



**Universitat Autònoma
de Barcelona**

PART-TIME WORK IN EUROPE

IRIS CASTELLS HUGAS

ADMINISTRACIÓ I DIRECCIÓ D'EMPRESES

ANGELA FIEDLER

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SUMMARY

For the past two decades part-time employment has been increasing in Europe. The aim of this thesis is to explore several variables which might explain differences in the incidence of part-time work across European countries.

First of all, I develop several hypotheses from economic literature taking into account empirical evidence in order to analyse the correlation of selected variables with the share of part-time workers at the country level. I take two different perspectives; one is from the supply-side and the other one from demand-side. Inside each perspective I suggest several variables which I expect to have a relevant correlation with part-time employment. The variables from the supply side are female labour force participation and elderly in the work and from the demand side the share of the service sector in the economy.

I use statistic data from *Eurostat* and *The World Bank* to check the expectations at the country level for European countries. I try to link my hypothesis to economic literature as Becker's time allocation model. I use the software *Gretl* to analyse the correlation of the variables mentioned before with the share of part-time workers, first at the cross-country level and in a second step at the cross-time dimension for a selected subset of countries

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1. INTRODUCTION

1.1. Analysis of the part-time work supply and demand

In order to understand the behaviour of the part-time employment across different countries in Europe, it is important to analyse different part-time variables from two perspectives; supply side and demand side. I expect to find positive points which make part-time attractive for employees (supply-side) and other interesting points which are important for employers (demand-side). By studying these variables we might be able to appreciate the evolution of part-time employment.

1.1.1. Part-time work from the supply side perspective

Theory of the allocation of time

First of all to comprehend why people decide if they want a full or part-time job we can take a look at an economic theory called *time allocation model*¹. This model emphasises the role of individual decisions in weighing up the costs and benefits of working relative to other activities. According to the model *a person will engage in*

*work up to the point where the benefits they derive from the income and personal fulfilment from an extra hour of work just equals the cost to them of losing this hour to spend on other activities, such as childcare, recreation or voluntary work*².

Figure 1 shows the trade-off between the time spend on work and non-work activities. The line called C_1 is the effective wage rate or budget constraint. The curve I_1 represents the indifference curve that is people's preferences between work and non-work

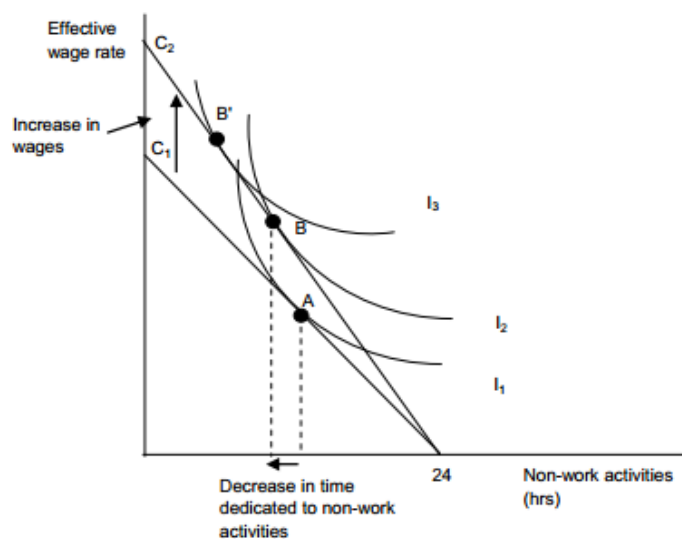


Figure 1: Time allocation model

¹ "A theory of the allocation of time" written by Gary S. Becker, published in *The Economic Journal* Vol. 75, No. 299 (September 1965).

² Article called "Lifestyle choices and work".

activities. People choose point A when working a specific amount of hours they get the highest level of satisfaction. If there is an increase in the wage rate and so an individual work more hours the budget constraint would be C_2 and the highest level of satisfaction would go from point A to point B.

From the supply side perspective we can find variables like the followings:

- **Why women supply more part-time work**

I expect to see a higher number of females than males in part-time employment because I think that women might have a higher opportunity cost by taking a full-time job.

The main characteristics would be:

- Better life-work balanced
- Take care of their own children
- Take care of adult people of the family

It could be noticeable in the data that in countries where the childcare is expensive or it does not last as the same working hours of parents there would be more part-time workers. Nevertheless, we can find differences in time allocations by men and women.³ The latest explanations say that household members determine the allocation of time. The key factor of bargaining power in the household is potential earnings.

Gary Becker argued that the opportunity cost of childcare rises when women increase investment in human capital and enter the workforce. Furthermore, the increased rate of

return to education raises the desire to provide children with formal and costly education. The impact of these two variables is to lower fertility rates. Becker also

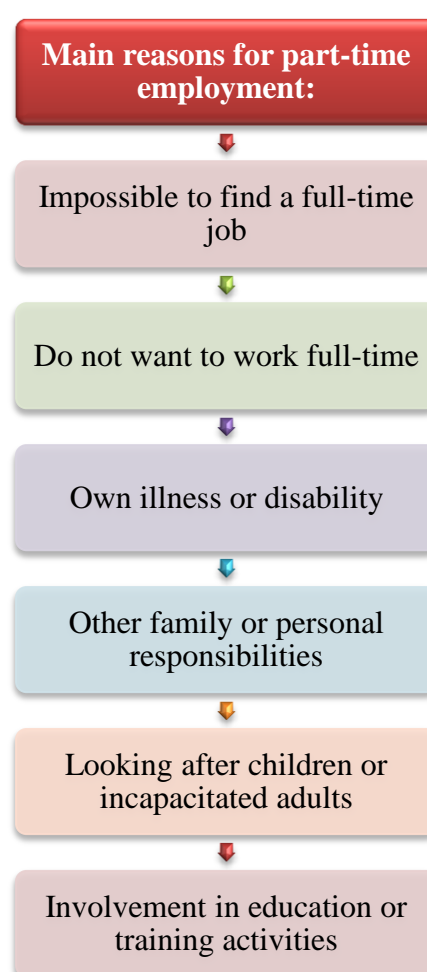


Figure 2: Main reasons in Europe.
Source: Eurostat

³Becker 1965 and Gronau 1973 suggested that women have comparative advantage in home duties and childcare.

supposed that women were more productive at home meaning that women's investment in children is worthwhile.

I expect to see a positive correlation between the share of females and the share of total part-time employment because this kind of jobs might be attractive for some women depending on the country they live (with its policies and quality of life).

- **Why old people supply more part-time work**

Older people rather prefer to work part-time for two reasons:

1. Health problems
2. In order to use attractive gradual retirement schemes.

In countries like Germany it is increasing the number of old people working to earn more money, especially women. It is called **mini-jobs** and it offers an extra salary to people who don't have enough resources to live with their pension.

I expect to see a positive relation between the two variables but I do not think that the correlation is high because there are a lot of old people who have a high cost of opportunity so they prefer to be retired and do not want to work more.

1.1.2. Part-time work from the demand side perspective

From demand side I consider service industry as a variable to analyse:

- **Why employers in the service sector demand more part-time workers**

In certain services employers demand part-time workers because they need them to work only rush hours. For that reason it is important that workers can be flexible distributing their timetable. The value added in this sector is not so high so most of the costs are variable instead of fixed.

In education, for example, teachers usually have to work different hours each day. This means that one day they might only work in the morning and the next one only in the afternoon or both.

Likewise in health and social work, doctors and nurses must have a flexible schedule because they need to have a good life quality in order to perform in their job. That's the

reason why in health and well-being services workers are really concerned about their working conditions and intensity.

As I mentioned before, employers need to organize the workload concentrated on only a few hours per day or different kind of variations either per day, per month or per year. This is an organizational need and employers' aim is to bring manpower levels in the line with work supply of work.⁴

Since I think that service sector is the one that uses more part-time workers than the others I expect to see a positive correlation between both variables. However, I suppose that the correlation is not so high because there are countries in Europe where the principle economic activity is related to service sectors whereas in other countries can be the agriculture.

⁴ McRae 1995: "Women are more likely than men to work in workplaces that experience substantial workload fluctuations per day and per year."

