to 1998. We restrict our descriptive and econometric analysis to establishments in West Germany. Furthermore, we exclude non-profit organisations, the government sector, public social security institutions and agricultural enterprises. Financial institutions and insurance companies also have to be excluded, since they do not report turnover as a measure for their business volume.

Our objective is to estimate a reduced-form model of the use of FLC, TWA and FL employment in West German establishments. Our dependent variables are the dummies which indicate whether these types of labour are used by the establishment. To test whether atypical work is used as an instrument of adjustment to changing demand conditions, we use changes in turnover as a measure for product demand. We also tried specifications with the level of turnover as an independent variable in order to test the implication of SAINT-PAUL's (1991, 1996) model. However, this variable was found to be always insignificant, and hence we do not report these results. Due to missing data, it is not feasible to subtract the material inputs to obtain a measure for value added. Since we take first differences of turnover and control for unobserved heterogeneity in the regressions, we believe this to be a minor issue. The turnover is deflated with the price index of net output from national account data for different industries provided by the Federal Statistical Office. As an alternative concept of demand shocks, we use a variable which contains the management's assessment of expected turnover change for the current year (given by June 30th). Ex ante, it is unclear whether the expected or the actual change of output explain the demand for atypical employment more accurately.

From subjective assessments of the establishments' management contained in the 1993 and the 1996 survey we create a dummy variable indicating whether there are seasonal fluctuations in the demand for the establishment's product.¹¹ This variable is used to check whether establishments subject to recurrent changes in demand conditions rely more heavily on atypical work as an adjustment mechanism, as the model of SAINT-PAUL (1996) suggests.

¹¹ We also calculated the coefficient of variation of the output for every firm as an additional explanatory variable, but results were far from being significant.

Apart from variables relating to demand changes, we need to control for a number of establishment characteristics. First, we included a set of firm size dummies (defined along total employment) to control for the fact that the probability of using atypical work is higher if the workforce is greater. To control for the industrial relations practices in the establishment, we use dummy variables indicating whether the establishment is bound to an industry-level or a firm-level collective wage agreement and whether a works council exists.

Two further variables capture the effect of the technology used in the establishment on the probability of employing atypical work. In line with the “skill-biased technological change”-hypothesis (BERMAN et al. 1994), one might argue that the probability of employing FTC and TWA workers declines with the production technology used because FTC and TWA workers are less skilled on average than permanent workers. Furthermore, new technologies often require further training. Since employers’ and employees’ incentives to engage in job-specific training increase with the expected duration of the employment contract, a firm will not hire secondary workers for tasks linked with new technologies. One would, therefore, expect the probability of employing secondary workers to decline with the technological level of the production technology (MAURIN, 2000). On the other hand, SEGAL and SULLIVAN (1997) stress that the trend toward open standards, such as those that allow for different kinds of computer hardware and software to be used together, leads organisations to avoid solutions that are highly firm-specific. As a measure for capital input and technological change we use firms’ own assessment of the state of their capital stock in the previous year. Alternatively, we include the volume of investments. We also use indicators for the kinds of investments undertaken. One dummy variable indicates investment into information and communication technologies (ICT), another stands for “other investments”, mainly investment into real estate and office and traffic equipment.

Among the characteristics of the workforce included is the share of skilled workers in the total number of employees, where skilled manual workers and white-collar workers with vocational training are aggregated into the skilled category. The expected sign of the coefficient of this variable is theoretically ambiguous (see section 4). We also use the share of women in the workforce.

In the IAB survey, establishments are asked whether they expect problems with the workforce to arise due to sickness or maternity leave within the next two years. We create two dummies accordingly and add them as a further explanatory variable. Illness or other unexpected absences of employees (due to child care etc.) are often cited as a reason for employing TWA workers (VOSSWINKEL, 1995), and

they are also legally accepted reasons for employing FTC workers in Germany (see section 2). In a theoretical model, ABRAHAM (1988) formalizes the notion that the stochastic absence time from work is a reason both for overstaffing and employing TWA workers.

As mentioned in section 2, exogenous variation of the minimum employment threshold level for the application of the Protection against Dismissal Law in October 1996 may be used to evaluate the effect of institutional firing costs for regular workers on the use of atypical employees. We expect that after October 1996, firms with 6 to 10 employees use atypical employment with a lower probability than before that date. To check for this effect, we use interaction terms of firm size and period dummies. To obtain a comparison group, we do the same for the firm size with 1-5 employees and the firm size with 11-19 employees. Our method of evaluation is thus the “difference-in-difference” principle (MEYER 1995). A Wald test is used to check whether the differences are significant.

