

Appendices to "Occupations and the non-standard employment career: How the occupational skill level and task types influence the career outcomes of non-standard employment".

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Appendix 1: Creation of the typology

The variable labour market position for the first channel of the sequence analysis is based upon two variables from the *System of social statistical datasets (SSD)* (Bakker et al., 2014): contract type and socio-economic position in a given month. The possible contract types are permanent contracts, fixed-term contracts, temporary work agency contracts, on-call workers and interns. The number of interns was, however, very small (<0.5%). Therefore, this group was merged with the fixed-term contracts. Furthermore, many studies on NSE also include part-time employment in their analyses as a form of NSE. Part-time employment is not included here as working hours are independent of contract type and part-time employment is usually voluntary in the Netherlands (Portegijs and Keuzenkamp, 2008).

For the individuals who were not in dependent employment, a distinction is made between the self-employedⁱ, the unemployed, those receiving non-work related welfare benefits, students, pensioners and a group in other states. Individuals are considered self-employed only when self-employment is their largest income source. Workers who combine self-employment and dependent employment cannot be observed. The number of workers receiving a pension benefit was limited (<0.5%). Therefore, this group is merged with the group of other states. The group 'other' is thus very heterogeneous, as it includes not only those receiving a pension benefit, but also inactive individuals and individuals with an unclassified labour force status. In total, there are 9 possible labour market positions (see table A1).

The second channel of the sequence analysis is based on monthly individual earnings from the main job or, in the absence of employment, from benefits. These are gross earnings, excluding special payments and bonuses. For the months in self-employment, the yearly earnings from self-employment are divided by the number of months someone was self-employed. The income of the self-employed is supplemented with income from other activities, such as freelancing. As sequence analysis treats all states nominally and computes costs for each state combination, it is impossible to include the worker's income as a continuous variable. Therefore, individual monthly income is classified into 13 categories

Table A1: Categories of sequence variablesⁱⁱ

Labour market position	Gross monthly income (in €)
<ul style="list-style-type: none"> ■ Permanent contract ■ Unemployed ■ Social benefit ■ Student ■ Other ■ Self-employment ■ On-call work ■ Temporary work agency employment ■ Fixed-term contract 	<ul style="list-style-type: none"> ■ No income ■ 1-250 ■ 251-500 ■ 501-750 ■ 751-1000 ■ 1001-1250 ■ 1251-1500 ■ 1501-1750 ■ 1751-2000 ■ 2001-2500 ■ 2501-3000 ■ 3001-4000 ■ 4000+

(see table A1). For reference, the modal monthly income in the Netherlands varied from €2400 in 2007 to €2700 in 2015.

The clustering of the career sequences was modelled to the typology of NSE careers by Mattijssen and Pavlopoulos (2019). For single channel sequence analysis, a procedure is included in TraMineR to model a typology on representative sequences. This procedure has not been developed yet for multichannel sequence analysis. Therefore, a detour was used to model the new typology to the representative sequences of the typology by Mattijssen and Pavlopoulos.

This process went as follows. First, medoid sequences from the 17 clusters of the typology created by Mattijssen and Pavlopoulos were extracted. These 17 medoid sequences were added to the dataset containing the sequences of the 6,004 observations. Consequently, a distance matrix was created using the same distance metric as Mattijssen and Pavlopoulos: an Optimal Matching procedure (Abbott and Forrest, 1986) with a *Hamming distance* cost setting with constant costs (Hamming, 1950) (more details about this distance metric can be found in Mattijssen and Pavlopoulos (2019)). This distance matrix thus contained the distances of the sample sequences to the medoid sequences of the clusters of the Mattijssen and Pavlopoulos typology. Finally, the sample sequences were placed in the cluster of the medoid sequence to which the distance was lowest. Some clusters could be placed in more than one cluster. They were randomly assigned to one of the clusters to which they had the lowest distance. This

resulted in a typology consisting of 17 clusters that are substantially similar to the original Mattijssen and Pavlopoulos typology.

