A Model descriptions

Artetxe et al. (2016) propose to learn a linear transformation matrix W between a source language space X and a target language space Z. The transformation matrix is enforced to be orthogonal ($W^\top W = I$) and the embedding matrices are length normalized and mean centered.

Artetxe et al. (2017) add a self-learning loop to the previous approach. They use the learned transformation matrix W to induce a bilingual dictionary by mapping each source language word to its nearest neighbour in the cross-lingual embedding space. These generated translation pairs are then used at the next iteration to learn a new translation matrix until a convergence criterion is reached.

Ruder et al. (2018) view self-learning as Expectation-Maximization and augment the seed lexicon in a latent-variable model. The source words $\{w_{L1}^i\}_{k=1}^K$ and target words $\{w_{L2}^j\}_{k=1}^K$ are seen as a fully connected bipartite weighted graph $G = (E, V_{L1} \cup V_{L2})$ with edges $E = V_{L1} \times V_{L2}$. By drawing embeddings from a Gaussian distribution and normalizing them, the weight of each edge $(i, j) \in E$ is shown to correspond to the cosine similarity between vectors. In the E-step, a maximal bipartite matching is found on the sparsified graph using the Jonker-Volgenant algorithm (Jonker and Volgenant, 1987). In the M-step, a better projection W_{L1} is learned solving the Procrustes problem.

B Hyper-parameter settings

For the model of Ruder et al. (2018), we set the parameter k to 15. k controls the number of candidate target words considered for each source word during matching (induction of a new dictionary). We experimented with different values of k and found that higher values of k yield better performance. Following Ruder et al. (2018) we also employed a rank constraint and had the model consider only 40,000 most frequent words during the matching. This speeds up the training and often also leads to improved performance.

C All results

Constraint	Normal				Lexeme			
	In vocab		+OOVs		In vocab		+OOVs	
	✗	✓	✗	✓	✗	✓	✗	✓
Czech–Polish	49.3 (3161)	-	40.9 (4166)	-	84.5	-	78.2	-
Czech–Russian	44.5 (3562)	-	37.3 (4762)	-	87.1	-	82.9	-
Czech–Slovak	53.1 (802)	-	45.5 (1027)	-	90.9	-	88.7	-
Czech–Ukrainian	32.4 (673)	-	26.7 (854)	-	84.1	-	80.2	-
Polish–Czech	40.0 (4043)	-	32.9 (5332)	-	82.4	-	76.7	-
Polish–Russian	47.0 (6814)	-	40.3 (9079)	-	84.9	-	82.2	-
Polish–Slovak	25.0 (1217)	-	19.8 (1689)	-	81.0	-	78.4	-
Polish–Ukrainian	29.9 (1118)	-	24.8 (1463)	-	75.2	-	72.0	-
Russian–Czech	32.0 (5708)	-	26.5 (7538)	-	79.5	-	75.7	-
Russian–Polish	40.2 (9183)	-	35.0 (11697)	-	83.1	-	80.4	-
Russian–Slovak	21.1 (1610)	-	18.0 (2150)	-	79.9	-	77.5	-
Russian–Ukrainian	45.0 (1165)	-	42.2 (1396)	-	85.2	-	83.7	-
Slovak–Czech	47.8 (858)	-	39.3 (1154)	-	90.2	-	88.6	-
Slovak–Polish	25.8 (830)	-	21.0 (1094)	-	82.8	-	81.8	-
Slovak–Russian	11.8 (814)	-	9.1 (1140)	-	82.6	-	81.7	-
Slovak–Ukrainian	20.0 (330)	-	16.7 (425)	-	83.0	-	81.6	-
Ukrainian–Czech	34.3 (699)	-	29.3 (869)	-	82.0	-	77.3	-
Ukrainian–Polish	44.6 (850)	-	38.6 (1054)	-	82.9	-	79.2	-
Ukrainian–Russian	61.3 (786)	-	56.5 (933)	-	90.5	-	89.8	-
Ukrainian–Slovak	18.6 (322)	-	15.7 (420)	-	84.8	-	83.6	-
Catalan–French	56.5 (5605)	-	33.8 (11367)	-	82.8	-	54.6	-
Catalan–Italian	53.8 (5518)	-	30.7 (11970)	-	83.1	-	53.4	-
Catalan–Portuguese	63.3 (5418)	-	41.8 (10759)	-	84.5	-	60.0	-
Catalan–Spanish	69.3 (5879)	-	45.0 (12282)	-	86.3	-	60.3	-
French–Catalan	41.6 (7845)	-	23.9 (16992)	-	79.4	-	52.2	-
French–Italian	49.4 (9891)	-	28.3 (22052)	-	83.1	-	55.4	-
French–Portuguese	49.5 (8930)	-	31.9 (17536)	-	81.0	-	58.1	-
French–Spanish	49.1 (9770)	-	29.3 (21087)	-	82.7	-	55.2	-
Italian–Catalan	36.6 (9035)	-	18.7 (22636)	-	77.2	-	49.4	-
Italian–French	40.8 (12595)	-	21.4 (31419)	-	79.3	-	53.4	-
Italian–Portuguese	43.0 (10072)	-	21.0 (25704)	-	79.2	-	50.3	-
Italian–Spanish	43.6 (11685)	-	22.6 (30686)	-	78.9	-	52.2	-
Portuguese–Catalan	49.2 (7199)	-	28.2 (16059)	-	81.0	-	53.1	-
Portuguese–French	48.7 (9664)	-	27.4 (22437)	-	81.4	-	52.4	-
Portuguese–Italian	46.9 (8939)	-	25.6 (20757)	-	80.2	-	52.6	-
Portuguese–Spanish	60.6 (9275)	-	37.3 (22638)	-	85.8	-	58.9	-
Spanish–Catalan	50.4 (8291)	-	30.4 (18442)	-	79.1	-	53.2	-
Spanish–French	46.9 (11457)	-	25.8 (25775)	-	78.6	-	49.5	-
Spanish–Italian	47.0 (10709)	-	27.8 (23528)	-	78.3	-	53.7	-
Spanish–Portuguese	57.4 (9732)	-	35.6 (23197)	-	82.3	-	56.3	-

Table 5: Full results for the standard BLI task and controlled for lexeme BLI for the model of (Artetxe et al., 2016) (with ✓an without ✗an enforced morphological constraint).

	Normal				Lexeme			
	In vocab		+OOVs		In vocab		+OOVs	
Constraint	✗	✓	✗	✓	✗	✓	✗	✓
Czech–Polish	51.7 (3161)	55.1	42.9 (4166)	46.1	84.2	85.2	78.1	79.4
Czech–Russian	44.9 (3562)	49.6	38.2 (4762)	42.5	84.8	87.3	81.1	83.8
Czech–Slovak	60.8 (802)	60.8	54.2 (1027)	52.4	89.5	89.7	87.1	87.3
Czech–Ukrainian	48.1 (673)	50.2	39.8 (854)	41.8	82.9	83.5	79.4	79.5
Polish–Czech	41.8 (4043)	43.6	34.6 (5332)	36.2	80.8	81.1	75.7	76.2
Polish–Russian	47.1 (6814)	49.8	40.4 (9079)	43.1	83.7	84.7	80.5	82.0
Polish–Slovak	33.0 (1217)	35.2	26.3 (1689)	27.5	78.1	78.5	75.7	76.1
Polish–Ukrainian	34.8 (1118)	36.4	29.6 (1463)	30.6	74.2	74.9	70.5	71.8
Russian–Czech	32.1 (5708)	33.4	26.4 (7538)	27.6	76.8	78.6	73.1	75.2
Russian–Polish	40.0 (9183)	40.7	35.0 (11697)	35.7	81.2	82.2	78.6	80.4
Russian–Slovak	24.0 (1610)	20.8	20.0 (2150)	17.0	78.3	77.5	74.7	75.1
Russian–Ukrainian	48.6 (1165)	49.1	44.4 (1396)	44.6	82.8	83.9	81.9	82.8
Slovak–Czech	58.7 (858)	62.9	49.6 (1154)	52.4	91.6	92.4	89.6	90.0
Slovak–Polish	38.3 (830)	45.9	30.8 (1094)	37.8	80.5	81.6	79.2	80.7
Slovak–Russian	23.3 (814)	31.6	18.4 (1140)	24.6	82.6	84.2	80.7	83.2
Slovak–Ukrainian	43.6 (330)	55.5	36.7 (425)	47.1	82.4	85.5	81.4	84.2
Ukrainian–Czech	43.3 (699)	49.6	38.6 (869)	43.6	79.0	81.4	75.4	76.8
Ukrainian–Polish	54.5 (850)	59.3	47.2 (1054)	52.1	82.6	83.8	79.4	80.6
Ukrainian–Russian	69.6 (786)	72.0	65.6 (933)	67.8	91.1	91.7	89.5	90.7
Ukrainian–Slovak	33.5 (322)	45.0	28.3 (420)	36.9	81.4	83.5	79.0	82.1
Catalan–French	55.0 (5605)	58.9	31.4 (11367)	36.0	78.6	82.5	48.9	55.5
Catalan–Italian	52.2 (5518)	55.8	29.0 (11970)	32.7	80.0	83.4	49.5	55.1
Catalan–Portuguese	62.4 (5418)	64.8	40.6 (10759)	43.9	82.8	84.6	57.4	61.0
Catalan–Spanish	67.2 (5879)	70.5	43.2 (12282)	46.8	83.4	86.7	57.2	61.6
French–Catalan	39.7 (7845)	42.1	22.6 (16992)	25.3	75.2	79.1	47.4	54.3
French–Italian	48.0 (9891)	50.0	26.8 (22052)	29.3	80.0	83.1	51.1	57.1
French–Portuguese	47.0 (8930)	49.5	29.5 (17536)	32.4	76.8	80.8	53.2	59.1
French–Spanish	48.4 (9770)	50.1	27.1 (21087)	30.8	79.3	82.2	49.3	57.1
Italian–Catalan	35.2 (9035)	36.3	17.8 (22636)	18.9	73.1	76.8	45.1	51.1
Italian–French	40.0 (12595)	41.7	20.8 (31419)	22.4	76.2	79.3	49.4	54.7
Italian–Portuguese	42.3 (10072)	43.1	20.5 (25704)	21.1	76.7	78.3	47.0	50.2
Italian–Spanish	42.6 (11685)	44.1	21.0 (30686)	23.5	76.2	78.7	47.6	53.7
Portuguese–Catalan	48.1 (7199)	49.7	28.1 (16059)	29.1	78.4	80.4	51.0	53.2
Portuguese–French	47.1 (9664)	50.1	25.9 (22437)	28.6	77.7	80.7	48.2	52.3
Portuguese–Italian	45.8 (8939)	48.0	24.8 (20757)	26.8	77.5	80.0	48.9	53.2
Portuguese–Spanish	60.2 (9275)	61.4	37.4 (22638)	38.5	84.7	85.7	57.9	59.6
Spanish–Catalan	49.2 (8291)	49.8	29.3 (18442)	30.6	76.5	78.6	50.5	53.5
Spanish–French	45.4 (11457)	47.6	24.1 (25775)	26.9	74.6	78.1	44.5	50.2
Spanish–Italian	46.4 (10709)	47.8	26.9 (23528)	28.6	75.9	78.8	50.4	54.9
Spanish–Portuguese	57.0 (9732)	58.0	35.1 (23197)	36.3	81.3	82.0	55.0	57.0

Table 6: Full results for the standard BLI task and controlled for lexeme BLI for the model of (Artetxe et al., 2017) (with ✓an without ✗an enforced morphological constraint).

Constraint	Normal				Lexeme			
	In vocab		+OOVs		In vocab		+OOVs	
	✗	✓	✗	✓	✗	✓	✗	✓
Czech–Polish	51.8 (3161)	54.9	42.8 (4166)	45.8	84.0	85.1	77.7	78.7
Czech–Russian	45.5 (3562)	45.4	38.6 (4762)	38.1	85.0	85.5	80.8	81.2
Czech–Slovak	61.5 (802)	59.2	54.0 (1027)	52.4	89.9	89.2	87.3	86.9
Czech–Ukrainian	48.4 (673)	52.9	39.9 (854)	44.3	83.5	83.1	80.0	80.1
Polish–Czech	42.0 (4043)	44.4	34.8 (5332)	36.7	80.6	81.1	75.3	75.9
Polish–Russian	47.4 (6814)	47.3	40.3 (9079)	40.3	83.6	84.2	80.2	81.2
Polish–Slovak	35.8 (1217)	33.6	28.5 (1689)	26.4	80.3	77.8	77.5	75.7
Polish–Ukrainian	35.8 (1118)	35.0	30.5 (1463)	30.2	75.1	75.7	71.7	72.4
Russian–Czech	33.1 (5708)	34.0	27.2 (7538)	28.0	77.3	78.5	73.1	74.3
Russian–Polish	39.8 (9183)	41.2	34.8 (11697)	36.1	80.8	82.6	77.7	80.2
Russian–Slovak	25.7 (1610)	21.1	20.9 (2150)	17.0	79.3	76.8	76.0	74.2
Russian–Ukrainian	47.9 (1165)	45.5	43.8 (1396)	41.6	83.3	82.5	82.1	82.2
Slovak–Czech	58.0 (858)	53.3	49.2 (1154)	43.5	91.1	91.3	89.3	89.3
Slovak–Polish	40.4 (830)	32.5	32.7 (1094)	25.7	81.4	79.8	79.4	78.2
Slovak–Russian	25.3 (814)	12.0	20.0 (1140)	9.6	83.5	81.1	81.7	80.0
Slovak–Ukrainian	45.5 (330)	49.4	38.1 (425)	41.9	84.2	85.2	82.4	83.3
Ukrainian–Czech	44.2 (699)	41.9	38.9 (869)	36.1	78.7	80.7	74.5	76.8
Ukrainian–Polish	54.6 (850)	50.6	47.2 (1054)	43.0	83.2	82.7	79.5	78.5
Ukrainian–Russian	68.4 (786)	61.1	63.7 (933)	56.1	89.9	89.1	88.6	87.6
Ukrainian–Slovak	39.1 (322)	44.4	31.7 (420)	35.7	82.0	82.0	80.2	81.9
Catalan–French	55.9 (5605)	58.4	32.0 (11367)	34.6	79.4	81.9	49.2	52.9
Catalan–Italian	53.0 (5518)	54.3	29.3 (11970)	30.7	80.1	81.8	49.2	51.5
Catalan–Portuguese	62.8 (5418)	64.2	41.1 (10759)	42.4	83.1	84.3	57.7	59.0
Catalan–Spanish	68.0 (5879)	68.6	43.3 (12282)	44.3	84.2	84.7	57.4	58.8
French–Catalan	40.3 (7845)	42.7	22.4 (16992)	25.3	74.6	78.1	45.9	51.4
French–Italian	48.3 (9891)	49.8	26.8 (22052)	28.1	79.9	81.5	50.9	53.4
French–Portuguese	47.4 (8930)	50.3	29.7 (17536)	32.1	76.9	80.0	52.5	56.6
French–Spanish	47.8 (9770)	50.2	26.7 (21087)	28.9	78.0	81.4	47.9	52.2
Italian–Catalan	35.5 (9035)	37.2	17.8 (22636)	19.1	73.5	75.6	45.0	47.8
Italian–French	40.5 (12595)	41.4	21.0 (31419)	21.6	76.8	77.7	49.8	51.7
Italian–Portuguese	42.6 (10072)	43.6	20.4 (25704)	21.3	76.7	77.8	46.6	48.6
Italian–Spanish	42.7 (11685)	43.8	21.1 (30686)	22.1	76.4	77.6	47.6	49.6
Portuguese–Catalan	47.8 (7199)	49.9	27.6 (16059)	29.0	77.6	80.2	49.9	52.5
Portuguese–French	47.1 (9664)	49.4	25.6 (22437)	27.7	77.4	80.0	47.2	50.7
Portuguese–Italian	46.4 (8939)	47.6	24.8 (20757)	25.9	77.8	78.8	49.0	50.6
Portuguese–Spanish	60.2 (9275)	61.1	36.8 (22638)	37.6	84.7	85.4	57.1	58.2
Spanish–Catalan	49.4 (8291)	50.3	29.8 (18442)	30.7	76.8	78.2	51.2	52.8
Spanish–French	45.5 (11457)	47.3	24.2 (25775)	25.7	74.1	77.1	44.2	47.0
Spanish–Italian	46.6 (10709)	47.3	27.1 (23528)	27.8	76.2	77.0	50.7	51.8
Spanish–Portuguese	57.3 (9732)	57.9	35.4 (23197)	35.7	81.5	81.8	55.1	55.7

Table 7: Full results for the standard BLI task and controlled for lexeme BLI for the model of (Ruder et al., 2018) (with ✓an without ✗an enforced morphological constraint).

	Czech–Polish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	49.32 (3161)	40.85 (4166)	84.5	78.2
ACC;ADJ;NEUT;SG	50.00 (68)	47.89 (71)	92.65	91.55
ADJ;GEN;PL	52.38 (63)	47.89 (71)	98.41	98.59
ADJ;GEN;MASC;SG	43.08 (65)	40.85 (71)	98.46	98.59
ADJ;ESS;MASC;SG	50.00 (56)	40.85 (71)	85.71	84.51
ADJ;FEM;INS;SG	16.67 (6)	16.67 (6)	66.67	66.67
ADJ;NOM;PL	16.67 (6)	16.67 (6)	66.67	66.67
ACC;ADJ;FEM;SG	52.24 (67)	50.70 (71)	95.52	95.77
ADJ;INS;NEUT;SG	20.00 (5)	16.67 (6)	100	100
ADJ;DAT;FEM;SG	50.00 (68)	47.89 (71)	92.65	91.55
ADJ;DAT;MASC;SG	65.85 (41)	46.48 (71)	100	100
ADJ;DAT;PL	41.54 (65)	39.44 (71)	98.46	98.59
ADJ;ESS;FEM;SG	50.00 (68)	47.89 (71)	92.65	91.55
ADJ;INS;MASC;SG	41.54 (65)	39.44 (71)	98.46	98.59
ADJ;ESS;NEUT;SG	47.37 (57)	38.03 (71)	94.74	91.55
ADJ;INS;PL	52.73 (55)	45.07 (71)	100	100
ACC;ADJ;PL	16.67 (6)	16.67 (6)	66.67	66.67
ADJ;ESS;PL	52.38 (63)	47.89 (71)	98.41	98.59
ADJ;FEM;GEN;SG	50.00 (68)	47.89 (71)	92.65	91.55
ACC;ADJ;MASC;SG	43.08 (65)	40.85 (71)	98.46	98.59
ADJ;GEN;NEUT;SG	43.08 (65)	40.85 (71)	98.46	98.59
ADJ;DAT;NEUT;SG	65.85 (41)	46.48 (71)	100	100
GEN;N;SG	54.26 (352)	54.37 (355)	85.8	84.79
ACC;N;PL	55.15 (330)	53.49 (344)	88.48	87.5
INS;N;PL	58.94 (263)	46.82 (346)	95.44	93.06
DAT;N;SG	47.62 (273)	43.06 (353)	72.89	68.56
N;NOM;PL	54.35 (333)	52.74 (347)	88.59	86.74
ESS;N;PL	60.70 (229)	46.67 (345)	92.14	93.33
N;SG;VOC	52.87 (157)	35.88 (354)	72.61	54.8
N;PL;VOC	54.22 (332)	52.45 (347)	88.55	86.46
ACC;N;SG	50.43 (347)	49.30 (355)	76.95	75.77
INS;N;SG	49.23 (325)	45.89 (353)	86.15	85.55
GEN;N;PL	53.55 (310)	49.43 (348)	80	75
ESS;N;SG	47.44 (312)	43.34 (353)	72.12	68.84
N;NOM;SG	49.58 (355)	49.58 (355)	77.75	77.75
DAT;N;PL	49.08 (163)	35.84 (346)	90.8	90.17
ADJ;FEM;NOM;SG	48.39 (62)	47.69 (65)	93.55	93.85
ADJ;MASC;NOM;SG	58.06 (62)	56.92 (65)	95.16	96.92
ACC;ADJ;INAN;MASC;SG	58.06 (62)	56.92 (65)	95.16	96.92
ACC;ADJ;MASC;PL	53.23 (62)	50.77 (65)	95.16	93.85
ADJ;MASC;NOM;PL	36.11 (36)	33.85 (65)	72.22	63.08
ADJ;NEUT;NOM;SG	53.23 (62)	50.77 (65)	95.16	93.85
3;MASC;PST;SG;V	52.63 (38)	48.78 (41)	89.47	85.37
2;IMP;PL;V	12.50 (8)	7.50 (40)	37.5	25
1;PRS;SG;V	46.15 (13)	20.59 (34)	69.23	32.35
3;FEM;PL;PST;V	55.56 (27)	43.90 (41)	92.59	85.37
1;PL;PRS;V	35.71 (14)	14.71 (34)	71.43	50
3;PL;PRS;V	46.43 (28)	41.18 (34)	92.86	79.41
3;MASC;PL;PST;V	38.71 (31)	31.71 (41)	90.32	82.93
3;NEUT;PST;SG;V	55.56 (27)	43.90 (41)	96.3	95.12
NFIN;V	33.33 (45)	32.61 (46)	100	95.65
2;PL;PRS;V	0.00 (5)	0.00 (34)	0	0
3;PRS;SG;V	46.88 (32)	44.12 (34)	75	64.71
3;FEM;PST;SG;V	51.52 (33)	48.78 (41)	93.94	90.24
2;PRS;SG;V	14.29 (7)	5.88 (34)	42.86	20.59
2;IMP;SG;V	15.38 (13)	10.00 (40)	23.08	20
1;IMP;PL;V	33.33 (3)	5.00 (40)	66.67	17.5
2;FUT;PL;V	0.00 (1)	0.00 (9)	0	0
1;FUT;SG;V	0.00 (5)	0.00 (9)	20	11.11
3;FUT;PL;V	14.29 (7)	11.11 (9)	28.57	33.33
1;FUT;PL;V	0.00 (3)	11.11 (9)	66.67	66.67
2;FUT;SG;V	0.00 (1)	11.11 (9)	100	33.33
3;FUT;SG;V	11.11 (9)	11.11 (9)	33.33	33.33

Table 8: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Czech–Polish language pair (the grey numbers correspond to the dictionary sizes).

	Czech–Russian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	44.47 (3562)	37.32 (4762)	87.11	82.89
GEN;N;PL	40.38 (312)	36.71 (365)	78.53	73.97
GEN;N;SG	47.40 (365)	46.65 (373)	84.66	83.65
DAT;N;PL	52.41 (187)	39.73 (365)	96.26	94.79
INS;N;SG	51.85 (324)	47.72 (373)	88.89	86.86
ACC;N;PL	45.78 (225)	43.55 (248)	81.33	78.63
N;NOM;PL	48.06 (335)	45.30 (362)	86.87	83.43
N;NOM;SG	44.69 (367)	43.94 (371)	79.56	79.25
DAT;N;SG	43.73 (311)	38.87 (373)	77.49	73.46
ESS;N;SG	43.59 (312)	38.61 (373)	77.56	72.92
INS;N;PL	45.70 (256)	37.53 (365)	86.72	85.48
ESS;N;PL	46.15 (208)	37.81 (365)	94.23	94.52
ACC;N;SG	44.78 (364)	43.43 (373)	80.49	79.36
ADJ;DAT;MASC;SG	61.40 (57)	50.60 (83)	98.25	98.8
ADJ;NEUT;NOM;SG	59.15 (71)	55.41 (74)	88.73	86.49
ADJ;FEM;GEN;SG	55.56 (81)	53.01 (83)	86.42	84.34
ACC;ADJ;INAN;MASC;SG	56.94 (72)	55.41 (74)	95.83	94.59
ADJ;INS;PL	65.22 (69)	59.04 (83)	100	100
ADJ;ESS;PL	63.64 (77)	60.24 (83)	98.7	98.8
ADJ;FEM;NOM;SG	59.72 (72)	58.11 (74)	97.22	97.3
ADJ;DAT;PL	62.34 (77)	59.04 (83)	100	100
ADJ;ESS;FEM;SG	55.56 (81)	53.01 (83)	86.42	84.34
ADJ;DAT;NEUT;SG	61.40 (57)	50.60 (83)	98.25	98.8
ADJ;GEN;PL	63.64 (77)	60.24 (83)	98.7	98.8
ADJ;MASC;NOM;SG	56.94 (72)	55.41 (74)	95.83	94.59
ADJ;GEN;MASC;SG	59.49 (79)	56.63 (83)	100	100
ACC;ADJ;NEUT;SG	56.25 (80)	53.01 (83)	86.25	84.34
ACC;ADJ;MASC;SG	59.49 (79)	56.63 (83)	100	100
ADJ;GEN;NEUT;SG	59.49 (79)	56.63 (83)	100	100
ADJ;DAT;FEM;SG	55.56 (81)	53.01 (83)	86.42	84.34
ADJ;INS;MASC;SG	62.34 (77)	59.04 (83)	100	100
ACC;ADJ;FEM;SG	62.50 (80)	60.24 (83)	96.25	96.39
ADJ;ESS;MASC;SG	54.93 (71)	51.81 (83)	98.59	98.8
ADJ;ESS;NEUT;SG	58.33 (72)	54.22 (83)	100	100
3;PRS;SG;V	29.63 (54)	28.57 (56)	90.74	87.5
2;PRS;SG;V	0.00 (7)	14.29 (56)	57.14	55.36
2;IMP;PL;V	5.88 (17)	7.79 (77)	88.24	71.43
1;PRS;SG;V	7.69 (13)	12.50 (56)	53.85	37.5
3;FEM;PST;SG;V	26.23 (61)	22.50 (80)	98.36	95
1;PL;PRS;V	7.14 (14)	8.93 (56)	78.57	71.43
3;NEUT;PST;SG;V	23.81 (42)	22.50 (80)	92.86	93.75
2;PL;PRS;V	27.27 (11)	16.07 (56)	63.64	73.21
3;MASC;PST;SG;V	28.57 (70)	26.25 (80)	91.43	86.25
3;PL;PRS;V	40.00 (40)	28.57 (56)	92.5	71.43
NFIN;V	26.92 (104)	24.14 (116)	99.04	99.14
3;MASC;PL;PST;V	25.00 (60)	23.75 (80)	98.33	96.25
2;IMP;SG;V	6.67 (15)	6.49 (77)	33.33	20.78
3;FEM;PL;PST;V	17.86 (56)	15.00 (80)	91.07	81.25
ADJ;FEM;INS;SG	33.33 (9)	33.33 (9)	66.67	66.67
ADJ;NOM;PL	33.33 (9)	33.33 (9)	66.67	66.67
ADJ;INS;NEUT;SG	44.44 (9)	44.44 (9)	100	100
ACC;ADJ;PL	33.33 (9)	33.33 (9)	66.67	66.67
1;FUT;PL;V	0.00 (6)	0.00 (26)	50	42.31
3;FUT;SG;V	14.29 (21)	11.54 (26)	76.19	65.38
2;FUT;PL;V	0.00 (7)	0.00 (26)	100	57.69
1;FUT;SG;V	0.00 (7)	0.00 (25)	14.29	8
2;FUT;SG;V	0.00 (2)	0.00 (26)	0	34.62
3;FUT;PL;V	15.79 (19)	11.54 (26)	73.68	65.38
ACC;INAN;N;SG	0.00 (2)	0.00 (2)	0	0
ACC;INAN;N;PL	0.00 (2)	0.00 (2)	50	50

Table 9: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Czech–Russian language pair (the grey numbers correspond to the dictionary sizes).

	Czech–Slovak			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	53.12 (802)	45.47 (1027)	90.90	88.7
ADJ;INS;MASC;SG	60.00 (10)	63.64 (11)	100.00	100
ADJ;ESS;PL	63.64 (11)	63.64 (11)	100.00	100
ADJ;DAT;NEUT;SG	62.50 (8)	63.64 (11)	100.00	100
ADJ;ESS;FEM;SG	63.64 (11)	63.64 (11)	90.91	90.91
ACC;ADJ;MASC;PL	63.64 (11)	63.64 (11)	90.91	90.91
ADJ;MASC;NOM;SG	54.55 (11)	54.55 (11)	100.00	100
ADJ;ESS;MASC;SG	62.50 (8)	54.55 (11)	87.50	81.82
ADJ;GEN;NEUT;SG	72.73 (11)	72.73 (11)	100.00	100
ADJ;DAT;PL	60.00 (10)	63.64 (11)	100.00	100
ADJ;MASC;NOM;PL	57.14 (7)	45.45 (11)	100.00	81.82
ACC;ADJ;INAN;MASC;SG	54.55 (11)	54.55 (11)	100.00	100
ADJ;GEN;MASC;SG	72.73 (11)	72.73 (11)	100.00	100
ACC;ADJ;MASC;SG	72.73 (11)	72.73 (11)	100.00	100
ACC;ADJ;NEUT;SG	63.64 (11)	63.64 (11)	90.91	90.91
ADJ;ESS;NEUT;SG	75.00 (8)	72.73 (11)	100.00	100
ADJ;NEUT;NOM;SG	63.64 (11)	63.64 (11)	90.91	90.91
ADJ;INS;PL	75.00 (8)	72.73 (11)	100.00	100
ADJ;GEN;PL	63.64 (11)	63.64 (11)	100.00	100
ADJ;FEM;NOM;SG	63.64 (11)	63.64 (11)	100.00	100
ADJ;DAT;MASC;SG	62.50 (8)	63.64 (11)	100.00	100
ADJ;FEM;GEN;SG	63.64 (11)	63.64 (11)	90.91	90.91
ADJ;DAT;FEM;SG	63.64 (11)	63.64 (11)	90.91	90.91
ACC;ADJ;FEM;SG	63.64 (11)	63.64 (11)	100.00	90.91
GEN;N;SG	52.58 (97)	51.49 (101)	87.63	89.11
N;NOM;PL	54.35 (92)	53.85 (104)	88.04	86.54
INS;N;SG	59.52 (84)	49.50 (101)	91.67	90.1
N;NOM;SG	53.54 (99)	52.48 (101)	88.89	88.12
ACC;N;SG	50.53 (95)	49.50 (101)	90.53	90.1
ACC;N;PL	52.13 (94)	52.88 (104)	84.04	86.54
DAT;N;SG	52.78 (72)	43.56 (101)	81.94	76.24
INS;N;PL	55.00 (60)	40.78 (103)	96.67	93.2
DAT;N;PL	37.25 (51)	29.13 (103)	88.24	89.32
ESS;N;SG	54.67 (75)	44.55 (101)	85.33	78.22
ESS;N;PL	52.73 (55)	37.86 (103)	98.18	97.09
GEN;N;PL	46.51 (86)	41.35 (104)	83.72	77.88
NFIN;V	58.33 (84)	53.68 (95)	100.00	100
3;FEM;PL;PST;V	0.00 (1)	0.00 (1)	100.00	100
1;PRS;SG;V	-	0.00 (1)	-	100
3;MASC;PL;PST;V	0.00 (1)	0.00 (1)	100.00	100
3;NEUT;PST;SG;V	0.00 (1)	0.00 (1)	100.00	100
3;MASC;PST;SG;V	0.00 (1)	0.00 (1)	100.00	100
1;PL;PRS;V	100.00 (1)	100.00 (1)	100.00	100
1;IMP;PL;V	-	0.00 (1)	-	0
3;FEM;PST;SG;V	0.00 (1)	0.00 (1)	100.00	100
2;IMP;PL;V	-	0.00 (1)	-	100
3;PRS;SG;V	100.00 (1)	100.00 (1)	100.00	100
2;IMP;SG;V	-	0.00 (1)	-	0
2;PL;PRS;V	-	0.00 (1)	-	0
2;PRS;SG;V	-	0.00 (1)	-	0
3;NEUT;PL;PST;V	0.00 (1)	0.00 (1)	100.00	100
3;PL;PRS;V	0.00 (1)	0.00 (1)	0.00	0

Table 10: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Czech–Slovak language pair (the grey numbers correspond to the dictionary sizes).

	Czech–Ukrainian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	32.39 (673)	26.70 (854)	84.1	80.21
ACC;N;SG	34.44 (90)	32.63 (95)	78.89	77.89
N;PL;VOC	33.71 (89)	31.91 (94)	84.27	81.91
N;SG;VOC	20.00 (35)	10.64 (94)	68.57	47.87
DAT;N;PL	36.84 (57)	27.66 (94)	96.49	96.81
N;NOM;SG	32.98 (94)	32.63 (95)	81.91	81.05
INS;N;SG	42.17 (83)	36.84 (95)	91.57	90.53
ACC;N;PL	34.44 (90)	32.98 (94)	83.33	82.98
INS;N;PL	32.89 (76)	26.60 (94)	92.11	90.43
GEN;N;SG	29.67 (91)	28.42 (95)	81.32	80
GEN;N;PL	32.94 (85)	31.58 (95)	84.71	82.11
N;NOM;PL	33.33 (90)	31.91 (94)	83.33	81.91
ESS;N;SG	28.05 (82)	24.21 (95)	73.17	65.26
DAT;N;SG	26.25 (80)	23.16 (95)	72.5	65.26
ESS;N;PL	36.67 (60)	24.47 (94)	91.67	94.68
3;PL;PRS;V	0.00 (2)	0.00 (3)	50	33.33
3;PRS;SG;V	33.33 (3)	33.33 (3)	66.67	66.67
1;PRS;SG;V	50.00 (2)	33.33 (3)	100	66.67
3;NEUT;PST;SG;V	0.00 (2)	0.00 (3)	100	100
3;FEM;PST;SG;V	33.33 (3)	33.33 (3)	100	100
3;FEM;PL;PST;V	0.00 (3)	0.00 (3)	66.67	66.67
NFIN;V	66.67 (3)	66.67 (3)	100	100
3;MASC;PL;PST;V	0.00 (3)	0.00 (3)	66.67	66.67
2;IMP;SG;V	0.00 (3)	0.00 (3)	33.33	33.33
2;PL;PRS;V	0.00 (2)	0.00 (3)	100	66.67
2;PRS;SG;V	0.00 (2)	0.00 (3)	50	33.33
2;IMP;PL;V	0.00 (3)	0.00 (3)	100	100
1;PL;PRS;V	50.00 (2)	33.33 (3)	100	100
1;IMP;PL;V	0.00 (1)	0.00 (3)	0	0
3;MASC;PST;SG;V	50.00 (2)	50.00 (2)	100	100
ADJ;FEM;GEN;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;PL	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;PL	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;PL	0.00 (1)	0.00 (1)	100	100
ADJ;INS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;FEM;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;INAN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;MASC;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;FEM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;NEUT;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;PL	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;FEM;SG	0.00 (1)	0.00 (1)	100	100

Table 11: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Czech–Ukrainian language pair (the grey numbers correspond to the dictionary sizes).

		Polish–Czech		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	39.97 (4043)	32.91 (5332)	82.39	76.73
DAT;N;SG	24.64 (280)	16.86 (427)	59.29	44.03
N;NOM;PL	40.72 (388)	37.89 (417)	85.05	82.73
GEN;N;SG	41.06 (414)	39.58 (427)	83.82	81.26
ESS;N;PL	49.80 (255)	36.30 (416)	93.33	93.03
N;SG;VOC	32.62 (187)	22.95 (427)	62.03	51.29
N;PL;VOC	40.72 (388)	37.89 (417)	85.05	82.73
ESS;N;SG	32.74 (336)	27.06 (425)	62.2	55.76
DAT;N;PL	45.05 (182)	29.33 (416)	96.15	95.43
GEN;N;PL	45.11 (368)	39.95 (418)	80.16	76.56
ACC;N;PL	42.13 (394)	39.71 (418)	85.28	83.49
INS;N;PL	30.79 (315)	26.20 (416)	85.71	85.1
INS;N;SG	42.35 (366)	37.32 (426)	81.97	80.99
ACC;N;SG	43.84 (406)	41.69 (427)	80.05	76.81
N;NOM;SG	41.71 (422)	40.75 (427)	80.81	78.69
ACC;ADJ;MASC;SG	49.28 (69)	49.28 (69)	100	100
ACC;ADJ;FEM;SG	46.97 (66)	46.38 (69)	100	98.55
ADJ;ESS;MASC;SG	44.26 (61)	40.58 (69)	100	100
ADJ;INS;MASC;SG	42.42 (66)	40.58 (69)	100	100
ADJ;MASC;NOM;SG	50.00 (66)	50.75 (67)	95.45	95.52
ADJ;FEM;NOM;SG	49.23 (65)	50.75 (67)	96.92	97.01
ADJ;NEUT;NOM;SG	49.25 (67)	49.25 (67)	97.01	97.01
ADJ;DAT;MASC;SG	50.00 (32)	40.58 (69)	100	100
ADJ;GEN;NEUT;SG	49.28 (69)	49.28 (69)	100	100
ADJ;GEN;MASC;SG	49.28 (69)	49.28 (69)	100	100
ADJ;MASC;NOM;PL	32.56 (43)	28.36 (67)	76.74	70.15
ADJ;ESS;NEUT;SG	44.26 (61)	40.58 (69)	100	100
ADJ;FEM;GEN;SG	41.79 (67)	43.48 (69)	89.55	86.96
ADJ;ESS;FEM;SG	41.79 (67)	43.48 (69)	89.55	86.96
ADJ;ESS;PL	41.79 (67)	42.03 (69)	100	100
ACC;ADJ;INAN;MASC;SG	50.00 (66)	50.75 (67)	95.45	95.52
ACC;ADJ;MASC;PL	41.79 (67)	43.28 (67)	100	100
ADJ;DAT;FEM;SG	41.79 (67)	43.48 (69)	89.55	86.96
ACC;ADJ;NEUT;SG	47.83 (69)	47.83 (69)	97.1	97.1
ADJ;GEN;PL	41.79 (67)	42.03 (69)	100	100
ADJ;INS;PL	42.11 (57)	39.13 (69)	100	100
ADJ;DAT;NEUT;SG	50.00 (32)	40.58 (69)	100	100
ADJ;DAT;PL	42.42 (66)	40.58 (69)	100	100
3;MASC;PST;SG;V	54.55 (33)	50.00 (36)	90.91	91.67
3;FEM;PST;SG;V	56.67 (30)	48.65 (37)	90	89.19
3;PL;PRS;V	35.00 (20)	32.00 (25)	80	72
2;PRS;SG;V	44.44 (9)	28.00 (25)	66.67	60
2;IMP;SG;V	0.00 (18)	0.00 (37)	11.11	0
2;IMP;PL;V	22.22 (9)	8.11 (37)	55.56	21.62
3;NEUT;PST;SG;V	69.23 (26)	51.35 (37)	96.15	89.19
1;IMP;PL;V	20.00 (5)	2.70 (37)	20	5.41
2;PL;PRS;V	0.00 (4)	0.00 (25)	0	24
NFIN;V	44.74 (38)	42.50 (40)	94.74	95
3;PRS;SG;V	41.67 (24)	40.00 (25)	83.33	80
3;MASC;PL;PST;V	56.25 (32)	48.65 (37)	96.88	94.59
3;FEM;PL;PST;V	56.52 (23)	40.54 (37)	95.65	94.59
1;PL;PRS;V	40.00 (10)	20.00 (25)	90	56
1;PRS;SG;V	14.29 (14)	8.00 (25)	50	32
ACC;ADJ;PL	0.00 (5)	0.00 (5)	100	100
ADJ;INS;NEUT;SG	0.00 (5)	0.00 (5)	100	100
ADJ;FEM;INS;SG	0.00 (5)	0.00 (5)	100	100
ADJ;NOM;PL	0.00 (5)	0.00 (5)	100	100
3;FUT;SG;V	50.00 (10)	30.77 (13)	60	46.15
1;FUT;PL;V	25.00 (8)	15.38 (13)	50	38.46
2;FUT;SG;V	0.00 (3)	15.38 (13)	66.67	46.15
2;FUT;PL;V	0.00 (3)	15.38 (13)	0	30.77
1;FUT;SG;V	12.50 (8)	0.00 (13)	62.5	30.77
3;FUT;PL;V	33.33 (9)	7.69 (13)	77.78	53.85

Table 12: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Polish–Czech language pair (the grey numbers correspond to the dictionary sizes).

	Polish–Russian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	47.04 (6814)	40.32 (9079)	84.88	82.18
N;NOM;SG	41.54 (768)	40.46 (786)	76.82	75.32
ACC;N;SG	41.18 (748)	39.44 (791)	76.47	74.21
DAT;N;SG	37.47 (459)	27.34 (790)	77.78	69.24
INS;N;SG	48.55 (688)	43.85 (789)	89.39	88.09
ESS;N;SG	42.23 (611)	37.28 (786)	73.00	67.56
GEN;N;SG	47.28 (753)	45.75 (789)	82.60	81.62
ADJ;INS;PL	63.16 (133)	59.73 (149)	100.00	100
ADJ;FEM;INS;SG	56.25 (144)	55.03 (149)	95.83	96.64
ADJ;FEM;NOM;SG	54.86 (144)	52.35 (149)	91.67	89.93
ADJ;DAT;FEM;SG	57.64 (144)	55.70 (149)	95.83	95.3
ADJ;ESS;MASC;SG	63.04 (138)	59.06 (149)	98.55	97.99
ADJ;INS;MASC;SG	60.42 (144)	59.06 (149)	98.61	97.99
ADJ;NEUT;NOM;SG	60.28 (141)	57.05 (149)	93.62	93.29
ADJ;DAT;PL	60.42 (144)	59.06 (149)	98.61	97.99
ADJ;ESS;NEUT;SG	63.04 (138)	59.06 (149)	98.55	97.99
ADJ;GEN;PL	62.07 (145)	60.40 (149)	99.31	98.66
ADJ;DAT;NEUT;SG	51.28 (78)	44.97 (149)	100.00	100
ACC;ADJ;FEM;SG	57.04 (142)	55.03 (149)	97.18	96.64
ADJ;GEN;MASC;SG	56.25 (144)	54.36 (149)	98.61	97.99
ACC;ADJ;MASC;SG	56.25 (144)	54.36 (149)	98.61	97.99
ADJ;FEM;GEN;SG	57.64 (144)	55.70 (149)	95.83	95.3
ACC;ADJ;INAN;MASC;SG	54.17 (144)	53.02 (149)	90.97	89.93
ADJ;INS;NEUT;SG	60.42 (144)	59.06 (149)	98.61	97.99
ADJ;MASC;NOM;SG	54.17 (144)	53.02 (149)	90.97	89.93
ADJ;NOM;PL	59.03 (144)	57.05 (149)	93.75	93.29
ACC;ADJ;PL	58.22 (146)	57.05 (149)	93.15	93.29
ADJ;DAT;MASC;SG	51.28 (78)	44.97 (149)	100.00	100
ADJ;ESS;PL	62.07 (145)	60.40 (149)	99.31	98.66
ACC;ADJ;NEUT;SG	60.28 (141)	57.05 (149)	93.62	93.29
ADJ;GEN;NEUT;SG	56.25 (144)	54.36 (149)	98.61	97.99
ADJ;ESS;FEM;SG	57.64 (144)	55.70 (149)	95.83	95.3
INS;N;PL	50.42 (480)	41.63 (723)	97.71	98.62
N;NOM;PL	45.22 (670)	43.27 (721)	80.75	79.33
DAT;N;PL	54.17 (240)	37.34 (723)	94.58	94.88
ACC;N;PL	46.77 (511)	44.19 (559)	82.00	80.5
GEN;N;PL	46.65 (641)	42.72 (728)	80.50	77.47
ESS;N;PL	55.76 (425)	43.98 (723)	96.00	95.57
NFIN;V	48.15 (27)	46.67 (30)	96.30	96.67
3;FEM;PL;PST;V	9.52 (21)	12.90 (31)	71.43	77.42
2;IMP;PL;V	0.00 (5)	9.68 (31)	80.00	41.94
2;FEM;PST;SG;V	0.00 (1)	6.45 (31)	100.00	16.13
3;NEUT;PST;SG;V	18.75 (16)	25.81 (31)	56.25	83.87
3;MASC;PL;PST;V	28.00 (25)	32.26 (31)	84.00	87.1
1;FEM;PST;SG;V	11.11 (9)	6.45 (31)	22.22	9.68
3;MASC;PST;SG;V	40.00 (25)	35.48 (31)	88.00	80.65
2;MASC;PL;PST;V	0.00 (1)	9.68 (31)	0.00	48.39
2;IMP;SG;V	5.88 (17)	3.23 (31)	23.53	19.35
2;PRS;SG;V	20.00 (5)	4.76 (21)	40.00	47.62
2;PL;PRS;V	0.00 (3)	4.76 (21)	66.67	19.05
3;PL;PRS;V	29.41 (17)	23.81 (21)	94.12	95.24
3;FEM;PST;SG;V	26.92 (26)	29.03 (31)	88.46	93.55
1;PL;PRS;V	12.50 (8)	4.76 (21)	62.50	47.62
3;PRS;SG;V	23.81 (21)	23.81 (21)	85.71	85.71
1;PRS;SG;V	8.33 (12)	9.52 (21)	50.00	57.14
1;MASC;PL;PST;V	14.29 (7)	6.45 (31)	14.29	19.35
1;MASC;PST;SG;V	0.00 (16)	0.00 (31)	18.75	9.68
1;FEM;PL;PST;V	-	19.35 (31)	-	77.42
2;MASC;PST;SG;V	0.00 (10)	0.00 (31)	0.00	3.23
2;FEM;PL;PST;V	-	19.35 (31)	-	54.84
2;FUT;PL;V	0.00 (1)	0.00 (10)	100.00	30
1;FUT;PL;V	33.33 (3)	20.00 (10)	33.33	20
1;FUT;SG;V	0.00 (4)	0.00 (10)	0.00	20
2;FUT;SG;V	0.00 (1)	0.00 (10)	0.00	50
3;FUT;SG;V	0.00 (8)	0.00 (10)	62.50	60
3;FUT;PL;V	0.00 (8)	0.00 (10)	62.50	50

Table 13: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Polish–Russian language pair (the grey numbers correspond to the dictionary sizes).

	Polish–Slovak			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	24.98 (1217)	19.83 (1689)	81.02	78.45
INS;N;SG	27.64 (123)	22.29 (157)	92.68	90.45
N;NOM;SG	21.43 (154)	21.02 (157)	72.73	71.34
GEN;N;SG	20.83 (144)	19.75 (157)	72.92	68.15
DAT;N;SG	13.19 (91)	9.55 (157)	65.93	54.14
ACC;N;PL	22.79 (136)	20.51 (156)	76.47	72.44
INS;N;PL	32.58 (89)	21.15 (156)	100.00	100
DAT;N;PL	25.00 (68)	16.03 (156)	73.53	79.49
N;NOM;PL	22.46 (138)	20.51 (156)	77.54	73.08
ESS;N;SG	20.00 (110)	16.03 (156)	68.18	53.85
GEN;N;PL	23.53 (119)	19.23 (156)	72.27	65.38
ESS;N;PL	32.47 (77)	22.44 (156)	96.10	97.44
ACC;N;SG	23.08 (143)	20.38 (157)	72.03	67.52
ADJ;ESS;FEM;SG	17.65 (17)	20.00 (20)	88.24	90
ADJ;ESS;MASC;SG	14.29 (14)	15.00 (20)	100.00	100
ADJ;DAT;NEUT;SG	18.18 (11)	15.00 (20)	100.00	100
ADJ;FEM;GEN;SG	17.65 (17)	20.00 (20)	88.24	90
ADJ;DAT;PL	17.65 (17)	15.00 (20)	100.00	100
ADJ;INS;PL	57.14 (14)	45.00 (20)	100.00	100
ADJ;MASC;NOM;PL	9.09 (11)	10.00 (20)	81.82	85
ADJ;GEN;NEUT;SG	22.22 (18)	25.00 (20)	94.44	95
ADJ;ESS;NEUT;SG	14.29 (14)	15.00 (20)	100.00	100
ACC;ADJ;MASC;SG	22.22 (18)	25.00 (20)	94.44	95
ADJ;GEN;PL	57.89 (19)	55.00 (20)	100.00	100
ADJ;FEM;INS;SG	53.85 (13)	40.00 (20)	100.00	100
ADJ;INS;MASC;SG	17.65 (17)	15.00 (20)	100.00	100
ADJ;INS;NEUT;SG	17.65 (17)	15.00 (20)	100.00	100
ACC;ADJ;NEUT;SG	33.33 (18)	30.00 (20)	100.00	100
ACC;ADJ;INAN;MASC;SG	42.11 (19)	40.00 (20)	100.00	100
ACC;ADJ;PL	33.33 (18)	30.00 (20)	100.00	100
ACC;ADJ;MASC;PL	57.89 (19)	55.00 (20)	100.00	100
ADJ;FEM;NOM;SG	22.22 (18)	20.00 (20)	83.33	75
ADJ;ESS;PL	57.89 (19)	55.00 (20)	100.00	100
ADJ;NOM;PL	33.33 (18)	30.00 (20)	100.00	100
ADJ;GEN;MASC;SG	22.22 (18)	25.00 (20)	94.44	95
ADJ;NEUT;NOM;SG	33.33 (18)	30.00 (20)	100.00	100
ACC;ADJ;FEM;SG	46.67 (15)	40.00 (20)	100.00	100
ADJ;MASC;NOM;SG	42.11 (19)	40.00 (20)	100.00	100
ADJ;DAT;MASC;SG	18.18 (11)	15.00 (20)	100.00	100
ADJ;DAT;FEM;SG	17.65 (17)	20.00 (20)	88.24	90
NFIN;V	50.00 (10)	27.27 (11)	100.00	100
2;PRS;SG;V	0.00 (1)	0.00 (1)	0.00	0
1;PL;PRS;V	100.00 (1)	100.00 (1)	100.00	100
3;NEUT;PST;SG;V	0.00 (1)	0.00 (1)	0.00	0
3;MASC;PST;SG;V	0.00 (1)	0.00 (1)	0.00	0
2;IMP;SG;V	-	0.00 (1)	-	0
3;MASC;PL;PST;V	0.00 (1)	0.00 (1)	0.00	0
3;FEM;PL;PST;V	0.00 (1)	0.00 (1)	0.00	0
1;IMP;PL;V	-	0.00 (1)	-	0
3;PRS;SG;V	100.00 (1)	100.00 (1)	100.00	100
2;PL;PRS;V	0.00 (1)	0.00 (1)	100.00	100
2;IMP;PL;V	-	0.00 (1)	-	0
3;FEM;PST;SG;V	0.00 (1)	0.00 (1)	0.00	0
1;PRS;SG;V	0.00 (1)	0.00 (1)	0.00	0
3;PL;PRS;V	100.00 (1)	100.00 (1)	100.00	100

Table 14: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Polish–Slovak language pair (the grey numbers correspond to the dictionary sizes).

	Polish–Ukrainian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	29.87 (1118)	24.81 (1463)	75.22	72.04
N;PL;VOC	28.68 (129)	27.82 (133)	75.97	72.93
N;NOM;PL	28.68 (129)	27.82 (133)	75.97	72.93
ACC;N;PL	28.68 (129)	27.82 (133)	76.74	73.68
ACC;N;SG	30.77 (130)	29.41 (136)	70.77	68.38
ESS;N;PL	35.63 (87)	27.82 (133)	91.95	93.23
N;SG;VOC	20.31 (64)	14.71 (136)	62.50	52.94
INS;N;PL	36.63 (101)	29.32 (133)	100.00	99.25
GEN;N;SG	30.83 (133)	30.15 (136)	75.19	73.53
DAT;N;PL	35.71 (56)	24.81 (133)	96.43	96.24
INS;N;SG	38.26 (115)	32.35 (136)	81.74	79.41
N;NOM;SG	28.68 (136)	28.47 (137)	67.65	66.42
ESS;N;SG	26.72 (116)	23.53 (136)	67.24	59.56
DAT;N;SG	20.21 (94)	14.71 (136)	57.45	41.91
GEN;N;PL	33.06 (121)	30.08 (133)	76.03	75.19
2;MASC;PST;SG;V	0.00 (4)	0.00 (7)	25.00	14.29
1;FEM;PL;PST;V	-	14.29 (7)	-	85.71
1;MASC;PST;SG;V	0.00 (5)	0.00 (7)	40.00	28.57
3;FEM;PL;PST;V	16.67 (6)	14.29 (7)	83.33	85.71
2;FUT;SG;V	0.00 (1)	0.00 (1)	0.00	0
2;MASC;PL;PST;V	0.00 (2)	14.29 (7)	0.00	42.86
3;NEUT;PST;SG;V	60.00 (5)	57.14 (7)	100.00	100
1;MASC;PL;PST;V	33.33 (3)	14.29 (7)	33.33	28.57
1;FUT;PL;V	0.00 (1)	0.00 (1)	100.00	100
1;FEM;PST;SG;V	0.00 (4)	0.00 (7)	50.00	28.57
NFIN;V	57.14 (7)	57.14 (7)	100.00	100
3;FUT;PL;V	100.00 (1)	100.00 (1)	100.00	100
2;FEM;PST;SG;V	0.00 (1)	0.00 (7)	0.00	28.57
3;MASC;PL;PST;V	16.67 (6)	14.29 (7)	83.33	85.71
2;IMP;SG;V	0.00 (7)	0.00 (7)	0.00	0
2;IMP;PL;V	0.00 (4)	0.00 (7)	50.00	28.57
3;MASC;PST;SG;V	28.57 (7)	28.57 (7)	100.00	100
3;FEM;PST;SG;V	42.86 (7)	42.86 (7)	100.00	100
3;FUT;SG;V	0.00 (1)	0.00 (1)	0.00	0
2;FEM;PL;PST;V	-	14.29 (7)	-	28.57
1;FUT;SG;V	0.00 (1)	0.00 (1)	100.00	100
2;FUT;PL;V	0.00 (1)	0.00 (1)	100.00	100
1;IMP;PL;V	0.00 (3)	0.00 (7)	0.00	0
1;PRS;SG;V	16.67 (6)	0.00 (6)	50.00	33.33
3;PL;PRS;V	33.33 (6)	33.33 (6)	83.33	83.33
2;PRS;SG;V	25.00 (4)	16.67 (6)	75.00	66.67
2;PL;PRS;V	0.00 (3)	16.67 (6)	0.00	16.67
1;PL;PRS;V	25.00 (4)	33.33 (6)	75.00	83.33
3;PRS;SG;V	50.00 (6)	50.00 (6)	83.33	83.33
ACC;ADJ;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;FEM;SG	-	0.00 (2)	-	100
ADJ;NEUT;NOM;SG	100.00 (2)	100.00 (2)	100.00	100
ACC;ADJ;PL	100.00 (2)	100.00 (2)	100.00	100
ADJ;FEM;INS;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;INS;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;FEM;NOM;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;GEN;PL	0.00 (2)	0.00 (2)	100.00	100
ADJ;NOM;PL	100.00 (2)	100.00 (2)	100.00	100
ADJ;DAT;NEUT;SG	-	0.00 (2)	-	100
ADJ;ESS;NEUT;SG	-	0.00 (2)	-	100
ADJ;MASC;NOM;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;GEN;NEUT;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;ESS;FEM;SG	-	0.00 (2)	-	100
ADJ;ESS;PL	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;MASC;SG	-	0.00 (2)	-	100
ADJ;INS;NEUT;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;INS;PL	0.00 (1)	0.00 (2)	100.00	100
ACC;ADJ;NEUT;SG	100.00 (2)	100.00 (2)	100.00	100
ACC;ADJ;FEM;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;PL	0.00 (2)	0.00 (2)	100.00	100
ACC;ADJ;INAN;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;FEM;GEN;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;ESS;MASC;SG	-	0.00 (2)	-	100
ADJ;GEN;MASC;SG	0.00 (2)	0.00 (2)	100.00	100

Table 15: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Polish–Ukrainian language pair (the grey numbers correspond to the dictionary sizes).

		Catalan–French		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	56.47 (5605)	33.77 (11367)	82.77	54.64
N;SG	62.34 (1293)	61.17 (1321)	88.48	88.57
N;PL	64.10 (1089)	60.28 (1221)	96.14	95.5
1;PL;PRS;SBJV;V	21.67 (60)	12.79 (219)	35.00	25.11
1;COND;SG;V	64.36 (101)	49.32 (219)	94.06	88.13
1;PST;SBJV;SG;V	3.33 (60)	18.26 (219)	16.67	39.73
2;PFV;PL;PST;V	-	0.46 (219)	-	0.46
2;IPFV;PL;PST;V	0.00 (2)	1.37 (219)	0.00	4.11
3;COND;PL;V	68.92 (74)	46.82 (220)	94.59	89.09
2;PL;PRS;V	38.33 (60)	30.14 (219)	65.00	52.05
3;PL;PST;SBJV;V	0.00 (64)	0.00 (220)	0.00	0
2;COND;PL;V	0.00 (1)	5.48 (219)	0.00	13.7
NFIN;V	62.56 (211)	59.64 (223)	90.05	87
2;IMP;POS;SG;V	49.01 (202)	44.29 (219)	64.85	59.36
3;FUT;PL;V	73.33 (75)	51.36 (220)	94.67	93.18
2;IMP;PL;POS;V	38.33 (60)	30.14 (219)	66.67	52.05
1;FUT;SG;V	30.77 (26)	36.53 (219)	73.08	67.58
2;PL;PST;SBJV;V	0.00 (1)	0.00 (219)	0.00	2.28
3;PST;SBJV;SG;V	15.32 (111)	18.18 (220)	32.43	39.55
3;PFV;PST;SG;V	52.44 (164)	40.91 (220)	73.17	59.55
2;PST;SBJV;SG;V	0.00 (3)	0.46 (219)	0.00	1.37
1;PRS;SBJV;SG;V	27.63 (152)	23.98 (221)	42.76	37.1
1;IPFV;PL;PST;V	0.00 (5)	1.37 (219)	0.00	3.65
1;COND;PL;V	0.00 (5)	11.42 (219)	20.00	26.03
3;PRS;SBJV;SG;V	27.45 (153)	23.87 (222)	42.48	36.94
3;PFV;PL;PST;V	64.89 (131)	49.09 (220)	98.47	97.27
2;PRS;SBJV;SG;V	5.56 (36)	6.33 (221)	13.89	11.31
3;IPFV;PL;PST;V	68.35 (158)	57.73 (220)	95.57	95.45
1;PL;PST;SBJV;V	0.00 (2)	0.00 (219)	0.00	0
3;FUT;SG;V	62.71 (118)	45.91 (220)	85.59	77.27
3;PL;PRS;SBJV;V	47.01 (117)	36.04 (222)	72.65	60.81
2;PFV;PST;SG;V	0.00 (2)	0.91 (219)	0.00	2.28
1;PFV;PL;PST;V	0.00 (2)	0.91 (219)	0.00	2.28
3;IPFV;PST;SG;V	60.92 (174)	54.55 (220)	91.95	88.18
2;PL;PRS;SBJV;V	30.77 (39)	27.40 (219)	61.54	49.32
1;FUT;PL;V	40.62 (32)	33.33 (219)	59.38	67.58
3;PRS;SG;V	49.51 (204)	44.80 (221)	65.69	60.18
1;PRS;SG;V	14.29 (98)	14.03 (221)	26.53	23.08
2;FUT;PL;V	14.29 (7)	20.55 (219)	28.57	38.36
1;IMP;PL;POS;V	22.22 (72)	12.84 (218)	36.11	25.23
1;IPFV;PST;SG;V	65.15 (132)	54.79 (219)	96.21	88.58
2;PRS;SG;V	29.07 (86)	19.09 (220)	46.51	32.27
2;FUT;SG;V	0.00 (5)	2.28 (219)	0.00	4.57
1;PFV;PST;SG;V	51.72 (29)	8.76 (217)	75.86	12.9
3;PL;PRS;V	61.90 (189)	55.66 (221)	88.89	85.07
3;COND;SG;V	64.41 (118)	49.09 (220)	92.37	88.18
2;COND;SG;V	0.00 (5)	0.46 (219)	40.00	4.57
2;IPFV;PST;SG;V	0.00 (8)	1.37 (219)	12.50	3.2
1;PL;PRS;V	21.05 (76)	12.79 (219)	38.16	24.66
ADJ;FEM;PL	67.47 (332)	67.16 (335)	98.80	98.81
ADJ;MASC;PL	67.17 (329)	64.47 (349)	96.35	95.7
ADJ;MASC;SG	70.39 (358)	69.51 (364)	96.65	96.7
ADJ;FEM;SG	70.28 (360)	69.59 (365)	96.67	96.71

Table 16: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Catalan–French language pair (the grey numbers correspond to the dictionary sizes).

	Catalan–Italian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	53.77 (5518)	30.74 (11970)	83.15	53.43
2;FUT;SG;V	0.00 (10)	3.73 (241)	20.00	11.62
2;IPFV;PL;PST;V	0.00 (1)	2.90 (241)	0.00	8.3
1;PFV;PL;PST;V	0.00 (1)	0.00 (241)	0.00	0.41
1;IPFV;PL;PST;V	33.33 (6)	16.60 (241)	66.67	31.54
3;IMP;PL;POS;V	22.64 (106)	15.70 (242)	33.96	28.1
2;PL;PRS;SBJV;V	20.69 (29)	10.83 (240)	34.48	28.33
2;PFV;PL;PST;V	-	0.83 (241)	-	3.32
3;IMP;POS;SG;V	24.11 (141)	16.94 (242)	39.72	30.17
3;PST;SBJV;SG;V	46.92 (130)	41.49 (241)	82.31	77.18
1;IPFV;PST;SG;V	65.00 (100)	59.34 (241)	92.00	87.97
1;FUT;PL;V	44.00 (25)	17.43 (241)	64.00	41.91
1;PL;PRS;V	27.14 (70)	20.42 (240)	64.29	52.5
1;FUT;SG;V	40.91 (22)	23.65 (241)	68.18	52.28
3;PRS;SG;V	50.68 (221)	48.56 (243)	70.59	66.67
2;PRS;SG;V	19.78 (91)	9.09 (242)	40.66	16.94
1;PL;PRS;SBJV;V	23.19 (69)	18.33 (240)	60.87	52.08
3;IPFV;PL;PST;V	68.94 (161)	58.68 (242)	96.89	96.69
3;COND;PL;V	14.06 (64)	17.36 (242)	28.12	43.8
3;COND;SG;V	23.01 (113)	23.55 (242)	46.90	61.16
2;PRS;SBJV;SG;V	5.41 (37)	7.05 (241)	18.92	14.11
2;FUT;PL;V	0.00 (8)	5.39 (241)	37.50	16.6
2;IPFV;PST;SG;V	0.00 (4)	3.73 (241)	0.00	3.73
3;PFV;PST;SG;V	51.16 (172)	44.21 (242)	72.67	69.42
NFIN;V	64.22 (232)	62.55 (243)	93.53	93
3;PL;PST;SBJV;V	48.39 (93)	36.10 (241)	98.92	99.17
2;IMP;POS;SG;V	52.09 (215)	48.76 (242)	70.23	65.7
3;IPFV;PST;SG;V	66.30 (184)	59.09 (242)	90.22	88.02
3;PFV;PL;PST;V	62.14 (140)	54.55 (242)	94.29	95.04
1;COND;SG;V	24.74 (97)	23.24 (241)	46.39	61
1;PRS;SG;V	15.96 (94)	12.81 (242)	37.23	23.97
2;IMP;PL;POS;V	22.64 (53)	12.45 (241)	45.28	29.46
3;FUT;SG;V	58.82 (119)	46.28 (242)	94.12	87.6
1;IMP;PL;POS;V	23.19 (69)	18.33 (240)	60.87	52.08
2;PST;SBJV;SG;V	0.00 (3)	0.83 (240)	66.67	5.42
2;PL;PRS;V	23.08 (52)	12.50 (240)	46.15	29.58
1;PST;SBJV;SG;V	47.83 (69)	41.67 (240)	85.51	77.5
2;PL;PST;SBJV;V	-	0.00 (240)	-	0
2;COND;PL;V	0.00 (2)	0.41 (241)	0.00	2.49
1;PFV;PST;SG;V	56.00 (25)	8.86 (237)	72.00	12.66
1;PRS;SBJV;SG;V	24.29 (140)	17.01 (241)	40.00	30.29
3;PRS;SBJV;SG;V	24.11 (141)	16.94 (242)	39.72	30.17
1;COND;PL;V	0.00 (5)	9.54 (241)	20.00	28.22
2;COND;SG;V	0.00 (5)	0.00 (241)	0.00	3.73
1;PL;PST;SBJV;V	0.00 (4)	4.58 (240)	25.00	12.92
3;PL;PRS;V	53.23 (201)	47.93 (242)	86.07	81.4
3;FUT;PL;V	53.95 (76)	42.15 (242)	90.79	90.08
3;PL;PRS;SBJV;V	22.64 (106)	15.70 (242)	33.96	28.1
2;PFV;PST;SG;V	-	0.00 (241)	-	1.24
N;PL	59.74 (1083)	56.71 (1192)	92.06	91.19
N;SG	63.58 (1307)	62.96 (1323)	93.19	92.89
ADJ;FEM;SG	60.34 (290)	59.79 (291)	97.93	97.59
ADJ;MASC;PL	65.33 (274)	64.18 (282)	95.62	95.74
ADJ;FEM;PL	66.17 (269)	65.93 (270)	96.65	96.3
ADJ;MASC;SG	60.14 (291)	59.59 (292)	97.94	97.6

Table 17: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Catalan–Italian language pair (the grey numbers correspond to the dictionary sizes).

Catalan–Portuguese				
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	63.34 (5418)	41.79 (10759)	84.50	60.01
N;PL	68.65 (1027)	64.98 (1128)	92.50	91.93
N;SG	66.25 (1209)	64.75 (1234)	88.92	88.98
3;PRS;SG;V	60.71 (224)	56.38 (243)	74.11	67.9
3;IPFV;PL;PST;V	75.29 (170)	65.98 (241)	97.65	97.93
1;FUT;PL;V	35.00 (20)	52.50 (240)	45.00	71.25
2;PRS;SBJV;SG;V	2.86 (35)	1.23 (243)	5.71	4.12
1;COND;PL;V	62.50 (8)	42.92 (240)	62.50	64.58
3;PRS;SBJV;SG;V	24.69 (162)	18.93 (243)	32.72	27.57
2;FUT;PL;V	0.00 (3)	0.00 (240)	0.00	0
1;PL;PRS;V	53.68 (95)	38.75 (240)	71.58	55.42
3;PFV;PL;PST;V	69.93 (153)	58.92 (241)	98.04	98.34
2;PRS;SG;V	41.98 (81)	31.28 (243)	50.62	38.68
2;IMP;POS;SG;V	59.19 (223)	55.14 (243)	73.09	67.08
3;COND;PL;V	71.95 (82)	61.41 (241)	86.59	88.38
3;IPFV;PST;SG;V	71.05 (190)	63.49 (241)	92.11	89.21
3;COND;SG;V	70.45 (132)	58.51 (241)	82.58	79.25
1;IMP;PL;POS;V	58.49 (53)	37.76 (241)	75.47	56.43
3;FUT;SG;V	74.80 (123)	61.83 (241)	91.06	92.12
2;IPFV;PST;SG;V	25.00 (4)	17.43 (241)	25.00	23.65
1;PL;PRS;SBJV;V	58.49 (53)	37.92 (240)	75.47	56.67
3;PL;PRS;SBJV;V	36.84 (133)	25.93 (243)	51.88	43.21
1;FUT;SG;V	57.89 (19)	55.60 (241)	68.42	78.01
1;IPFV;PST;SG;V	71.05 (190)	63.07 (241)	92.11	88.8
1;PFV;PST;SG;V	43.24 (37)	7.05 (241)	72.97	13.28
3;PL;PRS;V	66.83 (208)	60.49 (243)	90.38	85.6
2;PL;PRS;SBJV;V	10.00 (10)	3.33 (240)	10.00	5.83
3;IMP;PL;POS;V	36.84 (133)	25.93 (243)	51.88	43.21
1;PRS;SBJV;SG;V	24.69 (162)	18.93 (243)	32.72	27.57
3;FUT;PL;V	60.49 (81)	54.77 (241)	76.54	84.23
1;COND;SG;V	70.45 (132)	58.51 (241)	82.58	79.25
2;PFV;PL;PST;V	-	0.00 (240)	-	0.42
1;PFV;PL;PST;V	0.00 (1)	5.83 (240)	0.00	11.25
2;PL;PRS;V	5.88 (34)	4.17 (240)	5.88	6.67
2;COND;SG;V	66.67 (3)	22.41 (241)	100.00	36.51
2;FUT;SG;V	66.67 (6)	14.94 (241)	66.67	24.48
2;IMP;PL;POS;V	8.16 (49)	4.13 (242)	10.20	6.61
1;PRS;SG;V	36.63 (101)	24.28 (243)	49.50	34.57
3;IMP;POS;SG;V	24.69 (162)	18.93 (243)	32.72	27.57
3;PFV;PST;SG;V	65.78 (187)	55.60 (241)	84.49	77.59
2;PFV;PST;SG;V	0.00 (2)	0.41 (241)	0.00	0.41
1;IPFV;PL;PST;V	33.33 (3)	15.42 (240)	33.33	36.25
NFIN;V	72.41 (232)	70.08 (244)	92.67	89.34
2;IPFV;PL;PST;V	0.00 (2)	1.25 (240)	0.00	2.08
2;COND;PL;V	-	0.83 (240)	-	1.25
ADJ;FEM;SG	69.11 (327)	69.00 (329)	97.86	97.87
ADJ;FEM;PL	75.92 (299)	74.50 (302)	99.00	98.68
ADJ;MASC;PL	74.52 (310)	72.45 (323)	98.71	98.45
ADJ;MASC;SG	69.33 (326)	68.37 (332)	97.85	97.59

Table 18: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Catalan–Portuguese language pair (the grey numbers correspond to the dictionary sizes).

	Catalan–Spanish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	69.26 (5879)	44.98 (12282)	86.27	60.31
ADJ;FEM;SG	76.02 (342)	75.14 (346)	98.54	98.27
ADJ;FEM;PL	79.56 (318)	78.57 (322)	98.74	98.76
ADJ;MASC;SG	75.66 (341)	74.78 (345)	98.53	98.26
ADJ;MASC;PL	80.75 (322)	78.31 (332)	98.76	98.8
1;PL;PRS;SBJV;V	46.15 (78)	29.96 (247)	58.97	45.34
1;COND;SG;V	83.82 (136)	70.16 (248)	98.53	95.16
1;PST;SBJV;SG;V	40.00 (145)	34.01 (247)	50.34	53.04
1;PL;PST;SBJV;V	0.00 (4)	2.02 (247)	0.00	8.1
1;PL;PRS;V	51.69 (89)	33.33 (246)	64.04	49.19
3;IPFV;PL;PST;V	84.00 (175)	70.45 (247)	99.43	97.57
2;PFV;PL;PST;V	-	0.40 (248)	-	0.4
3;PST;SBJV;SG;V	40.00 (145)	34.01 (247)	50.34	53.04
2;IMP;PL;POS;V	3.33 (60)	6.48 (247)	6.67	10.53
3;COND;PL;V	83.33 (90)	69.35 (248)	98.89	97.98
2;FUT;SG;V	63.64 (11)	42.34 (248)	72.73	53.63
3;IMP;PL;POS;V	51.54 (130)	35.22 (247)	65.38	48.58
3;PL;PRS;V	71.08 (204)	61.79 (246)	92.16	84.15
1;PRS;SG;V	20.75 (106)	21.05 (247)	35.85	29.55
1;IPFV;PL;PST;V	20.00 (5)	18.62 (247)	60.00	38.46
2;PST;SBJV;SG;V	0.00 (2)	2.83 (247)	0.00	3.24
1;PRS;SBJV;SG;V	39.51 (162)	26.32 (247)	48.77	34.82
1;IPFV;PST;SG;V	79.58 (191)	72.06 (247)	94.76	92.71
3;PRS;SBJV;SG;V	39.51 (162)	26.32 (247)	48.77	34.82
NFIN;V	72.34 (235)	69.35 (248)	92.77	91.53
1;IMP;PL;POS;V	46.15 (78)	29.96 (247)	58.97	45.34
1;FUT;PL;V	72.50 (40)	62.10 (248)	92.50	82.26
2;COND;PL;V	0.00 (1)	4.84 (248)	0.00	7.66
2;IMP;POS;SG;V	68.42 (228)	64.52 (248)	77.63	72.58
3;COND;SG;V	83.82 (136)	70.16 (248)	98.53	95.16
1;PFV;PST;SG;V	61.29 (31)	10.57 (246)	77.42	14.63
2;IPFV;PST;SG;V	0.00 (4)	12.15 (247)	0.00	13.36
3;PL;PST;SBJV;V	37.04 (108)	28.34 (247)	53.70	65.18
3;PFV;PST;SG;V	64.84 (182)	53.23 (248)	81.87	74.19
2;IPFV;PL;PST;V	-	0.00 (247)	-	0.81
2;PL;PST;SBJV;V	-	0.00 (247)	-	0
3;IPFV;PST;SG;V	79.58 (191)	72.06 (247)	94.76	92.71
3;PFV;PL;PST;V	81.33 (150)	69.76 (248)	98.67	97.98
2;FUT;PL;V	0.00 (5)	21.37 (248)	20.00	32.26
1;PFV;PL;PST;V	0.00 (1)	13.31 (248)	0.00	20.16
2;PFV;PST;SG;V	-	0.00 (248)	-	0
1;COND;PL;V	66.67 (6)	60.08 (248)	83.33	81.45
3;PL;PRS;SBJV;V	51.54 (130)	35.22 (247)	65.38	48.58
3;PRS;SG;V	69.13 (230)	65.32 (248)	79.13	74.19
2;PL;PRS;V	2.17 (46)	6.50 (246)	6.52	10.57
3;FUT;PL;V	82.61 (92)	70.16 (248)	98.91	94.76
3;IMP;POS;SG;V	39.51 (162)	26.32 (247)	48.77	34.82
3;FUT;SG;V	80.92 (131)	72.18 (248)	95.42	95.16
1;FUT;SG;V	66.67 (30)	58.87 (248)	80.00	78.23
2;PL;PRS;SBJV;V	2.56 (39)	6.48 (247)	7.69	10.53
2;COND;SG;V	0.00 (2)	23.79 (248)	50.00	34.27
2;PRS;SG;V	50.00 (88)	35.22 (247)	61.36	43.32
2;PRS;SBJV;SG;V	8.70 (46)	4.05 (247)	21.74	8.1
N;SG	76.62 (1266)	75.82 (1278)	94.23	94.21
N;PL	74.24 (1079)	72.26 (1175)	93.79	93.36

Table 19: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Catalan–Spanish language pair (the grey numbers correspond to the dictionary sizes).

