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ABSTRACT

Explaining the Growth of Part-Time Employment: Factors of Supply and Demand*

Using the Dutch Labour Force Survey 1991-2001, the authors investigate the incidence of part-time employment in the country with the highest part-time employment rate of the OECD countries. Women fulfil most part-time jobs, but a considerable fraction of men works part-time as well. Evidence from descriptive statistics and a macro-econometric model at the sectoral level of industry suggests that the growth of part-time employment in the 1990s relates strongly to the growth in female labour force participation. Factors of labour demand, like the shift from manufacturing to services and the increase in the demand for flexible labour, turn out to play a significant role as well.

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1 Introduction

In international comparisons on labour force participation and employment, the Netherlands show a high rate of part-time employment. This rate is high among women, and compared to other countries it is high among men as well. Despite the high level, the rate of part-time employment continues to grow at a pace faster than for other OECD countries. Many Dutch and international studies on part-time employment focus on the supply side and in particular on the increasing labour force participation of women. In this study, we investigate the importance of factors of labour demand as well.

The international policy debate on part-time employment changed considerably in recent years. Before the 1990s, many economic observers highlighted the underutilization of labour and discussed the incidence of involuntary part-time employment. For instance, Leppel and Clain (1988) conclude that the growth in involuntary part-time employment in the US relates to the expansion of the service sector, while Blank (1989) suggests that part-time employment may be a stepping-stone into fulltime employment for US women. The OECD (1990, 1995) relates involuntary part-time employment to underemployment and labour market slack.

The particular interest of economic observers in involuntary unemployment suggests that labour demand is an important driving factor of part-time employment. The focus on involuntary unemployment seems, however, ill-directed as already in the beginning of the 1980s the OECD (1983) concluded that most part-time employment is voluntary. Moreover, authors like Hart (1987) and Hamermesh (1993) consider part-time employment as an outcome that can be in the interest of both firms and workers. In recent years, several economic observers started to open up their minds to part-time employment as a potential advantage rather than a trap for workers. Bollé (1997) concludes that if it is chosen freely and protected by law, part-time employment offers a good way of striking a balance between time to earn a living and time to devote to other activities. The OECD (2001) discusses part-time employment as a way in helping parents into paid employment and to balance work and family life. These insights suggest that labour supply may be an important driving factor of part-time employment as well.

Since the end of the 1980s, Dutch policy makers recognised that part-time employment may be a way for workers to balance work and other (family and care) responsibilities. In 1993, the Dutch government reinforced the legal position of part-time workers by regulating the statutory minimum wage and the minimum holiday allowance. Previously, these rights did not apply to employees working less than one-third of normal full-time hours. In 1996, the Dutch government installed a law that gave part-time workers an explicit right to equal treatment – pro rata – on wages, overtime payments, bonuses and training. So, recent policies made part-time

employment more attractive to workers. The view that part-time employment may be an attractive option for workers is reflected in the Dutch labour supply literature, see for example Grift and Siegers (1993) and Euwals and van Soest (1999).

Most studies on part-time employment consider either the demand or the supply side, an exception being Doris (1998) on Ireland. Studies on demand include Rice (1990) and Friesen (1997) for the UK, Fallick (1999) for the US, Columbino and Di Tommaso (2000) for Italy, and Delsen (1995) for an international perspective. Our contribution to the literature is that we consider factors of supply and demand simultaneously by using an empirical model at the sectoral level of industry. We include demand variables using data on sectors of industry and supply variables using survey data. We improve on Ehrenberg *et al.* (1988) by defining labour supply variables on the basis of sectoral needs on the educational mix of their work force. We find that the growth in part-time employment relates strongly to the growth in female labour force participation. Factors of labour demand, like the shift from manufacturing to services and the increase in the demand for flexible labour, turn out to play a significant role as well.

In the remainder, we first discuss the Dutch labour market during the 1990s. Next, we analyse part-time employment on the basis of the Dutch Labour Force Survey 1991-2001.

2 The Dutch Labour Market

During the 1990s, the Netherlands experienced strong economic growth. Growth of GDP was almost 3% per year, while OECD figures show that standardized unemployment dropped from 5.9% in 1990 to 2.8% in 2000. The employment-to-population ratio for persons aged 15-64 years grew from 61.1% to 74.1%. A large part of this increase was due to women as their employment-to-population ratio grew from 46.7% to 63.4%. Part-time employment increased as well: from 28.2% to 33.0% (of the total number of workers).²

As most part-time jobs are fulfilled by women, the relation between the growth in part-time employment and the growth in female employment seems obvious. Nevertheless, there is something left to explain as the rate of part-time employment increased for men and women. To investigate the growth of part-time employment we use the Dutch Labour Force Survey (DLFS). Appendix A discusses the data source.

² The OECD Employment Outlook defines part-time as usually working less than 30 hours per week in the main job.

In this study, we define part-time employed persons as those who usually work at least 12 hours and at most 34 hours per week. We consider these particular lower and upper bounds for several reasons. Individuals whose main daily task is not paid employment, like students and housewives, may nevertheless work for some hours per week. We do not want to include these kinds of marginal employment into the analysis and therefore individuals that work less than 12 hours per week are not considered to be part of the labour force. The DLFS forces us to implement this lower bound as questions about employment are not asked to persons working less than 12 hours. Secondly, in many industries the full-time working week is 36 or 38 hours per week. To be sure not to include full-timers among the part-timers we use 34 hours per week as upper bound.