Descriptive statistics for all the variables used can be found in tables A5 and A6 of the appendix. Note that the means of the dummy variables give unweighted proportions of the establishments in the dataset, as opposed to the descriptive measures presented in section 3. The panel character of the data allows us also to control for unobserved firm-specific heterogeneity. To this purpose, we use the random effects probit model of BUTLER and MOFFIT (1982). One possibility of evaluating the relevance of firm-specific heterogeneity is to calculate the proportion of the total variance contributed by the panel-level variance component. If the null hypothesis that the proportion of panel-level variance, ρ , equals zero is not rejected, there is no difference between a pooled probit and a random-effects probit estimator (GREENE, 2000). A potential drawback of the random effects probit model is that it is calculated using Gauss-Hermite quadrature as an approximation for the high-dimension integral that is part of the likelihood function. This requires the integrated function to be well-approximated by a polynomial. The approximation is appropriate if changing the number of quadrature points does not affect the results. Our findings seem to be robust concerning the quadrature points. Therefore, we conclude that the Gauss-Hermite quadrature is appropriate in our case and the random-effects probit is applicable.

6 *Estimation results*

We estimate two different specifications according to the measure of output change employed, i.e. either actual or expected changes in turnover. The results

are contained in tables 3 to 5. While the actual output change explains the use of FTC more accurately, the demand for TWA and FL work seems to be better explained by expected changes. Next, likelihood ratio tests are used to find out whether the estimation of separate coefficients for positive and negative demand changes (the unrestricted model) or a common coefficient for demand changes (the restricted model) is appropriate. Only in the case of FL workers does the likelihood-ratio test indicate that the unrestricted model should be preferred: positive output changes have a significantly positive effect whereas negative output changes have no effect. Due to limitations of space, we only show the results from the restricted model if this specification is not rejected and results from the unrestricted model otherwise.

The qualitative indicators for the state of capital stock as well as the sum of investment in the previous year were found to be insignificant in all specifications (not included in the tables). By contrast, the dummy indicating ICT investment in the previous year is significantly positive for all three kinds of atypical employment. Apart from reasons already referred to in section 5, this may be a confirmation of the specialisation argument particularly in the case of contract workers: for many smaller firms it will be profitable to contract out services provided with the help of the establishment's own ICT equipment. Furthermore, the highly significant dummy for ICT investment may be based on supply-side-effects. In particular, it may indicate that workers qualified for ICT jobs are more flexible than workers in other occupations. The dummy variable for other kinds of investments is significant only for FL workers.

The existence of collective wage agreements has no effect on the probability of using FTC or TWA workers. By contrast, collective wage agreements (in particular, those concluded at the industry level) have a significant negative effect on the probability of employing FL workers. KAISER and PFEIFFER (2000) obtain a similar results for the German service sector. This may be explained by the fact that FL workers are often covered by collective wage agreements. In establishments which apply collective agreements, the cost advantage of freelance work may be lower.

The estimated coefficient for works councils is in line with our expectation. It suggests that establishments with works councils tend to use FTCs more frequently, because works councils increase firing costs for regular workers. However, works councils do not seem to influence the use of the other two types of atypical work.

