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The wage curve across the wealth distribution☆

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ABSTRACT

This paper studies the relationship between wages and the unemployment rate across the wealth distribution. Using microdata from Norway covering the entire population of residents between 2000 and 2015, we introduce four novel findings on this relationship. First, the share of unemployed individuals belonging to the bottom decile of the gross wealth distribution is tenfold larger than that belonging to the top decile (**34%** and **3.2%**, respectively). Second, the share of unemployed individuals belonging to the bottom decile of the gross wealth distribution moves in the opposite manner to that of the top decile. Third, the negative slope of the wage curve is confirmed. Fourth, the wage-to-unemployment ratio increases monotonically with gross wealth.

1. Introduction

The relationship between the level of gross wages and the unemployment rate (wage curve) or between wage variation and the unemployment rate (Phillips curve) has been the subject of extensive analysis.[1] However, little is known about these relationships when only selected fractions or groups of the population are considered.[2]

In this work, we focus on the wage curve across wealth groups. Campbell and Orszag (1998), using a dynamic efficiency-wage model, show that nonwage income reduces the elasticity of the wage curve. However, the authors recognize the need for more empirical studies to better investigate this relationship. To this end, we address the following questions: is the wage-unemployment nexus the same when we refer to the wealthy rather than to the poor? Does the wealth status of an individual help predict her wage elasticity to unemployment? Exploiting register data from Norway covering the entire Norwegian population of residents between 2000 and 2015, we introduce four novel findings on the wage-unemployment relationship.

First, the share of unemployment belonging to the bottom 10% is, on average, **34**%, whereas that belonging to the top 10% is **3.2**%. This finding implies that the unemployment share at the bottom of the wealth distribution is tenfold larger than that belonging to the top 10%. We see the share of unemployed at the bottom of the wealth distribution as a proxy for the *vulnerability* of the unemployed. *Second*, the share of unemployment belonging to the bottom decile of the gross wealth distribution moves in the opposite manner to that belonging to the top 10%. *Third*, the negative slope of the wage curve is confirmed when plotting the level of gross wages against the unemployment rate for each percentile of the gross wealth distribution. The estimated average elasticity is $-\mathbf{0.10}$, which is consistent with the major findings from the literature. *Fourth*, the wage-to-unemployment ratio increases monotonically with wealth: the higher the wealth rank is, the higher the wage-to-unemployment ratio is. This result suggests that the elasticity of the wage curve increases with wealth, which is in contrast to the theoretical prediction of Campbell and Orszag (1998).

This paper is structured as follows. Section 2 describes the Norwegian context related to our findings. Section 3 presents the data as well as the main variables' definitions. Section 4 illustrates the principal stylized facts. Section 5 introduces the econometric analysis supporting these stylized facts. Section 6 concludes the paper and lays the groundwork for future research.

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[1] See Byrne and Zekaite (2020) for a recent study on the Phillips curve in the euro area and Montuenga-Gómez and Ramos-Parreño (2005) for a survey.

[2] See Blanchflower and Oswald (1994) for a study on the empirical wage curve in the UK at the regional level.

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2. The Norwegian context

In Norway, over half of the labor force is unionized (the same applies to employers), allowing unions to collectively bargain for nominal wages in an effective manner for a large part of the working population.

First, nominal wage increases are bargained for and settled in the tradable sector, to safeguard competitiveness in the open Norwegian economy. Second, the agreement reached for the exposed sector defines the path for wage settlements in the non-tradable "sheltered" sector (the so-called *main course model*, Aukrust, 1977).

The above context regarding wage formation implies that in Norway, "unemployment could vary quite a lot without any very noticeable effects on wages and prices in macro" (Nymoen, 2017). Hence, wages could fluctuate without any simultaneous or preceding change in unemployment. This is known as the L-shaped wage curve in macro, implying that wage formation is exogenous to unemployment (Nymoen, 2017).