Table 2.1 Part-time employment rate by gender in %, persons aged 15-64, 1991-2001^a

	Part-time employment rate ^b			Employment-to-population rate ^b		
	1991	2001	a.a.g. ^c	1991	2001	a.a.g. ^c
Total	23.6	32.7	3.3	56.2	65.4	1.5
Women	51.7	62.9	2.0	40.5	53.4	2.8
Men	8.1	12.2	4.2	71.5	77.1	0.8

^aSource: Dutch Labour Force Survey, Statistics Netherlands, own calculations.

^bFor the definitions we use 12 hours per week as an under bound and for part-time employment we use 34 hours as an upper bound.

^cAverage annual growth.

Table 2.1 shows that the average growth rate of part-time employment was 3.3%. The OECD reports a lower average growth rate of 1.6% per year. An explanation for this difference is that in the Netherlands it has become rather normal to work 32 hour per week. In the OECD figure this is not counted as part-time employment (see footnote 2).

The incidence of part-time employment differs between men and women (table 2.1). For men the part-time employment rate increased from 8.1% to 12.2%, while for women the rate increased from 51.7% to 62.9%. The part-time employment rate increased partly because the rate by gender increased. A considerable part of the increase in part-time employment is however explained by the increasing incidence of employment among women. The employment-to-population ratio of women increased from 40.5% to 53.4%. The ratio for men increased a lower pace so that the share of women in total employment increased from 35.5% to 40.3%. The growing share of women in total employment explains the increase in part-time employment for about 25%: if the part-time employment rate by gender would have remained constant after 1991, the part-time employment rate would have grown to 25.7% in 2001.

Table 2.2 Part-time employment rate by industry in %, persons aged 15-64, 1991-2001^a

	Part-time employment rate ^b			Employment rate ^b		
	1991	2001	a.a.g. ^c	1991	2001	a.a.g. ^c
Total	23.6	32.7	3.3	100.0	100.0	0.0
Health care	51.6	67.6	2.7	13.2	14.6	1.0
Services	28.9	31.9	1.0	14.9	17.7	1.8
Government	22.8	34.6	4.2	14.8	13.7	- 0.8
Trade	22.5	33.4	4.0	15.8	15.6	- 0.1
Finance, insurance	17.3	25.0	3.7	4.5	5.6	2.3
Transport, communication	14.7	22.3	4.3	6.4	6.4	0.0
Manufacturing, agriculture	14.0	18.5	2.8	23.4	19.0	- 2.1
Construction	6.4	8.1	2.4	7.0	7.3	0.5

^a Source: Dutch Labour Force Survey, Statistics Netherlands, own calculations.

^b For the definitions we use 12 hours per week as an under bound and for part-time employment we use 34 hours as an upper bound.

^c Average annual growth.

Table 2.2 shows that for the level of part-time employment differences between sectors play an important role. The high part-time employment rate of a sector like 'health care' sector is not explained by the large number of women in the sector as the part-time rate of the sector exceeds the part-time rate of women. Sectors like 'agriculture', 'manufacturing', 'construction' and 'transport and communication' have low rates of part-time employment.

The literature on part-time employment often suggests that the growth of the service sector offers a important explanation for the growth of part-time employment; see for instance Tilly (1995), Doris (1998), Walwei (1998) and Fallick (1999). Table 2.2 shows that sectors with many part-timers, like health care and services grew. Moreover, sectors with few part-timers, like manufacturing and agriculture declined. If the part-time employment rate by industry would have stayed constant after 1991 the part-time employment rate would have grown to 24.3% in 2001. The shift between sectors explains the growth in part-time employment for about 8%. Therefore the shift does play a role in explaining the growth of part-time employment. But at least for the period under investigation the importance of the shift between sectors is smaller than in the studies mentioned above

3 Factors of Labour Demand

In the previous section, we showed that the growth in part-time employment coincided with the growth in female employment. Arguments for the willingness of individuals to work part-time are easy to find, as it gives an opportunity to combine paid work with other activities like caring, studying or retirement. The labour supply literature therefore often explicitly allows for part-time employment. The explanation on why firms hire on a part-time basis gets however

less attention. In this section we consider possible reasons for employers to hire employees on a part-time basis.

Obviously, employers will hire part-time workers if their hourly productivity is larger than their hourly cost. But for which jobs and for which workers may this hold? A particular disadvantage of part-time employment is that there are fewer hours to cover quasi-fixed costs, like workplace and equipment costs and costs for firm and job specific knowledge. This makes part-time workers relatively expensive. So there must be particular advantages to part-time workers to make them attractive to employers.

It should be clear upfront that in the Netherlands fringe benefits are unlikely to be an important argument for employers to hire part-time workers. As explained before, in the Netherlands employers are by law not allowed to treat part-time workers different from full-time workers. Wages, fringe benefits, training opportunities and social security rights should be – pro rata – equal between workers. Moreover, there is no difference in employment protection. The position of part-time workers in the Netherlands contrasts to the position of these workers in many other countries. For example, US employers are allowed to offer less favourable fringe benefits to part-time workers. This makes part-time workers attractive to these employers: Ressler *et al.* (1996) show that US employers increased their demand for part-time workers in reaction to minimum wage increases to cut wage costs, while Buchmueller (1999) shows that US employers that offer generous fringe benefits make greater use of low-wage part-time workers. Arguments like these are irrelevant for the Netherlands.