Table 3: Determinants of Employing FTC Workers, 1996 – 1998

	<i>Actual changes</i>		<i>Expected changes</i>	
	Coeff.	Std.err.	Coeff.	Std.err.
Actual output change	0.308 ***	0.118		
Expected output change			0.299	0.188
Seasonal fluctuations	0.147 *	0.081	0.150 *	0.085
Collective wage: firm level	-0.055	0.130	-0.117	0.141
industry level	-0.055	0.100	-0.158	0.106
Works council	0.524 ***	0.101	0.325 ***	0.107
Share of skilled	0.061	0.127	-0.039	0.133
Share of women	0.081	0.162	-0.225	0.169
ICT investment t-1	0.198 **	0.091	0.200 ***	0.067
Other investments t-1	0.082	0.099	0.101	0.073
Problems due to maternity leave	0.354 ***	0.113	0.361 ***	0.124
Problems due to sickness	-0.003	0.086	-0.017	0.091
Wave 1997	0.039	0.067	0.014	0.075
Wave 1998	0.350 ***	0.072	0.378 ***	0.082
Mining, electricity, water supply	0.697 ***	0.263	0.399	0.306
Basic industry	0.407 **	0.162	0.619 ***	0.176
Investment goods industry	0.559 ***	0.147	0.783 ***	0.163
Consumer goods	0.294 *	0.160	0.406 **	0.175
Wholesale, retail	0.254 *	0.154	0.420 **	0.167
Transport, telecommunication	0.047	0.195	0.120 ***	0.210
Hotels, restaurants	0.624 ***	0.204	0.774 ***	0.213
Education, research, publication	0.657 **	0.306	1.016 ***	0.331
Health services	0.692 ***	0.253	1.024	0.278
Business related services	0.308	0.190	0.342 *	0.206
Other services	0.107	0.266	0.245	0.262
Std. err. of random effects	0.907 ***	0.068	0.868 ***	0.088
Rho	0.452 ***	0.037	0.430 ***	0.050
<i>LR-Tests for joint significance</i>				
Industry dummies	29.52 ***	0.002	43.07 ***	0.000
Wave dummies	28.3 ***	0.000	26.4 ***	0.000
Firm size dummies	334.86 ***	0.000	250.07 ***	0.000
Federal state dummies	29.18 ***	0.001	19.74 **	0.030
Number of observations	4873		3735	
Number of establishments	2285		2344	

Notes: Firm size and federal state dummies are included but not reported. The results are described in the text. ***, **, * variable or group of variables is significant at the 1, 5, 10 per cent level.

Source: IAB Establishment Panel waves 1 – 7 for West Germany.

Table 4: Determinants of Employing TWA Workers 1994 – 1998

	<i>Actual changes</i>		<i>Expected changes</i>	
	Coeff.	Std.err.	Coeff.	Std.err.
Actual output change	0.252 **	0.124		
Expected output change			0.457 ***	0.170
Seasonal fluctuations	0.017	0.089	-0.061	0.634
Collective wage: firm level	-0.032	0.161	-0.053	0.305
industry level	-0.082	0.134	-0.074	0.524
Works council	0.127	0.135	0.214	0.147
Share of skilled	0.301 *	0.159	0.166	0.992
Share of women	-1.138 ***	0.231	-1.226 ***	0.242
ICT investment t-1	0.328 ***	0.112	0.314 ***	0.114
Other investments t-1	0.162	0.120	0.156	0.121
Problems due to maternity leave	-0.107	0.112	-0.252 **	0.126
Problems due to sickness	0.106	0.081	0.059	0.503
Wave 1995	0.001	0.095	0.003	0.106
Wave 1996	-0.128	0.097	-0.049	0.112
Wave 1997	-0.001	0.098	0.131	0.113
Wave 1998	0.271 ***	0.102	0.432 ***	0.116
Mining, electricity, water supply	-0.083	0.305	-0.053	0.343
Basic industry	0.802 ***	0.199	0.770 ***	0.214
Investment goods industry	0.961 ***	0.187	0.945 ***	0.201
Consumer goods	0.361 *	0.213	0.214	0.938
Wholesale, retail	0.075	0.217	0.018	0.230
Transport, telecommunication	-0.382	0.290	-0.020	0.278
Hotels, restaurants	-0.203	0.348	-0.467	0.381
Education, research, publication	-0.009	0.456	0.025	0.440
Health services	0.381	0.352	0.620	0.378
Business related services	0.399	0.258	0.337	0.278
Other services	-0.080	0.369	0.211	0.359
Std. err. of random effects	1.304 ***	0.070	1.286 ***	0.081
Rho	0.630 ***	0.025	0.623 ***	0.030
<i>LR-Tests for joint significance</i>				
Industry dummies	75.15 ***	0.000	64.16 ***	0.000
Wave dummies	21.29 ***	0.000	27.66 ***	0.000
Firm size dummies	192.82 ***	0.000	155.99 ***	0.000
Federal state dummies	41.78 ***	0.000	29.88 ***	0.000
Number of observations	8680		7207	
Number of establishments	2708		2843	

Notes: Firm size and federal state dummies are included but not reported. The results are described in the text. ***, **, * variable or group of variables is significant at the 1, 5, 10 per cent level.