2. DATA

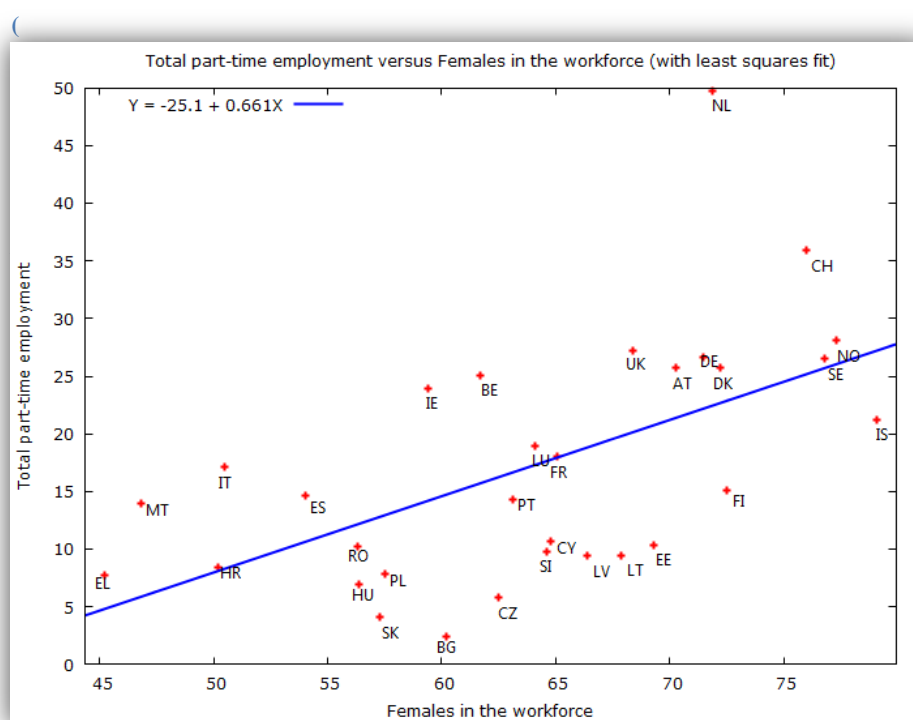
In this part of the project I use the data found in *Eurostat.com* in order to see the correlation between the share of total part-time workers in country level and the variables explained before. I use an econometric software called *Gretl* with the aim to represent graphically the relation among the different variables, check the correlation coefficient and observe the statistics summary⁵.

2.1 Correlations variables of the supply-side

It is time to analyse the variables of the supply-side, females in the workforce and old-people in the workforce, so that I can verify if my expectations exposed before are correct.

2.1.1. Females in the workforce

In Plot 1 we can see a graph where y (share of total part-time workers) is the dependent or explained variable and x (female employment rate) is the independent or explanatory variable.



Plot 1: Rate of total part-time employment versus female employment rate in Europe (2012). Data source: Eurostat

⁵ Statistics summary are exposed in Appendix 2.

As I expected, there is a positive and lineal relation between the share of total part-time workers and the female employment rate. The tendency is that in countries where there is a high percentage of part-timers there is also a high percentage of women who work. Nevertheless there are some other countries where there is a high percentage of females in the workforce but a low percentage of total part-time employment. The fitted line which represents this model is $y = -25.1 + 0.661x$ (left top in the Plot 1). Therefore the slope is 0.661 and we can interpret that if a country increase the percentage of females in the workforce by one point (1% higher) we expect that its percentage of total part-time employment will increase 0.661 points (0.661% higher).⁶

Model 1: OLS, using observations 1-31				
Dependent variable: Total				
	coefficient	std. error	t-ratio	p-value
-----	-----	-----	-----	-----
const	-25.0897	11.4175	-2.197	0.0361 **
Females	0.661436	0.177112	3.735	0.0008 ***
Mean dependent var	17.14194	S.D. dependent var	10.49040	
Sum squared resid	2229.316	S.E. of regression	8.767722	
R-squared	0.324748	Adjusted R-squared	0.301463	
F(1, 29)	13.94691	P-value(F)	0.000818	
Log-likelihood	-110.2568	Akaike criterion	224.5135	
Schwarz criterion	227.3815	Hannan-Quinn	225.4484	

Gretl Output 1: Ordinary Least Squares: Rate of total part-time employment versus female employment rate in Europe (2012). Data source: Eurostat

Looking to the previous plot and the coefficient of determination (R-squared of the regression in Gretl Output 1) we can detect the correlation between the share of total part-time workers and the female employment rate in Europe. However we cannot say anything about the causality since it could go into both directions; on one hand in countries where there is a high number of part-time jobs a high number of women could be interested in work rather than stay at home, as they would see the advantages it has to work part-time. So, women could keep doing other activities and earning some money with a lower opportunity cost that they would have in a full-time job. On the other hand due to the pressure from skilled females in the workforce the firm would try to adjust the number of working hours to the preferred ones by workers.

⁶ We can interpret the effect that “Part-time females” has respected to “Total part-time workers” (and for the following patterns) only under the assumption that the regressor “Part-time females” and the disturbance are not correlated. It means, under the assumption that the variation of “Part-time females” in the sample it has occurred in *ceteris paribus* conditions.

The coefficient of determination is 0.32 which indicates a poor fit of the Ordinary Least Squares (OLS) regression line: very little of the variation in the y_i is captured by the variation in the \hat{y}_i (which all lie on the OLS regression line). Since it is a number really close to 0 almost all data points do not lie on the same line. Multiplying R^2 by 100 we deduce that the variation in the share of total part-time is explained by 32.47% of the female employment rate.

The P-value is 0.0008 as we can see in Gretl Output 1. This value is smaller than 0.01 so the coefficient is significant at the 1% level which means that female labour force variable shows a very strong correlation with the share of part-time workers.

Netherlands is the highest point in the Plot 1; with a 49.8% of total part-timers and a 71.9% females in the workforce in 2012, followed by Switzerland with a 35.9% of total part-time workers and a 76% women are employed. While Bulgaria is the country which has the lowest rate of part-time employment (2.4%), but it has 60.2% females in the workforce. Greece has a low rate of part-time employment (7.7%) and the lowest rate of females in the workforce with a 45.2%. Finally, in the middle of the plot we can find Luxemburg for example, with a 19% of total part-timers and 64.1% participation of females in the workforce.

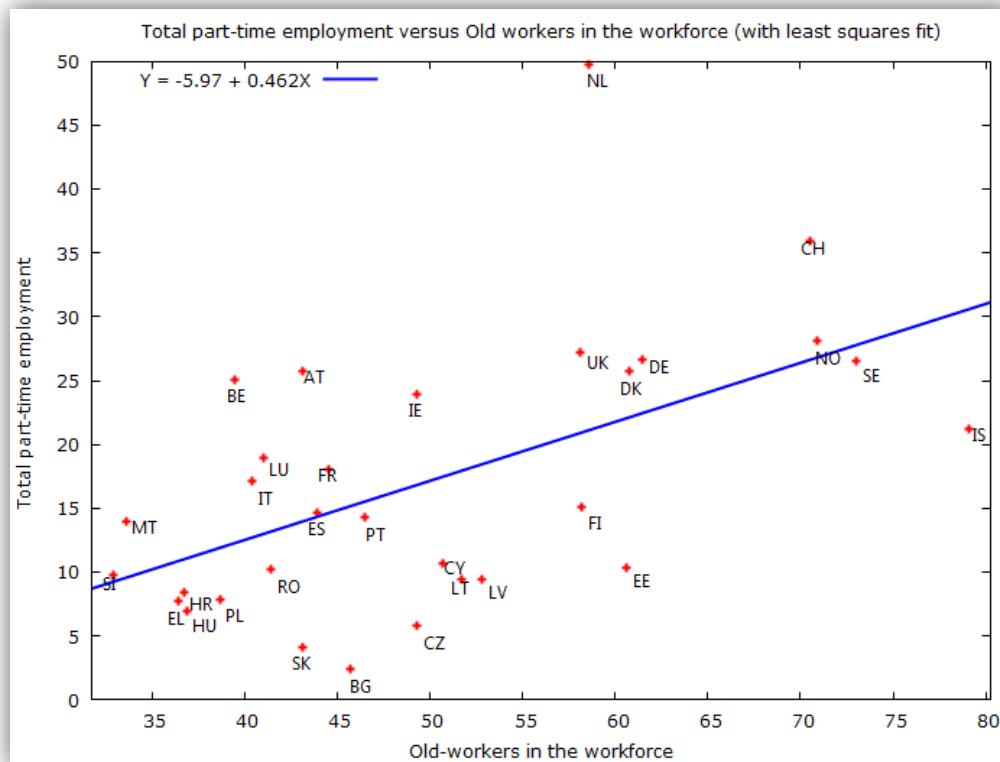
2.1.2. Old people in the workforce

In Plot 2 we can observe a graph where y (share of total part-time employment) is the dependent or explained variable and x (elderly employment rate aged 55 to 64 years old) is the independent or explanatory variable.

The fitted line is $y = -5.97 + 0.462x$ (left top in Plot 2) and it represents a positive and lineal relation, as I expected, between the share of total part-time employment and the elderly employment rate. The slope is 0.462 so I observe that a country which increases the percentage of old-people workers by one point (1% higher) would increase its percentage of total part-time workers by 0.462 points (0.462% higher).

In the scatterplot of this sample we can see that the majority of the points are centred in the left bottom. I guess there is a low rate of old-people working and also a low rate of

part-time employment. We could think that there is a tendency in a few countries like Switzerland, Sweden, Norway and Iceland where a high rate of old-people is working and a high rate has a part-time job.



Plot 2: Rate of total part-time employment versus elderly employment rate in Europe (2012).
Data source: Eurostat

Considering the results of the Plot 2 and the coefficient of determination (R^2 -squared of the regression in Gretl Output 2) we can identify the correlation between the share of total part-time employment and the elderly employment rate in Europe in 2012. The coefficient of determination is 0.29 which shows that the Ordinary Least Squares (OLS) regression line does not fit the data very well. It is a number close to 0 so the data points do not lie on the same line. If we multiply R^2 by 100 we can deduce that the elderly employment rate explains 29.69% of the variation in the share of total part-time.

The coefficient is significant at the 1% level because the p-value is 0.0015 (Gretl Output 2) smaller than 0.01.