One particular reason for firms to hire part-timers may be to achieve ‘dynamic flexibility’ (Friessen; 1997). Part-timers may form a flexible pool of workers that can be used to adjust to the business cycle. In good times, part-timers may be willing to work more hours. While in bad times, part-time workers may be willing to work fewer hours and new workers may be hired on a part-time basis. Empirical evidence for the relevance of such arguments exists: on the basis of firm level data, Friessen (1997) shows that part-time work plays a distinct role in the adjustment strategies of UK firms, while on the basis of country level data, Buddelmeier *et al.* (2004) show that part-time employment follows a stronger cyclical pattern than total employment.

The growth of part-time employment in the Netherlands in the 1990s cannot be explained by dynamic flexibility behaviour of firms. As economic growth has been rather high, firms and workers should have adjusted towards full-time employment during this period. We are nevertheless interested in testing the empirical relevance of this explanation.

Another particular reason for firms to hire part-time workers may be to achieve 'organisational flexibility': firms that face predictable or possibly unpredictable demand or production peaks may want to hire part-time workers to fulfil the demand for workers during these peaks. For example, the service and retail trade sector face predictable demand peaks for consumer goods after regular working time and during weekends. There exists ample empirical evidence that firms hire part-time workers as a form of flexible labour: on the basis of Canadian firm level data, Zeytinoglu (1992) finds that organisational flexibility is a major argument to hire part-time workers, while on the basis of Dutch firm level data, Van Lomwel (2000) finds that the decoupling of working time and operating hours has led to an increase in the demand for part-time workers. On the basis of international firm level data, Delsen (1995) finds that the introduction of part-time employment has led to positive outcomes for firms in several European countries. He concludes that firms generally underestimate the advantages of part-time employment. Furthermore, using a theoretical model for cooperating production factors, Deardorf and Stafford (1976) show that capital intensive industries have tight work schedules to use their capital optimally and therefore have little room for part-time employment.

An observation that may be consistent with an increase in the demand for flexible labour is the observed increase in firm volatility. In the last few decades, US firms have faced an increase in the uncertainty of the demand for their products. Authors like Comin and Mulani (2003) and Phillipon (2003) relate the increase in firm volatility to an increase in competition because of product market integration. Although this development may be slower in the European Union than in the US, it is consistent with an increase in the demand for flexible labour as firms may need flexibility to adjust to unanticipated demand shocks. Firms may use part-time employment as a form of flexible labour, and moreover in case of an unexpected negative shock firms may ask full-time workers to work part-time to avoid involuntary redundancies.

Organisational flexibility may be a major explanation for the growth of part-time employment in the 1990s. The service sector has been growing already for decades, the liberalization of the laws on opening hours of shops has led to more demand for labour on non-standard working hours, and the European policy on product market liberalisation may have led to more competition and therefore to more uncertainty in international competition for firms. The arguments discussed in this section are not easy to capture in an empirical framework. One problem is that the need for organisational flexibility is difficult to measure. Nevertheless, we will exploit data on evening and weekend production, capital intensity, and volatility in production to capture the importance of organisational flexibility. To capture the impact of the business cycle, we will exploit data on vacancies and the growth of production.

4 Empirical Model

In this section, we formulate an empirical model proposed by Ehrenberg *et al.* (1988) to explain the rate of part-time employment from a number of exogenous variables including factors of supply and demand. The model is a simple linear regression model, which may be interpreted as an approximation or a reduced form of more complicated models that account for the structure of the labour market.

Define y_{it} as the proportion of part-time employment in total employment, both measured in the numbers of persons, of sector of industry $i=1, \dots, I$ at year $t=1, \dots, T$. Define:

$$y_{it} = \alpha_i + x_{it}^s \alpha^s + x_{it}^d \alpha^d + x_{it} \alpha + \varepsilon_{it} \quad (4.1)$$

with $(x_{it}^s, x_{it}^d, x_{it})$ vectors of supply, demand and general exogenous variables. The sector specific effect α_i will be treated as a parameter, i.e. fixed effect, and $(\alpha^s, \alpha^d, \alpha)$ are vectors of parameters. We assume the error term ε_{it} to be independently and identically distributed. Some of the assumptions underlying the model are important, and we discuss them in more detail.

A first important assumption is on the exogeneity of the right-hand side variables: both labour supply and labour demand variables may not be exogenous. A prominent example is the labour force participation of women. While the descriptive analysis of Section 2 reveals a statistically significant correlation between part-time employment and female labour force participation, the econometric analysis assumes there is a causal relation from participation to part-time employment. This may indeed be a critical assumption: during the 1990s participation may have been encouraged by the increasing demand for (part-time) employment. This suggests a potential existence of a discouraged worker effect before the 1990s, as individuals may not have supplied labour because of the lack of part-time jobs. We cannot assess the importance of this explanation within our model. But at least we know for sure that socio-cultural factors played an important role for the increase in female labour force participation. We do not model this aspect of female labour force participation and part-time employment as it is beyond the scope of our study. Instead we try to interpret our estimation results with care.³

A second important assumption underlying the model is that the rate of part-time employment at a certain year is affected by the exogenous variables of that year and not by lagged

³ We conclude the growth in female labour force participation *relates* to the growth in part-time employment, and we refrain from drawing conclusions on a *causal* relation.

exogenous variables. In theory, we may expect employment in the Netherlands to adjust slowly over time because of inflexibilities in the labour market. Therefore may need to formulate a model with adjustments over time, leading to a model with time series properties. The time period of our data is however too short for such an approach. Furthermore, inflexibilities in the labour market may lead to slow adjustments in the amount of employment. With respect to part-time employment the Dutch labour market is however rather flexible. Employees have a lot of freedom in working part-time, while employers may use flexible employment contracts and temporary working agencies to fulfil their demand for part-time workers within a reasonably short time period.