Source: IAB Establishment Panel wave 1 – 7 for West Germany.

Table 5: Determinants of Employing FL Workers 1994 – 1998

	<i>Actual changes</i>		<i>Expected changes</i>	
	Coeff.	Std.err.	Coeff.	Std.err.
Actual output increase	0,161	1.163		
Actual output decrease	-0,029	0,270		
Expected output <i>increase</i>			0.558 ***	0.197
Expected output <i>decrease</i>			0.487	0.449
Seasonal fluctuations	-0.020	0.080	-0.074	0.084
Collective wage: firm level	-0.096	-0.712	-0.246 *	0.139
industry level	-0.425 ***	0.112	-0.543 ***	0.115
Works council	-0.055	0.129	-0.052	0.128
Share of skilled	0.504 ***	0.139	0.575 ***	0.145
Share of women	-0.095	0.186	-0.213	0.187
ICT investment t-1	0.624 ***	0.102	0.621 ***	0.104
Other investments t-1	0.328 ***	0.110	0.326 ***	0.114
Problems due to maternity leave	-0,058	0,105	-0.122	0.115
Problems due to sickness	-0,153 *	0,083	-0.154 *	0.087
Wave 1995	-0,052	0,084	-0.029	0.091
Wave 1996	-0,148 *	0,088	-0.076	0.097
Wave 1997	0,035	0,087	0.015	0.099
Wave 1998	0,120	0,090	0.113	0.100
Mining, electricity, water supply	-0.614 **	0.294	-0.584 *	0.327
Basic industry	-0.287	0.186	-0.317 *	0.192
Investment goods industry	0.120	0.165	0.143	0.171
Consumer goods	-0.148	0.192	-0.110	0.198
Wholesale, retail	-0.243	0.184	-0.154	0.188
Transport, telecommunication	-0.409	0.252	-0.247	0.247
Hotels, restaurants	-0.060	0.252	-0.123	0.257
Education, research, publication	1.342 ***	0.309	1.354 ***	0.292
Health services	0.062	0.280	0.309	0.282
Business related services	1.144 ***	0.199	1.033 ***	0.206
Other services	0.482 *	0.279	0.148	0.294
Std. err. of random effects	1.239 ***	0.071	1.154 ***	0.076
Rho	0.605 ***	0.028	0.567 ***	0.032
<i>LR-Tests for joint significance</i>				
Industry dummies	101.80 ***	0.000	87.73 ***	0.000
Wave dummies	10.05 **	0.040	4.160	0.385
Firm size dummies	155.82 ***	0.000	131.00 ***	0.000
Federal state dummies	21.35 **	0.011	17.42 **	0.045
Number of observations	8016		6303	
Number of establishments	2825		2928	

Notes: Firm size and federal state dummies are included but not reported. The results are described in the text. ***, **, * variable or group of variables is significant at the 1, 5, 10 percent level.

The probability of employing TWA workers declines with the share of women employed by the establishment. By contrast, the share of female employees has no effect on employing FL or FTC workers. The share of skilled employees has a positive effect on the probability of using FL workers. This may illustrate the tasks performed by FL workers. In addition, it may reflect the fact that adjustment costs for skilled (permanent) workers are higher in general than for unskilled (permanent) workers. *Ceteris paribus*, an increase in adjustment costs for permanent workers raises the probability of using temporary workers if both are substitutes in production. The effect of the indicator variable for problems with maternity leave is highly significant in the case of FTC workers while it is insignificant for FL workers and actually significantly negative for TWA workers. This may be due to the fact that FTC workers are employed more frequently if the absences are predictable, which may be the case with maternity leave.

The hypothesis that the service sector employs atypical workers with a higher probability due to limited possibilities of using inventories seems to be rejected in tables 3 and 4. As our descriptive tables already indicated, the highest probability of using TWA employment is found among establishments in the basic and investment goods industry.¹² By contrast, support for the hypothesis is found for FL workers whose probability of employment is highest in the business-related service sector. Furthermore, they are frequently used in the education, research and publication sector.