Model 1: OLS, using observations 1-31
Dependent variable: Total

	coefficient	std. error	t-ratio	p-value	
-----	-----	-----	-----	-----	
const	-5.96771	6.79503	-0.8782	0.3870	
Old_workers	0.462372	0.132098	3.500	0.0015	***
Mean dependent var	17.14194	S.D. dependent var	10.49040		
Sum squared resid	2320.934	S.E. of regression	8.946071		
R-squared	0.296997	Adjusted R-squared	0.272755		
F(1, 29)	12.25159	P-value(F)	0.001524		
Log-likelihood	-110.8810	Akaike criterion	225.7621		
Schwarz criterion	228.6300	Hannan-Quinn	226.6969		

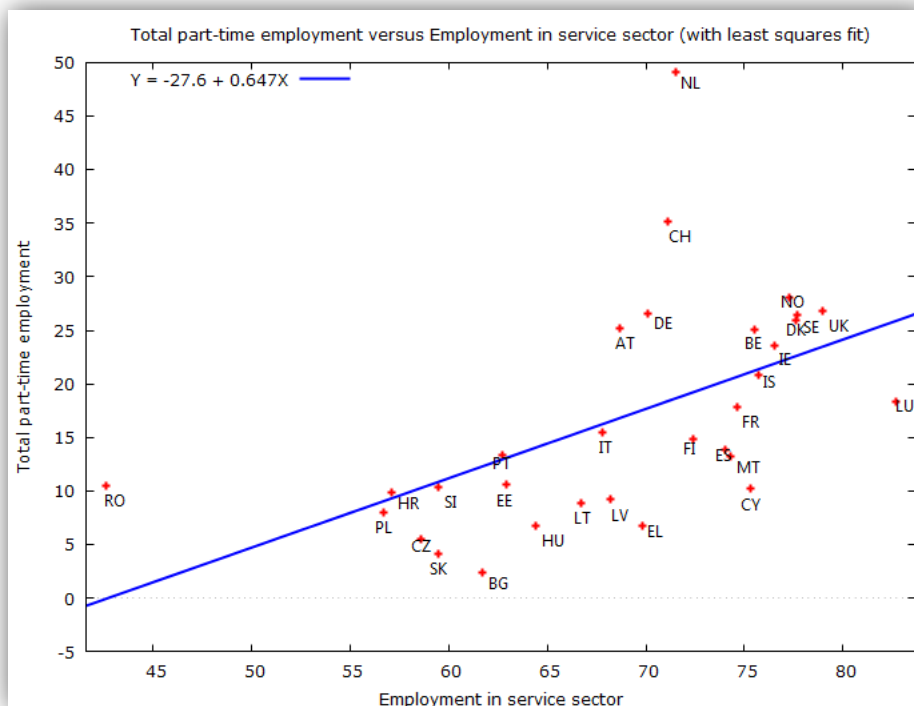
Gretl Output 2: Ordinary Least Squares: Rate of total part-time employment versus elderly employment rate in Europe (2012). Data source: Eurostat

Iceland is the country with the highest rate of old-people in the workforce with a 79.1% and a 21.2% of total part-time workers. The second country with a high rate of old-people working is Sweden with a 73% and a share of 26.5% of part-time employment. Slovenia has the lowest rate of old-people in the workforce (32.9%) and 9.8% share of total part-time employment. Finally, we can find United Kingdom in the middle of the scatterplot with a 27.2% of part-time workers and 58.1% of old-people in the workforce.

2.2 Correlations variables of the demand-side

2.2.1. Service sector

In Plot 3 we can see a graph where y (share of total part-time employment) is the dependent or explained variable and x (share of employment in service sector) is the independent or explanatory variable. For this plot I use the data from 2011 since it is the last year with all the countries data available.



Plot 3: Rate of total part-time employment versus rate of employment in service sector in Europe. (2011). Data source: World Development Indicators, The World Bank

As I expected there is a positive and lineal relation between the share of total part-time employment and the rate of employment in service sector. Almost all points are in the left side of the scatterplot. We can observe that in countries where the rate of employment in the service sector is high, the rate of total part-time employment is high too. The fitted line is $y = -27.6 + 0.647x$ (left top in Plot 3) so the slope is 0.647. Hence, we could interpret that a country which increases the percentage of employment in service sector by one point (1% higher) will increase its percentage of total part-time employment by 0.647 points (0.647% higher).

By looking at the coefficient of determination (R-squared in Gretl Output 3) we find the correlation between the share of total part-time workers and the share of employment in service sector in Europe in 2011. The coefficient of determination is 0.28 which indicates a poor fit of the Ordinary Least Squares (OLS) regression line. Since it is a number really close to 0 almost all data points do not lie on the same line. Multiplying R^2 by 100 we could think that the variation in the share of total part-time employment is explained by 28.98% of the share of employment in service sector.

In this case the coefficient is significant at the 1% level because the p-value is 0.0018 (Gretl Output 3) smaller than 0.01.

In the scatterplot Romania is the country with the lowest rate of employment in service sector with 42.6%. This country has a rate of total part-time employment of 10.5% in 2011. On the opposite side we can find Luxemburg which has a rate of 82.7% of employment in service sector and 18.4% of share of part-time employment. Luxemburg is followed by United Kingdom which has the second higher rate of employment in service sector (79%) and 26.8% rate of total part-time workers.

Model 1: OLS, using observations 1-31				
Dependent variable: Part_time				
	coefficient	std. error	t-ratio	p-value
-----	-----	-----	-----	-----
const	-27.6406	13.0391	-2.120	0.0427 **
service_sector	0.647293	0.188147	3.440	0.0018 ***
Mean dependent var	16.88065	S.D. dependent var	10.37453	
Sum squared resid	2293.047	S.E. of regression	8.892165	
R-squared	0.289843	Adjusted R-squared	0.265354	
F(1, 29)	11.83602	P-value(F)	0.001783	
Log-likelihood	-110.6937	Akaike criterion	225.3873	
Schwarz criterion	228.2553	Hannan-Quinn	226.3222	

Gretl Output 3: OLS: Rate of total part-time employment versus Rate of employment in service sector in Europe (2011). Data source: World Development Indicators, The World Bank

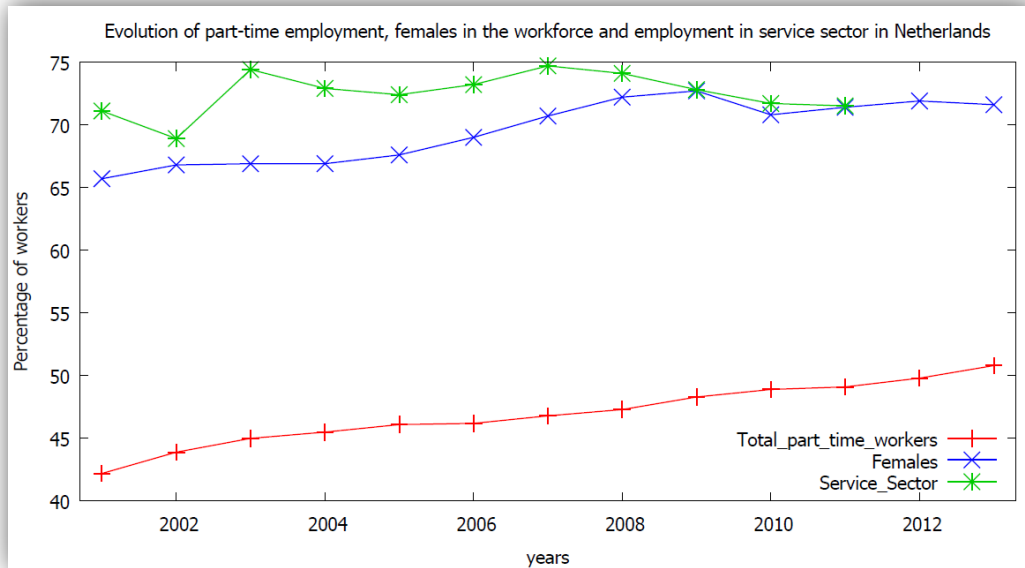
2.3. Trends in Europe

Observing all the data used before and the variables analysed, it is interesting to study the top and the bottom countries with respect to part-time employment; Netherlands and Bulgaria. The first one is the country which has the highest rate of part-time employment, whereas the second one has the lowest rate of part-time in Europe⁷.

In this way we can see the trends of two countries from the supply side and the demand side. I analyse the variable of females in the workforce, the variable of the employment in service sector and the variable of part-time employment in order to observe the evolution of this two countries. The time period used is from 2001 to 2013⁸.

2.3.1. Netherlands

First of all, I compute a plot with the three variables; part-time employment, females in the workforce and employment in service sector in Netherlands over the last 13 years.



Plot 4: Evolution of part-time employment, females in the workforce and employment in service sector in Netherlands. Time period: from 2001 to 2013. Data source: Eurostat and The World Development Indicators (The World Bank)

⁷ Reference year: 2012

⁸ The time period of the variable of employment in service sector is from 2001 to 2011 because there is no more data available for Netherlands.

In Plot 4 in y-axis variable we can see the percentage of workers and in x-axis we find the time period of the data which is from 2001 to 2013.