	French–Catalan			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	41.57 (7845)	23.92 (16992)	79.38	52.18
N;SG	49.06 (1643)	47.74 (1682)	87.04	86.56
N;PL	47.50 (1440)	45.76 (1593)	89.65	89.14
ADJ;FEM;PL	54.45 (393)	53.35 (403)	97.46	97.52
ADJ;FEM;SG	39.18 (416)	38.26 (426)	88.46	87.79
ADJ;MASC;PL	57.82 (403)	54.91 (428)	97.27	97.2
ADJ;MASC;SG	51.08 (417)	49.08 (434)	90.41	89.4
1;PL;PRS;SBJV;V	20.45 (44)	5.80 (379)	29.55	17.68
3;PRS;SG;V	39.23 (362)	37.76 (384)	57.46	54.43
3;PST;SBJV;SG;V	15.66 (83)	9.19 (381)	27.71	18.9
1;PST;SBJV;SG;V	18.18 (22)	1.32 (380)	27.27	4.74
1;PL;PRS;V	17.27 (139)	9.47 (380)	46.76	19.21
2;PRS;SBJV;SG;V	22.43 (107)	13.42 (380)	34.58	22.89
2;FUT;SG;V	13.04 (23)	7.07 (382)	34.78	14.92
3;IPFV;PL;PST;V	46.27 (255)	38.85 (381)	95.29	96.33
1;PFV;PST;SG;V	2.13 (47)	2.36 (382)	6.38	6.28
3;PFV;PST;SG;V	37.85 (288)	31.33 (383)	56.94	47.78
2;COND;PL;V	0.00 (5)	18.68 (380)	0.00	55.26
NFIN;V	46.49 (370)	45.83 (384)	92.70	88.8
2;PFV;PL;PST;V	-	0.00 (380)	-	0.53
3;PFV;PL;PST;V	39.91 (233)	29.66 (381)	97.42	97.64
1;PRS;SBJV;SG;V	35.26 (312)	33.95 (380)	53.53	49.74
1;IMP;PL;POS;V	17.65 (136)	9.47 (380)	47.79	19.21
3;COND;PL;V	48.72 (117)	29.13 (381)	88.89	89.5
2;IPFV;PST;SG;V	26.67 (30)	11.52 (382)	43.33	21.47
1;PFV;PL;PST;V	0.00 (2)	1.84 (380)	0.00	5
3;COND;SG;V	40.11 (187)	26.89 (383)	75.40	64.49
2;PRS;SG;V	22.70 (185)	14.62 (383)	36.22	26.11
1;FUT;PL;V	23.91 (46)	18.95 (380)	50.00	47.89
1;COND;PL;V	40.00 (5)	22.89 (380)	80.00	69.74
2;PST;SBJV;SG;V	0.00 (3)	0.00 (380)	33.33	1.05
3;FUT;PL;V	45.22 (157)	32.81 (381)	82.17	91.34
2;PL;PRS;V	16.30 (135)	10.26 (380)	47.41	26.84
2;PL;PST;SBJV;V	0.00 (1)	0.79 (379)	100.00	8.18
2;IMP;PL;POS;V	16.30 (135)	10.26 (380)	47.41	26.84
1;IPFV;PST;SG;V	20.22 (89)	11.52 (382)	35.96	21.47
2;PL;PRS;SBJV;V	19.44 (36)	7.92 (379)	63.89	27.7
1;FUT;SG;V	34.29 (70)	28.53 (382)	60.00	71.99
3;PL;PRS;SBJV;V	45.28 (265)	37.89 (380)	84.91	75
3;PL;PST;SBJV;V	32.14 (28)	2.63 (380)	50.00	11.58
3;IPFV;PST;SG;V	44.86 (292)	38.38 (383)	84.59	83.55
2;PFV;PST;SG;V	-	1.57 (382)	-	5.24
2;IPFV;PL;PST;V	33.33 (3)	7.89 (380)	33.33	27.37
2;IMP;POS;SG;V	33.15 (356)	31.94 (382)	50.84	48.69
1;COND;SG;V	7.46 (67)	1.05 (382)	16.42	3.14
3;PRS;SBJV;SG;V	35.14 (313)	33.86 (381)	53.67	49.87
3;PL;PRS;V	41.34 (329)	37.80 (381)	84.19	75.33
2;COND;SG;V	0.00 (17)	1.05 (382)	5.88	3.14
1;PRS;SG;V	32.18 (261)	32.11 (383)	49.04	48.83
1;PL;PST;SBJV;V	0.00 (1)	0.79 (379)	0.00	3.17
1;IPFV;PL;PST;V	10.53 (19)	6.05 (380)	21.05	17.89
3;FUT;SG;V	50.00 (228)	42.04 (383)	88.60	90.34
2;FUT;PL;V	4.76 (21)	6.32 (380)	4.76	14.74

Table 20: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the French–Catalan language pair (the grey numbers correspond to the dictionary sizes).

	French–Italian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	49.37 (9891)	28.30 (22052)	83.15	55.39
N;PL	51.16 (1943)	47.04 (2281)	87.60	85.09
N;SG	58.25 (2388)	56.20 (2491)	90.95	90.37
1;PFV;PL;PST;V	0.00 (3)	1.05 (477)	0.00	2.94
1;IMP;PL;POS;V	28.22 (163)	16.18 (482)	74.23	46.27
2;PL;PRS;V	28.06 (196)	20.79 (481)	65.31	44.28
3;PRS;SBJV;SG;V	48.11 (397)	44.63 (484)	64.74	59.3
1;PST;SBJV;SG;V	36.36 (11)	2.73 (477)	36.36	6.5
1;PL;PST;SBJV;V	66.67 (3)	0.42 (476)	100.00	2.94
2;COND;PL;V	25.00 (4)	0.21 (480)	25.00	3.54
NFIN;V	52.81 (462)	50.52 (485)	94.37	92.58
3;IPFV;PST;SG;V	51.52 (330)	45.57 (485)	87.58	79.38
2;PRS;SG;V	22.66 (256)	15.15 (482)	42.58	26.35
2;PFV;PST;SG;V	20.00 (20)	2.51 (478)	35.00	5.23
1;FUT;PL;V	19.51 (41)	12.92 (480)	43.90	35.62
2;PST;SBJV;SG;V	-	1.68 (477)	-	4.82
2;FUT;PL;V	4.35 (23)	7.92 (480)	17.39	33.33
2;COND;SG;V	18.92 (37)	16.42 (481)	40.54	55.93
3;FUT;SG;V	46.24 (266)	39.26 (484)	87.22	83.47
2;IPFV;PL;PST;V	6.67 (15)	5.41 (481)	13.33	27.03
1;IPFV;PL;PST;V	21.74 (23)	8.73 (481)	30.43	25.36
3;PFV;PST;SG;V	39.12 (363)	31.60 (481)	63.09	53.43
2;IMP;POS;SG;V	47.91 (430)	43.57 (482)	65.35	58.92
1;COND;PL;V	0.00 (5)	11.46 (480)	0.00	40.42
3;PL;PRS;V	47.65 (405)	42.74 (482)	81.73	73.65
1;COND;SG;V	16.90 (71)	16.42 (481)	50.70	56.13
2;IPFV;PST;SG;V	24.44 (45)	19.50 (482)	35.56	36.51
3;COND;PL;V	32.46 (114)	32.43 (481)	70.18	90.02
1;PRS;SBJV;SG;V	48.35 (395)	44.70 (481)	64.81	59.25
3;IPFV;PL;PST;V	54.01 (274)	45.23 (482)	97.08	96.89
2;PFV;PL;PST;V	-	0.00 (477)	-	1.26
1;PRS;SG;V	46.97 (379)	43.78 (482)	63.85	58.92
3;COND;SG;V	35.68 (185)	32.64 (484)	73.51	85.74
1;IPFV;PST;SG;V	23.29 (73)	19.50 (482)	34.25	36.51
2;PL;PST;SBJV;V	0.00 (1)	0.42 (476)	0.00	2.1
2;PL;PRS;SBJV;V	3.45 (29)	5.42 (480)	13.79	27.29
1;FUT;SG;V	22.22 (90)	20.79 (481)	60.00	53.64
2;FUT;SG;V	4.35 (23)	4.99 (481)	26.09	20.58
3;PST;SBJV;SG;V	30.43 (69)	19.38 (480)	52.17	38.96
1;PFV;PST;SG;V	16.28 (43)	12.55 (478)	25.58	20.08
3;PFV;PL;PST;V	47.33 (262)	37.03 (478)	95.80	97.28
3;PRS;SG;V	49.78 (452)	46.60 (485)	66.81	62.06
2;IMP;PL;POS;V	28.06 (196)	20.75 (482)	65.31	44.4
3;PL;PST;SBJV;V	55.00 (20)	5.24 (477)	60.00	12.79
1;PL;PRS;V	28.22 (163)	16.22 (481)	74.23	46.36
1;PL;PRS;SBJV;V	17.50 (40)	8.75 (480)	32.50	25.62
3;FUT;PL;V	50.00 (172)	37.63 (481)	97.09	98.54
2;PRS;SBJV;SG;V	23.29 (219)	13.93 (481)	42.92	24.32
3;PL;PRS;SBJV;V	48.87 (309)	42.62 (481)	81.55	73.8
ADJ;MASC;PL	67.27 (501)	65.39 (523)	96.01	95.79
ADJ;MASC;SG	65.37 (514)	64.33 (527)	95.14	94.88
ADJ;FEM;SG	63.28 (512)	62.74 (518)	93.75	93.63
ADJ;FEM;PL	62.53 (491)	61.92 (499)	95.93	95.79

Table 21: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the French–Italian language pair (the grey numbers correspond to the dictionary sizes).

	French–Portuguese			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	49.51 (8930)	31.89 (17536)	80.95	58.15
ADJ;MASC;SG	62.22 (495)	60.75 (507)	94.34	93.89
ADJ;FEM;PL	60.85 (470)	59.38 (480)	98.94	98.75
ADJ;FEM;SG	63.41 (492)	62.90 (496)	95.73	95.36
ADJ;MASC;PL	63.60 (478)	60.28 (501)	97.28	97.21
N;SG	52.81 (2151)	51.13 (2222)	87.49	86.77
N;PL	53.47 (1786)	50.32 (2039)	89.70	88.38
3;FUT;PL;V	46.21 (132)	39.73 (438)	81.82	95.89
3;IPFV;PST;SG;V	50.49 (309)	44.55 (440)	83.17	82.5
NFIN;V	58.77 (422)	56.24 (441)	92.89	89.8
2;PRS;SBJV;SG;V	31.65 (139)	25.92 (436)	43.88	37.61
2;IMP;PL;POS;V	3.03 (132)	2.75 (436)	7.58	3.9
2;FUT;SG;V	15.79 (19)	18.31 (437)	15.79	37.07
2;PL;PRS;SBJV;V	0.00 (12)	0.46 (436)	0.00	1.38
1;PL;PRS;V	41.01 (139)	24.03 (437)	76.26	42.79
3;PFV;PST;SG;V	41.19 (335)	33.72 (436)	62.39	52.29
2;PFV;PST;SG;V	13.04 (23)	1.15 (434)	17.39	1.61
2;FUT;PL;V	0.00 (13)	0.00 (437)	0.00	0
2;COND;SG;V	9.38 (32)	2.52 (437)	12.50	4.35
3;PL;PRS;SBJV;V	55.03 (298)	46.00 (437)	81.88	73.91
1;IPFV;PL;PST;V	3.70 (27)	5.26 (437)	11.11	14.87
3;PRS;SG;V	47.00 (417)	44.32 (440)	62.59	58.18
2;PL;PRS;V	2.53 (79)	2.75 (437)	5.06	3.89
1;PFV;PL;PST;V	33.33 (6)	5.53 (434)	50.00	16.59
1;IPFV;PST;SG;V	19.78 (91)	14.19 (437)	28.57	22.2
1;PL;PRS;SBJV;V	9.38 (32)	5.28 (436)	15.62	14.91
1;PRS;SBJV;SG;V	41.71 (374)	38.30 (436)	57.22	52.06
1;COND;PL;V	40.00 (5)	31.81 (437)	60.00	63.16
3;COND;PL;V	50.00 (112)	31.74 (438)	86.61	80.14
3;PFV;PL;PST;V	53.04 (247)	36.64 (434)	94.33	93.32
2;PRS;SG;V	32.00 (200)	27.23 (437)	45.50	40.05
3;FUT;SG;V	55.17 (203)	44.32 (440)	82.27	87.5
1;FUT;PL;V	41.67 (36)	27.69 (437)	44.44	50.57
3;COND;SG;V	42.71 (192)	30.00 (440)	65.10	52.27
1;IMP;PL;POS;V	41.30 (92)	24.08 (436)	75.00	42.89
2;PFV;PL;PST;V	0.00 (2)	0.00 (434)	0.00	0.92
2;IMP;POS;SG;V	43.17 (410)	40.37 (436)	59.76	54.36
3;PL;PRS;V	53.04 (362)	46.35 (438)	81.49	73.97
1;PRS;SG;V	43.50 (354)	40.27 (437)	59.89	54.23
3;PRS;SBJV;SG;V	41.91 (377)	38.50 (439)	57.29	52.16
2;IPFV;PST;SG;V	17.65 (34)	14.19 (437)	29.41	22.2
1;COND;SG;V	10.67 (75)	2.52 (437)	14.67	4.35
1;FUT;SG;V	47.89 (71)	38.67 (437)	76.06	82.15
2;IPFV;PL;PST;V	0.00 (26)	0.46 (437)	0.00	1.37
3;IPFV;PL;PST;V	54.65 (269)	43.84 (438)	94.05	96.12
1;PFV;PST;SG;V	13.21 (53)	2.30 (434)	16.98	4.84
2;COND;PL;V	-	0.00 (437)	-	0

Table 22: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the French–Portuguese language pair (the grey numbers correspond to the dictionary sizes).

		French–Spanish		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	49.13 (9770)	29.28 (21087)	82.68	55.2
N;PL	53.55 (1873)	49.44 (2154)	88.09	87.28
N;SG	55.49 (2242)	54.05 (2311)	90.54	90.13
1;PFV;PST;SG;V	5.26 (57)	1.98 (455)	10.53	5.27
2;COND;SG;V	23.26 (43)	3.52 (455)	30.23	4.4
3;FUT;PL;V	54.91 (173)	44.74 (456)	95.38	98.46
1;PRS;SBJV;SG;V	39.64 (386)	36.48 (455)	57.51	52.09
2;COND;PL;V	0.00 (2)	25.71 (455)	50.00	55.16
2;PL;PRS;SBJV;V	8.82 (34)	1.98 (455)	14.71	6.15
1;FUT;PL;V	50.00 (42)	31.87 (455)	73.81	63.96
2;PRS;SG;V	37.95 (224)	25.71 (455)	53.12	40.22
3;COND;SG;V	51.43 (210)	39.39 (457)	90.48	85.12
2;IMP;PL;POS;V	0.77 (130)	3.30 (455)	1.54	5.93
1;COND;PL;V	33.33 (12)	19.34 (455)	58.33	52.09
3;PRS;SBJV;SG;V	39.43 (388)	36.32 (457)	57.73	52.3
3;IPFV;PL;PST;V	55.35 (271)	43.64 (456)	98.15	97.59
1;FUT;SG;V	40.23 (87)	27.91 (455)	65.52	55.16
2;PL;PST;SBJV;V	-	0.00 (455)	-	0
2;PL;PRS;V	0.00 (91)	3.30 (455)	2.20	5.93
2;FUT;SG;V	28.12 (32)	16.70 (455)	43.75	36.04
3;PL;PRS;V	47.80 (387)	42.76 (456)	82.17	74.34
1;PL;PST;SBJV;V	-	0.22 (455)	-	1.98
2;IPFV;PST;SG;V	30.00 (50)	18.02 (455)	32.00	28.57
2;FUT;PL;V	6.67 (15)	22.42 (455)	40.00	50.11
NFIN;V	50.57 (437)	49.23 (457)	93.14	90.37
3;PL;PST;SBJV;V	38.46 (26)	3.73 (456)	69.23	9.21
2;PFV;PST;SG;V	8.89 (45)	1.54 (455)	17.78	3.96
3;FUT;SG;V	56.65 (263)	46.17 (457)	90.49	90.37
3;IPFV;PST;SG;V	55.09 (334)	46.61 (457)	90.42	85.78
2;PFV;PL;PST;V	0.00 (1)	0.00 (455)	0.00	0.22
2;PRS;SBJV;SG;V	38.80 (183)	23.96 (455)	56.83	37.36
1;PL;PRS;V	34.62 (156)	18.46 (455)	64.74	34.73
1;PL;PRS;SBJV;V	20.51 (39)	5.05 (455)	25.64	13.85
3;PST;SBJV;SG;V	11.11 (63)	10.07 (457)	23.81	19.47
1;IPFV;PST;SG;V	20.69 (87)	18.02 (455)	29.89	28.57
2;IMP;POS;SG;V	38.88 (427)	36.26 (455)	56.21	51.65
1;IPFV;PL;PST;V	20.69 (29)	5.05 (455)	24.14	13.85
2;IPFV;PL;PST;V	42.86 (7)	1.98 (455)	42.86	6.15
1;IMP;PL;POS;V	35.97 (139)	18.46 (455)	64.03	34.73
1;PST;SBJV;SG;V	15.00 (20)	2.64 (455)	20.00	5.05
3;PFV;PL;PST;V	46.80 (250)	35.96 (456)	98.40	95.39
3;PFV;PST;SG;V	38.83 (358)	33.26 (457)	56.98	49.02
2;PST;SBJV;SG;V	0.00 (3)	3.52 (455)	0.00	6.59
1;COND;SG;V	15.19 (79)	3.52 (455)	25.32	4.4
1;PFV;PL;PST;V	40.00 (5)	1.98 (455)	40.00	5.93
3;COND;PL;V	53.45 (116)	34.21 (456)	96.55	93.64
1;PRS;SG;V	38.90 (401)	36.26 (455)	56.61	51.87
3;PL;PRS;SBJV;V	49.30 (357)	42.54 (456)	84.31	74.34
3;PRS;SG;V	42.07 (435)	40.04 (457)	59.54	55.14
ADJ;FEM;SG	58.30 (578)	57.71 (584)	93.77	93.66
ADJ;MASC;PL	60.82 (564)	58.57 (589)	96.81	96.77
ADJ;MASC;SG	60.83 (577)	59.36 (593)	94.80	94.44
ADJ;FEM;PL	60.39 (558)	59.08 (567)	97.67	97.71

Table 23: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the French–Spanish language pair (the grey numbers correspond to the dictionary sizes).

		Italian–Catalan		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	36.64 (9035)	18.70 (22636)	77.17	49.41
N;SG	42.96 (2153)	40.91 (2278)	83.70	82.57
N;PL	42.76 (1665)	38.68 (1983)	90.03	88.1
2;FUT;SG;V	5.56 (18)	4.23 (473)	11.11	15.01
1;COND;PL;V	55.56 (9)	17.76 (473)	77.78	72.73
3;PFV;PST;SG;V	30.28 (327)	23.47 (473)	57.19	47.36
3;IMP;PL;POS;V	18.35 (158)	10.81 (472)	36.08	22.03
1;PRS;SBJV;SG;V	29.00 (269)	19.66 (473)	48.70	34.67
2;FUT;PL;V	0.00 (13)	1.06 (473)	0.00	3.17
1;IPFV;PL;PST;V	22.22 (9)	6.12 (474)	55.56	33.97
3;PRS;SBJV;SG;V	29.00 (269)	19.66 (473)	48.70	34.67
1;PL;PST;SBJV;V	0.00 (7)	2.96 (473)	0.00	12.9
2;PL;PST;SBJV;V	0.00 (1)	0.63 (473)	0.00	2.11
1;PRS;SG;V	21.30 (216)	14.80 (473)	39.81	23.47
1;PL;PRS;SBJV;V	23.36 (107)	3.81 (472)	51.40	13.98
2;PFV;PST;SG;V	-	0.21 (473)	-	0.63
2;COND;SG;V	0.00 (5)	0.00 (473)	0.00	0
3;IPFV;PST;SG;V	41.61 (298)	30.80 (474)	83.89	79.75
1;PL;PRS;V	23.15 (108)	3.81 (472)	51.85	13.98
2;IPFV;PST;SG;V	0.00 (3)	2.11 (474)	0.00	4.22
2;IPFV;PL;PST;V	0.00 (1)	1.05 (474)	0.00	2.74
3;COND;PL;V	28.57 (56)	12.26 (473)	80.36	85.2
2;PFV;PL;PST;V	-	0.63 (473)	-	2.11
3;FUT;PL;V	41.96 (112)	20.51 (473)	88.39	88.58
3;FUT;SG;V	41.05 (190)	28.33 (473)	94.74	96.19
2;COND;PL;V	0.00 (2)	4.02 (473)	0.00	15.22
1;FUT;SG;V	33.33 (39)	17.12 (473)	61.54	46.72
NFIN;V	41.22 (427)	37.55 (474)	93.44	89.45
3;IMP;POS;SG;V	29.10 (268)	19.70 (472)	49.25	34.96
3;PL;PRS;SBJV;V	18.24 (159)	10.78 (473)	35.85	21.99
1;PFV;PST;SG;V	2.38 (42)	2.33 (473)	4.76	3.38
3;PFV;PL;PST;V	36.08 (255)	30.02 (473)	95.29	95.77
2;IMP;PL;POS;V	2.21 (181)	1.69 (473)	7.73	6.55
3;PL;PRS;V	33.71 (350)	26.85 (473)	74.29	62.58
2;PST;SBJV;SG;V	22.22 (9)	3.81 (473)	33.33	11.21
2;IMP;POS;SG;V	30.47 (361)	23.68 (473)	50.42	38.48
2;PRS;SG;V	25.77 (194)	14.59 (473)	46.39	26.85
3;IPFV;PL;PST;V	42.34 (248)	30.80 (474)	94.76	94.94
3;PST;SBJV;SG;V	35.47 (172)	19.66 (473)	56.40	45.67
1;IPFV;PST;SG;V	25.58 (43)	10.76 (474)	39.53	22.57
1;COND;SG;V	13.21 (53)	5.07 (473)	33.96	10.99
2;PL;PRS;V	2.20 (182)	1.69 (473)	8.24	6.77
3;COND;SG;V	22.41 (116)	10.78 (473)	64.66	55.39
1;IMP;PL;POS;V	23.58 (106)	3.81 (472)	50.94	13.77
3;PRS;SG;V	34.29 (420)	31.22 (474)	57.86	51.48
2;PRS;SBJV;SG;V	30.56 (144)	19.66 (473)	55.56	34.67
1;PFV;PL;PST;V	0.00 (2)	1.06 (473)	0.00	2.33
2;PL;PRS;SBJV;V	3.23 (31)	2.97 (472)	25.81	9.96
1;PST;SBJV;SG;V	12.00 (25)	3.81 (473)	28.00	11.21
3;PL;PST;SBJV;V	44.44 (117)	22.20 (473)	94.02	94.29
1;FUT;PL;V	37.14 (35)	20.72 (473)	68.57	71.88
ADJ;MASC;SG	49.04 (416)	47.14 (437)	91.35	91.3
ADJ;MASC;PL	53.23 (402)	50.71 (422)	94.28	94.31
ADJ;FEM;SG	27.54 (414)	27.01 (422)	87.92	87.44
ADJ;FEM;PL	52.23 (381)	51.69 (385)	93.96	93.51

Table 24: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Italian–Catalan language pair (the grey numbers correspond to the dictionary sizes).

	Italian–French			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	40.84 (12595)	21.36 (31419)	79.32	53.41
N;SG	48.26 (3106)	45.01 (3355)	88.02	87.06
N;PL	49.34 (2333)	43.17 (2928)	91.08	88.97
3;PL;PST;SBJV;V	0.00 (74)	0.00 (645)	0.00	0.16
1;PL;PST;SBJV;V	0.00 (2)	0.00 (643)	0.00	0.16
1;FUT;PL;V	18.18 (33)	14.93 (643)	39.39	58.16
1;COND;PL;V	0.00 (9)	7.47 (643)	33.33	45.72
3;PL;PRS;V	40.80 (473)	33.33 (645)	85.84	75.5
1;COND;SG;V	40.00 (65)	23.64 (643)	78.46	88.18
1;PL;PRS;V	18.30 (153)	7.85 (637)	58.82	29.2
3;PFV;PST;SG;V	27.01 (448)	20.12 (646)	51.12	39.01
2;PFV;PST;SG;V	14.29 (7)	1.71 (643)	14.29	4.2
NFIN;V	42.58 (573)	38.70 (646)	92.15	89.47
2;IMP;POS;SG;V	29.16 (487)	23.17 (643)	48.87	37.48
1;PRS;SG;V	25.07 (371)	15.86 (643)	40.16	25.82
1;IMP;PL;POS;V	18.30 (153)	7.85 (637)	58.82	29.2
3;PL;PRS;SBJV;V	23.64 (220)	13.66 (644)	45.91	31.52
1;FUT;SG;V	45.59 (68)	21.31 (643)	85.29	66.1
2;IMP;PL;POS;V	7.08 (353)	7.15 (643)	34.56	32.19
1;PRS;SBJV;SG;V	32.85 (417)	24.92 (642)	52.76	42.52
2;PFV;PL;PST;V	0.00 (3)	0.47 (643)	0.00	4.2
3;COND;PL;V	52.05 (73)	22.79 (645)	97.26	98.91
3;COND;SG;V	48.76 (121)	25.23 (646)	94.21	96.13
3;FUT;SG;V	39.62 (265)	26.63 (646)	88.30	77.24
2;PST;SBJV;SG;V	0.00 (3)	1.40 (643)	0.00	4.2
3;PRS;SBJV;SG;V	32.86 (420)	24.96 (645)	52.62	42.48
2;FUT;SG;V	22.22 (18)	5.13 (643)	27.78	14.77
1;PL;PRS;SBJV;V	14.68 (109)	7.85 (637)	61.47	29.2
2;COND;SG;V	50.00 (16)	21.00 (643)	81.25	80.09
2;IPFV;PL;PST;V	-	0.31 (643)	-	2.33
2;PRS;SG;V	32.49 (354)	21.96 (642)	52.54	37.69
3;IPFV;PST;SG;V	44.68 (385)	35.76 (646)	89.09	82.2
3;FUT;PL;V	42.48 (153)	17.52 (645)	99.35	99.84
3;PFV;PL;PST;V	35.80 (352)	27.75 (645)	96.02	96.59
2;PRS;SBJV;SG;V	34.88 (367)	24.92 (642)	55.31	42.52
1;IPFV;PL;PST;V	0.00 (9)	0.47 (643)	0.00	1.87
2;IPFV;PST;SG;V	13.64 (22)	1.87 (643)	36.36	7.93
2;COND;PL;V	0.00 (6)	0.78 (643)	0.00	4.51
2;FUT;PL;V	25.00 (12)	10.11 (643)	33.33	33.59
1;PFV;PST;SG;V	15.87 (63)	6.69 (643)	22.22	12.29
3;PRS;SG;V	32.33 (566)	29.41 (646)	54.59	47.52
2;PL;PRS;SBJV;V	17.24 (29)	3.14 (637)	24.14	13.81
1;PST;SBJV;SG;V	0.00 (8)	1.40 (643)	0.00	4.2
1;IPFV;PST;SG;V	29.27 (41)	11.04 (643)	34.15	24.11
2;PL;PRS;V	7.37 (353)	7.31 (643)	34.56	32.19
2;PL;PST;SBJV;V	0.00 (2)	0.47 (643)	0.00	4.2
1;PFV;PL;PST;V	0.00 (8)	0.62 (643)	25.00	3.42
3;PST;SBJV;SG;V	3.95 (177)	7.12 (646)	9.60	25.54
3;IPFV;PL;PST;V	43.83 (324)	32.87 (645)	98.46	96.59
ADJ;FEM;SG	54.04 (631)	52.94 (646)	94.14	94.12
ADJ;MASC;SG	55.96 (638)	53.57 (672)	93.57	93.3
ADJ;FEM;PL	56.52 (598)	56.24 (601)	95.65	95.34
ADJ;MASC;PL	55.94 (606)	53.33 (645)	94.72	93.8

Table 25: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Italian–French language pair (the grey numbers correspond to the dictionary sizes).

	Italian–Portuguese			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	43.01 (10072)	21.02 (25704)	79.20	50.31
N;PL	47.10 (1968)	41.15 (2452)	87.91	86.83
N;SG	47.02 (2650)	43.96 (2846)	85.66	84.72
2;COND;SG;V	0.00 (4)	0.00 (586)	0.00	0.17
1;PL;PRS;V	40.18 (112)	15.89 (579)	75.89	42.83
1;FUT;PL;V	46.15 (26)	20.99 (586)	61.54	74.74
3;PRS;SBJV;SG;V	26.84 (313)	18.09 (586)	38.98	28.67
1;IPFV;PST;SG;V	21.05 (38)	9.20 (587)	21.05	17.21
3;IMP;PL;POS;V	19.75 (162)	8.36 (586)	33.33	18.43
3;PRS;SG;V	38.00 (479)	31.86 (587)	59.92	49.06
3;COND;SG;V	32.43 (111)	11.43 (586)	69.37	34.3
3;IMP;POS;SG;V	26.84 (313)	18.09 (586)	38.98	28.67
1;PRS;SG;V	30.36 (280)	19.32 (585)	43.21	28.21
1;COND;PL;V	41.67 (12)	16.04 (586)	50.00	48.98
3;IPFV;PST;SG;V	49.36 (312)	34.24 (587)	80.77	77.68
3;PL;PRS;SBJV;V	19.75 (162)	8.36 (586)	33.33	18.43
3;PFV;PL;PST;V	50.34 (292)	31.35 (587)	96.23	93.02
1;IPFV;PL;PST;V	37.50 (8)	12.78 (587)	62.50	63.03
1;PL;PRS;SBJV;V	54.24 (59)	15.89 (579)	81.36	42.83
2;IPFV;PL;PST;V	0.00 (3)	0.00 (587)	0.00	1.19
1;COND;SG;V	10.14 (69)	1.02 (586)	14.49	1.71
2;PRS;SBJV;SG;V	28.36 (201)	18.09 (586)	42.29	28.67
3;FUT;SG;V	44.51 (173)	28.16 (586)	90.17	92.66
3;PFV;PST;SG;V	40.67 (386)	28.28 (587)	71.50	59.11
1;PRS;SBJV;SG;V	26.84 (313)	18.09 (586)	38.98	28.67
3;FUT;PL;V	41.30 (92)	14.16 (586)	91.30	96.08
3;COND;PL;V	30.51 (59)	10.92 (586)	72.88	66.72
1;PFV;PST;SG;V	10.17 (59)	0.85 (587)	11.86	3.07
2;FUT;SG;V	7.14 (14)	5.63 (586)	7.14	17.06
2;IMP;POS;SG;V	33.72 (436)	25.89 (587)	53.67	40.03
3;PL;PRS;V	44.53 (375)	32.20 (587)	77.33	66.1
2;PL;PRS;SBJV;V	20.00 (5)	0.35 (579)	20.00	0.86
2;PFV;PL;PST;V	0.00 (3)	0.34 (586)	33.33	1.71
NFIN;V	46.25 (493)	40.89 (587)	95.13	87.73
2;COND;PL;V	-	0.00 (586)	-	0.17
3;IPFV;PL;PST;V	53.47 (245)	33.22 (587)	94.69	95.91
2;PFV;PST;SG;V	28.57 (7)	0.85 (586)	28.57	2.39
1;IMP;PL;POS;V	54.24 (59)	15.89 (579)	81.36	42.83
2;IMP;PL;POS;V	3.38 (148)	2.56 (587)	5.41	3.58
1;FUT;SG;V	39.53 (43)	21.67 (586)	74.42	70.31
2;IPFV;PST;SG;V	0.00 (4)	1.87 (587)	0.00	3.41
2;PRS;SG;V	22.97 (222)	16.24 (585)	35.59	25.13
2;PL;PRS;V	7.35 (68)	2.56 (587)	8.82	3.58
1;PFV;PL;PST;V	20.00 (10)	1.37 (586)	40.00	5.12
2;FUT;PL;V	0.00 (8)	0.00 (586)	0.00	0.34
ADJ;MASC;SG	54.51 (532)	52.06 (557)	93.61	92.64
ADJ;MASC;PL	54.58 (502)	51.59 (535)	95.62	95.89
ADJ;FEM;SG	53.73 (523)	52.82 (532)	95.03	94.92
ADJ;FEM;PL	55.26 (485)	53.74 (495)	96.08	95.76

Table 26: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Italian–Portuguese language pair (the grey numbers correspond to the dictionary sizes).

	Italian–Spanish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	43.64 (11685)	22.58 (30686)	78.87	52.24
N;SG	47.90 (2756)	44.79 (2965)	87.12	85.87
N;PL	46.65 (2092)	41.46 (2588)	86.95	85.94
ADJ;FEM;SG	56.38 (596)	55.46 (604)	94.46	94.54
ADJ;MASC;SG	54.02 (609)	52.29 (633)	91.46	91.63
ADJ;MASC;PL	55.75 (583)	53.65 (617)	94.85	94.49
ADJ;FEM;PL	56.01 (566)	56.04 (571)	92.40	92.47
1;PFV;PL;PST;V	7.14 (14)	7.00 (643)	7.14	12.44
2;IPFV;PST;SG;V	22.22 (9)	2.33 (644)	22.22	5.43
3;PFV;PST;SG;V	37.32 (426)	29.04 (644)	68.78	59.47
3;PL;PRS;V	48.42 (442)	37.58 (644)	75.57	63.35
1;FUT;PL;V	48.48 (33)	24.22 (644)	84.85	74.53
1;PL;PRS;V	33.09 (136)	17.58 (637)	72.06	43.17
2;PFV;PL;PST;V	0.00 (1)	0.00 (643)	0.00	0.47
3;IPFV;PST;SG;V	56.99 (365)	40.16 (645)	89.59	83.41
2;PL;PRS;V	3.85 (104)	1.86 (644)	3.85	4.04
1;COND;PL;V	44.44 (9)	24.53 (644)	88.89	91.15
3;FUT;PL;V	51.39 (144)	23.91 (644)	98.61	98.91
1;IPFV;PL;PST;V	50.00 (8)	16.93 (644)	100.00	68.94
3;PRS;SG;V	41.82 (550)	35.97 (645)	62.18	52.56
3;COND;SG;V	39.32 (117)	15.97 (645)	80.34	45.89
2;PL;PST;SBJV;V	-	0.00 (644)	-	0.47
1;FUT;SG;V	45.16 (62)	20.34 (644)	67.74	49.22
1;PFV;PST;SG;V	3.39 (59)	0.93 (643)	5.08	2.8
3;PRS;SBJV;SG;V	31.54 (409)	24.38 (644)	47.19	37.58
1;PRS;SBJV;SG;V	31.37 (408)	24.26 (643)	47.06	37.48
3;PL;PRS;SBJV;V	22.11 (199)	11.20 (643)	35.68	20.68
1;PRS;SG;V	30.35 (369)	21.12 (644)	46.07	31.68
3;IMP;POS;SG;V	31.54 (409)	24.42 (643)	47.19	37.64
1;PL;PRS;SBJV;V	33.62 (116)	17.58 (637)	68.97	43.17
2;IMP;PL;POS;V	2.79 (179)	1.82 (659)	4.47	3.95
3;FUT;SG;V	49.79 (243)	31.01 (645)	95.47	95.66
2;FUT;PL;V	16.67 (6)	10.56 (644)	33.33	33.85
1;PL;PST;SBJV;V	0.00 (7)	1.86 (644)	14.29	7.61
3;IMP;PL;POS;V	22.22 (198)	11.21 (642)	35.86	20.72
3;PL;PST;SBJV;V	18.94 (132)	16.61 (644)	33.33	52.02
3;IPFV;PL;PST;V	61.59 (289)	37.42 (644)	98.96	97.67
2;PST;SBJV;SG;V	0.00 (10)	2.95 (644)	0.00	7.3
3;PFV;PL;PST;V	50.00 (338)	34.84 (643)	96.75	95.18
NFIN;V	45.44 (581)	41.00 (661)	93.12	88.65
3;COND;PL;V	36.07 (61)	16.15 (644)	93.44	84.01
2;PFV;PST;SG;V	0.00 (1)	0.62 (643)	0.00	0.93
1;IMP;PL;POS;V	32.76 (116)	17.02 (652)	68.97	44.48
1;IPFV;PST;SG;V	15.00 (40)	10.71 (644)	20.00	18.32
2;PRS;SG;V	28.70 (331)	21.03 (642)	43.50	32.55
1;PST;SBJV;SG;V	0.00 (26)	2.95 (644)	0.00	7.3
2;PL;PRS;SBJV;V	0.00 (14)	0.16 (637)	0.00	0.94
2;IMP;POS;SG;V	37.55 (490)	28.98 (659)	55.92	42.64
2;IPFV;PL;PST;V	0.00 (1)	0.93 (644)	0.00	1.4
2;COND;SG;V	16.67 (6)	1.86 (644)	33.33	4.19
2;COND;PL;V	0.00 (1)	6.52 (644)	0.00	21.74
1;COND;SG;V	24.62 (65)	3.57 (644)	41.54	5.12
3;PST;SBJV;SG;V	31.98 (197)	22.64 (645)	47.72	48.22
2;PRS;SBJV;SG;V	34.62 (338)	24.26 (643)	49.70	37.48
2;FUT;SG;V	35.00 (20)	15.22 (644)	50.00	44.72

Table 27: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Italian–Spanish language pair (the grey numbers correspond to the dictionary sizes).

		Portuguese–Catalan		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	49.24 (7199)	28.24 (16059)	80.97	53.09
N;SG	53.70 (1527)	51.81 (1598)	88.93	88.61
N;PL	52.90 (1274)	50.07 (1424)	90.74	90.17
3;FUT;PL;V	61.33 (75)	41.95 (348)	85.33	84.48
1;COND;PL;V	60.00 (5)	26.44 (348)	60.00	77.59
NFIN;V	53.33 (330)	50.57 (348)	92.73	87.93
3;IPFV;PST;SG;V	55.34 (253)	44.83 (348)	86.17	81.32
1;FUT;PL;V	61.90 (21)	35.34 (348)	90.48	76.15
1;PFV;PL;PST;V	20.00 (5)	5.17 (348)	40.00	9.77
2;COND;SG;V	50.00 (2)	6.61 (348)	50.00	12.64
2;FUT;SG;V	0.00 (8)	3.74 (348)	0.00	9.77
1;IMP;PL;POS;V	14.29 (28)	10.37 (347)	39.29	24.78
2;PFV;PL;PST;V	-	0.00 (348)	-	0.57
1;PL;PRS;V	41.12 (107)	10.63 (348)	59.81	20.98
3;PRS;SG;V	43.89 (319)	42.36 (347)	60.82	58.5
3;IPFV;PL;PST;V	61.01 (218)	46.55 (348)	98.17	94.83
2;COND;PL;V	-	2.87 (348)	-	11.78
1;PL;PRS;SBJV;V	14.29 (28)	10.37 (347)	39.29	24.78
1;PRS;SG;V	23.56 (174)	16.76 (346)	40.23	28.32
3;IMP;PL;POS;V	30.25 (162)	17.87 (347)	43.83	34.58
2;PFV;PST;SG;V	0.00 (3)	0.29 (348)	0.00	0.29
3;PL;PRS;SBJV;V	30.25 (162)	17.87 (347)	43.83	34.58
2;PL;PRS;SBJV;V	0.00 (3)	2.02 (347)	0.00	2.31
3;PFV;PST;SG;V	45.85 (277)	40.52 (348)	68.59	62.07
2;PRS;SG;V	23.16 (95)	13.83 (347)	36.84	21.04
1;COND;SG;V	59.17 (169)	42.82 (348)	78.11	76.44
2;PL;PRS;V	28.57 (14)	1.72 (348)	35.71	1.72
1;IPFV;PST;SG;V	55.34 (253)	44.83 (348)	86.17	81.32
3;IMP;POS;SG;V	26.82 (220)	20.17 (347)	41.36	33.43
3;PFV;PL;PST;V	57.26 (234)	49.14 (348)	92.74	93.1
3;COND;PL;V	68.37 (98)	46.84 (348)	90.82	90.8
1;FUT;SG;V	67.74 (31)	34.77 (348)	83.87	60.34
3;PL;PRS;V	50.18 (283)	44.09 (347)	82.69	73.78
3;COND;SG;V	59.17 (169)	42.82 (348)	78.11	76.44
3;PRS;SBJV;SG;V	26.70 (221)	20.17 (347)	41.18	33.43
2;PRS;SBJV;SG;V	7.14 (42)	2.88 (347)	16.67	6.63
3;FUT;SG;V	69.85 (136)	50.86 (348)	96.32	93.97
2;IMP;PL;POS;V	7.32 (41)	0.57 (348)	9.76	4.31
2;IPFV;PL;PST;V	60.00 (5)	2.30 (348)	80.00	3.74
2;IMP;POS;SG;V	43.99 (316)	41.79 (347)	61.08	57.93
1;IPFV;PL;PST;V	22.22 (9)	8.91 (348)	66.67	64.66
1;PFV;PST;SG;V	1.25 (80)	1.15 (348)	1.25	2.87
2;FUT;PL;V	0.00 (1)	1.15 (348)	0.00	3.74
1;PRS;SBJV;SG;V	26.70 (221)	20.17 (347)	41.18	33.43
2;IPFV;PST;SG;V	0.00 (2)	4.02 (348)	0.00	7.76
ADJ;MASC;PL	64.66 (365)	60.90 (399)	97.26	96.49
ADJ;FEM;SG	30.13 (385)	29.77 (393)	84.16	83.97
ADJ;MASC;SG	59.64 (384)	57.96 (402)	92.71	92.04
ADJ;FEM;PL	63.03 (357)	61.92 (365)	97.20	96.71

Table 28: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Portuguese–Catalan language pair (the grey numbers correspond to the dictionary sizes).

	Portuguese–French			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	48.68 (9664)	27.39 (22437)	81.35	52.4
N;SG	52.98 (2095)	51.05 (2188)	88.07	87.39
N;PL	52.96 (1641)	49.08 (1960)	93.36	92.04
1;COND;PL;V	0.00 (10)	18.90 (492)	40.00	65.04
1;PRS;SBJV;SG;V	28.79 (323)	24.03 (491)	44.89	37.88
2;COND;PL;V	-	0.00 (492)	-	1.22
1;COND;SG;V	54.09 (159)	39.02 (492)	89.31	82.11
1;IPFV;PL;PST;V	0.00 (10)	1.42 (492)	10.00	3.25
2;PL;PRS;V	16.67 (24)	1.02 (492)	29.17	2.03
1;PRS;SG;V	25.00 (264)	18.33 (491)	38.26	29.12
1;IMP;PL;POS;V	20.00 (40)	7.13 (491)	60.00	25.46
1;FUT;SG;V	45.10 (51)	38.21 (492)	86.27	84.55
2;IMP;PL;POS;V	4.48 (67)	1.22 (492)	8.96	4.47
2;PFV;PST;SG;V	0.00 (19)	0.81 (491)	5.26	1.22
1;PL;PRS;SBJV;V	21.21 (33)	7.13 (491)	63.64	25.46
3;PRS;SBJV;SG;V	28.79 (323)	23.94 (493)	44.89	37.93
1;PFV;PST;SG;V	1.50 (133)	1.22 (491)	2.26	2.44
2;FUT;SG;V	12.50 (8)	2.03 (492)	25.00	7.52
2;IMP;POS;SG;V	41.59 (452)	38.09 (491)	60.62	55.19
2;PFV;PL;PST;V	0.00 (3)	1.83 (491)	0.00	6.92
3;COND;SG;V	50.99 (202)	38.87 (494)	84.16	81.78
2;FUT;PL;V	0.00 (1)	3.05 (492)	0.00	7.11
2;PRS;SBJV;SG;V	23.81 (105)	13.65 (491)	52.38	26.88
3;PL;PRS;SBJV;V	46.46 (198)	32.59 (491)	85.35	72.71
2;IPFV;PL;PST;V	19.51 (41)	2.24 (492)	31.71	3.86
1;IPFV;PST;SG;V	57.45 (235)	48.58 (492)	91.91	88.21
3;FUT;SG;V	58.13 (160)	38.46 (494)	85.00	71.05
3;PRS;SG;V	41.37 (452)	37.73 (493)	61.06	55.38
2;IPFV;PST;SG;V	0.00 (7)	0.81 (492)	28.57	2.44
1;FUT;PL;V	46.15 (26)	29.47 (492)	80.77	71.54
3;FUT;PL;V	63.41 (82)	41.46 (492)	93.90	91.26
2;PRS;SG;V	28.57 (126)	15.27 (491)	52.38	29.74
3;COND;PL;V	52.59 (116)	35.37 (492)	78.45	78.86
3;IPFV;PST;SG;V	57.06 (333)	48.38 (494)	91.89	88.26
2;PL;PRS;SBJV;V	-	0.61 (491)	-	1.63
1;PL;PRS;V	32.82 (131)	10.77 (492)	58.02	24.39
1;PFV;PL;PST;V	16.67 (18)	5.30 (491)	27.78	7.94
3;PFV;PL;PST;V	51.85 (324)	42.77 (491)	91.05	93.08
NFIN;V	55.72 (463)	52.02 (494)	90.28	86.23
3;PFV;PST;SG;V	36.79 (405)	31.44 (493)	60.74	53.55
2;COND;SG;V	0.00 (5)	0.41 (492)	40.00	3.66
3;PL;PRS;V	55.50 (373)	46.84 (491)	89.28	81.67
3;IPFV;PL;PST;V	60.22 (274)	47.15 (492)	96.35	96.75
ADJ;FEM;SG	60.00 (500)	59.84 (503)	95.00	95.03
ADJ;MASC;PL	59.51 (489)	56.70 (522)	96.11	95.02
ADJ;FEM;PL	62.26 (469)	61.38 (479)	97.44	96.87
ADJ;MASC;SG	57.93 (511)	57.01 (528)	91.19	91.1

Table 29: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Portuguese–French language pair (the grey numbers correspond to the dictionary sizes).

Portuguese–Italian				
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	46.92 (8939)	25.63 (20757)	80.24	52.6
N;SG	55.15 (2069)	52.99 (2159)	90.91	90.64
N;PL	50.13 (1598)	46.24 (1888)	89.55	87.29
3;IPFV;PL;PST;V	57.77 (251)	46.90 (452)	97.21	98.23
1;FUT;PL;V	23.81 (21)	15.71 (452)	52.38	55.53
1;IPFV;PL;PST;V	12.50 (8)	15.27 (452)	62.50	65.04
2;FUT;SG;V	16.67 (6)	3.10 (452)	33.33	13.27
2;COND;PL;V	-	0.00 (452)	-	0.44
2;IPFV;PL;PST;V	50.00 (4)	1.55 (452)	75.00	3.32
3;PL;PRS;V	51.16 (346)	45.23 (451)	88.44	77.83
2;IMP;PL;POS;V	0.00 (58)	1.11 (452)	5.17	4.65
3;IMP;PL;POS;V	13.64 (176)	9.53 (451)	34.66	24.83
3;PL;PRS;SBJV;V	13.64 (176)	9.53 (451)	34.66	24.83
2;PFV;PL;PST;V	0.00 (5)	4.65 (452)	20.00	10.62
1;COND;PL;V	28.57 (7)	15.71 (452)	85.71	57.96
3;FUT;SG;V	48.53 (136)	32.96 (452)	86.03	74.78
2;IMP;POS;SG;V	46.08 (408)	43.24 (451)	63.97	60.09
3;PRS;SBJV;SG;V	19.73 (294)	15.30 (451)	33.33	25.06
3;PFV;PST;SG;V	43.62 (376)	38.05 (452)	75.00	71.9
1;IMP;PL;POS;V	26.92 (26)	17.52 (451)	69.23	72.73
2;PFV;PST;SG;V	0.00 (7)	1.33 (452)	0.00	2.43
1;PL;PRS;SBJV;V	26.92 (26)	17.52 (451)	69.23	72.73
1;PFV;PL;PST;V	27.78 (18)	3.76 (452)	50.00	9.73
3;COND;PL;V	23.53 (85)	13.05 (452)	38.82	41.81
2;COND;SG;V	16.67 (6)	0.44 (452)	33.33	1.11
3;IMP;POS;SG;V	19.73 (294)	15.30 (451)	33.33	25.06
NFIN;V	54.67 (428)	52.43 (452)	97.43	95.8
1;FUT;SG;V	27.27 (44)	21.24 (452)	70.45	65.49
1;COND;SG;V	29.69 (128)	16.81 (452)	44.53	48.01
1;IPFV;PST;SG;V	50.34 (149)	43.81 (452)	88.59	83.19
2;FUT;PL;V	0.00 (1)	1.11 (452)	0.00	7.52
3;PRS;SG;V	46.04 (417)	43.24 (451)	64.27	60.09
2;PRS;SBJV;SG;V	17.58 (91)	10.42 (451)	43.96	21.06
2;PL;PRS;SBJV;V	0.00 (1)	0.67 (451)	0.00	2.44
1;PRS;SBJV;SG;V	19.73 (294)	15.30 (451)	33.33	25.06
2;PRS;SG;V	19.23 (130)	7.10 (451)	33.85	13.3
3;IPFV;PST;SG;V	50.97 (310)	43.81 (452)	88.06	83.19
2;IPFV;PST;SG;V	40.00 (5)	1.77 (452)	40.00	1.77
3;FUT;PL;V	53.12 (64)	30.53 (452)	93.75	84.07
3;PFV;PL;PST;V	54.97 (302)	46.68 (452)	94.70	96.02
3;COND;SG;V	29.11 (158)	16.81 (452)	44.30	48.01
2;PL;PRS;V	26.47 (34)	4.65 (452)	52.94	16.59
1;PFV;PST;SG;V	0.81 (124)	0.88 (452)	0.81	3.1
1;PRS;SG;V	27.57 (243)	21.51 (451)	44.86	32.15
1;PL;PRS;V	31.48 (108)	23.67 (452)	81.48	71.46
ADJ;MASC;PL	61.95 (431)	58.41 (464)	97.22	96.55
ADJ;FEM;PL	60.61 (424)	60.42 (427)	95.52	95.55
ADJ;MASC;SG	60.49 (448)	58.67 (467)	92.41	91.22
ADJ;FEM;SG	61.12 (445)	61.12 (445)	92.81	92.36

Table 30: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Portuguese–Italian language pair (the grey numbers correspond to the dictionary sizes).

	Portuguese–Spanish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	60.64 (9275)	37.32 (22638)	85.81	58.92
N;SG	63.92 (1940)	61.89 (2015)	90.10	89.58
N;PL	63.71 (1576)	60.35 (1816)	92.64	91.8
ADJ;FEM;SG	66.24 (542)	65.87 (545)	95.02	95.05
ADJ;MASC;SG	66.67 (543)	64.65 (563)	94.66	94.49
ADJ;MASC;PL	69.20 (526)	65.83 (559)	96.77	96.78
ADJ;FEM;PL	70.23 (514)	69.22 (523)	97.28	96.94
2;FUT;PL;V	50.00 (4)	15.52 (451)	75.00	35.48
3;PL;PRS;V	59.06 (342)	49.78 (450)	83.33	72.67
2;PFV;PL;PST;V	0.00 (2)	0.00 (451)	0.00	0.44
3;IPFV;PL;PST;V	69.92 (256)	55.43 (451)	98.83	97.56
3;PFV;PST;SG;V	56.67 (360)	48.78 (451)	80.28	74.94
3;FUT;PL;SBJV;V	0.00 (30)	0.67 (451)	0.00	0.67
2;IMP;POS;SG;V	53.92 (408)	49.78 (450)	68.87	63.33
3;FUT;PL;V	78.38 (74)	55.88 (451)	97.30	91.8
1;COND;SG;V	69.19 (198)	53.88 (451)	91.92	84.04
3;IMP;POS;SG;V	48.10 (289)	36.83 (448)	59.86	46.21
2;IMP;PL;POS;V	6.38 (47)	6.65 (451)	14.89	11.75
2;FUT;PL;SBJV;V	-	0.22 (451)	-	0.89
1;IMP;PL;POS;V	50.00 (34)	25.00 (448)	61.76	38.39
2;FUT;SG;V	45.45 (11)	27.05 (451)	63.64	44.79
3;PFV;PL;PST;V	66.44 (298)	54.77 (451)	95.64	93.35
2;PL;PRS;V	13.33 (15)	1.77 (451)	20.00	1.77
2;COND;SG;V	0.00 (5)	29.93 (451)	40.00	54.32
2;COND;PL;V	0.00 (1)	1.11 (451)	0.00	4.66
2;PRS;SG;V	51.64 (122)	39.11 (450)	61.48	49.78
3;COND;PL;V	77.78 (99)	54.10 (451)	96.97	95.57
2;PRS;SBJV;SG;V	46.81 (94)	28.95 (449)	67.02	40.31
3;IPFV;PST;SG;V	69.10 (301)	55.88 (451)	90.37	86.47
2;FUT;SBJV;SG;V	28.57 (7)	26.61 (451)	28.57	32.37
1;FUT;PL;SBJV;V	-	0.00 (451)	-	0.44
2;IPFV;PST;SG;V	14.29 (7)	9.31 (451)	28.57	13.97
2;PFV;PST;SG;V	47.62 (21)	26.83 (451)	57.14	35.7
1;FUT;SG;V	68.75 (48)	47.01 (451)	89.58	75.39
1;PFV;PST;SG;V	28.22 (163)	14.63 (451)	44.79	25.94
2;PL;PRS;SBJV;V	25.00 (4)	0.89 (449)	50.00	3.34
1;IPFV;PST;SG;V	69.10 (301)	55.88 (451)	90.37	86.47
1;PL;PRS;V	67.24 (116)	43.24 (451)	81.03	60.09
1;FUT;PL;V	51.72 (29)	47.23 (451)	86.21	86.25
3;PRS;SG;V	54.15 (410)	50.00 (450)	69.27	63.56
NFIN;V	57.78 (424)	54.99 (451)	91.75	88.47
3;IMP;PL;POS;V	46.88 (192)	26.95 (449)	67.19	44.54
3;PL;PRS;SBJV;V	46.88 (192)	26.95 (449)	67.19	44.54
1;PRS;SBJV;SG;V	48.28 (290)	36.97 (449)	60.00	46.33
1;IPFV;PL;PST;V	38.46 (13)	23.06 (451)	100.00	86.03
3;FUT;SBJV;SG;V	67.86 (140)	53.88 (451)	92.86	86.7
3;COND;SG;V	69.19 (198)	53.88 (451)	91.92	84.04
1;FUT;SBJV;SG;V	67.86 (140)	53.88 (451)	92.86	86.7
3;FUT;SG;V	79.73 (148)	58.09 (451)	97.30	93.35
1;PL;PRS;SBJV;V	50.00 (34)	24.72 (449)	61.76	38.08
1;PRS;SG;V	42.62 (237)	31.99 (447)	54.85	40.94
2;IPFV;PL;PST;V	0.00 (2)	2.00 (451)	50.00	2.66
3;PRS;SBJV;SG;V	48.28 (290)	36.97 (449)	60.00	46.33
1;COND;PL;V	87.50 (8)	48.12 (451)	100.00	93.57
1;PFV;PL;PST;V	50.00 (46)	22.84 (451)	67.39	34.37

Table 31: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Portuguese–Spanish language pair (the grey numbers correspond to the dictionary sizes).

	Spanish–Catalan			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	50.37 (8291)	30.43 (18442)	79.12	53.18
N;SG	59.43 (1639)	58.58 (1666)	90.12	89.2
N;PL	59.73 (1388)	56.87 (1542)	92.36	91.63
ADJ;FEM;SG	34.46 (383)	34.37 (387)	86.68	86.82
ADJ;MASC;SG	69.19 (383)	68.38 (389)	94.52	94.6
ADJ;FEM;PL	71.82 (362)	71.04 (366)	95.03	94.81
ADJ;MASC;PL	70.35 (371)	67.96 (387)	96.23	96.12
1;FUT;PL;V	35.90 (39)	43.90 (369)	64.10	88.89
2;PFV;PST;SG;V	0.00 (2)	0.00 (369)	0.00	0
2;IMP;PL;POS;V	2.70 (37)	0.54 (369)	8.11	2.17
2;PRS;SG;V	32.87 (143)	20.60 (369)	40.56	25.47
2;PST;SBJV;SG;V	66.67 (3)	0.54 (369)	66.67	1.63
3;PFV;PL;PST;V	55.33 (244)	52.03 (369)	89.75	95.39
2;PFV;PL;PST;V	-	0.00 (369)	-	0.54
1;PL;PRS;SBJV;V	31.34 (67)	14.63 (369)	59.70	26.29
2;COND;PL;V	0.00 (3)	1.36 (369)	0.00	3.25
3;IMP;POS;SG;V	22.27 (256)	19.78 (369)	37.50	30.62
1;PRS;SG;V	28.77 (212)	23.98 (367)	42.45	35.15
1;PL;PRS;V	34.59 (133)	12.74 (369)	53.38	19.51
3;PL;PRS;V	45.94 (320)	42.82 (369)	77.50	69.65
3;IPFV;PST;SG;V	53.61 (291)	48.51 (369)	88.32	86.99
1;IPFV;PST;SG;V	53.61 (291)	48.51 (369)	88.32	86.99
3;PL;PRS;SBJV;V	24.63 (203)	18.70 (369)	41.87	35.23
3;PRS;SG;V	52.59 (348)	51.22 (369)	66.38	62.6
2;IPFV;PST;SG;V	0.00 (7)	5.15 (369)	0.00	7.59
3;FUT;SG;V	60.43 (187)	52.03 (369)	89.84	94.04
3;COND;PL;V	53.79 (132)	50.41 (369)	75.00	94.85
3;COND;SG;V	56.72 (201)	42.55 (369)	81.59	76.15
2;PL;PST;SBJV;V	-	0.00 (369)	-	2.71
2;FUT;PL;V	0.00 (6)	1.63 (369)	0.00	2.17
3;PST;SBJV;SG;V	48.80 (166)	32.79 (369)	66.27	52.57
1;PL;PST;SBJV;V	33.33 (3)	1.36 (369)	33.33	7.59
3;FUT;PL;V	49.64 (139)	45.26 (369)	74.82	87.8
3;IMP;PL;POS;V	24.63 (203)	18.70 (369)	41.87	35.23
2;COND;SG;V	0.00 (3)	2.17 (369)	0.00	2.98
1;PRS;SBJV;SG;V	22.27 (256)	19.78 (369)	37.50	30.62
1;PFV;PL;PST;V	33.33 (6)	10.57 (369)	50.00	16.26
2;IPFV;PL;PST;V	0.00 (2)	0.54 (369)	0.00	1.08
1;IMP;PL;POS;V	31.34 (67)	14.63 (369)	59.70	26.29
2;PL;PRS;SBJV;V	25.00 (16)	4.61 (369)	43.75	10.03
2;PL;PRS;V	5.00 (20)	1.90 (369)	25.00	4.88
1;PFV;PST;SG;V	0.00 (71)	1.90 (369)	1.41	3.25
1;FUT;SG;V	37.50 (40)	47.70 (369)	52.50	76.69
1;COND;PL;V	42.86 (7)	37.13 (369)	71.43	85.91
3;IPFV;PL;PST;V	56.08 (255)	49.86 (369)	94.12	96.48
1;IPFV;PL;PST;V	25.00 (4)	18.70 (369)	75.00	76.69
3;PRS;SBJV;SG;V	22.27 (256)	19.78 (369)	37.50	30.62
3;PL;PST;SBJV;V	67.23 (119)	41.19 (369)	97.48	94.58
1;PST;SBJV;SG;V	48.80 (166)	32.79 (369)	66.27	52.57
2;FUT;SG;V	16.67 (12)	23.58 (369)	41.67	39.3
1;COND;SG;V	56.72 (201)	42.55 (369)	81.59	76.15
3;PFV;PST;SG;V	45.24 (294)	40.38 (369)	67.69	63.41
2;IMP;POS;SG;V	52.46 (345)	50.68 (369)	66.09	61.79
2;PRS;SBJV;SG;V	19.77 (86)	8.67 (369)	22.09	11.92
NFIN;V	55.03 (358)	53.93 (369)	91.90	88.89

Table 32: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Spanish–Catalan language pair (the grey numbers correspond to the dictionary sizes).

	Spanish–French			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	46.87 (11457)	25.84 (25775)	78.62	49.5
N;PL	55.83 (1886)	52.17 (2162)	94.17	92.92
N;SG	56.32 (2301)	55.19 (2352)	89.35	89.03
3;PRS;SBJV;SG;V	28.80 (382)	22.22 (513)	45.55	35.09
2;IMP;PL;POS;V	2.27 (44)	1.17 (513)	6.82	4.48
2;PRS;SBJV;SG;V	27.47 (182)	15.20 (513)	45.05	24.76
1;FUT;PL;V	30.19 (53)	28.65 (513)	62.26	76.22
1;PFV;PST;SG;V	0.91 (110)	1.36 (513)	1.82	2.73
2;IPFV;PL;PST;V	0.00 (1)	0.19 (513)	0.00	0.97
1;PFV;PL;PST;V	20.00 (60)	11.31 (513)	53.33	28.27
1;PL;PRS;SBJV;V	16.18 (68)	9.16 (513)	41.18	26.71
2;IPFV;PST;SG;V	13.33 (15)	5.26 (513)	20.00	11.89
3;PL;PRS;SBJV;V	42.96 (291)	29.24 (513)	77.66	61.4
2;PL;PRS;SBJV;V	0.00 (12)	1.75 (513)	0.00	5.07
3;PRS;SG;V	37.81 (484)	35.48 (513)	59.30	54.39
3;PFV;PST;SG;V	34.53 (417)	28.85 (513)	54.68	45.03
2;PL;PST;SBJV;V	-	0.39 (513)	-	3.51
2;PL;PRS;V	0.00 (27)	6.04 (513)	18.52	15.01
2;PFV;PL;PST;V	-	0.39 (513)	-	1.36
2;COND;SG;V	0.00 (9)	3.12 (513)	22.22	10.92
2;COND;PL;V	-	4.09 (513)	-	16.57
3;PST;SBJV;SG;V	10.39 (154)	15.01 (513)	24.03	34.7
1;PRS;SBJV;SG;V	28.80 (382)	22.22 (513)	45.55	35.09
2;FUT;PL;V	20.00 (5)	10.72 (513)	40.00	24.76
1;PRS;SG;V	24.44 (360)	20.35 (511)	39.72	30.33
1;IPFV;PL;PST;V	0.00 (15)	0.78 (513)	6.67	5.85
2;IMP;POS;SG;V	37.61 (476)	34.70 (513)	59.03	53.22
3;COND;SG;V	47.39 (249)	38.21 (513)	81.93	85.38
2;FUT;SG;V	16.67 (24)	3.31 (513)	20.83	8.77
3;FUT;SG;V	46.72 (244)	35.09 (513)	82.79	76.02
1;IPFV;PST;SG;V	53.76 (266)	45.03 (513)	90.98	84.6
3;FUT;PL;V	55.03 (169)	38.99 (513)	91.72	97.47
2;PFV;PST;SG;V	2.04 (49)	0.58 (513)	6.12	0.58
3;IPFV;PST;SG;V	52.97 (387)	45.03 (513)	89.92	84.6
2;PST;SBJV;SG;V	0.00 (3)	0.00 (513)	0.00	1.75
3;PL;PRS;V	49.19 (431)	42.50 (513)	86.08	76.61
1;COND;SG;V	47.69 (195)	38.21 (513)	83.08	85.38
1;PL;PRS;V	25.15 (167)	12.67 (513)	52.69	31.58
1;PL;PST;SBJV;V	0.00 (1)	0.00 (513)	0.00	0
3;COND;PL;V	43.20 (169)	37.82 (513)	81.66	86.35
3;PFV;PL;PST;V	44.92 (354)	39.96 (513)	91.53	93.37
1;IMP;PL;POS;V	18.29 (82)	9.16 (513)	46.34	26.71
NFIN;V	52.00 (475)	48.54 (513)	93.26	88.3
1;PST;SBJV;SG;V	8.70 (92)	15.01 (513)	18.48	34.7
2;PRS;SG;V	25.76 (198)	16.18 (513)	46.97	32.75
1;COND;PL;V	12.50 (8)	10.53 (513)	12.50	39.77
3;PL;PST;SBJV;V	0.00 (86)	0.00 (513)	0.00	0.39
3;IPFV;PL;PST;V	50.75 (333)	42.88 (513)	95.20	96.69
1;FUT;SG;V	47.22 (72)	29.63 (513)	79.17	67.06
ADJ;FEM;PL	66.21 (506)	65.75 (511)	97.83	97.26
ADJ;MASC;PL	66.02 (515)	64.43 (537)	95.53	95.34
ADJ;FEM;SG	62.38 (529)	62.03 (532)	95.09	95.11
ADJ;MASC;SG	65.16 (531)	64.33 (541)	93.03	92.98

Table 33: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Spanish–French language pair (the grey numbers correspond to the dictionary sizes).

		Spanish–Italian		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	46.99 (10709)	27.79 (23528)	78.26	53.66
N;SG	57.22 (2319)	56.11 (2365)	92.07	91.63
N;PL	48.98 (1805)	45.70 (2103)	86.59	84.88
ADJ;MASC;SG	68.91 (476)	68.46 (482)	93.28	93.57
ADJ;FEM;PL	68.99 (445)	68.82 (449)	95.73	95.77
ADJ;MASC;PL	67.46 (461)	67.30 (477)	95.23	95.39
ADJ;FEM;SG	69.36 (470)	69.36 (470)	95.53	95.53
2;IMP;PL;POS;V	3.17 (63)	1.28 (470)	12.7	5.96
1;PST;SBJV;SG;V	60.00 (90)	42.89 (457)	88.89	75.71
1;FUT;PL;V	22.45 (49)	15.75 (457)	48.98	50.77
2;PFV;PST;SG;V	0.00 (19)	0.22 (457)	0	1.09
NFIN;V	57.14 (441)	54.66 (472)	95.69	93.86
3;PRS;SBJV;SG;V	18.52 (324)	14.85 (458)	29.63	23.36
1;PL;PRS;SBJV;V	32.50 (80)	23.63 (457)	80	78.12
2;FUT;SG;V	22.58 (31)	9.41 (457)	35.48	26.7
3;PFV;PST;SG;V	42.78 (367)	38.21 (458)	72.21	67.9
2;PL;PST;SBJV;V	0.00 (1)	0.44 (457)	0	1.75
3;IPFV;PST;SG;V	54.60 (337)	47.16 (458)	88.72	83.19
2;IPFV;PL;PST;V	0.00 (1)	2.41 (457)	0	4.38
1;FUT;SG;V	28.36 (67)	22.32 (457)	64.18	56.02
3;COND;PL;V	16.10 (118)	16.19 (457)	33.05	47.48
1;IPFV;PL;PST;V	20.00 (15)	26.70 (457)	93.33	85.56
3;PL;PRS;V	50.27 (368)	45.73 (457)	82.88	74.18
3;PST;SBJV;SG;V	53.11 (177)	42.79 (458)	83.62	75.55
2;FUT;PL;V	0.00 (6)	2.84 (457)	0	11.6
1;COND;SG;V	14.65 (157)	16.63 (457)	38.22	46.61
2;PL;PRS;V	11.11 (27)	1.31 (457)	14.81	3.28
2;PST;SBJV;SG;V	0.00 (4)	3.06 (457)	0	5.69
1;COND;PL;V	25.00 (12)	21.88 (457)	58.33	75.93
3;PFV;PL;PST;V	55.27 (313)	49.02 (457)	95.53	95.84
1;PRS;SBJV;SG;V	18.52 (324)	14.88 (457)	29.63	23.41
3;IMP;PL;POS;V	17.21 (244)	12.91 (457)	28.69	24.07
2;PRS;SG;V	12.75 (204)	7.44 (457)	25	12.25
2;PRS;SBJV;SG;V	17.78 (180)	12.91 (457)	39.44	26.48
3;IMP;POS;SG;V	18.52 (324)	14.88 (457)	29.63	23.41
1;IMP;PL;POS;V	32.10 (81)	22.93 (471)	79.01	78.13
2;COND;PL;V	0.00 (1)	0.44 (457)	0	3.28
2;IMP;POS;SG;V	45.97 (409)	41.40 (471)	68.7	61.78
2;COND;SG;V	12.50 (8)	0.66 (457)	25	2.41
2;PL;PRS;SBJV;V	0.00 (13)	0.22 (457)	0	0.22
2;IPFV;PST;SG;V	0.00 (16)	1.09 (457)	0	1.53
3;COND;SG;V	14.97 (187)	16.59 (458)	37.43	46.72
3;IPFV;PL;PST;V	55.59 (304)	49.02 (457)	97.04	97.81
2;PFV;PL;PST;V	0.00 (2)	3.72 (457)	0	5.47
3;PL;PRS;SBJV;V	17.21 (244)	12.91 (457)	28.69	24.07
1;PL;PRS;V	35.44 (158)	27.57 (457)	82.28	79.43
3;FUT;PL;V	44.83 (145)	34.57 (457)	91.72	95.19
3;FUT;SG;V	44.39 (223)	38.43 (458)	88.79	84.28
3;PRS;SG;V	45.93 (418)	43.23 (458)	68.9	63.97
1;PFV;PST;SG;V	0.00 (112)	3.50 (457)	3.57	6.56
1;PL;PST;SBJV;V	0.00 (2)	1.97 (457)	50	5.25
1;IPFV;PST;SG;V	61.38 (145)	47.26 (457)	91.72	83.15
1;PFV;PL;PST;V	33.33 (48)	24.73 (457)	72.92	70.02
1;PRS;SG;V	29.55 (291)	23.19 (457)	45.7	34.79
3;PL;PST;SBJV;V	52.10 (119)	42.67 (457)	96.64	96.06

Table 34: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Spanish–Italian language pair (the grey numbers correspond to the dictionary sizes).

	Spanish–Portuguese			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	57.45 (9732)	35.62 (23197)	82.27	56.27
N;SG	63.84 (2066)	62.47 (2113)	90.17	89.68
N;PL	61.64 (1692)	58.56 (1904)	92.32	92.7
ADJ;FEM;PL	73.80 (439)	73.20 (444)	99.32	99.32
ADJ;MASC;PL	73.21 (448)	71.95 (467)	97.77	98.07
ADJ;FEM;SG	72.81 (456)	72.33 (459)	96.93	96.08
ADJ;MASC;SG	72.98 (459)	71.91 (470)	96.30	95.74
1;PL;PRS;SBJV;V	18.87 (53)	21.08 (465)	35.85	38.49
3;PFV;PST;SG;V	58.63 (365)	50.32 (465)	81.37	72.9
3;PRS;SBJV;SG;V	42.26 (310)	34.70 (464)	54.19	45.04
3;FUT;PL;V	50.00 (114)	46.45 (465)	68.42	89.25
2;PL;PRS;V	6.67 (15)	0.43 (465)	6.67	0.43
3;COND;PL;V	61.94 (134)	46.67 (465)	84.33	87.1
1;IPFV;PL;PST;V	50.00 (8)	24.30 (465)	87.50	89.68
2;FUT;PL;SBJV;V	-	0.00 (465)	-	0.43
2;IMP;PL;POS;V	0.00 (36)	2.80 (465)	2.78	3.87
2;PRS;SBJV;SG;V	29.27 (123)	26.29 (464)	42.28	35.78
1;COND;SG;V	54.17 (216)	38.71 (465)	74.54	56.77
3;IMP;PL;POS;V	39.47 (228)	30.17 (464)	57.89	48.49
3;IMP;POS;SG;V	42.26 (310)	34.70 (464)	54.19	45.04
3;IPFV;PST;SG;V	56.18 (340)	50.54 (465)	82.65	83.23
2;PRS;SG;V	37.21 (172)	36.64 (464)	48.26	44.83
2;IPFV;PST;SG;V	22.22 (9)	14.41 (465)	44.44	19.78
1;COND;PL;V	72.73 (11)	45.38 (465)	72.73	83.23
1;FUT;PL;SBJV;V	-	5.16 (465)	-	12.04
3;FUT;PL;SBJV;V	42.86 (7)	12.26 (465)	42.86	20
2;FUT;PL;V	0.00 (2)	0.00 (465)	0.00	0
3;FUT;SBJV;SG;V	30.23 (43)	20.43 (465)	34.88	26.67
NFIN;V	60.05 (433)	57.63 (465)	90.76	86.67
2;IPFV;PL;PST;V	-	0.22 (465)	-	0.22
2;PFV;PL;PST;V	-	0.86 (465)	-	1.29
2;FUT;SG;V	37.50 (16)	21.94 (465)	37.50	40.22
3;COND;SG;V	54.17 (216)	38.71 (465)	74.54	56.77
2;IMP;POS;SG;V	51.67 (418)	48.06 (464)	69.38	62.93
3;PFV;PL;PST;V	62.18 (312)	53.12 (465)	94.55	93.98
1;PFV;PL;PST;V	56.79 (81)	41.72 (465)	69.14	57.63
3;PL;PRS;V	57.98 (376)	50.43 (464)	83.78	75
1;PL;PRS;V	62.09 (153)	41.94 (465)	75.16	59.57
1;FUT;SG;V	46.03 (63)	48.82 (465)	63.49	83.44
3;PL;PRS;SBJV;V	39.47 (228)	30.17 (464)	57.89	48.49
3;PRS;SG;V	52.25 (423)	49.14 (464)	69.74	64.01
2;FUT;SBJV;SG;V	75.00 (4)	26.45 (465)	75.00	32.69
1;FUT;SBJV;SG;V	30.23 (43)	20.43 (465)	34.88	26.67
2;PFV;PST;SG;V	33.33 (30)	26.24 (465)	40.00	33.12
2;COND;SG;V	0.00 (4)	18.06 (465)	25.00	32.04
1;PRS;SBJV;SG;V	42.26 (310)	34.70 (464)	54.19	45.04
2;PL;PRS;SBJV;V	0.00 (3)	0.43 (465)	0.00	0.86
3;FUT;SG;V	59.16 (191)	53.55 (465)	83.25	92.47
1;IMP;PL;POS;V	18.87 (53)	21.08 (465)	35.85	38.49
1;IPFV;PST;SG;V	56.18 (340)	50.54 (465)	82.65	83.23
1;PRS;SG;V	39.79 (284)	34.99 (463)	51.06	45.57
2;COND;PL;V	-	0.00 (465)	-	0.22
1;PFV;PST;SG;V	35.66 (143)	17.63 (465)	55.24	26.88
3;IPFV;PL;PST;V	59.61 (307)	52.26 (465)	93.49	97.85
1;FUT;PL;V	42.11 (38)	44.30 (465)	50.00	81.29

Table 35: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Spanish–Portuguese language pair (the grey numbers correspond to the dictionary sizes).