Another interesting result are the significant differences between the federal state dummies. In city states like (West-) Berlin and Hamburg, establishments employ TWA workers with a significant higher probability than in the base category (Bavaria), which is a territorial state (the dummy variables for the states are omitted in the tables due to limitations of space). This may again reflect supply restrictions. It seems plausible that the density of temporary work agencies increases with urbanity. An exception is Bremen which does not have significantly more establishments employing secondary workers than Bavaria. Similar results are not found for FL and FTC employment.

Table 6 contains the effects of the increase in the minimum employment threshold level for the Protection against Dismissal Law in October 1996 on the probability of using atypical work. These effects are estimated by interactive terms between the firm size dummies and a dummy for the post-1996 panel waves. The table reports the coefficients of the interaction terms. Otherwise, the specifications used are the same as our preferred specifications in tables 3 to 5.

¹² The construction industry was chosen as the base category for the industry dummies.

The probability of using TWA workers decreased in all three firm size groups, but the effects are not significant. In the case of FL employment, the probability decreased only in establishments with 6-10 employees, which conforms with our expectation. However, the effects are not significant. Most interesting is the result for the probability of using FTC workers: The increase to 11 employees in the minimum employment threshold of the Protection Against Dismissal Law lowered the probability of using FTC workers for establishments with between 6 and up to 10 employees, while there are no significant changes in the two contiguous firm size groups. This may be regarded as evidence for firing costs to be a more important reason for using FTC workers than using TWA or FL workers. However, it should be taken into account that our endogenous variable is binary. If we looked at the *level* of atypical employment in establishments, we would perhaps obtain similar results for TWA and FL employees.

Table 6: Effects of the increase in the minimum employment threshold level for the Protection Against Dismissal Law in October 1996

Differences in the coefficients of firm-size dummies according to periods (up to 1996 and 1997-98)						
	FTC		TWA		FL	
Number of employees	Differences	Wald test (p-value)	Differences	Wald test (p-value)	Differences	Wald test (p-value)
1-5 employees	+ 0.274	0.463	-0.722	0.173	+ 0.256	0.292
6-10 employees	- 0.518**	0.050	-0.068	0.599	- 0.367	0.202
11-19 employees	- 0.178	0.432	-0.188	0.130	+ 0.113	0.667

7 Conclusions

Our results show that the probability of using atypical employment is influenced by changes in product demand. We conclude that this is evidence in favour of the validity of the notion that flexible labour is used as a means of adjustment during periods of transition to an equilibrium with higher employment.

Collective wage agreements as one possible source of firing costs (due to additional dismissal regulations in favour of employees) do not influence the probability of employing FTC and TCA workers. The use of FL workers is even less probable if the establishment is subject to a collective wage agreement. This may be explained by the fact that collective wage agreements can be applied to FL workers. In this case the advantage of using FL instead of regular workers may be

smaller. Works councils can also raise firing costs in Germany. In accordance with this hypothesis, the probability of employing FTC workers is influenced positively by the existence of a works council.

The effect of investments in information and communication technologies on the use of atypical employment is significantly positive in all estimations. This result can be given different interpretations. First, the trend toward standards such as computer hardware or software standards leads to organisations avoiding highly firm-specific solutions. Second, for many smaller firms it will be profitable to contract out services belonging to its own ICT-equipment. Third, firms use atypical employment in case of skill-shortage in this area.

Another commonly cited reason for using atypical employment are temporary absences of regular employees due to illness, holidays or maternity leave. Our estimations show that problems due to maternity leave increase the probability of using FTC workers. Similar results are not found for problems due to sickness.

The probability of employing TWA workers declines with the share of women in the establishment, which can be explained by the fact that the majority of TWA workers are men. The share of women has no effect on employing FL or FTC workers. The share of skilled employees has no negative effect and in the case of FL worker even a positive effect. This contradicts the view that atypical workers are used only for simple tasks. In addition, it can be explained by the positive correlation between adjustment costs and skill level of permanent employees. The hypothesis that the service sector employs atypical workers with a higher probability due to limited possibilities of using inventories seems only to be true in the case of FL workers.

Most importantly, by using a change in dismissal protection legislation as a “natural experiment”, we find evidence that the stringency of dismissal protection for permanent workers has a positive effect on the probability of using FTC workers. This indicates that firms do indeed use atypical work as a more flexible alternative to permanent employment.