First of all, the evolution of the rate of part-time employment has increased 8.6% over the last 13 years from 42.2% in 2001 to 50.8% in 2013. It is remarkable the constant increase during these years in Netherlands.

The variable of females in the workforce seems to have also a persistent increase until 2010 which decrease almost 2% from 72.7% to 70.8%. For the following years the rate of females increases again slowly until 2013 which decreases by 0.3%. The total increase from 2001 to 2013 is 5.9%.

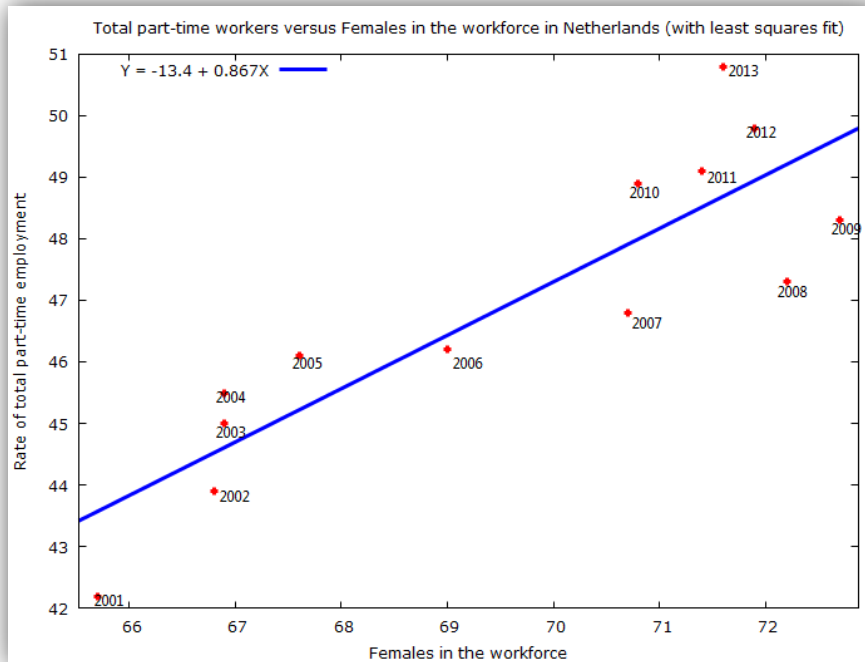
The employment in service sector has more fluctuations than the two variables explained before. In 2002 its percentage decreases 2.2% however the following year there is an increase 5.5% from 68.9% to 74.4%. Then during two years the rate decrease again but not so much. In 2007 it reaches the highest rate over the 13 years with 74.7% of employment in service sector. The following years the rate decreases achieving in 2011 a 71.5%. The rate of this variable has decrease from 2001 to 2011 by 0.4%.

- **From the supply side**

In Plot 5 we can see a graph where y (rate of total part-time workers in Netherlands) is the dependent or explained variable and x (rate of females in the workforce in Netherlands) is the independent or explanatory variable.

Plot 5 shows the positive and lineal relation between the rate of total part-time employment and the rate of females in the workforce in Netherlands from 2001 to 2013. The fitted line of this pattern is $y = -13.4 + 0.867x$ (left top in the Plot 5) so the slope is 0.867. Over the past decade we observed that on average for one percentage point more of females in the workforce in Netherlands (1% higher) its percentage of total part-time workers increase by 0.867 points (0.867% higher).

We can also observe the effect of the decline of females in the workforce that took place in 2010 as we detected in Plot 4. The increasing rate of part-time employment is shown in the last two plots of Netherlands reaching the maximum rate in 2013 by 50.8%. Nevertheless, last year was not the one with the highest rate of females in the workforce; here we can see clearly that in 2009 peaks.



Plot 5: Rate of total part-time employment versus Females in the workforce in Netherlands. Time period: from 2001 to 2013. Data source: Eurostat

The coefficient of determination (R-squared of the regression in Gretl Output 4) we can identify the correlation between the rate of total part-time workers and the rate of females in the workforce in Netherlands. The coefficient of determination is 0.76 (close to 1) hence a lot of the data points lie on the same line and the OLS provides good fit to the data. If we multiply R^2 by 100 we can affirm that the rate of females in the workforce explains 76.42% of the variation in the rate of total part-timers in Netherlands.

As we can see in Gretl Output 4 the p-value is 9.29e-05 (smaller than 0.01) so female employment rate coefficient is significant at the 1% level which it means that this variable shows a very strong correlation with the share of part-time workers.

In overall I observe that in Netherlands both variables have a tendency to grow with similar rates. The total increase analysed of part-time employment is $1.20 = \left(\frac{50.8}{42.2}\right)$ and the total rise analysed of females in the workforce is $1.09 = \left(\frac{71.9}{65.7}\right)$.

```

Model 1: OLS, using observations 2001-2013 (T = 13)
Dependent variable: Total_part_time_workers

      coefficient    std. error    t-ratio    p-value
-----
const      -13.4200      10.1084      -1.328     0.2112
Females      0.867463      0.145247      5.972     9.29e-05 ***

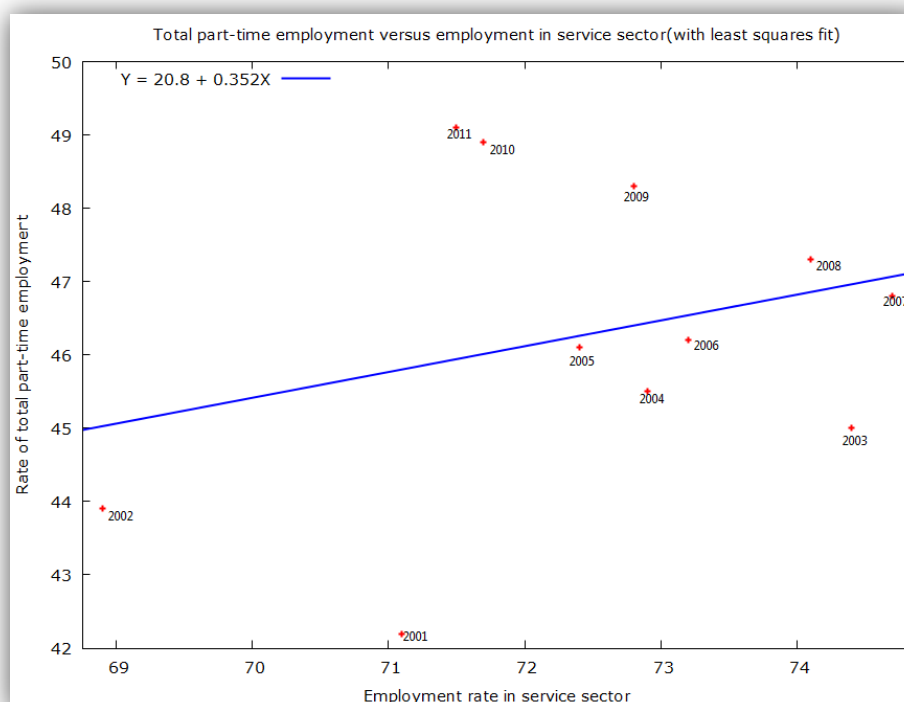
Mean dependent var    46.91538    S.D. dependent var    2.455893
Sum squared resid     17.05945    S.E. of regression     1.245335
R-squared              0.764297    Adjusted R-squared     0.742870
F(1, 11)              35.66891    P-value(F)             0.000093
Log-likelihood         -20.21261    Akaike criterion       44.42522
Schwarz criterion      45.55512    Hannan-Quinn           44.19297
rho                   0.641072    Durbin-Watson           0.681071

```

Gretl Output 4: OLS: rate of total part-time work versus rate of females in the workforce in Netherlands. Time period: from 2001 to 2013. Data source: Eurostat

- **From the demand side**

In Plot 6 we can see a graph where y (rate of total part-time employment in Netherlands) is the dependent or explained variable and x (rate of employment in service sector in Netherlands) is the independent or explanatory variable.



Plot 6: Rate of total part-time employment versus rate of employment in service sector in Netherlands. Time period: From 2001 to 2011. Data source: Eurostat and The World development indicators (The World Bank)

The relation between the rate of total part-time employment and the rate of employment in service sector is positive and lineal in Netherlands from 2001 to 2013. The fitted line of pattern of Plot 6 is $y = 20.8 + 0.352x$ and so the slope is 0.352. Therefore we could interpret that over the past 11 years we observed that on average for one percentage point of employment in service sector in Netherlands (1% higher) increase its percentage of total part-time workers by 0.352 points (0.352% higher).

In Plot 6 we can see the fluctuations among the last 11 years of employment rate in service sector.