Under the assumptions formulated above the model can be estimated with a method like ordinary least squares. The interpretation of the estimation results is rather straightforward as for many variables it will be clear whether they should be interpreted as a supply or a demand effect. For instance, the increase in the participation rate of certain groups in the population can be interpreted as a labour supply effect, while the vacancy rate of a sector of industry can be interpreted as a labour demand effect.⁴

5 Data

Estimation will be based on data derived from the Dutch Labour Force Survey (DLFS) and the Dutch national accounts. We distinguish 19 different sectors of industry. For illustration purposes we aggregated the 19 sectors to 8 sectors in table 2.2, but for our regression analysis such an aggregation is not necessary. We split up ‘manufacturing and agriculture’ into 9 different manufacturing industries and a sector ‘agriculture’. Furthermore, we separate the sector ‘real estate’ from the sector ‘finance and insurance’, and we subdivide the sector ‘transport and telecommunication’ into sectors ‘transport’ and ‘telecommunication’. As the resulting sectors vary in size, the model of Section 4 will be estimated using a weighted estimation procedure. We use labour input of a sector (in full-time equivalents) as weights. We will not use data for the year 1991 as in the DLFS the educational variables for that year deviate from later year, and we need them to construct the factors of labour supply (see below).

The factors of demand are derived at the sectoral level from national accounts (table 5.1). The variables on growth of production and capital intensity are based on figures on gross

⁴ Euwals and Hogerbrugge (2003) replicate Ehrenberg *et al.* (1988) by estimating a simultaneous equation model for supply and demand. An interesting outcome is that the results on the structural parameters are similar between both studies.

production, labour input and investments per sector. The growth of production will be interpreted as a measure for the business cycle. The growth of production reached its highest point at the end of the 1990s. The vacancy rate at the sectoral level is made available by Statistics Netherlands, and it reached its highest point at the end of the 1990s as well.

The variables to measure the need for organisational flexibility include capital intensity, production in weekends and evening, and firm volatility. The stock of capital is calculated using the perpetual inventory method (Van der Wiel, 2001). Capital intensity is measured in millions of euros per full-time equivalent employee, and has grown at the aggregated level despite the growing importance of services. Weekend and evening production of a sector of industry are calculated on the basis of the DLFS. They show an increasing trend, and this is in line with the increasing demand for goods and services and the accompanying liberalisation of the laws on opening hours. Firm volatility is measured as the standard deviation of changes in log production, and it increases only in the second part of the 1990s. Comin and Chaney (2002) and Phillippon (2003) find an increase in firm volatility for the US, but in contrast to our study they use firm level data over a long time period.

Table 5.1 Factors of supply and demand, 1992-2001

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Factors of supply^a										
Fraction women	0.349	0.356	0.363	0.368	0.374	0.384	0.391	0.401	0.399	0.406
Fraction women aged 25-44	0.583	0.583	0.588	0.598	0.600	0.602	0.604	0.598	0.590	0.581
Fraction women aged 45-64	0.196	0.206	0.215	0.223	0.224	0.234	0.246	0.252	0.265	0.270
Fraction women with children	0.344	0.352	0.358	0.359	0.367	0.375	0.391	0.396	0.401	0.414
Fraction men aged 25-44	0.582	0.584	0.581	0.583	0.582	0.575	0.570	0.560	0.552	0.547
Fraction men aged 45-64	0.284	0.289	0.299	0.304	0.310	0.318	0.326	0.336	0.342	0.345
Fraction men with children	0.420	0.417	0.416	0.412	0.415	0.409	0.407	0.406	0.404	0.410
Factors of demand										
Growth of production ^b	0.037	0.031	0.044	0.045	0.038	0.060	0.057	0.058	0.078	0.060
Vacancy rate ^c	0.011	0.007	0.008	0.010	0.011	0.015	0.020	0.025	0.027	0.025
Capital intensity ^d	0.192	0.197	0.202	0.203	0.202	0.201	0.201	0.202	0.205	0.208
Production in weekends ^a	0.410	0.414	0.425	0.427	0.437	0.438	0.445	0.454	0.468	0.471
Production in evenings ^a	0.165	0.166	0.167	0.164	0.173	0.179	0.180	0.183	0.187	0.187
Firm volatility ^e	0.006	0.005	0.005	0.005	0.004	0.004	0.004	0.005	0.007	0.008

^aSource: Dutch Labour Force Survey, own calculations. Factors of supply are at the sectoral level, Appendix C discusses details.

^bSource: National Accounts, growth of gross production measured in factor costs.

^cSources: Statistics Netherlands and National Accounts, vacancies per full-time labour input equivalents.