	Russian–Czech			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	32.03 (5708)	26.48 (7538)	79.54	75.7
INS;N;PL	30.03 (373)	23.46 (537)	87.13	85.1
DAT;N;SG	19.69 (457)	17.15 (554)	56.89	50.72
ESS;N;PL	40.79 (304)	29.80 (537)	89.47	89.39
ACC;N;SG	32.08 (533)	30.52 (557)	70.92	67.5
N;NOM;PL	31.29 (489)	28.81 (531)	77.51	74.39
DAT;N;PL	43.87 (269)	29.98 (537)	92.94	92.36
ACC;N;PL	27.31 (271)	24.50 (302)	74.91	72.19
GEN;N;SG	29.53 (535)	28.42 (556)	73.27	69.78
INS;N;SG	32.38 (488)	29.08 (557)	80.53	78.28
ESS;N;SG	25.54 (466)	22.08 (557)	61.16	56.01
GEN;N;PL	34.97 (449)	30.11 (538)	77.28	71.93
N;NOM;SG	32.90 (541)	31.76 (551)	73.01	69.87
ACC;ADJ;INAN;MASC;SG	41.58 (101)	40.00 (105)	98.02	98.1
ADJ;GEN;PL	42.11 (95)	38.39 (112)	100	100
ACC;ADJ;NEUT;SG	36.00 (100)	34.82 (112)	93	91.96
ADJ;FEM;NOM;SG	46.32 (95)	41.90 (105)	97.89	98.1
ADJ;DAT;FEM;SG	35.24 (105)	33.04 (112)	87.62	85.71
ADJ;NEUT;NOM;SG	38.30 (94)	37.14 (105)	94.68	93.33
ADJ;MASC;NOM;SG	41.58 (101)	40.00 (105)	98.02	98.1
ADJ;DAT;PL	45.26 (95)	39.29 (112)	100	100
ADJ;INS;PL	46.34 (82)	35.71 (112)	100	100
ADJ;ESS;PL	42.11 (95)	38.39 (112)	100	100
ACC;ADJ;FEM;SG	39.80 (98)	34.82 (112)	98.98	97.32
ADJ;GEN;MASC;SG	44.12 (102)	41.07 (112)	100	100
ADJ;GEN;NEUT;SG	44.12 (102)	41.07 (112)	100	100
ADJ;ESS;NEUT;SG	53.49 (86)	46.43 (112)	96.51	94.64
ADJ;INS;MASC;SG	45.26 (95)	39.29 (112)	100	100
ADJ;DAT;MASC;SG	49.28 (69)	42.86 (112)	100	100
ADJ;ESS;MASC;SG	53.57 (84)	46.43 (112)	97.62	94.64
ACC;ADJ;MASC;SG	44.12 (102)	41.07 (112)	100	100
ADJ;ESS;FEM;SG	35.24 (105)	33.04 (112)	87.62	85.71
ADJ;DAT;NEUT;SG	49.28 (69)	42.86 (112)	100	100
ADJ;FEM;GEN;SG	35.24 (105)	33.04 (112)	87.62	85.71
3;MASC;PL;PST;V	25.35 (71)	23.16 (95)	87.32	87.37
2;PL;PRS;V	13.33 (15)	10.17 (59)	93.33	84.75
1;PL;PRS;V	20.00 (15)	8.47 (59)	86.67	61.02
3;FEM;PST;SG;V	27.54 (69)	23.16 (95)	88.41	84.21
2;IMP;SG;V	12.50 (16)	1.06 (94)	37.5	13.83
3;FEM;PL;PST;V	26.15 (65)	23.16 (95)	87.69	87.37
3;NEUT;PST;SG;V	22.22 (45)	14.74 (95)	82.22	74.74
2;PRS;SG;V	28.57 (7)	8.47 (59)	57.14	55.93
2;IMP;PL;V	5.88 (17)	7.45 (94)	70.59	64.89
1;PRS;SG;V	23.81 (21)	11.86 (59)	52.38	32.2
3;PL;PRS;V	16.28 (43)	13.56 (59)	81.4	69.49
NFIN;V	25.64 (117)	24.00 (125)	100	98.4
3;MASC;PST;SG;V	27.71 (83)	24.73 (93)	84.34	77.42
3;PRS;SG;V	18.52 (54)	16.95 (59)	79.63	76.27
2;FUT;PL;V	0.00 (4)	10.81 (37)	75	70.27
2;FUT;SG;V	0.00 (1)	2.70 (37)	100	43.24
1;FUT;PL;V	20.00 (5)	5.41 (37)	80	21.62
1;FUT;SG;V	14.29 (7)	2.70 (37)	14.29	13.51
3;FUT;SG;V	10.71 (28)	8.11 (37)	35.71	35.14
3;FUT;PL;V	9.09 (22)	5.41 (37)	31.82	32.43
ACC;INAN;N;SG	0.00 (1)	0.00 (2)	0	50
ACC;INAN;N;PL	0.00 (1)	50.00 (2)	100	100
ADJ;INS;NEUT;SG	33.33 (9)	25.00 (12)	100	100
ADJ;FEM;INS;SG	18.18 (11)	16.67 (12)	90.91	91.67
ACC;ADJ;PL	36.36 (11)	33.33 (12)	100	100
ADJ;NOM;PL	10.00 (10)	16.67 (12)	100	100
2;FEM;PL;PST;V	0.00 (1)	0.00 (1)	0	0
2;MASC;PL;PST;V	0.00 (1)	0.00 (1)	0	0

Table 36: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Russian–Czech language pair (the grey numbers correspond to the dictionary sizes).

	Russian–Polish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	40.22 (9183)	35.01 (11697)	83.10	80.45
DAT;N;SG	29.86 (653)	24.92 (999)	62.17	58.86
INS;N;SG	39.70 (879)	35.40 (1000)	86.01	82.9
ACC;N;SG	38.20 (953)	36.20 (1000)	73.66	71.2
GEN;N;SG	40.62 (960)	39.20 (1000)	81.46	79.2
ESS;N;SG	32.86 (782)	28.56 (998)	64.07	56.71
N;NOM;SG	36.99 (976)	36.15 (993)	71.72	69.89
INS;N;PL	43.38 (634)	34.84 (930)	98.90	99.14
GEN;N;PL	41.24 (805)	36.64 (928)	78.39	73.06
DAT;N;PL	43.85 (358)	32.04 (930)	88.27	90.22
ESS;N;PL	47.50 (541)	35.48 (930)	91.31	89.35
ACC;N;PL	38.00 (579)	35.23 (633)	80.83	77.41
N;NOM;PL	39.86 (863)	37.81 (923)	84.36	81.69
ACC;ADJ;INAN;MASC;SG	48.63 (183)	47.89 (190)	94.54	94.21
ADJ;GEN;PL	50.00 (180)	47.37 (190)	98.33	98.42
ADJ;DAT;PL	45.00 (180)	43.16 (190)	93.89	94.74
ADJ;FEM;GEN;SG	45.00 (180)	43.68 (190)	93.89	94.21
ADJ;ESS;NEUT;SG	42.51 (167)	40.00 (190)	91.62	91.05
ACC;ADJ;NEUT;SG	41.90 (179)	40.53 (190)	92.74	92.63
ADJ;DAT;MASC;SG	50.44 (113)	41.58 (190)	99.12	99.47
ADJ;INS;NEUT;SG	45.00 (180)	43.16 (190)	93.89	94.74
ACC;ADJ;MASC;SG	44.02 (184)	43.16 (190)	96.20	96.32
ADJ;GEN;MASC;SG	44.02 (184)	43.16 (190)	96.20	96.32
ADJ;GEN;NEUT;SG	44.02 (184)	43.16 (190)	96.20	96.32
ADJ;ESS;FEM;SG	45.00 (180)	43.68 (190)	93.89	94.21
ADJ;NEUT;NOM;SG	41.90 (179)	40.53 (190)	92.74	92.63
ADJ;INS;MASC;SG	45.00 (180)	43.16 (190)	93.89	94.74
ADJ;FEM;NOM;SG	46.45 (183)	45.26 (190)	96.72	96.84
ADJ;MASC;NOM;SG	48.63 (183)	47.89 (190)	94.54	94.21
ADJ;DAT;FEM;SG	45.00 (180)	43.68 (190)	93.89	94.21
ADJ;ESS;PL	50.00 (180)	47.37 (190)	98.33	98.42
ACC;ADJ;FEM;SG	45.56 (169)	41.58 (190)	99.41	98.95
ADJ;FEM;INS;SG	45.76 (177)	43.68 (190)	94.35	94.21
ADJ;INS;PL	45.12 (164)	42.11 (190)	100.00	100
ADJ;ESS;MASC;SG	42.51 (167)	40.00 (190)	91.62	91.05
ADJ;DAT;NEUT;SG	50.44 (113)	41.58 (190)	99.12	99.47
ADJ;NOM;PL	44.57 (184)	43.68 (190)	90.76	90.53
ACC;ADJ;PL	49.18 (183)	47.37 (190)	97.27	98.42
NFIN;V	36.67 (30)	33.33 (33)	96.67	93.94
2;MASC;PL;PST;V	-	18.18 (33)	-	72.73
3;MASC;PST;SG;V	38.10 (21)	27.27 (33)	90.48	78.79
2;PRS;SG;V	0.00 (4)	8.00 (25)	75.00	20
2;IMP;SG;V	10.00 (10)	6.06 (33)	30.00	21.21
1;FEM;PST;SG;V	20.00 (5)	30.30 (33)	100.00	84.85
3;MASC;PL;PST;V	30.00 (20)	18.18 (33)	80.00	72.73
2;PL;PRS;V	0.00 (1)	0.00 (25)	0.00	8
2;MASC;PST;SG;V	25.00 (4)	27.27 (33)	50.00	78.79
1;PL;PRS;V	11.11 (9)	8.00 (25)	66.67	36
3;NEUT;PST;SG;V	38.46 (13)	24.24 (33)	84.62	81.82
3;FEM;PST;SG;V	42.86 (21)	30.30 (33)	90.48	84.85
2;IMP;PL;V	0.00 (4)	3.03 (33)	50.00	30.3
3;PL;PRS;V	27.78 (18)	20.00 (25)	72.22	72
2;FEM;PST;SG;V	-	30.30 (33)	-	84.85
1;FEM;PL;PST;V	-	18.18 (33)	-	72.73
2;FEM;PL;PST;V	-	18.18 (33)	-	72.73
1;MASC;PST;SG;V	28.57 (14)	27.27 (33)	85.71	78.79
3;PRS;SG;V	20.83 (24)	20.00 (25)	62.50	56
1;MASC;PL;PST;V	20.00 (5)	18.18 (33)	100.00	72.73
3;FEM;PL;PST;V	27.78 (18)	18.18 (33)	83.33	72.73
1;PRS;SG;V	44.44 (9)	24.00 (25)	55.56	28
1;FUT;SG;V	0.00 (2)	0.00 (8)	0.00	0
3;FUT;SG;V	0.00 (7)	0.00 (8)	14.29	12.5
2;FUT;SG;V	-	12.50 (8)	-	50
3;FUT;PL;V	0.00 (6)	0.00 (8)	50.00	25
1;FUT;PL;V	-	0.00 (8)	-	50
2;FUT;PL;V	0.00 (2)	0.00 (8)	50.00	37.5

Table 37: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Russian–Polish language pair (the grey numbers correspond to the dictionary sizes).

	Russian–Slovak			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	21.12 (1610)	18.00 (2150)	79.94	77.53
ACC;N;PL	15.38 (91)	12.84 (109)	68.13	64.22
ESS;N;PL	35.80 (81)	22.22 (189)	100.00	94.18
INS;N;SG	27.45 (153)	22.28 (193)	83.66	81.87
INS;N;PL	35.24 (105)	23.81 (189)	99.05	98.94
N;NOM;SG	22.58 (186)	21.58 (190)	73.12	72.11
GEN;N;PL	14.09 (149)	11.11 (189)	66.44	61.38
ACC;N;SG	21.47 (177)	19.69 (193)	74.58	72.54
ESS;N;SG	20.44 (137)	16.06 (193)	60.58	50.26
GEN;N;SG	23.16 (177)	21.24 (193)	71.75	69.95
DAT;N;SG	17.42 (132)	14.51 (193)	62.88	57.51
DAT;N;PL	30.53 (95)	21.81 (188)	87.37	84.57
N;NOM;PL	20.73 (164)	18.82 (186)	76.22	72.04
3;MASC;PST;SG;V	-	0.00 (2)	-	0
2;IMP;PL;V	-	0.00 (2)	-	0
2;PRS;SG;V	-	0.00 (2)	-	50
1;PL;PRS;V	-	50.00 (2)	-	100
3;FEM;PST;SG;V	-	0.00 (2)	-	0
2;IMP;SG;V	-	0.00 (2)	-	0
NFIN;V	7.50 (40)	6.25 (48)	100.00	100
1;PRS;SG;V	0.00 (1)	0.00 (2)	0.00	50
3;PL;PRS;V	0.00 (2)	0.00 (2)	50.00	50
2;PL;PRS;V	-	50.00 (2)	-	100
3;NEUT;PST;SG;V	-	0.00 (2)	-	0
3;FEM;PL;PST;V	-	0.00 (2)	-	0
3;PRS;SG;V	50.00 (2)	50.00 (2)	100.00	100
3;MASC;PL;PST;V	-	0.00 (2)	-	0
ADJ;FEM;GEN;SG	21.74 (23)	20.83 (24)	91.30	95.83
ADJ;ESS;NEUT;SG	4.76 (21)	8.33 (24)	80.95	83.33
ADJ;DAT;FEM;SG	21.74 (23)	20.83 (24)	91.30	95.83
ADJ;GEN;PL	8.33 (24)	8.33 (24)	91.67	91.67
ADJ;NOM;PL	4.35 (23)	8.33 (24)	78.26	79.17
ADJ;FEM;NOM;SG	13.04 (23)	16.67 (24)	100.00	100
ACC;ADJ;PL	8.70 (23)	8.33 (24)	91.30	91.67
ADJ;NEUT;NOM;SG	8.70 (23)	8.33 (24)	91.30	91.67
ADJ;INS;NEUT;SG	8.33 (24)	8.33 (24)	100.00	100
ADJ;INS;MASC;SG	8.33 (24)	8.33 (24)	100.00	100
ADJ;FEM;INS;SG	23.81 (21)	20.83 (24)	95.24	95.83
ADJ;ESS;FEM;SG	21.74 (23)	20.83 (24)	91.30	95.83
ACC;ADJ;INAN;MASC;SG	29.17 (24)	29.17 (24)	91.67	91.67
ACC;ADJ;FEM;SG	8.70 (23)	8.33 (24)	100.00	100
ADJ;ESS;PL	8.33 (24)	8.33 (24)	91.67	91.67
ADJ;GEN;MASC;SG	12.50 (24)	12.50 (24)	95.83	95.83
ACC;ADJ;MASC;SG	12.50 (24)	12.50 (24)	95.83	95.83
ADJ;GEN;NEUT;SG	12.50 (24)	12.50 (24)	95.83	95.83
ADJ;ESS;MASC;SG	4.76 (21)	8.33 (24)	80.95	83.33
ADJ;DAT;PL	8.33 (24)	8.33 (24)	100.00	100
ADJ;DAT;NEUT;SG	14.29 (21)	12.50 (24)	100.00	100
ACC;ADJ;NEUT;SG	8.70 (23)	8.33 (24)	91.30	91.67
ADJ;MASC;NOM;SG	29.17 (24)	29.17 (24)	91.67	91.67
ADJ;DAT;MASC;SG	14.29 (21)	12.50 (24)	100.00	100
ADJ;INS;PL	31.82 (22)	33.33 (24)	100.00	100

Table 38: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Russian–Slovak language pair (the grey numbers correspond to the dictionary sizes).

	Russian–Ukrainian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	44.98 (1165)	42.19 (1396)	85.15	83.67
N;NOM;SG	45.21 (146)	44.90 (147)	84.25	83.67
N;NOM;PL	43.88 (139)	43.88 (139)	84.17	84.17
GEN;N;SG	42.76 (145)	42.47 (146)	84.83	84.25
GEN;N;PL	44.27 (131)	42.14 (140)	80.92	77.86
ESS;N;PL	57.83 (83)	47.48 (139)	95.18	94.24
DAT;N;PL	60.00 (70)	51.08 (139)	98.57	97.12
ACC;N;PL	25.42 (59)	24.59 (61)	74.58	73.77
DAT;N;SG	32.80 (125)	28.57 (147)	64.00	55.1
ESS;N;SG	40.62 (128)	36.05 (147)	68.75	59.86
ACC;N;SG	45.83 (144)	45.58 (147)	82.64	80.95
INS;N;SG	46.32 (136)	42.86 (147)	94.85	92.52
INS;N;PL	53.54 (99)	46.76 (139)	100.00	100
ADJ;ESS;PL	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;INAN;MASC;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;DAT;PL	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;PL	33.33 (3)	33.33 (3)	100.00	100
ADJ;DAT;NEUT;SG	-	33.33 (3)	-	100
ADJ;NOM;PL	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;FEM;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;DAT;MASC;SG	-	33.33 (3)	-	100
ADJ;FEM;INS;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;INS;NEUT;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;GEN;PL	33.33 (3)	33.33 (3)	100.00	100
ADJ;DAT;FEM;SG	-	33.33 (3)	-	100
ADJ;ESS;NEUT;SG	-	33.33 (3)	-	100
ADJ;ESS;FEM;SG	-	33.33 (3)	-	100
ACC;ADJ;INAN;PL	33.33 (3)	33.33 (3)	100.00	100
ADJ;GEN;MASC;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;GEN;NEUT;SG	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;NEUT;SG	33.33 (3)	33.33 (3)	66.67	66.67
ADJ;INS;PL	33.33 (3)	33.33 (3)	100.00	100
ADJ;FEM;NOM;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;ESS;MASC;SG	-	33.33 (3)	-	100
ADJ;MASC;NOM;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;NEUT;NOM;SG	33.33 (3)	33.33 (3)	66.67	66.67
ADJ;FEM;GEN;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;INS;MASC;SG	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;MASC;SG	33.33 (3)	33.33 (3)	100.00	100
3;PRS;SG;V	66.67 (3)	66.67 (3)	100.00	100
2;IMP;SG;V	0.00 (3)	0.00 (3)	66.67	66.67
3;NEUT;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
2;MASC;PL;PST;V	33.33 (3)	33.33 (3)	100.00	100
3;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
2;PL;PRS;V	0.00 (2)	33.33 (3)	100.00	100
3;MASC;PL;PST;V	33.33 (3)	33.33 (3)	100.00	100
1;MASC;PL;PST;V	33.33 (3)	33.33 (3)	100.00	100
3;PL;PRS;V	66.67 (3)	66.67 (3)	100.00	100
2;IMP;PL;V	0.00 (3)	0.00 (3)	100.00	100
2;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
1;PRS;SG;V	0.00 (3)	0.00 (3)	66.67	66.67
1;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
1;PL;PRS;V	0.00 (3)	0.00 (3)	100.00	100
2;FEM;PL;PST;V	33.33 (3)	33.33 (3)	100.00	100
2;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
3;FEM;PL;PST;V	33.33 (3)	33.33 (3)	100.00	100
1;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
2;PRS;SG;V	50.00 (2)	33.33 (3)	100.00	100
NFIN;V	66.67 (3)	66.67 (3)	100.00	100
3;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
1;FEM;PL;PST;V	33.33 (3)	33.33 (3)	100.00	100

Table 39: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Russian–Ukrainian language pair (the grey numbers correspond to the dictionary sizes).

		Slovak–Czech		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	47.79 (858)	39.34 (1154)	90.21	88.56
GEN;N;SG	61.33 (75)	60.53 (76)	86.67	86.84
DAT;N;PL	54.76 (42)	39.74 (78)	95.24	94.87
ESS;N;SG	47.17 (53)	36.84 (76)	79.25	65.79
N;NOM;PL	52.24 (67)	44.87 (78)	79.10	74.36
ACC;N;SG	55.56 (72)	53.95 (76)	80.56	81.58
INS;N;SG	58.06 (62)	51.32 (76)	93.55	92.11
N;NOM;SG	52.63 (76)	51.32 (76)	81.58	78.95
ACC;N;PL	55.88 (68)	48.72 (78)	80.88	78.21
INS;N;PL	30.77 (52)	23.08 (78)	84.62	80.77
ESS;N;PL	66.67 (39)	41.03 (78)	100.00	97.44
DAT;N;SG	54.72 (53)	43.42 (76)	84.91	69.74
GEN;N;PL	56.45 (62)	48.05 (77)	85.48	81.82
NFIN;V	21.62 (185)	13.99 (286)	100.00	100
ADJ;NEUT;NOM;SG	73.33 (15)	73.33 (15)	93.33	93.33
ADJ;FEM;NOM;SG	66.67 (15)	66.67 (15)	100.00	100
ADJ;ESS;PL	80.00 (15)	80.00 (15)	100.00	100
ACC;ADJ;MASC;SG	60.00 (15)	60.00 (15)	100.00	100
ACC;ADJ;INAN;MASC;SG	66.67 (15)	66.67 (15)	100.00	100
ADJ;FEM;GEN;SG	64.29 (14)	66.67 (15)	85.71	86.67
ADJ;GEN;NEUT;SG	60.00 (15)	60.00 (15)	100.00	100
ADJ;DAT;MASC;SG	72.73 (11)	73.33 (15)	100.00	100
ADJ;DAT;NEUT;SG	72.73 (11)	73.33 (15)	100.00	100
ADJ;MASC;NOM;SG	66.67 (15)	66.67 (15)	100.00	100
ACC;ADJ;FEM;SG	50.00 (14)	53.33 (15)	92.86	93.33
ADJ;GEN;MASC;SG	60.00 (15)	60.00 (15)	100.00	100
ADJ;DAT;PL	61.54 (13)	66.67 (15)	100.00	100
ADJ;INS;PL	46.15 (13)	46.67 (15)	100.00	100
ACC;ADJ;NEUT;SG	73.33 (15)	73.33 (15)	93.33	93.33
ADJ;GEN;PL	80.00 (15)	80.00 (15)	100.00	100
ACC;ADJ;MASC;PL	80.00 (15)	80.00 (15)	100.00	100
ADJ;ESS;MASC;SG	41.67 (12)	46.67 (15)	75.00	80
ADJ;ESS;FEM;SG	64.29 (14)	66.67 (15)	85.71	86.67
ADJ;INS;MASC;SG	61.54 (13)	66.67 (15)	100.00	100
ADJ;DAT;FEM;SG	64.29 (14)	66.67 (15)	85.71	86.67
ADJ;ESS;NEUT;SG	41.67 (12)	46.67 (15)	75.00	80
ADJ;MASC;NOM;PL	50.00 (6)	33.33 (15)	100.00	73.33
3;MASC;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
2;IMP;SG;V	100.00 (1)	100.00 (2)	100.00	100
3;PL;PRS;V	100.00 (2)	100.00 (2)	100.00	100
3;NEUT;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
1;PL;PRS;V	100.00 (1)	100.00 (2)	100.00	100
2;PL;PRS;V	100.00 (1)	100.00 (2)	100.00	100
1;IMP;PL;V	-	50.00 (2)	-	100
3;FEM;PL;PST;V	100.00 (1)	100.00 (2)	100.00	100
3;FEM;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
2;IMP;PL;V	-	100.00 (2)	-	100
3;PRS;SG;V	50.00 (2)	50.00 (2)	100.00	100
2;PRS;SG;V	100.00 (1)	100.00 (2)	100.00	100
3;MASC;PL;PST;V	100.00 (1)	100.00 (2)	100.00	100
1;PRS;SG;V	0.00 (1)	0.00 (2)	0.00	0
3;NEUT;PL;PST;V	100.00 (1)	100.00 (2)	100.00	100

Table 40: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Slovak–Czech language pair (the grey numbers correspond to the dictionary sizes).

	Slovak–Polish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	25.78 (830)	21.02 (1094)	82.77	81.81
ESS;N;SG	19.74 (76)	15.38 (104)	61.84	58.65
GEN;N;PL	28.92 (83)	23.53 (102)	77.11	68.63
N;NOM;SG	25.24 (103)	25.00 (104)	72.82	71.15
INS;N;PL	25.00 (60)	14.71 (102)	100.00	99.02
ACC;N;PL	32.65 (98)	31.37 (102)	80.61	79.41
ACC;N;SG	25.00 (100)	24.04 (104)	72.00	73.08
DAT;N;SG	14.71 (68)	10.58 (104)	61.76	50.96
GEN;N;SG	28.57 (98)	26.92 (104)	78.57	76.92
ESS;N;PL	32.69 (52)	23.53 (102)	100.00	99.02
DAT;N;PL	32.65 (49)	19.61 (102)	87.76	85.29
N;NOM;PL	28.57 (98)	26.47 (102)	81.63	80.39
INS;N;SG	29.11 (79)	23.08 (104)	88.61	92.31
NFIN;V	28.57 (35)	23.91 (46)	97.14	97.83
ADJ;DAT;NEUT;SG	12.50 (8)	0.00 (12)	100.00	100
ADJ;DAT;PL	16.67 (12)	16.67 (12)	100.00	100
ADJ;NOM;PL	36.36 (11)	33.33 (12)	90.91	91.67
ACC;ADJ;MASC;SG	25.00 (12)	33.33 (12)	91.67	100
ADJ;ESS;PL	50.00 (12)	50.00 (12)	100.00	100
ADJ;ESS;NEUT;SG	10.00 (10)	8.33 (12)	90.00	91.67
ADJ;FEM;INS;SG	0.00 (11)	8.33 (12)	100.00	100
ACC;ADJ;PL	36.36 (11)	33.33 (12)	90.91	91.67
ADJ;MASC;NOM;SG	25.00 (12)	25.00 (12)	91.67	91.67
ADJ;DAT;MASC;SG	12.50 (8)	0.00 (12)	100.00	100
ACC;ADJ;FEM;SG	9.09 (11)	8.33 (12)	100.00	100
ADJ;FEM;GEN;SG	27.27 (11)	33.33 (12)	100.00	100
ADJ;FEM;NOM;SG	36.36 (11)	33.33 (12)	90.91	91.67
ACC;ADJ;NEUT;SG	36.36 (11)	33.33 (12)	90.91	91.67
ADJ;MASC;NOM;PL	0.00 (8)	0.00 (12)	75.00	75
ADJ;ESS;FEM;SG	27.27 (11)	33.33 (12)	100.00	100
ADJ;INS;PL	0.00 (9)	8.33 (12)	100.00	100
ADJ;INS;MASC;SG	16.67 (12)	16.67 (12)	100.00	100
ACC;ADJ;INAN;MASC;SG	25.00 (12)	25.00 (12)	91.67	91.67
ADJ;GEN;NEUT;SG	25.00 (12)	33.33 (12)	91.67	100
ADJ;ESS;MASC;SG	10.00 (10)	8.33 (12)	90.00	91.67
ADJ;DAT;FEM;SG	27.27 (11)	33.33 (12)	100.00	100
ADJ;INS;NEUT;SG	16.67 (12)	16.67 (12)	100.00	100
ADJ;GEN;MASC;SG	25.00 (12)	33.33 (12)	91.67	100
ADJ;GEN;PL	50.00 (12)	50.00 (12)	100.00	100
ADJ;NEUT;NOM;SG	36.36 (11)	33.33 (12)	90.91	91.67
ACC;ADJ;MASC;PL	50.00 (12)	50.00 (12)	100.00	100
3;FEM;PL;PST;V	-	0.00 (1)	-	100
3;PRS;SG;V	-	0.00 (1)	-	100
3;MASC;PST;SG;V	-	0.00 (1)	-	100
2;IMP;SG;V	-	0.00 (1)	-	0
3;MASC;PL;PST;V	-	0.00 (1)	-	100
2;IMP;PL;V	-	0.00 (1)	-	0
2;PL;PRS;V	-	0.00 (1)	-	0
1;IMP;PL;V	-	0.00 (1)	-	0
3;PL;PRS;V	-	0.00 (1)	-	100
2;PRS;SG;V	-	0.00 (1)	-	100
1;PL;PRS;V	-	0.00 (1)	-	100
3;NEUT;PST;SG;V	-	0.00 (1)	-	100
3;FEM;PST;SG;V	-	0.00 (1)	-	100
1;PRS;SG;V	-	0.00 (1)	-	0

Table 41: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Slovak–Polish language pair (the grey numbers correspond to the dictionary sizes).

		Slovak–Russian		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	11.79 (814)	9.12 (1140)	82.56	81.67
GEN;N;SG	11.11 (72)	10.00 (80)	73.61	73.75
ACC;N;SG	9.59 (73)	8.75 (80)	54.79	53.75
N;NOM;SG	3.85 (78)	3.75 (80)	53.85	52.5
DAT;N;SG	9.62 (52)	7.50 (80)	67.31	58.75
ESS;N;SG	7.55 (53)	5.00 (80)	66.04	52.5
GEN;N;PL	12.50 (64)	9.76 (82)	75.00	68.29
DAT;N;PL	16.67 (36)	9.64 (83)	97.22	93.98
INS;N;PL	6.82 (44)	4.82 (83)	97.73	96.39
N;NOM;PL	12.50 (72)	10.84 (83)	76.39	74.7
ESS;N;PL	12.20 (41)	9.64 (83)	97.56	95.18
INS;N;SG	19.30 (57)	13.75 (80)	92.98	96.25
ACC;N;PL	11.63 (43)	9.09 (55)	74.42	74.55
ADJ;DAT;NEUT;SG	0.00 (11)	0.00 (17)	100.00	100
ACC;ADJ;FEM;SG	38.46 (13)	29.41 (17)	100.00	88.24
ADJ;MASC;NOM;SG	17.65 (17)	17.65 (17)	76.47	76.47
ADJ;GEN;PL	35.29 (17)	35.29 (17)	100.00	100
ADJ;ESS;PL	35.29 (17)	35.29 (17)	100.00	100
ADJ;NEUT;NOM;SG	31.25 (16)	29.41 (17)	87.50	88.24
ACC;ADJ;INAN;MASC;SG	17.65 (17)	17.65 (17)	76.47	76.47
ADJ;NOM;PL	31.25 (16)	29.41 (17)	87.50	88.24
ADJ;FEM;GEN;SG	13.33 (15)	11.76 (17)	86.67	82.35
ADJ;FEM;NOM;SG	6.25 (16)	5.88 (17)	87.50	88.24
ADJ;DAT;FEM;SG	13.33 (15)	11.76 (17)	86.67	82.35
ADJ;GEN;MASC;SG	18.75 (16)	17.65 (17)	100.00	100
ACC;ADJ;PL	31.25 (16)	29.41 (17)	87.50	88.24
ACC;ADJ;NEUT;SG	31.25 (16)	29.41 (17)	87.50	88.24
ADJ;GEN;NEUT;SG	18.75 (16)	17.65 (17)	100.00	100
ADJ;ESS;NEUT;SG	6.25 (16)	5.88 (17)	68.75	64.71
ADJ;DAT;MASC;SG	0.00 (11)	0.00 (17)	100.00	100
ADJ;INS;PL	14.29 (14)	11.76 (17)	100.00	100
ADJ;ESS;FEM;SG	13.33 (15)	11.76 (17)	86.67	82.35
ADJ;INS;NEUT;SG	25.00 (16)	23.53 (17)	100.00	100
ADJ;INS;MASC;SG	25.00 (16)	23.53 (17)	100.00	100
ADJ;DAT;PL	25.00 (16)	23.53 (17)	100.00	100
ACC;ADJ;MASC;SG	18.75 (16)	17.65 (17)	100.00	100
ADJ;ESS;MASC;SG	6.25 (16)	5.88 (17)	68.75	64.71
ADJ;FEM;INS;SG	0.00 (12)	0.00 (17)	91.67	88.24
NFIN;V	6.87 (131)	4.88 (205)	99.24	97.56
2;PL;PRS;V	100.00 (1)	50.00 (2)	100.00	100
3;FEM;PL;PST;V	0.00 (1)	0.00 (2)	100.00	100
2;PRS;SG;V	0.00 (1)	0.00 (2)	0.00	0
2;IMP;PL;V	-	0.00 (2)	-	100
3;PRS;SG;V	50.00 (2)	50.00 (2)	50.00	50
3;NEUT;PST;SG;V	0.00 (1)	0.00 (2)	100.00	100
3;MASC;PL;PST;V	0.00 (1)	0.00 (2)	100.00	100
2;IMP;SG;V	0.00 (1)	0.00 (2)	0.00	0
3;MASC;PST;SG;V	100.00 (1)	50.00 (2)	100.00	50
3;FEM;PST;SG;V	0.00 (1)	0.00 (2)	100.00	100
1;PRS;SG;V	0.00 (1)	0.00 (2)	0.00	0
1;PL;PRS;V	100.00 (1)	50.00 (2)	100.00	50
3;PL;PRS;V	0.00 (2)	0.00 (2)	50.00	50

Table 42: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Slovak–Russian language pair (the grey numbers correspond to the dictionary sizes).

	Slovak–Ukrainian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	20.00 (330)	16.71 (425)	83.03	81.65
ACC;N;SG	15.91 (44)	15.22 (46)	68.18	65.22
ACC;N;PL	14.29 (42)	13.04 (46)	76.19	76.09
ESS;N;SG	14.71 (34)	10.87 (46)	76.47	65.22
ESS;N;PL	33.33 (24)	17.39 (46)	91.67	93.48
GEN;N;PL	29.73 (37)	23.91 (46)	83.78	73.91
N;NOM;SG	13.04 (46)	13.04 (46)	67.39	67.39
N;NOM;PL	11.90 (42)	10.87 (46)	76.19	76.09
DAT;N;SG	9.09 (33)	10.87 (46)	72.73	65.22
INS;N;PL	16.13 (31)	13.04 (46)	100	100
GEN;N;SG	4.55 (44)	4.35 (46)	77.27	78.26
INS;N;SG	22.86 (35)	17.39 (46)	88.57	89.13
DAT;N;PL	22.73 (22)	17.39 (46)	95.45	91.3
ADJ;GEN;MASC;SG	50.00 (2)	50.00 (2)	100	100
ADJ;NEUT;NOM;SG	100.00 (2)	100.00 (2)	100	100
ADJ;INS;PL	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;FEM;SG	0.00 (2)	0.00 (2)	100	100
ACC;ADJ;FEM;SG	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;PL	50.00 (2)	50.00 (2)	100	100
ADJ;INS;MASC;SG	0.00 (2)	0.00 (2)	100	100
ADJ;DAT;PL	0.00 (2)	0.00 (2)	100	100
ADJ;NOM;PL	100.00 (2)	100.00 (2)	100	100
ACC;ADJ;MASC;SG	50.00 (2)	50.00 (2)	100	100
ACC;ADJ;NEUT;SG	100.00 (2)	100.00 (2)	100	100
ADJ;FEM;INS;SG	0.00 (2)	0.00 (2)	100	100
ADJ;DAT;FEM;SG	0.00 (2)	0.00 (2)	100	100
ACC;ADJ;INAN;MASC;SG	50.00 (2)	50.00 (2)	100	100
ADJ;FEM;NOM;SG	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;MASC;SG	0.00 (2)	0.00 (2)	0	0
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (2)	100	100
ACC;ADJ;PL	100.00 (2)	100.00 (2)	100	100
ADJ;GEN;PL	50.00 (2)	50.00 (2)	100	100
ADJ;FEM;GEN;SG	0.00 (2)	0.00 (2)	100	100
ADJ;GEN;NEUT;SG	50.00 (2)	50.00 (2)	100	100
ADJ;ESS;NEUT;SG	0.00 (2)	0.00 (2)	0	0
ADJ;MASC;NOM;SG	50.00 (2)	50.00 (2)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (2)	100	100
ADJ;INS;NEUT;SG	0.00 (2)	0.00 (2)	100	100
NFIN;V	66.67 (3)	50.00 (4)	100	100

Table 43: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Slovak–Ukrainian language pair (the grey numbers correspond to the dictionary sizes).

	Ukrainian–Czech			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	34.33 (699)	29.34 (869)	81.97	77.33
N;PL;VOC	39.19 (74)	36.25 (80)	83.78	83.75
ACC;N;PL	43.24 (74)	40.00 (80)	89.19	88.75
INS;N;PL	24.62 (65)	21.25 (80)	90.77	86.25
ACC;N;SG	41.77 (79)	40.24 (82)	77.22	71.95
DAT;N;PL	41.46 (41)	27.50 (80)	97.56	96.25
GEN;N;PL	34.72 (72)	31.25 (80)	77.78	71.25
N;NOM;PL	39.19 (74)	36.25 (80)	83.78	83.75
ESS;N;PL	30.61 (49)	18.75 (80)	93.88	85
ESS;N;SG	32.35 (68)	27.16 (81)	72.06	67.9
DAT;N;SG	26.15 (65)	21.95 (82)	70.77	64.63
GEN;N;SG	40.51 (79)	39.02 (82)	88.61	85.37
INS;N;SG	41.33 (75)	37.80 (82)	86.67	85.37
N;NOM;SG	34.57 (81)	32.93 (82)	80.25	76.83
N;SG;VOC	28.57 (35)	23.17 (82)	54.29	48.78
1;IMP;PL;V	20.00 (5)	16.67 (6)	60	50
3;NEUT;PST;SG;V	60.00 (5)	66.67 (6)	80	83.33
NFIN;V	50.00 (6)	50.00 (6)	100	100
3;MASC;PST;SG;V	66.67 (6)	66.67 (6)	100	100
3;FEM;PST;SG;V	66.67 (6)	66.67 (6)	100	100
2;IMP;SG;V	0.00 (6)	0.00 (6)	33.33	33.33
2;IMP;PL;V	33.33 (6)	33.33 (6)	83.33	83.33
1;PRS;SG;V	25.00 (4)	20.00 (5)	50	40
3;PL;PRS;V	60.00 (5)	60.00 (5)	60	60
3;FEM;PL;PST;V	66.67 (6)	66.67 (6)	100	100
2;PL;PRS;V	50.00 (4)	40.00 (5)	100	80
3;PRS;SG;V	40.00 (5)	40.00 (5)	100	100
2;PRS;SG;V	20.00 (5)	20.00 (5)	80	80
3;MASC;PL;PST;V	66.67 (6)	66.67 (6)	100	100
1;PL;PRS;V	25.00 (4)	20.00 (5)	75	80
3;FUT;PL;V	0.00 (1)	0.00 (1)	0	0
3;FUT;SG;V	0.00 (1)	0.00 (1)	0	0
2;FUT;PL;V	0.00 (1)	0.00 (1)	100	100
1;FUT;PL;V	0.00 (1)	0.00 (1)	100	100
2;FUT;SG;V	0.00 (1)	0.00 (1)	0	0
1;FUT;SG;V	0.00 (1)	0.00 (1)	100	100
ADJ;MASC;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;PL	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;FEM;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;NEUT;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;FEM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;PL	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;GEN;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;PL	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;PL	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;INAN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;FEM;SG	0.00 (1)	0.00 (1)	100	100

Table 44: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Ukrainian–Czech language pair (the grey numbers correspond to the dictionary sizes).

Morph	Ukrainian–Polish			
	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	44.59 (850)	38.61 (1054)	82.94	79.22
INS;N;SG	50.00 (96)	45.71 (105)	95.83	93.33
GEN;N;PL	32.29 (96)	30.10 (103)	66.67	67.96
ACC;N;SG	51.96 (102)	50.48 (105)	84.31	82.86
DAT;N;PL	49.02 (51)	35.92 (103)	96.08	94.17
ACC;N;PL	51.52 (99)	49.51 (103)	87.88	85.44
ESS;N;PL	56.52 (69)	45.63 (103)	92.75	94.17
N;PL;VOC	52.00 (100)	50.49 (103)	87.00	84.47
N;NOM;SG	49.52 (105)	49.52 (105)	81.90	80.95
GEN;N;SG	51.96 (102)	50.48 (105)	89.22	86.67
INS;N;PL	47.13 (87)	41.75 (103)	98.85	99.03
ESS;N;SG	35.87 (92)	31.43 (105)	72.83	66.67
N;SG;VOC	35.29 (51)	23.81 (105)	60.78	45.71
N;NOM;PL	52.00 (100)	50.49 (103)	87.00	84.47
DAT;N;SG	36.25 (80)	28.57 (105)	73.75	66.67
2;IMP;PL;V	-	0.00 (2)	-	0
2;FEM;PL;PST;V	-	0.00 (2)	-	0
1;PL;PRS;V	50.00 (2)	50.00 (2)	50.00	50
2;PRS;SG;V	50.00 (2)	50.00 (2)	100.00	50
3;MASC;PL;PST;V	50.00 (2)	0.00 (2)	100.00	0
2;PL;PRS;V	0.00 (1)	0.00 (2)	0.00	0
1;FEM;PL;PST;V	-	0.00 (2)	-	0
3;FEM;PST;SG;V	0.00 (1)	0.00 (2)	100.00	50
2;FEM;PST;SG;V	-	0.00 (2)	-	50
1;PRS;SG;V	0.00 (2)	0.00 (2)	0.00	0
3;PRS;SG;V	0.00 (2)	0.00 (2)	100.00	100
3;NEUT;PST;SG;V	0.00 (1)	0.00 (2)	100.00	50
1;MASC;PL;PST;V	100.00 (1)	0.00 (2)	100.00	0
3;MASC;PST;SG;V	50.00 (2)	50.00 (2)	100.00	100
1;IMP;PL;V	-	50.00 (2)	-	50
2;MASC;PL;PST;V	-	0.00 (2)	-	0
3;FEM;PL;PST;V	100.00 (1)	0.00 (2)	100.00	0
2;MASC;PST;SG;V	100.00 (1)	50.00 (2)	100.00	100
3;PL;PRS;V	50.00 (2)	50.00 (2)	100.00	100
NFIN;V	0.00 (2)	0.00 (2)	50.00	50
1;FEM;PST;SG;V	0.00 (1)	0.00 (2)	100.00	50
2;IMP;SG;V	0.00 (1)	0.00 (2)	0.00	50
1;MASC;PST;SG;V	100.00 (1)	50.00 (2)	100.00	100
ADJ;ESS;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;MASC;NOM;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;GEN;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;NOM;PL	50.00 (2)	50.00 (2)	50.00	50
ADJ;NEUT;NOM;SG	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;INS;NEUT;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;PL	0.00 (2)	0.00 (2)	100.00	100
ADJ;INS;PL	50.00 (2)	50.00 (2)	100.00	100
ADJ;FEM;INS;SG	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;FEM;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;FEM;NOM;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;FEM;GEN;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;GEN;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;DAT;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;INS;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;ESS;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;GEN;PL	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;PL	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;INAN;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;ESS;FEM;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;ESS;PL	50.00 (2)	50.00 (2)	100.00	100
ADJ;DAT;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;DAT;FEM;SG	50.00 (2)	50.00 (2)	100.00	100

Table 45: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Ukrainian–Polish language pair (the grey numbers correspond to the dictionary sizes).

	Ukrainian–Russian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	61.32 (786)	56.48 (933)	90.46	89.82
ESS;N;SG	57.95 (88)	54.55 (99)	86.36	83.84
INS;N;PL	75.00 (76)	62.24 (98)	98.68	100
ACC;N;SG	65.98 (97)	64.65 (99)	92.78	90.91
GEN;N;PL	60.23 (88)	54.08 (98)	85.23	78.57
GEN;N;SG	67.71 (96)	65.66 (99)	91.67	88.89
DAT;N;PL	69.81 (53)	60.20 (98)	92.45	96.94
N;NOM;SG	61.62 (99)	61.62 (99)	88.89	88.89
INS;N;SG	68.82 (93)	64.65 (99)	97.85	95.96
N;NOM;PL	65.98 (97)	65.31 (98)	87.63	87.76
DAT;N;SG	53.41 (88)	48.48 (99)	79.55	74.75
ESS;N;PL	72.73 (55)	58.16 (98)	98.18	96.94
ACC;N;PL	54.24 (59)	54.10 (61)	81.36	83.61
ADJ;FEM;NOM;SG	0.00 (2)	0.00 (2)	100	100
ACC;ADJ;NEUT;SG	0.00 (2)	0.00 (2)	100	100
ACC;ADJ;FEM;SG	0.00 (2)	0.00 (2)	100	100
ADJ;DAT;PL	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;NEUT;SG	0.00 (1)	0.00 (2)	100	100
ADJ;MASC;NOM;SG	0.00 (2)	0.00 (2)	50	50
ADJ;FEM;GEN;SG	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;FEM;SG	0.00 (2)	0.00 (2)	50	50
ACC;ADJ;INAN;MASC;SG	0.00 (2)	0.00 (2)	50	50
ADJ;NOM;PL	0.00 (2)	0.00 (2)	100	100
ACC;ADJ;MASC;SG	0.00 (2)	0.00 (2)	100	100
ADJ;DAT;FEM;SG	0.00 (2)	0.00 (2)	50	50
ADJ;INS;PL	0.00 (2)	0.00 (2)	100	100
ADJ;INS;MASC;SG	0.00 (2)	0.00 (2)	100	100
ADJ;GEN;NEUT;SG	0.00 (2)	0.00 (2)	100	100
ADJ;FEM;INS;SG	0.00 (2)	0.00 (2)	50	50
ACC;ADJ;INAN;PL	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;PL	0.00 (2)	0.00 (2)	100	100
ADJ;GEN;PL	0.00 (2)	0.00 (2)	100	100
ADJ;NEUT;NOM;SG	0.00 (2)	0.00 (2)	100	100
ADJ;INS;NEUT;SG	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;MASC;SG	0.00 (1)	0.00 (2)	100	100
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (2)	100	100
ACC;ADJ;PL	0.00 (2)	0.00 (2)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (2)	100	100
ADJ;GEN;MASC;SG	0.00 (2)	0.00 (2)	100	100
1;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100	100
2;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100	100
2;IMP;SG;V	0.00 (3)	0.00 (3)	33.33	33.33
2;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100	100
3;PL;PRS;V	66.67 (3)	66.67 (3)	100	100
1;PRS;SG;V	0.00 (3)	0.00 (3)	33.33	33.33
2;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100	100
2;PRS;SG;V	0.00 (2)	0.00 (3)	100	100
1;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100	100
1;PL;PRS;V	0.00 (2)	0.00 (3)	50	66.67
NFIN;V	66.67 (3)	66.67 (3)	100	100
1;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100	100
2;IMP;PL;V	0.00 (2)	0.00 (3)	100	100
3;PRS;SG;V	66.67 (3)	66.67 (3)	100	100
1;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100	100
3;NEUT;PST;SG;V	66.67 (3)	66.67 (3)	100	100
2;PL;PRS;V	0.00 (2)	0.00 (3)	50	66.67
2;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100	100
3;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100	100
3;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100	100
3;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100	100
3;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100	100

Table 46: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Ukrainian–Russian language pair (the grey numbers correspond to the dictionary sizes).

	Ukrainian–Slovak			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	18.63 (322)	15.71 (420)	84.78	83.57
ESS;N;SG	21.21 (33)	15.56 (45)	84.85	71.11
ACC;N;SG	26.19 (42)	23.91 (46)	83.33	80.43
ACC;N;PL	17.07 (41)	15.56 (45)	85.37	82.22
GEN;N;PL	13.16 (38)	10.87 (46)	73.68	69.57
N;NOM;PL	16.67 (42)	15.56 (45)	85.71	84.44
ESS;N;PL	22.73 (22)	15.56 (45)	100	93.33
N;NOM;SG	15.56 (45)	15.22 (46)	71.11	69.57
INS;N;PL	16.67 (30)	11.11 (45)	100	100
DAT;N;PL	25.00 (20)	17.78 (45)	95	93.33
DAT;N;SG	18.92 (37)	17.39 (46)	81.08	76.09
INS;N;SG	15.79 (38)	15.22 (46)	86.84	89.13
GEN;N;SG	22.73 (44)	23.91 (46)	84.09	82.61
NFIN;V	50.00 (2)	50.00 (2)	100	100
ACC;ADJ;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;PL	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;INS;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;FEM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;PL	0.00 (1)	0.00 (1)	100	100
ADJ;INS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;PL	100.00 (1)	0.00 (1)	100	100
ADJ;FEM;GEN;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;PL	0.00 (1)	0.00 (1)	100	100
ADJ;MASC;NOM;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;FEM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;NEUT;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;NOM;PL	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;FEM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;INAN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;PL	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;MASC;SG	0.00 (1)	0.00 (1)	100	100

Table 47: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Ukrainian–Slovak language pair (the grey numbers correspond to the dictionary sizes).

Polish–Spanish				
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	38.01 (8964)	29.92 (12759)	80.82	71.62
ACC;N;PL	40.27 (827)	38.12 (884)	84.89	82.69
ACC;N;SG	40.89 (922)	39.40 (962)	82.43	81.81
DAT;N;PL	25.99 (304)	16.23 (881)	61.84	56.87
DAT;N;SG	31.89 (599)	23.20 (961)	73.12	68.26
ESS;N;PL	35.87 (552)	28.60 (881)	87.50	83.54
ESS;N;SG	33.29 (766)	28.99 (959)	73.76	70.28
GEN;N;PL	43.09 (782)	38.90 (887)	85.29	81.62
GEN;N;SG	40.09 (933)	38.98 (962)	85.10	84.72
INS;N;PL	33.12 (622)	27.13 (881)	88.91	88.42
INS;N;SG	37.04 (837)	33.58 (962)	81.36	79.52
N;NOM;PL	39.47 (826)	37.37 (883)	85.59	83.58
N;NOM;SG	41.05 (950)	40.75 (962)	83.58	83.16
N;PL;VOC	39.47 (826)	37.37 (883)	85.59	83.58
N;SG;VOC	32.80 (561)	27.89 (961)	74.33	71.07
1;COND;FEM;PL;V	-	4.17 (48)	-	33.33
1;COND;FEM;SG;V	0.00 (1)	2.08 (48)	0.00	2.08
1;COND;MASC;PL;V	50.00 (4)	25.00 (48)	75.00	77.08
1;COND;MASC;SG;V	0.00 (8)	0.00 (48)	12.50	0
1;FEM;PL;PST;V	-	0.00 (62)	-	9.68
1;FEM;PST;SG;V	18.75 (16)	8.06 (62)	31.25	14.52
1;IMP;PL;V	12.50 (8)	6.25 (48)	25.00	16.67
1;MASC;PL;PST;V	38.46 (13)	11.29 (62)	69.23	40.32
1;MASC;PST;SG;V	10.00 (30)	4.84 (62)	33.33	9.68
1;PL;PRS;V	34.48 (29)	27.08 (48)	65.52	52.08
1;PRS;SG;V	10.81 (37)	8.33 (48)	16.22	10.42
2;COND;FEM;PL;V	-	4.17 (48)	-	12.5
2;COND;FEM;SG;V	0.00 (1)	0.00 (48)	0.00	4.17
2;COND;MASC;PL;V	-	4.17 (48)	-	22.92
2;COND;MASC;SG;V	0.00 (2)	0.00 (48)	0.00	2.08
2;FEM;PL;PST;V	-	0.00 (62)	-	0
2;FEM;PST;SG;V	0.00 (4)	6.45 (62)	25.00	11.29
2;IMP;PL;V	0.00 (6)	0.00 (48)	0.00	0
2;IMP;SG;V	8.00 (25)	6.25 (48)	8.00	10.42
2;MASC;PL;PST;V	0.00 (1)	0.00 (62)	0.00	1.61
2;MASC;PST;SG;V	10.00 (10)	4.84 (62)	20.00	8.06
2;PL;PRS;V	0.00 (9)	0.00 (48)	0.00	0
2;PRS;SG;V	8.70 (23)	6.25 (48)	21.74	6.25
3;COND;FEM;PL;V	25.00 (8)	18.75 (48)	75.00	52.08
3;COND;FEM;SG;V	0.00 (9)	12.50 (48)	55.56	29.17
3;COND;MASC;PL;V	0.00 (4)	0.00 (48)	25.00	10.42
3;COND;MASC;SG;V	33.33 (12)	16.67 (48)	41.67	27.08
3;COND;NEUT;SG;V	14.29 (7)	14.58 (48)	42.86	20.83
3;FEM;PL;PST;V	48.84 (43)	45.16 (62)	76.74	79.03
3;FEM;PST;SG;V	50.98 (51)	45.16 (62)	78.43	72.58
3;MASC;PL;PST;V	30.61 (49)	27.42 (62)	73.47	66.13
3;MASC;PST;SG;V	37.04 (54)	33.87 (62)	72.22	69.35
3;NEUT;PST;SG;V	19.05 (42)	20.97 (62)	42.86	41.94
3;PL;PRS;V	52.38 (42)	47.92 (48)	78.57	75
3;PRS;SG;V	43.48 (46)	41.67 (48)	60.87	58.33
NFIN;V	38.30 (47)	37.50 (48)	95.74	95.83
ACC;ADJ;FEM;SG	49.72 (177)	47.34 (188)	85.88	86.17
ACC;ADJ;INAN;MASC;SG	47.34 (188)	46.32 (190)	88.30	87.89
ACC;ADJ;MASC;PL	53.63 (179)	50.26 (189)	98.88	98.94
ACC;ADJ;MASC;SG	42.08 (183)	40.53 (190)	84.15	84.21
ACC;ADJ;PL	51.35 (185)	49.74 (189)	91.35	91.53
ADJ;DAT;FEM;SG	43.50 (177)	41.49 (188)	80.23	80.32
ADJ;DAT;MASC;SG	31.73 (104)	24.21 (190)	71.15	72.11
ADJ;DAT;PL	51.67 (180)	49.21 (189)	97.78	97.88
ADJ;ESS;FEM;SG	43.50 (177)	41.49 (188)	80.23	80.32
ADJ;ESS;MASC;SG	51.38 (181)	48.95 (190)	97.79	97.89
ADJ;ESS;PL	53.63 (179)	50.26 (189)	98.88	98.94
ADJ;FEM;GEN;SG	43.50 (177)	41.49 (188)	80.23	80.32
ADJ;FEM;INS;SG	49.72 (177)	47.34 (188)	85.88	86.17
ADJ;FEM;NOM;SG	46.70 (182)	45.21 (188)	90.11	90.43
ADJ;GEN;MASC;SG	42.08 (183)	40.53 (190)	84.15	84.21
ADJ;GEN;PL	53.63 (179)	50.26 (189)	98.88	98.94
ADJ;INS;MASC;SG	51.38 (181)	48.95 (190)	97.79	97.89
ADJ;INS;PL	57.42 (155)	51.32 (189)	98.06	98.41
ADJ;MASC;NOM;PL	39.32 (117)	34.39 (189)	83.76	82.01
ADJ;MASC;NOM;SG	47.34 (188)	46.32 (190)	88.30	87.89
ADJ;NOM;PL	51.35 (185)	49.74 (189)	91.35	91.53

Table 48: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Polish–Spanish language pair (the grey numbers correspond to the dictionary sizes).

| | Spanish–Polish | | | |
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	29.74 (4270)	22.26 (6095)	83.61	67.83
N;PL	34.24 (1139)	32.30 (1226)	89.38	91.03
N;SG	32.45 (1316)	31.84 (1338)	87.39	86.62
ADJ;FEM;PL	40.85 (235)	39.92 (238)	95.74	95.8
ADJ;FEM;SG	36.44 (236)	35.83 (240)	90.25	89.58
ADJ;MASC;PL	41.10 (236)	40.33 (243)	96.19	95.88
ADJ;MASC;SG	36.63 (243)	36.63 (243)	92.18	92.59
1;COND;PL;V	50.00 (2)	18.02 (111)	100.00	88.29
1;COND;SG;V	7.41 (27)	14.41 (111)	44.44	61.26
1;IMP;PL;POS;V	4.55 (22)	0.86 (116)	18.18	12.93
1;IPFV;PL;PST;V	38.46 (13)	15.32 (111)	84.62	80.18
1;IPFV;PST;SG;V	24.19 (62)	21.62 (111)	79.03	65.77
1;PFV;PL;PST;V	11.54 (26)	13.51 (111)	73.08	68.47
1;PFV;PST;SG;V	9.52 (42)	4.50 (111)	59.52	31.53
1;PL;PRS;V	18.37 (49)	16.30 (92)	83.67	77.17
1;PRS;SG;V	12.70 (63)	10.99 (91)	47.62	32.97
2;COND;PL;V	-	0.90 (111)	-	12.61
2;COND;SG;V	100.00 (1)	4.50 (111)	100.00	17.12
2;IMP;PL;POS;V	0.00 (17)	0.00 (116)	11.76	6.03
2;IMP;POS;SG;V	25.00 (84)	20.69 (116)	44.05	43.97
2;IPFV;PL;PST;V	-	0.90 (111)	-	1.8
2;IPFV;PST;SG;V	0.00 (11)	1.80 (111)	27.27	14.41
2;PFV;PL;PST;V	-	0.00 (111)	-	0
2;PFV;PST;SG;V	6.67 (15)	9.91 (111)	60.00	51.35
2;PL;PRS;V	0.00 (13)	0.00 (92)	0.00	3.26
2;PRS;SG;V	18.18 (44)	8.70 (92)	27.27	14.13
3;COND;PL;V	15.79 (19)	8.11 (111)	63.16	32.43
3;COND;SG;V	10.53 (38)	14.41 (111)	50.00	61.26
3;IPFV;PL;PST;V	25.00 (92)	21.62 (111)	77.17	68.47
3;IPFV;PST;SG;V	23.71 (97)	21.62 (111)	76.29	65.77
3;PFV;PL;PST;V	16.48 (91)	14.41 (111)	90.11	85.59
3;PFV;PST;SG;V	12.12 (99)	10.81 (111)	75.76	68.47
3;PL;PRS;V	23.17 (82)	20.65 (92)	79.27	73.91
3;PRS;SG;V	25.00 (88)	23.91 (92)	54.55	52.17
NFIN;V	19.64 (112)	19.83 (116)	97.32	92.24
1;FUT;PL;V	25.00 (12)	11.11 (36)	100.00	63.89
1;FUT;SG;V	0.00 (14)	2.78 (36)	21.43	13.89
2;FUT;PL;V	0.00 (1)	0.00 (36)	0.00	0
2;FUT;SG;V	0.00 (5)	5.56 (36)	60.00	25
3;FUT;PL;V	11.76 (17)	5.56 (36)	64.71	61.11
3;FUT;SG;V	14.29 (28)	11.11 (36)	64.29	47.22

Table 49: The performance of Artetxe et al. (2016)'s model on translating words belonging to a specific morphological category for the Spanish–Polish language pair (the grey numbers correspond to the dictionary sizes).

	Czech–Polish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	51.66 (3161)	42.87 (4166)	84.15	78.06
ACC;ADJ;NEUT;SG	55.88 (68)	53.52 (71)	94.12	92.96
ADJ;GEN;PL	53.97 (63)	49.30 (71)	98.41	98.59
ADJ;GEN;MASC;SG	52.31 (65)	47.89 (71)	98.46	98.59
ADJ;ESS;MASC;SG	42.86 (56)	33.80 (71)	80.36	78.87
ADJ;FEM;INS;SG	16.67 (6)	16.67 (6)	66.67	66.67
ADJ;NOM;PL	16.67 (6)	16.67 (6)	66.67	66.67
ACC;ADJ;FEM;SG	55.22 (67)	53.52 (71)	95.52	95.77
ADJ;INS;NEUT;SG	20.00 (5)	16.67 (6)	100	100
ADJ;DAT;FEM;SG	55.88 (68)	53.52 (71)	94.12	92.96
ADJ;DAT;MASC;SG	68.29 (41)	46.48 (71)	100	100
ADJ;DAT;PL	44.62 (65)	42.25 (71)	100	100
ADJ;ESS;FEM;SG	55.88 (68)	53.52 (71)	94.12	92.96
ADJ;INS;MASC;SG	44.62 (65)	42.25 (71)	100	100
ADJ;ESS;NEUT;SG	52.63 (57)	42.25 (71)	94.74	92.96
ADJ;INS;PL	52.73 (55)	45.07 (71)	100	100
ACC;ADJ;PL	16.67 (6)	16.67 (6)	66.67	66.67
ADJ;ESS;PL	53.97 (63)	49.30 (71)	98.41	98.59
ADJ;FEM;GEN;SG	55.88 (68)	53.52 (71)	94.12	92.96
ACC;ADJ;MASC;SG	52.31 (65)	47.89 (71)	98.46	98.59
ADJ;GEN;NEUT;SG	52.31 (65)	47.89 (71)	98.46	98.59
ADJ;DAT;NEUT;SG	68.29 (41)	46.48 (71)	100	100
GEN;N;SG	56.82 (352)	56.90 (355)	84.94	84.79
ACC;N;PL	58.18 (330)	56.10 (344)	87.88	86.92
INS;N;PL	63.12 (263)	50.87 (346)	93.54	91.04
DAT;N;SG	48.72 (273)	44.76 (353)	71.06	68.27
N;NOM;PL	57.66 (333)	55.62 (347)	88.29	87.03
ESS;N;PL	62.45 (229)	49.28 (345)	93.01	93.62
N;SG;VOC	51.59 (157)	35.31 (354)	70.06	55.08
N;PL;VOC	57.53 (332)	55.33 (347)	88.25	86.74
ACC;N;SG	52.45 (347)	51.27 (355)	76.95	76.34
INS;N;SG	52.62 (325)	49.29 (353)	85.23	84.42
GEN;N;PL	53.87 (310)	49.43 (348)	80.65	76.44
ESS;N;SG	48.72 (312)	44.76 (353)	70.83	68.56
N;NOM;SG	51.83 (355)	51.83 (355)	77.46	78.31
DAT;N;PL	52.15 (163)	37.57 (346)	85.89	87.28
ADJ;FEM;NOM;SG	56.45 (62)	53.85 (65)	95.16	95.38
ADJ;MASC;NOM;SG	58.06 (62)	56.92 (65)	96.77	98.46
ACC;ADJ;INAN;MASC;SG	58.06 (62)	56.92 (65)	96.77	98.46
ACC;ADJ;MASC;PL	59.68 (62)	56.92 (65)	96.77	95.38
ADJ;MASC;NOM;PL	47.22 (36)	38.46 (65)	72.22	63.08
ADJ;NEUT;NOM;SG	59.68 (62)	56.92 (65)	96.77	95.38
3;MASC;PST;SG;V	50.00 (38)	48.78 (41)	92.11	87.8
2;IMP;PL;V	0.00 (8)	5.00 (40)	37.5	12.5
1;PRS;SG;V	30.77 (13)	8.82 (34)	61.54	20.59
3;FEM;PL;PST;V	59.26 (27)	48.78 (41)	92.59	87.8
1;PL;PRS;V	42.86 (14)	17.65 (34)	85.71	58.82
3;PL;PRS;V	46.43 (28)	38.24 (34)	92.86	76.47
3;MASC;PL;PST;V	35.48 (31)	31.71 (41)	93.55	90.24
3;NEUT;PST;SG;V	66.67 (27)	53.66 (41)	96.3	95.12
NFIN;V	40.00 (45)	39.13 (46)	95.56	95.65
2;PL;PRS;V	0.00 (5)	0.00 (34)	0	0
3;PRS;SG;V	53.12 (32)	50.00 (34)	81.25	73.53
3;FEM;PST;SG;V	51.52 (33)	48.78 (41)	90.91	85.37
2;PRS;SG;V	14.29 (7)	11.76 (34)	42.86	23.53
2;IMP;SG;V	7.69 (13)	10.00 (40)	23.08	22.5
1;IMP;PL;V	33.33 (3)	5.00 (40)	33.33	15
2;FUT;PL;V	0.00 (1)	0.00 (9)	0	0
1;FUT;SG;V	0.00 (5)	0.00 (9)	20	11.11
3;FUT;PL;V	0.00 (7)	0.00 (9)	42.86	44.44
1;FUT;PL;V	0.00 (3)	11.11 (9)	33.33	77.78
2;FUT;SG;V	0.00 (1)	0.00 (9)	100	22.22
3;FUT;SG;V	11.11 (9)	11.11 (9)	66.67	66.67

Table 50: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Czech–Polish language pair (the grey numbers correspond to the dictionary sizes).

		Czech–Russian		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	44.86 (3562)	38.18 (4762)	84.81	81.06
GEN;N;PL	44.23 (312)	39.45 (365)	76.28	70.68
GEN;N;SG	49.04 (365)	48.26 (373)	84.66	83.65
DAT;N;PL	56.15 (187)	42.74 (365)	95.19	93.15
INS;N;SG	48.46 (324)	45.04 (373)	87.65	84.45
ACC;N;PL	48.44 (225)	45.97 (248)	82.22	78.23
N;NOM;PL	50.15 (335)	47.24 (362)	86.57	82.6
N;NOM;SG	46.59 (367)	46.09 (371)	77.66	77.09
DAT;N;SG	45.02 (311)	40.21 (373)	76.85	72.65
ESS;N;SG	44.55 (312)	39.68 (373)	76.6	72.12
INS;N;PL	47.27 (256)	38.63 (365)	86.72	84.38
ESS;N;PL	48.08 (208)	39.73 (365)	94.23	94.25
ACC;N;SG	44.51 (364)	43.43 (373)	76.65	75.6
ADJ;DAT;MASC;SG	64.91 (57)	54.22 (83)	98.25	98.8
ADJ;NEUT;NOM;SG	16.90 (71)	16.22 (74)	21.13	21.62
ADJ;FEM;GEN;SG	16.05 (81)	15.66 (83)	24.69	25.3
ACC;ADJ;INAN;MASC;SG	59.72 (72)	58.11 (74)	93.06	93.24
ADJ;INS;PL	68.12 (69)	61.45 (83)	100	100
ADJ;ESS;PL	59.74 (77)	56.63 (83)	97.4	97.59
ADJ;FEM;NOM;SG	63.89 (72)	63.51 (74)	94.44	94.59
ADJ;DAT;PL	63.64 (77)	61.45 (83)	100	100
ADJ;ESS;FEM;SG	16.05 (81)	15.66 (83)	24.69	25.3
ADJ;DAT;NEUT;SG	64.91 (57)	54.22 (83)	98.25	98.8
ADJ;GEN;PL	59.74 (77)	56.63 (83)	97.4	97.59
ADJ;MASC;NOM;SG	59.72 (72)	58.11 (74)	93.06	93.24
ADJ;GEN;MASC;SG	60.76 (79)	59.04 (83)	98.73	98.8
ACC;ADJ;NEUT;SG	16.25 (80)	15.66 (83)	25	25.3
ACC;ADJ;MASC;SG	60.76 (79)	59.04 (83)	98.73	98.8
ADJ;GEN;NEUT;SG	60.76 (79)	59.04 (83)	98.73	98.8
ADJ;DAT;FEM;SG	16.05 (81)	15.66 (83)	24.69	25.3
ADJ;INS;MASC;SG	63.64 (77)	61.45 (83)	100	100
ACC;ADJ;FEM;SG	62.50 (80)	61.45 (83)	95	95.18
ADJ;ESS;MASC;SG	60.56 (71)	57.83 (83)	100	100
ADJ;ESS;NEUT;SG	61.11 (72)	57.83 (83)	100	100
3;PRS;SG;V	27.78 (54)	26.79 (56)	92.59	87.5
2;PRS;SG;V	0.00 (7)	16.07 (56)	57.14	60.71
2;IMP;PL;V	17.65 (17)	11.69 (77)	88.24	68.83
1;PRS;SG;V	15.38 (13)	17.86 (56)	61.54	44.64
3;FEM;PST;SG;V	31.15 (61)	27.50 (80)	98.36	97.5
1;PL;PRS;V	21.43 (14)	12.50 (56)	78.57	67.86
3;NEUT;PST;SG;V	21.43 (42)	21.25 (80)	92.86	95
2;PL;PRS;V	27.27 (11)	16.07 (56)	81.82	80.36
3;MASC;PST;SG;V	28.57 (70)	27.50 (80)	92.86	87.5
3;PL;PRS;V	32.50 (40)	23.21 (56)	90	66.07
NFIN;V	31.73 (104)	28.45 (116)	99.04	99.14
3;MASC;PL;PST;V	23.33 (60)	23.75 (80)	98.33	97.5
2;IMP;SG;V	20.00 (15)	7.79 (77)	26.67	20.78
3;FEM;PL;PST;V	8.93 (56)	10.00 (80)	82.14	77.5
ADJ;FEM;INS;SG	11.11 (9)	11.11 (9)	55.56	55.56
ADJ;NOM;PL	11.11 (9)	11.11 (9)	55.56	55.56
ADJ;INS;NEUT;SG	33.33 (9)	33.33 (9)	100	100
ACC;ADJ;PL	11.11 (9)	11.11 (9)	55.56	55.56
1;FUT;PL;V	0.00 (6)	3.85 (26)	66.67	42.31
3;FUT;SG;V	9.52 (21)	7.69 (26)	76.19	65.38
2;FUT;PL;V	0.00 (7)	0.00 (26)	100	61.54
1;FUT;SG;V	0.00 (7)	4.00 (25)	14.29	12
2;FUT;SG;V	0.00 (2)	7.69 (26)	50	50
3;FUT;PL;V	10.53 (19)	7.69 (26)	73.68	65.38
ACC;INAN;N;SG	50.00 (2)	50.00 (2)	50	50
ACC;INAN;N;PL	0.00 (2)	0.00 (2)	0	0

Table 51: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Czech–Russian language pair (the grey numbers correspond to the dictionary sizes).

	Czech–Slovak			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	60.85 (802)	54.24 (1027)	89.53	87.15
ADJ;INS;MASC;SG	70.00 (10)	81.82 (11)	100.00	100
ADJ;ESS;PL	63.64 (11)	63.64 (11)	100.00	100
ADJ;DAT;NEUT;SG	75.00 (8)	81.82 (11)	100.00	100
ADJ;ESS;FEM;SG	72.73 (11)	72.73 (11)	90.91	90.91
ACC;ADJ;MASC;PL	72.73 (11)	72.73 (11)	90.91	90.91
ADJ;MASC;NOM;SG	81.82 (11)	81.82 (11)	100.00	100
ADJ;ESS;MASC;SG	62.50 (8)	54.55 (11)	87.50	72.73
ADJ;GEN;NEUT;SG	72.73 (11)	72.73 (11)	100.00	100
ADJ;DAT;PL	70.00 (10)	81.82 (11)	100.00	100
ADJ;MASC;NOM;PL	57.14 (7)	54.55 (11)	85.71	81.82
ACC;ADJ;INAN;MASC;SG	81.82 (11)	81.82 (11)	100.00	100
ADJ;GEN;MASC;SG	72.73 (11)	72.73 (11)	100.00	100
ACC;ADJ;MASC;SG	72.73 (11)	72.73 (11)	100.00	100
ACC;ADJ;NEUT;SG	72.73 (11)	72.73 (11)	90.91	90.91
ADJ;ESS;NEUT;SG	75.00 (8)	81.82 (11)	100.00	100
ADJ;NEUT;NOM;SG	72.73 (11)	72.73 (11)	90.91	90.91
ADJ;INS;PL	75.00 (8)	81.82 (11)	100.00	100
ADJ;GEN;PL	63.64 (11)	63.64 (11)	100.00	100
ADJ;FEM;NOM;SG	72.73 (11)	72.73 (11)	100.00	100
ADJ;DAT;MASC;SG	75.00 (8)	81.82 (11)	100.00	100
ADJ;FEM;GEN;SG	72.73 (11)	72.73 (11)	90.91	90.91
ADJ;DAT;FEM;SG	72.73 (11)	72.73 (11)	90.91	90.91
ACC;ADJ;FEM;SG	63.64 (11)	63.64 (11)	100.00	90.91
GEN;N;SG	62.89 (97)	61.39 (101)	84.54	86.14
N;NOM;PL	59.78 (92)	57.69 (104)	89.13	87.5
INS;N;SG	64.29 (84)	59.41 (101)	91.67	90.1
N;NOM;SG	62.63 (99)	61.39 (101)	83.84	83.17
ACC;N;SG	65.26 (95)	62.38 (101)	87.37	87.13
ACC;N;PL	60.64 (94)	61.54 (104)	86.17	89.42
DAT;N;SG	59.72 (72)	53.47 (101)	79.17	73.27
INS;N;PL	61.67 (60)	53.40 (103)	90.00	90.29
DAT;N;PL	43.14 (51)	32.04 (103)	82.35	82.52
ESS;N;SG	61.33 (75)	54.46 (101)	80.00	73.27
ESS;N;PL	65.45 (55)	49.51 (103)	98.18	96.12
GEN;N;PL	51.16 (86)	47.12 (104)	84.88	79.81
NFIN;V	60.71 (84)	58.95 (95)	100.00	100
3;FEM;PL;PST;V	0.00 (1)	0.00 (1)	100.00	100
1;PRS;SG;V	-	0.00 (1)	-	100
3;MASC;PL;PST;V	0.00 (1)	0.00 (1)	100.00	100
3;NEUT;PST;SG;V	0.00 (1)	0.00 (1)	100.00	100
3;MASC;PST;SG;V	0.00 (1)	0.00 (1)	100.00	100
1;PL;PRS;V	0.00 (1)	0.00 (1)	100.00	100
1;IMP;PL;V	-	0.00 (1)	-	0
3;FEM;PST;SG;V	0.00 (1)	0.00 (1)	100.00	100
2;IMP;PL;V	-	0.00 (1)	-	100
3;PRS;SG;V	0.00 (1)	0.00 (1)	100.00	100
2;IMP;SG;V	-	0.00 (1)	-	100
2;PL;PRS;V	-	0.00 (1)	-	0
2;PRS;SG;V	-	0.00 (1)	-	0
3;NEUT;PL;PST;V	0.00 (1)	0.00 (1)	100.00	100
3;PL;PRS;V	0.00 (1)	0.00 (1)	0.00	0

Table 52: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Czech–Slovak language pair (the grey numbers correspond to the dictionary sizes).