The clusters are placed on a grid with employment security on the horizontal axis and income security on the vertical axis. The employment and income security of the clusters are determined qualitatively, as a combination of quantitative measures did not lead to a classification that fully rendered justice to the qualitative conception of the clusters' employment and income quality. Other research has also aimed at creating employment precarity indices (Ritschard et al., 2018), but the results have not been satisfactory. Therefore, the clusters have been placed qualitatively, taking into account the time spent in employment, the mean duration until the transition to permanent employment is made, the number of job changes and the types of employment encountered in the cluster. Income security is determined looking at the mean within-career income and the within-career standard deviation of the income. It is stressed that the grid is a graphic help for the interpretation of results and that distances between clusters are not based on calculations.

Such a large amount of clusters does justice to the complexity of the labour market, but complicates explanatory analyses. Therefore, the clusters were regrouped into larger cluster groups based on similarity in employment and income security. This resulted in seven cluster groups, which are given names that broadly describe the careers that are present in the cluster group. Cluster group *Prosperous permanent* consists of clusters 1 to 5, cluster group *Precarious permanent* consists of clusters 6 and 7, cluster group *Infinite insecurity* consists of clusters 11 to 13 and cluster group *Employment exit* consists of clusters 14 to 17. Cluster 8, 9 and 10 form cluster groups on their own, as there are no clusters similar to them in terms of employment and income security. Cluster 8 is called *Fortunate fixed-term*, cluster 9 is called *Shift to self-employment* and cluster 10 is named *Passing permanency*.

Appendix 2: Task scales

The task measures were created following the approach by Acemoglu and Autor (2011), using syntax created by the Institute for Structural Research.ⁱⁱⁱ

The scale for non-routine analytical tasks consists of the importance of:

- Analyzing data/information
- Thinking creatively
- Interpreting information for others

The scale for non-routine interactive tasks consists of the importance of:

- Establishing and maintaining personal relationships
- Guiding, directing and motivating subordinates
- Coaching/developing others

The scale for routine cognitive tasks consists of the importance of:

- Repeating the same tasks
- Being exact or accurate
- Structured versus unstructured work (reverse coded)

The scale for routine manual tasks consists of the importance of:

- Pace determined by speed of equipment
- Controlling machines and processes
- Spending time making repetitive motions

The scale for non-routine manual tasks consists of the importance of:

- Operating vehicles, mechanized devices, or equipment
- Spending time using hands to handle, control or feel objects, tools or controls
- Manual dexterity
- Spatial orientation

For each scale, the mean score of the included items was calculated. Consequently, these scores were standardized on the occupational level.

Appendix 3: Descriptive statistics

Table A2: Descriptive statistics of categorical variables, in %

	Gender		Weekly working hours			Level of education				Ethnicity			N
	Male	Female	Small part-time	Large part-time	Full-time	Low education	Middle education	High education	Education unknown	Native Dutch	Non-western background	Western background	Abs. N in ()
Precarious permanent	12.58	87.42	64.06	19.34	16.6	36.89	47.78	14.06	1.27	81.29	9.73	8.99	15.76 (946)
Prosperous permanent	58.97	41.03	14.48	16.29	69.23	16	42.84	39.31	1.85	85.4	6.46	8.14	41.52 (2493)
Fortunate fixed-term	58.39	41.61	14.7	13.25	72.05	22.77	48.03	26.71	2.48	84.89	6.42	8.7	8.04 (483)
Infinite insecurity	34.88	65.12	49.05	15.94	35.01	32.83	51.09	14.17	1.91	76.7	12.81	10.49	12.23 (734)
Employment exit	37.18	62.82	47.51	15.8	36.7	40.1	40.34	17.13	2.43	67.19	21.02	11.79	13.71 (823)
Passing permanency	47.9	52.1	23.95	16.77	59.28	19.76	47.9	30.54	1.8	82.63	6.59	10.78	2.78 (167)
Shift to self-employment	50.84	49.16	29.05	14.25	56.7	17.32	42.74	38.55	1.4	85.2	6.7	8.1	5.96 (358)
Total	44.89	55.11	32.2	16.31	51.5	25.38	44.84	27.91	1.87	81.06	9.76	9.18	(6004)