Model 1: OLS, using observations 2001-2011 (T = 11)
Dependent variable: Total_part_time_workers

	coefficient	std. error	t-ratio	p-value
-----	-----	-----	-----	-----
const	20.7924	29.1992	0.7121	0.4945
Service_Sector	0.351740	0.402548	0.8738	0.4049
Mean dependent var	46.30000	S.D. dependent var	2.116601	
Sum squared resid	41.29667	S.E. of regression	2.142083	
R-squared	0.078199	Adjusted R-squared	-0.024223	
F(1, 9)	0.763499	P-value(F)	0.404947	
Log-likelihood	-22.88420	Akaike criterion	49.76840	
Schwarz criterion	50.56419	Hannan-Quinn	49.26677	
rho	0.757632	Durbin-Watson	0.295150	

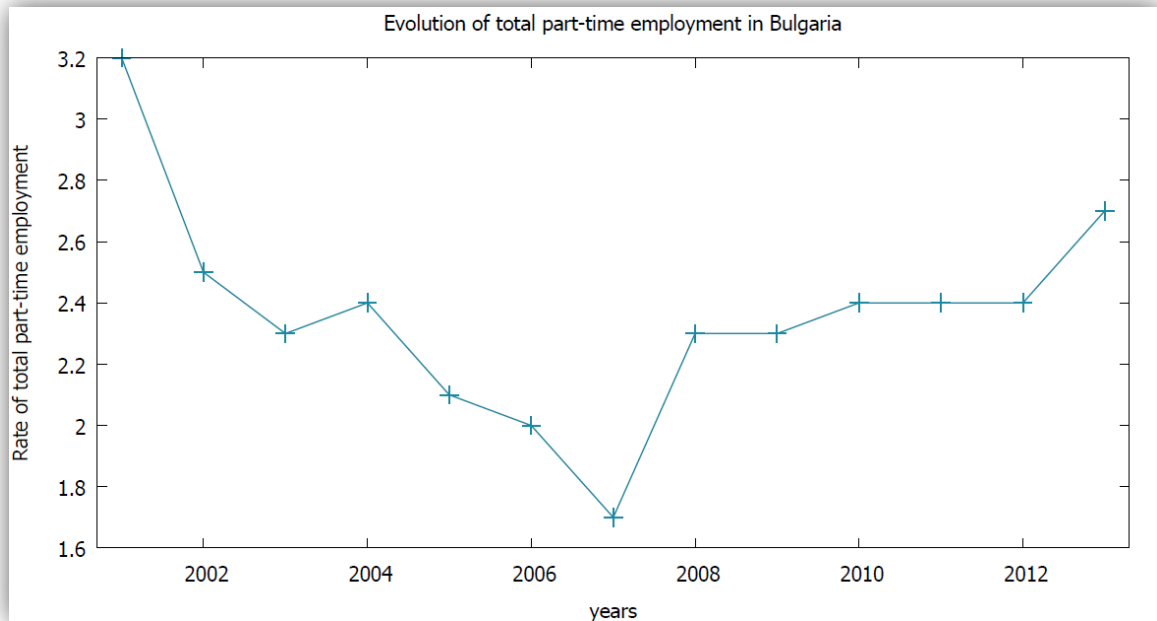
Gretl Output 5: OLS: Rate of total part-time employment versus employment rate in service sector in Netherlands. Time period: from 2001 to 2011. Data source: Eurostat and The World Development Indicators (The World Bank)

If we check the coefficient of determination (R-squared of the regression in Gretl Output 5) we find the correlation between the rate of total part-time employment and the rate of employment in service sector in Netherlands. The coefficient of determination is 0.07 and as it is really close to 0 the OLS provides a poor fit to the data; The data points does not lie on the same. By multiplying R^2 by 100 we can observe that the variation in the rate of total part-time employment is explained by 7.81% of the employment rate in service sector in Netherlands.

The coefficient is not significant in Netherlands because the p-value is 0.4049 (Gretl Output 5) which is bigger than 0.1.

2.3.2. Bulgaria

I compute a plot (Plot 7) with only part-time employment variable in Bulgaria because the rates are really low compared to the other two variables. The second plot (Plot 8) shows the evolution of the rate of females in the workforce and the employment rate in service sector in Bulgaria from 2001 to 2013.



Plot 7: Evolution of the rate of total part-time employment in Bulgaria. Time period: From 2001 to 2013. Data source: Eurostat

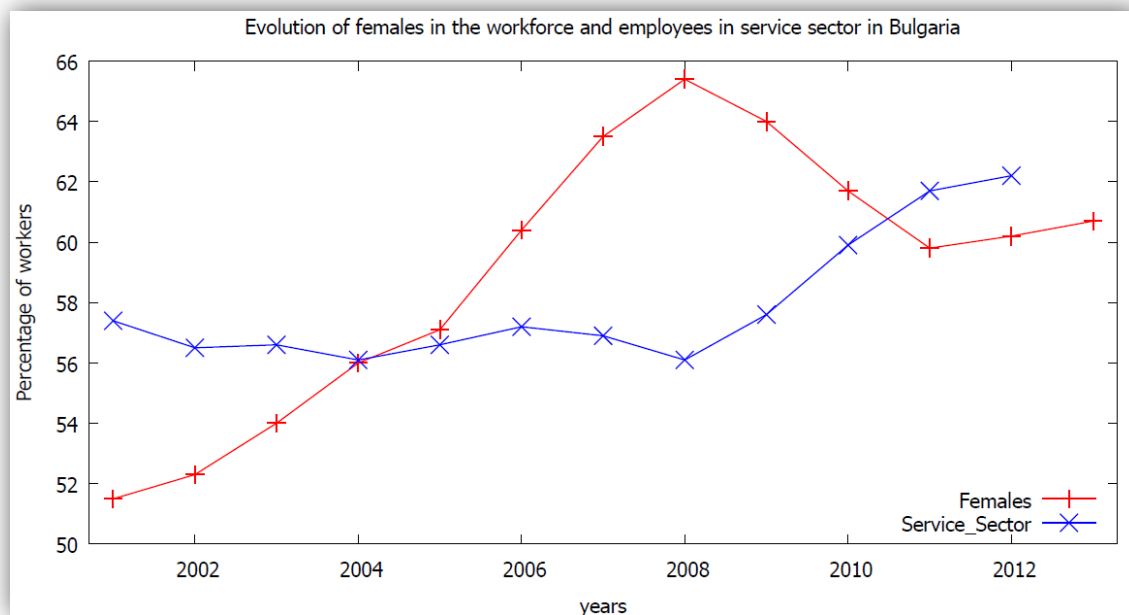
In Plot 7 in y-axis variable we can see the percentage total part-time employment and in x-axis we find the time period of the data which is from 2001 to 2013.

In Bulgaria the evolution of total part-time employment has been really irregular along the years. I divide Plot 7 in three parts; the first one is from 2001 to 2007 which is characterized by a negative slope. The decrease is about 1.5% in the first section although in 2004 there is increase of 0.1%. The second section is from 2007 to 2008 which the slope starts to be positive. The main characteristic is the rise from 1.7% to 2.3% in only one year. The last section goes from 2008 to 2013 that in the plot we can see a stable period with a rise in 2012 of 0.3%.

In Plot 8 in y-axis variable we can see the percentage of workers and in x-axis we find the time period of the data which is from 2001 to 2013.

Analysing the evolution of females' rate in the workforce in Bulgaria (Plot 8) we can observe big rise from 2001 to 2008 of a 13.9%. The period that goes from 2008 to 2011 is characterized by a diminution of the females' rate in the workforce of 5.6%. The three last years there is a growth reaching a 60.7% of females in the workforce in 2013.

The percentage of workers in service sector in Bulgaria is a bit constant from 2001 to 2008 with small fluctuations. Then, as we can see in Plot 8, there is a growth from 56.1% in 2008 to 62.2% in 2012 in this sector.

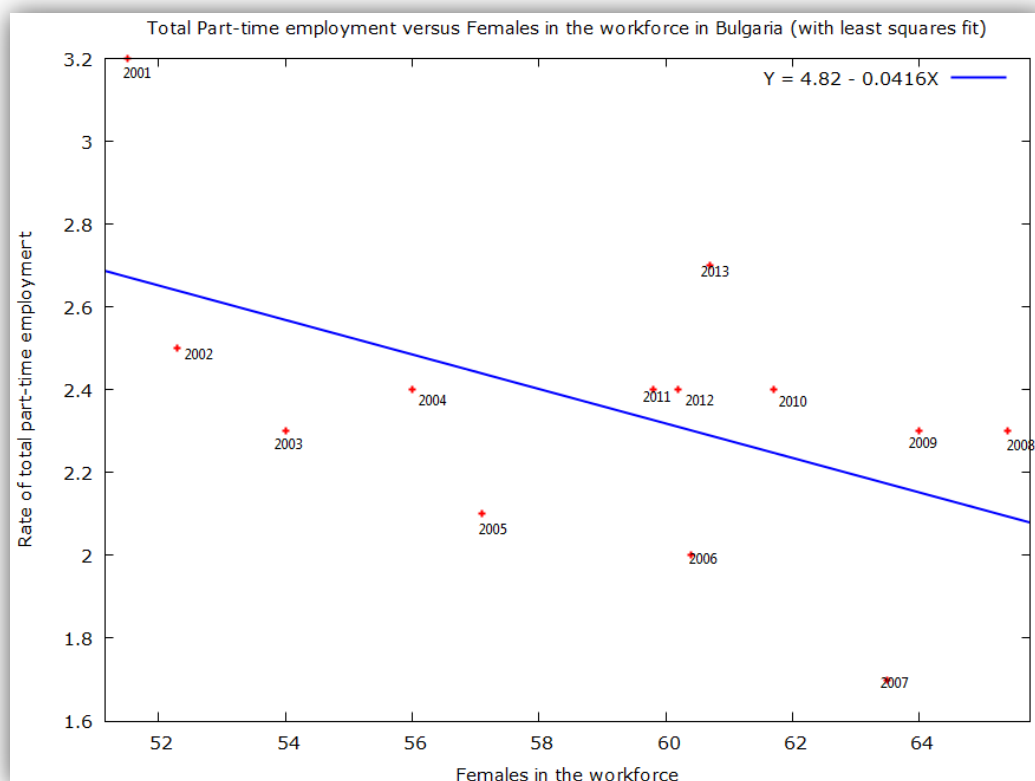


Plot 8: Evolution of females' rate in the workforce and employment rate in service sector in Bulgaria. Time period: from 2001 to 2013. Data source: Eurostat and The World Development Indicators (The World Bank)

- **From the supply side**

In Plot 9 we can observe a graph where y (rate of total part-time employment in Bulgaria) is the dependent or explained variable and x (rate of females in the workforce in Bulgaria) is the independent or explanatory variable.