Starting from the above context, we revisit the macroeconomic L-shaped wage curve at the individual level by highlighting its distributive dimension. Namely, we rank individuals according to their level of private (gross and net) wealth and calculate both the average wage level and the unemployment rate for each percentile of the (gross or net) wealth distribution. Then, we estimate the wage curve, as is commonly done in the literature. In this way, we reveal which types of wealth owners are behind the different parts of the L-shaped wage curve.

Economic shocks have different impacts on people depending on their level of wealth holding or their wealth rank. This is why we study the interplay between the wage-unemployment nexus, on the one hand, and the wealth status of individuals, on the other hand.

Hansen and Wiborg (2019) indicate instead the correlation between social hierarchy (defined by the amount of accumulated wealth) and wealth transfer in Norway, showing that wealth redistribution considerably reduces intergenerational mobility. In this work, we therefore highlight the role played by wealth rank in shaping another source of economic inequality, namely, inequality in labor market conditions.

3. Data and definitions

We employ register data from Norway that cover the *entire* population of residents in between 2000 and 2015 (e.g. the total for 2000 is approximately 4.5 million individuals).[3] For each individual, the following definitions of private wealth and wage income are considered:

Gross wealth: taxable gross wealth, including real and gross financial capital and real estate. Missing values and 0s are excluded by default.

Net wealth: taxable gross wealth as above, but net of private debt.

Gross wages: total taxable wage income earned in the calendar year, including taxable in-kind contributions, sick and maternity leave. Missing values and 0s are excluded by default.

Two versions of this database are exploited:

Version 1: this database covers from 2000 to 2015 (high coverage). In this version, only the cadastral value of real estate is considered, on average approximately 25% of the estimated market value.

Version 2: this database covers from 2010 to 2015 (low coverage). In this version, the wealth series includes the sum of the estimated market value of real estate and the estimated gross financial capital, hence significantly improving the quality of the wealth variable with respect to Version 1. The wealth data include the estimated market value of primary and secondary dwellings, in addition to commercial properties. On average, the estimated market value of real estate primary dwellings is 4 times the cadastral value included in Version 1. The estimated gross financial capital comprises bank deposits, shares in equity funds, bonds and money market funds, shares and other securities, which are adjusted to their estimated net asset value or market value.

4. Stylized facts

Let us start by introducing a key variable for our analysis, namely, the unemployment share per wealth percentile $u_{i,t}$:

$$u_{i,t} = \frac{U_{i,t}}{U_t}, \tag{1}$$

where $U_{i,t}$ is the total number of unemployed individuals in the ith percentile of the wealth distribution, whereas U_t is the total number of unemployed individuals in the overall population in a given year.

Furthermore, it can be observed that the unemployment rate of the ith percentile $\tilde{u}_{i,t}$, as defined by the ratio between the number of unemployed individuals in percentile i and the total labor force, is straightforwardly related to the unemployment share:

$$\tilde{u}_{i,t} = u_{i,t} \times \tilde{u}_t, \tag{2}$$

where $\tilde{u}_t$ is the unemployment rate of the overall population.[4]

The unemployment share at the bottom of the wealth distribution can be seen as a measure of the *vulnerability* of the unemployed. If one assumes that two countries have the *same* level of overall unemployment rate but a *different* share of unemployed at the bottom of the wealth distribution, then an economic shock might be more harmful to the country with a higher share of unemployed at the bottom. This definition of the vulnerability of the unemployed is different from that put forward by Basu and Nolen (2008). Basu and Nolen (2008) consider the vulnerability of the unemployed as the probability to become employed, which varies across unemployed individuals. To this end, the authors adopt the expression of the *iniquity of the pain of unemployment*. Our definition, rather than focusing on the probability to become employed, instead reflects the impact that an economic shock is likely to have on the overall mass of unemployed individuals. In fact, should an economic shock, such as a financial crisis or a pandemic, suddenly occur, the ability to economically overcome it is a positive function of the wealth held by the unemployed.