^dSources: National Accounts and CPB, millions of euros per full-time equivalent employee.

^eSources: National Accounts, standard deviation of $\log(\text{production}(t,q)) - \log(\text{production}(t-1,q))$ with production in millions of euros, with index t for year and index q for quarter, standard deviation taken over all quarters in the period (t-2, t+2).

Factors of labour supply, like the participation rate of women, are usually measured on the national level. Measurement of labour supply on the sectoral level is difficult as for most

individuals it is not clear to which sectors of industry they supply labour. Even an individual that works in a certain sector could potentially work in another sector. One way to solve the problem is to use labour supply variables on the national level in the empirical analysis, but as we have only 11 years of observations we could include only a few of such variables. Another way to solve the problem is to use the individuals that work in a certain sector to construct labour supply variables for that particular sector (Ehrenberg *et al.*, 1988). The interpretation of such variables in explaining the level of part-time employment is however problematic: Is the rate of part-time employment in a sector high because so many women work in the sector, or work so many women in the sector because they can work part-time? In other words, the direction of causality is unclear.

In this section, we will use female labour force participation as our major example as it is easy to understand. In the empirical exercise we will consider the participation of age groups and groups that have children as well. What we like to have as an explanatory variable is the share of women in the group of individuals that could work in a particular sector. If the share of women in the group is large the sector will have to take the preferences of women into account. We do know which persons could work in a sector by using data on the type of education of the workers in a sector. Say, for example, that the sector 'health care' only employs individuals that have an education in 'health care'. Then the share of women in the labour supply of the sector is the share of women among those who have an education in 'health care.' This group includes individuals that are working other sectors and that are unemployed. Reversed causality, so from part-time employment to participation, only occurs in case individuals choose a certain type of education (f.i. 'health care') because they want to work part-time later on in their life.

We will construct factors of labour supply by using educational data from the DLFS. Of course, no sector of industry needs one particular type of education. For this reason, we calculate the educational mix of the workers in a particular sector (we observe 20 different combinations of levels and directions). For example, about 39% of workers in the sector 'health care' have a medium vocational education in 'health care'. Next, we calculate the share of women in the total labour force that fulfils the particular educational needs of a sector by using a weighting procedure on the basis of the education mix. For instance, all individuals with a medium level education in 'health care' get a weight of 0.39 for the sector 'health care.' Individuals with another kind of education get a lower weight for the sector 'health care' as they are less important for the relevant labour supply of the sector. Appendix C presents details on the weighting procedure and the construction of the sector specific labour supply variables.

Table 5.1 shows that the share of women in the labour force increases over time. One should keep in mind that the factors of supply vary over the different sectors of industry: for instance,

the share of women in the relevant labour supply for a sector in the year 2000 varies from 18.1% in construction to 62.0% in health care. Besides the sector specific share of women, we construct sector specific labour supply variables for age groups and for having children. The share of elderly among the labour force participants for both women and men increased from 19.6% and 28.4% in 1992 to 27.0% and 34.5% in 2001. The share of women with children increased from 34.4% to 41.4% despite the decrease in birth rates.

Tabel 6.1 Estimation results on the part-time employment rate, 1992-2001

	Model 1	Model 2	Model 3
Factors of supply			
Fraction women	0.8911 **(0.1650)	0.7515 **(0.1677)	0.5278 **(0.1381)
Fraction women aged 25-44			0.3411 *(0.1899)
Fraction women aged 45-64			0.5506 **(0.2505)
Fraction women with children			- 0.1725 (0.2471)
Fraction men aged 25-44			- 1.9746 **(0.4406)
Fraction men aged 45-64			-1.2944 **(0.4234)
Fraction men with children			-0.3597 (0.3444)
Factors of demand			
Growth of production		- 0.0696 *(0.0379)	- 0.1132 **(0.0300)
Vacancy rate		- 0.5625 **(0.2422)	- 0.8713 **(0.2047)
Capital intensity		0.0049 (0.0435)	0.0357 (0.0335)
Production in weekends		- 0.1136 *(0.0611)	0.0392 (0.0491)
Production in evenings		0.2756 **(0.1210)	0.2740 **(0.1069)
Firm volatility		- 0.8176 **(0.3641)	- 0.3272 (0.2855)
Additional controls			
Time trend	**yes	**yes	*yes
Sectoral dummies	**yes	**yes	**yes

Note: The model is estimated by weighted least squares. The dependent variable is the rate of part-time employment of a sector of industry. We use data from 1992 on because the labour supply variables of 1991 could not be constructed. The additional controls include an intercept, a quadratic time trend and sectoral dummies. Table 5.1 discusses the definitions of the explanatory variables. Between parentheses are standard errors. Variables marked with * and ** are significant at a 10% and 5% significance level.

6 Results

We estimate the model of Section 4 by using weighted least squares. The model includes all variables of supply and demand. To highlight the importance of female labour force participation, we start our investigation with a model that includes the share of women only. In later steps, we add more variables to see how the importance of the variable changes.

The first column of table 6.1 shows a statistically significant relation between the share of women and the share of part-time employment. A 1%-point increase in the share of women among the labour force participants leads to a 0.89%-point increase in the share of part-time employment. The model includes a flexible time trend as the high growth rate of both variables may lead to spurious correlation (excluding the time trend makes the variable on the share of women very significant). The substantial significance of the time trend indicates that there may indeed be important unexplained factors that drive the growth of part-time employment.