Table A3: Descriptive statistics of continuous variables

	Non-routine analytic		Non-routine interactive		Routine cognitive		Routine manual		Non-routine manual		Occupational skill level		Age	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Precarious permanent	-0.776	0.892	-0.310	0.800	0.092	0.962	-0.216	0.701	-0.264	0.667	12.487	1.682	37.235	9.824
Prosperous permanent	0.140	0.923	0.211	0.905	0.171	0.889	-0.342	0.812	-0.372	0.971	13.992	2.282	35.572	9.402
Fortunate fixed-term	-0.118	0.905	0.055	0.918	0.184	0.809	-0.107	0.871	-0.109	1.002	13.302	2.359	33.776	9.319
Infinite insecurity	-0.592	0.908	-0.254	0.840	0.141	0.931	-0.044	0.777	-0.043	0.866	12.527	1.892	35.448	10.930
Employment exit	-0.613	0.992	-0.254	0.864	0.087	0.938	0.002	0.795	-0.035	0.864	12.464	1.989	37.510	11.090
Passing permanency	-0.131	0.919	0.087	0.904	0.209	0.872	-0.111	0.828	-0.173	0.919	13.303	2.056	34.042	9.825
Shift to self-employment	0.055	1.000	0.172	0.951	-0.176	0.898	-0.316	0.771	-0.264	0.924	14.090	2.484	37.316	9.674
Total	-0.230	1.005	-0.010	0.909	0.125	0.910	-0.211	0.803	-0.236	0.911	13.298	2.242	36.002	9.990

Appendix 4: Full results

Table A4: Results of multinomial logistic regression with clusters groups as dependent variable

	Precarious permanent	Fortunate fixed-term	Infinite insecurity	Employment exit	Passing permanency	Shift to self- employment
	b/se	b/se	b/se	b/se	b/se	b/se
Occupational skill level	-0.220*** (0.053)	-0.023 (0.053)	-0.109* (0.050)	-0.141** (0.048)	-0.058 (0.090)	0.288*** (0.067)
Occupational skill level ²	-0.018 (0.010)	0.020* (0.008)	0.004 (0.009)	0.003 (0.008)	-0.023 (0.017)	-0.009 (0.009)
Task types						
Non-routine analytic	-0.324** (0.108)	-0.182 (0.106)	-0.144 (0.103)	-0.065 (0.100)	-0.014 (0.177)	-0.315** (0.120)
Non-routine interactive	0.013 (0.084)	-0.003 (0.074)	-0.169* (0.078)	-0.185* (0.074)	0.043 (0.121)	-0.159 (0.084)
Routine cognitive	-0.134* (0.061)	-0.077 (0.068)	-0.136* (0.061)	-0.198*** (0.059)	-0.145 (0.111)	-0.547*** (0.078)
Routine manual	-0.008 (0.109)	0.175 (0.116)	0.163 (0.104)	0.260* (0.101)	0.483** (0.181)	0.323* (0.140)
Non-routine manual	-0.011 (0.103)	0.033 (0.102)	0.122 (0.098)	-0.013 (0.095)	-0.102 (0.168)	0.258* (0.117)
Age	0.002 (0.005)	-0.019*** (0.005)	-0.012** (0.004)	0.006 (0.004)	-0.020* (0.008)	0.014* (0.006)
Age ²	0.001** (0.000)	-0.000 (0.001)	0.003*** (0.000)	0.003*** (0.000)	0.001 (0.001)	0.000 (0.001)
Female	1.563*** (0.136)	0.234 (0.126)	0.676*** (0.121)	0.608*** (0.117)	0.497* (0.204)	0.162 (0.148)
Ethnicity (ref: Native Dutch)						
Non-western background	0.349* (0.159)	-0.183 (0.207)	0.696*** (0.152)	1.332*** (0.135)	-0.009 (0.329)	0.042 (0.233)
Western background	0.231 (0.156)	0.089 (0.180)	0.436** (0.154)	0.652*** (0.145)	0.356 (0.264)	0.006 (0.211)
Level of education (ref: medium education)						
Low education	0.594*** (0.111)	0.074 (0.138)	0.281* (0.114)	0.646*** (0.111)	-0.023 (0.227)	-0.009 (0.171)
High education	-0.413** (0.136)	-0.301* (0.144)	-0.601*** (0.144)	-0.209 (0.136)	0.034 (0.219)	-0.126 (0.159)
Education unknown	0.160 (0.361)	0.081 (0.337)	0.008 (0.331)	0.436 (0.301)	-0.160 (0.613)	-0.219 (0.487)
Weekly working hours (ref: full-time)						
Small part-time	2.024*** (0.128)	-0.079 (0.163)	1.693*** (0.125)	1.642*** (0.122)	0.575* (0.230)	0.742*** (0.164)
Large part-time	1.017*** (0.139)	-0.245 (0.158)	0.558*** (0.140)	0.524*** (0.136)	0.151 (0.238)	-0.029 (0.181)
Constant	-3.224*** (0.143)	-1.661*** (0.111)	-2.495*** (0.119)	-2.650*** (0.118)	-3.016*** (0.193)	-2.057*** (0.127)
AIC	17499.490					
BIC	18223.109					
N	6004					