	Czech–Ukrainian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	48.14 (673)	39.81 (854)	82.91	79.39
ACC;N;SG	50.00 (90)	47.37 (95)	83.33	82.11
N;PL;VOC	46.07 (89)	43.62 (94)	82.02	79.79
N;SG;VOC	42.86 (35)	23.40 (94)	80	59.57
DAT;N;PL	61.40 (57)	44.68 (94)	96.49	96.81
N;NOM;SG	45.74 (94)	45.26 (95)	86.17	84.21
INS;N;SG	56.63 (83)	49.47 (95)	84.34	82.11
ACC;N;PL	48.89 (90)	46.81 (94)	82.22	81.91
INS;N;PL	44.74 (76)	37.23 (94)	84.21	84.04
GEN;N;SG	49.45 (91)	47.37 (95)	82.42	82.11
GEN;N;PL	54.12 (85)	48.42 (95)	82.35	78.95
N;NOM;PL	45.56 (90)	43.62 (94)	82.22	80.85
ESS;N;SG	43.90 (82)	37.89 (95)	70.73	65.26
DAT;N;SG	43.75 (80)	36.84 (95)	70	65.26
ESS;N;PL	56.67 (60)	41.49 (94)	86.67	89.36
3;PL;PRS;V	0.00 (2)	0.00 (3)	50	33.33
3;PRS;SG;V	66.67 (3)	66.67 (3)	100	100
1;PRS;SG;V	50.00 (2)	33.33 (3)	100	66.67
3;NEUT;PST;SG;V	0.00 (2)	0.00 (3)	100	100
3;FEM;PST;SG;V	33.33 (3)	33.33 (3)	100	100
3;FEM;PL;PST;V	0.00 (3)	0.00 (3)	0	0
NFIN;V	33.33 (3)	33.33 (3)	100	100
3;MASC;PL;PST;V	0.00 (3)	0.00 (3)	66.67	66.67
2;IMP;SG;V	0.00 (3)	0.00 (3)	33.33	33.33
2;PL;PRS;V	0.00 (2)	0.00 (3)	100	66.67
2;PRS;SG;V	0.00 (2)	0.00 (3)	50	33.33
2;IMP;PL;V	0.00 (3)	0.00 (3)	100	100
1;PL;PRS;V	50.00 (2)	0.00 (3)	100	100
1;IMP;PL;V	0.00 (1)	0.00 (3)	0	0
3;MASC;PST;SG;V	50.00 (2)	50.00 (2)	100	100
ADJ;FEM;GEN;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;PL	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;PL	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;PL	0.00 (1)	0.00 (1)	100	100
ADJ;INS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;FEM;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;INAN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;MASC;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;FEM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;NEUT;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;PL	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;FEM;SG	0.00 (1)	0.00 (1)	100	100

Table 53: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Czech–Ukrainian language pair (the grey numbers correspond to the dictionary sizes).

Polish–Czech				
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	41.83 (4043)	34.58 (5332)	80.76	75.68
DAT;N;SG	24.29 (280)	17.10 (427)	58.57	44.96
N;NOM;PL	44.07 (388)	41.25 (417)	82.73	80.1
GEN;N;SG	44.44 (414)	42.86 (427)	81.64	79.63
ESS;N;PL	52.94 (255)	39.42 (416)	91.76	92.55
N;SG;VOC	34.76 (187)	23.89 (427)	58.29	49.41
N;PL;VOC	44.07 (388)	41.25 (417)	82.73	80.1
ESS;N;SG	32.74 (336)	27.53 (425)	60.42	54.59
DAT;N;PL	51.65 (182)	32.93 (416)	95.6	93.51
GEN;N;PL	44.29 (368)	39.71 (418)	79.35	74.88
ACC;N;PL	45.18 (394)	42.58 (418)	82.99	81.1
INS;N;PL	28.57 (315)	23.32 (416)	82.54	81.25
INS;N;SG	45.63 (366)	39.91 (426)	81.15	80.75
ACC;N;SG	43.60 (406)	41.22 (427)	75.86	73.77
N;NOM;SG	44.08 (422)	43.56 (427)	77.96	77.05
ACC;ADJ;MASC;SG	47.83 (69)	47.83 (69)	98.55	98.55
ACC;ADJ;FEM;SG	48.48 (66)	47.83 (69)	100	100
ADJ;ESS;MASC;SG	47.54 (61)	47.83 (69)	96.72	97.1
ADJ;INS;MASC;SG	46.97 (66)	47.83 (69)	96.97	97.1
ADJ;MASC;NOM;SG	53.03 (66)	53.73 (67)	95.45	95.52
ADJ;FEM;NOM;SG	52.31 (65)	53.73 (67)	93.85	94.03
ADJ;NEUT;NOM;SG	53.73 (67)	53.73 (67)	95.52	94.03
ADJ;DAT;MASC;SG	53.12 (32)	42.03 (69)	100	100
ADJ;GEN;NEUT;SG	47.83 (69)	47.83 (69)	98.55	98.55
ADJ;GEN;MASC;SG	47.83 (69)	47.83 (69)	98.55	98.55
ADJ;MASC;NOM;PL	39.53 (43)	32.84 (67)	76.74	71.64
ADJ;ESS;NEUT;SG	47.54 (61)	47.83 (69)	96.72	97.1
ADJ;FEM;GEN;SG	49.25 (67)	50.72 (69)	89.55	89.86
ADJ;ESS;FEM;SG	49.25 (67)	50.72 (69)	89.55	89.86
ADJ;ESS;PL	40.30 (67)	42.03 (69)	100	100
ACC;ADJ;INAN;MASC;SG	53.03 (66)	53.73 (67)	95.45	95.52
ACC;ADJ;MASC;PL	40.30 (67)	43.28 (67)	100	100
ADJ;DAT;FEM;SG	49.25 (67)	50.72 (69)	89.55	89.86
ACC;ADJ;NEUT;SG	52.17 (69)	52.17 (69)	94.2	92.75
ADJ;GEN;PL	40.30 (67)	42.03 (69)	100	100
ADJ;INS;PL	49.12 (57)	44.93 (69)	100	100
ADJ;DAT;NEUT;SG	53.12 (32)	42.03 (69)	100	100
ADJ;DAT;PL	46.97 (66)	47.83 (69)	96.97	97.1
3;MASC;PST;SG;V	57.58 (33)	52.78 (36)	90.91	91.67
3;FEM;PST;SG;V	56.67 (30)	45.95 (37)	93.33	91.89
3;PL;PRS;V	35.00 (20)	28.00 (25)	80	76
2;PRS;SG;V	44.44 (9)	24.00 (25)	55.56	56
2;IMP;SG;V	0.00 (18)	0.00 (37)	16.67	2.7
2;IMP;PL;V	11.11 (9)	8.11 (37)	44.44	29.73
3;NEUT;PST;SG;V	73.08 (26)	56.76 (37)	96.15	89.19
1;IMP;PL;V	0.00 (5)	0.00 (37)	0	5.41
2;PL;PRS;V	0.00 (4)	8.00 (25)	25	32
NFIN;V	52.63 (38)	50.00 (40)	94.74	95
3;PRS;SG;V	41.67 (24)	40.00 (25)	83.33	80
3;MASC;PL;PST;V	56.25 (32)	48.65 (37)	96.88	94.59
3;FEM;PL;PST;V	56.52 (23)	45.95 (37)	95.65	94.59
1;PL;PRS;V	40.00 (10)	16.00 (25)	90	52
1;PRS;SG;V	21.43 (14)	16.00 (25)	50	36
ACC;ADJ;PL	0.00 (5)	0.00 (5)	60	60
ADJ;INS;NEUT;SG	0.00 (5)	0.00 (5)	100	100
ADJ;FEM;INS;SG	0.00 (5)	0.00 (5)	100	100
ADJ;NOM;PL	0.00 (5)	0.00 (5)	60	60
3;FUT;SG;V	50.00 (10)	30.77 (13)	60	53.85
1;FUT;PL;V	50.00 (8)	23.08 (13)	62.5	30.77
2;FUT;SG;V	0.00 (3)	23.08 (13)	33.33	46.15
2;FUT;PL;V	0.00 (3)	7.69 (13)	0	30.77
1;FUT;SG;V	12.50 (8)	7.69 (13)	75	46.15
3;FUT;PL;V	44.44 (9)	23.08 (13)	66.67	46.15

Table 54: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Polish–Czech language pair (the grey numbers correspond to the dictionary sizes).

	Polish–Russian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	47.14 (6814)	40.43 (9079)	83.72	80.54
N;NOM;SG	41.93 (768)	40.84 (786)	76.30	74.17
ACC;N;SG	42.11 (748)	40.20 (791)	75.94	73.45
DAT;N;SG	36.17 (459)	28.23 (790)	76.91	70.76
INS;N;SG	46.08 (688)	41.57 (789)	84.74	82.51
ESS;N;SG	40.26 (611)	35.75 (786)	71.69	65.39
GEN;N;SG	46.35 (753)	44.74 (789)	81.81	79.85
ADJ;INS;PL	63.91 (133)	59.73 (149)	100.00	100
ADJ;FEM;INS;SG	59.03 (144)	57.05 (149)	96.53	97.32
ADJ;FEM;NOM;SG	56.94 (144)	53.69 (149)	90.97	89.26
ADJ;DAT;FEM;SG	56.25 (144)	54.36 (149)	95.83	95.97
ADJ;ESS;MASC;SG	62.32 (138)	59.06 (149)	99.28	98.66
ADJ;INS;MASC;SG	60.42 (144)	59.06 (149)	99.31	98.66
ADJ;NEUT;NOM;SG	62.41 (141)	59.06 (149)	94.33	93.29
ADJ;DAT;PL	60.42 (144)	59.06 (149)	99.31	98.66
ADJ;ESS;NEUT;SG	62.32 (138)	59.06 (149)	99.28	98.66
ADJ;GEN;PL	63.45 (145)	61.74 (149)	97.93	97.32
ADJ;DAT;NEUT;SG	52.56 (78)	48.32 (149)	100.00	99.33
ACC;ADJ;FEM;SG	59.86 (142)	57.05 (149)	97.89	97.32
ADJ;GEN;MASC;SG	61.81 (144)	59.73 (149)	97.92	97.32
ACC;ADJ;MASC;SG	61.81 (144)	59.73 (149)	97.92	97.32
ADJ;FEM;GEN;SG	56.25 (144)	54.36 (149)	95.83	95.97
ACC;ADJ;INAN;MASC;SG	57.64 (144)	56.38 (149)	89.58	88.59
ADJ;INS;NEUT;SG	60.42 (144)	59.06 (149)	99.31	98.66
ADJ;MASC;NOM;SG	57.64 (144)	56.38 (149)	89.58	88.59
ADJ;NOM;PL	61.11 (144)	59.06 (149)	94.44	93.29
ACC;ADJ;PL	60.27 (146)	59.06 (149)	93.84	93.29
ADJ;DAT;MASC;SG	52.56 (78)	48.32 (149)	100.00	99.33
ADJ;ESS;PL	63.45 (145)	61.74 (149)	97.93	97.32
ACC;ADJ;NEUT;SG	62.41 (141)	59.06 (149)	94.33	93.29
ADJ;GEN;NEUT;SG	61.81 (144)	59.73 (149)	97.92	97.32
ADJ;ESS;FEM;SG	56.25 (144)	54.36 (149)	95.83	95.97
INS;N;PL	51.46 (480)	42.60 (723)	97.71	98.48
N;NOM;PL	44.78 (670)	42.72 (721)	80.75	78.92
DAT;N;PL	52.92 (240)	35.68 (723)	88.33	88.8
ACC;N;PL	47.55 (511)	44.72 (559)	83.17	80.86
GEN;N;PL	46.80 (641)	42.72 (728)	78.78	74.59
ESS;N;PL	55.76 (425)	45.23 (723)	94.35	93.78
NFIN;V	44.44 (27)	40.00 (30)	100.00	100
3;FEM;PL;PST;V	9.52 (21)	12.90 (31)	80.95	87.1
2;IMP;PL;V	0.00 (5)	6.45 (31)	100.00	41.94
2;FEM;PST;SG;V	0.00 (1)	6.45 (31)	0.00	19.35
3;NEUT;PST;SG;V	25.00 (16)	29.03 (31)	62.50	87.1
3;MASC;PL;PST;V	28.00 (25)	32.26 (31)	88.00	87.1
1;FEM;PST;SG;V	0.00 (9)	0.00 (31)	11.11	3.23
3;MASC;PST;SG;V	36.00 (25)	32.26 (31)	92.00	83.87
2;MASC;PL;PST;V	0.00 (1)	12.90 (31)	0.00	41.94
2;IMP;SG;V	11.76 (17)	3.23 (31)	23.53	12.9
2;PRS;SG;V	20.00 (5)	4.76 (21)	20.00	33.33
2;PL;PRS;V	0.00 (3)	4.76 (21)	66.67	28.57
3;PL;PRS;V	35.29 (17)	28.57 (21)	94.12	95.24
3;FEM;PST;SG;V	30.77 (26)	32.26 (31)	88.46	93.55
1;PL;PRS;V	37.50 (8)	9.52 (21)	75.00	57.14
3;PRS;SG;V	19.05 (21)	19.05 (21)	76.19	76.19
1;PRS;SG;V	8.33 (12)	14.29 (21)	50.00	47.62
1;MASC;PL;PST;V	14.29 (7)	6.45 (31)	14.29	12.9
1;MASC;PST;SG;V	0.00 (16)	0.00 (31)	6.25	3.23
1;FEM;PL;PST;V	-	22.58 (31)	-	77.42
2;MASC;PST;SG;V	0.00 (10)	0.00 (31)	0.00	0
2;FEM;PL;PST;V	-	19.35 (31)	-	51.61
2;FUT;PL;V	0.00 (1)	0.00 (10)	0.00	10
1;FUT;PL;V	33.33 (3)	10.00 (10)	33.33	30
1;FUT;SG;V	0.00 (4)	0.00 (10)	0.00	10
2;FUT;SG;V	0.00 (1)	0.00 (10)	0.00	50
3;FUT;SG;V	0.00 (8)	0.00 (10)	75.00	60
3;FUT;PL;V	12.50 (8)	10.00 (10)	62.50	50

Table 55: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Polish–Russian language pair (the grey numbers correspond to the dictionary sizes).

	Polish–Slovak			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	33.03 (1217)	26.29 (1689)	78.06	75.73
INS;N;SG	30.89 (123)	24.84 (157)	84.55	82.17
N;NOM;SG	28.57 (154)	28.03 (157)	71.43	69.43
GEN;N;SG	27.78 (144)	26.11 (157)	74.31	72.61
DAT;N;SG	21.98 (91)	13.38 (157)	67.03	58.6
ACC;N;PL	25.74 (136)	23.08 (156)	76.47	73.72
INS;N;PL	39.33 (89)	26.28 (156)	98.88	98.72
DAT;N;PL	23.53 (68)	16.03 (156)	61.76	66.67
N;NOM;PL	24.64 (138)	22.44 (156)	77.54	73.72
ESS;N;SG	29.09 (110)	22.44 (156)	66.36	52.56
GEN;N;PL	38.66 (119)	30.13 (156)	75.63	64.74
ESS;N;PL	40.26 (77)	29.49 (156)	90.91	94.87
ACC;N;SG	31.47 (143)	28.03 (157)	62.94	59.87
ADJ;ESS;FEM;SG	47.06 (17)	45.00 (20)	88.24	90
ADJ;ESS;MASC;SG	50.00 (14)	40.00 (20)	100.00	100
ADJ;DAT;NEUT;SG	45.45 (11)	30.00 (20)	100.00	100
ADJ;FEM;GEN;SG	47.06 (17)	45.00 (20)	88.24	90
ADJ;DAT;PL	41.18 (17)	40.00 (20)	100.00	100
ADJ;INS;PL	71.43 (14)	55.00 (20)	100.00	100
ADJ;MASC;NOM;PL	36.36 (11)	30.00 (20)	90.91	90
ADJ;GEN;NEUT;SG	55.56 (18)	50.00 (20)	94.44	95
ADJ;ESS;NEUT;SG	50.00 (14)	40.00 (20)	100.00	100
ACC;ADJ;MASC;SG	55.56 (18)	50.00 (20)	94.44	95
ADJ;GEN;PL	57.89 (19)	55.00 (20)	100.00	100
ADJ;FEM;INS;SG	53.85 (13)	40.00 (20)	100.00	95
ADJ;INS;MASC;SG	41.18 (17)	40.00 (20)	100.00	100
ADJ;INS;NEUT;SG	41.18 (17)	40.00 (20)	100.00	100
ACC;ADJ;NEUT;SG	61.11 (18)	55.00 (20)	100.00	100
ACC;ADJ;INAN;MASC;SG	57.89 (19)	55.00 (20)	100.00	100
ACC;ADJ;PL	61.11 (18)	55.00 (20)	100.00	100
ACC;ADJ;MASC;PL	57.89 (19)	55.00 (20)	100.00	100
ADJ;FEM;NOM;SG	38.89 (18)	35.00 (20)	83.33	80
ADJ;ESS;PL	57.89 (19)	55.00 (20)	100.00	100
ADJ;NOM;PL	61.11 (18)	55.00 (20)	100.00	100
ADJ;GEN;MASC;SG	55.56 (18)	50.00 (20)	94.44	95
ADJ;NEUT;NOM;SG	61.11 (18)	55.00 (20)	100.00	100
ACC;ADJ;FEM;SG	46.67 (15)	40.00 (20)	86.67	95
ADJ;MASC;NOM;SG	57.89 (19)	55.00 (20)	100.00	100
ADJ;DAT;MASC;SG	45.45 (11)	30.00 (20)	100.00	100
ADJ;DAT;FEM;SG	47.06 (17)	45.00 (20)	88.24	90
NFIN;V	60.00 (10)	54.55 (11)	100.00	100
2;PRS;SG;V	0.00 (1)	0.00 (1)	100.00	100
1;PL;PRS;V	100.00 (1)	100.00 (1)	100.00	100
3;NEUT;PST;SG;V	0.00 (1)	0.00 (1)	0.00	0
3;MASC;PST;SG;V	0.00 (1)	0.00 (1)	0.00	0
2;IMP;SG;V	-	0.00 (1)	-	0
3;MASC;PL;PST;V	0.00 (1)	0.00 (1)	0.00	0
3;FEM;PL;PST;V	0.00 (1)	0.00 (1)	0.00	0
1;IMP;PL;V	-	0.00 (1)	-	0
3;PRS;SG;V	100.00 (1)	100.00 (1)	100.00	100
2;PL;PRS;V	0.00 (1)	0.00 (1)	100.00	100
2;IMP;PL;V	-	0.00 (1)	-	0
3;FEM;PST;SG;V	0.00 (1)	0.00 (1)	0.00	0
1;PRS;SG;V	0.00 (1)	0.00 (1)	100.00	100
3;PL;PRS;V	100.00 (1)	100.00 (1)	100.00	100

Table 56: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Polish–Slovak language pair (the grey numbers correspond to the dictionary sizes).

	Polish–Ukrainian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	34.79 (1118)	29.60 (1463)	74.15	70.54
N;PL;VOC	34.11 (129)	33.08 (133)	77.52	75.94
N;NOM;PL	34.11 (129)	33.08 (133)	77.52	75.94
ACC;N;PL	34.88 (129)	33.83 (133)	76.74	75.19
ACC;N;SG	37.69 (130)	36.03 (136)	68.46	66.18
ESS;N;PL	40.23 (87)	34.59 (133)	88.51	89.47
N;SG;VOC	18.75 (64)	16.18 (136)	62.50	50
INS;N;PL	36.63 (101)	30.08 (133)	99.01	98.5
GEN;N;SG	37.59 (133)	36.76 (136)	76.69	75.74
DAT;N;PL	42.86 (56)	33.08 (133)	94.64	92.48
INS;N;SG	42.61 (115)	36.76 (136)	78.26	77.21
N;NOM;SG	37.50 (136)	37.23 (137)	67.65	66.42
ESS;N;SG	27.59 (116)	23.53 (136)	61.21	54.41
DAT;N;SG	23.40 (94)	16.18 (136)	52.13	37.5
GEN;N;PL	40.50 (121)	36.84 (133)	79.34	76.69
2;MASC;PST;SG;V	0.00 (4)	0.00 (7)	0.00	0
1;FEM;PL;PST;V	-	28.57 (7)	-	42.86
1;MASC;PST;SG;V	0.00 (5)	0.00 (7)	20.00	14.29
3;FEM;PL;PST;V	16.67 (6)	14.29 (7)	83.33	85.71
2;FUT;SG;V	0.00 (1)	0.00 (1)	0.00	0
2;MASC;PL;PST;V	0.00 (2)	0.00 (7)	0.00	57.14
3;NEUT;PST;SG;V	60.00 (5)	42.86 (7)	100.00	100
1;MASC;PL;PST;V	0.00 (3)	0.00 (7)	33.33	14.29
1;FUT;PL;V	0.00 (1)	0.00 (1)	0.00	0
1;FEM;PST;SG;V	0.00 (4)	0.00 (7)	0.00	0
NFIN;V	57.14 (7)	57.14 (7)	100.00	100
3;FUT;PL;V	100.00 (1)	100.00 (1)	100.00	100
2;FEM;PST;SG;V	0.00 (1)	0.00 (7)	0.00	0
3;MASC;PL;PST;V	66.67 (6)	57.14 (7)	83.33	85.71
2;IMP;SG;V	0.00 (7)	0.00 (7)	0.00	0
2;IMP;PL;V	0.00 (4)	0.00 (7)	50.00	28.57
3;MASC;PST;SG;V	57.14 (7)	57.14 (7)	100.00	100
3;FEM;PST;SG;V	57.14 (7)	57.14 (7)	100.00	100
3;FUT;SG;V	0.00 (1)	0.00 (1)	0.00	0
2;FEM;PL;PST;V	-	14.29 (7)	-	57.14
1;FUT;SG;V	0.00 (1)	0.00 (1)	100.00	100
2;FUT;PL;V	0.00 (1)	0.00 (1)	0.00	0
1;IMP;PL;V	0.00 (3)	0.00 (7)	0.00	0
1;PRS;SG;V	33.33 (6)	33.33 (6)	50.00	50
3;PL;PRS;V	66.67 (6)	66.67 (6)	100.00	100
2;PRS;SG;V	0.00 (4)	0.00 (6)	25.00	33.33
2;PL;PRS;V	0.00 (3)	16.67 (6)	0.00	33.33
1;PL;PRS;V	50.00 (4)	50.00 (6)	50.00	66.67
3;PRS;SG;V	50.00 (6)	50.00 (6)	100.00	100
ACC;ADJ;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;FEM;SG	-	0.00 (2)	-	100
ADJ;NEUT;NOM;SG	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;PL	50.00 (2)	50.00 (2)	100.00	100
ADJ;FEM;INS;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;INS;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;FEM;NOM;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;GEN;PL	0.00 (2)	0.00 (2)	100.00	100
ADJ;NOM;PL	50.00 (2)	50.00 (2)	100.00	100
ADJ;DAT;NEUT;SG	-	0.00 (2)	-	100
ADJ;ESS;NEUT;SG	-	50.00 (2)	-	100
ADJ;MASC;NOM;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;GEN;NEUT;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;ESS;FEM;SG	-	0.00 (2)	-	100
ADJ;ESS;PL	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;MASC;SG	-	0.00 (2)	-	100
ADJ;INS;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;INS;PL	0.00 (1)	0.00 (2)	100.00	100
ACC;ADJ;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;FEM;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;PL	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;INAN;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;FEM;GEN;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;ESS;MASC;SG	-	50.00 (2)	-	100
ADJ;GEN;MASC;SG	0.00 (2)	0.00 (2)	100.00	100

Table 57: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Polish–Ukrainian language pair (the grey numbers correspond to the dictionary sizes).

	Catalan–French			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	54.95 (5605)	31.42 (11367)	78.57	48.91
N;SG	63.81 (1293)	62.53 (1321)	87.63	87.66
N;PL	66.02 (1089)	61.83 (1221)	95.96	95.17
1;PL;PRS;SBJV;V	10.00 (60)	8.22 (219)	16.67	17.35
1;COND;SG;V	36.63 (101)	28.31 (219)	55.45	52.97
1;PST;SBJV;SG;V	3.33 (60)	8.68 (219)	6.67	16.89
2;PFV;PL;PST;V	-	0.46 (219)	-	0.91
2;IPFV;PL;PST;V	0.00 (2)	0.46 (219)	0.00	1.37
3;COND;PL;V	51.35 (74)	31.36 (220)	62.16	51.82
2;PL;PRS;V	21.67 (60)	14.61 (219)	28.33	23.29
3;PL;PST;SBJV;V	0.00 (64)	0.00 (220)	0.00	0
2;COND;PL;V	0.00 (1)	2.74 (219)	0.00	4.57
NFIN;V	61.14 (211)	58.30 (223)	89.10	86.1
2;IMP;POS;SG;V	49.50 (202)	46.12 (219)	63.37	57.53
3;FUT;PL;V	74.67 (75)	48.18 (220)	94.67	89.55
2;IMP;PL;POS;V	21.67 (60)	14.61 (219)	30.00	23.29
1;FUT;SG;V	42.31 (26)	32.42 (219)	69.23	56.16
2;PL;PST;SBJV;V	0.00 (1)	0.00 (219)	0.00	0.91
3;PST;SBJV;SG;V	6.31 (111)	8.64 (220)	10.81	16.82
3;PFV;PST;SG;V	53.05 (164)	42.73 (220)	71.95	59.55
2;PST;SBJV;SG;V	0.00 (3)	0.46 (219)	0.00	0.91
1;PRS;SBJV;SG;V	17.76 (152)	17.19 (221)	25.00	23.98
1;IPFV;PL;PST;V	0.00 (5)	0.91 (219)	0.00	3.65
1;COND;PL;V	20.00 (5)	2.28 (219)	20.00	5.02
3;PRS;SBJV;SG;V	17.65 (153)	17.12 (222)	24.84	23.87
3;PFV;PL;PST;V	66.41 (131)	50.91 (220)	98.47	95.91
2;PRS;SBJV;SG;V	8.33 (36)	4.52 (221)	16.67	9.95
3;IPFV;PL;PST;V	67.72 (158)	57.27 (220)	95.57	95
1;PL;PST;SBJV;V	0.00 (2)	0.00 (219)	0.00	0
3;FUT;SG;V	66.10 (118)	48.18 (220)	84.75	75.91
3;PL;PRS;SBJV;V	26.50 (117)	20.72 (222)	39.32	32.43
2;PFV;PST;SG;V	0.00 (2)	5.48 (219)	50.00	10.5
1;PFV;PL;PST;V	0.00 (2)	3.20 (219)	0.00	7.31
3;IPFV;PST;SG;V	60.92 (174)	55.45 (220)	90.23	86.82
2;PL;PRS;SBJV;V	17.95 (39)	13.70 (219)	25.64	22.37
1;FUT;PL;V	28.12 (32)	17.81 (219)	37.50	32.42
3;PRS;SG;V	49.51 (204)	46.15 (221)	64.22	58.82
1;PRS;SG;V	7.14 (98)	7.24 (221)	14.29	12.22
2;FUT;PL;V	14.29 (7)	5.02 (219)	14.29	10.96
1;IMP;PL;POS;V	11.11 (72)	8.26 (218)	16.67	17.43
1;IPFV;PST;SG;V	63.64 (132)	55.71 (219)	92.42	87.21
2;PRS;SG;V	30.23 (86)	20.00 (220)	45.35	32.73
2;FUT;SG;V	20.00 (5)	5.48 (219)	20.00	9.13
1;PFV;PST;SG;V	58.62 (29)	8.76 (217)	75.86	11.52
3;PL;PRS;V	62.96 (189)	56.56 (221)	91.01	87.33
3;COND;SG;V	37.29 (118)	28.18 (220)	55.08	53.18
2;COND;SG;V	0.00 (5)	0.00 (219)	20.00	2.28
2;IPFV;PST;SG;V	12.50 (8)	0.91 (219)	12.50	1.83
1;PL;PRS;V	11.84 (76)	8.68 (219)	22.37	18.72
ADJ;FEM;PL	68.07 (332)	67.76 (335)	98.80	98.81
ADJ;MASC;PL	68.69 (329)	65.90 (349)	97.87	97.71
ADJ;MASC;SG	69.27 (358)	68.41 (364)	95.81	95.6
ADJ;FEM;SG	69.17 (360)	68.49 (365)	95.83	95.62

Table 58: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Catalan–French language pair (the grey numbers correspond to the dictionary sizes).

	Catalan–Italian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	52.25 (5518)	29.00 (11970)	80.01	49.53
2;FUT;SG;V	0.00 (10)	1.24 (241)	10.00	2.9
2;IPFV;PL;PST;V	0.00 (1)	0.41 (241)	0.00	2.07
1;PFV;PL;PST;V	0.00 (1)	1.24 (241)	0.00	1.66
1;IPFV;PL;PST;V	66.67 (6)	24.07 (241)	100.00	54.77
3;IMP;PL;POS;V	14.15 (106)	9.92 (242)	22.64	20.25
2;PL;PRS;SBJV;V	0.00 (29)	0.42 (240)	0.00	0.83
2;PFV;PL;PST;V	-	1.24 (241)	-	2.9
3;IMP;POS;SG;V	19.86 (141)	14.46 (242)	31.21	23.14
3;PST;SBJV;SG;V	44.62 (130)	37.76 (241)	76.15	69.71
1;IPFV;PST;SG;V	65.00 (100)	55.60 (241)	93.00	86.72
1;FUT;PL;V	32.00 (25)	20.75 (241)	56.00	45.23
1;PL;PRS;V	20.00 (70)	12.50 (240)	54.29	37.5
1;FUT;SG;V	50.00 (22)	19.92 (241)	77.27	41.91
3;PRS;SG;V	49.32 (221)	48.15 (243)	69.23	65.02
2;PRS;SG;V	25.27 (91)	11.16 (242)	37.36	14.46
1;PL;PRS;SBJV;V	15.94 (69)	10.42 (240)	50.72	36.25
3;IPFV;PL;PST;V	64.60 (161)	56.61 (242)	95.03	95.45
3;COND;PL;V	1.56 (64)	0.83 (242)	3.12	4.55
3;COND;SG;V	5.31 (113)	2.48 (242)	11.50	14.05
2;PRS;SBJV;SG;V	2.70 (37)	4.98 (241)	16.22	10.79
2;FUT;PL;V	0.00 (8)	1.24 (241)	25.00	10.79
2;IPFV;PST;SG;V	0.00 (4)	3.32 (241)	0.00	3.32
3;PFV;PST;SG;V	47.67 (172)	41.32 (242)	68.60	63.64
NFIN;V	60.34 (232)	58.85 (243)	90.95	91.36
3;PL;PST;SBJV;V	50.54 (93)	37.34 (241)	98.92	98.76
2;IMP;POS;SG;V	50.70 (215)	48.35 (242)	68.84	64.05
3;IPFV;PST;SG;V	61.96 (184)	55.37 (242)	90.22	86.78
3;PFV;PL;PST;V	63.57 (140)	55.79 (242)	95.00	95.87
1;COND;SG;V	6.19 (97)	2.49 (241)	8.25	13.69
1;PRS;SG;V	15.96 (94)	10.33 (242)	38.30	22.73
2;IMP;PL;POS;V	1.89 (53)	1.24 (241)	7.55	1.66
3;FUT;SG;V	57.14 (119)	45.04 (242)	89.08	84.3
1;IMP;PL;POS;V	15.94 (69)	10.42 (240)	50.72	36.25
2;PST;SBJV;SG;V	0.00 (3)	0.83 (240)	33.33	6.67
2;PL;PRS;V	1.92 (52)	1.25 (240)	7.69	1.67
1;PST;SBJV;SG;V	47.83 (69)	37.92 (240)	82.61	70
2;PL;PST;SBJV;V	-	0.00 (240)	-	0
2;COND;PL;V	0.00 (2)	0.41 (241)	0.00	1.66
1;PFV;PST;SG;V	60.00 (25)	8.86 (237)	68.00	12.24
1;PRS;SBJV;SG;V	20.00 (140)	14.52 (241)	31.43	23.24
3;PRS;SBJV;SG;V	19.86 (141)	14.46 (242)	31.21	23.14
1;COND;PL;V	0.00 (5)	7.47 (241)	40.00	25.73
2;COND;SG;V	0.00 (5)	0.00 (241)	0.00	1.24
1;PL;PST;SBJV;V	0.00 (4)	7.50 (240)	50.00	22.08
3;PL;PRS;V	54.23 (201)	47.93 (242)	85.07	80.58
3;FUT;PL;V	51.32 (76)	38.02 (242)	84.21	82.23
3;PL;PRS;SBJV;V	14.15 (106)	9.92 (242)	22.64	20.25
2;PFV;PST;SG;V	-	0.00 (241)	-	1.66
N;PL	59.56 (1083)	56.54 (1192)	90.77	89.85
N;SG	64.65 (1307)	63.87 (1323)	92.96	92.67
ADJ;FEM;SG	62.76 (290)	62.54 (291)	96.55	96.22
ADJ;MASC;PL	64.60 (274)	63.83 (282)	94.53	94.68
ADJ;FEM;PL	66.91 (269)	66.30 (270)	97.03	96.67
ADJ;MASC;SG	62.54 (291)	62.33 (292)	96.56	96.23

Table 59: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Catalan–Italian language pair (the grey numbers correspond to the dictionary sizes).

		Catalan–Portuguese		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	62.42 (5418)	40.64 (10759)	82.76	57.37
N;PL	68.06 (1027)	64.72 (1128)	92.60	92.11
N;SG	67.49 (1209)	66.13 (1234)	90.90	90.68
3;PRS;SG;V	59.82 (224)	55.56 (243)	74.11	67.9
3;IPFV;PL;PST;V	76.47 (170)	66.80 (241)	97.06	97.1
1;FUT;PL;V	40.00 (20)	47.50 (240)	40.00	61.67
2;PRS;SBJV;SG;V	2.86 (35)	0.82 (243)	8.57	3.7
1;COND;PL;V	25.00 (8)	35.42 (240)	50.00	51.25
3;PRS;SBJV;SG;V	16.05 (162)	12.35 (243)	19.75	16.87
2;FUT;PL;V	0.00 (3)	0.00 (240)	0.00	0
1;PL;PRS;V	44.21 (95)	26.67 (240)	52.63	37.08
3;PFV;PL;PST;V	69.93 (153)	58.51 (241)	96.73	95.85
2;PRS;SG;V	43.21 (81)	29.63 (243)	49.38	36.63
2;IMP;POS;SG;V	58.30 (223)	54.32 (243)	72.65	66.67
3;COND;PL;V	68.29 (82)	61.41 (241)	82.93	87.55
3;IPFV;PST;SG;V	72.11 (190)	64.73 (241)	87.89	88.38
3;COND;SG;V	66.67 (132)	57.68 (241)	79.55	76.76
1;IMP;PL;POS;V	49.06 (53)	26.14 (241)	54.72	36.51
3;FUT;SG;V	72.36 (123)	61.00 (241)	86.18	87.14
2;IPFV;PST;SG;V	25.00 (4)	18.67 (241)	25.00	23.24
1;PL;PRS;SBJV;V	49.06 (53)	26.25 (240)	54.72	36.67
3;PL;PRS;SBJV;V	36.09 (133)	25.93 (243)	45.11	38.68
1;FUT;SG;V	36.84 (19)	51.45 (241)	42.11	68.88
1;IPFV;PST;SG;V	72.11 (190)	64.32 (241)	87.89	87.97
1;PFV;PST;SG;V	45.95 (37)	7.47 (241)	72.97	11.62
3;PL;PRS;V	65.38 (208)	58.85 (243)	88.94	83.95
2;PL;PRS;SBJV;V	0.00 (10)	1.25 (240)	10.00	4.17
3;IMP;PL;POS;V	36.09 (133)	25.93 (243)	45.11	38.68
1;PRS;SBJV;SG;V	16.05 (162)	12.35 (243)	19.75	16.87
3;FUT;PL;V	56.79 (81)	52.70 (241)	67.90	77.59
1;COND;SG;V	66.67 (132)	57.68 (241)	79.55	76.76
2;PFV;PL;PST;V	-	0.00 (240)	-	0
1;PFV;PL;PST;V	0.00 (1)	7.08 (240)	0.00	10.42
2;PL;PRS;V	2.94 (34)	2.08 (240)	5.88	5
2;COND;SG;V	66.67 (3)	20.33 (241)	66.67	31.12
2;FUT;SG;V	33.33 (6)	8.30 (241)	50.00	14.11
2;IMP;PL;POS;V	4.08 (49)	2.07 (242)	6.12	4.96
1;PRS;SG;V	31.68 (101)	20.58 (243)	51.49	34.57
3;IMP;POS;SG;V	16.05 (162)	12.35 (243)	19.75	16.87
3;PFV;PST;SG;V	62.57 (187)	53.11 (241)	80.21	70.54
2;PFV;PST;SG;V	0.00 (2)	0.41 (241)	0.00	0.41
1;IPFV;PL;PST;V	33.33 (3)	13.33 (240)	33.33	31.67
NFIN;V	69.40 (232)	66.80 (244)	89.22	86.48
2;IPFV;PL;PST;V	0.00 (2)	1.25 (240)	0.00	2.08
2;COND;PL;V	-	2.08 (240)	-	2.08
ADJ;FEM;SG	71.56 (327)	71.43 (329)	96.94	96.96
ADJ;FEM;PL	77.26 (299)	75.83 (302)	98.33	98.34
ADJ;MASC;PL	74.84 (310)	72.45 (323)	98.39	98.45
ADJ;MASC;SG	71.78 (326)	71.08 (332)	96.93	96.99

Table 60: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Catalan–Portuguese language pair (the grey numbers correspond to the dictionary sizes).

	Catalan–Spanish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	67.22 (5879)	43.19 (12282)	83.45	57.23
ADJ;FEM;SG	76.02 (342)	75.14 (346)	98.25	98.27
ADJ;FEM;PL	79.25 (318)	78.26 (322)	98.74	98.76
ADJ;MASC;SG	75.95 (341)	75.07 (345)	98.24	98.26
ADJ;MASC;PL	81.37 (322)	78.92 (332)	98.14	98.19
1;PL;PRS;SBJV;V	47.44 (78)	28.34 (247)	62.82	44.94
1;COND;SG;V	85.29 (136)	70.56 (248)	96.32	90.32
1;PST;SBJV;SG;V	16.55 (145)	14.17 (247)	24.83	29.15
1;PL;PST;SBJV;V	0.00 (4)	1.62 (247)	0.00	6.07
1;PL;PRS;V	51.69 (89)	31.71 (246)	66.29	48.37
3;IPFV;PL;PST;V	81.71 (175)	70.45 (247)	98.29	96.76
2;PFV;PL;PST;V	-	0.40 (248)	-	1.21
3;PST;SBJV;SG;V	16.55 (145)	14.17 (247)	24.83	29.15
2;IMP;PL;POS;V	3.33 (60)	4.45 (247)	5.00	8.5
3;COND;PL;V	82.22 (90)	72.18 (248)	98.89	97.18
2;FUT;SG;V	36.36 (11)	31.05 (248)	45.45	39.11
3;IMP;PL;POS;V	43.85 (130)	28.34 (247)	55.38	38.06
3;PL;PRS;V	72.06 (204)	61.79 (246)	90.69	81.71
1;PRS;SG;V	18.87 (106)	18.62 (247)	33.96	29.55
1;IPFV;PL;PST;V	20.00 (5)	15.79 (247)	60.00	34.41
2;PST;SBJV;SG;V	0.00 (2)	5.67 (247)	50.00	5.67
1;PRS;SBJV;SG;V	32.10 (162)	21.86 (247)	40.74	28.74
1;IPFV;PST;SG;V	77.49 (191)	68.83 (247)	93.19	90.69
3;PRS;SBJV;SG;V	32.10 (162)	21.86 (247)	40.74	28.74
NFIN;V	67.66 (235)	65.32 (248)	87.23	86.69
1;IMP;PL;POS;V	47.44 (78)	28.34 (247)	62.82	44.94
1;FUT;PL;V	75.00 (40)	62.90 (248)	90.00	81.45
2;COND;PL;V	0.00 (1)	10.89 (248)	0.00	16.53
2;IMP;POS;SG;V	67.11 (228)	63.71 (248)	75.88	71.37
3;COND;SG;V	85.29 (136)	70.56 (248)	96.32	90.32
1;PFV;PST;SG;V	61.29 (31)	11.79 (246)	77.42	15.85
2;IPFV;PST;SG;V	0.00 (4)	10.93 (247)	25.00	12.55
3;PL;PST;SBJV;V	7.41 (108)	7.29 (247)	10.19	24.29
3;PFV;PST;SG;V	59.89 (182)	48.79 (248)	75.82	67.74
2;IPFV;PL;PST;V	-	0.81 (247)	-	2.02
2;PL;PST;SBJV;V	-	0.00 (247)	-	0
3;IPFV;PST;SG;V	77.49 (191)	68.83 (247)	93.19	90.69
3;PFV;PL;PST;V	78.67 (150)	67.34 (248)	98.00	96.37
2;FUT;PL;V	0.00 (5)	17.34 (248)	0.00	27.82
1;PFV;PL;PST;V	0.00 (1)	10.08 (248)	0.00	13.71
2;PFV;PST;SG;V	-	0.00 (248)	-	0
1;COND;PL;V	66.67 (6)	60.89 (248)	83.33	80.24
3;PL;PRS;SBJV;V	43.85 (130)	28.34 (247)	55.38	38.06
3;PRS;SG;V	67.83 (230)	64.52 (248)	77.39	72.98
2;PL;PRS;V	2.17 (46)	4.47 (246)	4.35	8.54
3;FUT;PL;V	79.35 (92)	67.34 (248)	94.57	91.94
3;IMP;POS;SG;V	32.10 (162)	21.86 (247)	40.74	28.74
3;FUT;SG;V	83.97 (131)	75.00 (248)	96.95	95.56
1;FUT;SG;V	70.00 (30)	59.68 (248)	80.00	75
2;PL;PRS;SBJV;V	0.00 (39)	5.26 (247)	2.56	8.91
2;COND;SG;V	0.00 (2)	16.13 (248)	50.00	23.79
2;PRS;SG;V	43.18 (88)	31.17 (247)	55.68	41.3
2;PRS;SBJV;SG;V	8.70 (46)	2.43 (247)	17.39	3.64
N;SG	77.25 (1266)	76.53 (1278)	94.31	94.21
N;PL	74.51 (1079)	72.60 (1175)	93.51	93.28

Table 61: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Catalan–Spanish language pair (the grey numbers correspond to the dictionary sizes).

		French–Catalan		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	39.68 (7845)	22.56 (16992)	75.22	47.37
N;SG	50.09 (1643)	48.99 (1682)	85.82	85.37
N;PL	47.99 (1440)	46.20 (1593)	90.90	90.02
ADJ;FEM;PL	55.73 (393)	54.59 (403)	97.71	97.77
ADJ;FEM;SG	28.37 (416)	27.70 (426)	77.16	76.29
ADJ;MASC;PL	56.58 (403)	54.21 (428)	97.27	96.96
ADJ;MASC;SG	45.56 (417)	44.24 (434)	89.45	88.25
1;PL;PRS;SBJV;V	13.64 (44)	3.69 (379)	25.00	11.87
3;PRS;SG;V	35.36 (362)	34.64 (384)	51.38	50.26
3;PST;SBJV;SG;V	15.66 (83)	8.66 (381)	33.73	19.69
1;PST;SBJV;SG;V	9.09 (22)	0.79 (380)	13.64	1.84
1;PL;PRS;V	14.39 (139)	8.16 (380)	36.69	17.89
2;PRS;SBJV;SG;V	24.30 (107)	14.74 (380)	35.51	22.11
2;FUT;SG;V	4.35 (23)	4.97 (382)	13.04	9.69
3;IPFV;PL;PST;V	45.88 (255)	38.58 (381)	94.51	94.75
1;PFV;PST;SG;V	0.00 (47)	2.88 (382)	4.26	5.5
3;PFV;PST;SG;V	29.86 (288)	24.80 (383)	44.79	36.55
2;COND;PL;V	0.00 (5)	10.79 (380)	0.00	39.21
NFIN;V	45.68 (370)	45.05 (384)	90.81	86.46
2;PFV;PL;PST;V	-	0.00 (380)	-	0.26
3;PFV;PL;PST;V	42.49 (233)	32.28 (381)	93.56	94.75
1;PRS;SBJV;SG;V	32.37 (312)	31.58 (380)	48.08	47.37
1;IMP;PL;POS;V	14.71 (136)	8.16 (380)	37.50	17.89
3;COND;PL;V	42.74 (117)	26.25 (381)	75.21	71.13
2;IPFV;PST;SG;V	16.67 (30)	6.02 (382)	26.67	9.42
1;PFV;PL;PST;V	0.00 (2)	1.32 (380)	0.00	4.74
3;COND;SG;V	27.81 (187)	19.58 (383)	45.99	34.46
2;PRS;SG;V	24.32 (185)	16.19 (383)	37.30	26.37
1;FUT;PL;V	21.74 (46)	17.37 (380)	34.78	40.79
1;COND;PL;V	20.00 (5)	21.58 (380)	80.00	59.47
2;PST;SBJV;SG;V	0.00 (3)	0.26 (380)	33.33	1.05
3;FUT;PL;V	39.49 (157)	31.23 (381)	71.34	77.17
2;PL;PRS;V	9.63 (135)	9.47 (380)	31.85	20.79
2;PL;PST;SBJV;V	0.00 (1)	0.00 (379)	100.00	3.43
2;IMP;PL;POS;V	9.63 (135)	9.47 (380)	31.85	20.79
1;IPFV;PST;SG;V	7.87 (89)	6.02 (382)	16.85	9.42
2;PL;PRS;SBJV;V	13.89 (36)	6.07 (379)	41.67	19
1;FUT;SG;V	21.43 (70)	19.90 (382)	48.57	49.48
3;PL;PRS;SBJV;V	40.38 (265)	36.05 (380)	83.40	75.26
3;PL;PST;SBJV;V	28.57 (28)	2.89 (380)	53.57	10.53
3;IPFV;PST;SG;V	43.84 (292)	38.38 (383)	80.48	77.02
2;PFV;PST;SG;V	-	2.36 (382)	-	14.66
2;IPFV;PL;PST;V	0.00 (3)	6.05 (380)	33.33	18.95
2;IMP;POS;SG;V	31.46 (356)	30.89 (382)	48.03	47.91
1;COND;SG;V	0.00 (67)	0.26 (382)	4.48	0.52
3;PRS;SBJV;SG;V	32.27 (313)	31.50 (381)	48.24	47.51
3;PL;PRS;V	38.91 (329)	36.22 (381)	81.76	75.85
2;COND;SG;V	0.00 (17)	0.26 (382)	0.00	0.52
1;PRS;SG;V	30.65 (261)	30.81 (383)	47.89	48.04
1;PL;PST;SBJV;V	0.00 (1)	0.26 (379)	0.00	1.06
1;IPFV;PL;PST;V	5.26 (19)	3.95 (380)	15.79	11.84
3;FUT;SG;V	48.25 (228)	39.43 (383)	82.02	83.29
2;FUT;PL;V	4.76 (21)	3.95 (380)	4.76	7.89

Table 62: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the French–Catalan language pair (the grey numbers correspond to the dictionary sizes).

	French–Italian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	48.02 (9891)	26.83 (22052)	80.00	51.09
N;PL	50.80 (1943)	46.69 (2281)	86.88	84
N;SG	57.29 (2388)	55.48 (2491)	89.91	89.28
1;PFV;PL;PST;V	33.33 (3)	0.21 (477)	33.33	1.89
1;IMP;PL;POS;V	30.06 (163)	13.90 (482)	60.12	37.14
2;PL;PRS;V	2.55 (196)	1.04 (481)	5.10	2.49
3;PRS;SBJV;SG;V	45.09 (397)	41.94 (484)	62.97	56.4
1;PST;SBJV;SG;V	45.45 (11)	3.14 (477)	45.45	5.03
1;PL;PST;SBJV;V	66.67 (3)	0.42 (476)	100.00	3.78
2;COND;PL;V	0.00 (4)	0.21 (480)	0.00	1.04
NFIN;V	51.95 (462)	50.10 (485)	94.37	91.75
3;IPFV;PST;SG;V	50.91 (330)	44.74 (485)	84.55	76.08
2;PRS;SG;V	22.27 (256)	13.69 (482)	37.50	21.16
2;PFV;PST;SG;V	15.00 (20)	1.67 (478)	20.00	5.02
1;FUT;PL;V	31.71 (41)	18.75 (480)	53.66	46.67
2;PST;SBJV;SG;V	-	0.21 (477)	-	1.68
2;FUT;PL;V	13.04 (23)	2.50 (480)	17.39	8.33
2;COND;SG;V	29.73 (37)	19.13 (481)	59.46	62.37
3;FUT;SG;V	46.24 (266)	38.64 (484)	85.34	79.96
2;IPFV;PL;PST;V	0.00 (15)	0.00 (481)	0.00	0.42
1;IPFV;PL;PST;V	13.04 (23)	5.82 (481)	26.09	21.62
3;PFV;PST;SG;V	38.29 (363)	30.98 (481)	61.98	51.35
2;IMP;POS;SG;V	44.19 (430)	40.46 (482)	62.56	56.22
1;COND;PL;V	0.00 (5)	9.79 (480)	20.00	37.5
3;PL;PRS;V	46.91 (405)	41.91 (482)	78.77	68.88
1;COND;SG;V	23.94 (71)	19.13 (481)	63.38	62.58
2;IPFV;PST;SG;V	20.00 (45)	19.92 (482)	28.89	35.68
3;COND;PL;V	27.19 (114)	25.16 (481)	50.88	74.01
1;PRS;SBJV;SG;V	45.06 (395)	41.79 (481)	63.04	56.34
3;IPFV;PL;PST;V	52.55 (274)	44.61 (482)	95.62	95.44
2;PFV;PL;PST;V	-	0.42 (477)	-	0.84
1;PRS;SG;V	43.54 (379)	40.87 (482)	62.01	56.64
3;COND;SG;V	27.03 (185)	23.14 (484)	54.59	69.21
1;IPFV;PST;SG;V	17.81 (73)	19.92 (482)	31.51	35.68
2;PL;PST;SBJV;V	0.00 (1)	0.00 (476)	0.00	0.21
2;PL;PRS;SBJV;V	0.00 (29)	0.00 (480)	0.00	0.42
1;FUT;SG;V	18.89 (90)	16.22 (481)	42.22	39.5
2;FUT;SG;V	0.00 (23)	2.29 (481)	21.74	11.23
3;PST;SBJV;SG;V	21.74 (69)	17.08 (480)	43.48	32.71
1;PFV;PST;SG;V	13.95 (43)	16.11 (478)	25.58	22.59
3;PFV;PL;PST;V	48.09 (262)	37.03 (478)	97.33	97.91
3;PRS;SG;V	47.35 (452)	44.54 (485)	65.27	60.62
2;IMP;PL;POS;V	2.55 (196)	1.04 (482)	5.10	2.7
3;PL;PST;SBJV;V	55.00 (20)	4.40 (477)	65.00	9.64
1;PL;PRS;V	30.06 (163)	13.93 (481)	60.12	37.21
1;PL;PRS;SBJV;V	12.50 (40)	5.83 (480)	30.00	21.88
3;FUT;PL;V	49.42 (172)	37.01 (481)	95.93	97.92
2;PRS;SBJV;SG;V	23.74 (219)	12.47 (481)	37.44	18.5
3;PL;PRS;SBJV;V	47.90 (309)	41.79 (481)	78.64	68.81
ADJ;MASC;PL	66.27 (501)	64.44 (523)	94.61	94.65
ADJ;MASC;SG	64.40 (514)	63.00 (527)	95.33	94.88
ADJ;FEM;SG	63.28 (512)	62.36 (518)	93.75	93.44
ADJ;FEM;PL	62.12 (491)	61.72 (499)	95.93	95.79

Table 63: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the French–Italian language pair (the grey numbers correspond to the dictionary sizes).

	French–Portuguese			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	47.04 (8930)	29.48 (17536)	76.84	53.18
ADJ;MASC;SG	61.21 (495)	59.76 (507)	93.33	93.1
ADJ;FEM;PL	62.55 (470)	61.25 (480)	98.72	98.33
ADJ;FEM;SG	62.60 (492)	62.10 (496)	94.31	93.95
ADJ;MASC;PL	63.81 (478)	60.68 (501)	97.28	97.01
N;SG	51.88 (2151)	50.50 (2222)	86.15	85.28
N;PL	52.07 (1786)	49.19 (2039)	89.14	87.94
3;FUT;PL;V	41.67 (132)	34.02 (438)	63.64	77.4
3;IPFV;PST;SG;V	50.81 (309)	42.95 (440)	81.88	77.5
NFIN;V	57.58 (422)	54.65 (441)	91.94	87.76
2;PRS;SBJV;SG;V	28.06 (139)	24.31 (436)	41.73	36.7
2;IMP;PL;POS;V	0.76 (132)	0.92 (436)	0.76	1.15
2;FUT;SG;V	0.00 (19)	12.13 (437)	5.26	23.57
2;PL;PRS;SBJV;V	0.00 (12)	0.23 (436)	0.00	0.69
1;PL;PRS;V	37.41 (139)	20.37 (437)	63.31	37.53
3;PFV;PST;SG;V	36.12 (335)	28.90 (436)	49.25	41.28
2;PFV;PST;SG;V	8.70 (23)	0.92 (434)	17.39	1.84
2;FUT;PL;V	0.00 (13)	0.00 (437)	0.00	0
2;COND;SG;V	3.12 (32)	0.46 (437)	3.12	1.14
3;PL;PRS;SBJV;V	51.34 (298)	43.02 (437)	77.18	69.57
1;IPFV;PL;PST;V	11.11 (27)	4.81 (437)	25.93	13.27
3;PRS;SG;V	38.61 (417)	37.05 (440)	53.24	50.91
2;PL;PRS;V	1.27 (79)	0.92 (437)	1.27	1.14
1;PFV;PL;PST;V	33.33 (6)	3.46 (434)	66.67	14.06
1;IPFV;PST;SG;V	7.69 (91)	7.32 (437)	13.19	11.9
1;PL;PRS;SBJV;V	15.62 (32)	4.82 (436)	28.12	13.3
1;PRS;SBJV;SG;V	35.56 (374)	32.57 (436)	49.73	46.56
1;COND;PL;V	20.00 (5)	16.93 (437)	20.00	39.13
3;COND;PL;V	44.64 (112)	26.26 (438)	72.32	63.47
3;PFV;PL;PST;V	51.01 (247)	35.02 (434)	84.21	77.65
2;PRS;SG;V	29.50 (200)	26.32 (437)	44.00	39.59
3;FUT;SG;V	38.92 (203)	35.91 (440)	58.62	66.14
1;FUT;PL;V	36.11 (36)	27.92 (437)	38.89	53.09
3;COND;SG;V	29.69 (192)	18.86 (440)	40.10	27.05
1;IMP;PL;POS;V	41.30 (92)	20.41 (436)	60.87	37.61
2;PFV;PL;PST;V	0.00 (2)	0.00 (434)	0.00	1.38
2;IMP;POS;SG;V	36.10 (410)	34.63 (436)	51.71	48.62
3;PL;PRS;V	48.90 (362)	42.92 (438)	76.80	69.63
1;PRS;SG;V	36.16 (354)	34.55 (437)	51.41	48.51
3;PRS;SBJV;SG;V	35.81 (377)	32.80 (439)	49.87	46.7
2;IPFV;PST;SG;V	5.88 (34)	7.32 (437)	8.82	11.9
1;COND;SG;V	1.33 (75)	0.46 (437)	4.00	1.14
1;FUT;SG;V	43.66 (71)	37.30 (437)	73.24	80.78
2;IPFV;PL;PST;V	0.00 (26)	0.23 (437)	0.00	0.69
3;IPFV;PL;PST;V	54.65 (269)	43.61 (438)	94.80	95.89
1;PFV;PST;SG;V	5.66 (53)	2.76 (434)	15.09	6.68
2;COND;PL;V	-	0.00 (437)	-	0

Table 64: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the French–Portuguese language pair (the grey numbers correspond to the dictionary sizes).

| | French–Spanish | | | |
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	48.40 (9770)	27.15 (21087)	79.30	49.31
N;PL	53.92 (1873)	50.37 (2154)	88.41	87.51
N;SG	55.62 (2242)	54.13 (2311)	88.63	88.1
1;PFV;PST;SG;V	5.26 (57)	1.76 (455)	7.02	4.4
2;COND;SG;V	9.30 (43)	0.66 (455)	13.95	1.32
3;FUT;PL;V	50.29 (173)	38.38 (456)	85.55	86.62
1;PRS;SBJV;SG;V	39.64 (386)	36.26 (455)	51.30	47.03
2;COND;PL;V	0.00 (2)	3.96 (455)	0.00	7.91
2;PL;PRS;SBJV;V	0.00 (34)	0.00 (455)	2.94	1.76
1;FUT;PL;V	42.86 (42)	25.93 (455)	66.67	56.04
2;PRS;SG;V	35.27 (224)	24.84 (455)	47.77	40.44
3;COND;SG;V	46.67 (210)	35.01 (457)	76.19	63.89
2;IMP;PL;POS;V	1.54 (130)	1.54 (455)	1.54	2.42
1;COND;PL;V	0.00 (12)	6.37 (455)	16.67	24.62
3;PRS;SBJV;SG;V	39.69 (388)	36.32 (457)	51.29	47.05
3;IPFV;PL;PST;V	56.46 (271)	44.52 (456)	98.15	96.93
1;FUT;SG;V	48.28 (87)	32.31 (455)	70.11	62.2
2;PL;PST;SBJV;V	-	0.00 (455)	-	0.22
2;PL;PRS;V	0.00 (91)	1.54 (455)	0.00	2.42
2;FUT;SG;V	9.38 (32)	4.62 (455)	12.50	9.89
3;PL;PRS;V	46.51 (387)	42.11 (456)	73.39	69.3
1;PL;PST;SBJV;V	-	0.44 (455)	-	1.54
2;IPFV;PST;SG;V	18.00 (50)	10.99 (455)	20.00	14.07
2;FUT;PL;V	6.67 (15)	6.81 (455)	6.67	14.95
NFIN;V	50.11 (437)	48.58 (457)	91.30	87.75
3;PL;PST;SBJV;V	34.62 (26)	2.85 (456)	57.69	6.58
2;PFV;PST;SG;V	11.11 (45)	1.32 (455)	11.11	2.64
3;FUT;SG;V	50.57 (263)	40.92 (457)	77.57	74.84
3;IPFV;PST;SG;V	55.99 (334)	47.05 (457)	89.22	83.15
2;PFV;PL;PST;V	0.00 (1)	0.00 (455)	0.00	0
2;PRS;SBJV;SG;V	36.07 (183)	23.30 (455)	52.46	37.8
1;PL;PRS;V	30.13 (156)	16.92 (455)	58.97	34.73
1;PL;PRS;SBJV;V	23.08 (39)	3.74 (455)	25.64	9.45
3;PST;SBJV;SG;V	4.76 (63)	7.66 (457)	11.11	16.41
1;IPFV;PST;SG;V	11.49 (87)	10.99 (455)	18.39	14.07
2;IMP;POS;SG;V	39.34 (427)	36.70 (455)	50.35	47.47
1;IPFV;PL;PST;V	24.14 (29)	3.74 (455)	24.14	9.45
2;IPFV;PL;PST;V	0.00 (7)	0.00 (455)	14.29	1.76
1;IMP;PL;POS;V	31.65 (139)	16.92 (455)	58.99	34.73
1;PST;SBJV;SG;V	10.00 (20)	2.42 (455)	15.00	5.27
3;PFV;PL;PST;V	47.60 (250)	37.50 (456)	92.00	90.13
3;PFV;PST;SG;V	34.08 (358)	28.88 (457)	48.88	42.01
2;PST;SBJV;SG;V	0.00 (3)	3.96 (455)	0.00	6.37
1;COND;SG;V	5.06 (79)	0.66 (455)	10.13	1.32
1;PFV;PL;PST;V	40.00 (5)	1.32 (455)	40.00	3.08
3;COND;PL;V	50.86 (116)	32.24 (456)	93.10	85.53
1;PRS;SG;V	39.65 (401)	36.70 (455)	51.12	47.47
3;PL;PRS;SBJV;V	48.46 (357)	41.89 (456)	75.07	69.08
3;PRS;SG;V	42.30 (435)	40.48 (457)	54.02	50.77
ADJ;FEM;SG	58.82 (578)	58.22 (584)	92.04	91.95
ADJ;MASC;PL	61.70 (564)	59.25 (589)	96.63	96.6
ADJ;MASC;SG	62.56 (577)	60.88 (593)	93.76	93.42
ADJ;FEM;PL	61.65 (558)	60.32 (567)	97.67	97.71

Table 65: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the French–Spanish language pair (the grey numbers correspond to the dictionary sizes).

		Italian–Catalan		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	35.20 (9035)	17.79 (22636)	73.15	45.1
N;SG	43.29 (2153)	41.35 (2278)	82.68	81.65
N;PL	41.98 (1665)	37.72 (1983)	88.11	86.28
2;FUT;SG;V	5.56 (18)	2.33 (473)	5.56	7.82
1;COND;PL;V	44.44 (9)	20.08 (473)	88.89	75.69
3;PFV;PST;SG;V	25.38 (327)	19.45 (473)	44.34	35.94
3;IMP;PL;POS;V	20.25 (158)	9.96 (472)	28.48	18.64
1;PRS;SBJV;SG;V	27.14 (269)	18.82 (473)	43.49	30.87
2;FUT;PL;V	0.00 (13)	1.90 (473)	0.00	4.44
1;IPFV;PL;PST;V	11.11 (9)	4.22 (474)	33.33	27
3;PRS;SBJV;SG;V	27.14 (269)	18.82 (473)	43.49	30.87
1;PL;PST;SBJV;V	0.00 (7)	3.81 (473)	0.00	17.76
2;PL;PST;SBJV;V	0.00 (1)	0.00 (473)	0.00	2.54
1;PRS;SG;V	22.69 (216)	14.80 (473)	40.74	23.26
1;PL;PRS;SBJV;V	22.43 (107)	4.66 (472)	45.79	12.5
2;PFV;PST;SG;V	-	0.63 (473)	-	1.9
2;COND;SG;V	0.00 (5)	0.00 (473)	0.00	0.42
3;IPFV;PST;SG;V	41.95 (298)	32.49 (474)	80.87	74.47
1;PL;PRS;V	22.22 (108)	4.66 (472)	46.30	12.5
2;IPFV;PST;SG;V	0.00 (3)	2.53 (474)	0.00	4.85
2;IPFV;PL;PST;V	0.00 (1)	0.00 (474)	0.00	0.42
3;COND;PL;V	10.71 (56)	5.92 (473)	39.29	49.05
2;PFV;PL;PST;V	-	0.00 (473)	-	2.54
3;FUT;PL;V	37.50 (112)	20.51 (473)	83.93	88.79
3;FUT;SG;V	41.58 (190)	30.44 (473)	92.11	94.71
2;COND;PL;V	50.00 (2)	8.25 (473)	50.00	29.6
1;FUT;SG;V	35.90 (39)	15.43 (473)	58.97	40.59
NFIN;V	40.52 (427)	37.13 (474)	92.04	85.86
3;IMP;POS;SG;V	27.24 (268)	18.86 (472)	43.66	30.93
3;PL;PRS;SBJV;V	20.13 (159)	9.94 (473)	28.30	18.6
1;PFV;PST;SG;V	2.38 (42)	2.96 (473)	7.14	4.02
3;PFV;PL;PST;V	36.86 (255)	30.23 (473)	93.33	93.23
2;IMP;PL;POS;V	1.10 (181)	1.48 (473)	2.76	2.96
3;PL;PRS;V	32.57 (350)	25.16 (473)	72.29	60.04
2;PST;SBJV;SG;V	22.22 (9)	2.11 (473)	22.22	5.07
2;IMP;POS;SG;V	29.64 (361)	22.83 (473)	46.81	35.94
2;PRS;SG;V	22.68 (194)	14.16 (473)	38.14	23.68
3;IPFV;PL;PST;V	45.16 (248)	32.07 (474)	93.15	94.73
3;PST;SBJV;SG;V	24.42 (172)	14.38 (473)	40.70	32.77
1;IPFV;PST;SG;V	16.28 (43)	5.70 (474)	27.91	12.24
1;COND;SG;V	0.00 (53)	0.21 (473)	3.77	0.21
2;PL;PRS;V	1.10 (182)	1.48 (473)	3.30	3.17
3;COND;SG;V	8.62 (116)	4.65 (473)	33.62	13.53
1;IMP;PL;POS;V	22.64 (106)	4.66 (472)	45.28	12.5
3;PRS;SG;V	33.33 (420)	30.17 (474)	53.33	48.95
2;PRS;SBJV;SG;V	29.17 (144)	18.82 (473)	50.00	30.87
1;PFV;PL;PST;V	0.00 (2)	1.06 (473)	0.00	1.48
2;PL;PRS;SBJV;V	0.00 (31)	0.21 (472)	0.00	1.06
1;PST;SBJV;SG;V	8.00 (25)	2.11 (473)	16.00	5.07
3;PL;PST;SBJV;V	36.75 (117)	21.35 (473)	79.49	85.62
1;FUT;PL;V	40.00 (35)	19.66 (473)	51.43	57.29
ADJ;MASC;SG	48.32 (416)	46.45 (437)	93.03	92.68
ADJ;MASC;PL	51.74 (402)	49.05 (422)	93.28	93.13
ADJ;FEM;SG	21.50 (414)	21.09 (422)	76.81	76.54
ADJ;FEM;PL	50.66 (381)	50.13 (385)	94.23	93.51

Table 66: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Italian–Catalan language pair (the grey numbers correspond to the dictionary sizes).

| | Italian–French | | | |
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	40.01 (12595)	20.75 (31419)	76.20	49.39
N;SG	48.04 (3106)	44.80 (3355)	86.67	85.31
N;PL	48.91 (2333)	43.00 (2928)	89.84	87.67
3;PL;PST;SBJV;V	0.00 (74)	0.00 (645)	0.00	0
1;PL;PST;SBJV;V	0.00 (2)	0.00 (643)	0.00	0
1;FUT;PL;V	12.12 (33)	12.75 (643)	33.33	48.21
1;COND;PL;V	0.00 (9)	4.67 (643)	0.00	25.35
3;PL;PRS;V	41.44 (473)	33.49 (645)	82.66	70.08
1;COND;SG;V	33.85 (65)	23.64 (643)	78.46	85.23
1;PL;PRS;V	16.34 (153)	8.63 (637)	47.06	24.18
3;PFV;PST;SG;V	26.34 (448)	19.66 (646)	47.54	35.91
2;PFV;PST;SG;V	14.29 (7)	2.18 (643)	14.29	4.82
NFIN;V	45.03 (573)	40.40 (646)	91.97	87.77
2;IMP;POS;SG;V	27.10 (487)	21.46 (643)	44.97	34.68
1;PRS;SG;V	22.64 (371)	14.31 (643)	38.01	23.02
1;IMP;PL;POS;V	16.34 (153)	8.63 (637)	47.06	24.18
3;PL;PRS;SBJV;V	13.64 (220)	6.52 (644)	30.00	16.46
1;FUT;SG;V	41.18 (68)	20.22 (643)	83.82	62.21
2;IMP;PL;POS;V	1.98 (353)	1.56 (643)	6.80	5.13
1;PRS;SBJV;SG;V	29.02 (417)	20.72 (642)	44.36	35.05
2;PFV;PL;PST;V	0.00 (3)	0.47 (643)	0.00	5.13
3;COND;PL;V	50.68 (73)	23.88 (645)	97.26	99.07
3;COND;SG;V	48.76 (121)	26.47 (646)	95.04	92.11
3;FUT;SG;V	40.00 (265)	27.40 (646)	82.26	68.58
2;PST;SBJV;SG;V	0.00 (3)	1.56 (643)	0.00	4.35
3;PRS;SBJV;SG;V	29.05 (420)	20.78 (645)	44.29	35.04
2;FUT;SG;V	0.00 (18)	0.31 (643)	0.00	1.71
1;PL;PRS;SBJV;V	13.76 (109)	8.63 (637)	51.38	24.18
2;COND;SG;V	43.75 (16)	20.84 (643)	75.00	74.34
2;IPFV;PL;PST;V	-	0.16 (643)	-	0.47
2;PRS;SG;V	29.66 (354)	19.00 (642)	45.48	32.24
3;IPFV;PST;SG;V	43.12 (385)	33.90 (646)	83.90	78.79
3;FUT;PL;V	46.41 (153)	22.48 (645)	99.35	99.07
3;PFV;PL;PST;V	36.36 (352)	28.99 (645)	95.74	96.43
2;PRS;SBJV;SG;V	30.25 (367)	20.72 (642)	45.78	35.05
1;IPFV;PL;PST;V	0.00 (9)	0.47 (643)	0.00	0.93
2;IPFV;PST;SG;V	13.64 (22)	2.02 (643)	22.73	6.84
2;COND;PL;V	0.00 (6)	0.62 (643)	0.00	5.29
2;FUT;PL;V	16.67 (12)	6.22 (643)	25.00	17.11
1;PFV;PST;SG;V	17.46 (63)	8.55 (643)	23.81	14.15
3;PRS;SG;V	31.10 (566)	28.17 (646)	51.59	44.89
2;PL;PRS;SBJV;V	0.00 (29)	0.31 (637)	0.00	1.88
1;PST;SBJV;SG;V	0.00 (8)	1.56 (643)	0.00	4.35
1;IPFV;PST;SG;V	26.83 (41)	11.51 (643)	29.27	24.26
2;PL;PRS;V	2.27 (353)	1.71 (643)	7.08	5.13
2;PL;PST;SBJV;V	0.00 (2)	0.47 (643)	0.00	5.13
1;PFV;PL;PST;V	0.00 (8)	0.62 (643)	12.50	2.8
3;PST;SBJV;SG;V	1.13 (177)	4.33 (646)	2.82	13.93
3;IPFV;PL;PST;V	43.83 (324)	32.87 (645)	97.84	95.81
ADJ;FEM;SG	53.09 (631)	52.01 (646)	93.82	93.65
ADJ;MASC;SG	54.39 (638)	52.23 (672)	92.32	92.26
ADJ;FEM;PL	55.69 (598)	55.41 (601)	94.65	94.18
ADJ;MASC;PL	56.93 (606)	54.57 (645)	94.06	93.18

Table 67: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Italian–French language pair (the grey numbers correspond to the dictionary sizes).

	Italian–Portuguese			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	42.35 (10072)	20.51 (25704)	76.68	47
N;PL	46.49 (1968)	40.58 (2452)	86.38	85.32
N;SG	46.72 (2650)	43.75 (2846)	84.98	84.12
2;COND;SG;V	0.00 (4)	0.00 (586)	0.00	0
1;PL;PRS;V	28.57 (112)	10.71 (579)	57.14	25.91
1;FUT;PL;V	53.85 (26)	22.01 (586)	69.23	73.72
3;PRS;SBJV;SG;V	23.64 (313)	16.21 (586)	38.02	25.6
1;IPFV;PST;SG;V	15.79 (38)	7.33 (587)	15.79	12.61
3;IMP;PL;POS;V	14.20 (162)	6.14 (586)	24.07	15.19
3;PRS;SG;V	38.41 (479)	32.03 (587)	56.37	47.19
3;COND;SG;V	15.32 (111)	4.61 (586)	29.73	10.75
3;IMP;POS;SG;V	23.64 (313)	16.21 (586)	38.02	25.6
1;PRS;SG;V	28.93 (280)	18.29 (585)	41.07	26.5
1;COND;PL;V	33.33 (12)	14.85 (586)	33.33	43.69
3;IPFV;PST;SG;V	50.00 (312)	34.41 (587)	79.81	75.3
3;PL;PRS;SBJV;V	14.20 (162)	6.14 (586)	24.07	15.19
3;PFV;PL;PST;V	50.68 (292)	31.69 (587)	95.21	90.8
1;IPFV;PL;PST;V	50.00 (8)	10.90 (587)	62.50	49.91
1;PL;PRS;SBJV;V	32.20 (59)	10.71 (579)	55.93	25.91
2;IPFV;PL;PST;V	0.00 (3)	0.00 (587)	0.00	1.36
1;COND;SG;V	0.00 (69)	0.00 (586)	0.00	0
2;PRS;SBJV;SG;V	24.38 (201)	16.21 (586)	40.80	25.6
3;FUT;SG;V	43.93 (173)	29.01 (586)	83.24	87.37
3;PFV;PST;SG;V	39.64 (386)	27.77 (587)	64.25	51.96
1;PRS;SBJV;SG;V	23.64 (313)	16.21 (586)	38.02	25.6
3;FUT;PL;V	33.70 (92)	14.68 (586)	92.39	94.71
3;COND;PL;V	22.03 (59)	7.17 (586)	52.54	37.03
1;PFV;PST;SG;V	10.17 (59)	1.36 (587)	16.95	3.58
2;FUT;SG;V	0.00 (14)	4.10 (586)	0.00	11.43
2;IMP;POS;SG;V	33.94 (436)	26.24 (587)	50.23	38.33
3;PL;PRS;V	43.20 (375)	32.03 (587)	74.67	62.52
2;PL;PRS;SBJV;V	20.00 (5)	0.52 (579)	20.00	0.86
2;PFV;PL;PST;V	0.00 (3)	0.17 (586)	0.00	3.07
NFIN;V	46.25 (493)	40.89 (587)	93.91	85.86
2;COND;PL;V	-	0.00 (586)	-	0.34
3;IPFV;PL;PST;V	55.92 (245)	34.58 (587)	94.69	95.23
2;PFV;PST;SG;V	28.57 (7)	0.85 (586)	28.57	1.71
1;IMP;PL;POS;V	32.20 (59)	10.71 (579)	55.93	25.91
2;IMP;PL;POS;V	3.38 (148)	2.21 (587)	4.05	2.73
1;FUT;SG;V	44.19 (43)	22.35 (586)	72.09	72.7
2;IPFV;PST;SG;V	0.00 (4)	2.04 (587)	0.00	3.41
2;PRS;SG;V	21.17 (222)	14.70 (585)	34.23	22.91
2;PL;PRS;V	7.35 (68)	2.21 (587)	8.82	2.73
1;PFV;PL;PST;V	10.00 (10)	0.85 (586)	10.00	3.75
2;FUT;PL;V	0.00 (8)	0.00 (586)	0.00	0.17
ADJ;MASC;SG	54.70 (532)	52.60 (557)	93.23	92.1
ADJ;MASC;PL	55.58 (502)	52.90 (535)	94.22	94.02
ADJ;FEM;SG	55.07 (523)	54.14 (532)	95.03	94.55
ADJ;FEM;PL	57.32 (485)	55.56 (495)	95.26	94.75

Table 68: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Italian–Portuguese language pair (the grey numbers correspond to the dictionary sizes).