Including the factors of labour demand, see second column of table 6.1, decreases the impact of the share of women slightly. The time trend stays highly significant, indicating that there are still important unexplained factors that drive the growth of part-time employment.

The variables that represent the business cycle clearly have a negative impact: the rate of part-time employment is high when the growth of production and the vacancy rate are low. Capital intensity does not significantly relate to part-time employment and stays insignificant in any other specification that we try in this study. The interpretation of the theory by Deardorf and Stafford (1976) that high capital intensity leads to a low demand for part-time employment is not supported by the results. Production in evenings leads to more part-time employment, confirming that production on non-standard working hours leads to more part-time employment. The weakly significant negative sign of weekend production seems to contradict this conclusion, but the last specification of the model (column 3 of table 6.1) shows that the impact of weekend production is insignificant. The result on firm volatility contradicts the theory of section 3 as well, but also here the last specification of the model shows that the impact of firm volatility is insignificant. The time period may simply be too short to show a significant impact of changing product market conditions.

In the last column of table 6.1 we include labour supply variables at the sectoral level of industry. The size of the impact of the share of women decreases substantially compared to the two previous specifications: a 1%-point increase in the share of women among the labour force participants leads to a 0.53%-point increase in part-time employment.

The results on the labour supply variables show that women of age 25 to 64 are more likely to work part-time than the reference group of women of age 15 to 24. The oldest group of women have the highest probability to work part-time. Men of age 25 to 64 are less likely to work part-time. Women with children are equally likely to work part-time than women without children. This contradicts the literature on labour supply which almost always finds strong effects of children. The time trend is still weakly significant, indicating the possible existence of unexplained factors driving the growth of part-time employment.

Table 6.2 Estimation results on the part-time employment rate, 1992-2001

	Model 4	
	Effect in 1997	Effect of one additional year
Factors of supply		
Fraction women (sectoral level)	0.4562 **(0.1305)	0.0242 **(0.0070)
Fraction women aged 25-44	0.4375 **(0.1769)	-0.0559 (0.0463)
Fraction women aged 45-64	0.5439 **(0.2380)	-0.0374 (0.5440)
Fraction men aged 25-44	-1.0718 **(0.4517)	-0.0579 (0.0895)
Fraction men aged 45-64	-0.3291 (0.4901)	-0.1085 (0.0811)
Factors of demand		
Growth of production	-0.1085 **(0.0276)	0.0005 (0.0008)
Vacancy rate	-0.4443 **(0.2230)	-0.1135 **(0.0550)
Production in evenings	0.1761 *(0.1020)	-0.0051 (0.0058)
Firm volatility	-0.1201 (0.2922)	-0.0630 (0.0644)
Additional controls		
Time trend	**yes	
Sectoral dummies	**yes	

Note: The model is estimated by weighted least squares. The dependent variable is the rate of part-time employment of a sector of industry. We use data from 1992 on because the labour supply variables of 1991 could not be constructed. The additional controls include an intercept, a quadratic time trend and sectoral dummies. Between parentheses are standard errors. Variables marked with * and ** are significant at a 10% and 5% significance level.

Sensitivity analysis

The results of Table 6.1 are derived from a model that assumes the impact of the exogenous variables to be constant over time. Given the relatively small number of observations, 10 time-periods for 19 sectors of industry, it is not straightforward to go beyond this assumption. On the other hand, on the basis of economic arguments one may expect the impact of the factors of

supply and demand to depend on the business cycle. For example, the importance of labour supply variables may be larger during a booming period than during a slack period. So instead of equation (4.1), we may expect:

$$y_{it} = \alpha_i + x_{it}^s \alpha_i^s + x_{it}^d \alpha_i^d + x_{it} \alpha + \varepsilon_{it} \quad (6.1)$$

whereby the parameters (α_i^s, α_i^d) depend on the business cycle. As the number of observations is too small to identify separate parameters for each time period we experimented with several restrictive forms of the time dependence. Table 6.2 presents estimation results for the following functional form:

$$\alpha_i^x = \alpha_0^x + \alpha_1^x t, \quad x = s, d \quad (6.2)$$

which implies that we allow the impact of a variable to change linearly over time. Hypothesis testing shows that the first order (linear) time dependence of the exogenous variables is jointly significant. Hypothesis testing shows that the second order (quadratic) time dependence of the exogenous variables is jointly insignificant.

Table 6.2 shows that the impact of the fraction of women is larger in the second half of the 1990s than in the first half. This is in line with the economic interpretation that labour supply variables are more important during a booming period: the Dutch economy grew particularly strong in the second half of the 1990s. It is however puzzling that this story does not hold for the other labour supply variables. For the labour demand variables, one may expect that they are more important during a slack period. The results of Table 6.2 do not confirm this hypothesis. The impact of the vacancy rate changes over time, but the stronger effect in the second half of the 1990s is not in line with the hypothesis formulated above.

Simulations

The estimation results of Tables 6.1 and 6.2 show which variables significantly relate to part-time employment. The results are however less insightful on the question which variables are most relevant. We present a number of simulations to show how changes in the factors of supply and demand relate to the growth of part-time employment. We use the estimation results of Table 6.1 and discuss the results of Table 6.2 in the text.