In this scatterplot we can notice that both variables have a lineal relation from 2001 to 2013 with a negative slope. The value of the slope is -0.04 and the fitted line of this pattern is $y = 4.82 - 0.0416x$ (right top in Plot 9). We can interpret that over the last 13 years we observe that on average for one percentage point (1% higher) of the rate of females in the workforce in Bulgaria its percentage of total part-time employment decreases 0.04 points (0.041% lower).



Plot 9: Rate of total part-time employment versus rate of females in the workforce in Bulgaria. Time period: from 2001 to 2013. Data source: Eurostat

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Model 2: OLS, using observations 2001-2013 (T = 13)
Dependent variable: Total_Part_time

      coefficient    std. error    t-ratio    p-value
-----
const      4.81614      1.19593      4.027      0.0020 ***
Females    -0.0416251     0.0202271    -2.058      0.0641  *

Mean dependent var      2.361538    S.D. dependent var      0.352464
Sum squared resid       1.076375    S.E. of regression      0.312813
R-squared                0.277973    Adjusted R-squared      0.212335
F(1, 11)                4.234895    P-value(F)              0.064099
Log-likelihood           -2.252424    Akaike criterion        8.504848
Schwarz criterion        9.634746    Hannan-Quinn            8.272603
rho                     0.298436    Durbin-Watson           1.081451
  
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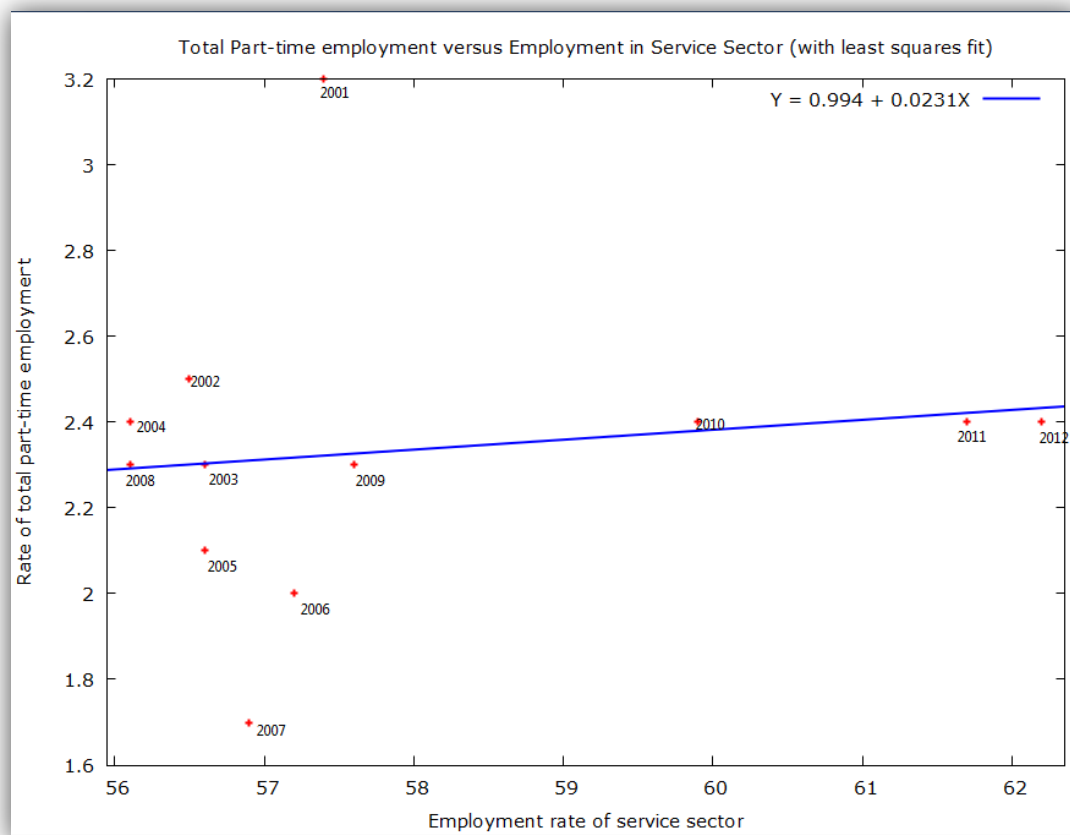
Gretl Output 6: OLS: Rate of total part-time employment versus females'rate in the workforce. Time period: From 2001 to 2013. Data source: Eurostat

To identify the correlation between both variables of Bulgaria we have to take a look to the coefficient of determination (R-squared of the regression in Gretl Output 6). The coefficient of determination is 0.27 which is really close to 0. Therefore the OLS provides a poor fit to the data and the majority of data points do not lie on the same line. By multiplying R^2 by 100 we could interpret that the variation in the rate of total part-timers in Bulgaria is explained by 27.79% of the females' rate in the workforce in Bulgaria.

Females in the labour force is a significant coefficient at the 10% level because the p-value is 0.0641 (Gretl Output 6) smaller than 0.1.

- **From the demand side**

In Plot 10 we can see a graph where y (rate of total part-time employment in Bulgaria) is the dependent or explained variable and x (rate of employment in service sector in Bulgaria) is the independent or explanatory variable.



Plot 10: Rate of total part-time employment versus rate of employment in service sector. Time period: from 2001 to 2012. Data source: Eurostat and The World Development Indicators (The World Bank)

In Bulgaria' scatterplot we can observe the slope is really low. In fact, it is 0.0231 and the fitted line of this pattern is $y = 0.994 + 0.0231x$ (right top in Plot 10). The relation is lineal and positive between the two variables analysed. We can interpret that over the last 12 years we observe that on average for one percentage point (1% higher) of the employment rate in service sector in Bulgaria its percentage of total part-time employment increase by 0.023 points (0.023% higher).

Model 1: OLS, using observations 2001-2012 (T = 12)
Dependent variable: Total_Part_time

	coefficient	std. error	t-ratio	p-value
const	0.994010	2.98160	0.3334	0.7457
Service_Sector	0.0231317	0.0514634	0.4495	0.6627
Mean dependent var	2.333333	S.D. dependent var	0.352480	
Sum squared resid	1.339603	S.E. of regression	0.366006	
R-squared	0.019803	Adjusted R-squared	-0.078217	
F(1, 10)	0.202031	P-value(F)	0.662672	
Log-likelihood	-3.872060	Akaike criterion	11.74412	
Schwarz criterion	12.71393	Hannan-Quinn	11.38506	
rho	0.301987	Durbin-Watson	0.819946	

Gretl Output 7: OLS: Rate of total part-time employment versus rate of employment in service sector. Time period: from 2001 to 2012. Data source: Eurostat and The World Development Indicators (The World Bank)

The correlation between the two variables of Bulgaria we need to know coefficient of determination (R-squared of the regression in Gretl Output 7). The coefficient of determination is 0.01 so the OLS provides a poor fit to the data and the majority of data points do not lie on the same line because R-squared is really close to 0. By multiplying R^2 by 100 we could interpret that the variation in the rate of total part-timers in Bulgaria is explained by 1.98% of the employment rate in service sector in Bulgaria.

The p-value of the Gretl Output 7 is 0.6627 bigger than 0.1 so in this case the coefficient is not significant.

2.3.3. *Comparison between Netherlands and Bulgaria*

It is well-known that there are different labour laws across countries. Therefore these differences in legislation, the quality of available part-time jobs, the access to childcare and the differences in working hours are factors that can influence the part-time employment rates upon different countries.

Netherlands has been the first part-time economy of the world (Freeman, 1998; Visser 2002). The rapid expansion of part-time work in Netherlands could be the outcome designed by public policy or maybe could be the result of the late entry of married women in the labour force. The second hypothesis could force to change the policies of governments. In the plots of Netherlands I see that females in the workforce has a good relation to the total part-time rates variable which make me think that women in Netherlands has a good reason to work part-time and reject full-time jobs. In this country families has no support and facilities for childcare and this fact can induce women to prefer a part-time job.