References

- ABRAHAM, K. G. (1988), Flexible Staffing Arrangements and Employers' Short-Term Adjustment Strategies, in: Hart, R. A. (ed.), *Employment, Unemployment and Hours of Work*, London, 288-311.
- ABRAHAM, K. G. and S. K. TAYLOR (1996), Firms' Use of Outside Contractors: Theory and Evidence, *Journal of Labour Economics* 14, 394-424.
- ATKINSON, J. (1985), *Flexibility, Uncertainty and Manpower Management*, IMS-Report No. 89, London.
- AUTOR, D. H. (2000), *Outsourcing at Will: Unjust Dismissal Doctrine and the Growth of Temporary Help Employment*, NBER working paper No. 7557, Cambridge, Mass.
- BERMAN, E., J. BOUND and Z. GRILICHES (1994), Changes in the Demand for Skilled Labor within US Manufacturing: Evidence from the Annual Survey of Manufactures, *Quarterly Journal of Economics* 109, 367-397.
- BENTOLILA, S. and G. SAINT-PAUL (1992), The Macroeconomic Impact of Flexible Labour Contracts with an Application to Spain, *European Economic Review* 36, 1013-53.
- BROSE, H.G., M. SCHULZE-BÖING and W. MEYER (1990), *Arbeit auf Zeit – Zur Karriere eines neuen Beschäftigungsverhältnisses*, Opladen: Leske + Budrich.
- BUNDESANSTALT FÜR ARBEIT (2000), *Arbeitsmarkt 1999*, Vol. 48, ANBA Sondernummer, Nürnberg.
- BUTLER, J. and R. MOFFIT (1982), A Computationally Efficient Quadrature Procedure for the One Factor Multinomial Probit Model, *Econometrica* 50, 761-764.
- DICKENS, W. and K. LANG (1992), *Labour Market Segmentation Theory: Reconsidering the Evidence*, NBER Working Paper No. 4087.
- DIETRICH, H. (1999), Freelance and Contract Workers in Germany – Enterprise Perspectives from the IAB Establishment, in: Merz, J. and M. Ehling (eds.), *Time Use – Research, Data and Policy*, Baden-Baden, 227-240.
- FITZENBERGER, B. and W. FRANZ (2000), *Jobs. Jobs? Jobs! Orientierungshilfen für den Weg zu mehr Beschäftigung*, ZEW Discussion Paper No. 00-49.
- FRANZ, W. and F. PFEIFFER (2001), *Tarifbindung und die ökonomische Rationalität von Lohnrigiditäten*, ZEW Discussion Paper No. 01-01.
- GREENE, W. (2000), *Econometric Analysis*, Forth Edition, Upper Saddle River, N.J.: Prentice Hall.
- HAMERMESH, D. S. (1993), *Labor Demand*, Princeton (University Press).
- HUNT, J. (2000), Firing Costs, Employment Fluctuations and Average Employment: An Examination of Germany, *Economica* 67, 177-202.
- KAISER, U. and F. PFEIFFER (2000), *Collective Wage Agreements and the Adjustment of Workers and Hours in German Service Firms*, ZEW Discussion Paper No. 00-33.
- KELLER, B. and H. SEIFERT (eds.) (1995), *Atypische Beschäftigung – Verbieten oder gestalten?*, Bund-Verlag, Köln.
- KÖLLING, A. (2000), The IAB-Establishment Panel, Schmollers Jahrbuch, *Journal of Applied Social Science Studies* 120, 291-300.
- MAURIN, E. (2000), *The European Paradox: Do flexible Contracts Create Rigid Labour Markets?*, Document de travail No. 2000-07, CREST.
- MEYER, B. (1995), Natural and Quasi-Experiments in Economics, *Journal of Business & Economic Statistics* 13, 151-161.
- NADIRI, M. I. and S. ROSEN (1969), Interrelated Factor Demand Functions, *American Economic Review* 59, 457-471.