Our first simulation ('basic simulation') gives the prediction of the reduced form model on the basis of the development of the observed exogenous variables. At the aggregated level, the predicted rate of part-time employment deviates at most 0.3%-points from the observed rate of part-time employment. The average absolute prediction error is about 0.2%-points. We isolate

the impact of the variable(s) of interest by keeping these variable(s) constant at the 1992 value and by allowing the other variables to change over time.

	1992	1995	1998	2001
	%			
Data (part-time employment rate)	24,3	27,1	29,8	32,5
Basic simulation	24,0	27,0	29,7	32,5
Simulation: fraction of women	24,0	26,1	27,8	29,9
Simulation: factors of supply	24,0	26,8	27,6	27,5
Simulation: sectors of industry	24,0	26,7	29,1	31,6
Simulation: factors of demand	24,0	26,7	28,5	30,8

Note: the part-time employment rate is the fraction of persons who work at most 34 hours per week (and at least 12 hours per week). We use data from 1992 on because the labour supply variables of 1991 could not be constructed. The basis simulation predicts the part-time employment rate on the basis of the observed factors of supply and demand. The simulation 'fraction of women' keeps the fraction of women constant since 1992. The simulation 'factors of supply' keeps all factors of supply constant since 1992. The simulation 'factors of demand' keeps the sectors of industry and the factors related to organisational flexibility constant since 1992.

Table 6.3 shows that the fraction of women plays an important role: keeping the fraction of women constant since 1992 leads to an increase from 24.0% to 29.9%, instead of an increase to 32.5%. So a substantial part of the increase in part-time employment, about 31% (=2.6% of the 8.5% increase), is due to the higher employment rate of women. In the case of a changing impact of the exogenous variables, Table 6.2, this becomes about 33% instead of 31%. The second simulation shows that labour supply altogether played an important role during the 1990s: the increase in part-time employment is by almost 60% (=5.0% of the 8.5% increase) explained by the factors of labour supply. In case of a changing impact of the exogenous variables this percentage becomes almost 100%.

As the business cycle reached its highest point at the end of the 1990s, the growth of production and the vacancy rate should have led to *lower* part-time employment rates by the end of the 1990s. But part-time employment grew despite the business cycle. To isolate the effect of the other labour demand variables we keep the size of the sectors of industry and the variables related to flexibility constant since 1992. The shift between the sectors of industry explains the growth of part-time employment by about 10% (=0.9% of the 8.5% increase), while the factors of labour demand jointly explain the increase for about 20% (=1.7% of the 8.5% increase). In case of a changing impact of the exogenous variables the impact of the labour demand variables becomes somewhat smaller. Nevertheless, we conclude that factors of labour demand, the shift between sectors of industry and the increase in the demand for flexible labour, have contributed significantly to the growth of part-time employment.

7 Conclusion and Discussion

The Dutch labour market shows a high rate of part-time employment, and the rate continues growing at a pace faster than for any other European country and the US. In this study, we investigate the driving forces behind this growth. Most studies on working hours and part-time employment focus on the supply side and in particular on the increasing participation rate of women. We investigate the importance of factors of labour demand as well.

Descriptive statistics derived from the Dutch Labour Force Survey 1991-2001 reveal that the growth in part-time employment indeed strongly relates to the growth in female labour force participation. The shift between sectors of industries, from manufacturing to services, explains a part of the growth in part-time employment as well. Although factors of labour supply seem to play a major role, conclusions on the basis of partial effects ('cross-tabulations') are premature. In this study, we consider the impact of factors of labour demand for part-time employment: firms may need flexibility to adjust to the business cycle ('dynamic flexibility') and firms may need flexibility to meet expected and unexpected peaks in the demand for goods and services ('organisational flexibility'). To investigate the importance of the factors of supply and demand simultaneously we formulate a macro-econometric model at the sectoral level of industry.

Considering factors of labour demand, it is clear upfront that adjustments to the business cycle cannot explain the growth of part-time employment in the Netherlands: during the end of the 1990s economic growth was high and firms and employees should have adjusted towards full-time employment. But organisational flexibility can be an important explanation for the growth of part-time employment as the service sector has been growing, the laws on opening hours have been liberalised, and the European policy on product market competition may have led to more uncertainty due to more international competition. Our estimation results of the macro-econometric model confirm the importance of organisational flexibility.

The international literature on human resources management and industrial relations reports an increasing demand and use of flexible work arrangements as well and partly relates this to part-time employment (see for instance Zeytinoglu (1992)). The increasing demand for flexible working arrangements is however an international phenomenon and it is hard to find arguments on why this should be more important for the Netherlands than for other countries. So the need of firms for 'organisational flexibility' it is unlikely to be a major explanation for the rather high growth of part-time employment in the Netherlands compared to other countries.

On the basis of our results, it seems obvious to conclude that that the high growth rate of part-time employment is largely caused by factors of labour supply, in particular by the increasing

female labour force participation. On the one hand, we have to be careful with the interpretation as it may be that female labour force participation in the Netherlands was encouraged by the increasing demand for (part-time) employment. The estimated impact of female labour force participation on part-time employment may therefore be biased upward. On the other hand, we just argued that it is hard to find factors of demand that explain why the growth of part-time employment is high in the Netherlands compared to other countries. Therefore factors of labour supply are nevertheless likely to be the major explanation for the substantial growth of part-time employment in the Netherlands.