The plots of Bulgaria show really low rates of part-time employment and a negative slope between this variable and females' rates in the workforce variable. Therefore the situation might be really different. In Bulgaria the principal economic activity is agriculture so the employment in service sectors is not so relevant. Actually, Bulgarian social policy and labour minister, Totyu Mladenov announced in April 14th 2011 that they would implement new rules for the work of employment agencies, dealing with part-time jobs in 2012. This would help companies to find part-time employees. If we observe Plot 7 we can see that in 2012 part-time employment starts to rise, however we have to wait to see the effects of the new rules for the following years too.

3. CONCLUSION

Empirical evidence suggests that the variable female labour force supply shows a very strong correlation with the share of part-time workers whereas the size of the service sector shows a weak correlation with the share of part-time employment. It seems to hold in the cross section as well as a cross-time even though there are differences in legislation, quality of available part-time jobs, access to childcare and differences in working hours.

To conclude it is important to realise how part-time work provides positive and negative things to supply and demand side. Studying the correlation between females in the workforce and part-time employment can suggest us that for women it is important to have a work-life balance. Employees who work part-time may increase life satisfaction because the opportunity cost is lower than working in a full-time job. The negative aspects for employees are that part-time work reduces career prospects and the access to training opportunities.

In the demand side, after I analyse the employment rates in service sector with part-time variable I think that the relation is not as strong as the relation with females but it does not mean that employers do not want part-time workers. In fact, part-time jobs allow employers to adjust hours worked to cyclical conditions. Employers also want part-timers in order to recruit those who can be paid low wages and can be offered flexible labour contracts.⁹ According to Hakim (1995) *in Britain, women are more likely to work part-time, among others, because part-timers have higher leaving rates than full-timers.* Due to the pressure from the workforce the firm will try to adjust the number of working hours to the preferred ones by workers. As reported by Craig et al (1985) *skilled female workers will use their bargaining power as skilled workers to limit their working hours, whereas unskilled women have to adapt their domestic arrangements to the employer's requirements*

There is voluntary part-time work which is requested by the employee and involuntary work is demanded by the employer. As a result, we can find two perspectives on

⁹ Craig et al 1985: "Secondary labour market theories state that employers will create secondary segments for which they will recruit secondary workers on cheap labour conditions."

flexibility; the organization is more flexible in order to satisfy workers' needs or in order to increase competitiveness by promoting and using flexible work forms.

4. APPENDIX 1

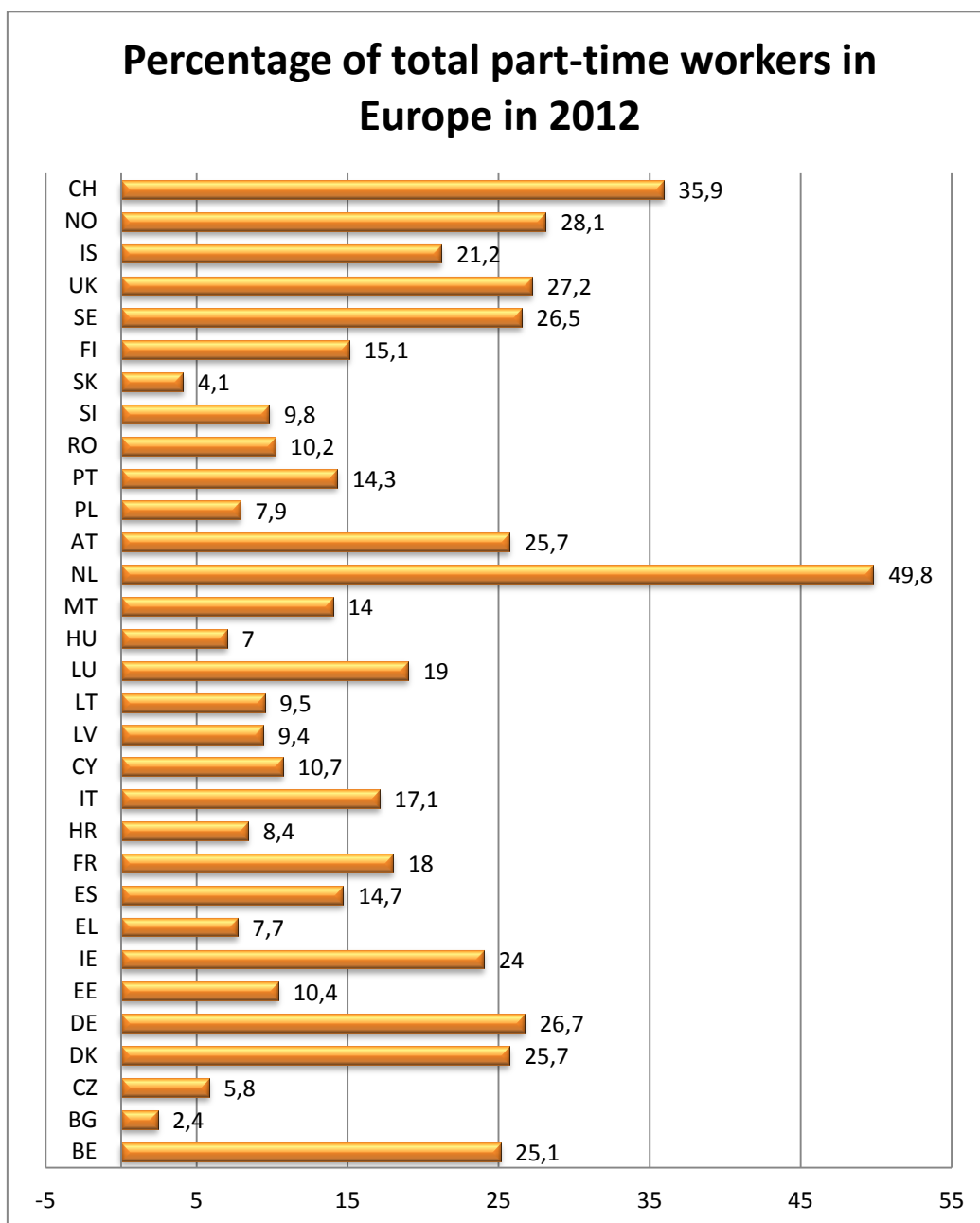
4.1. Country codes abbreviations

Belgium	BE
Bulgaria	BG
Czech Republic	CZ
Denmark	DK
Germany	DE
Estonia	EE
Ireland	IE
Greece	EL
Spain	ES
France	FR
Croatia	HR
Italy	IT
Cyprus	CY
Latvia	LV
Lithuania	LT
Luxembourg	LU

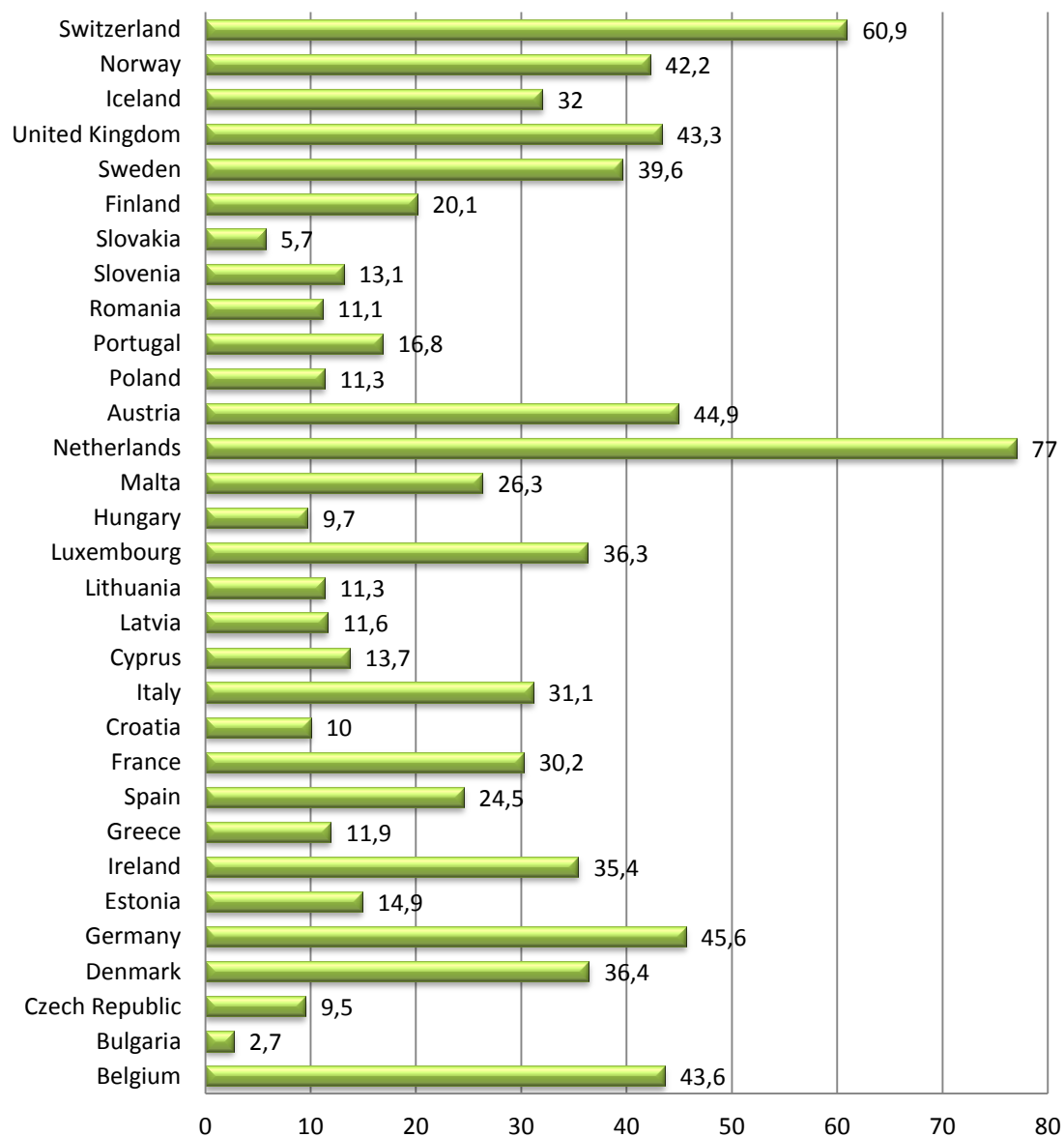
Hungary	HU
Malta	MT
Netherlands	NL
Austria	AT
Poland	PL
Portugal	PT
Romania	RO
Slovenia	SI
Slovakia	SK
Finland	FI
Sweden	SE
United Kingdom	UK
Iceland	IS
Norway	NO
Switzerland	CH