- NICKELL, S. J. (1986), Dynamic Models of Labour Demand, in: O. Ashenfelter and R. Layard (eds.), *Handbook of Labor Economics*, North-Holland, Amsterdam, 473-522.
- POLIVKA and NARDONE (1989), On the definition of “contingent work”, *Monthly Labour Review*, December 1989, 9-16.
- RUDOLPH, H. (1996), Befristete Beschäftigung von jüngeren Arbeitnehmern stark gestiegen, *IAB-Kurzbericht*, Nr. 1, 22.1.1996.
- RUDOLPH, H. (2000), Befristete Arbeitsverträge sind bald neu zu regeln, *IAB-Kurzbericht*, Nr. 12, 1.9.2000.
- SAINT-PAUL, G (1991), Dynamic Labor Demand with Dual Labor markets, *Economic Letters* 36, 219-222.
- SAINT-PAUL, G. (1996), *Dual Labor Markets: A Macroeconomic Perspective*, MIT Press, Cambridge MA.
- SALANT, S. W. (1977), Search Theory and Duration Data: A Theory of Sorts, *Quarterly Journal of Economics* 91, 39-57.
- SEGAL, L. M. and , D. G. SULLIVAN (1997): The Growth of Temporary Services Work, *Journal of Economic Perspectives*, 11, 117-136.
- VOSSWINKEL, S. (1995), Die Regulierung der Leiharbeit. Zeitarbeit zwischen Arbeitsvermittlung und überbetrieblicher Beschäftigung, in: B. KELLER and H. SEIFERT (eds.) (1995), *Atypische Beschäftigung – Verbieten oder gestalten?*, Köln, 108-138.

Appendix

Table A1: Duration of FTCs in West Germany in 1997 (cumulated percentages)

Months	All	Age < 25	Age > 50	Probationary period	No vocational qualification	Vocational qualification
≤ 2	6.9	6.2	9.2	11.0	7.0	7.2
≤ 4	16.0	16.4	15.6	21.3	16.6	15.4
≤ 6	35.4	42.4	29.4	37.7	37.5	32.2
≤ 8	40.2	46.6	34.4	42.0	42.8	36.3
≤ 10	44.0	50.5	37.3	45.2	47.0	39.0
≤ 12	68.5	76.3	61.4	67.8	71.7	63.2
≤ 18	76.7	84.5	67.3	74.4	80.2	71.3
≤ 24	84.8	90.5	75.0	81.6	87.4	81.0
≤ 36	90.1	95.0	79.4	90.7	91.9	87.4
≥ 37	100.0	100.0	100.0	100.0	100.0	100.0

Notes: Public sector and employees in vocational training are excluded. The column “vocational qualification” includes college and university degrees as well as persons with A-levels but without vocational training.

Source: German Microcensus 1997.

Table A2: New and Terminated Employment Relationships with TWAs in Germany (thousands and percentages)

Year	Stock of TWA employment	Terminated employment relationships			
		total	<i>with a duration of employment of</i>		
			<i>less than 1 week</i>	<i>1 week up to 3 months</i>	<i>3 months and more</i>
1992	140.6	276.9	8.9	54.6	36.6
1993	121.4	235.1	9.9	54.0	36.2
1994	138.5	274.1	11.9	56.6	31.5
1995	176.2	329.1	11.0	54.3	34.6
1996	177.9	315.2	11.1	52.7	36.3
1997	212.7	373.9	11.3	52.8	35.9
1998	252.9	482.4	12.0	52.3	35.7

Source: Bundesanstalt für Arbeit (2000).

Table A3: Share of Establishments Employing Atypical Workers by Number of Employees and Industry (percentages)

	FTC workers 1996-1998	TWA workers 1994-1998	FL workers 1994-1998
<i>Number of employees</i>			
1-5	2.4	0.9	3.4
6-10	6.8	1.5	3.8
11-19	11.9	1.8	5.2
20-49	24.0	5.3	8.3
50-99	36.6	11.2	11.4
100-199	56.6	24.9	11.7
200-499	69.8	30.2	17.2
500-999	80.0	31.6	21.3
1000-4999	80.0	43.1	25.0
5000 and more	*	49.1	24.1
<i>Industry</i>			
Mining, electricity, water supply	24.0	7.2	2.7
Basic industry	12.8	8.6	3.4
Investment goods industry	11.0	5.5	3.9
Consumer goods	8.2	1.7	1.9
Construction	5.7	4.9	3.5
Wholesale, retail	7.4	1.1	2.5
Transport, telecommunication	9.9	1.4	3.6
Hotels, restaurants	8.9	0.5	0.8
Education, research, publication	6.9	*	14.8
Health services	7.4	0.4	2.7
Business related services	5.5	1.5	13.8
Other services	9.3	2.9	8.8
Total	7.6	2.0	4.4

Notes: Weighted and extrapolated data for West Germany and the sample described in the text. * inadequate number of observations

Source: IAB-Establishment Panel waves 2 – 6, West Germany only.