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Appendix A: Dutch Labour Force Survey

The Dutch Labour Force Survey (DLFS, 'Enquête Beroepsbevolking') is administrated by Statistics Netherlands and is designed to monitor the labour force. The DLFS is a stratified sample from the population of Dutch inhabitants, excluding those living in institutions.

The sampling procedure of the survey consists of two steps. In the first step, local communities are randomly drawn from the population of all local communities. Large local communities are included in the sample, while small communities are redrawn with probabilities that inversely relate to the number of addresses. In the second step, a certain number of addresses are randomly drawn for each local community. This step uses the Geographic Basic Register which is a list of all addresses in the Netherlands administrated by Dutch Telecom. Because of the stratification, the DLFS is not a random sample. Population means can be estimated by using weights that are provided together with the survey.

The DLFS contains detailed demographic and employment information. Employees provide information on their jobs (but not on salary) while non-employed provide information on their willingness to work and on their job search activities. In the 1990s, non-response rates vary between 40 and 45%, the number of households varies between 45 and 65 thousand, and the number of individuals varies between 90 and 120 thousand individuals.

Appendix B: Dutch Terms of Employment Survey

The Dutch Terms of Employment Survey (DTES, 'Arbeidsvoorwaardenonderzoek') is administrated by the Dutch Ministry of Social Affairs and it is designed to monitor changes in terms of employment. The DTES is a stratified sample from the population of employees in the Netherlands, and it is based on the administrative record of a large number of firms.

The sampling procedure consists of two steps. In the first step, firms are drawn from the firm register of the ministry (which is roughly similar to the database of Statistics Netherlands). In the second step, a number of employees are drawn from the administrated records of the firms. The number of employees drawn depends on the size of the firm, and also on the number of employees that does not fall under a collective bargaining agreement. Because of the stratification, the DTES is not a random sample. Population means can be estimated by using weights that are provided together with the survey.

The DTES contains detailed information wages and fringe benefits, and some information on demographic, socio-economic and firm characteristics. The number of firms is about 1800 per year, while the number of employees is about 45 thousand per year.

Appendix C: Variables on Labour Supply

Decisions on labour supply and part-time employment are made by individuals, and individuals take their family situation into account. As our empirical analysis in this study is on the sectoral level of industry, it is not easy to account for factors of labour supply. As we have only 11 years of observations, aggregated (macro-economic) variables on labour supply are unlikely to give good explanatory power. Ehrenberg (1988) uses sector specific labour supply variables like the fraction of women per sector as explanatory variables. The interpretation of these variables is however problematic as the direction of causality is unclear.

In this study, we use a weighting procedure to calculate sector specific labour supply variables. We construct labour supply variables on the basis of educational needs of a particular sector. The labour force of a sector will be defined on the basis the individuals that fulfil the educational needs of that sector. Note that this group of individuals will include individuals that are employed in other sectors and individuals that are unemployed. This prevents causality from the demand for part-time employment to labour supply as we do not consider individuals that may be working in a sector because they can work part-time in that sector. It does not prevent all problems of causality, as in the end individuals may have a certain education because they want to work part-time later on in their career.

Consider the employed in the Dutch Labour Force Survey (DLFS) with a number of $j=1, \dots, N$ individuals. Define educational weight α_{it}^e for sector i at time t and level and direction of education e as:

$$\alpha_i^e = \frac{\sum_{j=1, \dots, N} I(x_j^i = 1, x_j^e = 1)}{\sum_{j=1, \dots, N} I(x_j^i = 1)}$$

with (x_{jt}^i, x_{jt}^e) dummies for individual j working in sector i and having education level and direction e . The educational levels vary from ‘basic education’, ‘lower vocational’, ‘medium vocational’, ‘higher vocational’ to ‘scientific education’, while the directions vary from ‘general’, ‘technical’, ‘economic’, ‘health care’ to ‘other’. We observe 20 combinations as not all combinations exist in the Dutch education system. To give some examples, a medium vocational education has a weight of 0.386 for the sector ‘health care’ and a weight of 0.016 for the sector ‘agriculture’. Per sector the weights add up to one.

Next, consider the labour force (including unemployed) observed in the DLFS with a number of $j=1, \dots, M$ individuals. Every individual gets per sector a weight attached that belongs to his or her kind of education. Define weight α_{ijt} for individual j and sector i at time t :

$$\alpha_{ij} = \sum_{e=1, \dots, E} \alpha_i^e I(x_j^e = 1)$$

We use the individual weights to construct labour supply variables as weighted averages over the population of individuals that fulfil the educational need of a sector. For example, an individual with educational direction ‘health care’ will be important for the labour force of that sector, while the individual will be much less important for a sector like ‘agriculture’. Define x_{it}^w as the fraction of women in the labour force of sector i at time t :

$$x_i^w = \frac{\sum_{j=1, \dots, M} \alpha_{ij} I(x_j^v = 1)}{\sum_{j=1, \dots, M} \alpha_{ij}}$$

with x_j^v a dummy variable for individual j on being a woman.

Besides the fraction of women in the labour force of a sector, we calculate the fractions of women that have certain ages and have children among the total female labour force. The same we do for men among the total male labour force. These variables allow for gender specific effects of age and children in the empirical analysis of Section 5.