We present the dynamics of the unemployment share of both the top and bottom gross wealth deciles in the period 2000−2015 (Database Version 1, high coverage) in Fig. 1.

We observe that the share of unemployment belonging to the bottom decile of the gross wealth distribution moves in the opposite manner to that belonging to the top 10%. Moreover, between 2000 and 2015, the share of unemployed people belonging to the bottom 10% of the gross wealth distribution (**34**%) is on average tenfold larger than that belonging to the top (**3.2**%).

Let us now move to the wage-unemployment nexus. What happens when we plot the level of gross nominal wages (current

[3] The data are retrieved from microdata.no, an online portal administered by Statistics Norway. Access is restricted to researchers affiliated with a Norwegian university or research institute. For replication purposes, the code used to create the dataset on microdata.no and Stata .do files are available upon request. Variable names: Gross Wages (*Lønnsinntekter*), Gross Wealth series (*Skattepliktig Bruttoformue* for Database Version 1, *Beregnet Bruttoformue* for Database Version 2), Private Debt (*Gjeld*).

[4] This definition assumes that the labor force is equally distributed across the wealth distribution, which is confirmed by the empirical evidence.

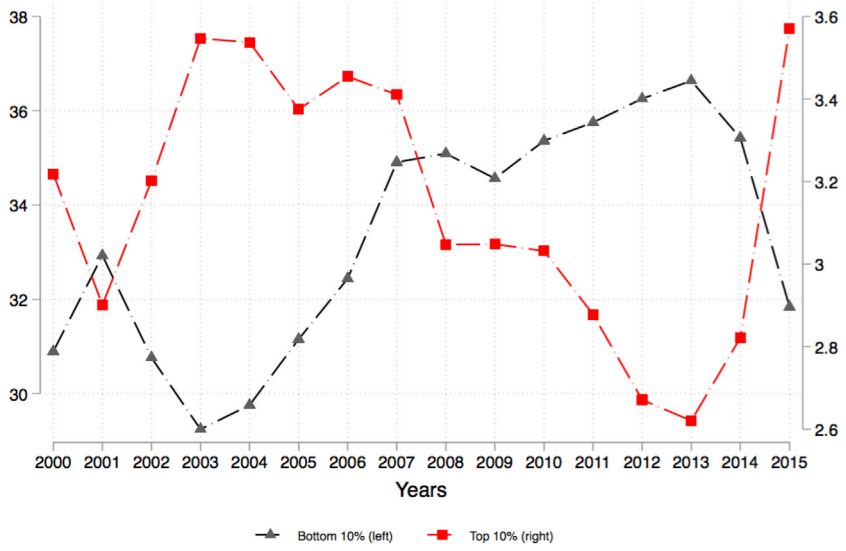

Fig. 1. Share of Unemployed by Gross Wealth Decile. *Note*: The two series of the unemployment share of the bottom (black line) and top (red line) 10% of the gross wealth distribution for Norway in the period 2000:2015 are presented. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

prices Norwegian kroner) against the unemployment rate per percentile of the gross wealth distribution? This is shown by Fig. 2 (Database Version 1, high coverage).

The negative slope of the wage curve is confirmed, and this result also holds when we separately plot the gross wages of the employees and the gross wages of the self-employed against the unemployment rate in each percentile of the gross wealth distribution.[5] Furthermore, the wage-to-unemployment ratio *increases monotonically with wealth*: the higher the gross wealth rank is, the higher the wage-to-unemployment ratio is. Although no causal relationship has been identified here, this result suggests that the gross wealth rank of an individual is a reliable predictor of the structure of the corresponding labor market in terms of wages and unemployment rate. The individuals at the top of the distribution are related to a labor market characterized by a low unemployment rate and high wages. The reverse is true for individuals at the bottom of the distribution. Moreover, we can observe that the wage curve is almost vertical for individuals at the top of the distribution and almost flat for individuals at the bottom. This implies that the same increase in the unemployment rate in different fractions of the gross wealth distribution has different effects on the related wage dynamics.