* p<0.05, ** p<0.01, *** p<0.001

Dependent variable reference category: Prosperous permanent

Appendix 5: Additional analysis

In this analysis, individual level of education was excluded from the analysis, to see whether the effect of occupational skill level would have been stronger without controlling for level of education. This turns out to have been the case.

Table A5: Marginal effects of the multinomial logistic regressions with the cluster groups as dependent variable

	Prosperous permanent	Precarious permanent	Fortunate fixed-term	Passing permanency	Shift to self-employment	Infinite insecurity	Employment exit
Overall probability	0.415 (0.006)	0.158 (0.004)	0.08 (0.003)	0.028 (0.002)	0.06 (0.003)	0.122 (0.004)	0.137 (0.004)
Occupational skill level	0.021** (0.006)	-0.024*** (0.005)	0.001 (0.003)	0.001 (0.002)	0.020*** (0.004)	-0.007 (0.004)	-0.011* (0.005)
Occupational skill level ²	0 (0.001)	-0.002* (0.001)	0.002** (0.001)	-0.001 (0)	-0.001 (0)	0 (0.001)	0.001 (0.001)
Task types							
Non-routine analytic	0.039** (0.012)	-0.027* (0.011)	-0.007 (0.007)	0.003 (0.005)	-0.012 (0.006)	-0.002 (0.01)	0.007 (0.01)
Non-routine interactive	0.018* (0.009)	0.011 (0.009)	0.003 (0.005)	0.003 (0.003)	-0.006 (0.004)	-0.013 (0.008)	-0.016* (0.008)
Routine cognitive	0.038*** (0.008)	-0.001 (0.006)	0.002 (0.005)	-0.001 (0.003)	-0.026*** (0.004)	-0.001 (0.005)	-0.011 (0.006)
Routine manual	-0.041** (0.013)	-0.015 (0.011)	0.006 (0.008)	0.01* (0.005)	0.012 (0.007)	0.006 (0.009)	0.022* (0.01)
Non-routine manual	-0.014 (0.012)	-0.005 (0.011)	0.001 (0.007)	-0.004 (0.004)	0.014* (0.006)	0.013 (0.009)	-0.005 (0.01)
Age	0.001 (0.001)	0.001 (0)	-0.001** (0)	-0.001 (0)	0.001** (0)	-0.001** (0)	0.001* (0)
Age ²	-0.00032** (0.00006)	-0.00003 (0.00004)	-0.00007 (0.00004)	0.00001 (0.00002)	-0.00003 (0.00003)	0.00019*** (0.00004)	0.00025*** (0.00004)
Female	-0.131*** (0.016)	0.124*** (0.011)	-0.01 (0.009)	0.003 (0.006)	-0.013 (0.008)	0.018 (0.012)	0.009 (0.012)
Weekly hours worked							
Small part-time	-0.260*** (0.017)	0.138*** (0.012)	-0.063*** (0.009)	-0.007 (0.006)	0 (0.009)	0.097*** (0.013)	0.094*** (0.014)
Large part-time	-0.086*** (0.019)	0.085*** (0.013)	-0.04*** (0.011)	-0.002 (0.007)	-0.013 (0.009)	0.029* (0.013)	0.028* (0.013)
Ethnicity							
Non-western background	-0.105*** (0.019)	-0.024 (0.014)	-0.033** (0.01)	-0.009 (0.006)	-0.016 (0.01)	0.028 (0.015)	0.159*** (0.019)
Western background	-0.062** (0.02)	-0.008 (0.015)	-0.006 (0.012)	0.005 (0.008)	-0.01 (0.01)	0.024 (0.015)	0.058*** (0.016)
AIC	17550.23						
BIC	18153.25						
N	6004						