	Italian–Spanish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	42.60 (11685)	20.98 (30686)	76.19	47.58
N;SG	48.58 (2756)	45.36 (2965)	86.79	85.43
N;PL	45.98 (2092)	40.84 (2588)	85.80	84.62
ADJ;FEM;SG	56.21 (596)	55.30 (604)	93.62	93.54
ADJ;MASC;SG	53.69 (609)	51.66 (633)	91.95	91.79
ADJ;MASC;PL	56.09 (583)	53.97 (617)	94.17	93.68
ADJ;FEM;PL	56.54 (566)	56.57 (571)	91.52	91.59
1;PFV;PL;PST;V	0.00 (14)	4.82 (643)	7.14	8.86
2;IPFV;PST;SG;V	11.11 (9)	2.48 (644)	22.22	5.9
3;PFV;PST;SG;V	37.56 (426)	28.26 (644)	63.15	52.48
3;PL;PRS;V	47.06 (442)	36.02 (644)	73.30	60.71
1;FUT;PL;V	51.52 (33)	20.96 (644)	81.82	64.13
1;PL;PRS;V	36.03 (136)	18.52 (637)	80.15	51.33
2;PFV;PL;PST;V	0.00 (1)	0.00 (643)	0.00	0.47
3;IPFV;PST;SG;V	57.26 (365)	40.31 (645)	86.30	81.86
2;PL;PRS;V	4.81 (104)	1.71 (644)	4.81	2.95
1;COND;PL;V	44.44 (9)	19.57 (644)	77.78	80.43
3;FUT;PL;V	53.47 (144)	23.76 (644)	97.92	96.74
1;IPFV;PL;PST;V	62.50 (8)	15.37 (644)	100.00	64.6
3;PRS;SG;V	40.18 (550)	35.04 (645)	59.82	49.92
3;COND;SG;V	16.24 (117)	5.58 (645)	41.88	11.32
2;PL;PST;SBJV;V	-	0.00 (644)	-	0.47
1;FUT;SG;V	46.77 (62)	22.05 (644)	70.97	47.67
1;PFV;PST;SG;V	3.39 (59)	0.93 (643)	5.08	2.18
3;PRS;SBJV;SG;V	28.85 (409)	22.52 (644)	43.52	34.94
1;PRS;SBJV;SG;V	28.68 (408)	22.40 (643)	43.38	34.84
3;PL;PRS;SBJV;V	17.09 (199)	8.40 (643)	28.14	15.4
1;PRS;SG;V	30.62 (369)	21.12 (644)	46.34	31.83
3;IMP;POS;SG;V	28.85 (409)	22.55 (643)	43.52	34.99
1;PL;PRS;SBJV;V	37.07 (116)	18.52 (637)	79.31	51.33
2;IMP;PL;POS;V	3.35 (179)	1.67 (659)	4.47	2.88
3;FUT;SG;V	52.26 (243)	31.94 (645)	93.42	92.87
2;FUT;PL;V	33.33 (6)	7.45 (644)	50.00	25.31
1;PL;PST;SBJV;V	0.00 (7)	1.71 (644)	0.00	10.56
3;IMP;PL;POS;V	17.17 (198)	8.41 (642)	28.28	15.42
3;PL;PST;SBJV;V	1.52 (132)	4.97 (644)	6.06	21.43
3;IPFV;PL;PST;V	60.55 (289)	36.80 (644)	98.27	97.36
2;PST;SBJV;SG;V	0.00 (10)	2.95 (644)	0.00	5.75
3;PFV;PL;PST;V	51.78 (338)	36.08 (643)	97.04	93.62
NFIN;V	45.27 (581)	40.70 (661)	92.25	86.99
3;COND;PL;V	24.59 (61)	9.32 (644)	57.38	46.89
2;PFV;PST;SG;V	0.00 (1)	0.16 (643)	0.00	1.09
1;IMP;PL;POS;V	36.21 (116)	17.94 (652)	79.31	52.3
1;IPFV;PST;SG;V	12.50 (40)	6.83 (644)	12.50	11.96
2;PRS;SG;V	25.38 (331)	18.85 (642)	39.58	29.6
1;PST;SBJV;SG;V	0.00 (26)	2.95 (644)	0.00	5.75
2;PL;PRS;SBJV;V	0.00 (14)	0.00 (637)	0.00	0.31
2;IMP;POS;SG;V	35.92 (490)	27.92 (659)	54.29	40.06
2;IPFV;PL;PST;V	0.00 (1)	0.47 (644)	0.00	0.78
2;COND;SG;V	16.67 (6)	0.62 (644)	33.33	2.17
2;COND;PL;V	0.00 (1)	2.33 (644)	0.00	14.75
1;COND;SG;V	1.54 (65)	0.00 (644)	1.54	0.16
3;PST;SBJV;SG;V	13.20 (197)	11.32 (645)	23.86	28.37
2;PRS;SBJV;SG;V	30.77 (338)	22.40 (643)	46.15	34.84
2;FUT;SG;V	30.00 (20)	12.58 (644)	50.00	36.96

Table 69: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Italian–Spanish language pair (the grey numbers correspond to the dictionary sizes).

	Portuguese–Catalan			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	48.09 (7199)	28.12 (16059)	78.39	51.02
N;SG	53.63 (1527)	51.75 (1598)	87.10	86.48
N;PL	53.69 (1274)	50.84 (1424)	91.13	90.8
3;FUT;PL;V	64.00 (75)	42.53 (348)	80.00	79.31
1;COND;PL;V	40.00 (5)	30.46 (348)	40.00	75.86
NFIN;V	51.82 (330)	49.43 (348)	91.82	85.63
3;IPFV;PST;SG;V	56.52 (253)	45.98 (348)	86.96	80.75
1;FUT;PL;V	66.67 (21)	33.62 (348)	80.95	69.54
1;PFV;PL;PST;V	20.00 (5)	4.31 (348)	40.00	8.62
2;COND;SG;V	50.00 (2)	7.47 (348)	50.00	11.21
2;FUT;SG;V	0.00 (8)	9.48 (348)	12.50	17.82
1;IMP;PL;POS;V	17.86 (28)	12.10 (347)	35.71	21.9
2;PFV;PL;PST;V	-	0.29 (348)	-	1.15
1;PL;PRS;V	36.45 (107)	12.93 (348)	53.27	20.11
3;PRS;SG;V	42.63 (319)	41.50 (347)	61.13	57.64
3;IPFV;PL;PST;V	62.39 (218)	48.28 (348)	98.62	95.11
2;COND;PL;V	-	5.17 (348)	-	14.08
1;PL;PRS;SBJV;V	17.86 (28)	12.10 (347)	35.71	21.9
1;PRS;SG;V	25.29 (174)	15.90 (346)	37.93	25.14
3;IMP;PL;POS;V	25.31 (162)	15.85 (347)	37.04	30.55
2;PFV;PST;SG;V	0.00 (3)	0.29 (348)	0.00	0.86
3;PL;PRS;SBJV;V	25.31 (162)	15.85 (347)	37.04	30.55
2;PL;PRS;SBJV;V	0.00 (3)	2.31 (347)	0.00	3.75
3;PFV;PST;SG;V	38.63 (277)	33.62 (348)	56.32	50.86
2;PRS;SG;V	23.16 (95)	13.26 (347)	33.68	21.04
1;COND;SG;V	57.40 (169)	40.80 (348)	73.96	66.67
2;PL;PRS;V	28.57 (14)	1.72 (348)	35.71	2.01
1;IPFV;PST;SG;V	56.52 (253)	45.98 (348)	86.96	80.75
3;IMP;POS;SG;V	21.36 (220)	14.41 (347)	34.55	25.36
3;PFV;PL;PST;V	54.27 (234)	46.84 (348)	87.61	88.22
3;COND;PL;V	65.31 (98)	44.54 (348)	83.67	80.17
1;FUT;SG;V	51.61 (31)	31.32 (348)	67.74	50.57
3;PL;PRS;V	46.64 (283)	41.50 (347)	79.15	70.32
3;COND;SG;V	57.40 (169)	40.80 (348)	73.96	66.67
3;PRS;SBJV;SG;V	21.27 (221)	14.41 (347)	34.39	25.36
2;PRS;SBJV;SG;V	7.14 (42)	2.59 (347)	16.67	6.63
3;FUT;SG;V	69.12 (136)	48.56 (348)	92.65	86.21
2;IMP;PL;POS;V	2.44 (41)	0.29 (348)	4.88	2.59
2;IPFV;PL;PST;V	60.00 (5)	2.30 (348)	80.00	3.45
2;IMP;POS;SG;V	42.72 (316)	40.92 (347)	61.39	57.06
1;IPFV;PL;PST;V	0.00 (9)	12.93 (348)	44.44	62.93
1;PFV;PST;SG;V	1.25 (80)	0.57 (348)	2.50	1.72
2;FUT;PL;V	0.00 (1)	7.76 (348)	0.00	12.36
1;PRS;SBJV;SG;V	21.27 (221)	14.41 (347)	34.39	25.36
2;IPFV;PST;SG;V	0.00 (2)	3.74 (348)	0.00	6.9
ADJ;MASC;PL	64.66 (365)	61.65 (399)	96.44	96.24
ADJ;FEM;SG	23.90 (385)	23.66 (393)	74.03	73.54
ADJ;MASC;SG	59.90 (384)	58.46 (402)	93.49	92.79
ADJ;FEM;PL	64.15 (357)	63.01 (365)	96.92	96.44

Table 70: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Portuguese–Catalan language pair (the grey numbers correspond to the dictionary sizes).

	Portuguese–French			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	47.09 (9664)	25.92 (22437)	77.70	48.19
N;SG	53.37 (2095)	51.46 (2188)	87.40	86.56
N;PL	53.26 (1641)	49.44 (1960)	93.42	92.4
1;COND;PL;V	0.00 (10)	18.90 (492)	40.00	59.15
1;PRS;SBJV;SG;V	21.36 (323)	18.13 (491)	30.65	26.68
2;COND;PL;V	-	0.00 (492)	-	1.02
1;COND;SG;V	30.82 (159)	18.50 (492)	46.54	38.62
1;IPFV;PL;PST;V	0.00 (10)	1.63 (492)	20.00	4.88
2;PL;PRS;V	16.67 (24)	1.02 (492)	29.17	2.03
1;PRS;SG;V	22.35 (264)	15.48 (491)	35.98	23.63
1;IMP;PL;POS;V	17.50 (40)	7.13 (491)	52.50	23.01
1;FUT;SG;V	45.10 (51)	37.80 (492)	84.31	79.47
2;IMP;PL;POS;V	1.49 (67)	0.20 (492)	2.99	2.24
2;PFV;PST;SG;V	0.00 (19)	0.81 (491)	0.00	1.63
1;PL;PRS;SBJV;V	18.18 (33)	7.13 (491)	57.58	23.01
3;PRS;SBJV;SG;V	21.36 (323)	18.05 (493)	30.65	26.77
1;PFV;PST;SG;V	2.26 (133)	2.04 (491)	2.26	4.28
2;FUT;SG;V	25.00 (8)	7.52 (492)	25.00	17.48
2;IMP;POS;SG;V	42.26 (452)	38.49 (491)	57.52	51.32
2;PFV;PL;PST;V	0.00 (3)	1.83 (491)	0.00	7.13
3;COND;SG;V	29.21 (202)	18.42 (494)	42.57	38.46
2;FUT;PL;V	0.00 (1)	2.44 (492)	0.00	6.71
2;PRS;SBJV;SG;V	19.05 (105)	13.44 (491)	48.57	27.7
3;PL;PRS;SBJV;V	36.87 (198)	26.27 (491)	63.64	52.14
2;IPFV;PL;PST;V	19.51 (41)	2.03 (492)	31.71	4.07
1;IPFV;PST;SG;V	54.04 (235)	46.75 (492)	87.66	83.13
3;FUT;SG;V	49.38 (160)	30.97 (494)	71.25	53.44
3;PRS;SG;V	42.04 (452)	38.13 (493)	57.96	51.32
2;IPFV;PST;SG;V	0.00 (7)	0.20 (492)	42.86	0.81
1;FUT;PL;V	50.00 (26)	26.63 (492)	73.08	63.62
3;FUT;PL;V	56.10 (82)	34.35 (492)	87.80	77.03
2;PRS;SG;V	23.81 (126)	13.65 (491)	53.17	27.9
3;COND;PL;V	34.48 (116)	18.50 (492)	51.72	40.24
3;IPFV;PST;SG;V	53.15 (333)	46.56 (494)	86.49	83.2
2;PL;PRS;SBJV;V	-	0.81 (491)	-	1.63
1;PL;PRS;V	29.01 (131)	11.18 (492)	47.33	22.56
1;PFV;PL;PST;V	11.11 (18)	7.94 (491)	27.78	12.42
3;PFV;PL;PST;V	53.09 (324)	42.36 (491)	89.20	89
NFIN;V	56.59 (463)	52.83 (494)	89.42	85.22
3;PFV;PST;SG;V	33.83 (405)	28.80 (493)	53.09	45.64
2;COND;SG;V	0.00 (5)	0.00 (492)	20.00	0.41
3;PL;PRS;V	54.96 (373)	45.82 (491)	89.01	80.04
3;IPFV;PL;PST;V	58.39 (274)	46.75 (492)	94.16	95.12
ADJ;FEM;SG	60.40 (500)	60.04 (503)	93.60	93.64
ADJ;MASC;PL	59.10 (489)	56.51 (522)	96.52	95.98
ADJ;FEM;PL	62.26 (469)	61.38 (479)	97.87	97.7
ADJ;MASC;SG	58.90 (511)	57.77 (528)	91.39	91.29

Table 71: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Portuguese–French language pair (the grey numbers correspond to the dictionary sizes).

	Portuguese–Italian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	45.82 (8939)	24.83 (20757)	77.48	48.9
N;SG	55.29 (2069)	53.17 (2159)	90.04	89.62
N;PL	49.12 (1598)	45.55 (1888)	87.98	85.38
3;IPFV;PL;PST;V	56.18 (251)	46.24 (452)	96.41	96.9
1;FUT;PL;V	23.81 (21)	19.69 (452)	61.90	61.28
1;IPFV;PL;PST;V	37.50 (8)	20.35 (452)	87.50	77.21
2;FUT;SG;V	0.00 (6)	3.10 (452)	16.67	14.82
2;COND;PL;V	-	0.00 (452)	-	1.55
2;IPFV;PL;PST;V	50.00 (4)	1.99 (452)	75.00	3.76
3;PL;PRS;V	50.87 (346)	45.01 (451)	84.39	75.61
2;IMP;PL;POS;V	0.00 (58)	0.00 (452)	3.45	1.33
3;IMP;PL;POS;V	13.07 (176)	7.32 (451)	26.14	15.74
3;PL;PRS;SBJV;V	13.07 (176)	7.32 (451)	26.14	15.74
2;PFV;PL;PST;V	0.00 (5)	4.42 (452)	0.00	9.96
1;COND;PL;V	57.14 (7)	23.67 (452)	85.71	74.12
3;FUT;SG;V	40.44 (136)	27.88 (452)	70.59	59.29
2;IMP;POS;SG;V	44.61 (408)	43.02 (451)	65.69	61.64
3;PRS;SBJV;SG;V	16.67 (294)	12.64 (451)	28.91	19.96
3;PFV;PST;SG;V	43.35 (376)	38.72 (452)	72.07	69.69
1;IMP;PL;POS;V	26.92 (26)	17.07 (451)	53.85	56.76
2;PFV;PST;SG;V	0.00 (7)	1.33 (452)	0.00	2.21
1;PL;PRS;SBJV;V	26.92 (26)	17.07 (451)	53.85	56.76
1;PFV;PL;PST;V	11.11 (18)	2.21 (452)	22.22	7.08
3;COND;PL;V	2.35 (85)	0.66 (452)	2.35	3.32
2;COND;SG;V	16.67 (6)	0.44 (452)	33.33	1.33
3;IMP;POS;SG;V	16.67 (294)	12.64 (451)	28.91	19.96
NFIN;V	53.74 (428)	51.99 (452)	97.20	95.13
1;FUT;SG;V	27.27 (44)	20.35 (452)	54.55	51.99
1;COND;SG;V	5.47 (128)	1.55 (452)	9.38	7.96
1;IPFV;PST;SG;V	48.99 (149)	44.03 (452)	87.25	82.52
2;FUT;PL;V	0.00 (1)	0.44 (452)	0.00	5.75
3;PRS;SG;V	44.84 (417)	43.02 (451)	65.95	61.64
2;PRS;SBJV;SG;V	13.19 (91)	6.21 (451)	36.26	13.75
2;PL;PRS;SBJV;V	0.00 (1)	0.67 (451)	0.00	2.88
1;PRS;SBJV;SG;V	16.67 (294)	12.64 (451)	28.91	19.96
2;PRS;SG;V	20.00 (130)	6.87 (451)	31.54	11.53
3;IPFV;PST;SG;V	50.00 (310)	44.03 (452)	86.77	82.52
2;IPFV;PST;SG;V	20.00 (5)	1.55 (452)	40.00	1.99
3;FUT;PL;V	50.00 (64)	26.11 (452)	82.81	71.68
3;PFV;PL;PST;V	53.97 (302)	46.68 (452)	95.36	95.35
3;COND;SG;V	4.43 (158)	1.55 (452)	8.86	7.96
2;PL;PRS;V	26.47 (34)	5.09 (452)	47.06	14.82
1;PFV;PST;SG;V	0.81 (124)	1.55 (452)	0.81	2.43
1;PRS;SG;V	25.93 (243)	20.18 (451)	44.86	32.82
1;PL;PRS;V	28.70 (108)	17.26 (452)	67.59	48.45
ADJ;MASC;PL	62.88 (431)	59.70 (464)	96.52	95.47
ADJ;FEM;PL	61.56 (424)	61.36 (427)	94.10	94.15
ADJ;MASC;SG	62.05 (448)	60.17 (467)	92.63	91.65
ADJ;FEM;SG	63.37 (445)	63.37 (445)	92.58	92.13

Table 72: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Portuguese–Italian language pair (the grey numbers correspond to the dictionary sizes).

	Portuguese–Spanish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	60.18 (9275)	37.38 (22638)	84.66	57.89
N;SG	64.43 (1940)	62.28 (2015)	89.74	88.98
N;PL	64.66 (1576)	61.07 (1816)	92.45	91.63
ADJ;FEM;SG	64.76 (542)	64.40 (545)	93.54	93.58
ADJ;MASC;SG	65.75 (543)	63.77 (563)	93.00	92.72
ADJ;MASC;PL	69.77 (526)	66.37 (559)	96.77	96.78
ADJ;FEM;PL	69.46 (514)	68.45 (523)	96.89	96.75
2;FUT;PL;V	25.00 (4)	15.08 (451)	50.00	33.04
3;PL;PRS;V	60.53 (342)	50.89 (450)	82.46	71.56
2;PFV;PL;PST;V	0.00 (2)	0.00 (451)	0.00	0.44
3;IPFV;PL;PST;V	69.92 (256)	55.43 (451)	99.22	97.78
3;PFV;PST;SG;V	56.39 (360)	48.34 (451)	78.89	72.95
3;FUT;PL;SBJV;V	0.00 (30)	0.22 (451)	0.00	0.22
2;IMP;POS;SG;V	52.70 (408)	48.89 (450)	68.87	62.44
3;FUT;PL;V	78.38 (74)	55.21 (451)	97.30	88.69
1;COND;SG;V	63.13 (198)	47.67 (451)	82.83	69.84
3;IMP;POS;SG;V	46.71 (289)	35.94 (448)	58.13	43.75
2;IMP;PL;POS;V	4.26 (47)	8.20 (451)	14.89	13.3
2;FUT;PL;SBJV;V	-	0.00 (451)	-	0.89
1;IMP;PL;POS;V	47.06 (34)	28.12 (448)	55.88	42.41
2;FUT;SG;V	54.55 (11)	29.71 (451)	72.73	48.34
3;PFV;PL;PST;V	67.79 (298)	56.32 (451)	95.30	92.24
2;PL;PRS;V	13.33 (15)	2.00 (451)	20.00	2.22
2;COND;SG;V	0.00 (5)	30.38 (451)	60.00	51.66
2;COND;PL;V	0.00 (1)	1.55 (451)	0.00	4.66
2;PRS;SG;V	49.18 (122)	37.56 (450)	60.66	48
3;COND;PL;V	73.74 (99)	53.88 (451)	93.94	92.24
2;PRS;SBJV;SG;V	43.62 (94)	29.62 (449)	64.89	41.87
3;IPFV;PST;SG;V	68.77 (301)	56.54 (451)	90.03	85.81
2;FUT;SBJV;SG;V	14.29 (7)	25.94 (451)	28.57	31.49
1;FUT;PL;SBJV;V	-	0.00 (451)	-	0.22
2;IPFV;PST;SG;V	14.29 (7)	9.98 (451)	42.86	12.64
2;PFV;PST;SG;V	47.62 (21)	28.82 (451)	52.38	37.92
1;FUT;SG;V	66.67 (48)	46.78 (451)	87.50	73.61
1;PFV;PST;SG;V	19.02 (163)	10.64 (451)	34.36	20.84
2;PL;PRS;SBJV;V	25.00 (4)	1.34 (449)	25.00	3.12
1;IPFV;PST;SG;V	68.77 (301)	56.54 (451)	90.03	85.81
1;PL;PRS;V	68.10 (116)	45.68 (451)	80.17	59.65
1;FUT;PL;V	65.52 (29)	49.45 (451)	82.76	82.93
3;PRS;SG;V	52.93 (410)	49.11 (450)	69.27	62.67
NFIN;V	55.90 (424)	53.66 (451)	91.27	87.8
3;IMP;PL;POS;V	42.71 (192)	25.17 (449)	59.38	39.87
3;PL;PRS;SBJV;V	42.71 (192)	25.17 (449)	59.38	39.87
1;PRS;SBJV;SG;V	46.90 (290)	36.08 (449)	58.28	43.88
1;IPFV;PL;PST;V	30.77 (13)	27.05 (451)	100.00	90.24
3;FUT;SBJV;SG;V	66.43 (140)	52.55 (451)	90.71	86.03
3;COND;SG;V	63.13 (198)	47.67 (451)	82.83	69.84
1;FUT;SBJV;SG;V	66.43 (140)	52.55 (451)	90.71	86.03
3;FUT;SG;V	79.05 (148)	57.65 (451)	95.95	90.91
1;PL;PRS;SBJV;V	47.06 (34)	28.06 (449)	55.88	42.32
1;PRS;SG;V	41.77 (237)	31.99 (447)	52.74	41.16
2;IPFV;PL;PST;V	0.00 (2)	1.77 (451)	50.00	2.22
3;PRS;SBJV;SG;V	46.90 (290)	36.08 (449)	58.28	43.88
1;COND;PL;V	75.00 (8)	47.01 (451)	100.00	93.13
1;PFV;PL;PST;V	50.00 (46)	21.29 (451)	63.04	29.05

Table 73: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Portuguese–Spanish language pair (the grey numbers correspond to the dictionary sizes).

		Spanish–Catalan		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	49.23 (8291)	29.31 (18442)	76.50	50.48
N;SG	59.67 (1639)	58.94 (1666)	89.81	89.08
N;PL	58.86 (1388)	56.23 (1542)	91.57	91.18
ADJ;FEM;SG	31.85 (383)	31.52 (387)	76.76	77
ADJ;MASC;SG	68.15 (383)	67.35 (389)	94.52	94.6
ADJ;FEM;PL	73.48 (362)	72.68 (366)	94.75	94.81
ADJ;MASC;PL	70.08 (371)	67.70 (387)	95.96	96.12
1;FUT;PL;V	41.03 (39)	45.26 (369)	66.67	88.62
2;PFV;PST;SG;V	0.00 (2)	0.00 (369)	0.00	0
2;IMP;PL;POS;V	2.70 (37)	0.27 (369)	5.41	1.9
2;PRS;SG;V	34.27 (143)	21.68 (369)	41.26	26.56
2;PST;SBJV;SG;V	66.67 (3)	0.54 (369)	66.67	1.08
3;PFV;PL;PST;V	52.87 (244)	48.51 (369)	88.52	93.77
2;PFV;PL;PST;V	-	0.00 (369)	-	0.27
1;PL;PRS;SBJV;V	29.85 (67)	14.91 (369)	53.73	21.41
2;COND;PL;V	0.00 (3)	3.25 (369)	0.00	8.94
3;IMP;POS;SG;V	19.53 (256)	17.07 (369)	32.42	26.56
1;PRS;SG;V	29.25 (212)	22.62 (367)	42.92	33.51
1;PL;PRS;V	29.32 (133)	10.03 (369)	42.86	14.09
3;PL;PRS;V	44.69 (320)	42.01 (369)	74.06	67.21
3;IPFV;PST;SG;V	54.30 (291)	49.32 (369)	87.29	86.18
1;IPFV;PST;SG;V	54.30 (291)	49.32 (369)	87.29	86.18
3;PL;PRS;SBJV;V	20.20 (203)	15.45 (369)	33.00	29
3;PRS;SG;V	52.30 (348)	51.22 (369)	64.66	60.7
2;IPFV;PST;SG;V	0.00 (7)	3.52 (369)	0.00	5.15
3;FUT;SG;V	59.36 (187)	50.95 (369)	87.17	94.04
3;COND;PL;V	56.06 (132)	50.41 (369)	73.48	90.79
3;COND;SG;V	49.25 (201)	36.31 (369)	66.67	57.99
2;PL;PST;SBJV;V	-	0.00 (369)	-	2.98
2;FUT;PL;V	0.00 (6)	2.17 (369)	0.00	2.71
3;PST;SBJV;SG;V	47.59 (166)	30.08 (369)	59.64	47.15
1;PL;PST;SBJV;V	66.67 (3)	0.81 (369)	66.67	5.42
3;FUT;PL;V	45.32 (139)	43.36 (369)	68.35	83.47
3;IMP;PL;POS;V	20.20 (203)	15.45 (369)	33.00	29
2;COND;SG;V	0.00 (3)	1.36 (369)	0.00	2.17
1;PRS;SBJV;SG;V	19.53 (256)	17.07 (369)	32.42	26.56
1;PFV;PL;PST;V	33.33 (6)	7.86 (369)	33.33	11.38
2;IPFV;PL;PST;V	0.00 (2)	0.54 (369)	0.00	1.36
1;IMP;PL;POS;V	29.85 (67)	14.91 (369)	53.73	21.41
2;PL;PRS;SBJV;V	31.25 (16)	3.52 (369)	50.00	8.94
2;PL;PRS;V	5.00 (20)	1.63 (369)	10.00	4.34
1;PFV;PST;SG;V	1.41 (71)	1.36 (369)	4.23	1.63
1;FUT;SG;V	37.50 (40)	45.26 (369)	47.50	71.82
1;COND;PL;V	42.86 (7)	39.57 (369)	85.71	88.62
3;IPFV;PL;PST;V	55.69 (255)	49.59 (369)	94.90	95.93
1;IPFV;PL;PST;V	25.00 (4)	17.07 (369)	50.00	63.96
3;PRS;SBJV;SG;V	19.53 (256)	17.07 (369)	32.42	26.56
3;PL;PST;SBJV;V	65.55 (119)	39.02 (369)	92.44	86.72
1;PST;SBJV;SG;V	47.59 (166)	30.08 (369)	59.64	47.15
2;FUT;SG;V	25.00 (12)	10.03 (369)	33.33	18.16
1;COND;SG;V	49.25 (201)	36.31 (369)	66.67	57.99
3;PFV;PST;SG;V	36.73 (294)	32.79 (369)	56.12	50.14
2;IMP;POS;SG;V	52.17 (345)	50.68 (369)	64.35	59.89
2;PRS;SBJV;SG;V	18.60 (86)	7.86 (369)	20.93	10.3
NFIN;V	53.91 (358)	52.85 (369)	91.90	88.35

Table 74: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Spanish–Catalan language pair (the grey numbers correspond to the dictionary sizes).

		Spanish–French		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	45.42 (11457)	24.10 (25775)	74.57	44.52
N;PL	57.16 (1886)	53.70 (2162)	94.17	92.51
N;SG	56.24 (2301)	55.31 (2352)	88.48	88.27
3;PRS;SBJV;SG;V	20.68 (382)	15.98 (513)	34.82	26.71
2;IMP;PL;POS;V	2.27 (44)	0.97 (513)	6.82	4.68
2;PRS;SBJV;SG;V	25.27 (182)	14.81 (513)	45.05	23.78
1;FUT;PL;V	28.30 (53)	27.49 (513)	54.72	70.57
1;PFV;PST;SG;V	0.91 (110)	1.36 (513)	0.91	1.75
2;IPFV;PL;PST;V	0.00 (1)	0.19 (513)	100.00	1.17
1;PFV;PL;PST;V	20.00 (60)	10.72 (513)	50.00	24.17
1;PL;PRS;SBJV;V	17.65 (68)	7.60 (513)	36.76	22.42
2;IPFV;PST;SG;V	20.00 (15)	4.48 (513)	26.67	8.19
3;PL;PRS;SBJV;V	31.96 (291)	20.47 (513)	55.33	39.18
2;PL;PRS;SBJV;V	0.00 (12)	1.17 (513)	0.00	2.73
3;PRS;SG;V	38.22 (484)	36.06 (513)	58.68	53.61
3;PFV;PST;SG;V	31.41 (417)	25.93 (513)	48.68	39.57
2;PL;PST;SBJV;V	-	0.19 (513)	-	2.14
2;PL;PRS;V	0.00 (27)	3.12 (513)	3.70	7.6
2;PFV;PL;PST;V	-	0.78 (513)	-	1.17
2;COND;SG;V	0.00 (9)	1.36 (513)	22.22	4.09
2;COND;PL;V	-	2.92 (513)	-	15.59
3;PST;SBJV;SG;V	2.60 (154)	7.21 (513)	8.44	18.32
1;PRS;SBJV;SG;V	20.68 (382)	15.98 (513)	34.82	26.71
2;FUT;PL;V	20.00 (5)	3.70 (513)	20.00	9.16
1;PRS;SG;V	20.28 (360)	16.63 (511)	33.33	26.22
1;IPFV;PL;PST;V	0.00 (15)	0.58 (513)	6.67	2.92
2;IMP;POS;SG;V	38.03 (476)	35.28 (513)	58.40	52.44
3;COND;SG;V	25.30 (249)	18.91 (513)	45.78	45.81
2;FUT;SG;V	0.00 (24)	0.78 (513)	0.00	3.51
3;FUT;SG;V	45.90 (244)	32.94 (513)	75.00	68.62
1;IPFV;PST;SG;V	54.51 (266)	44.83 (513)	86.47	80.51
3;FUT;PL;V	54.44 (169)	39.38 (513)	91.72	95.32
2;PFV;PST;SG;V	0.00 (49)	0.19 (513)	0.00	0.39
3;IPFV;PST;SG;V	53.23 (387)	44.83 (513)	86.30	80.51
2;PST;SBJV;SG;V	0.00 (3)	0.19 (513)	0.00	3.12
3;PL;PRS;V	48.96 (431)	41.72 (513)	83.29	73.88
1;COND;SG;V	27.18 (195)	18.91 (513)	50.26	45.81
1;PL;PRS;V	25.15 (167)	12.28 (513)	46.11	26.9
1;PL;PST;SBJV;V	0.00 (1)	0.00 (513)	0.00	0
3;COND;PL;V	28.99 (169)	20.47 (513)	50.89	46.78
3;PFV;PL;PST;V	43.79 (354)	38.99 (513)	87.57	91.03
1;IMP;PL;POS;V	17.07 (82)	7.60 (513)	41.46	22.42
NFIN;V	52.00 (475)	48.34 (513)	91.79	86.55
1;PST;SBJV;SG;V	2.17 (92)	7.21 (513)	6.52	18.32
2;PRS;SG;V	23.74 (198)	15.98 (513)	43.94	30.41
1;COND;PL;V	12.50 (8)	3.70 (513)	12.50	17.93
3;PL;PST;SBJV;V	0.00 (86)	0.00 (513)	0.00	0
3;IPFV;PL;PST;V	53.75 (333)	45.61 (513)	92.79	96.49
1;FUT;SG;V	50.00 (72)	30.02 (513)	79.17	67.25
ADJ;FEM;PL	67.79 (506)	67.32 (511)	97.63	97.06
ADJ;MASC;PL	66.60 (515)	64.62 (537)	96.12	95.53
ADJ;FEM;SG	60.87 (529)	60.53 (532)	94.33	94.36
ADJ;MASC;SG	64.41 (531)	63.40 (541)	91.71	91.5

Table 75: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Spanish–French language pair (the grey numbers correspond to the dictionary sizes).

| | Spanish–Italian | | | |
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	46.41 (10709)	26.87 (23528)	75.92	50.38
N;SG	58.65 (2319)	57.51 (2365)	92.02	91.5
N;PL	49.09 (1805)	45.65 (2103)	85.87	83.45
ADJ;MASC;SG	67.23 (476)	66.60 (482)	93.28	93.57
ADJ;FEM;PL	69.44 (445)	69.04 (449)	96.18	95.99
ADJ;MASC;PL	66.16 (461)	65.83 (477)	95.01	95.18
ADJ;FEM;SG	68.94 (470)	68.94 (470)	95.11	95.11
2;IMP;PL;POS;V	3.17 (63)	1.06 (470)	12.7	5.32
1;PST;SBJV;SG;V	58.89 (90)	39.82 (457)	84.44	69.37
1;FUT;PL;V	24.49 (49)	19.69 (457)	59.18	61.49
2;PFV;PST;SG;V	0.00 (19)	0.44 (457)	0	0.88
NFIN;V	55.56 (441)	52.75 (472)	95.92	93.43
3;PRS;SBJV;SG;V	15.43 (324)	13.10 (458)	22.84	18.12
1;PL;PRS;SBJV;V	33.75 (80)	21.23 (457)	77.5	66.74
2;FUT;SG;V	16.13 (31)	4.38 (457)	19.35	11.38
3;PFV;PST;SG;V	42.78 (367)	38.21 (458)	71.12	66.38
2;PL;PST;SBJV;V	0.00 (1)	0.22 (457)	0	0.66
3;IPFV;PST;SG;V	54.90 (337)	47.16 (458)	88.72	81.88
2;IPFV;PL;PST;V	0.00 (1)	1.75 (457)	0	3.5
1;FUT;SG;V	32.84 (67)	22.32 (457)	62.69	54.27
3;COND;PL;V	0.85 (118)	1.09 (457)	3.39	3.72
1;IPFV;PL;PST;V	33.33 (15)	28.67 (457)	93.33	91.68
3;PL;PRS;V	47.55 (368)	41.79 (457)	79.08	70.46
3;PST;SBJV;SG;V	52.54 (177)	39.74 (458)	79.1	69.43
2;FUT;PL;V	16.67 (6)	3.72 (457)	16.67	13.57
1;COND;SG;V	1.91 (157)	2.41 (457)	4.46	6.56
2;PL;PRS;V	11.11 (27)	1.09 (457)	14.81	2.41
2;PST;SBJV;SG;V	0.00 (4)	2.19 (457)	0	4.16
1;COND;PL;V	25.00 (12)	20.35 (457)	66.67	70.02
3;PFV;PL;PST;V	56.23 (313)	50.55 (457)	93.61	95.4
1;PRS;SBJV;SG;V	15.43 (324)	13.13 (457)	22.84	18.16
3;IMP;PL;POS;V	11.48 (244)	10.07 (457)	22.95	19.04
2;PRS;SG;V	11.76 (204)	6.78 (457)	22.55	11.38
2;PRS;SBJV;SG;V	13.89 (180)	9.19 (457)	30	19.04
3;IMP;POS;SG;V	15.43 (324)	13.13 (457)	22.84	18.16
1;IMP;PL;POS;V	33.33 (81)	20.59 (471)	76.54	67.09
2;COND;PL;V	0.00 (1)	1.53 (457)	0	5.69
2;IMP;POS;SG;V	45.72 (409)	41.40 (471)	67.48	60.51
2;COND;SG;V	0.00 (8)	0.22 (457)	0	1.09
2;PL;PRS;SBJV;V	0.00 (13)	0.22 (457)	0	0.22
2;IPFV;PST;SG;V	0.00 (16)	0.66 (457)	0	1.09
3;COND;SG;V	2.14 (187)	2.40 (458)	3.74	6.55
3;IPFV;PL;PST;V	55.26 (304)	48.80 (457)	95.72	96.5
2;PFV;PL;PST;V	0.00 (2)	1.97 (457)	0	3.94
3;PL;PRS;SBJV;V	11.48 (244)	10.07 (457)	22.95	19.04
1;PL;PRS;V	32.91 (158)	26.04 (457)	72.78	66.96
3;FUT;PL;V	46.21 (145)	35.23 (457)	87.59	91.9
3;FUT;SG;V	44.39 (223)	36.90 (458)	85.65	80.79
3;PRS;SG;V	45.69 (418)	43.23 (458)	68.42	63.1
1;PFV;PST;SG;V	0.00 (112)	2.84 (457)	2.68	5.03
1;PL;PST;SBJV;V	0.00 (2)	5.03 (457)	0	8.53
1;IPFV;PST;SG;V	62.07 (145)	47.26 (457)	90.34	81.84
1;PFV;PL;PST;V	31.25 (48)	23.41 (457)	64.58	57.77
1;PRS;SG;V	28.87 (291)	22.54 (457)	44.33	33.7
3;PL;PST;SBJV;V	53.78 (119)	43.54 (457)	91.6	93.44

Table 76: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Spanish–Italian language pair (the grey numbers correspond to the dictionary sizes).

	Spanish–Portuguese			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	57.02 (9732)	35.10 (23197)	81.27	54.98
N;SG	63.79 (2066)	62.33 (2113)	89.79	89.21
N;PL	62.06 (1692)	58.98 (1904)	92.26	92.59
ADJ;FEM;PL	73.80 (439)	72.97 (444)	99.32	99.32
ADJ;MASC;PL	72.54 (448)	70.88 (467)	97.54	97.86
ADJ;FEM;SG	73.25 (456)	72.77 (459)	96.93	96.08
ADJ;MASC;SG	71.90 (459)	70.85 (470)	95.42	94.68
1;PL;PRS;SBJV;V	16.98 (53)	22.58 (465)	35.85	35.91
3;PFV;PST;SG;V	57.26 (365)	49.89 (465)	82.47	74.84
3;PRS;SBJV;SG;V	40.65 (310)	34.48 (464)	51.61	43.97
3;FUT;PL;V	46.49 (114)	43.66 (465)	63.16	86.02
2;PL;PRS;V	6.67 (15)	0.22 (465)	6.67	0.43
3;COND;PL;V	60.45 (134)	45.38 (465)	80.60	82.15
1;IPFV;PL;PST;V	50.00 (8)	27.96 (465)	87.50	89.68
2;FUT;PL;SBJV;V	-	0.22 (465)	-	0.86
2;IMP;PL;POS;V	0.00 (36)	2.80 (465)	2.78	3.87
2;PRS;SBJV;SG;V	32.52 (123)	27.59 (464)	43.09	36.42
1;COND;SG;V	46.30 (216)	30.32 (465)	60.65	42.37
3;IMP;PL;POS;V	36.84 (228)	28.23 (464)	53.51	44.61
3;IMP;POS;SG;V	40.65 (310)	34.48 (464)	51.61	43.97
3;IPFV;PST;SG;V	58.24 (340)	51.40 (465)	80.59	81.29
2;PRS;SG;V	36.63 (172)	35.99 (464)	44.19	43.75
2;IPFV;PST;SG;V	22.22 (9)	12.90 (465)	44.44	18.49
1;COND;PL;V	63.64 (11)	46.02 (465)	72.73	86.24
1;FUT;PL;SBJV;V	-	4.95 (465)	-	11.4
3;FUT;PL;SBJV;V	28.57 (7)	6.45 (465)	28.57	11.4
2;FUT;PL;V	0.00 (2)	0.00 (465)	0.00	0
3;FUT;SBJV;SG;V	25.58 (43)	18.28 (465)	34.88	23.87
NFIN;V	59.35 (433)	57.20 (465)	91.45	86.45
2;IPFV;PL;PST;V	-	0.22 (465)	-	0.43
2;PFV;PL;PST;V	-	0.65 (465)	-	0.65
2;FUT;SG;V	37.50 (16)	19.35 (465)	37.50	35.48
3;COND;SG;V	46.30 (216)	30.32 (465)	60.65	42.37
2;IMP;POS;SG;V	52.39 (418)	48.06 (464)	70.33	62.93
3;PFV;PL;PST;V	62.18 (312)	52.69 (465)	93.59	91.18
1;PFV;PL;PST;V	55.56 (81)	39.14 (465)	66.67	52.26
3;PL;PRS;V	59.57 (376)	51.08 (464)	83.51	75.65
1;PL;PRS;V	58.82 (153)	39.14 (465)	68.63	53.12
1;FUT;SG;V	49.21 (63)	45.59 (465)	60.32	77.42
3;PL;PRS;SBJV;V	36.84 (228)	28.23 (464)	53.51	44.61
3;PRS;SG;V	52.96 (423)	49.14 (464)	70.69	64.01
2;FUT;SBJV;SG;V	50.00 (4)	27.74 (465)	75.00	34.19
1;FUT;SBJV;SG;V	25.58 (43)	18.28 (465)	34.88	23.87
2;PFV;PST;SG;V	30.00 (30)	28.17 (465)	36.67	34.19
2;COND;SG;V	0.00 (4)	16.56 (465)	25.00	29.89
1;PRS;SBJV;SG;V	40.65 (310)	34.48 (464)	51.61	43.97
2;PL;PRS;SBJV;V	0.00 (3)	0.43 (465)	0.00	0.65
3;FUT;SG;V	60.21 (191)	53.98 (465)	82.20	91.4
1;IMP;PL;POS;V	16.98 (53)	22.58 (465)	35.85	35.91
1;IPFV;PST;SG;V	58.24 (340)	51.40 (465)	80.59	81.29
1;PRS;SG;V	40.14 (284)	36.93 (463)	51.41	47.95
2;COND;PL;V	-	0.00 (465)	-	0.22
1;PFV;PST;SG;V	30.07 (143)	12.90 (465)	49.65	20.43
3;IPFV;PL;PST;V	59.93 (307)	53.76 (465)	93.16	97.42
1;FUT;PL;V	42.11 (38)	45.59 (465)	52.63	85.59

Table 77: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Spanish–Portuguese language pair (the grey numbers correspond to the dictionary sizes).

		Russian–Czech		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	32.08 (5708)	26.40 (7538)	76.77	73.11
INS;N;PL	24.40 (373)	20.11 (537)	80.16	79.7
DAT;N;SG	18.38 (457)	15.52 (554)	50.11	45.31
ESS;N;PL	38.49 (304)	28.12 (537)	88.49	86.96
ACC;N;SG	33.77 (533)	32.32 (557)	69.42	66.79
N;NOM;PL	33.95 (489)	31.45 (531)	73.82	71.37
DAT;N;PL	43.87 (269)	29.98 (537)	91.82	91.06
ACC;N;PL	28.41 (271)	26.16 (302)	69.74	67.22
GEN;N;SG	31.96 (535)	30.76 (556)	71.03	68.53
INS;N;SG	32.99 (488)	29.08 (557)	79.51	76.3
ESS;N;SG	22.53 (466)	18.67 (557)	53.86	46.32
GEN;N;PL	33.41 (449)	28.81 (538)	74.83	68.77
N;NOM;SG	33.64 (541)	33.03 (551)	70.06	67.88
ACC;ADJ;INAN;MASC;SG	44.55 (101)	42.86 (105)	94.06	94.29
ADJ;GEN;PL	43.16 (95)	37.50 (112)	98.95	99.11
ACC;ADJ;NEUT;SG	32.00 (100)	29.46 (112)	86	82.14
ADJ;FEM;NOM;SG	47.37 (95)	42.86 (105)	96.84	97.14
ADJ;DAT;FEM;SG	38.10 (105)	35.71 (112)	83.81	80.36
ADJ;NEUT;NOM;SG	34.04 (94)	31.43 (105)	86.17	81.9
ADJ;MASC;NOM;SG	44.55 (101)	42.86 (105)	94.06	94.29
ADJ;DAT;PL	48.42 (95)	42.86 (112)	98.95	99.11
ADJ;INS;PL	47.56 (82)	38.39 (112)	100	100
ADJ;ESS;PL	43.16 (95)	37.50 (112)	98.95	99.11
ACC;ADJ;FEM;SG	41.84 (98)	36.61 (112)	98.98	97.32
ADJ;GEN;MASC;SG	45.10 (102)	41.96 (112)	100	100
ADJ;GEN;NEUT;SG	45.10 (102)	41.96 (112)	100	100
ADJ;ESS;NEUT;SG	50.00 (86)	42.86 (112)	95.35	94.64
ADJ;INS;MASC;SG	48.42 (95)	42.86 (112)	98.95	99.11
ADJ;DAT;MASC;SG	52.17 (69)	41.07 (112)	100	100
ADJ;ESS;MASC;SG	50.00 (84)	42.86 (112)	96.43	94.64
ACC;ADJ;MASC;SG	45.10 (102)	41.96 (112)	100	100
ADJ;ESS;FEM;SG	38.10 (105)	35.71 (112)	83.81	80.36
ADJ;DAT;NEUT;SG	52.17 (69)	41.07 (112)	100	100
ADJ;FEM;GEN;SG	38.10 (105)	35.71 (112)	83.81	80.36
3;MASC;PL;PST;V	28.17 (71)	23.16 (95)	91.55	90.53
2;PL;PRS;V	20.00 (15)	11.86 (59)	93.33	86.44
1;PL;PRS;V	26.67 (15)	11.86 (59)	73.33	55.93
3;FEM;PST;SG;V	31.88 (69)	25.26 (95)	94.2	84.21
2;IMP;SG;V	6.25 (16)	3.19 (94)	25	17.02
3;FEM;PL;PST;V	27.69 (65)	23.16 (95)	87.69	90.53
3;NEUT;PST;SG;V	26.67 (45)	18.95 (95)	82.22	80
2;PRS;SG;V	42.86 (7)	15.25 (59)	57.14	57.63
2;IMP;PL;V	23.53 (17)	11.70 (94)	58.82	63.83
1;PRS;SG;V	28.57 (21)	13.56 (59)	71.43	37.29
3;PL;PRS;V	18.60 (43)	13.56 (59)	74.42	64.41
NFIN;V	26.50 (117)	24.80 (125)	100	97.6
3;MASC;PST;SG;V	27.71 (83)	24.73 (93)	85.54	79.57
3;PRS;SG;V	20.37 (54)	18.64 (59)	79.63	74.58
2;FUT;PL;V	0.00 (4)	5.41 (37)	75	62.16
2;FUT;SG;V	0.00 (1)	10.81 (37)	100	45.95
1;FUT;PL;V	20.00 (5)	2.70 (37)	80	21.62
1;FUT;SG;V	14.29 (7)	2.70 (37)	42.86	21.62
3;FUT;SG;V	14.29 (28)	10.81 (37)	42.86	40.54
3;FUT;PL;V	4.55 (22)	2.70 (37)	36.36	32.43
ACC;INAN;N;SG	0.00 (1)	50.00 (2)	0	50
ACC;INAN;N;PL	0.00 (1)	50.00 (2)	100	100
ADJ;INS;NEUT;SG	22.22 (9)	16.67 (12)	100	100
ADJ;FEM;INS;SG	36.36 (11)	33.33 (12)	100	100
ACC;ADJ;PL	27.27 (11)	25.00 (12)	100	100
ADJ;NOM;PL	20.00 (10)	16.67 (12)	90	83.33
2;FEM;PL;PST;V	0.00 (1)	0.00 (1)	0	0
2;MASC;PL;PST;V	0.00 (1)	0.00 (1)	0	0

Table 78: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Russian–Czech language pair (the grey numbers correspond to the dictionary sizes).

	Russian–Polish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	39.99 (9183)	35.02 (11697)	81.19	78.64
DAT;N;SG	28.02 (653)	24.62 (999)	60.03	57.16
INS;N;SG	38.79 (879)	34.80 (1000)	82.03	79.3
ACC;N;SG	37.78 (953)	35.60 (1000)	71.46	68.6
GEN;N;SG	40.94 (960)	39.30 (1000)	79.79	77.6
ESS;N;SG	32.10 (782)	28.36 (998)	62.28	55.71
N;NOM;SG	35.86 (976)	34.94 (993)	69.06	66.77
INS;N;PL	45.11 (634)	35.81 (930)	98.58	98.71
GEN;N;PL	40.12 (805)	35.56 (928)	75.40	69.94
DAT;N;PL	42.46 (358)	31.72 (930)	83.24	85.27
ESS;N;PL	47.13 (541)	36.56 (930)	91.87	89.03
ACC;N;PL	37.13 (579)	34.60 (633)	77.89	74.09
N;NOM;PL	40.44 (863)	38.14 (923)	81.92	79.41
ACC;ADJ;INAN;MASC;SG	49.18 (183)	48.42 (190)	93.44	93.68
ADJ;GEN;PL	51.67 (180)	49.47 (190)	97.78	97.89
ADJ;DAT;PL	43.33 (180)	42.11 (190)	94.44	94.74
ADJ;FEM;GEN;SG	46.67 (180)	45.26 (190)	94.44	94.21
ADJ;ESS;NEUT;SG	40.72 (167)	37.89 (190)	88.62	88.42
ACC;ADJ;NEUT;SG	41.34 (179)	40.00 (190)	88.83	88.95
ADJ;DAT;MASC;SG	51.33 (113)	44.21 (190)	98.23	98.95
ADJ;INS;NEUT;SG	43.33 (180)	42.11 (190)	94.44	94.74
ACC;ADJ;MASC;SG	45.11 (184)	44.21 (190)	95.65	95.79
ADJ;GEN;MASC;SG	45.11 (184)	44.21 (190)	95.65	95.79
ADJ;GEN;NEUT;SG	45.11 (184)	44.21 (190)	95.65	95.79
ADJ;ESS;FEM;SG	46.67 (180)	45.26 (190)	94.44	94.21
ADJ;NEUT;NOM;SG	41.34 (179)	40.00 (190)	88.83	88.95
ADJ;INS;MASC;SG	43.33 (180)	42.11 (190)	94.44	94.74
ADJ;FEM;NOM;SG	42.62 (183)	41.58 (190)	95.63	95.79
ADJ;MASC;NOM;SG	49.18 (183)	48.42 (190)	93.44	93.68
ADJ;DAT;FEM;SG	46.67 (180)	45.26 (190)	94.44	94.21
ADJ;ESS;PL	51.67 (180)	49.47 (190)	97.78	97.89
ACC;ADJ;FEM;SG	46.75 (169)	42.63 (190)	99.41	98.95
ADJ;FEM;INS;SG	47.46 (177)	45.26 (190)	93.79	94.21
ADJ;INS;PL	49.39 (164)	44.74 (190)	100.00	100
ADJ;ESS;MASC;SG	40.72 (167)	37.89 (190)	88.62	88.42
ADJ;DAT;NEUT;SG	51.33 (113)	44.21 (190)	98.23	98.95
ADJ;NOM;PL	44.57 (184)	43.68 (190)	89.13	88.42
ACC;ADJ;PL	50.82 (183)	49.47 (190)	96.17	97.89
NFIN;V	36.67 (30)	33.33 (33)	96.67	96.97
2;MASC;PL;PST;V	-	21.21 (33)	-	84.85
3;MASC;PST;SG;V	33.33 (21)	24.24 (33)	85.71	84.85
2;PRS;SG;V	25.00 (4)	4.00 (25)	75.00	24
2;IMP;SG;V	0.00 (10)	3.03 (33)	40.00	18.18
1;FEM;PST;SG;V	20.00 (5)	24.24 (33)	100.00	93.94
3;MASC;PL;PST;V	30.00 (20)	21.21 (33)	80.00	84.85
2;PL;PRS;V	0.00 (1)	0.00 (25)	0.00	0
2;MASC;PST;SG;V	25.00 (4)	24.24 (33)	50.00	84.85
1;PL;PRS;V	22.22 (9)	12.00 (25)	88.89	28
3;NEUT;PST;SG;V	38.46 (13)	24.24 (33)	76.92	81.82
3;FEM;PST;SG;V	33.33 (21)	24.24 (33)	90.48	93.94
2;IMP;PL;V	0.00 (4)	0.00 (33)	50.00	21.21
3;PL;PRS;V	38.89 (18)	28.00 (25)	83.33	76
2;FEM;PST;SG;V	-	24.24 (33)	-	93.94
1;FEM;PL;PST;V	-	21.21 (33)	-	84.85
2;FEM;PL;PST;V	-	21.21 (33)	-	84.85
1;MASC;PST;SG;V	28.57 (14)	24.24 (33)	78.57	84.85
3;PRS;SG;V	20.83 (24)	20.00 (25)	66.67	60
1;MASC;PL;PST;V	20.00 (5)	21.21 (33)	100.00	84.85
3;FEM;PL;PST;V	27.78 (18)	21.21 (33)	77.78	84.85
1;PRS;SG;V	44.44 (9)	16.00 (25)	55.56	28
1;FUT;SG;V	0.00 (2)	0.00 (8)	0.00	0
3;FUT;SG;V	0.00 (7)	0.00 (8)	42.86	37.5
2;FUT;SG;V	-	25.00 (8)	-	62.5
3;FUT;PL;V	0.00 (6)	0.00 (8)	50.00	37.5
1;FUT;PL;V	-	0.00 (8)	-	12.5
2;FUT;PL;V	0.00 (2)	0.00 (8)	0.00	25

Table 79: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Russian–Polish language pair (the grey numbers correspond to the dictionary sizes).

		Russian–Slovak		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	24.04 (1610)	19.95 (2150)	78.32	74.74
ACC;N;PL	14.29 (91)	11.93 (109)	74.73	68.81
ESS;N;PL	41.98 (81)	24.87 (189)	98.77	93.12
INS;N;SG	23.53 (153)	18.13 (193)	86.93	80.83
INS;N;PL	31.43 (105)	23.81 (189)	99.05	99.47
N;NOM;SG	23.12 (186)	22.63 (190)	73.12	70
GEN;N;PL	18.79 (149)	14.81 (189)	68.46	61.38
ACC;N;SG	19.77 (177)	18.13 (193)	71.19	69.43
ESS;N;SG	18.25 (137)	13.99 (193)	56.93	45.6
GEN;N;SG	22.03 (177)	20.21 (193)	71.19	67.88
DAT;N;SG	21.97 (132)	17.62 (193)	66.67	58.55
DAT;N;PL	27.37 (95)	18.09 (188)	65.26	67.55
N;NOM;PL	20.12 (164)	18.28 (186)	77.44	73.12
3;MASC;PST;SG;V	-	0.00 (2)	-	0
2;IMP;PL;V	-	0.00 (2)	-	0
2;PRS;SG;V	-	0.00 (2)	-	0
1;PL;PRS;V	-	50.00 (2)	-	100
3;FEM;PST;SG;V	-	0.00 (2)	-	0
2;IMP;SG;V	-	0.00 (2)	-	0
NFIN;V	25.00 (40)	18.75 (48)	100.00	100
1;PRS;SG;V	0.00 (1)	0.00 (2)	100.00	50
3;PL;PRS;V	0.00 (2)	0.00 (2)	50.00	50
2;PL;PRS;V	-	0.00 (2)	-	50
3;NEUT;PST;SG;V	-	0.00 (2)	-	0
3;FEM;PL;PST;V	-	0.00 (2)	-	0
3;PRS;SG;V	0.00 (2)	0.00 (2)	50.00	50
3;MASC;PL;PST;V	-	0.00 (2)	-	0
ADJ;FEM;GEN;SG	26.09 (23)	25.00 (24)	95.65	100
ADJ;ESS;NEUT;SG	33.33 (21)	37.50 (24)	80.95	79.17
ADJ;DAT;FEM;SG	26.09 (23)	25.00 (24)	95.65	100
ADJ;GEN;PL	33.33 (24)	33.33 (24)	95.83	95.83
ADJ;NOM;PL	26.09 (23)	25.00 (24)	82.61	83.33
ADJ;FEM;NOM;SG	26.09 (23)	29.17 (24)	100.00	100
ACC;ADJ;PL	34.78 (23)	33.33 (24)	95.65	95.83
ADJ;NEUT;NOM;SG	17.39 (23)	16.67 (24)	69.57	70.83
ADJ;INS;NEUT;SG	33.33 (24)	33.33 (24)	100.00	100
ADJ;INS;MASC;SG	33.33 (24)	33.33 (24)	100.00	100
ADJ;FEM;INS;SG	28.57 (21)	25.00 (24)	100.00	100
ADJ;ESS;FEM;SG	26.09 (23)	25.00 (24)	95.65	100
ACC;ADJ;INAN;MASC;SG	45.83 (24)	45.83 (24)	87.50	87.5
ACC;ADJ;FEM;SG	13.04 (23)	12.50 (24)	95.65	95.83
ADJ;ESS;PL	33.33 (24)	33.33 (24)	95.83	95.83
ADJ;GEN;MASC;SG	33.33 (24)	33.33 (24)	95.83	95.83
ACC;ADJ;MASC;SG	33.33 (24)	33.33 (24)	95.83	95.83
ADJ;GEN;NEUT;SG	33.33 (24)	33.33 (24)	95.83	95.83
ADJ;ESS;MASC;SG	33.33 (21)	37.50 (24)	80.95	79.17
ADJ;DAT;PL	33.33 (24)	33.33 (24)	100.00	100
ADJ;DAT;NEUT;SG	23.81 (21)	16.67 (24)	100.00	100
ACC;ADJ;NEUT;SG	17.39 (23)	16.67 (24)	69.57	70.83
ADJ;MASC;NOM;SG	45.83 (24)	45.83 (24)	87.50	87.5
ADJ;DAT;MASC;SG	23.81 (21)	16.67 (24)	100.00	100
ADJ;INS;PL	40.91 (22)	45.83 (24)	100.00	100

Table 80: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Russian–Slovak language pair (the grey numbers correspond to the dictionary sizes).

	Russian–Ukrainian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	48.58 (1165)	44.41 (1396)	82.83	81.88
N;NOM;SG	48.63 (146)	48.30 (147)	83.56	82.99
N;NOM;PL	48.20 (139)	48.20 (139)	81.29	81.29
GEN;N;SG	50.34 (145)	50.00 (146)	82.76	82.19
GEN;N;PL	41.98 (131)	40.00 (140)	77.86	75.71
ESS;N;PL	62.65 (83)	51.08 (139)	92.77	93.53
DAT;N;PL	61.43 (70)	49.64 (139)	97.14	97.12
ACC;N;PL	25.42 (59)	24.59 (61)	72.88	72.13
DAT;N;SG	38.40 (125)	31.29 (147)	60.00	49.66
ESS;N;SG	39.84 (128)	34.69 (147)	60.16	55.1
ACC;N;SG	47.22 (144)	46.26 (147)	79.86	78.91
INS;N;SG	51.47 (136)	47.62 (147)	91.18	88.44
INS;N;PL	58.59 (99)	48.20 (139)	100.00	99.28
ADJ;ESS;PL	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;INAN;MASC;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;DAT;PL	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;PL	33.33 (3)	33.33 (3)	100.00	100
ADJ;DAT;NEUT;SG	-	0.00 (3)	-	100
ADJ;NOM;PL	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;FEM;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;DAT;MASC;SG	-	0.00 (3)	-	100
ADJ;FEM;INS;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;INS;NEUT;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;GEN;PL	33.33 (3)	33.33 (3)	100.00	100
ADJ;DAT;FEM;SG	-	33.33 (3)	-	100
ADJ;ESS;NEUT;SG	-	33.33 (3)	-	100
ADJ;ESS;FEM;SG	-	33.33 (3)	-	100
ACC;ADJ;INAN;PL	33.33 (3)	33.33 (3)	100.00	100
ADJ;GEN;MASC;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;GEN;NEUT;SG	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;NEUT;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;INS;PL	33.33 (3)	33.33 (3)	100.00	100
ADJ;FEM;NOM;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;ESS;MASC;SG	-	33.33 (3)	-	100
ADJ;MASC;NOM;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;NEUT;NOM;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;FEM;GEN;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;INS;MASC;SG	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;MASC;SG	33.33 (3)	33.33 (3)	100.00	100
3;PRS;SG;V	66.67 (3)	66.67 (3)	100.00	100
2;IMP;SG;V	66.67 (3)	66.67 (3)	66.67	66.67
3;NEUT;PST;SG;V	100.00 (3)	100.00 (3)	100.00	100
2;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100.00	100
3;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
2;PL;PRS;V	50.00 (2)	33.33 (3)	100.00	100
3;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100.00	100
1;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100.00	100
3;PL;PRS;V	66.67 (3)	66.67 (3)	100.00	100
2;IMP;PL;V	0.00 (3)	0.00 (3)	66.67	66.67
2;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
1;PRS;SG;V	33.33 (3)	33.33 (3)	66.67	66.67
1;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
1;PL;PRS;V	33.33 (3)	33.33 (3)	100.00	100
2;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100.00	100
2;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
3;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100.00	100
1;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
2;PRS;SG;V	100.00 (2)	66.67 (3)	100.00	100
NFIN;V	66.67 (3)	66.67 (3)	100.00	100
3;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
1;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100.00	100

Table 81: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Russian–Ukrainian language pair (the grey numbers correspond to the dictionary sizes).

Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
		Slovak–Czech		
ALL	58.74 (858)	49.57 (1154)	91.61	89.6
GEN;N;SG	69.33 (75)	68.42 (76)	89.33	88.16
DAT;N;PL	73.81 (42)	56.41 (78)	97.62	93.59
ESS;N;SG	58.49 (53)	46.05 (76)	77.36	65.79
N;NOM;PL	62.69 (67)	56.41 (78)	80.60	76.92
ACC;N;SG	72.22 (72)	69.74 (76)	86.11	86.84
INS;N;SG	62.90 (62)	56.58 (76)	91.94	92.11
N;NOM;SG	69.74 (76)	69.74 (76)	86.84	85.53
ACC;N;PL	66.18 (68)	60.26 (78)	82.35	79.49
INS;N;PL	38.46 (52)	29.49 (78)	84.62	79.49
ESS;N;PL	79.49 (39)	56.41 (78)	100.00	94.87
DAT;N;SG	67.92 (53)	55.26 (76)	86.79	73.68
GEN;N;PL	61.29 (62)	54.55 (77)	85.48	80.52
NFIN;V	22.16 (185)	15.03 (286)	99.46	99.65
ADJ;NEUT;NOM;SG	86.67 (15)	86.67 (15)	93.33	93.33
ADJ;FEM;NOM;SG	86.67 (15)	86.67 (15)	100.00	100
ADJ;ESS;PL	86.67 (15)	86.67 (15)	100.00	100
ACC;ADJ;MASC;SG	80.00 (15)	80.00 (15)	100.00	100
ACC;ADJ;INAN;MASC;SG	93.33 (15)	93.33 (15)	100.00	100
ADJ;FEM;GEN;SG	71.43 (14)	73.33 (15)	92.86	93.33
ADJ;GEN;NEUT;SG	80.00 (15)	80.00 (15)	100.00	100
ADJ;DAT;MASC;SG	90.91 (11)	80.00 (15)	100.00	100
ADJ;DAT;NEUT;SG	90.91 (11)	80.00 (15)	100.00	100
ADJ;MASC;NOM;SG	93.33 (15)	93.33 (15)	100.00	100
ACC;ADJ;FEM;SG	85.71 (14)	86.67 (15)	100.00	100
ADJ;GEN;MASC;SG	80.00 (15)	80.00 (15)	100.00	100
ADJ;DAT;PL	84.62 (13)	86.67 (15)	100.00	100
ADJ;INS;PL	84.62 (13)	80.00 (15)	100.00	100
ACC;ADJ;NEUT;SG	86.67 (15)	86.67 (15)	93.33	93.33
ADJ;GEN;PL	86.67 (15)	86.67 (15)	100.00	100
ACC;ADJ;MASC;PL	86.67 (15)	86.67 (15)	100.00	100
ADJ;ESS;MASC;SG	83.33 (12)	80.00 (15)	100.00	100
ADJ;ESS;FEM;SG	71.43 (14)	73.33 (15)	92.86	93.33
ADJ;INS;MASC;SG	84.62 (13)	86.67 (15)	100.00	100
ADJ;DAT;FEM;SG	71.43 (14)	73.33 (15)	92.86	93.33
ADJ;ESS;NEUT;SG	83.33 (12)	80.00 (15)	100.00	100
ADJ;MASC;NOM;PL	83.33 (6)	53.33 (15)	100.00	80
3;MASC;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
2;IMP;SG;V	100.00 (1)	100.00 (2)	100.00	100
3;PL;PRS;V	100.00 (2)	100.00 (2)	100.00	100
3;NEUT;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
1;PL;PRS;V	100.00 (1)	100.00 (2)	100.00	100
2;PL;PRS;V	0.00 (1)	50.00 (2)	0.00	50
1;IMP;PL;V	-	100.00 (2)	-	100
3;FEM;PL;PST;V	100.00 (1)	100.00 (2)	100.00	100
3;FEM;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
2;IMP;PL;V	-	100.00 (2)	-	100
3;PRS;SG;V	100.00 (2)	100.00 (2)	100.00	100
2;PRS;SG;V	100.00 (1)	100.00 (2)	100.00	100
3;MASC;PL;PST;V	100.00 (1)	100.00 (2)	100.00	100
1;PRS;SG;V	0.00 (1)	50.00 (2)	0.00	50
3;NEUT;PL;PST;V	100.00 (1)	100.00 (2)	100.00	100

Table 82: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Slovak–Czech language pair (the grey numbers correspond to the dictionary sizes).

	Slovak–Polish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	38.31 (830)	30.80 (1094)	80.48	79.16
ESS;N;SG	32.89 (76)	25.96 (104)	61.84	58.65
GEN;N;PL	39.76 (83)	32.35 (102)	75.90	67.65
N;NOM;SG	33.98 (103)	33.65 (104)	65.05	63.46
INS;N;PL	31.67 (60)	18.63 (102)	98.33	98.04
ACC;N;PL	40.82 (98)	38.24 (102)	78.57	76.47
ACC;N;SG	35.00 (100)	33.65 (104)	68.00	68.27
DAT;N;SG	27.94 (68)	20.19 (104)	66.18	54.81
GEN;N;SG	40.82 (98)	37.50 (104)	77.55	74.04
ESS;N;PL	57.69 (52)	35.29 (102)	98.08	96.08
DAT;N;PL	48.98 (49)	27.45 (102)	85.71	83.33
N;NOM;PL	40.82 (98)	37.25 (102)	78.57	76.47
INS;N;SG	35.44 (79)	27.88 (104)	83.54	86.54
NFIN;V	20.00 (35)	17.39 (46)	97.14	95.65
ADJ;DAT;NEUT;SG	50.00 (8)	50.00 (12)	100.00	100
ADJ;DAT;PL	33.33 (12)	33.33 (12)	100.00	100
ADJ;NOM;PL	54.55 (11)	50.00 (12)	90.91	91.67
ACC;ADJ;MASC;SG	50.00 (12)	50.00 (12)	100.00	100
ADJ;ESS;PL	58.33 (12)	58.33 (12)	100.00	100
ADJ;ESS;NEUT;SG	0.00 (10)	8.33 (12)	80.00	83.33
ADJ;FEM;INS;SG	0.00 (11)	0.00 (12)	81.82	83.33
ACC;ADJ;PL	54.55 (11)	50.00 (12)	90.91	91.67
ADJ;MASC;NOM;SG	66.67 (12)	66.67 (12)	91.67	91.67
ADJ;DAT;MASC;SG	50.00 (8)	50.00 (12)	100.00	100
ACC;ADJ;FEM;SG	36.36 (11)	41.67 (12)	100.00	100
ADJ;FEM;GEN;SG	81.82 (11)	75.00 (12)	100.00	100
ADJ;FEM;NOM;SG	72.73 (11)	66.67 (12)	90.91	91.67
ACC;ADJ;NEUT;SG	54.55 (11)	50.00 (12)	90.91	91.67
ADJ;MASC;NOM;PL	25.00 (8)	16.67 (12)	100.00	91.67
ADJ;ESS;FEM;SG	81.82 (11)	75.00 (12)	100.00	100
ADJ;INS;PL	55.56 (9)	58.33 (12)	100.00	100
ADJ;INS;MASC;SG	33.33 (12)	33.33 (12)	100.00	100
ACC;ADJ;INAN;MASC;SG	66.67 (12)	66.67 (12)	91.67	91.67
ADJ;GEN;NEUT;SG	50.00 (12)	50.00 (12)	100.00	100
ADJ;ESS;MASC;SG	0.00 (10)	8.33 (12)	80.00	83.33
ADJ;DAT;FEM;SG	81.82 (11)	75.00 (12)	100.00	100
ADJ;INS;NEUT;SG	33.33 (12)	33.33 (12)	100.00	100
ADJ;GEN;MASC;SG	50.00 (12)	50.00 (12)	100.00	100
ADJ;GEN;PL	58.33 (12)	58.33 (12)	100.00	100
ADJ;NEUT;NOM;SG	54.55 (11)	50.00 (12)	90.91	91.67
ACC;ADJ;MASC;PL	58.33 (12)	58.33 (12)	100.00	100
3;FEM;PL;PST;V	-	0.00 (1)	-	100
3;PRS;SG;V	-	0.00 (1)	-	100
3;MASC;PST;SG;V	-	0.00 (1)	-	100
2;IMP;SG;V	-	0.00 (1)	-	0
3;MASC;PL;PST;V	-	0.00 (1)	-	100
2;IMP;PL;V	-	0.00 (1)	-	0
2;PL;PRS;V	-	0.00 (1)	-	0
1;IMP;PL;V	-	0.00 (1)	-	0
3;PL;PRS;V	-	0.00 (1)	-	100
2;PRS;SG;V	-	100.00 (1)	-	100
1;PL;PRS;V	-	0.00 (1)	-	100
3;NEUT;PST;SG;V	-	0.00 (1)	-	100
3;FEM;PST;SG;V	-	0.00 (1)	-	100
1;PRS;SG;V	-	0.00 (1)	-	0

Table 83: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Slovak–Polish language pair (the grey numbers correspond to the dictionary sizes).

Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
		Slovak–Russian		
ALL	23.34 (814)	18.42 (1140)	82.56	80.7
GEN;N;SG	23.61 (72)	21.25 (80)	79.17	78.75
ACC;N;SG	23.29 (73)	21.25 (80)	64.38	62.5
N;NOM;SG	24.36 (78)	23.75 (80)	70.51	66.25
DAT;N;SG	21.15 (52)	16.25 (80)	65.38	56.25
ESS;N;SG	20.75 (53)	15.00 (80)	66.04	53.75
GEN;N;PL	25.00 (64)	19.51 (82)	71.88	64.63
DAT;N;PL	30.56 (36)	19.28 (83)	94.44	86.75
INS;N;PL	25.00 (44)	14.46 (83)	100.00	97.59
N;NOM;PL	26.39 (72)	22.89 (83)	76.39	73.49
ESS;N;PL	29.27 (41)	16.87 (83)	92.68	91.57
INS;N;SG	31.58 (57)	23.75 (80)	85.96	87.5
ACC;N;PL	30.23 (43)	23.64 (55)	81.40	76.36
ADJ;DAT;NEUT;SG	18.18 (11)	11.76 (17)	100.00	100
ACC;ADJ;FEM;SG	46.15 (13)	41.18 (17)	100.00	88.24
ADJ;MASC;NOM;SG	41.18 (17)	41.18 (17)	88.24	88.24
ADJ;GEN;PL	41.18 (17)	41.18 (17)	100.00	100
ADJ;ESS;PL	41.18 (17)	41.18 (17)	100.00	100
ADJ;NEUT;NOM;SG	37.50 (16)	41.18 (17)	75.00	76.47
ACC;ADJ;INAN;MASC;SG	41.18 (17)	41.18 (17)	88.24	88.24
ADJ;NOM;PL	37.50 (16)	41.18 (17)	75.00	76.47
ADJ;FEM;GEN;SG	33.33 (15)	29.41 (17)	93.33	94.12
ADJ;FEM;NOM;SG	25.00 (16)	29.41 (17)	87.50	88.24
ADJ;DAT;FEM;SG	33.33 (15)	29.41 (17)	93.33	94.12
ADJ;GEN;MASC;SG	31.25 (16)	29.41 (17)	100.00	100
ACC;ADJ;PL	37.50 (16)	41.18 (17)	75.00	76.47
ACC;ADJ;NEUT;SG	37.50 (16)	41.18 (17)	75.00	76.47
ADJ;GEN;NEUT;SG	31.25 (16)	29.41 (17)	100.00	100
ADJ;ESS;NEUT;SG	31.25 (16)	29.41 (17)	75.00	70.59
ADJ;DAT;MASC;SG	18.18 (11)	11.76 (17)	100.00	100
ADJ;INS;PL	35.71 (14)	41.18 (17)	100.00	100
ADJ;ESS;FEM;SG	33.33 (15)	29.41 (17)	93.33	94.12
ADJ;INS;NEUT;SG	37.50 (16)	35.29 (17)	100.00	100
ADJ;INS;MASC;SG	37.50 (16)	35.29 (17)	100.00	100
ADJ;DAT;PL	37.50 (16)	35.29 (17)	100.00	100
ACC;ADJ;MASC;SG	31.25 (16)	29.41 (17)	100.00	100
ADJ;ESS;MASC;SG	31.25 (16)	29.41 (17)	75.00	70.59
ADJ;FEM;INS;SG	0.00 (12)	0.00 (17)	58.33	58.82
NFIN;V	3.82 (131)	2.44 (205)	95.42	95.12
2;PL;PRS;V	100.00 (1)	50.00 (2)	100.00	50
3;FEM;PL;PST;V	0.00 (1)	50.00 (2)	100.00	100
2;PRS;SG;V	0.00 (1)	0.00 (2)	0.00	0
2;IMP;PL;V	-	50.00 (2)	-	50
3;PRS;SG;V	50.00 (2)	50.00 (2)	50.00	50
3;NEUT;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
3;MASC;PL;PST;V	0.00 (1)	50.00 (2)	100.00	100
2;IMP;SG;V	0.00 (1)	0.00 (2)	0.00	0
3;MASC;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
3;FEM;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
1;PRS;SG;V	0.00 (1)	0.00 (2)	0.00	0
1;PL;PRS;V	100.00 (1)	50.00 (2)	100.00	50
3;PL;PRS;V	50.00 (2)	50.00 (2)	50.00	50

Table 84: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Slovak–Russian language pair (the grey numbers correspond to the dictionary sizes).

	Slovak–Ukrainian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	43.64 (330)	36.71 (425)	82.42	81.41
ACC;N;SG	45.45 (44)	43.48 (46)	79.55	78.26
ACC;N;PL	50.00 (42)	45.65 (46)	85.71	86.96
ESS;N;SG	38.24 (34)	28.26 (46)	67.65	58.7
ESS;N;PL	58.33 (24)	34.78 (46)	87.5	89.13
GEN;N;PL	45.95 (37)	39.13 (46)	86.49	76.09
N;NOM;SG	36.96 (46)	36.96 (46)	76.09	76.09
N;NOM;PL	50.00 (42)	45.65 (46)	85.71	86.96
DAT;N;SG	27.27 (33)	21.74 (46)	63.64	58.7
INS;N;PL	35.48 (31)	26.09 (46)	100	97.83
GEN;N;SG	50.00 (44)	47.83 (46)	84.09	84.78
INS;N;SG	37.14 (35)	30.43 (46)	80	84.78
DAT;N;PL	50.00 (22)	41.30 (46)	90.91	91.3
ADJ;GEN;MASC;SG	100.00 (2)	100.00 (2)	100	100
ADJ;NEUT;NOM;SG	50.00 (2)	50.00 (2)	100	100
ADJ;INS;PL	50.00 (2)	50.00 (2)	100	100
ADJ;ESS;FEM;SG	50.00 (2)	50.00 (2)	50	50
ACC;ADJ;FEM;SG	50.00 (2)	50.00 (2)	100	100
ADJ;ESS;PL	50.00 (2)	50.00 (2)	100	100
ADJ;INS;MASC;SG	50.00 (2)	50.00 (2)	100	100
ADJ;DAT;PL	50.00 (2)	50.00 (2)	100	100
ADJ;NOM;PL	50.00 (2)	50.00 (2)	100	100
ACC;ADJ;MASC;SG	100.00 (2)	100.00 (2)	100	100
ACC;ADJ;NEUT;SG	50.00 (2)	50.00 (2)	100	100
ADJ;FEM;INS;SG	50.00 (2)	50.00 (2)	100	100
ADJ;DAT;FEM;SG	50.00 (2)	50.00 (2)	50	50
ACC;ADJ;INAN;MASC;SG	50.00 (2)	50.00 (2)	100	100
ADJ;FEM;NOM;SG	50.00 (2)	50.00 (2)	50	50
ADJ;ESS;MASC;SG	50.00 (2)	50.00 (2)	50	50
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (2)	0	0
ACC;ADJ;PL	50.00 (2)	50.00 (2)	100	100
ADJ;GEN;PL	50.00 (2)	50.00 (2)	100	100
ADJ;FEM;GEN;SG	50.00 (2)	50.00 (2)	50	50
ADJ;GEN;NEUT;SG	100.00 (2)	100.00 (2)	100	100
ADJ;ESS;NEUT;SG	50.00 (2)	50.00 (2)	50	50
ADJ;MASC;NOM;SG	50.00 (2)	50.00 (2)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (2)	0	0
ADJ;INS;NEUT;SG	50.00 (2)	50.00 (2)	100	100
NFIN;V	33.33 (3)	25.00 (4)	100	100

Table 85: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Slovak–Ukrainian language pair (the grey numbers correspond to the dictionary sizes).

	Ukrainian–Czech			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	43.35 (699)	38.55 (869)	78.97	75.37
N;PL;VOC	50.00 (74)	46.25 (80)	83.78	83.75
ACC;N;PL	54.05 (74)	50.00 (80)	87.84	87.5
INS;N;PL	27.69 (65)	25.00 (80)	81.54	78.75
ACC;N;SG	53.16 (79)	52.44 (82)	77.22	74.39
DAT;N;PL	56.10 (41)	41.25 (80)	95.12	93.75
GEN;N;PL	51.39 (72)	47.50 (80)	79.17	77.5
N;NOM;PL	50.00 (74)	46.25 (80)	83.78	83.75
ESS;N;PL	40.82 (49)	32.50 (80)	85.71	80
ESS;N;SG	36.76 (68)	33.33 (81)	70.59	65.43
DAT;N;SG	38.46 (65)	34.15 (82)	66.15	60.98
GEN;N;SG	59.49 (79)	57.32 (82)	87.34	84.15
INS;N;SG	44.00 (75)	41.46 (82)	82.67	80.49
N;NOM;SG	49.38 (81)	48.78 (82)	79.01	78.05
N;SG;VOC	40.00 (35)	30.49 (82)	54.29	50
1;IMP;PL;V	20.00 (5)	16.67 (6)	40	33.33
3;NEUT;PST;SG;V	40.00 (5)	50.00 (6)	100	100
NFIN;V	66.67 (6)	66.67 (6)	100	100
3;MASC;PST;SG;V	50.00 (6)	50.00 (6)	100	100
3;FEM;PST;SG;V	83.33 (6)	83.33 (6)	100	100
2;IMP;SG;V	0.00 (6)	0.00 (6)	33.33	33.33
2;IMP;PL;V	33.33 (6)	33.33 (6)	100	100
1;PRS;SG;V	25.00 (4)	20.00 (5)	50	40
3;PL;PRS;V	40.00 (5)	40.00 (5)	60	60
3;FEM;PL;PST;V	66.67 (6)	66.67 (6)	100	100
2;PL;PRS;V	25.00 (4)	20.00 (5)	75	80
3;PRS;SG;V	40.00 (5)	40.00 (5)	80	80
2;PRS;SG;V	40.00 (5)	40.00 (5)	80	80
3;MASC;PL;PST;V	66.67 (6)	66.67 (6)	100	100
1;PL;PRS;V	25.00 (4)	20.00 (5)	75	60
3;FUT;PL;V	0.00 (1)	0.00 (1)	0	0
3;FUT;SG;V	0.00 (1)	0.00 (1)	0	0
2;FUT;PL;V	0.00 (1)	0.00 (1)	0	0
1;FUT;PL;V	0.00 (1)	0.00 (1)	100	100
2;FUT;SG;V	0.00 (1)	0.00 (1)	0	0
1;FUT;SG;V	0.00 (1)	0.00 (1)	100	100
ADJ;MASC;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;PL	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;FEM;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;NEUT;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;FEM;SG	0.00 (1)	0.00 (1)	0	0
ADJ;DAT;PL	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;GEN;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;PL	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;PL	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;INAN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;FEM;SG	0.00 (1)	0.00 (1)	0	0

Table 86: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Ukrainian–Czech language pair (the grey numbers correspond to the dictionary sizes).

Morph	Ukrainian–Polish			
	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	54.47 (850)	47.15 (1054)	82.59	79.41
INS;N;SG	54.17 (96)	49.52 (105)	88.54	86.67
GEN;N;PL	45.83 (96)	43.69 (103)	65.62	67.96
ACC;N;SG	56.86 (102)	55.24 (105)	85.29	83.81
DAT;N;PL	60.78 (51)	43.69 (103)	94.12	90.29
ACC;N;PL	64.65 (99)	62.14 (103)	90.91	89.32
ESS;N;PL	71.01 (69)	61.17 (103)	92.75	93.2
N;PL;VOC	65.00 (100)	63.11 (103)	92.00	90.29
N;NOM;SG	55.24 (105)	55.24 (105)	83.81	83.81
GEN;N;SG	61.76 (102)	60.00 (105)	91.18	87.62
INS;N;PL	65.52 (87)	53.40 (103)	98.85	99.03
ESS;N;SG	47.83 (92)	40.95 (105)	71.74	66.67
N;SG;VOC	33.33 (51)	25.71 (105)	62.75	53.33
N;NOM;PL	65.00 (100)	63.11 (103)	92.00	90.29
DAT;N;SG	48.75 (80)	37.14 (105)	70.00	60.95
2;IMP;PL;V	-	0.00 (2)	-	0
2;FEM;PL;PST;V	-	50.00 (2)	-	100
1;PL;PRS;V	0.00 (2)	0.00 (2)	50.00	50
2;PRS;SG;V	0.00 (2)	0.00 (2)	50.00	50
3;MASC;PL;PST;V	50.00 (2)	50.00 (2)	100.00	100
2;PL;PRS;V	0.00 (1)	0.00 (2)	0.00	0
1;FEM;PL;PST;V	-	50.00 (2)	-	100
3;FEM;PST;SG;V	100.00 (1)	50.00 (2)	100.00	50
2;FEM;PST;SG;V	-	50.00 (2)	-	50
1;PRS;SG;V	0.00 (2)	0.00 (2)	50.00	50
3;PRS;SG;V	50.00 (2)	50.00 (2)	100.00	100
3;NEUT;PST;SG;V	100.00 (1)	50.00 (2)	100.00	50
1;MASC;PL;PST;V	100.00 (1)	50.00 (2)	100.00	100
3;MASC;PST;SG;V	50.00 (2)	50.00 (2)	100.00	100
1;IMP;PL;V	-	0.00 (2)	-	50
2;MASC;PL;PST;V	-	50.00 (2)	-	100
3;FEM;PL;PST;V	100.00 (1)	50.00 (2)	100.00	100
2;MASC;PST;SG;V	100.00 (1)	50.00 (2)	100.00	100
3;PL;PRS;V	50.00 (2)	50.00 (2)	100.00	100
NFIN;V	0.00 (2)	0.00 (2)	50.00	50
1;FEM;PST;SG;V	100.00 (1)	50.00 (2)	100.00	50
2;IMP;SG;V	0.00 (1)	0.00 (2)	100.00	100
1;MASC;PST;SG;V	100.00 (1)	50.00 (2)	100.00	100
ADJ;ESS;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;MASC;NOM;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;GEN;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;NOM;PL	100.00 (2)	100.00 (2)	100.00	100
ADJ;NEUT;NOM;SG	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;INS;NEUT;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;PL	0.00 (2)	0.00 (2)	100.00	100
ADJ;INS;PL	100.00 (2)	100.00 (2)	100.00	100
ADJ;FEM;INS;SG	100.00 (2)	100.00 (2)	100.00	100
ACC;ADJ;FEM;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;FEM;NOM;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;FEM;GEN;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;GEN;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;DAT;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;INS;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;ESS;NEUT;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;GEN;PL	100.00 (2)	100.00 (2)	100.00	100
ACC;ADJ;PL	100.00 (2)	100.00 (2)	100.00	100
ACC;ADJ;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;INAN;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;ESS;FEM;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;ESS;PL	100.00 (2)	100.00 (2)	100.00	100
ADJ;DAT;NEUT;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;FEM;SG	50.00 (2)	50.00 (2)	100.00	100

Table 87: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Ukrainian–Polish language pair (the grey numbers correspond to the dictionary sizes).

Ukrainian–Russian				
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	69.59 (786)	65.59 (933)	91.09	89.5
ESS;N;SG	65.91 (88)	63.64 (99)	85.23	81.82
INS;N;PL	81.58 (76)	69.39 (98)	98.68	100
ACC;N;SG	73.20 (97)	71.72 (99)	93.81	91.92
GEN;N;PL	69.32 (88)	64.29 (98)	84.09	78.57
GEN;N;SG	78.12 (96)	75.76 (99)	93.75	91.92
DAT;N;PL	77.36 (53)	67.35 (98)	92.45	93.88
N;NOM;SG	71.72 (99)	71.72 (99)	92.93	92.93
INS;N;SG	72.04 (93)	69.70 (99)	95.7	93.94
N;NOM;PL	70.10 (97)	69.39 (98)	89.69	89.8
DAT;N;SG	63.64 (88)	59.60 (99)	81.82	76.77
ESS;N;PL	83.64 (55)	72.45 (98)	96.36	90.82
ACC;N;PL	62.71 (59)	63.93 (61)	84.75	85.25
ADJ;FEM;NOM;SG	0.00 (2)	0.00 (2)	100	100
ACC;ADJ;NEUT;SG	0.00 (2)	0.00 (2)	100	100
ACC;ADJ;FEM;SG	0.00 (2)	0.00 (2)	100	100
ADJ;DAT;PL	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;NEUT;SG	0.00 (1)	0.00 (2)	100	100
ADJ;MASC;NOM;SG	0.00 (2)	0.00 (2)	100	100
ADJ;FEM;GEN;SG	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;FEM;SG	0.00 (2)	0.00 (2)	100	50
ACC;ADJ;INAN;MASC;SG	0.00 (2)	0.00 (2)	100	100
ADJ;NOM;PL	0.00 (2)	0.00 (2)	50	50
ACC;ADJ;MASC;SG	0.00 (2)	0.00 (2)	100	100
ADJ;DAT;FEM;SG	0.00 (2)	0.00 (2)	100	50
ADJ;INS;PL	0.00 (2)	0.00 (2)	100	100
ADJ;INS;MASC;SG	0.00 (2)	0.00 (2)	100	100
ADJ;GEN;NEUT;SG	0.00 (2)	0.00 (2)	100	100
ADJ;FEM;INS;SG	0.00 (2)	0.00 (2)	50	50
ACC;ADJ;INAN;PL	0.00 (2)	0.00 (2)	50	50
ADJ;ESS;PL	0.00 (2)	0.00 (2)	100	100
ADJ;GEN;PL	0.00 (2)	0.00 (2)	100	100
ADJ;NEUT;NOM;SG	0.00 (2)	0.00 (2)	100	100
ADJ;INS;NEUT;SG	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;MASC;SG	0.00 (1)	0.00 (2)	100	100
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (2)	100	100
ACC;ADJ;PL	0.00 (2)	0.00 (2)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (2)	100	100
ADJ;GEN;MASC;SG	0.00 (2)	0.00 (2)	100	100
1;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100	100
2;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100	100
2;IMP;SG;V	33.33 (3)	33.33 (3)	33.33	66.67
2;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100	100
3;PL;PRS;V	66.67 (3)	66.67 (3)	100	100
1;PRS;SG;V	66.67 (3)	66.67 (3)	100	100
2;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100	100
2;PRS;SG;V	100.00 (2)	66.67 (3)	100	100
1;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100	100
1;PL;PRS;V	100.00 (2)	66.67 (3)	100	100
NFIN;V	66.67 (3)	66.67 (3)	100	100
1;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100	100
2;IMP;PL;V	50.00 (2)	33.33 (3)	100	66.67
3;PRS;SG;V	66.67 (3)	66.67 (3)	100	100
1;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100	100
3;NEUT;PST;SG;V	66.67 (3)	66.67 (3)	100	100
2;PL;PRS;V	50.00 (2)	33.33 (3)	50	66.67
2;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100	100
3;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100	100
3;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100	100
3;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100	100
3;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100	100

Table 88: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Ukrainian–Russian language pair (the grey numbers correspond to the dictionary sizes).

Ukrainian–Slovak				
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	33.54 (322)	28.33 (420)	81.37	79.05
ESS;N;SG	33.33 (33)	26.67 (45)	84.85	68.89
ACC;N;SG	26.19 (42)	23.91 (46)	78.57	73.91
ACC;N;PL	29.27 (41)	26.67 (45)	87.8	84.44
GEN;N;PL	31.58 (38)	26.09 (46)	73.68	69.57
N;NOM;PL	28.57 (42)	26.67 (45)	88.1	84.44
ESS;N;PL	59.09 (22)	35.56 (45)	95.45	93.33
N;NOM;SG	24.44 (45)	23.91 (46)	71.11	69.57
INS;N;PL	36.67 (30)	28.89 (45)	100	100
DAT;N;PL	40.00 (20)	26.67 (45)	75	71.11
DAT;N;SG	27.03 (37)	21.74 (46)	78.38	67.39
INS;N;SG	34.21 (38)	30.43 (46)	81.58	82.61
GEN;N;SG	31.82 (44)	30.43 (46)	88.64	86.96
NFIN;V	50.00 (2)	50.00 (2)	100	100
ACC;ADJ;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;PL	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;INS;SG	100.00 (1)	100.00 (1)	100	100
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;FEM;SG	0.00 (1)	0.00 (1)	0	0
ADJ;ESS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;PL	0.00 (1)	0.00 (1)	100	100
ADJ;INS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;PL	100.00 (1)	100.00 (1)	100	100
ADJ;FEM;GEN;SG	100.00 (1)	100.00 (1)	100	100
ADJ;DAT;PL	0.00 (1)	0.00 (1)	100	100
ADJ;MASC;NOM;SG	100.00 (1)	100.00 (1)	100	100
ACC;ADJ;FEM;SG	100.00 (1)	100.00 (1)	100	100
ADJ;NEUT;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;NOM;PL	100.00 (1)	100.00 (1)	100	100
ADJ;ESS;FEM;SG	0.00 (1)	0.00 (1)	0	0
ADJ;GEN;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;INAN;MASC;SG	100.00 (1)	100.00 (1)	100	100
ADJ;ESS;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;PL	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;MASC;SG	0.00 (1)	0.00 (1)	100	100

Table 89: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Ukrainian–Slovak language pair (the grey numbers correspond to the dictionary sizes).

	Polish–Spanish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	34.98 (8964)	27.42 (12759)	78.07	68.34
ACC;N;PL	38.45 (827)	36.43 (884)	84.76	82.92
ACC;N;SG	40.02 (922)	38.67 (962)	79.72	79.11
DAT;N;PL	20.07 (304)	13.28 (881)	50.66	50.17
DAT;N;SG	27.88 (599)	19.77 (961)	78.30	71.18
ESS;N;PL	32.61 (552)	26.11 (881)	81.34	77.98
ESS;N;SG	34.33 (766)	30.76 (959)	77.94	74.45
GEN;N;PL	40.41 (782)	36.30 (887)	82.99	79.14
GEN;N;SG	40.84 (933)	39.60 (962)	87.03	86.38
INS;N;PL	26.53 (622)	22.25 (881)	84.41	82.29
INS;N;SG	34.53 (837)	31.29 (962)	76.46	74.74
N;NOM;PL	38.01 (826)	36.01 (883)	84.38	82.45
N;NOM;SG	40.95 (950)	40.44 (962)	84.00	83.37
N;PL;VOC	38.01 (826)	36.01 (883)	84.38	82.45
N;SG;VOC	32.98 (561)	29.14 (961)	75.58	71.7
1;COND;FEM;PL;V	-	2.08 (48)	-	27.08
1;COND;FEM;SG;V	0.00 (1)	2.08 (48)	0.00	2.08
1;COND;MASC;PL;V	25.00 (4)	20.83 (48)	75.00	70.83
1;COND;MASC;SG;V	0.00 (8)	0.00 (48)	0.00	0
1;FEM;PL;PST;V	-	0.00 (62)	-	8.06
1;FEM;PST;SG;V	18.75 (16)	6.45 (62)	25.00	9.68
1;IMP;PL;V	0.00 (8)	4.17 (48)	25.00	16.67
1;MASC;PL;PST;V	30.77 (13)	8.06 (62)	46.15	27.42
1;MASC;PST;SG;V	6.67 (30)	3.23 (62)	26.67	4.84
1;PL;PRS;V	41.38 (29)	29.17 (48)	58.62	41.67
1;PRS;SG;V	13.51 (37)	10.42 (48)	16.22	12.5
2;COND;FEM;PL;V	-	0.00 (48)	-	0
2;COND;FEM;SG;V	0.00 (1)	2.08 (48)	0.00	6.25
2;COND;MASC;PL;V	-	0.00 (48)	-	10.42
2;COND;MASC;SG;V	0.00 (2)	4.17 (48)	0.00	4.17
2;FEM;PL;PST;V	-	0.00 (62)	-	0
2;FEM;PST;SG;V	0.00 (4)	9.68 (62)	0.00	11.29
2;IMP;PL;V	0.00 (6)	0.00 (48)	0.00	0
2;IMP;SG;V	8.00 (25)	8.33 (48)	12.00	12.5
2;MASC;PL;PST;V	0.00 (1)	0.00 (62)	0.00	1.61
2;MASC;PST;SG;V	0.00 (10)	3.23 (62)	10.00	4.84
2;PL;PRS;V	11.11 (9)	0.00 (48)	11.11	0
2;PRS;SG;V	4.35 (23)	4.17 (48)	13.04	6.25
3;COND;FEM;PL;V	12.50 (8)	14.58 (48)	62.50	45.83
3;COND;FEM;SG;V	11.11 (9)	20.83 (48)	66.67	35.42
3;COND;MASC;PL;V	0.00 (4)	2.08 (48)	25.00	18.75
3;COND;MASC;SG;V	33.33 (12)	22.92 (48)	66.67	39.58
3;COND;NEUT;SG;V	0.00 (7)	4.17 (48)	28.57	4.17
3;FEM;PL;PST;V	51.16 (43)	41.94 (62)	74.42	72.58
3;FEM;PST;SG;V	43.14 (51)	40.32 (62)	68.63	67.74
3;MASC;PL;PST;V	20.41 (49)	17.74 (62)	61.22	51.61
3;MASC;PST;SG;V	37.04 (54)	32.26 (62)	61.11	54.84
3;NEUT;PST;SG;V	4.76 (42)	3.23 (62)	9.52	8.06
3;PL;PRS;V	47.62 (42)	43.75 (48)	78.57	72.92
3;PRS;SG;V	34.78 (46)	33.33 (48)	54.35	52.08
NFIN;V	21.28 (47)	20.83 (48)	89.36	87.5
ACC;ADJ;FEM;SG	25.99 (177)	25.00 (188)	69.49	67.02
ACC;ADJ;INAN;MASC;SG	50.00 (188)	49.47 (190)	88.83	88.42
ACC;ADJ;MASC;PL	54.19 (179)	51.32 (189)	96.09	96.3
ACC;ADJ;MASC;SG	43.17 (183)	41.58 (190)	78.69	78.42
ACC;ADJ;PL	56.76 (185)	55.03 (189)	94.05	94.18
ADJ;DAT;FEM;SG	50.28 (177)	47.34 (188)	87.57	87.23
ADJ;DAT;MASC;SG	8.65 (104)	8.95 (190)	56.73	58.42
ADJ;DAT;PL	46.11 (180)	43.92 (189)	95.00	94.71
ADJ;ESS;FEM;SG	50.28 (177)	47.34 (188)	87.57	87.23
ADJ;ESS;MASC;SG	46.41 (181)	44.21 (190)	95.03	94.74
ADJ;ESS;PL	54.19 (179)	51.32 (189)	96.09	96.3
ADJ;FEM;GEN;SG	50.28 (177)	47.34 (188)	87.57	87.23
ADJ;FEM;INS;SG	25.99 (177)	25.00 (188)	69.49	67.02
ADJ;FEM;NOM;SG	50.55 (182)	48.94 (188)	93.41	93.62
ADJ;GEN;MASC;SG	43.17 (183)	41.58 (190)	78.69	78.42
ADJ;GEN;PL	54.19 (179)	51.32 (189)	96.09	96.3
ADJ;INS;MASC;SG	46.41 (181)	44.21 (190)	95.03	94.74
ADJ;INS;PL	25.16 (155)	23.28 (189)	90.32	91.01
ADJ;MASC;NOM;PL	29.06 (117)	20.63 (189)	65.81	55.56
ADJ;MASC;NOM;SG	50.00 (188)	49.47 (190)	88.83	88.42
ADJ;NOM;PL	56.76 (185)	55.03 (189)	94.05	94.18

Table 90: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Polish–Spanish language pair (the grey numbers correspond to the dictionary sizes).

	Spanish–Polish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	27.80 (4270)	20.85 (6095)	81.17	65.5
N;PL	30.99 (1139)	29.45 (1226)	87.09	87.68
N;SG	33.74 (1316)	33.26 (1338)	85.33	84.08
ADJ;FEM;PL	40.85 (235)	40.34 (238)	96.60	96.64
ADJ;FEM;SG	31.78 (236)	31.25 (240)	82.63	82.08
ADJ;MASC;PL	40.68 (236)	39.92 (243)	96.19	96.3
ADJ;MASC;SG	35.80 (243)	35.39 (243)	87.65	88.07
1;COND;PL;V	50.00 (2)	18.02 (111)	100.00	86.49
1;COND;SG;V	7.41 (27)	4.50 (111)	40.74	36.94
1;IMP;PL;POS;V	0.00 (22)	0.00 (116)	13.64	7.76
1;IPFV;PL;PST;V	7.69 (13)	12.61 (111)	100.00	89.19
1;IPFV;PST;SG;V	22.58 (62)	18.92 (111)	80.65	73.87
1;PFV;PL;PST;V	15.38 (26)	18.02 (111)	69.23	72.07
1;PFV;PST;SG;V	11.90 (42)	7.21 (111)	59.52	35.14
1;PL;PRS;V	18.37 (49)	20.65 (92)	79.59	75
1;PRS;SG;V	9.52 (63)	8.79 (91)	44.44	31.87
2;COND;PL;V	-	6.31 (111)	-	27.93
2;COND;SG;V	100.00 (1)	2.70 (111)	100.00	10.81
2;IMP;PL;POS;V	0.00 (17)	0.00 (116)	11.76	4.31
2;IMP;POS;SG;V	21.43 (84)	17.24 (116)	45.24	42.24
2;IPFV;PL;PST;V	-	0.00 (111)	-	2.7
2;IPFV;PST;SG;V	0.00 (11)	1.80 (111)	27.27	14.41
2;PFV;PL;PST;V	-	0.00 (111)	-	1.8
2;PFV;PST;SG;V	6.67 (15)	5.41 (111)	66.67	45.95
2;PL;PRS;V	0.00 (13)	1.09 (92)	0.00	2.17
2;PRS;SG;V	11.36 (44)	5.43 (92)	18.18	8.7
3;COND;PL;V	0.00 (19)	0.00 (111)	10.53	8.11
3;COND;SG;V	7.89 (38)	4.50 (111)	36.84	36.94
3;IPFV;PL;PST;V	13.04 (92)	12.61 (111)	80.43	81.98
3;IPFV;PST;SG;V	20.62 (97)	18.92 (111)	79.38	73.87
3;PFV;PL;PST;V	15.38 (91)	17.12 (111)	90.11	89.19
3;PFV;PST;SG;V	6.06 (99)	5.41 (111)	75.76	70.27
3;PL;PRS;V	23.17 (82)	21.74 (92)	80.49	73.91
3;PRS;SG;V	21.59 (88)	19.57 (92)	53.41	50
NFIN;V	16.07 (112)	15.52 (116)	92.86	87.07
1;FUT;PL;V	16.67 (12)	5.56 (36)	91.67	44.44
1;FUT;SG;V	0.00 (14)	2.78 (36)	28.57	16.67
2;FUT;PL;V	0.00 (1)	0.00 (36)	0.00	0
2;FUT;SG;V	0.00 (5)	0.00 (36)	20.00	8.33
3;FUT;PL;V	0.00 (17)	0.00 (36)	64.71	58.33
3;FUT;SG;V	0.00 (28)	0.00 (36)	50.00	33.33

Table 91: The performance of Artetxe et al. (2017)'s model on translating words belonging to a specific morphological category for the Spanish–Polish language pair (the grey numbers correspond to the dictionary sizes).

		Czech–Polish		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	51.76 (3161)	42.80 (4166)	84.02	77.65
ACC;ADJ;NEUT;SG	57.35 (68)	54.93 (71)	94.12	92.96
ADJ;GEN;PL	50.79 (63)	46.48 (71)	98.41	98.59
ADJ;GEN;MASC;SG	52.31 (65)	47.89 (71)	96.92	97.18
ADJ;ESS;MASC;SG	39.29 (56)	32.39 (71)	64.29	64.79
ADJ;FEM;INS;SG	16.67 (6)	16.67 (6)	66.67	66.67
ADJ;NOM;PL	16.67 (6)	16.67 (6)	66.67	66.67
ACC;ADJ;FEM;SG	55.22 (67)	52.11 (71)	94.03	94.37
ADJ;INS;NEUT;SG	20.00 (5)	16.67 (6)	100	100
ADJ;DAT;FEM;SG	57.35 (68)	54.93 (71)	94.12	92.96
ADJ;DAT;MASC;SG	68.29 (41)	49.30 (71)	95.12	100
ADJ;DAT;PL	44.62 (65)	40.85 (71)	100	100
ADJ;ESS;FEM;SG	57.35 (68)	54.93 (71)	94.12	92.96
ADJ;INS;MASC;SG	44.62 (65)	40.85 (71)	100	100
ADJ;ESS;NEUT;SG	49.12 (57)	39.44 (71)	84.21	80.28
ADJ;INS;PL	56.36 (55)	46.48 (71)	100	100
ACC;ADJ;PL	16.67 (6)	16.67 (6)	66.67	66.67
ADJ;ESS;PL	50.79 (63)	46.48 (71)	98.41	98.59
ADJ;FEM;GEN;SG	57.35 (68)	54.93 (71)	94.12	92.96
ACC;ADJ;MASC;SG	52.31 (65)	47.89 (71)	96.92	97.18
ADJ;GEN;NEUT;SG	52.31 (65)	47.89 (71)	96.92	97.18
ADJ;DAT;NEUT;SG	68.29 (41)	49.30 (71)	95.12	100
GEN;N;SG	56.53 (352)	56.62 (355)	86.08	85.92
ACC;N;PL	57.58 (330)	55.52 (344)	89.09	88.08
INS;N;PL	62.74 (263)	50.58 (346)	93.92	91.33
DAT;N;SG	50.18 (273)	45.04 (353)	72.53	69.69
N;NOM;PL	57.96 (333)	55.91 (347)	89.19	87.9
ESS;N;PL	62.88 (229)	50.14 (345)	93.01	93.62
N;SG;VOC	53.50 (157)	34.46 (354)	73.25	54.24
N;PL;VOC	57.83 (332)	55.62 (347)	89.16	87.61
ACC;N;SG	53.60 (347)	51.83 (355)	78.1	76.9
INS;N;SG	53.23 (325)	49.86 (353)	85.23	84.7
GEN;N;PL	53.87 (310)	48.85 (348)	80.65	75.86
ESS;N;SG	49.68 (312)	45.33 (353)	72.12	69.97
N;NOM;SG	52.96 (355)	52.68 (355)	79.72	79.72
DAT;N;PL	51.53 (163)	37.57 (346)	82.82	83.82
ADJ;FEM;NOM;SG	54.84 (62)	50.77 (65)	91.94	92.31
ADJ;MASC;NOM;SG	58.06 (62)	55.38 (65)	96.77	98.46
ACC;ADJ;INAN;MASC;SG	58.06 (62)	55.38 (65)	96.77	98.46
ACC;ADJ;MASC;PL	61.29 (62)	58.46 (65)	96.77	95.38
ADJ;MASC;NOM;PL	44.44 (36)	40.00 (65)	75	63.08
ADJ;NEUT;NOM;SG	61.29 (62)	58.46 (65)	96.77	95.38
3;MASC;PST;SG;V	50.00 (38)	48.78 (41)	89.47	85.37
2;IMP;PL;V	0.00 (8)	5.00 (40)	37.5	17.5
1;PRS;SG;V	30.77 (13)	8.82 (34)	69.23	23.53
3;FEM;PL;PST;V	59.26 (27)	48.78 (41)	92.59	87.8
1;PL;PRS;V	28.57 (14)	11.76 (34)	85.71	58.82
3;PL;PRS;V	42.86 (28)	35.29 (34)	89.29	73.53
3;MASC;PL;PST;V	38.71 (31)	36.59 (41)	96.77	92.68
3;NEUT;PST;SG;V	66.67 (27)	51.22 (41)	96.3	95.12
NFIN;V	35.56 (45)	34.78 (46)	95.56	93.48
2;PL;PRS;V	0.00 (5)	0.00 (34)	0	0
3;PRS;SG;V	40.62 (32)	38.24 (34)	75	67.65
3;FEM;PST;SG;V	51.52 (33)	48.78 (41)	93.94	87.8
2;PRS;SG;V	14.29 (7)	8.82 (34)	57.14	26.47
2;IMP;SG;V	7.69 (13)	12.50 (40)	23.08	22.5
1;IMP;PL;V	33.33 (3)	5.00 (40)	66.67	20
2;FUT;PL;V	0.00 (1)	11.11 (9)	0	11.11
1;FUT;SG;V	0.00 (5)	0.00 (9)	20	11.11
3;FUT;PL;V	0.00 (7)	0.00 (9)	42.86	44.44
1;FUT;PL;V	0.00 (3)	11.11 (9)	33.33	77.78
2;FUT;SG;V	0.00 (1)	0.00 (9)	100	0
3;FUT;SG;V	11.11 (9)	11.11 (9)	55.56	55.56

Table 92: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Czech–Polish language pair (the grey numbers correspond to the dictionary sizes).

		Czech–Russian		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	45.48 (3562)	38.64 (4762)	84.95	80.85
GEN;N;PL	45.83 (312)	40.82 (365)	76.28	70.96
GEN;N;SG	50.96 (365)	50.13 (373)	85.75	84.45
DAT;N;PL	52.94 (187)	41.64 (365)	94.12	91.78
INS;N;SG	50.00 (324)	46.11 (373)	87.35	84.18
ACC;N;PL	50.67 (225)	47.98 (248)	83.11	79.44
N;NOM;PL	52.54 (335)	49.45 (362)	86.87	83.15
N;NOM;SG	46.59 (367)	46.09 (371)	77.11	76.55
DAT;N;SG	46.62 (311)	41.29 (373)	77.49	71.85
ESS;N;SG	46.15 (312)	40.75 (373)	77.24	71.58
INS;N;PL	49.22 (256)	40.00 (365)	85.55	83.56
ESS;N;PL	48.08 (208)	39.73 (365)	93.27	92.88
ACC;N;SG	45.60 (364)	44.50 (373)	77.2	75.87
ADJ;DAT;MASC;SG	66.67 (57)	56.63 (83)	98.25	98.8
ADJ;NEUT;NOM;SG	32.39 (71)	29.73 (74)	43.66	43.24
ADJ;FEM;GEN;SG	29.63 (81)	27.71 (83)	45.68	44.58
ACC;ADJ;INAN;MASC;SG	59.72 (72)	58.11 (74)	94.44	93.24
ADJ;INS;PL	65.22 (69)	60.24 (83)	100	100
ADJ;ESS;PL	59.74 (77)	56.63 (83)	100	100
ADJ;FEM;NOM;SG	62.50 (72)	62.16 (74)	94.44	94.59
ADJ;DAT;PL	64.94 (77)	62.65 (83)	100	100
ADJ;ESS;FEM;SG	29.63 (81)	27.71 (83)	45.68	44.58
ADJ;DAT;NEUT;SG	66.67 (57)	56.63 (83)	98.25	98.8
ADJ;GEN;PL	59.74 (77)	56.63 (83)	100	100
ADJ;MASC;NOM;SG	59.72 (72)	58.11 (74)	94.44	93.24
ADJ;GEN;MASC;SG	58.23 (79)	56.63 (83)	100	100
ACC;ADJ;NEUT;SG	30.00 (80)	27.71 (83)	45	44.58
ACC;ADJ;MASC;SG	58.23 (79)	56.63 (83)	100	100
ADJ;GEN;NEUT;SG	58.23 (79)	56.63 (83)	100	100
ADJ;DAT;FEM;SG	29.63 (81)	27.71 (83)	45.68	44.58
ADJ;INS;MASC;SG	64.94 (77)	62.65 (83)	100	100
ACC;ADJ;FEM;SG	57.50 (80)	56.63 (83)	92.5	92.77
ADJ;ESS;MASC;SG	59.15 (71)	56.63 (83)	100	100
ADJ;ESS;NEUT;SG	61.11 (72)	57.83 (83)	100	100
3;PRS;SG;V	27.78 (54)	26.79 (56)	94.44	89.29
2;PRS;SG;V	0.00 (7)	14.29 (56)	28.57	55.36
2;IMP;PL;V	17.65 (17)	12.99 (77)	94.12	71.43
1;PRS;SG;V	15.38 (13)	17.86 (56)	61.54	39.29
3;FEM;PST;SG;V	29.51 (61)	25.00 (80)	96.72	96.25
1;PL;PRS;V	21.43 (14)	14.29 (56)	71.43	64.29
3;NEUT;PST;SG;V	21.43 (42)	18.75 (80)	92.86	95
2;PL;PRS;V	27.27 (11)	17.86 (56)	81.82	82.14
3;MASC;PST;SG;V	28.57 (70)	27.50 (80)	90	85
3;PL;PRS;V	35.00 (40)	25.00 (56)	92.5	69.64
NFIN;V	31.73 (104)	28.45 (116)	99.04	99.14
3;MASC;PL;PST;V	25.00 (60)	25.00 (80)	98.33	97.5
2;IMP;SG;V	13.33 (15)	7.79 (77)	20	22.08
3;FEM;PL;PST;V	8.93 (56)	8.75 (80)	80.36	75
ADJ;FEM;INS;SG	11.11 (9)	11.11 (9)	55.56	55.56
ADJ;NOM;PL	11.11 (9)	11.11 (9)	55.56	55.56
ADJ;INS;NEUT;SG	33.33 (9)	33.33 (9)	100	100
ACC;ADJ;PL	11.11 (9)	11.11 (9)	55.56	55.56
1;FUT;PL;V	0.00 (6)	3.85 (26)	0	26.92
3;FUT;SG;V	9.52 (21)	7.69 (26)	80.95	69.23
2;FUT;PL;V	0.00 (7)	3.85 (26)	100	65.38
1;FUT;SG;V	0.00 (7)	0.00 (25)	14.29	8
2;FUT;SG;V	0.00 (2)	7.69 (26)	50	38.46
3;FUT;PL;V	10.53 (19)	7.69 (26)	78.95	69.23
ACC;INAN;N;SG	50.00 (2)	50.00 (2)	50	50
ACC;INAN;N;PL	0.00 (2)	0.00 (2)	50	50

Table 93: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Czech–Russian language pair (the grey numbers correspond to the dictionary sizes).

Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
		Czech–Slovak		
ALL	61.47 (802)	54.04 (1027)	89.90	87.34
ADJ;INS;MASC;SG	60.00 (10)	72.73 (11)	100.00	100
ADJ;ESS;PL	63.64 (11)	63.64 (11)	100.00	100
ADJ;DAT;NEUT;SG	75.00 (8)	81.82 (11)	100.00	100
ADJ;ESS;FEM;SG	72.73 (11)	72.73 (11)	100.00	100
ACC;ADJ;MASC;PL	72.73 (11)	72.73 (11)	100.00	100
ADJ;MASC;NOM;SG	81.82 (11)	81.82 (11)	100.00	100
ADJ;ESS;MASC;SG	62.50 (8)	54.55 (11)	87.50	72.73
ADJ;GEN;NEUT;SG	72.73 (11)	72.73 (11)	100.00	100
ADJ;DAT;PL	60.00 (10)	72.73 (11)	100.00	100
ADJ;MASC;NOM;PL	71.43 (7)	63.64 (11)	100.00	90.91
ACC;ADJ;INAN;MASC;SG	81.82 (11)	81.82 (11)	100.00	100
ADJ;GEN;MASC;SG	72.73 (11)	72.73 (11)	100.00	100
ACC;ADJ;MASC;SG	72.73 (11)	72.73 (11)	100.00	100
ACC;ADJ;NEUT;SG	72.73 (11)	72.73 (11)	100.00	100
ADJ;ESS;NEUT;SG	75.00 (8)	72.73 (11)	100.00	100
ADJ;NEUT;NOM;SG	72.73 (11)	72.73 (11)	100.00	100
ADJ;INS;PL	75.00 (8)	81.82 (11)	100.00	100
ADJ;GEN;PL	63.64 (11)	63.64 (11)	100.00	100
ADJ;FEM;NOM;SG	81.82 (11)	81.82 (11)	100.00	100
ADJ;DAT;MASC;SG	75.00 (8)	81.82 (11)	100.00	100
ADJ;FEM;GEN;SG	72.73 (11)	72.73 (11)	100.00	100
ADJ;DAT;FEM;SG	72.73 (11)	72.73 (11)	100.00	100
ACC;ADJ;FEM;SG	45.45 (11)	36.36 (11)	90.91	72.73
GEN;N;SG	64.95 (97)	63.37 (101)	85.57	87.13
N;NOM;PL	64.13 (92)	61.54 (104)	88.04	84.62
INS;N;SG	66.67 (84)	58.42 (101)	91.67	90.1
N;NOM;SG	66.67 (99)	65.35 (101)	86.87	87.13
ACC;N;SG	65.26 (95)	63.37 (101)	89.47	88.12
ACC;N;PL	61.70 (94)	61.54 (104)	85.11	87.5
DAT;N;SG	56.94 (72)	50.50 (101)	76.39	72.28
INS;N;PL	61.67 (60)	49.51 (103)	90.00	89.32
DAT;N;PL	41.18 (51)	30.10 (103)	84.31	83.5
ESS;N;SG	58.67 (75)	51.49 (101)	78.67	73.27
ESS;N;PL	63.64 (55)	49.51 (103)	98.18	96.12
GEN;N;PL	53.49 (86)	49.04 (104)	83.72	79.81
NFIN;V	61.90 (84)	58.95 (95)	100.00	100
3;FEM;PL;PST;V	0.00 (1)	0.00 (1)	100.00	100
1;PRS;SG;V	-	0.00 (1)	-	100
3;MASC;PL;PST;V	0.00 (1)	0.00 (1)	100.00	100
3;NEUT;PST;SG;V	0.00 (1)	0.00 (1)	100.00	100
3;MASC;PST;SG;V	0.00 (1)	0.00 (1)	100.00	100
1;PL;PRS;V	0.00 (1)	0.00 (1)	100.00	100
1;IMP;PL;V	-	0.00 (1)	-	0
3;FEM;PST;SG;V	0.00 (1)	0.00 (1)	100.00	100
2;IMP;PL;V	-	0.00 (1)	-	100
3;PRS;SG;V	0.00 (1)	0.00 (1)	100.00	100
2;IMP;SG;V	-	0.00 (1)	-	100
2;PL;PRS;V	-	0.00 (1)	-	0
2;PRS;SG;V	-	0.00 (1)	-	0
3;NEUT;PL;PST;V	0.00 (1)	0.00 (1)	100.00	100
3;PL;PRS;V	0.00 (1)	0.00 (1)	0.00	0

Table 94: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Czech–Slovak language pair (the grey numbers correspond to the dictionary sizes).

	Czech–Ukrainian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	48.44 (673)	39.93 (854)	83.51	79.98
ACC;N;SG	51.11 (90)	48.42 (95)	83.33	81.05
N;PL;VOC	50.56 (89)	47.87 (94)	82.02	80.85
N;SG;VOC	42.86 (35)	23.40 (94)	77.14	56.38
DAT;N;PL	57.89 (57)	42.55 (94)	96.49	95.74
N;NOM;SG	53.19 (94)	52.63 (95)	87.23	85.26
INS;N;SG	56.63 (83)	49.47 (95)	86.75	85.26
ACC;N;PL	54.44 (90)	52.13 (94)	81.11	81.91
INS;N;PL	47.37 (76)	39.36 (94)	89.47	88.3
GEN;N;SG	54.95 (91)	52.63 (95)	83.52	83.16
GEN;N;PL	54.12 (85)	48.42 (95)	83.53	81.05
N;NOM;PL	50.00 (90)	47.87 (94)	81.11	80.85
ESS;N;SG	40.24 (82)	34.74 (95)	74.39	68.42
DAT;N;SG	38.75 (80)	32.63 (95)	73.75	67.37
ESS;N;PL	55.00 (60)	39.36 (94)	86.67	89.36
3;PL;PRS;V	50.00 (2)	33.33 (3)	50	33.33
3;PRS;SG;V	33.33 (3)	33.33 (3)	100	100
1;PRS;SG;V	50.00 (2)	33.33 (3)	100	66.67
3;NEUT;PST;SG;V	0.00 (2)	0.00 (3)	100	100
3;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100	100
3;FEM;PL;PST;V	0.00 (3)	0.00 (3)	0	0
NFIN;V	33.33 (3)	33.33 (3)	100	100
3;MASC;PL;PST;V	0.00 (3)	0.00 (3)	66.67	66.67
2;IMP;SG;V	0.00 (3)	0.00 (3)	33.33	33.33
2;PL;PRS;V	0.00 (2)	0.00 (3)	100	66.67
2;PRS;SG;V	0.00 (2)	0.00 (3)	50	33.33
2;IMP;PL;V	0.00 (3)	0.00 (3)	100	100
1;PL;PRS;V	0.00 (2)	0.00 (3)	100	100
1;IMP;PL;V	0.00 (1)	0.00 (3)	0	0
3;MASC;PST;SG;V	50.00 (2)	50.00 (2)	100	100
ADJ;FEM;GEN;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;PL	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;PL	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;PL	0.00 (1)	0.00 (1)	100	100
ADJ;INS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;FEM;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;INAN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;MASC;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;FEM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;NEUT;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (1)	0	0
ADJ;INS;PL	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (1)	0	0
ADJ;GEN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;FEM;SG	0.00 (1)	0.00 (1)	100	100

Table 95: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Czech–Ukrainian language pair (the grey numbers correspond to the dictionary sizes).

		Polish–Czech		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	42.05 (4043)	34.81 (5332)	80.63	75.34
DAT;N;SG	26.07 (280)	18.74 (427)	58.93	44.73
N;NOM;PL	44.59 (388)	41.49 (417)	81.44	78.42
GEN;N;SG	45.41 (414)	43.79 (427)	82.13	79.39
ESS;N;PL	52.94 (255)	38.94 (416)	90.98	91.11
N;SG;VOC	33.69 (187)	24.12 (427)	58.29	49.41
N;PL;VOC	44.59 (388)	41.49 (417)	81.44	78.42
ESS;N;SG	32.74 (336)	27.76 (425)	58.63	53.18
DAT;N;PL	48.35 (182)	32.21 (416)	95.05	93.03
GEN;N;PL	44.02 (368)	39.23 (418)	81.25	76.32
ACC;N;PL	44.92 (394)	42.34 (418)	81.47	79.43
INS;N;PL	29.52 (315)	23.80 (416)	80.95	80.77
INS;N;SG	44.26 (366)	38.97 (426)	83.06	82.63
ACC;N;SG	44.83 (406)	42.62 (427)	77.83	75.41
N;NOM;SG	45.97 (422)	45.43 (427)	81.75	80.09
ACC;ADJ;MASC;SG	47.83 (69)	47.83 (69)	98.55	98.55
ACC;ADJ;FEM;SG	46.97 (66)	46.38 (69)	100	100
ADJ;ESS;MASC;SG	49.18 (61)	49.28 (69)	96.72	97.1
ADJ;INS;MASC;SG	48.48 (66)	49.28 (69)	96.97	97.1
ADJ;MASC;NOM;SG	54.55 (66)	55.22 (67)	95.45	95.52
ADJ;FEM;NOM;SG	52.31 (65)	53.73 (67)	93.85	94.03
ADJ;NEUT;NOM;SG	53.73 (67)	53.73 (67)	98.51	98.51
ADJ;DAT;MASC;SG	53.12 (32)	46.38 (69)	100	100
ADJ;GEN;NEUT;SG	47.83 (69)	47.83 (69)	98.55	98.55
ADJ;GEN;MASC;SG	47.83 (69)	47.83 (69)	98.55	98.55
ADJ;MASC;NOM;PL	39.53 (43)	31.34 (67)	76.74	68.66
ADJ;ESS;NEUT;SG	49.18 (61)	49.28 (69)	96.72	97.1
ADJ;FEM;GEN;SG	41.79 (67)	42.03 (69)	71.64	69.57
ADJ;ESS;FEM;SG	41.79 (67)	42.03 (69)	71.64	69.57
ADJ;ESS;PL	43.28 (67)	44.93 (69)	100	100
ACC;ADJ;INAN;MASC;SG	54.55 (66)	55.22 (67)	95.45	95.52
ACC;ADJ;MASC;PL	43.28 (67)	46.27 (67)	100	100
ADJ;DAT;FEM;SG	41.79 (67)	42.03 (69)	71.64	69.57
ACC;ADJ;NEUT;SG	52.17 (69)	52.17 (69)	98.55	97.1
ADJ;GEN;PL	43.28 (67)	44.93 (69)	100	100
ADJ;INS;PL	47.37 (57)	43.48 (69)	100	100
ADJ;DAT;NEUT;SG	53.12 (32)	46.38 (69)	100	100
ADJ;DAT;PL	48.48 (66)	49.28 (69)	96.97	97.1
3;MASC;PST;SG;V	57.58 (33)	52.78 (36)	90.91	91.67
3;FEM;PST;SG;V	60.00 (30)	51.35 (37)	86.67	86.49
3;PL;PRS;V	40.00 (20)	32.00 (25)	80	76
2;PRS;SG;V	44.44 (9)	28.00 (25)	55.56	56
2;IMP;SG;V	11.11 (18)	2.70 (37)	16.67	2.7
2;IMP;PL;V	11.11 (9)	8.11 (37)	55.56	35.14
3;NEUT;PST;SG;V	73.08 (26)	56.76 (37)	92.31	86.49
1;IMP;PL;V	0.00 (5)	0.00 (37)	0	5.41
2;PL;PRS;V	0.00 (4)	0.00 (25)	0	24
NFIN;V	47.37 (38)	45.00 (40)	94.74	95
3;PRS;SG;V	37.50 (24)	36.00 (25)	79.17	76
3;MASC;PL;PST;V	59.38 (32)	51.35 (37)	96.88	94.59
3;FEM;PL;PST;V	56.52 (23)	40.54 (37)	95.65	94.59
1;PL;PRS;V	40.00 (10)	16.00 (25)	90	52
1;PRS;SG;V	21.43 (14)	16.00 (25)	50	36
ACC;ADJ;PL	0.00 (5)	0.00 (5)	100	80
ADJ;INS;NEUT;SG	0.00 (5)	0.00 (5)	100	100
ADJ;FEM;INS;SG	0.00 (5)	0.00 (5)	100	100
ADJ;NOM;PL	0.00 (5)	0.00 (5)	100	80
3;FUT;SG;V	50.00 (10)	30.77 (13)	70	46.15
1;FUT;PL;V	50.00 (8)	23.08 (13)	62.5	38.46
2;FUT;SG;V	0.00 (3)	15.38 (13)	33.33	38.46
2;FUT;PL;V	0.00 (3)	7.69 (13)	0	23.08
1;FUT;SG;V	25.00 (8)	15.38 (13)	75	38.46
3;FUT;PL;V	44.44 (9)	23.08 (13)	66.67	53.85

Table 96: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Polish–Czech language pair (the grey numbers correspond to the dictionary sizes).

	Polish–Russian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	47.37 (6814)	40.32 (9079)	83.56	80.24
N;NOM;SG	42.97 (768)	41.86 (786)	77.08	75.32
ACC;N;SG	42.38 (748)	40.46 (791)	76.60	74.46
DAT;N;SG	37.25 (459)	28.35 (790)	78.43	71.27
INS;N;SG	46.80 (688)	42.21 (789)	85.90	84.41
ESS;N;SG	41.41 (611)	36.39 (786)	73.81	67.56
GEN;N;SG	47.54 (753)	45.88 (789)	82.87	81.5
ADJ;INS;PL	63.91 (133)	60.40 (149)	100.00	100
ADJ;FEM;INS;SG	58.33 (144)	56.38 (149)	95.14	95.97
ADJ;FEM;NOM;SG	59.03 (144)	56.38 (149)	89.58	89.26
ADJ;DAT;FEM;SG	54.86 (144)	53.02 (149)	95.83	95.3
ADJ;ESS;MASC;SG	63.04 (138)	59.73 (149)	99.28	98.66
ADJ;INS;MASC;SG	61.11 (144)	59.73 (149)	99.31	98.66
ADJ;NEUT;NOM;SG	61.70 (141)	58.39 (149)	92.20	91.28
ADJ;DAT;PL	61.11 (144)	59.73 (149)	99.31	98.66
ADJ;ESS;NEUT;SG	63.04 (138)	59.73 (149)	99.28	98.66
ADJ;GEN;PL	62.07 (145)	60.40 (149)	97.93	97.32
ADJ;DAT;NEUT;SG	48.72 (78)	44.97 (149)	100.00	99.33
ACC;ADJ;FEM;SG	59.15 (142)	56.38 (149)	96.48	95.97
ADJ;GEN;MASC;SG	62.50 (144)	60.40 (149)	97.92	96.64
ACC;ADJ;MASC;SG	62.50 (144)	60.40 (149)	97.92	96.64
ADJ;FEM;GEN;SG	54.86 (144)	53.02 (149)	95.83	95.3
ACC;ADJ;INAN;MASC;SG	56.94 (144)	55.70 (149)	88.89	87.92
ADJ;INS;NEUT;SG	61.11 (144)	59.73 (149)	99.31	98.66
ADJ;MASC;NOM;SG	56.94 (144)	55.70 (149)	88.89	87.92
ADJ;NOM;PL	60.42 (144)	58.39 (149)	92.36	91.28
ACC;ADJ;PL	59.59 (146)	58.39 (149)	91.78	91.28
ADJ;DAT;MASC;SG	48.72 (78)	44.97 (149)	100.00	99.33
ADJ;ESS;PL	62.07 (145)	60.40 (149)	97.93	97.32
ACC;ADJ;NEUT;SG	61.70 (141)	58.39 (149)	92.20	91.28
ADJ;GEN;NEUT;SG	62.50 (144)	60.40 (149)	97.92	96.64
ADJ;ESS;FEM;SG	54.86 (144)	53.02 (149)	95.83	95.3
INS;N;PL	51.67 (480)	42.19 (723)	97.71	98.62
N;NOM;PL	45.67 (670)	43.69 (721)	79.55	78.22
DAT;N;PL	46.67 (240)	31.67 (723)	80.00	80.64
ACC;N;PL	46.77 (511)	44.19 (559)	81.21	79.43
GEN;N;PL	46.80 (641)	42.72 (728)	78.47	74.73
ESS;N;PL	57.65 (425)	46.06 (723)	93.65	93.78
NFIN;V	44.44 (27)	43.33 (30)	100.00	100
3;FEM;PL;PST;V	4.76 (21)	6.45 (31)	80.95	80.65
2;IMP;PL;V	0.00 (5)	3.23 (31)	100.00	41.94
2;FEM;PST;SG;V	0.00 (1)	0.00 (31)	0.00	12.9
3;NEUT;PST;SG;V	25.00 (16)	25.81 (31)	75.00	90.32
3;MASC;PL;PST;V	32.00 (25)	32.26 (31)	84.00	87.1
1;FEM;PST;SG;V	0.00 (9)	0.00 (31)	22.22	3.23
3;MASC;PST;SG;V	36.00 (25)	32.26 (31)	92.00	83.87
2;MASC;PL;PST;V	0.00 (1)	6.45 (31)	0.00	51.61
2;IMP;SG;V	11.76 (17)	3.23 (31)	23.53	16.13
2;PRS;SG;V	20.00 (5)	9.52 (21)	20.00	38.1
2;PL;PRS;V	0.00 (3)	0.00 (21)	100.00	38.1
3;PL;PRS;V	41.18 (17)	28.57 (21)	94.12	95.24
3;FEM;PST;SG;V	34.62 (26)	35.48 (31)	84.62	90.32
1;PL;PRS;V	37.50 (8)	14.29 (21)	62.50	47.62
3;PRS;SG;V	19.05 (21)	19.05 (21)	80.95	80.95
1;PRS;SG;V	25.00 (12)	23.81 (21)	50.00	57.14
1;MASC;PL;PST;V	14.29 (7)	6.45 (31)	14.29	12.9
1;MASC;PST;SG;V	0.00 (16)	0.00 (31)	0.00	3.23
1;FEM;PL;PST;V	-	22.58 (31)	-	70.97
2;MASC;PST;SG;V	0.00 (10)	0.00 (31)	0.00	0
2;FEM;PL;PST;V	-	19.35 (31)	-	51.61
2;FUT;PL;V	0.00 (1)	0.00 (10)	100.00	40
1;FUT;PL;V	33.33 (3)	10.00 (10)	33.33	20
1;FUT;SG;V	0.00 (4)	0.00 (10)	0.00	20
2;FUT;SG;V	0.00 (1)	0.00 (10)	0.00	40
3;FUT;SG;V	0.00 (8)	0.00 (10)	75.00	60
3;FUT;PL;V	12.50 (8)	10.00 (10)	62.50	50

Table 97: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Polish–Russian language pair (the grey numbers correspond to the dictionary sizes).

Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
		Polish–Slovak		
ALL	35.83 (1217)	28.54 (1689)	80.28	77.5
INS;N;SG	35.77 (123)	28.66 (157)	87.80	85.99
N;NOM;SG	34.42 (154)	33.76 (157)	74.68	71.97
GEN;N;SG	29.17 (144)	27.39 (157)	73.61	71.97
DAT;N;SG	26.37 (91)	16.56 (157)	68.13	56.69
ACC;N;PL	30.15 (136)	26.92 (156)	75.74	73.08
INS;N;PL	40.45 (89)	28.21 (156)	100.00	99.36
DAT;N;PL	23.53 (68)	15.38 (156)	66.18	69.23
N;NOM;PL	29.71 (138)	26.92 (156)	76.81	73.08
ESS;N;SG	30.00 (110)	22.44 (156)	68.18	56.41
GEN;N;PL	38.66 (119)	30.77 (156)	73.95	64.74
ESS;N;PL	41.56 (77)	31.41 (156)	90.91	94.23
ACC;N;SG	32.87 (143)	29.94 (157)	74.13	70.06
ADJ;ESS;FEM;SG	41.18 (17)	40.00 (20)	88.24	90
ADJ;ESS;MASC;SG	50.00 (14)	45.00 (20)	100.00	100
ADJ;DAT;NEUT;SG	63.64 (11)	40.00 (20)	100.00	100
ADJ;FEM;GEN;SG	41.18 (17)	40.00 (20)	88.24	90
ADJ;DAT;PL	47.06 (17)	45.00 (20)	100.00	100
ADJ;INS;PL	78.57 (14)	55.00 (20)	100.00	100
ADJ;MASC;NOM;PL	36.36 (11)	30.00 (20)	100.00	95
ADJ;GEN;NEUT;SG	55.56 (18)	50.00 (20)	94.44	95
ADJ;ESS;NEUT;SG	50.00 (14)	45.00 (20)	100.00	100
ACC;ADJ;MASC;SG	55.56 (18)	50.00 (20)	94.44	95
ADJ;GEN;PL	63.16 (19)	60.00 (20)	100.00	100
ADJ;FEM;INS;SG	92.31 (13)	65.00 (20)	100.00	100
ADJ;INS;MASC;SG	47.06 (17)	45.00 (20)	100.00	100
ADJ;INS;NEUT;SG	47.06 (17)	45.00 (20)	100.00	100
ACC;ADJ;NEUT;SG	66.67 (18)	60.00 (20)	100.00	100
ACC;ADJ;INAN;MASC;SG	52.63 (19)	50.00 (20)	100.00	100
ACC;ADJ;PL	66.67 (18)	60.00 (20)	100.00	100
ACC;ADJ;MASC;PL	63.16 (19)	60.00 (20)	100.00	100
ADJ;FEM;NOM;SG	44.44 (18)	40.00 (20)	88.89	85
ADJ;ESS;PL	63.16 (19)	60.00 (20)	100.00	100
ADJ;NOM;PL	66.67 (18)	60.00 (20)	100.00	100
ADJ;GEN;MASC;SG	55.56 (18)	50.00 (20)	94.44	95
ADJ;NEUT;NOM;SG	66.67 (18)	60.00 (20)	100.00	100
ACC;ADJ;FEM;SG	80.00 (15)	65.00 (20)	100.00	100
ADJ;MASC;NOM;SG	52.63 (19)	50.00 (20)	100.00	100
ADJ;DAT;MASC;SG	63.64 (11)	40.00 (20)	100.00	100
ADJ;DAT;FEM;SG	41.18 (17)	40.00 (20)	88.24	90
NFIN;V	60.00 (10)	54.55 (11)	100.00	100
2;PRS;SG;V	0.00 (1)	0.00 (1)	100.00	100
1;PL;PRS;V	0.00 (1)	0.00 (1)	100.00	100
3;NEUT;PST;SG;V	0.00 (1)	0.00 (1)	0.00	0
3;MASC;PST;SG;V	0.00 (1)	0.00 (1)	0.00	0
2;IMP;SG;V	-	0.00 (1)	-	0
3;MASC;PL;PST;V	0.00 (1)	0.00 (1)	0.00	0
3;FEM;PL;PST;V	0.00 (1)	0.00 (1)	0.00	0
1;IMP;PL;V	-	0.00 (1)	-	0
3;PRS;SG;V	100.00 (1)	100.00 (1)	100.00	100
2;PL;PRS;V	0.00 (1)	0.00 (1)	100.00	100
2;IMP;PL;V	-	0.00 (1)	-	0
3;FEM;PST;SG;V	0.00 (1)	0.00 (1)	0.00	0
1;PRS;SG;V	0.00 (1)	0.00 (1)	100.00	100
3;PL;PRS;V	100.00 (1)	100.00 (1)	100.00	100

Table 98: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Polish–Slovak language pair (the grey numbers correspond to the dictionary sizes).

	Polish–Ukrainian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	35.78 (1118)	30.49 (1463)	75.13	71.7
N;PL;VOC	34.11 (129)	33.08 (133)	74.42	71.43
N;NOM;PL	34.11 (129)	33.08 (133)	74.42	71.43
ACC;N;PL	34.88 (129)	33.83 (133)	73.64	71.43
ACC;N;SG	40.00 (130)	38.24 (136)	73.08	71.32
ESS;N;PL	40.23 (87)	33.83 (133)	87.36	87.97
N;SG;VOC	26.56 (64)	22.06 (136)	64.06	52.21
INS;N;PL	36.63 (101)	30.83 (133)	100.00	99.25
GEN;N;SG	39.85 (133)	38.97 (136)	74.44	73.53
DAT;N;PL	46.43 (56)	33.83 (133)	94.64	93.98
INS;N;SG	41.74 (115)	36.03 (136)	80.87	80.15
N;NOM;SG	37.50 (136)	37.23 (137)	72.06	71.53
ESS;N;SG	32.76 (116)	28.68 (136)	62.07	55.88
DAT;N;SG	24.47 (94)	17.65 (136)	51.06	38.24
GEN;N;PL	37.19 (121)	33.83 (133)	79.34	77.44
2;MASC;PST;SG;V	0.00 (4)	0.00 (7)	0.00	0
1;FEM;PL;PST;V	-	28.57 (7)	-	71.43
1;MASC;PST;SG;V	0.00 (5)	0.00 (7)	20.00	14.29
3;FEM;PL;PST;V	33.33 (6)	28.57 (7)	83.33	85.71
2;FUT;SG;V	0.00 (1)	0.00 (1)	0.00	0
2;MASC;PL;PST;V	0.00 (2)	14.29 (7)	0.00	42.86
3;NEUT;PST;SG;V	60.00 (5)	42.86 (7)	100.00	100
1;MASC;PL;PST;V	0.00 (3)	0.00 (7)	33.33	14.29
1;FUT;PL;V	0.00 (1)	0.00 (1)	100.00	100
1;FEM;PST;SG;V	0.00 (4)	0.00 (7)	25.00	14.29
NFIN;V	57.14 (7)	57.14 (7)	100.00	100
3;FUT;PL;V	100.00 (1)	100.00 (1)	100.00	100
2;FEM;PST;SG;V	0.00 (1)	0.00 (7)	0.00	0
3;MASC;PL;PST;V	66.67 (6)	57.14 (7)	83.33	85.71
2;IMP;SG;V	0.00 (7)	0.00 (7)	0.00	0
2;IMP;PL;V	25.00 (4)	14.29 (7)	50.00	28.57
3;MASC;PST;SG;V	57.14 (7)	57.14 (7)	100.00	100
3;FEM;PST;SG;V	57.14 (7)	57.14 (7)	100.00	100
3;FUT;SG;V	0.00 (1)	0.00 (1)	0.00	0
2;FEM;PL;PST;V	-	14.29 (7)	-	71.43
1;FUT;SG;V	100.00 (1)	100.00 (1)	100.00	100
2;FUT;PL;V	0.00 (1)	0.00 (1)	0.00	0
1;IMP;PL;V	0.00 (3)	0.00 (7)	0.00	0
1;PRS;SG;V	33.33 (6)	33.33 (6)	50.00	50
3;PL;PRS;V	66.67 (6)	66.67 (6)	100.00	100
2;PRS;SG;V	25.00 (4)	33.33 (6)	50.00	50
2;PL;PRS;V	0.00 (3)	16.67 (6)	33.33	50
1;PL;PRS;V	50.00 (4)	33.33 (6)	75.00	83.33
3;PRS;SG;V	50.00 (6)	50.00 (6)	100.00	100
ACC;ADJ;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;FEM;SG	-	0.00 (2)	-	100
ADJ;NEUT;NOM;SG	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;PL	50.00 (2)	50.00 (2)	100.00	100
ADJ;FEM;INS;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;INS;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;FEM;NOM;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;GEN;PL	0.00 (2)	0.00 (2)	100.00	100
ADJ;NOM;PL	50.00 (2)	50.00 (2)	100.00	100
ADJ;DAT;NEUT;SG	-	0.00 (2)	-	100
ADJ;ESS;NEUT;SG	-	0.00 (2)	-	100
ADJ;MASC;NOM;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;GEN;NEUT;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;ESS;FEM;SG	-	0.00 (2)	-	100
ADJ;ESS;PL	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;MASC;SG	-	0.00 (2)	-	100
ADJ;INS;NEUT;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;INS;PL	0.00 (1)	0.00 (2)	100.00	100
ACC;ADJ;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;FEM;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;PL	0.00 (2)	0.00 (2)	100.00	100
ACC;ADJ;INAN;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;FEM;GEN;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;ESS;MASC;SG	-	0.00 (2)	-	100
ADJ;GEN;MASC;SG	0.00 (2)	0.00 (2)	100.00	100

Table 99: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Polish–Ukrainian language pair (the grey numbers correspond to the dictionary sizes).

	Catalan–French			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	55.86 (5605)	32.00 (11367)	79.38	49.21
N;SG	66.13 (1293)	64.88 (1321)	89.48	89.48
N;PL	66.12 (1089)	62.16 (1221)	95.04	93.69
1;PL;PRS;SBJV;V	13.33 (60)	9.13 (219)	21.67	19.18
1;COND;SG;V	39.60 (101)	29.22 (219)	58.42	52.51
1;PST;SBJV;SG;V	1.67 (60)	10.05 (219)	6.67	23.29
2;PFV;PL;PST;V	-	0.46 (219)	-	0.46
2;IPFV;PL;PST;V	0.00 (2)	0.00 (219)	50.00	2.28
3;COND;PL;V	54.05 (74)	31.82 (220)	63.51	54.09
2;PL;PRS;V	30.00 (60)	22.37 (219)	46.67	35.62
3;PL;PST;SBJV;V	0.00 (64)	0.00 (220)	0.00	0
2;COND;PL;V	0.00 (1)	4.57 (219)	0.00	12.33
NFIN;V	61.14 (211)	58.74 (223)	89.57	86.55
2;IMP;POS;SG;V	51.49 (202)	47.95 (219)	67.82	61.19
3;FUT;PL;V	65.33 (75)	45.45 (220)	82.67	82.27
2;IMP;PL;POS;V	30.00 (60)	22.37 (219)	46.67	35.62
1;FUT;SG;V	26.92 (26)	27.40 (219)	57.69	48.86
2;PL;PST;SBJV;V	0.00 (1)	0.00 (219)	0.00	1.37
3;PST;SBJV;SG;V	8.11 (111)	10.00 (220)	16.22	23.18
3;PFV;PST;SG;V	53.05 (164)	42.73 (220)	71.95	60.45
2;PST;SBJV;SG;V	0.00 (3)	0.46 (219)	0.00	0.46
1;PRS;SBJV;SG;V	22.37 (152)	20.81 (221)	32.89	28.05
1;IPFV;PL;PST;V	0.00 (5)	0.46 (219)	0.00	1.83
1;COND;PL;V	20.00 (5)	2.74 (219)	20.00	5.48
3;PRS;SBJV;SG;V	22.22 (153)	20.72 (222)	32.68	27.93
3;PFV;PL;PST;V	65.65 (131)	51.36 (220)	97.71	95.45
2;PRS;SBJV;SG;V	8.33 (36)	6.79 (221)	13.89	10.41
3;IPFV;PL;PST;V	68.35 (158)	58.64 (220)	95.57	94.09
1;PL;PST;SBJV;V	0.00 (2)	0.00 (219)	0.00	0
3;FUT;SG;V	61.02 (118)	46.36 (220)	80.51	73.64
3;PL;PRS;SBJV;V	27.35 (117)	22.07 (222)	42.74	33.78
2;PFV;PST;SG;V	0.00 (2)	3.65 (219)	50.00	9.13
1;PFV;PL;PST;V	0.00 (2)	3.65 (219)	0.00	7.76
3;IPFV;PST;SG;V	62.07 (174)	55.45 (220)	90.80	85.91
2;PL;PRS;SBJV;V	25.64 (39)	21.00 (219)	38.46	33.79
1;FUT;PL;V	18.75 (32)	10.96 (219)	21.88	18.72
3;PRS;SG;V	51.47 (204)	47.96 (221)	68.63	62.44
1;PRS;SG;V	8.16 (98)	8.14 (221)	15.31	13.12
2;FUT;PL;V	14.29 (7)	7.76 (219)	28.57	17.35
1;IMP;PL;POS;V	12.50 (72)	9.17 (218)	22.22	19.27
1;IPFV;PST;SG;V	65.15 (132)	55.71 (219)	93.18	86.3
2;PRS;SG;V	31.40 (86)	20.45 (220)	47.67	31.82
2;FUT;SG;V	20.00 (5)	2.28 (219)	20.00	4.11
1;PFV;PST;SG;V	51.72 (29)	8.29 (217)	68.97	10.6
3;PL;PRS;V	62.96 (189)	57.47 (221)	92.59	90.95
3;COND;SG;V	37.29 (118)	29.09 (220)	55.93	52.73
2;COND;SG;V	0.00 (5)	0.00 (219)	20.00	2.28
2;IPFV;PST;SG;V	0.00 (8)	0.46 (219)	25.00	3.2
1;PL;PRS;V	14.47 (76)	10.05 (219)	25.00	20.55
ADJ;FEM;PL	69.88 (332)	68.96 (335)	98.49	98.51
ADJ;MASC;PL	68.69 (329)	65.62 (349)	96.05	95.7
ADJ;MASC;SG	70.95 (358)	70.05 (364)	96.65	96.43
ADJ;FEM;SG	70.83 (360)	70.14 (365)	96.67	96.44

Table 100: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Catalan–French language pair (the grey numbers correspond to the dictionary sizes).