However, when we rank individuals according to their net wealth rather than their gross wealth, we find a slightly different story. Individuals with negative values of net wealth earn salaries similar to those with positive and high values of net wealth. Furthermore, these individuals experience low unemployment levels, as shown by Fig. 3 (Database Version 1).

This result can be explained by the hypothesis that only wage-rich individuals can afford a net negative financial position over a longer time period.[6]

5. Regression analysis

To econometrically estimate the relationship between gross wages and unemployment rate across the wealth distribution, the following fixed effects model is considered:

$$\ln(w_{it}) = \alpha + \beta \ln(\tilde{u}_{it}) + p_i + f_t + \gamma X_t + \epsilon_{it}, \quad (3)$$

where $\ln(\tilde{u}_{it})$ and $\ln(w_{it})$ are the natural logarithms of the unemployment rate and average gross nominal wages, respectively, at the ith percentile of the gross wealth distribution. p_i and f_t are the fixed percentile and time effects, respectively. X_t represents a set of control variables, which includes the Gini coefficient of total wealth.[7] The main results are shown in Table 1.

Table 1
Unemployment elasticity of wages.

	(1)	(2)	(3)	(4)	(5)
	$\ln(w_{it})$	$\ln(w_{it})$	$\ln(w_{it})$	$\ln(w_{it})$	$\ln(w_{it})$
$\ln(\tilde{u}_{it})$	-0.514^{***}	-0.513^{***}	-0.514^{***}	-0.102^{***}	-0.100^{***}
	(-62.86)	(-63.28)	(-62.29)	(-3.80)	(-3.62)
Controls	no	yes	yes	yes	yes
Percentile FE	no	no	no	yes	yes
Year FE	no	no	yes	no	yes
Observations	1584	1584	1584	1584	1584

t-statistics in parentheses, clustered robust standard errors.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

All specifications are statistically significant and report a negatively sloped relationship. In terms of the magnitude, the wage elasticity of unemployment equals $-\mathbf{0.10}$ in models 4 and 5. These two models are the most complete as they account for both fixed percentile and time effects. Our result is in line with those from the literature on the wage curve (Blanchflower and Oswald, 1994, 1995), which also find the wage elasticity of unemployment to be approximately -0.10.

Although our model focuses on the relationship between the unemployment rate and the wage level across percentiles, it is also important to understand how this relationship changes when we move from one decile to another of the gross wealth distribution. This information allows to analyze the extent to which changes in the wealth rank (or status) of an individual

[5] The same result holds when we employ Database Version 2, figures available from the authors upon request.

[6] The same result holds when we employ Database Version 2, figures available from the authors upon request.

[7] The series of the Gini coefficient of total wealth is taken from Aaberge and Stubhaug, 2018).

Fig. 2. Wage Curve Across the Wealth Distribution *2000 : 2015 (Database Version* 1*). Note*: The average level of gross wages is plotted here against the unemployment rate for each percentile of the gross wealth distribution in Norway in the period 2000:2015. Each dot in the graph corresponds to a given combination of average wage level and unemployment rate for each percentile of the gross wealth distribution in a given year in Norway.