5. APPENDIX 2

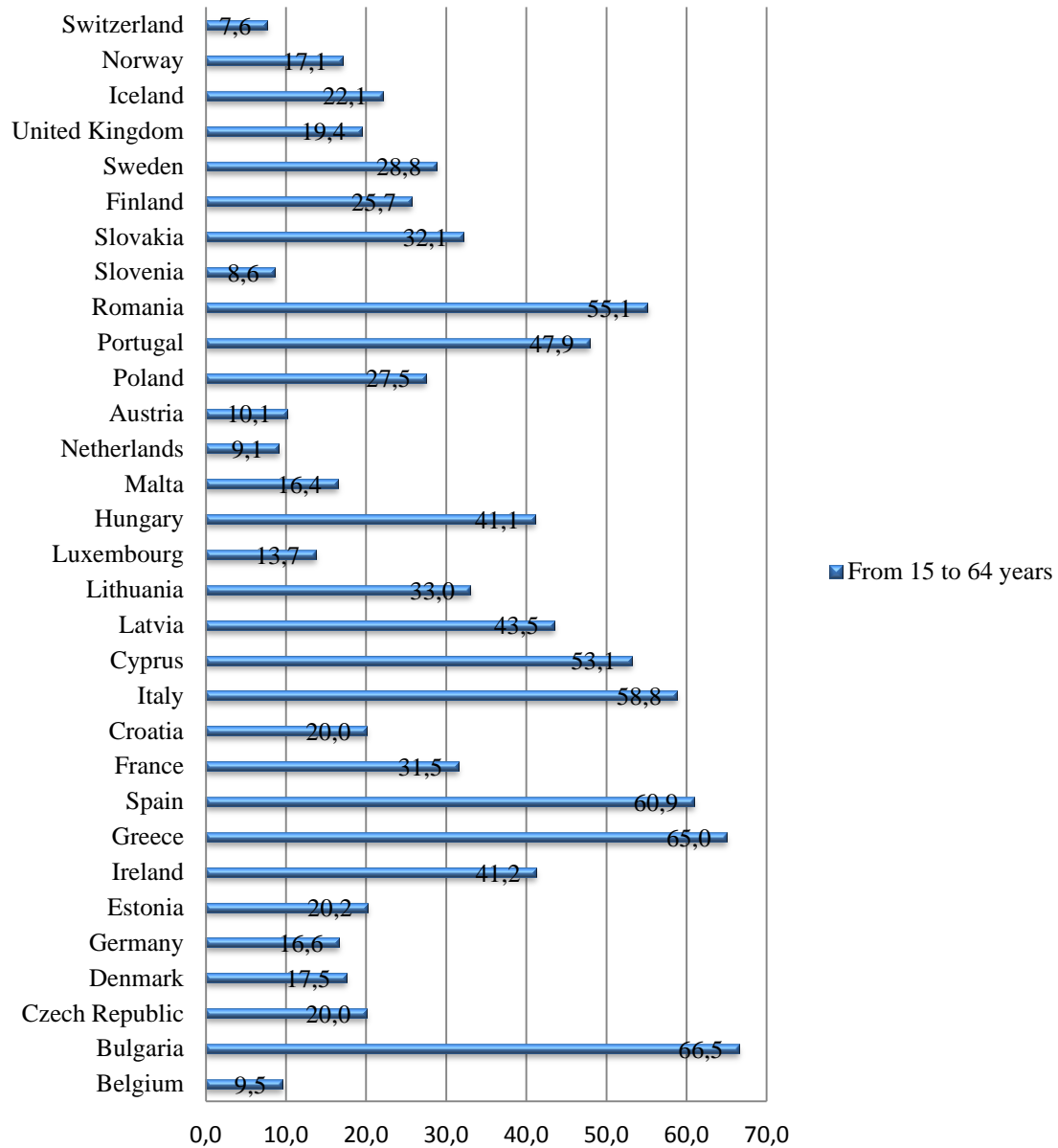
5.1. Eurostat data



Percentage of females employed part-time in Europe in 2012



Involuntary part-time employment as percentage of the total part-time employment



5.2. Summary statistics of the patterns

5.2.1. Patterns of the supply side

Total part-time employment versus Females in the workforce pattern

	Mean	Median	Minimum	Maximum
Total	17.142	14.700	2.4000	49.800
Females	63.848	64.600	45.200	79.100
	Std. Dev.	C.V.	Skewness	Ex. kurtosis
Total	10.490	0.61197	1.0301	1.1520
Females	9.0381	0.14156	-0.27931	-0.67765
	5% perc.	95% perc.	IQ range	Missing obs.
Total	3.4200	41.460	16.300	0
Females	46.160	78.020	14.200	0

Total part-time employment versus Old-people in the workforce pattern

	Mean	Median	Minimum	Maximum
Total	17.142	14.700	2.4000	49.800
Old_workers	49.981	46.500	32.900	79.100
	Std. Dev.	C.V.	Skewness	Ex. kurtosis
Total	10.490	0.61197	1.0301	1.1520
Old_workers	12.365	0.24739	0.68092	-0.44391
	5% perc.	95% perc.	IQ range	Missing obs.
Total	3.4200	41.460	16.300	0
Old_workers	33.320	75.440	18.200	0

5.2.2. Patterns of the demand side

Total part-time employment versus employment in the service sector

	Mean	Median	Minimum	Maximum
Part_time	16.881	13.800	2.4000	49.100
service_sector	68.781	70.100	42.600	82.700
	Std. Dev.	C.V.	Skewness	Ex. kurtosis
Part_time	10.375	0.61458	1.0381	1.1101
service_sector	8.6288	0.12545	-0.90148	0.84992
	5% perc.	95% perc.	IQ range	Missing obs.
Part_time	3.4800	40.760	16.000	0
service_sector	51.060	80.480	12.800	0

5.2.3. Trends patterns

Total part-time employment versus females in the workforce in Netherlands

	Mean	Median	Minimum	Maximum
Total_part_time_~	46.915	46.800	42.200	50.800
Females	69.554	70.700	65.700	72.700
	Std. Dev.	C.V.	Skewness	Ex. kurtosis
Total_part_time_~	2.4559	0.052347	-0.23105	-0.68167
Females	2.4751	0.035585	-0.24168	-1.5505
	IQ range	Missing obs.		
Total_part_time_~	3.7500	0		
Females	4.8500	0		

Total part-time employment versus employment in service sector in Netherlands

	Mean	Median	Minimum	Maximum
Total_part_time_~	46.915	46.800	42.200	50.800
Service_Sector	72.518	72.800	68.900	74.700
	Std. Dev.	C.V.	Skewness	Ex. kurtosis
Total_part_time_~	2.4559	0.052347	-0.23105	-0.68167
Service_Sector	1.6827	0.023204	-0.66959	-0.00031747
	IQ range	Missing obs.		
Total_part_time_~	3.7500	0		
Service_Sector	2.6000	2		

Total part-time employment versus females in the workforce in Bulgaria

	Mean	Median	Minimum	Maximum
Total_Part_time	2.3615	2.4000	1.7000	3.2000
Females	58.969	60.200	51.500	65.400
	Std. Dev.	C.V.	Skewness	Ex. kurtosis
Total_Part_time	0.35246	0.14925	0.54623	1.2179
Females	4.4644	0.075707	-0.34271	-1.0377
	IQ range	Missing obs.		
Total_Part_time	0.25000	0		
Females	7.6000	0		

Total part-time employment versus employment in service sector in Bulgaria

	Mean	Median	Minimum	Maximum
Total_Part_time	2.3615	2.4000	1.7000	3.2000
Service_Sector	57.900	57.050	56.100	62.200
	Std. Dev.	C.V.	Skewness	Ex. kurtosis
Total_Part_time	0.35246	0.14925	0.54623	1.2179
Service_Sector	2.1443	0.037035	1.1756	-0.19386
	IQ range	Missing obs.		
Total_Part_time	0.25000	0		
Service_Sector	2.8000	1		

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