		Catalan–Italian		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	52.97 (5518)	29.30 (11970)	80.10	49.2
2;FUT;SG;V	0.00 (10)	2.07 (241)	10.00	4.98
2;IPFV;PL;PST;V	0.00 (1)	0.41 (241)	0.00	1.66
1;PFV;PL;PST;V	0.00 (1)	1.24 (241)	0.00	1.66
1;IPFV;PL;PST;V	50.00 (6)	22.82 (241)	83.33	53.53
3;IMP;PL;POS;V	16.04 (106)	11.57 (242)	25.47	21.49
2;PL;PRS;SBJV;V	0.00 (29)	0.83 (240)	0.00	2.08
2;PFV;PL;PST;V	-	0.41 (241)	-	1.66
3;IMP;POS;SG;V	23.40 (141)	16.53 (242)	33.33	23.55
3;PST;SBJV;SG;V	40.00 (130)	32.78 (241)	66.92	65.15
1;IPFV;PST;SG;V	63.00 (100)	55.19 (241)	90.00	84.65
1;FUT;PL;V	32.00 (25)	15.77 (241)	56.00	38.59
1;PL;PRS;V	22.86 (70)	13.75 (240)	57.14	37.5
1;FUT;SG;V	40.91 (22)	19.50 (241)	63.64	36.51
3;PRS;SG;V	50.23 (221)	48.97 (243)	69.23	65.02
2;PRS;SG;V	23.08 (91)	10.33 (242)	39.56	14.05
1;PL;PRS;SBJV;V	18.84 (69)	12.08 (240)	53.62	37.5
3;IPFV;PL;PST;V	67.70 (161)	59.09 (242)	93.79	94.21
3;COND;PL;V	3.12 (64)	2.89 (242)	4.69	8.68
3;COND;SG;V	7.08 (113)	4.55 (242)	15.93	16.12
2;PRS;SBJV;SG;V	2.70 (37)	5.81 (241)	16.22	10.37
2;FUT;PL;V	0.00 (8)	1.24 (241)	0.00	7.47
2;IPFV;PST;SG;V	0.00 (4)	2.07 (241)	0.00	2.07
3;PFV;PST;SG;V	49.42 (172)	43.39 (242)	72.67	67.36
NFIN;V	60.34 (232)	58.85 (243)	90.95	90.53
3;PL;PST;SBJV;V	45.16 (93)	35.27 (241)	95.70	96.68
2;IMP;POS;SG;V	51.63 (215)	49.17 (242)	68.84	64.05
3;IPFV;PST;SG;V	62.50 (184)	54.96 (242)	87.50	84.71
3;PFV;PL;PST;V	61.43 (140)	54.55 (242)	96.43	96.28
1;COND;SG;V	8.25 (97)	4.56 (241)	13.40	15.77
1;PRS;SG;V	15.96 (94)	12.40 (242)	38.30	21.49
2;IMP;PL;POS;V	3.77 (53)	1.24 (241)	11.32	2.49
3;FUT;SG;V	57.14 (119)	44.21 (242)	84.87	80.99
1;IMP;PL;POS;V	18.84 (69)	12.08 (240)	53.62	37.5
2;PST;SBJV;SG;V	0.00 (3)	1.25 (240)	0.00	4.58
2;PL;PRS;V	3.85 (52)	1.25 (240)	11.54	2.5
1;PST;SBJV;SG;V	47.83 (69)	32.92 (240)	75.36	65.42
2;PL;PST;SBJV;V	-	0.00 (240)	-	0
2;COND;PL;V	0.00 (2)	0.00 (241)	0.00	1.66
1;PFV;PST;SG;V	60.00 (25)	10.55 (237)	72.00	14.77
1;PRS;SBJV;SG;V	23.57 (140)	16.60 (241)	33.57	23.65
3;PRS;SBJV;SG;V	23.40 (141)	16.53 (242)	33.33	23.55
1;COND;PL;V	0.00 (5)	7.88 (241)	40.00	25.31
2;COND;SG;V	0.00 (5)	0.00 (241)	0.00	1.24
1;PL;PST;SBJV;V	0.00 (4)	8.33 (240)	75.00	23.33
3;PL;PRS;V	55.22 (201)	49.59 (242)	85.07	79.34
3;FUT;PL;V	55.26 (76)	38.02 (242)	85.53	80.99
3;PL;PRS;SBJV;V	16.04 (106)	11.57 (242)	25.47	21.49
2;PFV;PST;SG;V	-	0.00 (241)	-	1.66
N;PL	60.66 (1083)	57.38 (1192)	90.67	90.1
N;SG	65.26 (1307)	64.63 (1323)	93.50	93.27
ADJ;FEM;SG	63.45 (290)	62.54 (291)	96.90	96.56
ADJ;MASC;PL	66.42 (274)	65.60 (282)	94.89	95.04
ADJ;FEM;PL	67.66 (269)	67.41 (270)	97.03	96.67
ADJ;MASC;SG	63.23 (291)	62.33 (292)	96.91	96.58

Table 101: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Catalan–Italian language pair (the grey numbers correspond to the dictionary sizes).

	Catalan–Portuguese			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	62.75 (5418)	41.05 (10759)	83.11	57.73
N;PL	68.06 (1027)	64.63 (1128)	92.21	91.58
N;SG	67.41 (1209)	66.21 (1234)	90.98	90.92
3;PRS;SG;V	62.05 (224)	57.61 (243)	74.11	68.31
3;IPFV;PL;PST;V	75.88 (170)	66.80 (241)	95.29	96.68
1;FUT;PL;V	35.00 (20)	47.50 (240)	40.00	65.42
2;PRS;SBJV;SG;V	2.86 (35)	1.23 (243)	8.57	3.29
1;COND;PL;V	37.50 (8)	43.33 (240)	50.00	62.5
3;PRS;SBJV;SG;V	20.37 (162)	14.81 (243)	25.31	20.99
2;FUT;PL;V	0.00 (3)	0.00 (240)	0.00	0
1;PL;PRS;V	40.00 (95)	25.42 (240)	50.53	35.42
3;PFV;PL;PST;V	69.93 (153)	58.09 (241)	95.42	95.02
2;PRS;SG;V	44.44 (81)	31.28 (243)	49.38	37.45
2;IMP;POS;SG;V	60.54 (223)	56.38 (243)	73.09	67.49
3;COND;PL;V	68.29 (82)	61.00 (241)	81.71	87.14
3;IPFV;PST;SG;V	71.58 (190)	63.90 (241)	87.37	86.72
3;COND;SG;V	68.18 (132)	58.92 (241)	83.33	78.84
1;IMP;PL;POS;V	47.17 (53)	26.14 (241)	52.83	36.1
3;FUT;SG;V	73.17 (123)	61.83 (241)	86.18	85.89
2;IPFV;PST;SG;V	25.00 (4)	19.92 (241)	25.00	24.07
1;PL;PRS;SBJV;V	47.17 (53)	26.25 (240)	52.83	36.25
3;PL;PRS;SBJV;V	36.84 (133)	25.51 (243)	48.12	40.74
1;FUT;SG;V	36.84 (19)	53.11 (241)	47.37	73.03
1;IPFV;PST;SG;V	71.58 (190)	63.49 (241)	87.37	86.31
1;PFV;PST;SG;V	40.54 (37)	6.64 (241)	67.57	11.62
3;PL;PRS;V	64.90 (208)	58.85 (243)	87.98	82.3
2;PL;PRS;SBJV;V	0.00 (10)	0.83 (240)	10.00	3.33
3;IMP;PL;POS;V	36.84 (133)	25.51 (243)	48.12	40.74
1;PRS;SBJV;SG;V	20.37 (162)	14.81 (243)	25.31	20.99
3;FUT;PL;V	55.56 (81)	54.77 (241)	70.37	77.59
1;COND;SG;V	68.18 (132)	58.92 (241)	83.33	78.84
2;PFV;PL;PST;V	-	0.00 (240)	-	0
1;PFV;PL;PST;V	0.00 (1)	7.08 (240)	0.00	9.17
2;PL;PRS;V	2.94 (34)	1.67 (240)	8.82	4.17
2;COND;SG;V	66.67 (3)	20.75 (241)	66.67	31.95
2;FUT;SG;V	16.67 (6)	4.15 (241)	33.33	7.88
2;IMP;PL;POS;V	4.08 (49)	1.65 (242)	10.20	4.13
1;PRS;SG;V	33.66 (101)	23.46 (243)	52.48	34.98
3;IMP;POS;SG;V	20.37 (162)	14.81 (243)	25.31	20.99
3;PFV;PST;SG;V	63.64 (187)	54.36 (241)	81.82	71.78
2;PFV;PST;SG;V	0.00 (2)	0.41 (241)	0.00	0.41
1;IPFV;PL;PST;V	33.33 (3)	12.08 (240)	33.33	30
NFIN;V	71.55 (232)	68.85 (244)	91.38	88.52
2;IPFV;PL;PST;V	0.00 (2)	0.42 (240)	0.00	2.5
2;COND;PL;V	-	1.67 (240)	-	2.08
ADJ;FEM;SG	71.56 (327)	71.12 (329)	96.94	96.96
ADJ;FEM;PL	76.92 (299)	76.16 (302)	98.33	98.34
ADJ;MASC;PL	75.48 (310)	73.07 (323)	98.39	98.45
ADJ;MASC;SG	71.78 (326)	70.78 (332)	96.93	96.99

Table 102: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Catalan–Portuguese language pair (the grey numbers correspond to the dictionary sizes).

	Catalan–Spanish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	68.04 (5879)	43.32 (12282)	84.16	57.36
ADJ;FEM;SG	76.90 (342)	76.01 (346)	98.54	98.55
ADJ;FEM;PL	79.87 (318)	78.57 (322)	98.74	98.76
ADJ;MASC;SG	76.54 (341)	75.65 (345)	98.53	98.55
ADJ;MASC;PL	82.30 (322)	79.82 (332)	98.76	98.8
1;PL;PRS;SBJV;V	47.44 (78)	29.15 (247)	66.67	44.53
1;COND;SG;V	83.09 (136)	68.55 (248)	94.12	88.31
1;PST;SBJV;SG;V	17.93 (145)	14.57 (247)	26.21	26.72
1;PL;PST;SBJV;V	0.00 (4)	2.02 (247)	0.00	8.1
1;PL;PRS;V	52.81 (89)	32.11 (246)	69.66	47.15
3;IPFV;PL;PST;V	84.00 (175)	70.85 (247)	99.43	97.17
2;PFV;PL;PST;V	-	0.40 (248)	-	0.81
3;PST;SBJV;SG;V	17.93 (145)	14.57 (247)	26.21	26.72
2;IMP;PL;POS;V	5.00 (60)	4.45 (247)	5.00	8.5
3;COND;PL;V	84.44 (90)	70.97 (248)	98.89	96.37
2;FUT;SG;V	36.36 (11)	29.84 (248)	36.36	37.9
3;IMP;PL;POS;V	43.85 (130)	28.74 (247)	56.15	39.68
3;PL;PRS;V	71.57 (204)	61.79 (246)	91.18	82.93
1;PRS;SG;V	23.58 (106)	19.43 (247)	36.79	29.55
1;IPFV;PL;PST;V	20.00 (5)	12.96 (247)	60.00	27.53
2;PST;SBJV;SG;V	0.00 (2)	4.45 (247)	0.00	4.45
1;PRS;SBJV;SG;V	33.95 (162)	23.08 (247)	42.59	29.55
1;IPFV;PST;SG;V	77.49 (191)	69.64 (247)	93.19	90.69
3;PRS;SBJV;SG;V	33.95 (162)	23.08 (247)	42.59	29.55
NFIN;V	65.53 (235)	63.31 (248)	86.38	85.48
1;IMP;PL;POS;V	47.44 (78)	29.15 (247)	66.67	44.53
1;FUT;PL;V	80.00 (40)	59.27 (248)	90.00	81.05
2;COND;PL;V	0.00 (1)	7.26 (248)	0.00	12.5
2;IMP;POS;SG;V	68.86 (228)	64.92 (248)	78.07	72.18
3;COND;SG;V	83.09 (136)	68.55 (248)	94.12	88.31
1;PFV;PST;SG;V	61.29 (31)	11.79 (246)	80.65	16.26
2;IPFV;PST;SG;V	0.00 (4)	10.53 (247)	25.00	11.74
3;PL;PST;SBJV;V	11.11 (108)	11.34 (247)	17.59	31.98
3;PFV;PST;SG;V	65.93 (182)	52.82 (248)	81.32	72.18
2;IPFV;PL;PST;V	-	0.40 (247)	-	1.21
2;PL;PST;SBJV;V	-	0.00 (247)	-	0
3;IPFV;PST;SG;V	77.49 (191)	69.64 (247)	93.19	90.69
3;PFV;PL;PST;V	80.67 (150)	68.15 (248)	99.33	97.58
2;FUT;PL;V	0.00 (5)	17.34 (248)	0.00	27.42
1;PFV;PL;PST;V	0.00 (1)	10.08 (248)	0.00	14.92
2;PFV;PST;SG;V	-	0.00 (248)	-	0
1;COND;PL;V	66.67 (6)	59.27 (248)	83.33	80.24
3;PL;PRS;SBJV;V	43.85 (130)	28.74 (247)	56.15	39.68
3;PRS;SG;V	69.57 (230)	65.73 (248)	79.57	73.79
2;PL;PRS;V	4.35 (46)	4.47 (246)	4.35	8.54
3;FUT;PL;V	79.35 (92)	68.15 (248)	95.65	91.53
3;IMP;POS;SG;V	33.95 (162)	23.08 (247)	42.59	29.55
3;FUT;SG;V	82.44 (131)	72.98 (248)	96.18	95.16
1;FUT;SG;V	73.33 (30)	62.90 (248)	80.00	77.82
2;PL;PRS;SBJV;V	2.56 (39)	5.26 (247)	2.56	9.31
2;COND;SG;V	0.00 (2)	18.15 (248)	50.00	25.81
2;PRS;SG;V	45.45 (88)	32.39 (247)	59.09	41.7
2;PRS;SBJV;SG;V	8.70 (46)	2.43 (247)	17.39	4.05
N;SG	77.33 (1266)	76.53 (1278)	94.87	94.91
N;PL	75.16 (1079)	73.36 (1175)	93.42	93.11

Table 103: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Catalan–Spanish language pair (the grey numbers correspond to the dictionary sizes).

	French–Catalan			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	40.31 (7845)	22.43 (16992)	74.57	45.9
N;SG	51.19 (1643)	50.12 (1682)	86.85	86.44
N;PL	49.44 (1440)	47.46 (1593)	90.56	89.89
ADJ;FEM;PL	57.00 (393)	55.83 (403)	97.71	97.52
ADJ;FEM;SG	29.81 (416)	29.11 (426)	78.85	77.93
ADJ;MASC;PL	58.06 (403)	55.37 (428)	97.52	97.43
ADJ;MASC;SG	47.00 (417)	45.62 (434)	91.37	90.09
1;PL;PRS;SBJV;V	15.91 (44)	4.22 (379)	22.73	12.14
3;PRS;SG;V	36.46 (362)	35.42 (384)	51.38	50.26
3;PST;SBJV;SG;V	12.05 (83)	7.87 (381)	26.51	19.95
1;PST;SBJV;SG;V	4.55 (22)	0.53 (380)	9.09	2.37
1;PL;PRS;V	14.39 (139)	9.74 (380)	39.57	20.79
2;PRS;SBJV;SG;V	25.23 (107)	15.53 (380)	31.78	22.37
2;FUT;SG;V	4.35 (23)	4.45 (382)	17.39	9.69
3;IPFV;PL;PST;V	46.27 (255)	38.85 (381)	95.29	95.8
1;PFV;PST;SG;V	0.00 (47)	2.36 (382)	4.26	5.5
3;PFV;PST;SG;V	34.03 (288)	28.72 (383)	50.00	41.25
2;COND;PL;V	0.00 (5)	11.05 (380)	0.00	30.53
NFIN;V	46.76 (370)	46.35 (384)	91.08	87.24
2;PFV;PL;PST;V	-	0.00 (380)	-	0.53
3;PFV;PL;PST;V	45.49 (233)	32.55 (381)	92.70	91.34
1;PRS;SBJV;SG;V	33.01 (312)	32.11 (380)	48.40	47.37
1;IMP;PL;POS;V	14.71 (136)	9.74 (380)	39.71	20.53
3;COND;PL;V	40.17 (117)	22.05 (381)	63.25	54.07
2;IPFV;PST;SG;V	13.33 (30)	7.59 (382)	20.00	11.52
1;PFV;PL;PST;V	0.00 (2)	1.84 (380)	0.00	3.42
3;COND;SG;V	25.67 (187)	16.45 (383)	41.18	31.07
2;PRS;SG;V	25.95 (185)	16.71 (383)	34.59	25.85
1;FUT;PL;V	13.04 (46)	12.63 (380)	28.26	32.63
1;COND;PL;V	40.00 (5)	18.95 (380)	60.00	53.68
2;PST;SBJV;SG;V	0.00 (3)	0.00 (380)	33.33	1.05
3;FUT;PL;V	32.48 (157)	24.93 (381)	54.14	58.27
2;PL;PRS;V	15.56 (135)	8.95 (380)	26.67	15.53
2;PL;PST;SBJV;V	100.00 (1)	0.53 (379)	100.00	5.54
2;IMP;PL;POS;V	15.56 (135)	8.95 (380)	25.93	15.26
1;IPFV;PST;SG;V	10.11 (89)	7.59 (382)	17.98	11.52
2;PL;PRS;SBJV;V	22.22 (36)	5.28 (379)	36.11	12.14
1;FUT;SG;V	24.29 (70)	20.42 (382)	44.29	50.26
3;PL;PRS;SBJV;V	41.89 (265)	37.37 (380)	80.00	73.42
3;PL;PST;SBJV;V	28.57 (28)	2.89 (380)	53.57	12.89
3;IPFV;PST;SG;V	44.18 (292)	38.90 (383)	86.30	83.29
2;PFV;PST;SG;V	-	2.62 (382)	-	12.3
2;IPFV;PL;PST;V	0.00 (3)	5.26 (380)	0.00	12.37
2;IMP;POS;SG;V	32.58 (356)	31.41 (382)	48.03	46.86
1;COND;SG;V	0.00 (67)	0.79 (382)	5.97	1.05
3;PRS;SBJV;SG;V	32.91 (313)	32.02 (381)	48.56	47.51
3;PL;PRS;V	39.82 (329)	37.53 (381)	79.94	74.02
2;COND;SG;V	0.00 (17)	0.79 (382)	0.00	1.05
1;PRS;SG;V	32.95 (261)	31.33 (383)	48.66	47
1;PL;PST;SBJV;V	0.00 (1)	0.26 (379)	0.00	1.32
1;IPFV;PL;PST;V	5.26 (19)	4.47 (380)	15.79	12.37
3;FUT;SG;V	40.79 (228)	34.20 (383)	69.30	72.06
2;FUT;PL;V	0.00 (21)	2.63 (380)	0.00	5

Table 104: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the French–Catalan language pair (the grey numbers correspond to the dictionary sizes).

	French–Italian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	48.35 (9891)	26.84 (22052)	79.87	50.86
N;PL	51.47 (1943)	47.57 (2281)	86.93	84.26
N;SG	58.25 (2388)	56.28 (2491)	90.87	90.49
1;PFV;PL;PST;V	0.00 (3)	0.21 (477)	33.33	1.47
1;IMP;PL;POS;V	28.22 (163)	13.69 (482)	56.44	35.27
2;PL;PRS;V	2.55 (196)	0.62 (481)	4.59	2.08
3;PRS;SBJV;SG;V	44.33 (397)	41.53 (484)	61.71	56.4
1;PST;SBJV;SG;V	9.09 (11)	1.89 (477)	18.18	4.82
1;PL;PST;SBJV;V	66.67 (3)	0.42 (476)	100.00	3.57
2;COND;PL;V	0.00 (4)	0.21 (480)	0.00	1.04
NFIN;V	51.08 (462)	49.07 (485)	94.16	90.93
3;IPFV;PST;SG;V	52.12 (330)	44.74 (485)	85.45	78.14
2;PRS;SG;V	21.09 (256)	13.49 (482)	37.11	21.58
2;PFV;PST;SG;V	20.00 (20)	2.09 (478)	25.00	5.44
1;FUT;PL;V	29.27 (41)	19.17 (480)	48.78	43.54
2;PST;SBJV;SG;V	-	0.21 (477)	-	2.31
2;FUT;PL;V	8.70 (23)	2.92 (480)	17.39	11.25
2;COND;SG;V	29.73 (37)	16.84 (481)	51.35	55.72
3;FUT;SG;V	46.24 (266)	37.81 (484)	84.21	78.1
2;IPFV;PL;PST;V	0.00 (15)	0.00 (481)	0.00	0.62
1;IPFV;PL;PST;V	17.39 (23)	4.37 (481)	21.74	19.33
3;PFV;PST;SG;V	36.91 (363)	29.94 (481)	63.91	52.81
2;IMP;POS;SG;V	45.12 (430)	41.29 (482)	61.86	57.05
1;COND;PL;V	0.00 (5)	9.38 (480)	20.00	34.58
3;PL;PRS;V	45.68 (405)	40.66 (482)	76.30	66.18
1;COND;SG;V	23.94 (71)	16.84 (481)	56.34	55.93
2;IPFV;PST;SG;V	20.00 (45)	20.33 (482)	35.56	39.21
3;COND;PL;V	22.81 (114)	22.45 (481)	48.25	67.98
1;PRS;SBJV;SG;V	44.56 (395)	41.58 (481)	61.77	56.34
3;IPFV;PL;PST;V	54.74 (274)	45.02 (482)	95.99	95.64
2;PFV;PL;PST;V	-	0.21 (477)	-	0.84
1;PRS;SG;V	44.33 (379)	41.70 (482)	61.21	57.47
3;COND;SG;V	22.16 (185)	20.87 (484)	46.49	61.78
1;IPFV;PST;SG;V	19.18 (73)	20.33 (482)	36.99	39.21
2;PL;PST;SBJV;V	0.00 (1)	0.00 (476)	0.00	0.21
2;PL;PRS;SBJV;V	0.00 (29)	0.00 (480)	0.00	0.62
1;FUT;SG;V	18.89 (90)	17.88 (481)	46.67	45.53
2;FUT;SG;V	0.00 (23)	1.04 (481)	17.39	9.98
3;PST;SBJV;SG;V	21.74 (69)	18.96 (480)	43.48	35.83
1;PFV;PST;SG;V	16.28 (43)	15.48 (478)	23.26	22.8
3;PFV;PL;PST;V	48.47 (262)	36.61 (478)	96.18	97.28
3;PRS;SG;V	47.35 (452)	44.74 (485)	64.82	61.03
2;IMP;PL;POS;V	2.55 (196)	0.62 (482)	4.59	2.28
3;PL;PST;SBJV;V	50.00 (20)	4.40 (477)	65.00	11.32
1;PL;PRS;V	28.22 (163)	13.72 (481)	56.44	35.34
1;PL;PRS;SBJV;V	15.00 (40)	4.38 (480)	27.50	19.58
3;FUT;PL;V	50.58 (172)	37.63 (481)	94.77	96.47
2;PRS;SBJV;SG;V	22.37 (219)	12.27 (481)	37.90	18.71
3;PL;PRS;SBJV;V	46.60 (309)	40.54 (481)	76.38	66.11
ADJ;MASC;PL	68.26 (501)	66.35 (523)	95.41	95.41
ADJ;MASC;SG	66.73 (514)	65.28 (527)	95.72	95.45
ADJ;FEM;SG	65.43 (512)	64.48 (518)	94.14	93.82
ADJ;FEM;PL	63.75 (491)	63.33 (499)	95.72	95.79

Table 105: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the French–Italian language pair (the grey numbers correspond to the dictionary sizes).

	French–Portuguese			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	47.42 (8930)	29.73 (17536)	76.94	52.5
ADJ;MASC;SG	63.03 (495)	61.74 (507)	93.94	93.69
ADJ;FEM;PL	62.77 (470)	61.46 (480)	98.51	98.33
ADJ;FEM;SG	64.23 (492)	63.71 (496)	94.72	94.56
ADJ;MASC;PL	63.39 (478)	60.08 (501)	97.49	97.41
N;SG	53.00 (2151)	51.58 (2222)	87.59	86.81
N;PL	52.30 (1786)	49.29 (2039)	88.63	87.3
3;FUT;PL;V	34.09 (132)	31.28 (438)	51.52	64.84
3;IPFV;PST;SG;V	49.84 (309)	42.95 (440)	82.52	81.14
NFIN;V	58.29 (422)	56.01 (441)	93.60	87.76
2;PRS;SBJV;SG;V	28.78 (139)	24.31 (436)	43.17	34.86
2;IMP;PL;POS;V	0.76 (132)	0.69 (436)	0.76	0.92
2;FUT;SG;V	10.53 (19)	13.96 (437)	10.53	25.86
2;PL;PRS;SBJV;V	0.00 (12)	0.46 (436)	0.00	0.92
1;PL;PRS;V	39.57 (139)	19.45 (437)	60.43	37.3
3;PFV;PST;SG;V	36.12 (335)	28.21 (436)	51.64	41.51
2;PFV;PST;SG;V	8.70 (23)	1.15 (434)	21.74	2.07
2;FUT;PL;V	0.00 (13)	0.00 (437)	0.00	0
2;COND;SG;V	3.12 (32)	0.23 (437)	3.12	0.69
3;PL;PRS;SBJV;V	48.32 (298)	40.73 (437)	73.49	68.19
1;IPFV;PL;PST;V	14.81 (27)	5.03 (437)	29.63	11.67
3;PRS;SG;V	40.53 (417)	39.32 (440)	58.27	54.55
2;PL;PRS;V	1.27 (79)	0.69 (437)	1.27	0.92
1;PFV;PL;PST;V	33.33 (6)	2.53 (434)	83.33	9.22
1;IPFV;PST;SG;V	6.59 (91)	6.86 (437)	14.29	12.36
1;PL;PRS;SBJV;V	18.75 (32)	5.05 (436)	31.25	11.7
1;PRS;SBJV;SG;V	36.63 (374)	34.86 (436)	54.28	49.77
1;COND;PL;V	20.00 (5)	16.25 (437)	20.00	33.18
3;COND;PL;V	44.64 (112)	27.17 (438)	68.75	56.85
3;PFV;PL;PST;V	51.01 (247)	34.56 (434)	81.78	73.5
2;PRS;SG;V	30.50 (200)	26.32 (437)	45.50	37.99
3;FUT;SG;V	36.95 (203)	32.50 (440)	52.71	57.27
1;FUT;PL;V	38.89 (36)	29.98 (437)	41.67	55.84
3;COND;SG;V	27.08 (192)	18.18 (440)	39.06	27.27
1;IMP;PL;POS;V	42.39 (92)	19.50 (436)	58.70	37.39
2;PFV;PL;PST;V	0.00 (2)	0.00 (434)	0.00	1.38
2;IMP;POS;SG;V	37.80 (410)	36.93 (436)	56.34	51.83
3;PL;PRS;V	46.69 (362)	40.87 (438)	73.48	68.26
1;PRS;SG;V	37.29 (354)	36.84 (437)	56.21	51.72
3;PRS;SBJV;SG;V	36.87 (377)	35.08 (439)	54.38	49.89
2;IPFV;PST;SG;V	2.94 (34)	6.86 (437)	11.76	12.36
1;COND;SG;V	1.33 (75)	0.23 (437)	2.67	0.69
1;FUT;SG;V	45.07 (71)	39.82 (437)	71.83	82.38
2;IPFV;PL;PST;V	0.00 (26)	0.46 (437)	0.00	0.92
3;IPFV;PL;PST;V	55.39 (269)	45.43 (438)	94.80	95.66
1;PFV;PST;SG;V	5.66 (53)	3.23 (434)	15.09	6.68
2;COND;PL;V	-	0.23 (437)	-	0.46

Table 106: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the French–Portuguese language pair (the grey numbers correspond to the dictionary sizes).

		French–Spanish		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	47.83 (9770)	26.69 (21087)	77.97	47.88
N;PL	53.55 (1873)	49.91 (2154)	87.83	86.95
N;SG	56.74 (2242)	55.13 (2311)	89.61	89.27
1;PFV;PST;SG;V	5.26 (57)	1.32 (455)	7.02	3.74
2;COND;SG;V	16.28 (43)	1.54 (455)	18.60	1.76
3;FUT;PL;V	34.68 (173)	23.25 (456)	51.45	46.93
1;PRS;SBJV;SG;V	41.71 (386)	38.02 (455)	54.15	48.57
2;COND;PL;V	0.00 (2)	13.19 (455)	50.00	30.99
2;PL;PRS;SBJV;V	0.00 (34)	0.66 (455)	2.94	2.42
1;FUT;PL;V	42.86 (42)	24.18 (455)	64.29	48.79
2;PRS;SG;V	35.71 (224)	25.93 (455)	48.21	38.9
3;COND;SG;V	40.95 (210)	30.63 (457)	71.90	56.02
2;IMP;PL;POS;V	1.54 (130)	1.98 (455)	1.54	2.86
1;COND;PL;V	0.00 (12)	7.25 (455)	8.33	22.86
3;PRS;SBJV;SG;V	41.75 (388)	38.07 (457)	54.12	48.58
3;IPFV;PL;PST;V	54.61 (271)	42.32 (456)	98.52	97.81
1;FUT;SG;V	44.83 (87)	31.21 (455)	68.97	58.02
2;PL;PST;SBJV;V	-	0.00 (455)	-	0.22
2;PL;PRS;V	0.00 (91)	1.98 (455)	0.00	2.86
2;FUT;SG;V	12.50 (32)	5.05 (455)	12.50	10.99
3;PL;PRS;V	45.74 (387)	41.01 (456)	70.80	65.57
1;PL;PST;SBJV;V	-	0.22 (455)	-	1.98
2;IPFV;PST;SG;V	24.00 (50)	13.41 (455)	26.00	18.68
2;FUT;PL;V	0.00 (15)	7.69 (455)	0.00	14.73
NFIN;V	50.57 (437)	49.02 (457)	91.53	88.62
3;PL;PST;SBJV;V	38.46 (26)	3.29 (456)	57.69	6.8
2;PFV;PST;SG;V	11.11 (45)	1.32 (455)	11.11	2.2
3;FUT;SG;V	33.84 (263)	26.26 (457)	51.33	48.36
3;IPFV;PST;SG;V	56.29 (334)	47.48 (457)	88.92	84.68
2;PFV;PL;PST;V	0.00 (1)	0.00 (455)	0.00	0
2;PRS;SBJV;SG;V	36.07 (183)	23.96 (455)	53.01	36.92
1;PL;PRS;V	30.77 (156)	17.14 (455)	56.41	32.97
1;PL;PRS;SBJV;V	20.51 (39)	3.74 (455)	23.08	10.11
3;PST;SBJV;SG;V	7.94 (63)	7.44 (457)	15.87	15.97
1;IPFV;PST;SG;V	14.94 (87)	13.41 (455)	21.84	18.68
2;IMP;POS;SG;V	41.45 (427)	38.68 (455)	52.93	49.01
1;IPFV;PL;PST;V	20.69 (29)	3.74 (455)	20.69	10.11
2;IPFV;PL;PST;V	0.00 (7)	0.66 (455)	14.29	2.42
1;IMP;PL;POS;V	32.37 (139)	17.14 (455)	55.40	32.97
1;PST;SBJV;SG;V	10.00 (20)	2.42 (455)	10.00	4.4
3;PFV;PL;PST;V	47.60 (250)	36.18 (456)	88.80	85.75
3;PFV;PST;SG;V	35.75 (358)	30.42 (457)	51.40	43.76
2;PST;SBJV;SG;V	0.00 (3)	3.52 (455)	0.00	5.49
1;COND;SG;V	8.86 (79)	1.54 (455)	12.66	1.76
1;PFV;PL;PST;V	20.00 (5)	1.54 (455)	20.00	3.74
3;COND;PL;V	50.00 (116)	30.26 (456)	86.21	77.63
1;PRS;SG;V	41.65 (401)	38.68 (455)	54.36	49.01
3;PL;PRS;SBJV;V	47.34 (357)	40.79 (456)	71.71	65.35
3;PRS;SG;V	44.37 (435)	42.67 (457)	56.78	53.17
ADJ;FEM;SG	59.17 (578)	58.56 (584)	92.73	92.64
ADJ;MASC;PL	60.99 (564)	58.40 (589)	96.81	96.77
ADJ;MASC;SG	62.74 (577)	60.88 (593)	94.11	93.59
ADJ;FEM;PL	61.29 (558)	59.96 (567)	97.49	97.53

Table 107: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the French–Spanish language pair (the grey numbers correspond to the dictionary sizes).

	Italian–Catalan			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	35.51 (9035)	17.81 (22636)	73.50	44.96
N;SG	43.89 (2153)	41.83 (2278)	83.74	82.79
N;PL	42.70 (1665)	38.63 (1983)	88.89	87.34
2;FUT;SG;V	5.56 (18)	2.75 (473)	5.56	11.63
1;COND;PL;V	33.33 (9)	19.45 (473)	77.78	74.42
3;PFV;PST;SG;V	25.99 (327)	20.51 (473)	45.57	38.69
3;IMP;PL;POS;V	17.72 (158)	9.32 (472)	28.48	18.01
1;PRS;SBJV;SG;V	27.88 (269)	18.60 (473)	45.35	30.66
2;FUT;PL;V	7.69 (13)	2.33 (473)	7.69	6.55
1;IPFV;PL;PST;V	11.11 (9)	5.06 (474)	55.56	28.48
3;PRS;SBJV;SG;V	27.88 (269)	18.60 (473)	45.35	30.66
1;PL;PST;SBJV;V	0.00 (7)	5.07 (473)	0.00	17.34
2;PL;PST;SBJV;V	0.00 (1)	0.00 (473)	0.00	2.11
1;PRS;SG;V	23.15 (216)	14.59 (473)	40.28	22.83
1;PL;PRS;SBJV;V	25.23 (107)	5.30 (472)	52.34	15.89
2;PFV;PST;SG;V	-	0.21 (473)	-	1.48
2;COND;SG;V	0.00 (5)	0.00 (473)	0.00	0
3;IPFV;PST;SG;V	40.60 (298)	31.22 (474)	81.54	76.37
1;PL;PRS;V	25.00 (108)	5.30 (472)	52.78	15.89
2;IPFV;PST;SG;V	0.00 (3)	2.74 (474)	0.00	5.06
2;IPFV;PL;PST;V	0.00 (1)	0.00 (474)	0.00	0.84
3;COND;PL;V	10.71 (56)	5.71 (473)	42.86	51.37
2;PFV;PL;PST;V	-	0.00 (473)	-	2.11
3;FUT;PL;V	45.54 (112)	21.99 (473)	83.93	87.1
3;FUT;SG;V	43.16 (190)	31.08 (473)	90.53	91.97
2;COND;PL;V	50.00 (2)	7.40 (473)	50.00	27.48
1;FUT;SG;V	38.46 (39)	13.53 (473)	58.97	32.35
NFIN;V	39.11 (427)	35.86 (474)	91.80	85.86
3;IMP;POS;SG;V	27.99 (268)	18.64 (472)	45.52	30.72
3;PL;PRS;SBJV;V	17.61 (159)	9.30 (473)	28.30	17.97
1;PFV;PST;SG;V	2.38 (42)	2.54 (473)	4.76	3.59
3;PFV;PL;PST;V	37.25 (255)	29.39 (473)	90.59	89.85
2;IMP;PL;POS;V	1.66 (181)	2.11 (473)	3.87	3.17
3;PL;PRS;V	32.29 (350)	24.74 (473)	74.29	62.16
2;PST;SBJV;SG;V	22.22 (9)	2.75 (473)	22.22	7.82
2;IMP;POS;SG;V	30.19 (361)	23.68 (473)	49.86	37.42
2;PRS;SG;V	23.71 (194)	14.38 (473)	41.24	24.1
3;IPFV;PL;PST;V	42.74 (248)	31.22 (474)	94.76	95.99
3;PST;SBJV;SG;V	24.42 (172)	14.38 (473)	39.53	30.44
1;IPFV;PST;SG;V	18.60 (43)	5.91 (474)	25.58	12.03
1;COND;SG;V	0.00 (53)	0.00 (473)	3.77	0
2;PL;PRS;V	1.65 (182)	2.11 (473)	4.40	3.38
3;COND;SG;V	8.62 (116)	3.59 (473)	30.17	12.68
1;IMP;PL;POS;V	25.47 (106)	5.30 (472)	51.89	15.89
3;PRS;SG;V	33.81 (420)	30.80 (474)	56.19	50.63
2;PRS;SBJV;SG;V	28.47 (144)	18.60 (473)	52.08	30.66
1;PFV;PL;PST;V	0.00 (2)	1.06 (473)	0.00	1.69
2;PL;PRS;SBJV;V	0.00 (31)	0.00 (472)	3.23	1.06
1;PST;SBJV;SG;V	8.00 (25)	2.75 (473)	8.00	7.82
3;PL;PST;SBJV;V	31.62 (117)	19.45 (473)	73.50	77.8
1;FUT;PL;V	37.14 (35)	17.97 (473)	48.57	54.12
ADJ;MASC;SG	49.04 (416)	47.14 (437)	92.55	91.99
ADJ;MASC;PL	52.49 (402)	49.76 (422)	93.28	92.42
ADJ;FEM;SG	21.50 (414)	21.09 (422)	74.64	74.41
ADJ;FEM;PL	50.66 (381)	50.13 (385)	94.23	93.25

Table 108: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Italian–Catalan language pair (the grey numbers correspond to the dictionary sizes).

		Italian–French		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	40.55 (12595)	20.99 (31419)	76.77	49.78
N;SG	48.45 (3106)	45.13 (3355)	87.15	85.84
N;PL	49.81 (2333)	43.68 (2928)	89.63	87.53
3;PL;PST;SBJV;V	0.00 (74)	0.00 (645)	0.00	0
1;PL;PST;SBJV;V	0.00 (2)	0.00 (643)	0.00	0
1;FUT;PL;V	12.12 (33)	14.46 (643)	39.39	50.54
1;COND;PL;V	0.00 (9)	4.98 (643)	0.00	23.48
3;PL;PRS;V	40.59 (473)	33.02 (645)	83.93	71.47
1;COND;SG;V	35.38 (65)	23.64 (643)	80.00	83.67
1;PL;PRS;V	17.65 (153)	8.79 (637)	47.71	25.27
3;PFV;PST;SG;V	27.01 (448)	20.12 (646)	47.32	35.76
2;PFV;PST;SG;V	14.29 (7)	1.87 (643)	14.29	4.82
NFIN;V	44.85 (573)	40.56 (646)	91.97	88.24
2;IMP;POS;SG;V	28.13 (487)	22.40 (643)	46.00	35.93
1;PRS;SG;V	23.72 (371)	14.77 (643)	38.27	23.79
1;IMP;PL;POS;V	17.65 (153)	8.79 (637)	47.71	25.27
3;PL;PRS;SBJV;V	14.09 (220)	7.61 (644)	32.27	19.57
1;FUT;SG;V	39.71 (68)	18.35 (643)	77.94	55.99
2;IMP;PL;POS;V	2.27 (353)	2.02 (643)	7.08	5.75
1;PRS;SBJV;SG;V	30.22 (417)	21.50 (642)	47.48	37.85
2;PFV;PL;PST;V	0.00 (3)	0.47 (643)	0.00	5.13
3;COND;PL;V	49.32 (73)	23.41 (645)	95.89	98.91
3;COND;SG;V	48.76 (121)	26.32 (646)	94.21	92.26
3;FUT;SG;V	40.00 (265)	27.86 (646)	84.53	71.52
2;PST;SBJV;SG;V	0.00 (3)	1.87 (643)	0.00	4.51
3;PRS;SBJV;SG;V	30.24 (420)	21.55 (645)	47.38	37.83
2;FUT;SG;V	11.11 (18)	0.62 (643)	11.11	1.56
1;PL;PRS;SBJV;V	15.60 (109)	8.79 (637)	51.38	25.27
2;COND;SG;V	43.75 (16)	17.42 (643)	68.75	64.07
2;IPFV;PL;PST;V	-	0.16 (643)	-	0.93
2;PRS;SG;V	29.94 (354)	19.16 (642)	48.02	33.49
3;IPFV;PST;SG;V	43.38 (385)	33.90 (646)	86.23	78.64
3;FUT;PL;V	47.06 (153)	23.57 (645)	98.69	98.91
3;PFV;PL;PST;V	37.22 (352)	29.92 (645)	94.89	95.81
2;PRS;SBJV;SG;V	31.61 (367)	21.50 (642)	49.32	37.85
1;IPFV;PL;PST;V	0.00 (9)	0.47 (643)	0.00	1.09
2;IPFV;PST;SG;V	18.18 (22)	2.64 (643)	36.36	7.62
2;COND;PL;V	0.00 (6)	1.24 (643)	0.00	7
2;FUT;PL;V	25.00 (12)	8.86 (643)	25.00	26.91
1;PFV;PST;SG;V	19.05 (63)	7.15 (643)	23.81	13.37
3;PRS;SG;V	32.33 (566)	29.26 (646)	53.71	46.75
2;PL;PRS;SBJV;V	0.00 (29)	0.31 (637)	0.00	2.2
1;PST;SBJV;SG;V	0.00 (8)	1.87 (643)	0.00	4.51
1;IPFV;PST;SG;V	26.83 (41)	10.89 (643)	34.15	25.97
2;PL;PRS;V	2.55 (353)	2.18 (643)	7.37	5.75
2;PL;PST;SBJV;V	0.00 (2)	0.47 (643)	0.00	5.13
1;PFV;PL;PST;V	0.00 (8)	0.62 (643)	12.50	3.27
3;PST;SBJV;SG;V	3.39 (177)	6.19 (646)	7.34	20.12
3;IPFV;PL;PST;V	44.44 (324)	32.40 (645)	98.15	95.81
ADJ;FEM;SG	53.41 (631)	52.32 (646)	94.29	94.12
ADJ;MASC;SG	55.02 (638)	52.83 (672)	92.32	92.26
ADJ;FEM;PL	57.36 (598)	57.07 (601)	94.98	94.68
ADJ;MASC;PL	56.93 (606)	54.42 (645)	93.73	92.71

Table 109: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Italian–French language pair (the grey numbers correspond to the dictionary sizes).

	Italian–Portuguese			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	42.59 (10072)	20.40 (25704)	76.74	46.63
N;PL	46.54 (1968)	40.62 (2452)	86.38	85.11
N;SG	47.51 (2650)	44.31 (2846)	85.02	84.01
2;COND;SG;V	0.00 (4)	0.00 (586)	0.00	0
1;PL;PRS;V	28.57 (112)	11.74 (579)	61.61	28.84
1;FUT;PL;V	50.00 (26)	20.99 (586)	61.54	71.16
3;PRS;SBJV;SG;V	24.60 (313)	17.06 (586)	38.34	26.62
1;IPFV;PST;SG;V	13.16 (38)	6.81 (587)	13.16	11.93
3;IMP;PL;POS;V	17.28 (162)	7.68 (586)	29.63	17.41
3;PRS;SG;V	38.83 (479)	32.20 (587)	58.04	48.04
3;COND;SG;V	13.51 (111)	4.27 (586)	26.13	9.73
3;IMP;POS;SG;V	24.60 (313)	17.06 (586)	38.34	26.62
1;PRS;SG;V	31.43 (280)	19.49 (585)	43.21	28.89
1;COND;PL;V	33.33 (12)	14.16 (586)	33.33	43.52
3;IPFV;PST;SG;V	50.32 (312)	34.75 (587)	78.21	75.81
3;PL;PRS;SBJV;V	17.28 (162)	7.68 (586)	29.63	17.41
3;PFV;PL;PST;V	51.03 (292)	31.69 (587)	94.52	90.46
1;IPFV;PL;PST;V	50.00 (8)	9.03 (587)	62.50	45.49
1;PL;PRS;SBJV;V	33.90 (59)	11.74 (579)	61.02	28.84
2;IPFV;PL;PST;V	0.00 (3)	0.17 (587)	0.00	1.19
1;COND;SG;V	0.00 (69)	0.00 (586)	0.00	0
2;PRS;SBJV;SG;V	25.87 (201)	17.06 (586)	40.80	26.62
3;FUT;SG;V	42.77 (173)	26.96 (586)	80.35	83.62
3;PFV;PST;SG;V	40.41 (386)	27.94 (587)	65.28	51.96
1;PRS;SBJV;SG;V	24.60 (313)	17.06 (586)	38.34	26.62
3;FUT;PL;V	38.04 (92)	16.04 (586)	91.30	92.83
3;COND;PL;V	18.64 (59)	5.46 (586)	45.76	32.76
1;PFV;PST;SG;V	8.47 (59)	1.19 (587)	15.25	3.58
2;FUT;SG;V	7.14 (14)	4.10 (586)	7.14	11.43
2;IMP;POS;SG;V	33.94 (436)	26.06 (587)	52.06	39.01
3;PL;PRS;V	43.47 (375)	31.01 (587)	75.20	62.01
2;PL;PRS;SBJV;V	20.00 (5)	0.52 (579)	20.00	0.86
2;PFV;PL;PST;V	0.00 (3)	0.34 (586)	0.00	2.9
NFIN;V	45.64 (493)	40.03 (587)	93.51	84.16
2;COND;PL;V	-	0.00 (586)	-	0.34
3;IPFV;PL;PST;V	55.92 (245)	33.90 (587)	94.29	95.06
2;PFV;PST;SG;V	28.57 (7)	0.85 (586)	28.57	1.71
1;IMP;PL;POS;V	33.90 (59)	11.74 (579)	61.02	28.84
2;IMP;PL;POS;V	3.38 (148)	2.21 (587)	4.05	2.73
1;FUT;SG;V	41.86 (43)	21.16 (586)	72.09	69.28
2;IPFV;PST;SG;V	0.00 (4)	1.87 (587)	0.00	3.92
2;PRS;SG;V	21.62 (222)	15.04 (585)	34.68	23.42
2;PL;PRS;V	7.35 (68)	2.21 (587)	8.82	2.73
1;PFV;PL;PST;V	0.00 (10)	0.68 (586)	0.00	3.75
2;FUT;PL;V	0.00 (8)	0.00 (586)	0.00	0.51
ADJ;MASC;SG	54.70 (532)	52.60 (557)	93.42	92.46
ADJ;MASC;PL	54.98 (502)	52.34 (535)	94.62	94.39
ADJ;FEM;SG	54.49 (523)	53.57 (532)	94.46	94.17
ADJ;FEM;PL	56.70 (485)	55.15 (495)	95.67	95.15

Table 110: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Italian–Portuguese language pair (the grey numbers correspond to the dictionary sizes).

		Italian–Spanish		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	42.69 (11685)	21.07 (30686)	76.43	47.57
N;SG	48.95 (2756)	45.70 (2965)	87.41	86.27
N;PL	46.27 (2092)	41.11 (2588)	86.57	85.51
ADJ;FEM;SG	56.54 (596)	55.79 (604)	93.29	93.21
ADJ;MASC;SG	54.68 (609)	52.76 (633)	91.46	91.15
ADJ;MASC;PL	56.26 (583)	54.13 (617)	94.51	94.17
ADJ;FEM;PL	56.01 (566)	56.04 (571)	91.52	91.59
1;PFV;PL;PST;V	0.00 (14)	6.07 (643)	0.00	11.2
2;IPFV;PST;SG;V	11.11 (9)	2.17 (644)	11.11	5.59
3;PFV;PST;SG;V	37.56 (426)	28.11 (644)	62.68	52.02
3;PL;PRS;V	47.96 (442)	36.49 (644)	75.11	63.2
1;FUT;PL;V	54.55 (33)	19.25 (644)	78.79	62.27
1;PL;PRS;V	36.03 (136)	19.31 (637)	77.21	49.92
2;PFV;PL;PST;V	0.00 (1)	0.00 (643)	0.00	0.78
3;IPFV;PST;SG;V	55.07 (365)	39.38 (645)	86.30	82.02
2;PL;PRS;V	4.81 (104)	1.71 (644)	4.81	3.26
1;COND;PL;V	44.44 (9)	19.72 (644)	77.78	76.71
3;FUT;PL;V	52.78 (144)	23.91 (644)	96.53	94.25
1;IPFV;PL;PST;V	62.50 (8)	15.22 (644)	100.00	63.82
3;PRS;SG;V	39.64 (550)	34.73 (645)	60.55	50.85
3;COND;SG;V	17.09 (117)	5.58 (645)	40.17	9.92
2;PL;PST;SBJV;V	-	0.00 (644)	-	0.78
1;FUT;SG;V	45.16 (62)	20.19 (644)	69.35	43.17
1;PFV;PST;SG;V	3.39 (59)	0.93 (643)	5.08	1.71
3;PRS;SBJV;SG;V	28.36 (409)	21.89 (644)	42.79	34.94
1;PRS;SBJV;SG;V	28.19 (408)	21.77 (643)	42.65	34.84
3;PL;PRS;SBJV;V	17.09 (199)	8.86 (643)	29.15	16.02
1;PRS;SG;V	30.08 (369)	20.96 (644)	46.07	31.83
3;IMP;POS;SG;V	28.36 (409)	22.08 (643)	42.79	34.99
1;PL;PRS;SBJV;V	37.07 (116)	19.31 (637)	75.86	49.92
2;IMP;PL;POS;V	3.35 (179)	1.67 (659)	5.03	3.19
3;FUT;SG;V	51.44 (243)	31.01 (645)	92.18	91.16
2;FUT;PL;V	33.33 (6)	7.45 (644)	50.00	25
1;PL;PST;SBJV;V	0.00 (7)	1.71 (644)	14.29	11.34
3;IMP;PL;POS;V	17.17 (198)	8.88 (642)	29.29	16.04
3;PL;PST;SBJV;V	3.79 (132)	7.76 (644)	8.33	25.31
3;IPFV;PL;PST;V	60.55 (289)	37.42 (644)	98.27	97.67
2;PST;SBJV;SG;V	10.00 (10)	2.80 (644)	10.00	6.21
3;PFV;PL;PST;V	51.48 (338)	35.93 (643)	97.04	94.09
NFIN;V	44.92 (581)	40.39 (661)	91.74	86.99
3;COND;PL;V	29.51 (61)	9.63 (644)	59.02	45.03
2;PFV;PST;SG;V	0.00 (1)	0.16 (643)	0.00	0.93
1;IMP;PL;POS;V	36.21 (116)	18.71 (652)	75.86	50.92
1;IPFV;PST;SG;V	12.50 (40)	6.52 (644)	15.00	11.65
2;PRS;SG;V	25.68 (331)	19.00 (642)	39.88	30.69
1;PST;SBJV;SG;V	3.85 (26)	2.80 (644)	3.85	6.21
2;PL;PRS;SBJV;V	0.00 (14)	0.00 (637)	0.00	0.31
2;IMP;POS;SG;V	35.51 (490)	27.92 (659)	54.90	41.12
2;IPFV;PL;PST;V	0.00 (1)	0.47 (644)	0.00	0.93
2;COND;SG;V	16.67 (6)	0.78 (644)	33.33	2.17
2;COND;PL;V	0.00 (1)	2.80 (644)	0.00	13.51
1;COND;SG;V	1.54 (65)	0.00 (644)	4.62	0.16
3;PST;SBJV;SG;V	13.71 (197)	11.63 (645)	22.84	26.67
2;PRS;SBJV;SG;V	30.47 (338)	21.77 (643)	45.56	34.84
2;FUT;SG;V	35.00 (20)	13.51 (644)	45.00	40.68

Table 111: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Italian–Spanish language pair (the grey numbers correspond to the dictionary sizes).

	Portuguese–Catalan			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	47.78 (7199)	27.60 (16059)	77.64	49.85
N;SG	53.50 (1527)	51.50 (1598)	87.62	87.05
N;PL	54.08 (1274)	50.91 (1424)	90.82	90.24
3;FUT;PL;V	62.67 (75)	42.82 (348)	78.67	76.72
1;COND;PL;V	20.00 (5)	29.89 (348)	40.00	69.83
NFIN;V	51.21 (330)	48.85 (348)	90.00	86.21
3;IPFV;PST;SG;V	55.73 (253)	45.69 (348)	85.38	80.75
1;FUT;PL;V	57.14 (21)	32.76 (348)	76.19	64.94
1;PFV;PL;PST;V	20.00 (5)	6.32 (348)	40.00	10.63
2;COND;SG;V	50.00 (2)	5.17 (348)	50.00	9.77
2;FUT;SG;V	0.00 (8)	6.90 (348)	0.00	16.09
1;IMP;PL;POS;V	10.71 (28)	13.54 (347)	39.29	25.65
2;PFV;PL;PST;V	-	0.00 (348)	-	0.86
1;PL;PRS;V	39.25 (107)	15.23 (348)	57.01	24.71
3;PRS;SG;V	44.20 (319)	42.94 (347)	60.19	57.93
3;IPFV;PL;PST;V	61.01 (218)	46.84 (348)	98.17	95.4
2;COND;PL;V	-	2.30 (348)	-	8.91
1;PL;PRS;SBJV;V	10.71 (28)	13.54 (347)	39.29	25.65
1;PRS;SG;V	24.71 (174)	14.45 (346)	36.78	21.97
3;IMP;PL;POS;V	21.60 (162)	13.54 (347)	33.95	26.8
2;PFV;PST;SG;V	0.00 (3)	0.00 (348)	0.00	0.29
3;PL;PRS;SBJV;V	21.60 (162)	13.54 (347)	33.95	26.8
2;PL;PRS;SBJV;V	33.33 (3)	2.59 (347)	33.33	4.9
3;PFV;PST;SG;V	37.91 (277)	33.33 (348)	53.79	47.99
2;PRS;SG;V	21.05 (95)	12.10 (347)	30.53	20.46
1;COND;SG;V	53.25 (169)	35.63 (348)	69.23	60.06
2;PL;PRS;V	28.57 (14)	1.72 (348)	35.71	2.3
1;IPFV;PST;SG;V	55.73 (253)	45.69 (348)	85.38	80.75
3;IMP;POS;SG;V	20.45 (220)	13.83 (347)	35.00	25.36
3;PFV;PL;PST;V	52.14 (234)	43.97 (348)	83.76	78.74
3;COND;PL;V	64.29 (98)	42.24 (348)	82.65	75.29
1;FUT;SG;V	51.61 (31)	27.87 (348)	67.74	44.83
3;PL;PRS;V	46.64 (283)	41.21 (347)	80.21	71.18
3;COND;SG;V	53.25 (169)	35.63 (348)	69.23	60.06
3;PRS;SBJV;SG;V	20.36 (221)	13.83 (347)	34.84	25.36
2;PRS;SBJV;SG;V	7.14 (42)	3.17 (347)	16.67	6.63
3;FUT;SG;V	65.44 (136)	47.70 (348)	88.97	82.76
2;IMP;PL;POS;V	2.44 (41)	0.29 (348)	7.32	2.59
2;IPFV;PL;PST;V	60.00 (5)	2.30 (348)	80.00	3.45
2;IMP;POS;SG;V	44.30 (316)	42.36 (347)	60.44	57.35
1;IPFV;PL;PST;V	22.22 (9)	14.94 (348)	55.56	63.22
1;PFV;PST;SG;V	1.25 (80)	0.57 (348)	2.50	2.3
2;FUT;PL;V	0.00 (1)	6.61 (348)	0.00	11.78
1;PRS;SBJV;SG;V	20.36 (221)	13.83 (347)	34.84	25.36
2;IPFV;PST;SG;V	0.00 (2)	3.45 (348)	0.00	6.61
ADJ;MASC;PL	65.75 (365)	62.66 (399)	96.44	96.24
ADJ;FEM;SG	25.19 (385)	24.94 (393)	70.91	70.74
ADJ;MASC;SG	60.16 (384)	58.21 (402)	92.19	91.79
ADJ;FEM;PL	63.87 (357)	62.74 (365)	97.20	96.71

Table 112: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Portuguese–Catalan language pair (the grey numbers correspond to the dictionary sizes).

	Portuguese–French			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	47.11 (9664)	25.58 (22437)	77.40	47.22
N;SG	54.13 (2095)	52.10 (2188)	87.64	86.93
N;PL	53.93 (1641)	49.85 (1960)	93.30	92.09
1;COND;PL;V	0.00 (10)	9.55 (492)	40.00	39.02
1;PRS;SBJV;SG;V	20.74 (323)	16.29 (491)	32.20	25.66
2;COND;PL;V	-	0.00 (492)	-	1.63
1;COND;SG;V	32.08 (159)	18.70 (492)	49.69	36.99
1;IPFV;PL;PST;V	0.00 (10)	1.42 (492)	10.00	6.5
2;PL;PRS;V	16.67 (24)	1.02 (492)	25.00	2.24
1;PRS;SG;V	23.48 (264)	16.09 (491)	36.74	24.64
1;IMP;PL;POS;V	15.00 (40)	6.92 (491)	42.50	20.98
1;FUT;SG;V	41.18 (51)	34.55 (492)	74.51	70.12
2;IMP;PL;POS;V	2.99 (67)	0.61 (492)	4.48	2.44
2;PFV;PST;SG;V	0.00 (19)	1.02 (491)	5.26	1.83
1;PL;PRS;SBJV;V	15.15 (33)	6.92 (491)	45.45	20.98
3;PRS;SBJV;SG;V	20.74 (323)	16.23 (493)	32.20	25.76
1;PFV;PST;SG;V	3.01 (133)	1.63 (491)	3.01	4.48
2;FUT;SG;V	25.00 (8)	5.28 (492)	25.00	11.18
2;IMP;POS;SG;V	43.14 (452)	39.51 (491)	59.51	53.56
2;PFV;PL;PST;V	0.00 (3)	1.83 (491)	0.00	6.31
3;COND;SG;V	29.21 (202)	18.62 (494)	44.55	36.84
2;FUT;PL;V	0.00 (1)	2.85 (492)	100.00	7.72
2;PRS;SBJV;SG;V	21.90 (105)	13.24 (491)	52.38	25.87
3;PL;PRS;SBJV;V	33.33 (198)	23.22 (491)	62.12	49.9
2;IPFV;PL;PST;V	19.51 (41)	2.24 (492)	31.71	3.86
1;IPFV;PST;SG;V	53.62 (235)	46.34 (492)	87.23	81.91
3;FUT;SG;V	45.62 (160)	28.95 (494)	66.88	51.21
3;PRS;SG;V	42.92 (452)	39.15 (493)	59.96	53.75
2;IPFV;PST;SG;V	0.00 (7)	0.00 (492)	42.86	0.81
1;FUT;PL;V	42.31 (26)	27.03 (492)	65.38	62.2
3;FUT;PL;V	57.32 (82)	33.74 (492)	86.59	74.19
2;PRS;SG;V	24.60 (126)	15.07 (491)	53.97	29.53
3;COND;PL;V	33.62 (116)	20.73 (492)	51.72	44.51
3;IPFV;PST;SG;V	52.85 (333)	46.15 (494)	86.19	81.98
2;PL;PRS;SBJV;V	-	0.81 (491)	-	2.04
1;PL;PRS;V	29.01 (131)	10.16 (492)	45.04	21.34
1;PFV;PL;PST;V	16.67 (18)	8.15 (491)	27.78	14.46
3;PFV;PL;PST;V	46.91 (324)	38.09 (491)	80.25	82.48
NFIN;V	57.02 (463)	53.04 (494)	90.71	86.64
3;PFV;PST;SG;V	32.84 (405)	28.19 (493)	52.59	45.64
2;COND;SG;V	0.00 (5)	0.00 (492)	20.00	0.81
3;PL;PRS;V	55.76 (373)	46.64 (491)	90.88	81.87
3;IPFV;PL;PST;V	58.76 (274)	47.56 (492)	91.97	93.5
ADJ;FEM;SG	60.60 (500)	60.44 (503)	93.80	93.64
ADJ;MASC;PL	60.12 (489)	57.66 (522)	96.52	95.79
ADJ;FEM;PL	62.69 (469)	61.80 (479)	97.65	97.29
ADJ;MASC;SG	60.47 (511)	59.47 (528)	91.59	91.29

Table 113: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Portuguese–French language pair (the grey numbers correspond to the dictionary sizes).

	Portuguese–Italian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	46.38 (8939)	24.82 (20757)	77.76	48.98
N;SG	56.74 (2069)	54.65 (2159)	90.72	90.37
N;PL	50.00 (1598)	45.97 (1888)	88.17	85.81
3;IPFV;PL;PST;V	58.17 (251)	45.58 (452)	96.02	96.68
1;FUT;PL;V	19.05 (21)	18.14 (452)	61.90	59.73
1;IPFV;PL;PST;V	37.50 (8)	19.47 (452)	87.50	81.19
2;FUT;SG;V	0.00 (6)	2.43 (452)	16.67	11.73
2;COND;PL;V	-	0.00 (452)	-	2.43
2;IPFV;PL;PST;V	50.00 (4)	2.21 (452)	75.00	4.2
3;PL;PRS;V	50.29 (346)	44.35 (451)	85.55	76.27
2;IMP;PL;POS;V	0.00 (58)	0.44 (452)	1.72	1.99
3;IMP;PL;POS;V	13.07 (176)	7.32 (451)	25.57	15.52
3;PL;PRS;SBJV;V	13.07 (176)	7.32 (451)	25.57	15.52
2;PFV;PL;PST;V	0.00 (5)	5.97 (452)	20.00	11.5
1;COND;PL;V	57.14 (7)	18.58 (452)	85.71	69.25
3;FUT;SG;V	41.91 (136)	26.99 (452)	65.44	55.75
2;IMP;POS;SG;V	46.57 (408)	44.35 (451)	66.42	62.75
3;PRS;SBJV;SG;V	17.35 (294)	12.86 (451)	27.55	18.63
3;PFV;PST;SG;V	40.69 (376)	36.95 (452)	72.61	70.13
1;IMP;PL;POS;V	23.08 (26)	16.85 (451)	53.85	51.66
2;PFV;PST;SG;V	0.00 (7)	0.88 (452)	0.00	1.77
1;PL;PRS;SBJV;V	23.08 (26)	16.85 (451)	53.85	51.66
1;PFV;PL;PST;V	11.11 (18)	2.21 (452)	27.78	5.97
3;COND;PL;V	2.35 (85)	0.88 (452)	2.35	4.65
2;COND;SG;V	16.67 (6)	0.44 (452)	33.33	1.11
3;IMP;POS;SG;V	17.35 (294)	12.86 (451)	27.55	18.63
NFIN;V	55.14 (428)	53.32 (452)	97.66	96.24
1;FUT;SG;V	25.00 (44)	20.13 (452)	59.09	55.75
1;COND;SG;V	4.69 (128)	2.88 (452)	10.16	11.95
1;IPFV;PST;SG;V	51.01 (149)	44.47 (452)	86.58	82.74
2;FUT;PL;V	0.00 (1)	0.66 (452)	0.00	6.19
3;PRS;SG;V	46.52 (417)	44.35 (451)	66.67	62.75
2;PRS;SBJV;SG;V	13.19 (91)	6.87 (451)	37.36	15.74
2;PL;PRS;SBJV;V	0.00 (1)	0.67 (451)	0.00	2.66
1;PRS;SBJV;SG;V	17.35 (294)	12.86 (451)	27.55	18.63
2;PRS;SG;V	20.00 (130)	6.87 (451)	33.85	11.53
3;IPFV;PST;SG;V	51.94 (310)	44.47 (452)	86.77	82.74
2;IPFV;PST;SG;V	40.00 (5)	1.77 (452)	40.00	1.77
3;FUT;PL;V	46.88 (64)	23.67 (452)	79.69	71.46
3;PFV;PL;PST;V	54.97 (302)	46.90 (452)	94.70	94.03
3;COND;SG;V	4.43 (158)	2.88 (452)	10.76	11.95
2;PL;PRS;V	23.53 (34)	4.20 (452)	47.06	15.04
1;PFV;PST;SG;V	0.81 (124)	0.88 (452)	0.81	1.55
1;PRS;SG;V	28.40 (243)	22.17 (451)	46.09	34.59
1;PL;PRS;V	25.93 (108)	16.59 (452)	59.26	43.36
ADJ;MASC;PL	62.18 (431)	59.05 (464)	96.98	96.12
ADJ;FEM;PL	61.08 (424)	60.89 (427)	94.81	94.85
ADJ;MASC;SG	61.38 (448)	59.53 (467)	93.53	92.51
ADJ;FEM;SG	64.04 (445)	64.04 (445)	93.26	93.03

Table 114: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Portuguese–Italian language pair (the grey numbers correspond to the dictionary sizes).

	Portuguese–Spanish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	60.15 (9275)	36.80 (22638)	84.72	57.08
N;SG	64.38 (1940)	62.28 (2015)	90.31	89.63
N;PL	64.40 (1576)	60.74 (1816)	92.32	91.52
ADJ;FEM;SG	64.76 (542)	64.40 (545)	94.10	94.13
ADJ;MASC;SG	66.11 (543)	64.12 (563)	93.74	93.43
ADJ;MASC;PL	69.20 (526)	66.01 (559)	96.77	96.78
ADJ;FEM;PL	68.87 (514)	68.07 (523)	97.47	97.32
2;FUT;PL;V	0.00 (4)	9.76 (451)	25.00	25.28
3;PL;PRS;V	60.82 (342)	50.44 (450)	83.63	72.67
2;PFV;PL;PST;V	0.00 (2)	0.00 (451)	0.00	0.44
3;IPFV;PL;PST;V	70.70 (256)	55.65 (451)	99.22	97.78
3;PFV;PST;SG;V	56.67 (360)	48.56 (451)	78.61	73.17
3;FUT;PL;SBJV;V	0.00 (30)	0.22 (451)	0.00	0.22
2;IMP;POS;SG;V	53.68 (408)	49.78 (450)	68.14	61.78
3;FUT;PL;V	77.03 (74)	54.99 (451)	95.95	88.69
1;COND;SG;V	60.61 (198)	46.12 (451)	79.29	67.85
3;IMP;POS;SG;V	47.06 (289)	35.71 (448)	57.44	44.42
2;IMP;PL;POS;V	4.26 (47)	6.43 (451)	12.77	11.53
2;FUT;PL;SBJV;V	-	0.00 (451)	-	0.44
1;IMP;PL;POS;V	47.06 (34)	27.01 (448)	58.82	39.96
2;FUT;SG;V	45.45 (11)	25.94 (451)	63.64	42.79
3;PFV;PL;PST;V	67.11 (298)	56.10 (451)	94.97	92.46
2;PL;PRS;V	13.33 (15)	1.77 (451)	26.67	2
2;COND;SG;V	0.00 (5)	26.61 (451)	60.00	44.57
2;COND;PL;V	0.00 (1)	1.77 (451)	0.00	4.88
2;PRS;SG;V	48.36 (122)	38.44 (450)	59.02	49.33
3;COND;PL;V	73.74 (99)	51.88 (451)	95.96	91.35
2;PRS;SBJV;SG;V	45.74 (94)	28.95 (449)	64.89	40.53
3;IPFV;PST;SG;V	68.77 (301)	56.54 (451)	89.70	84.26
2;FUT;SBJV;SG;V	14.29 (7)	25.94 (451)	28.57	32.15
1;FUT;PL;SBJV;V	-	0.00 (451)	-	0.22
2;IPFV;PST;SG;V	14.29 (7)	8.43 (451)	42.86	11.97
2;PFV;PST;SG;V	47.62 (21)	27.94 (451)	52.38	37.03
1;FUT;SG;V	64.58 (48)	41.91 (451)	87.50	64.75
1;PFV;PST;SG;V	19.63 (163)	9.98 (451)	33.74	17.74
2;PL;PRS;SBJV;V	25.00 (4)	0.89 (449)	50.00	2.45
1;IPFV;PST;SG;V	68.77 (301)	56.54 (451)	89.70	84.26
1;PL;PRS;V	68.10 (116)	45.01 (451)	81.90	59.87
1;FUT;PL;V	58.62 (29)	48.56 (451)	86.21	82.93
3;PRS;SG;V	53.90 (410)	50.00 (450)	68.54	62
NFIN;V	57.08 (424)	54.77 (451)	91.98	88.03
3;IMP;PL;POS;V	42.71 (192)	24.72 (449)	59.38	39.42
3;PL;PRS;SBJV;V	42.71 (192)	24.72 (449)	59.38	39.42
1;PRS;SBJV;SG;V	47.24 (290)	35.86 (449)	57.59	44.54
1;IPFV;PL;PST;V	30.77 (13)	27.05 (451)	100.00	89.58
3;FUT;SBJV;SG;V	65.71 (140)	53.88 (451)	91.43	86.25
3;COND;SG;V	60.61 (198)	46.12 (451)	79.29	67.85
1;FUT;SBJV;SG;V	65.71 (140)	53.88 (451)	91.43	86.25
3;FUT;SG;V	79.05 (148)	57.87 (451)	95.27	89.58
1;PL;PRS;SBJV;V	47.06 (34)	26.73 (449)	58.82	39.64
1;PRS;SG;V	40.93 (237)	31.99 (447)	51.48	41.39
2;IPFV;PL;PST;V	0.00 (2)	1.55 (451)	50.00	2.22
3;PRS;SBJV;SG;V	47.24 (290)	35.86 (449)	57.59	44.54
1;COND;PL;V	87.50 (8)	47.89 (451)	100.00	91.13
1;PFV;PL;PST;V	52.17 (46)	20.84 (451)	67.39	28.82

Table 115: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Portuguese–Spanish language pair (the grey numbers correspond to the dictionary sizes).

	Spanish–Catalan			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	49.40 (8291)	29.83 (18442)	76.82	51.19
N;SG	60.16 (1639)	59.42 (1666)	90.24	89.5
N;PL	59.15 (1388)	56.61 (1542)	91.71	91.18
ADJ;FEM;SG	30.55 (383)	30.23 (387)	77.55	77.78
ADJ;MASC;SG	68.41 (383)	67.61 (389)	95.56	95.63
ADJ;FEM;PL	72.10 (362)	71.31 (366)	94.20	94.26
ADJ;MASC;PL	69.81 (371)	67.70 (387)	96.23	96.38
1;FUT;PL;V	38.46 (39)	45.80 (369)	64.10	90.79
2;PFV;PST;SG;V	0.00 (2)	0.00 (369)	0.00	0
2;IMP;PL;POS;V	2.70 (37)	0.54 (369)	5.41	2.44
2;PRS;SG;V	33.57 (143)	22.22 (369)	39.86	27.64
2;PST;SBJV;SG;V	66.67 (3)	0.81 (369)	66.67	1.36
3;PFV;PL;PST;V	52.87 (244)	48.51 (369)	85.25	89.7
2;PFV;PL;PST;V	-	0.00 (369)	-	0
1;PL;PRS;SBJV;V	28.36 (67)	15.72 (369)	53.73	23.85
2;COND;PL;V	0.00 (3)	6.78 (369)	0.00	14.36
3;IMP;POS;SG;V	20.70 (256)	18.16 (369)	35.94	28.18
1;PRS;SG;V	29.25 (212)	22.34 (367)	41.04	32.43
1;PL;PRS;V	31.58 (133)	12.74 (369)	43.61	17.89
3;PL;PRS;V	45.62 (320)	42.82 (369)	74.69	68.83
3;IPFV;PST;SG;V	54.98 (291)	49.32 (369)	87.97	85.91
1;IPFV;PST;SG;V	54.98 (291)	49.32 (369)	87.97	85.91
3;PL;PRS;SBJV;V	21.18 (203)	15.99 (369)	36.45	31.71
3;PRS;SG;V	52.30 (348)	51.22 (369)	67.24	63.41
2;IPFV;PST;SG;V	0.00 (7)	3.25 (369)	0.00	4.88
3;FUT;SG;V	60.43 (187)	50.95 (369)	85.56	93.77
3;COND;PL;V	53.79 (132)	49.59 (369)	73.48	90.51
3;COND;SG;V	50.75 (201)	38.21 (369)	68.66	62.06
2;PL;PST;SBJV;V	-	0.00 (369)	-	3.25
2;FUT;PL;V	0.00 (6)	3.52 (369)	0.00	4.88
3;PST;SBJV;SG;V	42.77 (166)	29.54 (369)	57.23	46.34
1;PL;PST;SBJV;V	33.33 (3)	0.81 (369)	33.33	4.34
3;FUT;PL;V	45.32 (139)	44.72 (369)	70.50	84.28
3;IMP;PL;POS;V	21.18 (203)	15.99 (369)	36.45	31.71
2;COND;SG;V	0.00 (3)	1.90 (369)	0.00	2.71
1;PRS;SBJV;SG;V	20.70 (256)	18.16 (369)	35.94	28.18
1;PFV;PL;PST;V	50.00 (6)	10.57 (369)	66.67	15.18
2;IPFV;PL;PST;V	0.00 (2)	0.54 (369)	0.00	0.81
1;IMP;PL;POS;V	28.36 (67)	15.72 (369)	53.73	23.85
2;PL;PRS;SBJV;V	25.00 (16)	4.34 (369)	56.25	10.57
2;PL;PRS;V	10.00 (20)	2.17 (369)	20.00	5.96
1;PFV;PST;SG;V	0.00 (71)	1.36 (369)	2.82	1.63
1;FUT;SG;V	35.00 (40)	43.36 (369)	45.00	65.58
1;COND;PL;V	42.86 (7)	39.57 (369)	57.14	86.99
3;IPFV;PL;PST;V	55.69 (255)	49.86 (369)	95.29	96.48
1;IPFV;PL;PST;V	25.00 (4)	17.62 (369)	75.00	65.85
3;PRS;SBJV;SG;V	20.70 (256)	18.16 (369)	35.94	28.18
3;PL;PST;SBJV;V	64.71 (119)	39.30 (369)	90.76	86.18
1;PST;SBJV;SG;V	42.77 (166)	29.54 (369)	57.23	46.34
2;FUT;SG;V	25.00 (12)	15.45 (369)	33.33	27.1
1;COND;SG;V	50.75 (201)	38.21 (369)	68.66	62.06
3;PFV;PST;SG;V	37.76 (294)	34.15 (369)	56.12	51.22
2;IMP;POS;SG;V	52.17 (345)	50.68 (369)	66.96	62.6
2;PRS;SBJV;SG;V	19.77 (86)	8.67 (369)	20.93	11.92
NFIN;V	54.19 (358)	53.12 (369)	91.90	88.35

Table 116: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Spanish–Catalan language pair (the grey numbers correspond to the dictionary sizes).