Fig. 3. Wage Curve across the Net Wealth Distribution *2000 : 2015 (Database Version* 1*). Note*: The average level of gross wages is plotted here against the unemployment rate for each percentile of the net wealth distribution in Norway in the period 2000:2015. Each dot in the graph hence corresponds to a given combination of average wage level and unemployment rate for each percentile of the net wealth distribution in a given year in Norway.

are related to the labor market characteristics that she has access to. To precisely assess this aspect, we estimate the relationship between gross wealth deciles, our preferred measure of wealth status, and the wage-to-unemployment ratio, which summarizes the principal characteristics of the labor market associated with it. A high wage-to-unemployment ratio describes a labor market with high wages and low unemployment rates. In contrast, a low wage-to-unemployment ratio describes a labor market with low wages and high unemployment rates. The following model is estimated:

$$\frac{\ln(w_{it})}{\tilde{u}_{it}} = \alpha + \beta\,(d_i \times \mathbb{1}_{d=i}) + f_t + \epsilon_{it}. \tag{4}$$

where $\mathbb{1}_{d=i}$ is an indicator function that equals 1 when the decile is equal to i. This model is then weighted by the inverse of the unemployment rate (Kronmal, 1993). Fig. 4 plots the main coefficients of the regression and shows that the wage-to-unemployment ratio monotonically increases with wealth.

A caveat as regards this evidence has to be issued here.[8] Unemployment rates normally vary within a considerably smaller range of values than wages do, leading to caution as regards giving a clear interpretation to any given value of the wage-to-unemployment ratio. Although we acknowledge that the absolute value of the ratio is not of particular interest *per se*, we believe it is still meaningful to show graphically that the wage-to-unemployment ratio monotonically increases when moving up from one decile to another of the gross wealth distribution.

6. Conclusions

We study the relationship between wage level and unemployment rate across the gross and net wealth distributions in Norway between 2000 and 2015. To this end, we employ register data

[8] We thank the anonymous reviewer for her contribution in making this aspect clearer in the paper.

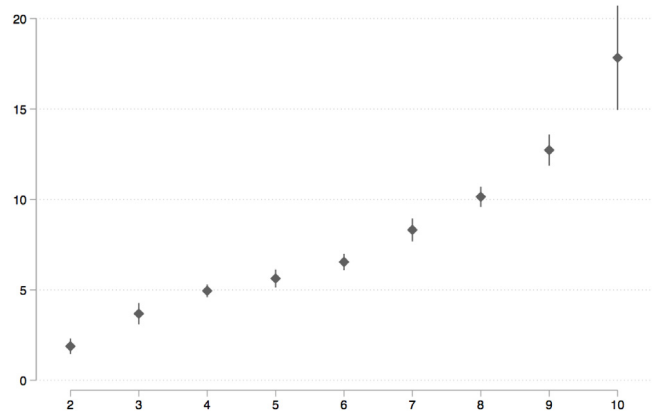

Fig. 4. The *Wage-to-Unemployment* Ratio across the Wealth Distribution. *Note*: The estimated wage-to-unemployment ratio for each decile of the gross wealth distribution is presented here. These coefficients illustrate the extent to which the wage-to-unemployment ratio changes when one moves from one decile of the gross wealth distribution to the next.

covering the entire Norwegian population of residents. Four novel stylized facts on this relationship are reported. The first stylized fact shows that the unemployment share at the bottom 10% of the gross wealth distribution is tenfold larger than that at the top 10%. The second stylized fact illustrates that these two shares move in the opposite manner. The third stylized fact shows that the wage elasticity of unemployment is -0.10, which is in line with the empirical evidence from the literature. Finally, the fourth stylized fact suggests that the wage-to-unemployment ratio increases monotonically with gross wealth. This result contrasts with the theoretical prediction of Campbell and Orszag (1998), whereby non-wage income is supposed to reduce the elasticity of the wage curve. We also argue that the share of unemployed individuals at the bottom deciles of the wealth distribution is a measure of the vulnerability of the unemployed.

Given the striking descriptive results reported by this analysis, we advocate additional testing of this relationship in other settings potentially more conducive to causality claims, and for other countries and years. Further analysis can strengthen our understanding of the role of wealth holding in affecting employment opportunities in the labor market. Moreover, we argue that our results, whereby the slope of the wage curve is a positive function of gross wealth, can easily be incorporated in any macroeconomic model of the labor market that wishes to account for wealth inequality in its dynamics.

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