References

- Abbott A and Forrest J (1986) Optimal matching methods for historical sequences. *The Journal of Interdisciplinary History* 16(3): 471–494. DOI: 10.2307/204500.
- Acemoglu D and Autor DH (2011) Skills, tasks and technologies: Implications for employment and earnings. In: *Handbook of Labor Economics*. Elsevier B.V., pp. 1043–1171. DOI: 10.1016/S0169-7218(11)02410-5.
- Bakker BFM, Van Rooijen J and Van Toor L (2014) The System of social statistical datasets of Statistics Netherlands: An integral approach to the production of register-based social statistics. *Statistical Journal of the IAOS* 30(4). IOS Press: 411–424. DOI: 10.3233/SJI-140803.
- Hamming RW (1950) Error Detecting and Error Correcting Codes. *Bell System Technical Journal* 29(2): 147–160. DOI: 10.1002/j.1538-7305.1950.tb00463.x.
- Mattijssen L and Pavlopoulos D (2019) A multichannel typology of temporary careers: Identifying traps and stepping stones in terms of career and income security. *Social Science Research* 77: 101–114. DOI: <https://doi.org/10.1016/j.ssresearch.2018.10.001>.
- Portegijs W and Keuzenkamp S (2008) *Nederland Deeltijdland: Vrouwen En Deeltijdwerk* ('*Netherlands Part-Time Country: Women and Part-Time Work*'). The Hague: The Netherlands Institute for Social Research. Available at: http://www.scp.nl/english/Publications/Summaries_by_year/Summaries_2008/Part_time_working_in_the_Netherlands.
- Ritschard G, Bussi M and O'Reilly J (2018) An index of precarity for measuring early employment insecurity. In: Ritschard G and Studer M (eds) *Sequence Analysis and Related Approaches*. Cham: Springer, pp. 279–295. DOI: 10.1007/978-3-319-95420-2.

ⁱ Workers who start their non-standard employment career in self-employment are not part of the population of this dataset, but when workers enter non-standard employment and consequently become self-employed, their later position as self-employed is registered.

ⁱⁱ As the channels are constructed in the same way as done by Mattijssen and Pavlopoulos (2019), their previously printed table is used for this work as well.

ⁱⁱⁱ www.ibs.org.pl/resources