		Spanish–French		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	45.46 (11457)	24.17 (25775)	74.10	44.19
N;PL	58.96 (1886)	55.13 (2162)	94.06	92.6
N;SG	57.71 (2301)	56.68 (2352)	89.57	89.33
3;PRS;SBJV;SG;V	20.16 (382)	15.98 (513)	36.39	29.04
2;IMP;PL;POS;V	2.27 (44)	0.97 (513)	6.82	4.09
2;PRS;SBJV;SG;V	26.92 (182)	16.18 (513)	45.05	25.34
1;FUT;PL;V	28.30 (53)	25.93 (513)	50.94	61.79
1;PFV;PST;SG;V	0.91 (110)	1.56 (513)	0.91	1.95
2;IPFV;PL;PST;V	0.00 (1)	0.39 (513)	100.00	1.75
1;PFV;PL;PST;V	18.33 (60)	12.67 (513)	43.33	25.54
1;PL;PRS;SBJV;V	14.71 (68)	7.21 (513)	32.35	22.22
2;IPFV;PST;SG;V	20.00 (15)	4.87 (513)	26.67	9.16
3;PL;PRS;SBJV;V	32.99 (291)	19.88 (513)	56.01	38.79
2;PL;PRS;SBJV;V	0.00 (12)	1.17 (513)	0.00	2.34
3;PRS;SG;V	39.67 (484)	37.62 (513)	58.68	54.19
3;PFV;PST;SG;V	30.46 (417)	25.93 (513)	47.48	39.38
2;PL;PST;SBJV;V	-	0.00 (513)	-	2.14
2;PL;PRS;V	0.00 (27)	4.48 (513)	3.70	8.38
2;PFV;PL;PST;V	-	0.97 (513)	-	1.56
2;COND;SG;V	11.11 (9)	1.95 (513)	22.22	5.07
2;COND;PL;V	-	6.04 (513)	-	23.2
3;PST;SBJV;SG;V	5.84 (154)	11.31 (513)	14.29	28.07
1;PRS;SBJV;SG;V	20.16 (382)	15.98 (513)	36.39	29.04
2;FUT;PL;V	20.00 (5)	5.46 (513)	20.00	11.7
1;PRS;SG;V	20.00 (360)	16.44 (511)	34.72	27.4
1;IPFV;PL;PST;V	0.00 (15)	0.58 (513)	0.00	2.92
2;IMP;POS;SG;V	39.50 (476)	36.84 (513)	58.61	53.22
3;COND;SG;V	19.28 (249)	15.40 (513)	36.14	39.57
2;FUT;SG;V	0.00 (24)	0.00 (513)	0.00	1.17
3;FUT;SG;V	41.80 (244)	30.02 (513)	67.62	62.57
1;IPFV;PST;SG;V	53.38 (266)	43.47 (513)	85.71	79.53
3;FUT;PL;V	49.11 (169)	35.67 (513)	81.07	85.96
2;PFV;PST;SG;V	0.00 (49)	0.00 (513)	0.00	0.39
3;IPFV;PST;SG;V	52.20 (387)	43.47 (513)	85.79	79.53
2;PST;SBJV;SG;V	0.00 (3)	0.00 (513)	0.00	3.7
3;PL;PRS;V	46.87 (431)	40.74 (513)	82.60	73.1
1;COND;SG;V	21.03 (195)	15.40 (513)	40.00	39.57
1;PL;PRS;V	24.55 (167)	14.04 (513)	42.51	28.27
1;PL;PST;SBJV;V	0.00 (1)	0.00 (513)	0.00	0
3;COND;PL;V	18.34 (169)	15.79 (513)	40.83	42.3
3;PFV;PL;PST;V	40.11 (354)	35.48 (513)	84.18	86.55
1;IMP;PL;POS;V	12.20 (82)	7.21 (513)	35.37	22.22
NFIN;V	52.00 (475)	48.73 (513)	93.05	88.69
1;PST;SBJV;SG;V	6.52 (92)	11.31 (513)	10.87	28.07
2;PRS;SG;V	27.78 (198)	17.93 (513)	45.45	31.38
1;COND;PL;V	12.50 (8)	2.53 (513)	12.50	9.75
3;PL;PST;SBJV;V	0.00 (86)	0.00 (513)	0.00	0.19
3;IPFV;PL;PST;V	54.05 (333)	45.42 (513)	92.49	95.32
1;FUT;SG;V	47.22 (72)	28.65 (513)	79.17	64.52
ADJ;FEM;PL	67.98 (506)	67.32 (511)	97.43	96.87
ADJ;MASC;PL	68.35 (515)	66.29 (537)	96.31	95.9
ADJ;FEM;SG	62.38 (529)	62.03 (532)	94.52	94.55
ADJ;MASC;SG	64.97 (531)	63.96 (541)	93.60	93.35

Table 117: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Spanish–French language pair (the grey numbers correspond to the dictionary sizes).

	Spanish–Italian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	46.62 (10709)	27.08 (23528)	76.19	50.67
N;SG	58.65 (2319)	57.51 (2365)	92.19	91.67
N;PL	49.42 (1805)	45.93 (2103)	85.82	83.59
ADJ;MASC;SG	67.44 (476)	67.22 (482)	93.28	93.78
ADJ;FEM;PL	69.21 (445)	68.82 (449)	95.51	95.32
ADJ;MASC;PL	66.38 (461)	65.83 (477)	95.66	95.81
ADJ;FEM;SG	70.00 (470)	70.00 (470)	95.32	95.32
2;IMP;PL;POS;V	1.59 (63)	1.06 (470)	12.7	5.32
1;PST;SBJV;SG;V	56.67 (90)	37.86 (457)	78.89	68.71
1;FUT;PL;V	28.57 (49)	20.57 (457)	57.14	60.83
2;PFV;PST;SG;V	0.00 (19)	0.88 (457)	0	1.31
NFIN;V	56.46 (441)	54.24 (472)	96.15	93.43
3;PRS;SBJV;SG;V	16.05 (324)	13.54 (458)	23.15	19.43
1;PL;PRS;SBJV;V	30.00 (80)	22.10 (457)	80	65.21
2;FUT;SG;V	16.13 (31)	6.56 (457)	22.58	20.57
3;PFV;PST;SG;V	44.41 (367)	39.96 (458)	73.57	67.9
2;PL;PST;SBJV;V	0.00 (1)	0.22 (457)	0	0.88
3;IPFV;PST;SG;V	54.90 (337)	48.25 (458)	90.5	85.37
2;IPFV;PL;PST;V	0.00 (1)	0.66 (457)	0	2.19
1;FUT;SG;V	26.87 (67)	20.57 (457)	59.7	49.45
3;COND;PL;V	3.39 (118)	3.06 (457)	7.63	8.32
1;IPFV;PL;PST;V	33.33 (15)	27.35 (457)	93.33	93.22
3;PL;PRS;V	48.91 (368)	43.98 (457)	78.53	70.24
3;PST;SBJV;SG;V	50.28 (177)	37.77 (458)	75.14	68.78
2;FUT;PL;V	16.67 (6)	4.16 (457)	16.67	14.22
1;COND;SG;V	3.18 (157)	4.16 (457)	8.28	10.94
2;PL;PRS;V	11.11 (27)	1.09 (457)	14.81	3.28
2;PST;SBJV;SG;V	0.00 (4)	3.28 (457)	0	5.69
1;COND;PL;V	33.33 (12)	21.44 (457)	75	70.24
3;PFV;PL;PST;V	56.87 (313)	50.77 (457)	94.25	95.84
1;PRS;SBJV;SG;V	16.05 (324)	13.57 (457)	23.15	19.47
3;IMP;PL;POS;V	11.89 (244)	10.28 (457)	22.13	19.04
2;PRS;SG;V	12.75 (204)	7.22 (457)	23.04	12.25
2;PRS;SBJV;SG;V	13.33 (180)	8.53 (457)	29.44	18.16
3;IMP;POS;SG;V	16.05 (324)	13.57 (457)	23.15	19.47
1;IMP;PL;POS;V	29.63 (81)	21.44 (471)	79.01	65.61
2;COND;PL;V	0.00 (1)	1.53 (457)	0	5.47
2;IMP;POS;SG;V	46.94 (409)	42.46 (471)	69.44	62.63
2;COND;SG;V	0.00 (8)	0.00 (457)	0	1.53
2;PL;PRS;SBJV;V	0.00 (13)	0.22 (457)	0	0.22
2;IPFV;PST;SG;V	0.00 (16)	1.09 (457)	0	1.09
3;COND;SG;V	3.74 (187)	4.15 (458)	7.49	10.92
3;IPFV;PL;PST;V	55.26 (304)	49.02 (457)	95.07	96.06
2;PFV;PL;PST;V	0.00 (2)	1.75 (457)	0	2.84
3;PL;PRS;SBJV;V	11.89 (244)	10.28 (457)	22.13	19.04
1;PL;PRS;V	32.28 (158)	26.26 (457)	72.78	64.33
3;FUT;PL;V	44.14 (145)	33.26 (457)	86.9	89.93
3;FUT;SG;V	45.29 (223)	37.12 (458)	87.44	81.88
3;PRS;SG;V	46.89 (418)	44.32 (458)	70.57	65.28
1;PFV;PST;SG;V	0.00 (112)	2.19 (457)	2.68	3.5
1;PL;PST;SBJV;V	0.00 (2)	5.03 (457)	50	10.28
1;IPFV;PST;SG;V	62.76 (145)	48.36 (457)	91.72	85.34
1;PFV;PL;PST;V	29.17 (48)	23.63 (457)	66.67	55.58
1;PRS;SG;V	28.52 (291)	21.66 (457)	45.02	31.73
3;PL;PST;SBJV;V	50.42 (119)	42.01 (457)	86.55	90.15

Table 118: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Spanish–Italian language pair (the grey numbers correspond to the dictionary sizes).

	Spanish–Portuguese			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	57.30 (9732)	35.37 (23197)	81.49	55.12
N;SG	63.46 (2066)	62.00 (2113)	90.42	90.01
N;PL	62.35 (1692)	59.51 (1904)	92.20	92.49
ADJ;FEM;PL	73.58 (439)	72.75 (444)	99.09	99.1
ADJ;MASC;PL	72.10 (448)	70.66 (467)	97.54	97.86
ADJ;FEM;SG	72.59 (456)	72.11 (459)	96.71	96.08
ADJ;MASC;SG	72.55 (459)	71.28 (470)	96.08	95.11
1;PL;PRS;SBJV;V	20.75 (53)	22.58 (465)	35.85	38.71
3;PFV;PST;SG;V	59.18 (365)	50.97 (465)	81.37	73.12
3;PRS;SBJV;SG;V	41.61 (310)	34.91 (464)	52.26	43.97
3;FUT;PL;V	49.12 (114)	45.38 (465)	64.04	86.67
2;PL;PRS;V	6.67 (15)	0.22 (465)	6.67	0.22
3;COND;PL;V	59.70 (134)	45.38 (465)	79.85	81.94
1;IPFV;PL;PST;V	50.00 (8)	27.31 (465)	75.00	85.81
2;FUT;PL;SBJV;V	-	0.22 (465)	-	0.86
2;IMP;PL;POS;V	0.00 (36)	2.80 (465)	2.78	3.87
2;PRS;SBJV;SG;V	33.33 (123)	28.23 (464)	43.90	35.56
1;COND;SG;V	48.15 (216)	31.18 (465)	62.96	44.95
3;IMP;PL;POS;V	39.47 (228)	29.53 (464)	56.58	45.69
3;IMP;POS;SG;V	41.61 (310)	34.91 (464)	52.26	43.97
3;IPFV;PST;SG;V	59.71 (340)	52.04 (465)	83.82	83.23
2;PRS;SG;V	37.79 (172)	36.21 (464)	45.35	43.97
2;IPFV;PST;SG;V	22.22 (9)	14.19 (465)	44.44	19.78
1;COND;PL;V	54.55 (11)	46.88 (465)	63.64	83.44
1;FUT;PL;SBJV;V	-	5.59 (465)	-	11.18
3;FUT;PL;SBJV;V	28.57 (7)	7.74 (465)	28.57	13.33
2;FUT;PL;V	0.00 (2)	0.00 (465)	0.00	0
3;FUT;SBJV;SG;V	13.95 (43)	17.42 (465)	20.93	22.8
NFIN;V	58.89 (433)	56.56 (465)	91.69	86.67
2;IPFV;PL;PST;V	-	0.22 (465)	-	0.43
2;PFV;PL;PST;V	-	0.86 (465)	-	1.51
2;FUT;SG;V	37.50 (16)	19.57 (465)	37.50	35.27
3;COND;SG;V	48.15 (216)	31.18 (465)	62.96	44.95
2;IMP;POS;SG;V	52.87 (418)	48.49 (464)	69.86	62.28
3;PFV;PL;PST;V	62.18 (312)	53.12 (465)	93.27	90.75
1;PFV;PL;PST;V	55.56 (81)	39.57 (465)	66.67	53.98
3;PL;PRS;V	58.78 (376)	50.43 (464)	81.65	73.71
1;PL;PRS;V	59.48 (153)	39.35 (465)	69.28	54.84
1;FUT;SG;V	47.62 (63)	46.67 (465)	57.14	77.85
3;PL;PRS;SBJV;V	39.47 (228)	29.53 (464)	56.58	45.69
3;PRS;SG;V	53.43 (423)	49.57 (464)	70.21	63.36
2;FUT;SBJV;SG;V	50.00 (4)	26.67 (465)	75.00	33.98
1;FUT;SBJV;SG;V	13.95 (43)	17.42 (465)	20.93	22.8
2;PFV;PST;SG;V	30.00 (30)	28.82 (465)	36.67	36.99
2;COND;SG;V	0.00 (4)	16.56 (465)	25.00	29.25
1;PRS;SBJV;SG;V	41.61 (310)	34.91 (464)	52.26	43.97
2;PL;PRS;SBJV;V	0.00 (3)	0.86 (465)	0.00	0.86
3;FUT;SG;V	59.69 (191)	54.19 (465)	81.15	90.75
1;IMP;PL;POS;V	20.75 (53)	22.58 (465)	35.85	38.71
1;IPFV;PST;SG;V	59.71 (340)	52.04 (465)	83.82	83.23
1;PRS;SG;V	41.20 (284)	37.37 (463)	52.11	48.6
2;COND;PL;V	-	0.00 (465)	-	0
1;PFV;PST;SG;V	32.87 (143)	14.84 (465)	51.75	23.01
3;IPFV;PL;PST;V	60.26 (307)	53.33 (465)	93.16	97.42
1;FUT;PL;V	42.11 (38)	45.59 (465)	52.63	83.01

Table 119: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Spanish–Portuguese language pair (the grey numbers correspond to the dictionary sizes).

	Russian–Czech			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	33.09 (5708)	27.16 (7538)	77.33	73.08
INS;N;PL	27.08 (373)	22.16 (537)	80.7	80.26
DAT;N;SG	21.23 (457)	17.69 (554)	51.42	44.58
ESS;N;PL	40.79 (304)	28.12 (537)	88.16	86.59
ACC;N;SG	34.90 (533)	33.03 (557)	70.17	67.32
N;NOM;PL	34.56 (489)	32.02 (531)	75.87	72.5
DAT;N;PL	43.49 (269)	30.73 (537)	90.33	89.57
ACC;N;PL	28.78 (271)	26.16 (302)	73.8	69.54
GEN;N;SG	33.46 (535)	32.19 (556)	71.4	68.88
INS;N;SG	34.84 (488)	30.70 (557)	80.74	78.46
ESS;N;SG	24.89 (466)	21.01 (557)	55.36	47.94
GEN;N;PL	34.08 (449)	29.00 (538)	74.61	69.33
N;NOM;SG	35.12 (541)	34.12 (551)	72.83	69.87
ACC;ADJ;INAN;MASC;SG	45.54 (101)	43.81 (105)	97.03	97.14
ADJ;GEN;PL	42.11 (95)	37.50 (112)	98.95	99.11
ACC;ADJ;NEUT;SG	25.00 (100)	23.21 (112)	82	78.57
ADJ;FEM;NOM;SG	46.32 (95)	41.90 (105)	96.84	97.14
ADJ;DAT;FEM;SG	33.33 (105)	31.25 (112)	72.38	66.96
ADJ;NEUT;NOM;SG	26.60 (94)	24.76 (105)	82.98	79.05
ADJ;MASC;NOM;SG	45.54 (101)	43.81 (105)	97.03	97.14
ADJ;DAT;PL	47.37 (95)	41.96 (112)	98.95	99.11
ADJ;INS;PL	48.78 (82)	40.18 (112)	100	100
ADJ;ESS;PL	42.11 (95)	37.50 (112)	98.95	99.11
ACC;ADJ;FEM;SG	42.86 (98)	37.50 (112)	98.98	97.32
ADJ;GEN;MASC;SG	42.16 (102)	38.39 (112)	100	100
ADJ;GEN;NEUT;SG	42.16 (102)	38.39 (112)	100	100
ADJ;ESS;NEUT;SG	53.49 (86)	45.54 (112)	97.67	96.43
ADJ;INS;MASC;SG	47.37 (95)	41.96 (112)	98.95	99.11
ADJ;DAT;MASC;SG	52.17 (69)	42.86 (112)	100	100
ADJ;ESS;MASC;SG	53.57 (84)	45.54 (112)	98.81	96.43
ACC;ADJ;MASC;SG	42.16 (102)	38.39 (112)	100	100
ADJ;ESS;FEM;SG	33.33 (105)	31.25 (112)	72.38	66.96
ADJ;DAT;NEUT;SG	52.17 (69)	42.86 (112)	100	100
ADJ;FEM;GEN;SG	33.33 (105)	31.25 (112)	72.38	66.96
3;MASC;PL;PST;V	32.39 (71)	25.26 (95)	92.96	87.37
2;PL;PRS;V	26.67 (15)	11.86 (59)	100	84.75
1;PL;PRS;V	26.67 (15)	11.86 (59)	86.67	55.93
3;FEM;PST;SG;V	30.43 (69)	25.26 (95)	94.2	84.21
2;IMP;SG;V	6.25 (16)	3.19 (94)	37.5	17.02
3;FEM;PL;PST;V	30.77 (65)	25.26 (95)	89.23	87.37
3;NEUT;PST;SG;V	28.89 (45)	18.95 (95)	80	74.74
2;PRS;SG;V	28.57 (7)	15.25 (59)	71.43	59.32
2;IMP;PL;V	17.65 (17)	9.57 (94)	52.94	55.32
1;PRS;SG;V	28.57 (21)	13.56 (59)	71.43	38.98
3;PL;PRS;V	20.93 (43)	15.25 (59)	72.09	62.71
NFIN;V	28.21 (117)	27.20 (125)	100	97.6
3;MASC;PST;SG;V	25.30 (83)	22.58 (93)	89.16	83.87
3;PRS;SG;V	20.37 (54)	18.64 (59)	77.78	69.49
2;FUT;PL;V	0.00 (4)	2.70 (37)	50	54.05
2;FUT;SG;V	0.00 (1)	10.81 (37)	100	45.95
1;FUT;PL;V	0.00 (5)	2.70 (37)	80	21.62
1;FUT;SG;V	14.29 (7)	2.70 (37)	28.57	13.51
3;FUT;SG;V	14.29 (28)	13.51 (37)	46.43	43.24
3;FUT;PL;V	4.55 (22)	2.70 (37)	40.91	35.14
ACC;INAN;N;SG	0.00 (1)	50.00 (2)	0	50
ACC;INAN;N;PL	0.00 (1)	50.00 (2)	100	100
ADJ;INS;NEUT;SG	22.22 (9)	16.67 (12)	100	100
ADJ;FEM;INS;SG	36.36 (11)	33.33 (12)	100	100
ACC;ADJ;PL	27.27 (11)	25.00 (12)	100	100
ADJ;NOM;PL	20.00 (10)	16.67 (12)	90	83.33
2;FEM;PL;PST;V	0.00 (1)	0.00 (1)	0	0
2;MASC;PL;PST;V	0.00 (1)	0.00 (1)	0	0

Table 120: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Russian–Czech language pair (the grey numbers correspond to the dictionary sizes).

	Russian–Polish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	39.80 (9183)	34.78 (11697)	80.81	77.71
DAT;N;SG	26.34 (653)	22.92 (999)	56.66	53.65
INS;N;SG	39.14 (879)	35.40 (1000)	83.05	80.1
ACC;N;SG	38.30 (953)	36.30 (1000)	73.45	71.2
GEN;N;SG	40.83 (960)	39.30 (1000)	80.10	77.4
ESS;N;SG	31.46 (782)	27.56 (998)	62.28	56.01
N;NOM;SG	36.78 (976)	35.95 (993)	72.13	69.89
INS;N;PL	45.58 (634)	36.34 (930)	98.58	98.82
GEN;N;PL	40.37 (805)	36.10 (928)	76.27	70.8
DAT;N;PL	36.03 (358)	28.17 (930)	73.46	75.7
ESS;N;PL	46.40 (541)	35.70 (930)	89.65	87.53
ACC;N;PL	36.79 (579)	34.28 (633)	78.58	74.41
N;NOM;PL	39.86 (863)	37.70 (923)	82.50	79.63
ACC;ADJ;INAN;MASC;SG	48.63 (183)	47.89 (190)	93.44	93.68
ADJ;GEN;PL	50.00 (180)	47.89 (190)	98.33	98.42
ADJ;DAT;PL	46.67 (180)	45.26 (190)	94.44	94.74
ADJ;FEM;GEN;SG	46.11 (180)	44.74 (190)	93.33	93.16
ADJ;ESS;NEUT;SG	40.72 (167)	36.84 (190)	82.63	81.58
ACC;ADJ;NEUT;SG	39.11 (179)	37.89 (190)	81.56	80.53
ADJ;DAT;MASC;SG	51.33 (113)	45.79 (190)	95.58	98.95
ADJ;INS;NEUT;SG	46.67 (180)	45.26 (190)	94.44	94.74
ACC;ADJ;MASC;SG	44.57 (184)	43.68 (190)	96.20	96.32
ADJ;GEN;MASC;SG	44.57 (184)	43.68 (190)	96.20	96.32
ADJ;GEN;NEUT;SG	44.57 (184)	43.68 (190)	96.20	96.32
ADJ;ESS;FEM;SG	46.11 (180)	44.74 (190)	93.33	93.16
ADJ;NEUT;NOM;SG	39.11 (179)	37.89 (190)	81.56	80.53
ADJ;INS;MASC;SG	46.67 (180)	45.26 (190)	94.44	94.74
ADJ;FEM;NOM;SG	45.36 (183)	44.21 (190)	96.17	96.32
ADJ;MASC;NOM;SG	48.63 (183)	47.89 (190)	93.44	93.68
ADJ;DAT;FEM;SG	46.11 (180)	44.74 (190)	93.33	93.16
ADJ;ESS;PL	50.00 (180)	47.89 (190)	98.33	98.42
ACC;ADJ;FEM;SG	45.56 (169)	41.58 (190)	99.41	98.95
ADJ;FEM;INS;SG	46.89 (177)	44.74 (190)	92.66	93.16
ADJ;INS;PL	49.39 (164)	45.26 (190)	100.00	100
ADJ;ESS;MASC;SG	40.72 (167)	36.84 (190)	82.63	81.58
ADJ;DAT;NEUT;SG	51.33 (113)	45.79 (190)	95.58	98.95
ADJ;NOM;PL	47.28 (184)	46.32 (190)	91.30	91.05
ACC;ADJ;PL	49.18 (183)	47.89 (190)	96.72	98.42
NFIN;V	40.00 (30)	36.36 (33)	96.67	96.97
2;MASC;PL;PST;V	-	21.21 (33)	-	84.85
3;MASC;PST;SG;V	38.10 (21)	27.27 (33)	90.48	90.91
2;PRS;SG;V	25.00 (4)	8.00 (25)	75.00	20
2;IMP;SG;V	0.00 (10)	3.03 (33)	50.00	21.21
1;FEM;PST;SG;V	20.00 (5)	30.30 (33)	100.00	87.88
3;MASC;PL;PST;V	30.00 (20)	21.21 (33)	80.00	84.85
2;PL;PRS;V	0.00 (1)	0.00 (25)	0.00	0
2;MASC;PST;SG;V	25.00 (4)	27.27 (33)	75.00	90.91
1;PL;PRS;V	22.22 (9)	12.00 (25)	88.89	32
3;NEUT;PST;SG;V	38.46 (13)	24.24 (33)	84.62	84.85
3;FEM;PST;SG;V	42.86 (21)	30.30 (33)	90.48	87.88
2;IMP;PL;V	0.00 (4)	0.00 (33)	25.00	12.12
3;PL;PRS;V	33.33 (18)	24.00 (25)	72.22	72
2;FEM;PST;SG;V	-	30.30 (33)	-	87.88
1;FEM;PL;PST;V	-	21.21 (33)	-	84.85
2;FEM;PL;PST;V	-	21.21 (33)	-	84.85
1;MASC;PST;SG;V	28.57 (14)	27.27 (33)	85.71	90.91
3;PRS;SG;V	20.83 (24)	20.00 (25)	70.83	64
1;MASC;PL;PST;V	20.00 (5)	21.21 (33)	100.00	84.85
3;FEM;PL;PST;V	33.33 (18)	21.21 (33)	83.33	84.85
1;PRS;SG;V	44.44 (9)	16.00 (25)	66.67	24
1;FUT;SG;V	0.00 (2)	0.00 (8)	0.00	0
3;FUT;SG;V	0.00 (7)	0.00 (8)	57.14	50
2;FUT;SG;V	-	12.50 (8)	-	50
3;FUT;PL;V	0.00 (6)	0.00 (8)	33.33	37.5
1;FUT;PL;V	-	0.00 (8)	-	25
2;FUT;PL;V	0.00 (2)	0.00 (8)	0.00	0

Table 121: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Russian–Polish language pair (the grey numbers correspond to the dictionary sizes).

	Russian–Slovak			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	25.65 (1610)	20.93 (2150)	79.25	76.05
ACC;N;PL	16.48 (91)	13.76 (109)	75.82	66.06
ESS;N;PL	40.74 (81)	23.28 (189)	97.53	92.06
INS;N;SG	25.49 (153)	20.21 (193)	85.62	83.42
INS;N;PL	33.33 (105)	23.81 (189)	99.05	98.94
N;NOM;SG	26.34 (186)	25.79 (190)	74.73	73.16
GEN;N;PL	22.82 (149)	17.99 (189)	68.46	60.85
ACC;N;SG	22.03 (177)	20.21 (193)	75.14	73.58
ESS;N;SG	22.63 (137)	17.10 (193)	62.77	51.3
GEN;N;SG	23.73 (177)	21.24 (193)	71.19	67.88
DAT;N;SG	21.97 (132)	17.10 (193)	65.15	57.51
DAT;N;PL	28.42 (95)	18.09 (188)	72.63	72.87
N;NOM;PL	23.17 (164)	21.51 (186)	78.05	73.12
3;MASC;PST;SG;V	-	0.00 (2)	-	0
2;IMP;PL;V	-	0.00 (2)	-	0
2;PRS;SG;V	-	0.00 (2)	-	50
1;PL;PRS;V	-	50.00 (2)	-	100
3;FEM;PST;SG;V	-	0.00 (2)	-	0
2;IMP;SG;V	-	0.00 (2)	-	0
NFIN;V	25.00 (40)	18.75 (48)	100.00	100
1;PRS;SG;V	0.00 (1)	0.00 (2)	100.00	50
3;PL;PRS;V	0.00 (2)	0.00 (2)	50.00	50
2;PL;PRS;V	-	0.00 (2)	-	50
3;NEUT;PST;SG;V	-	0.00 (2)	-	0
3;FEM;PL;PST;V	-	0.00 (2)	-	0
3;PRS;SG;V	0.00 (2)	0.00 (2)	50.00	50
3;MASC;PL;PST;V	-	0.00 (2)	-	0
ADJ;FEM;GEN;SG	26.09 (23)	25.00 (24)	95.65	95.83
ADJ;ESS;NEUT;SG	33.33 (21)	37.50 (24)	80.95	83.33
ADJ;DAT;FEM;SG	26.09 (23)	25.00 (24)	95.65	95.83
ADJ;GEN;PL	25.00 (24)	25.00 (24)	95.83	95.83
ADJ;NOM;PL	21.74 (23)	25.00 (24)	73.91	75
ADJ;FEM;NOM;SG	30.43 (23)	33.33 (24)	100.00	100
ACC;ADJ;PL	26.09 (23)	25.00 (24)	95.65	95.83
ADJ;NEUT;NOM;SG	21.74 (23)	20.83 (24)	73.91	75
ADJ;INS;NEUT;SG	33.33 (24)	33.33 (24)	100.00	100
ADJ;INS;MASC;SG	33.33 (24)	33.33 (24)	100.00	100
ADJ;FEM;INS;SG	28.57 (21)	25.00 (24)	95.24	95.83
ADJ;ESS;FEM;SG	26.09 (23)	25.00 (24)	95.65	95.83
ACC;ADJ;INAN;MASC;SG	41.67 (24)	41.67 (24)	87.50	87.5
ACC;ADJ;FEM;SG	13.04 (23)	12.50 (24)	95.65	95.83
ADJ;ESS;PL	25.00 (24)	25.00 (24)	95.83	95.83
ADJ;GEN;MASC;SG	37.50 (24)	37.50 (24)	91.67	91.67
ACC;ADJ;MASC;SG	37.50 (24)	37.50 (24)	91.67	91.67
ADJ;GEN;NEUT;SG	37.50 (24)	37.50 (24)	91.67	91.67
ADJ;ESS;MASC;SG	33.33 (21)	37.50 (24)	80.95	83.33
ADJ;DAT;PL	33.33 (24)	33.33 (24)	100.00	100
ADJ;DAT;NEUT;SG	33.33 (21)	20.83 (24)	100.00	100
ACC;ADJ;NEUT;SG	21.74 (23)	20.83 (24)	73.91	75
ADJ;MASC;NOM;SG	41.67 (24)	41.67 (24)	87.50	87.5
ADJ;DAT;MASC;SG	33.33 (21)	20.83 (24)	100.00	100
ADJ;INS;PL	36.36 (22)	41.67 (24)	100.00	100

Table 122: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Russian–Slovak language pair (the grey numbers correspond to the dictionary sizes).

	Russian–Ukrainian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	47.90 (1165)	43.84 (1396)	83.26	82.09
N;NOM;SG	48.63 (146)	48.30 (147)	81.51	81.63
N;NOM;PL	47.48 (139)	47.48 (139)	79.86	79.86
GEN;N;SG	46.90 (145)	46.58 (146)	81.38	80.82
GEN;N;PL	43.51 (131)	41.43 (140)	79.39	77.14
ESS;N;PL	60.24 (83)	48.92 (139)	93.98	94.24
DAT;N;PL	58.57 (70)	47.48 (139)	95.71	94.96
ACC;N;PL	27.12 (59)	26.23 (61)	74.58	73.77
DAT;N;SG	35.20 (125)	29.25 (147)	60.00	50.34
ESS;N;SG	41.41 (128)	36.05 (147)	66.41	60.54
ACC;N;SG	47.92 (144)	46.94 (147)	80.56	80.27
INS;N;SG	52.21 (136)	48.30 (147)	93.38	90.48
INS;N;PL	57.58 (99)	48.20 (139)	100.00	100
ADJ;ESS;PL	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;INAN;MASC;SG	0.00 (3)	0.00 (3)	100.00	100
ADJ;DAT;PL	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;PL	33.33 (3)	33.33 (3)	100.00	100
ADJ;DAT;NEUT;SG	-	0.00 (3)	-	0
ADJ;NOM;PL	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;FEM;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;DAT;MASC;SG	-	0.00 (3)	-	0
ADJ;FEM;INS;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;INS;NEUT;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;GEN;PL	33.33 (3)	33.33 (3)	100.00	100
ADJ;DAT;FEM;SG	-	33.33 (3)	-	100
ADJ;ESS;NEUT;SG	-	33.33 (3)	-	100
ADJ;ESS;FEM;SG	-	33.33 (3)	-	100
ACC;ADJ;INAN;PL	33.33 (3)	33.33 (3)	100.00	100
ADJ;GEN;MASC;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;GEN;NEUT;SG	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;NEUT;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;INS;PL	33.33 (3)	33.33 (3)	100.00	100
ADJ;FEM;NOM;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;ESS;MASC;SG	-	33.33 (3)	-	100
ADJ;MASC;NOM;SG	0.00 (3)	0.00 (3)	100.00	100
ADJ;NEUT;NOM;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;FEM;GEN;SG	33.33 (3)	33.33 (3)	100.00	100
ADJ;INS;MASC;SG	33.33 (3)	33.33 (3)	100.00	100
ACC;ADJ;MASC;SG	33.33 (3)	33.33 (3)	100.00	100
3;PRS;SG;V	66.67 (3)	66.67 (3)	100.00	100
2;IMP;SG;V	66.67 (3)	66.67 (3)	66.67	66.67
3;NEUT;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
2;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100.00	100
3;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
2;PL;PRS;V	50.00 (2)	33.33 (3)	100.00	100
3;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100.00	100
1;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100.00	100
3;PL;PRS;V	66.67 (3)	66.67 (3)	100.00	100
2;IMP;PL;V	0.00 (3)	0.00 (3)	66.67	66.67
2;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
1;PRS;SG;V	33.33 (3)	33.33 (3)	33.33	33.33
1;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
1;PL;PRS;V	33.33 (3)	33.33 (3)	100.00	100
2;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100.00	100
2;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
3;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100.00	100
1;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
2;PRS;SG;V	100.00 (2)	66.67 (3)	100.00	100
NFIN;V	66.67 (3)	66.67 (3)	100.00	100
3;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100.00	100
1;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100.00	100

Table 123: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Russian–Ukrainian language pair (the grey numbers correspond to the dictionary sizes).

Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
		Slovak–Czech		
ALL	58.04 (858)	49.22 (1154)	91.14	89.25
GEN;N;SG	70.67 (75)	69.74 (76)	88.00	86.84
DAT;N;PL	71.43 (42)	55.13 (78)	97.62	94.87
ESS;N;SG	56.60 (53)	46.05 (76)	81.13	69.74
N;NOM;PL	62.69 (67)	56.41 (78)	79.10	75.64
ACC;N;SG	73.61 (72)	69.74 (76)	87.50	86.84
INS;N;SG	64.52 (62)	57.89 (76)	93.55	93.42
N;NOM;SG	69.74 (76)	69.74 (76)	88.16	85.53
ACC;N;PL	66.18 (68)	60.26 (78)	80.88	78.21
INS;N;PL	40.38 (52)	32.05 (78)	84.62	79.49
ESS;N;PL	76.92 (39)	56.41 (78)	100.00	96.15
DAT;N;SG	64.15 (53)	52.63 (76)	81.13	69.74
GEN;N;PL	62.90 (62)	57.14 (77)	85.48	80.52
NFIN;V	22.16 (185)	15.03 (286)	98.92	99.3
ADJ;NEUT;NOM;SG	86.67 (15)	86.67 (15)	93.33	93.33
ADJ;FEM;NOM;SG	93.33 (15)	93.33 (15)	100.00	100
ADJ;ESS;PL	86.67 (15)	86.67 (15)	100.00	100
ACC;ADJ;MASC;SG	73.33 (15)	73.33 (15)	100.00	100
ACC;ADJ;INAN;MASC;SG	86.67 (15)	86.67 (15)	100.00	100
ADJ;FEM;GEN;SG	64.29 (14)	66.67 (15)	92.86	93.33
ADJ;GEN;NEUT;SG	73.33 (15)	73.33 (15)	100.00	100
ADJ;DAT;MASC;SG	90.91 (11)	86.67 (15)	100.00	100
ADJ;DAT;NEUT;SG	90.91 (11)	86.67 (15)	100.00	100
ADJ;MASC;NOM;SG	86.67 (15)	86.67 (15)	100.00	100
ACC;ADJ;FEM;SG	71.43 (14)	73.33 (15)	92.86	93.33
ADJ;GEN;MASC;SG	73.33 (15)	73.33 (15)	100.00	100
ADJ;DAT;PL	84.62 (13)	86.67 (15)	100.00	100
ADJ;INS;PL	84.62 (13)	80.00 (15)	100.00	100
ACC;ADJ;NEUT;SG	86.67 (15)	86.67 (15)	93.33	93.33
ADJ;GEN;PL	86.67 (15)	86.67 (15)	100.00	100
ACC;ADJ;MASC;PL	86.67 (15)	86.67 (15)	100.00	100
ADJ;ESS;MASC;SG	75.00 (12)	73.33 (15)	91.67	93.33
ADJ;ESS;FEM;SG	64.29 (14)	66.67 (15)	92.86	93.33
ADJ;INS;MASC;SG	84.62 (13)	86.67 (15)	100.00	100
ADJ;DAT;FEM;SG	64.29 (14)	66.67 (15)	92.86	93.33
ADJ;ESS;NEUT;SG	75.00 (12)	73.33 (15)	91.67	93.33
ADJ;MASC;NOM;PL	66.67 (6)	46.67 (15)	100.00	80
3;MASC;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
2;IMP;SG;V	100.00 (1)	100.00 (2)	100.00	100
3;PL;PRS;V	100.00 (2)	100.00 (2)	100.00	100
3;NEUT;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
1;PL;PRS;V	100.00 (1)	100.00 (2)	100.00	100
2;PL;PRS;V	0.00 (1)	50.00 (2)	0.00	50
1;IMP;PL;V	-	100.00 (2)	-	100
3;FEM;PL;PST;V	100.00 (1)	50.00 (2)	100.00	100
3;FEM;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
2;IMP;PL;V	-	100.00 (2)	-	100
3;PRS;SG;V	100.00 (2)	100.00 (2)	100.00	100
2;PRS;SG;V	100.00 (1)	50.00 (2)	100.00	50
3;MASC;PL;PST;V	100.00 (1)	50.00 (2)	100.00	100
1;PRS;SG;V	0.00 (1)	50.00 (2)	0.00	50
3;NEUT;PL;PST;V	100.00 (1)	50.00 (2)	100.00	100

Table 124: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Slovak–Czech language pair (the grey numbers correspond to the dictionary sizes).

		Slovak–Polish		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	40.36 (830)	32.72 (1094)	81.45	79.43
ESS;N;SG	36.84 (76)	27.88 (104)	61.84	58.65
GEN;N;PL	43.37 (83)	35.29 (102)	74.70	67.65
N;NOM;SG	37.86 (103)	37.50 (104)	71.84	69.23
INS;N;PL	33.33 (60)	21.57 (102)	98.33	98.04
ACC;N;PL	41.84 (98)	39.22 (102)	78.57	75.49
ACC;N;SG	40.00 (100)	38.46 (104)	71.00	70.19
DAT;N;SG	30.88 (68)	20.19 (104)	63.24	53.85
GEN;N;SG	42.86 (98)	39.42 (104)	79.59	75.96
ESS;N;PL	57.69 (52)	36.27 (102)	98.08	95.1
DAT;N;PL	48.98 (49)	27.45 (102)	85.71	80.39
N;NOM;PL	39.80 (98)	37.25 (102)	79.59	76.47
INS;N;SG	41.77 (79)	32.69 (104)	84.81	87.5
NFIN;V	20.00 (35)	17.39 (46)	97.14	95.65
ADJ;DAT;NEUT;SG	37.50 (8)	50.00 (12)	100.00	100
ADJ;DAT;PL	41.67 (12)	41.67 (12)	100.00	100
ADJ;NOM;PL	63.64 (11)	58.33 (12)	90.91	91.67
ACC;ADJ;MASC;SG	50.00 (12)	58.33 (12)	100.00	100
ADJ;ESS;PL	75.00 (12)	75.00 (12)	100.00	100
ADJ;ESS;NEUT;SG	10.00 (10)	16.67 (12)	80.00	83.33
ADJ;FEM;INS;SG	9.09 (11)	16.67 (12)	90.91	91.67
ACC;ADJ;PL	63.64 (11)	58.33 (12)	90.91	91.67
ADJ;MASC;NOM;SG	58.33 (12)	58.33 (12)	91.67	91.67
ADJ;DAT;MASC;SG	37.50 (8)	50.00 (12)	100.00	100
ACC;ADJ;FEM;SG	36.36 (11)	41.67 (12)	100.00	100
ADJ;FEM;GEN;SG	81.82 (11)	75.00 (12)	100.00	100
ADJ;FEM;NOM;SG	54.55 (11)	50.00 (12)	90.91	91.67
ACC;ADJ;NEUT;SG	63.64 (11)	58.33 (12)	90.91	91.67
ADJ;MASC;NOM;PL	37.50 (8)	25.00 (12)	100.00	91.67
ADJ;ESS;FEM;SG	81.82 (11)	75.00 (12)	100.00	100
ADJ;INS;PL	66.67 (9)	66.67 (12)	100.00	100
ADJ;INS;MASC;SG	41.67 (12)	41.67 (12)	100.00	100
ACC;ADJ;INAN;MASC;SG	58.33 (12)	58.33 (12)	91.67	91.67
ADJ;GEN;NEUT;SG	50.00 (12)	58.33 (12)	100.00	100
ADJ;ESS;MASC;SG	10.00 (10)	16.67 (12)	80.00	83.33
ADJ;DAT;FEM;SG	81.82 (11)	75.00 (12)	100.00	100
ADJ;INS;NEUT;SG	41.67 (12)	41.67 (12)	100.00	100
ADJ;GEN;MASC;SG	50.00 (12)	58.33 (12)	100.00	100
ADJ;GEN;PL	75.00 (12)	75.00 (12)	100.00	100
ADJ;NEUT;NOM;SG	63.64 (11)	58.33 (12)	90.91	91.67
ACC;ADJ;MASC;PL	75.00 (12)	75.00 (12)	100.00	100
3;FEM;PL;PST;V	-	0.00 (1)	-	100
3;PRS;SG;V	-	0.00 (1)	-	100
3;MASC;PST;SG;V	-	0.00 (1)	-	100
2;IMP;SG;V	-	0.00 (1)	-	0
3;MASC;PL;PST;V	-	0.00 (1)	-	100
2;IMP;PL;V	-	0.00 (1)	-	0
2;PL;PRS;V	-	0.00 (1)	-	0
1;IMP;PL;V	-	0.00 (1)	-	0
3;PL;PRS;V	-	0.00 (1)	-	100
2;PRS;SG;V	-	0.00 (1)	-	100
1;PL;PRS;V	-	0.00 (1)	-	0
3;NEUT;PST;SG;V	-	0.00 (1)	-	100
3;FEM;PST;SG;V	-	0.00 (1)	-	100
1;PRS;SG;V	-	0.00 (1)	-	0

Table 125: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Slovak–Polish language pair (the grey numbers correspond to the dictionary sizes).

	Slovak–Russian			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	25.31 (814)	20.00 (1140)	83.54	81.67
GEN;N;SG	26.39 (72)	23.75 (80)	81.94	81.25
ACC;N;SG	26.03 (73)	23.75 (80)	64.38	62.5
N;NOM;SG	25.64 (78)	25.00 (80)	70.51	67.5
DAT;N;SG	26.92 (52)	18.75 (80)	71.15	62.5
ESS;N;SG	24.53 (53)	17.50 (80)	71.70	57.5
GEN;N;PL	23.44 (64)	18.29 (82)	67.19	59.76
DAT;N;PL	33.33 (36)	21.69 (83)	94.44	87.95
INS;N;PL	31.82 (44)	18.07 (83)	100.00	97.59
N;NOM;PL	30.56 (72)	26.51 (83)	80.56	74.7
ESS;N;PL	29.27 (41)	18.07 (83)	90.24	90.36
INS;N;SG	33.33 (57)	25.00 (80)	89.47	91.25
ACC;N;PL	37.21 (43)	29.09 (55)	81.40	76.36
ADJ;DAT;NEUT;SG	18.18 (11)	17.65 (17)	100.00	100
ACC;ADJ;FEM;SG	46.15 (13)	41.18 (17)	100.00	88.24
ADJ;MASC;NOM;SG	41.18 (17)	41.18 (17)	82.35	82.35
ADJ;GEN;PL	41.18 (17)	41.18 (17)	100.00	100
ADJ;ESS;PL	41.18 (17)	41.18 (17)	100.00	100
ADJ;NEUT;NOM;SG	31.25 (16)	35.29 (17)	75.00	76.47
ACC;ADJ;INAN;MASC;SG	41.18 (17)	41.18 (17)	82.35	82.35
ADJ;NOM;PL	31.25 (16)	35.29 (17)	75.00	76.47
ADJ;FEM;GEN;SG	33.33 (15)	35.29 (17)	100.00	100
ADJ;FEM;NOM;SG	31.25 (16)	35.29 (17)	87.50	88.24
ADJ;DAT;FEM;SG	33.33 (15)	35.29 (17)	100.00	100
ADJ;GEN;MASC;SG	43.75 (16)	41.18 (17)	100.00	100
ACC;ADJ;PL	31.25 (16)	35.29 (17)	75.00	76.47
ACC;ADJ;NEUT;SG	31.25 (16)	35.29 (17)	75.00	76.47
ADJ;GEN;NEUT;SG	43.75 (16)	41.18 (17)	100.00	100
ADJ;ESS;NEUT;SG	31.25 (16)	29.41 (17)	75.00	70.59
ADJ;DAT;MASC;SG	18.18 (11)	17.65 (17)	100.00	100
ADJ;INS;PL	35.71 (14)	35.29 (17)	100.00	100
ADJ;ESS;FEM;SG	33.33 (15)	35.29 (17)	100.00	100
ADJ;INS;NEUT;SG	37.50 (16)	35.29 (17)	100.00	100
ADJ;INS;MASC;SG	37.50 (16)	35.29 (17)	100.00	100
ADJ;DAT;PL	37.50 (16)	35.29 (17)	100.00	100
ACC;ADJ;MASC;SG	43.75 (16)	41.18 (17)	100.00	100
ADJ;ESS;MASC;SG	31.25 (16)	29.41 (17)	75.00	70.59
ADJ;FEM;INS;SG	0.00 (12)	0.00 (17)	75.00	76.47
NFIN;V	3.82 (131)	2.44 (205)	95.42	95.61
2;PL;PRS;V	100.00 (1)	50.00 (2)	100.00	50
3;FEM;PL;PST;V	0.00 (1)	50.00 (2)	100.00	100
2;PRS;SG;V	0.00 (1)	0.00 (2)	0.00	0
2;IMP;PL;V	-	50.00 (2)	-	100
3;PRS;SG;V	50.00 (2)	50.00 (2)	50.00	50
3;NEUT;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
3;MASC;PL;PST;V	0.00 (1)	50.00 (2)	100.00	100
2;IMP;SG;V	0.00 (1)	0.00 (2)	0.00	0
3;MASC;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
3;FEM;PST;SG;V	100.00 (1)	100.00 (2)	100.00	100
1;PRS;SG;V	100.00 (1)	50.00 (2)	100.00	50
1;PL;PRS;V	100.00 (1)	50.00 (2)	100.00	50
3;PL;PRS;V	50.00 (2)	50.00 (2)	50.00	50

Table 126: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Slovak–Russian language pair (the grey numbers correspond to the dictionary sizes).

		Slovak–Ukrainian		
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	45.45 (330)	38.12 (425)	84.24	82.35
ACC;N;SG	40.91 (44)	39.13 (46)	79.55	76.09
ACC;N;PL	42.86 (42)	39.13 (46)	88.1	86.96
ESS;N;SG	35.29 (34)	26.09 (46)	70.59	56.52
ESS;N;PL	62.50 (24)	39.13 (46)	83.33	89.13
GEN;N;PL	45.95 (37)	39.13 (46)	89.19	80.43
N;NOM;SG	41.30 (46)	41.30 (46)	80.43	80.43
N;NOM;PL	42.86 (42)	39.13 (46)	88.1	86.96
DAT;N;SG	30.30 (33)	23.91 (46)	63.64	54.35
INS;N;PL	38.71 (31)	30.43 (46)	100	100
GEN;N;SG	47.73 (44)	45.65 (46)	88.64	89.13
INS;N;SG	37.14 (35)	30.43 (46)	80	82.61
DAT;N;PL	54.55 (22)	36.96 (46)	86.36	86.96
ADJ;GEN;MASC;SG	100.00 (2)	100.00 (2)	100	100
ADJ;NEUT;NOM;SG	50.00 (2)	50.00 (2)	50	50
ADJ;INS;PL	50.00 (2)	50.00 (2)	100	100
ADJ;ESS;FEM;SG	50.00 (2)	50.00 (2)	100	100
ACC;ADJ;FEM;SG	50.00 (2)	50.00 (2)	100	100
ADJ;ESS;PL	50.00 (2)	50.00 (2)	100	100
ADJ;INS;MASC;SG	100.00 (2)	100.00 (2)	100	100
ADJ;DAT;PL	100.00 (2)	100.00 (2)	100	100
ADJ;NOM;PL	50.00 (2)	50.00 (2)	50	50
ACC;ADJ;MASC;SG	100.00 (2)	100.00 (2)	100	100
ACC;ADJ;NEUT;SG	50.00 (2)	50.00 (2)	50	50
ADJ;FEM;INS;SG	100.00 (2)	100.00 (2)	100	100
ADJ;DAT;FEM;SG	50.00 (2)	50.00 (2)	100	100
ACC;ADJ;INAN;MASC;SG	50.00 (2)	50.00 (2)	100	100
ADJ;FEM;NOM;SG	100.00 (2)	100.00 (2)	100	100
ADJ;ESS;MASC;SG	50.00 (2)	50.00 (2)	50	50
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (2)	0	0
ACC;ADJ;PL	50.00 (2)	50.00 (2)	50	50
ADJ;GEN;PL	50.00 (2)	50.00 (2)	100	100
ADJ;FEM;GEN;SG	50.00 (2)	50.00 (2)	100	100
ADJ;GEN;NEUT;SG	100.00 (2)	100.00 (2)	100	100
ADJ;ESS;NEUT;SG	50.00 (2)	50.00 (2)	50	50
ADJ;MASC;NOM;SG	50.00 (2)	50.00 (2)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (2)	0	0
ADJ;INS;NEUT;SG	100.00 (2)	100.00 (2)	100	100
NFIN;V	33.33 (3)	25.00 (4)	100	100

Table 127: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Slovak–Ukrainian language pair (the grey numbers correspond to the dictionary sizes).

	Ukrainian–Czech			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	44.21 (699)	38.90 (869)	78.68	74.45
N;PL;VOC	48.65 (74)	45.00 (80)	83.78	83.75
ACC;N;PL	52.70 (74)	48.75 (80)	87.84	87.5
INS;N;PL	32.31 (65)	28.75 (80)	81.54	77.5
ACC;N;SG	54.43 (79)	51.22 (82)	77.22	73.17
DAT;N;PL	58.54 (41)	42.50 (80)	95.12	92.5
GEN;N;PL	51.39 (72)	47.50 (80)	79.17	76.25
N;NOM;PL	48.65 (74)	45.00 (80)	83.78	83.75
ESS;N;PL	46.94 (49)	35.00 (80)	87.76	81.25
ESS;N;SG	36.76 (68)	33.33 (81)	72.06	66.67
DAT;N;SG	36.92 (65)	34.15 (82)	63.08	58.54
GEN;N;SG	58.23 (79)	56.10 (82)	84.81	81.71
INS;N;SG	44.00 (75)	41.46 (82)	81.33	79.27
N;NOM;SG	54.32 (81)	52.44 (82)	83.95	79.27
N;SG;VOC	31.43 (35)	28.05 (82)	48.57	47.56
1;IMP;PL;V	0.00 (5)	0.00 (6)	60	50
3;NEUT;PST;SG;V	40.00 (5)	50.00 (6)	100	100
NFIN;V	66.67 (6)	66.67 (6)	100	100
3;MASC;PST;SG;V	50.00 (6)	50.00 (6)	100	100
3;FEM;PST;SG;V	83.33 (6)	83.33 (6)	100	100
2;IMP;SG;V	0.00 (6)	0.00 (6)	33.33	33.33
2;IMP;PL;V	16.67 (6)	16.67 (6)	83.33	83.33
1;PRS;SG;V	25.00 (4)	20.00 (5)	50	40
3;PL;PRS;V	40.00 (5)	40.00 (5)	60	60
3;FEM;PL;PST;V	66.67 (6)	66.67 (6)	100	100
2;PL;PRS;V	50.00 (4)	20.00 (5)	100	100
3;PRS;SG;V	40.00 (5)	40.00 (5)	80	80
2;PRS;SG;V	40.00 (5)	40.00 (5)	80	80
3;MASC;PL;PST;V	66.67 (6)	66.67 (6)	100	100
1;PL;PRS;V	50.00 (4)	40.00 (5)	75	60
3;FUT;PL;V	0.00 (1)	0.00 (1)	0	0
3;FUT;SG;V	0.00 (1)	0.00 (1)	0	0
2;FUT;PL;V	0.00 (1)	0.00 (1)	0	0
1;FUT;PL;V	0.00 (1)	0.00 (1)	100	100
2;FUT;SG;V	0.00 (1)	0.00 (1)	0	0
1;FUT;SG;V	0.00 (1)	0.00 (1)	100	100
ADJ;MASC;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;PL	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;FEM;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;NEUT;NOM;SG	0.00 (1)	0.00 (1)	0	0
ADJ;GEN;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;FEM;SG	0.00 (1)	0.00 (1)	0	0
ADJ;DAT;PL	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;GEN;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;PL	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;PL	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;NEUT;SG	0.00 (1)	0.00 (1)	0	0
ACC;ADJ;INAN;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;FEM;SG	0.00 (1)	0.00 (1)	0	0

Table 128: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Ukrainian–Czech language pair (the grey numbers correspond to the dictionary sizes).

	Ukrainian–Polish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	54.59 (850)	47.25 (1054)	83.18	79.51
INS;N;SG	56.25 (96)	51.43 (105)	91.67	89.52
GEN;N;PL	48.96 (96)	46.60 (103)	67.71	68.93
ACC;N;SG	58.82 (102)	57.14 (105)	86.27	84.76
DAT;N;PL	62.75 (51)	44.66 (103)	92.16	87.38
ACC;N;PL	67.68 (99)	65.05 (103)	91.92	89.32
ESS;N;PL	68.12 (69)	54.37 (103)	92.75	93.2
N;PL;VOC	66.00 (100)	64.08 (103)	92.00	89.32
N;NOM;SG	56.19 (105)	56.19 (105)	85.71	84.76
GEN;N;SG	60.78 (102)	59.05 (105)	92.16	88.57
INS;N;PL	64.37 (87)	55.34 (103)	98.85	99.03
ESS;N;SG	44.57 (92)	39.05 (105)	69.57	66.67
N;SG;VOC	31.37 (51)	24.76 (105)	60.78	51.43
N;NOM;PL	66.00 (100)	64.08 (103)	92.00	89.32
DAT;N;SG	42.50 (80)	33.33 (105)	65.00	61.9
2;IMP;PL;V	-	0.00 (2)	-	0
2;FEM;PL;PST;V	-	50.00 (2)	-	100
1;PL;PRS;V	0.00 (2)	0.00 (2)	50.00	50
2;PRS;SG;V	0.00 (2)	0.00 (2)	50.00	50
3;MASC;PL;PST;V	50.00 (2)	50.00 (2)	100.00	100
2;PL;PRS;V	0.00 (1)	0.00 (2)	0.00	0
1;FEM;PL;PST;V	-	50.00 (2)	-	100
3;FEM;PST;SG;V	100.00 (1)	50.00 (2)	100.00	50
2;FEM;PST;SG;V	-	50.00 (2)	-	50
1;PRS;SG;V	0.00 (2)	0.00 (2)	50.00	50
3;PRS;SG;V	50.00 (2)	50.00 (2)	100.00	100
3;NEUT;PST;SG;V	100.00 (1)	50.00 (2)	100.00	50
1;MASC;PL;PST;V	100.00 (1)	50.00 (2)	100.00	100
3;MASC;PST;SG;V	0.00 (2)	0.00 (2)	100.00	100
1;IMP;PL;V	-	0.00 (2)	-	0
2;MASC;PL;PST;V	-	50.00 (2)	-	100
3;FEM;PL;PST;V	100.00 (1)	50.00 (2)	100.00	100
2;MASC;PST;SG;V	0.00 (1)	0.00 (2)	100.00	100
3;PL;PRS;V	50.00 (2)	50.00 (2)	100.00	100
NFIN;V	0.00 (2)	0.00 (2)	50.00	50
1;FEM;PST;SG;V	100.00 (1)	50.00 (2)	100.00	50
2;IMP;SG;V	0.00 (1)	0.00 (2)	100.00	50
1;MASC;PST;SG;V	0.00 (1)	0.00 (2)	100.00	100
ADJ;ESS;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;MASC;NOM;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;GEN;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;NOM;PL	100.00 (2)	100.00 (2)	100.00	100
ADJ;NEUT;NOM;SG	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;INS;NEUT;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;DAT;PL	0.00 (2)	0.00 (2)	100.00	100
ADJ;INS;PL	100.00 (2)	100.00 (2)	100.00	100
ADJ;FEM;INS;SG	100.00 (2)	100.00 (2)	100.00	100
ACC;ADJ;FEM;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;FEM;NOM;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;FEM;GEN;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;GEN;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;DAT;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;INS;MASC;SG	0.00 (2)	0.00 (2)	100.00	100
ADJ;ESS;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;GEN;PL	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;PL	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ACC;ADJ;INAN;MASC;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;ESS;FEM;SG	50.00 (2)	50.00 (2)	50.00	50
ADJ;ESS;PL	50.00 (2)	50.00 (2)	100.00	100
ADJ;DAT;NEUT;SG	50.00 (2)	50.00 (2)	100.00	100
ADJ;DAT;FEM;SG	50.00 (2)	50.00 (2)	50.00	50

Table 129: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Ukrainian–Polish language pair (the grey numbers correspond to the dictionary sizes).

Ukrainian–Russian				
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	68.45 (786)	63.67 (933)	89.95	88.64
ESS;N;SG	63.64 (88)	60.61 (99)	82.95	79.8
INS;N;PL	81.58 (76)	68.37 (98)	98.68	100
ACC;N;SG	70.10 (97)	68.69 (99)	92.78	91.92
GEN;N;PL	67.05 (88)	61.22 (98)	84.09	77.55
GEN;N;SG	76.04 (96)	73.74 (99)	94.79	92.93
DAT;N;PL	77.36 (53)	63.27 (98)	92.45	93.88
N;NOM;SG	69.70 (99)	69.70 (99)	91.92	91.92
INS;N;SG	72.04 (93)	69.70 (99)	94.62	92.93
N;NOM;PL	68.04 (97)	67.35 (98)	88.66	88.78
DAT;N;SG	59.09 (88)	54.55 (99)	78.41	73.74
ESS;N;PL	83.64 (55)	70.41 (98)	96.36	91.84
ACC;N;PL	61.02 (59)	62.30 (61)	83.05	83.61
ADJ;FEM;NOM;SG	0.00 (2)	0.00 (2)	50	50
ACC;ADJ;NEUT;SG	0.00 (2)	0.00 (2)	100	100
ACC;ADJ;FEM;SG	0.00 (2)	0.00 (2)	100	100
ADJ;DAT;PL	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;NEUT;SG	0.00 (1)	0.00 (2)	100	100
ADJ;MASC;NOM;SG	0.00 (2)	0.00 (2)	50	50
ADJ;FEM;GEN;SG	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;FEM;SG	0.00 (2)	0.00 (2)	50	0
ACC;ADJ;INAN;MASC;SG	0.00 (2)	0.00 (2)	50	50
ADJ;NOM;PL	0.00 (2)	0.00 (2)	50	50
ACC;ADJ;MASC;SG	0.00 (2)	0.00 (2)	100	100
ADJ;DAT;FEM;SG	0.00 (2)	0.00 (2)	50	0
ADJ;INS;PL	0.00 (2)	0.00 (2)	100	100
ADJ;INS;MASC;SG	0.00 (2)	0.00 (2)	100	100
ADJ;GEN;NEUT;SG	0.00 (2)	0.00 (2)	100	100
ADJ;FEM;INS;SG	0.00 (2)	0.00 (2)	50	50
ACC;ADJ;INAN;PL	0.00 (2)	0.00 (2)	50	50
ADJ;ESS;PL	0.00 (2)	0.00 (2)	100	100
ADJ;GEN;PL	0.00 (2)	0.00 (2)	100	100
ADJ;NEUT;NOM;SG	0.00 (2)	0.00 (2)	100	100
ADJ;INS;NEUT;SG	0.00 (2)	0.00 (2)	100	100
ADJ;ESS;MASC;SG	0.00 (1)	0.00 (2)	100	100
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (2)	100	100
ACC;ADJ;PL	0.00 (2)	0.00 (2)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (2)	100	100
ADJ;GEN;MASC;SG	0.00 (2)	0.00 (2)	100	100
1;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100	100
2;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100	100
2;IMP;SG;V	33.33 (3)	33.33 (3)	33.33	66.67
2;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100	100
3;PL;PRS;V	66.67 (3)	66.67 (3)	100	100
1;PRS;SG;V	66.67 (3)	66.67 (3)	100	100
2;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100	100
2;PRS;SG;V	100.00 (2)	66.67 (3)	100	100
1;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100	100
1;PL;PRS;V	100.00 (2)	66.67 (3)	100	100
NFIN;V	66.67 (3)	66.67 (3)	100	100
1;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100	100
2;IMP;PL;V	50.00 (2)	33.33 (3)	100	66.67
3;PRS;SG;V	66.67 (3)	66.67 (3)	100	100
1;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100	100
3;NEUT;PST;SG;V	66.67 (3)	66.67 (3)	100	100
2;PL;PRS;V	50.00 (2)	33.33 (3)	50	66.67
2;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100	100
3;MASC;PL;PST;V	66.67 (3)	66.67 (3)	100	100
3;MASC;PST;SG;V	66.67 (3)	66.67 (3)	100	100
3;FEM;PST;SG;V	66.67 (3)	66.67 (3)	100	100
3;FEM;PL;PST;V	66.67 (3)	66.67 (3)	100	100

Table 130: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Ukrainian–Russian language pair (the grey numbers correspond to the dictionary sizes).

Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
	Ukrainian–Slovak			
ALL	39.13 (322)	31.67 (420)	81.99	80.24
ESS;N;SG	39.39 (33)	28.89 (45)	81.82	68.89
ACC;N;SG	35.71 (42)	34.78 (46)	80.95	78.26
ACC;N;PL	29.27 (41)	26.67 (45)	82.93	80
GEN;N;PL	34.21 (38)	28.26 (46)	73.68	69.57
N;NOM;PL	28.57 (42)	26.67 (45)	83.33	80
ESS;N;PL	59.09 (22)	33.33 (45)	95.45	93.33
N;NOM;SG	37.78 (45)	36.96 (46)	77.78	76.09
INS;N;PL	46.67 (30)	35.56 (45)	100	100
DAT;N;PL	50.00 (20)	28.89 (45)	75	77.78
DAT;N;SG	40.54 (37)	32.61 (46)	81.08	69.57
INS;N;SG	28.95 (38)	23.91 (46)	84.21	82.61
GEN;N;SG	38.64 (44)	36.96 (46)	86.36	84.78
NFIN;V	100.00 (2)	100.00 (2)	100	100
ACC;ADJ;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;GEN;PL	100.00 (1)	100.00 (1)	100	100
ADJ;FEM;INS;SG	100.00 (1)	100.00 (1)	100	100
ADJ;DAT;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;FEM;NOM;SG	100.00 (1)	100.00 (1)	100	100
ADJ;DAT;FEM;SG	0.00 (1)	0.00 (1)	0	0
ADJ;ESS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ACC;ADJ;MASC;SG	100.00 (1)	100.00 (1)	100	100
ACC;ADJ;PL	100.00 (1)	100.00 (1)	100	100
ADJ;INS;MASC;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;PL	100.00 (1)	100.00 (1)	100	100
ADJ;FEM;GEN;SG	0.00 (1)	0.00 (1)	100	100
ADJ;DAT;PL	0.00 (1)	0.00 (1)	100	100
ADJ;MASC;NOM;SG	100.00 (1)	100.00 (1)	100	100
ACC;ADJ;FEM;SG	100.00 (1)	100.00 (1)	100	100
ADJ;NEUT;NOM;SG	0.00 (1)	0.00 (1)	100	100
ADJ;INS;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;NOM;PL	100.00 (1)	100.00 (1)	100	100
ADJ;ESS;FEM;SG	0.00 (1)	0.00 (1)	0	0
ADJ;GEN;NEUT;SG	100.00 (1)	100.00 (1)	100	100
ACC;ADJ;INAN;MASC;SG	100.00 (1)	100.00 (1)	100	100
ADJ;ESS;NEUT;SG	0.00 (1)	0.00 (1)	100	100
ADJ;ESS;PL	100.00 (1)	100.00 (1)	100	100
ADJ;GEN;MASC;SG	100.00 (1)	100.00 (1)	100	100

Table 131: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Ukrainian–Slovak language pair (the grey numbers correspond to the dictionary sizes).

	Polish–Spanish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	36.09 (8964)	28.25 (12759)	78.10	68.56
ACC;N;PL	40.15 (827)	38.12 (884)	85.97	84.05
ACC;N;SG	39.48 (922)	38.05 (962)	80.15	79.42
DAT;N;PL	19.74 (304)	13.17 (881)	55.26	53.92
DAT;N;SG	30.22 (599)	21.96 (961)	75.29	67.43
ESS;N;PL	32.79 (552)	25.88 (881)	82.43	79.23
ESS;N;SG	32.51 (766)	28.68 (959)	77.15	72.89
GEN;N;PL	40.66 (782)	36.75 (887)	83.63	79.71
GEN;N;SG	42.02 (933)	40.64 (962)	86.60	86.28
INS;N;PL	31.35 (622)	25.20 (881)	79.58	77.87
INS;N;SG	35.96 (837)	32.74 (962)	79.93	79.11
N;NOM;PL	39.83 (826)	37.94 (883)	85.35	83.47
N;NOM;SG	40.84 (950)	40.33 (962)	84.63	84.2
N;PL;VOC	39.83 (826)	37.94 (883)	85.35	83.47
N;SG;VOC	32.44 (561)	28.20 (961)	75.22	70.76
1;COND;FEM;PL;V	-	6.25 (48)	-	39.58
1;COND;FEM;SG;V	0.00 (1)	0.00 (48)	0.00	0
1;COND;MASC;PL;V	25.00 (4)	27.08 (48)	75.00	81.25
1;COND;MASC;SG;V	0.00 (8)	0.00 (48)	0.00	0
1;FEM;PL;PST;V	-	1.61 (62)	-	11.29
1;FEM;PST;SG;V	12.50 (16)	8.06 (62)	25.00	9.68
1;IMP;PL;V	0.00 (8)	2.08 (48)	12.50	12.5
1;MASC;PL;PST;V	30.77 (13)	8.06 (62)	46.15	32.26
1;MASC;PST;SG;V	10.00 (30)	4.84 (62)	20.00	4.84
1;PL;PRS;V	37.93 (29)	25.00 (48)	51.72	39.58
1;PRS;SG;V	13.51 (37)	10.42 (48)	21.62	12.5
2;COND;FEM;PL;V	-	0.00 (48)	-	0
2;COND;FEM;SG;V	0.00 (1)	4.17 (48)	0.00	6.25
2;COND;MASC;PL;V	-	0.00 (48)	-	2.08
2;COND;MASC;SG;V	0.00 (2)	6.25 (48)	0.00	6.25
2;FEM;PL;PST;V	-	0.00 (62)	-	0
2;FEM;PST;SG;V	0.00 (4)	8.06 (62)	25.00	17.74
2;IMP;PL;V	0.00 (6)	0.00 (48)	0.00	0
2;IMP;SG;V	8.00 (25)	8.33 (48)	12.00	12.5
2;MASC;PL;PST;V	0.00 (1)	0.00 (62)	0.00	1.61
2;MASC;PST;SG;V	10.00 (10)	6.45 (62)	20.00	9.68
2;PL;PRS;V	11.11 (9)	0.00 (48)	22.22	2.08
2;PRS;SG;V	8.70 (23)	6.25 (48)	21.74	10.42
3;COND;FEM;PL;V	12.50 (8)	16.67 (48)	37.50	39.58
3;COND;FEM;SG;V	33.33 (9)	18.75 (48)	55.56	33.33
3;COND;MASC;PL;V	0.00 (4)	2.08 (48)	25.00	14.58
3;COND;MASC;SG;V	33.33 (12)	16.67 (48)	58.33	31.25
3;COND;NEUT;SG;V	14.29 (7)	10.42 (48)	28.57	16.67
3;FEM;PL;PST;V	48.84 (43)	43.55 (62)	74.42	74.19
3;FEM;PST;SG;V	37.25 (51)	32.26 (62)	58.82	54.84
3;MASC;PL;PST;V	22.45 (49)	19.35 (62)	55.10	46.77
3;MASC;PST;SG;V	33.33 (54)	29.03 (62)	62.96	59.68
3;NEUT;PST;SG;V	11.90 (42)	8.06 (62)	19.05	16.13
3;PL;PRS;V	50.00 (42)	45.83 (48)	80.95	77.08
3;PRS;SG;V	36.96 (46)	35.42 (48)	56.52	54.17
NFIN;V	40.43 (47)	39.58 (48)	95.74	95.83
ACC;ADJ;FEM;SG	46.89 (177)	44.68 (188)	80.79	80.32
ACC;ADJ;INAN;MASC;SG	48.94 (188)	48.42 (190)	92.02	91.58
ACC;ADJ;MASC;PL	54.19 (179)	51.32 (189)	97.21	97.35
ACC;ADJ;MASC;SG	45.36 (183)	43.68 (190)	85.25	85.26
ACC;ADJ;PL	54.59 (185)	52.91 (189)	94.05	93.65
ADJ;DAT;FEM;SG	45.20 (177)	42.55 (188)	80.23	79.79
ADJ;DAT;MASC;SG	14.42 (104)	13.68 (190)	50.96	52.63
ADJ;DAT;PL	39.44 (180)	37.57 (189)	91.11	91.01
ADJ;ESS;FEM;SG	45.20 (177)	42.55 (188)	80.23	79.79
ADJ;ESS;MASC;SG	39.23 (181)	37.37 (190)	91.16	91.05
ADJ;ESS;PL	54.19 (179)	51.32 (189)	97.21	97.35
ADJ;FEM;GEN;SG	45.20 (177)	42.55 (188)	80.23	79.79
ADJ;FEM;INS;SG	46.89 (177)	44.68 (188)	80.79	80.32
ADJ;FEM;NOM;SG	49.45 (182)	47.87 (188)	91.76	91.49
ADJ;GEN;MASC;SG	45.36 (183)	43.68 (190)	85.25	85.26
ADJ;GEN;PL	54.19 (179)	51.32 (189)	97.21	97.35
ADJ;INS;MASC;SG	39.23 (181)	37.37 (190)	91.16	91.05
ADJ;INS;PL	34.84 (155)	31.22 (189)	73.55	75.66
ADJ;MASC;NOM;PL	28.21 (117)	20.63 (189)	63.25	55.03
ADJ;MASC;NOM;SG	48.94 (188)	48.42 (190)	92.02	91.58
ADJ;NOM;PL	54.59 (185)	52.91 (189)	94.05	93.65

Table 132: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Polish–Spanish language pair (the grey numbers correspond to the dictionary sizes).

	Spanish–Polish			
Morph	Normal (In vocab)	Normal (+OOV)	Lexeme (In vocab)	Lexeme (+OOV)
ALL	28.10 (4270)	21.02 (6095)	81.17	64.25
N;PL	31.61 (1139)	30.02 (1226)	87.53	87.68
N;SG	33.66 (1316)	33.18 (1338)	87.01	85.5
ADJ;FEM;PL	42.13 (235)	41.60 (238)	98.30	97.9
ADJ;FEM;SG	33.05 (236)	32.92 (240)	86.86	87.5
ADJ;MASC;PL	41.53 (236)	41.15 (243)	96.61	96.71
ADJ;MASC;SG	37.04 (243)	37.04 (243)	87.65	87.24
1;COND;PL;V	50.00 (2)	16.22 (111)	50.00	72.07
1;COND;SG;V	7.41 (27)	9.01 (111)	44.44	51.35
1;IMP;PL;POS;V	0.00 (22)	0.00 (116)	13.64	7.76
1;IPFV;PL;PST;V	23.08 (13)	10.81 (111)	92.31	79.28
1;IPFV;PST;SG;V	19.35 (62)	16.22 (111)	75.81	63.96
1;PFV;PL;PST;V	15.38 (26)	13.51 (111)	73.08	55.86
1;PFV;PST;SG;V	7.14 (42)	3.60 (111)	64.29	34.23
1;PL;PRS;V	12.24 (49)	15.22 (92)	79.59	61.96
1;PRS;SG;V	12.70 (63)	10.99 (91)	46.03	32.97
2;COND;PL;V	-	3.60 (111)	-	22.52
2;COND;SG;V	100.00 (1)	6.31 (111)	100.00	15.32
2;IMP;PL;POS;V	0.00 (17)	0.00 (116)	0.00	2.59
2;IMP;POS;SG;V	20.24 (84)	17.24 (116)	44.05	41.38
2;IPFV;PL;PST;V	-	0.90 (111)	-	5.41
2;IPFV;PST;SG;V	0.00 (11)	0.90 (111)	18.18	11.71
2;PFV;PL;PST;V	-	0.00 (111)	-	0.9
2;PFV;PST;SG;V	6.67 (15)	5.41 (111)	46.67	36.94
2;PL;PRS;V	0.00 (13)	1.09 (92)	7.69	4.35
2;PRS;SG;V	15.91 (44)	7.61 (92)	29.55	13.04
3;COND;PL;V	10.53 (19)	0.90 (111)	47.37	14.41
3;COND;SG;V	7.89 (38)	9.01 (111)	44.74	51.35
3;IPFV;PL;PST;V	17.39 (92)	15.32 (111)	56.52	50.45
3;IPFV;PST;SG;V	17.53 (97)	16.22 (111)	73.20	63.96
3;PFV;PL;PST;V	13.19 (91)	11.71 (111)	78.02	77.48
3;PFV;PST;SG;V	8.08 (99)	7.21 (111)	75.76	68.47
3;PL;PRS;V	20.73 (82)	19.57 (92)	70.73	66.3
3;PRS;SG;V	20.45 (88)	19.57 (92)	51.14	47.83
NFIN;V	15.18 (112)	14.66 (116)	85.71	75.86
1;FUT;PL;V	16.67 (12)	8.33 (36)	100.00	47.22
1;FUT;SG;V	0.00 (14)	2.78 (36)	28.57	16.67
2;FUT;PL;V	0.00 (1)	0.00 (36)	0.00	0
2;FUT;SG;V	0.00 (5)	5.56 (36)	60.00	25
3;FUT;PL;V	0.00 (17)	5.56 (36)	58.82	44.44
3;FUT;SG;V	0.00 (28)	0.00 (36)	53.57	36.11

Table 133: The performance of Ruder et al. (2018)'s model on translating words belonging to a specific morphological category for the Spanish–Polish language pair (the grey numbers correspond to the dictionary sizes).