Table A4: Instruments of Adjustment to Expected or Unexpected Demand Changes During the Year in West Germany in 1996 (Percentages)

	Kind of prevailing demand changes	
	<i>Expected</i>	<i>Unexpected</i>
Inventories	12	12
Overtimes hours / extra-shifts	35	31
Shifting of holiday or free-time periods	43	37
Short-time working	2	5
Additional FTC workers	20	15
Additional TWA workers	3	6
Hiring / firing of staff	10	15
total	55	30

Notes: Weighted and extrapolated data for West Germany.

Source: IAB Establishment Panel wave 4 for West Germany.

Table A5: Descriptive Statistics for the Estimation Sample, Dependent Variables

Variable	Data	Mean	Std. Dev.	Min	Max	Observations
TWA Workers (Dummy)	<i>overall</i>	0.176	0.381	0.000	1.000	<i>N</i> 7207
	<i>between</i>		0.342			<i>I</i> 2843
	<i>within</i>		0.193			\bar{T}_i 2.731
FTC Workers (Dummy)	<i>overall</i>	0.377	0.485	0.000	1.000	<i>N</i> 4873
	<i>between</i>		0.444			<i>I</i> 2285
	<i>within</i>		0.232			\bar{T}_i 2.277
FL Workers (Dummy)	<i>overall</i>	0.114	0.317	0.000	1.000	<i>N</i> 6303
	<i>between</i>		0.279			<i>I</i> 2928
	<i>within</i>		0.185			\bar{T}_i 2.728

Notes: *N* is overall number of used observations, *I* is the number of establishments and \bar{T}_i is the average number an establishment is observed in this sample. The between data are generated by calculating the means over time by establishment \bar{x}_i . The within data are defined as $x_{it} - \bar{x}_i + \bar{x}$, where the overall mean \bar{x} is added to equate the mean of all data (overall, between and within).

Source: IAB Establishment Panel waves 1 – 7 for West Germany.

Table A6: Descriptive Statistics for the Estimation Sample, Independent Variables

Variable	Data	Mean	Std. Dev.	Min	Max
Actual output change	<i>overall</i>	0.031	0.261	-0.992	3.169
	<i>between</i>		0.187		
	<i>within</i>		0.210		
Expected output change	<i>overall</i>	0.027	0.220	-1.000	5.000
	<i>between</i>		0.218		
	<i>within</i>		0.121		
Seasonal fluctuations (Dummy)	<i>overall</i>	0.292	0.455	0.000	1.000
	<i>between</i>		0.432		
	<i>within</i>		0.173		
Collective wage agreement industry level (Dummy)	<i>overall</i>	0.693	0.461	0.000	1.000
	<i>between</i>		0.437		
	<i>within</i>		0.181		
Collective wage agreement firms level (Dummy)	<i>overall</i>	0.093	0.291	0.000	1.000
	<i>between</i>		0.262		
	<i>within</i>		0.159		
Works council (Dummy)	<i>overall</i>	0.462	0.499	0.000	1.000
	<i>between</i>		0.492		
	<i>within</i>		0,095		
ICT-investment (Dummy)	<i>overall</i>	0.521	0.500	0.000	1.000
	<i>between</i>		0.421		
	<i>within</i>		0.303		
Other Investments (Dummy)	<i>overall</i>	0.258	0.437	0.000	1.000
	<i>between</i>		0.343		
	<i>within</i>		0.304		
Share of skilled	<i>overall</i>	0.599	0.294	0.000	1.000
	<i>between</i>		0.275		
	<i>within</i>		0.129		
Share of women	<i>overall</i>	0.348	0.286	0.000	1.000
	<i>between</i>		0.284		
	<i>within</i>		0.062		
Problems due to maternity leave (Dummy)	<i>overall</i>	0.092	0.289	0.000	1.000
	<i>between</i>		0.253		
	<i>within</i>		0.171		
Problems due to sickness (Dummy)	<i>overall</i>	0.177	0.382	0.000	1.000
	<i>between</i>		0.336		
	<i>within</i>		0.216		

Notes: See previous table. All statistics are from the estimation sample of the regression for TWA workers ($N = 7207$).

Source: IAB Establishment Panel waves 1 – 7 for West Germany.