

## Point Forecast Accuracy

Table 1: Wilcoxon rank sum test with continuity correction for Point Forecast accuracy comparing ARIMA with Baseline models

		sMAPE								MASE							
		Quarter (1)		Year (1-4)		Long (5-6)		Total (1-6)		Quarter (1)		Year (1-4)		Long (5-6)		Total (1-6)	
<b>EBIT</b>																	
	Naive	102,116	***	103,389	**	105,432	**	104,060	**	102,508	**	90,581	***	98,646	***	92,371	***
	Snaive	89,594	***	106,113	*	101,726	***	104,377	**	64,307	***	96,182	***	95,803	***	95,071	***
	Drift	102,192	***	103,292	**	106,603	*	104,433	**	102,675	**	90,403	***	98,004	***	92,695	***
	Holt	100,871	***	103,790	**	105,351	**	104,411	**	98,052	***	90,125	***	93,716	***	90,890	***
<b>Net Income</b>																	
	Naive	106,526	*	108,012	*	109,657	.	108,586	*	105,805	*	95,696	***	102,102	***	97,243	***
	Snaive	98,110	***	107,829	*	105,480	**	106,778	*	73,580	***	94,999	***	96,767	***	94,854	***
	Drift	106,698	*	107,950	*	111,024	.	109,169	.	105,443	**	94,909	***	101,742	***	97,119	***
	Holt	106,898	*	109,053	.	110,116	.	109,430	.	103,237	**	97,027	***	100,152	***	97,872	***
<b>EPS</b>																	
	Naive	106,223	*	107,617	*	108,670	.	107,950	*	105,526	**	95,457	***	101,556	***	96,796	***
	Snaive	97,633	***	106,920	*	103,906	**	105,602	**	74,129	***	91,467	***	94,034	***	91,432	***
	Drift	106,253	*	107,554	*	110,176	.	108,577	*	105,207	**	95,519	***	101,654	***	97,478	***
	Holt	107,142	*	110,008	.	112,023	.	110,710	.	104,669	**	100,432	***	104,424	**	101,857	***

Note: . p < 0.1; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

Table 2: Wilcoxon rank sum test with continuity correction for Point Forecast accuracy comparing LSTM with Baseline models, ARIMA and Simple RNN

	sMAPE						MASE							
	Quarter (1)	Year (1-4)	Long (5-6)		Total (1-6)		Quarter (1)		Year (1-4)		Long (5-6)		Total (1-6)	
<b>EBIT</b>														
Naive	122,375	112,449	101,123	***	108,253	*	134,614		108,217	*	91,784	***	100,201	***
Snaive	111,496	115,933	96,675	***	108,609	.	101,251	***	118,058		88,237	***	104,367	**
Drift	122,178	112,036	102,624	**	108,432	*	134,677		108,054	*	91,109	***	100,699	***
Holt	122,181	112,869	101,267	***	108,468	*	131,381		108,800	.	86,594	***	98,929	***
ARIMA	138,093	125,307	112,085		120,488		154,073		137,488		108,101	*	125,564	
Simple	120,822	120,195	121,034		120,504		123,231		124,729		123,231		124,439	
<b>Net Income</b>														
Naive	120,938	114,000	105,229	**	110,823		132,224		109,695	.	95,540	***	102,945	**
Snaive	113,965	114,034	100,481	***	108,857	.	103,915	**	112,469		89,735	***	102,017	***
Drift	121,078	113,783	107,089	*	111,298		131,816		108,896	.	95,023	***	102,809	**
Holt	121,775	115,117	105,787	*	111,637		131,226		111,808		93,448	***	103,685	**
ARIMA	131,316	121,819	111,820		118,156		146,740		132,663		108,408	*	122,622	
Simple	119,040	118,648	118,568		118,587		121,667		123,031		119,923		121,998	
<b>EPS</b>														
Naive	119,482	114,352	105,784	*	111,253		129,539		111,764		99,000	***	105,738	*
Snaive	112,646	114,018	100,266	***	108,869	.	101,092	***	111,414		91,496	***	101,921	***
Drift	119,371	114,046	107,765	*	111,739		129,079		111,849		99,170	***	106,658	*
Holt	121,443	117,008	109,776	.	114,287		130,530		117,746		101,758	***	110,969	
ARIMA	130,131	122,448	113,578		119,270		143,834		135,381		112,809		126,234	
Simple	118,683	119,134	119,138		119,118		120,204		124,048		121,392		123,475	

Note: . p < 0.1; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

Table 3: Wilcoxon rank sum test with continuity correction for Point Forecast accuracy comparing GRU with Baseline models, ARIMA and Simple RNN

	sMAPE					MASE							
	Quarter (1)	Year (1-4)	Long (5-6)		Total (1-6)		Quarter (1)		Year (1-4)		Long (5-6)		Total (1-6)
<b>EBIT</b>													
Naive	121,368	110,922	97,446	***	105,896	*	132,937		104,149	**	85,546	***	94,920
Snaive	110,450	114,177	93,333	***	106,397	*	97,980	***	112,688		80,960	***	97,545
Drift	121,201	110,532	99,120	***	106,261	*	132,824		103,990	**	84,704	***	95,518
Holt	121,072	111,258	97,717	***	106,308	*	129,421		104,525	**	80,269	***	93,477
ARIMA	136,812	123,569	108,420	*	118,010		151,663		132,962		101,177	***	119,412
Simple	119,534	118,459	116,886		117,829		120,106		119,502		116,447		118,133
<b>Net Income</b>													
Naive	118,854	112,087	102,423	**	108,646	.	127,674		104,854	**	89,726	***	97,417
Snaive	111,853	111,974	97,913	***	106,645	*	98,478	***	105,893	*	83,247	***	94,931
Drift	119,030	111,947	104,304	**	109,202	.	127,374		103,937	**	89,210	***	97,296
Holt	119,594	113,129	103,132	**	109,416	.	126,039		106,664	*	87,871	***	98,296
ARIMA	129,016	119,840	108,904	.	115,819		141,038		126,497		102,253	***	115,972
Simple	116,914	116,417	115,458		116,117		115,833		116,873		113,808		115,356
<b>EPS</b>													
Naive	118,583	112,410	103,030	**	109,021	.	127,701		105,953	*	93,021	***	99,551
Snaive	111,288	111,748	97,541	***	106,371	*	97,978	***	103,733	**	85,180	***	94,087
Drift	118,544	112,213	105,169	**	109,567	.	127,288		106,222	*	92,962	***	100,363
Holt	120,399	114,882	106,956	*	111,957		128,609		111,517		95,841	***	104,737
ARIMA	129,041	120,359	110,829		116,916		141,569		128,498		106,212	*	118,946
Simple	117,470	116,985	116,000		116,686		117,733		116,912		114,966		116,269

Note: . p < 0.1; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

Table 4: Wilcoxon rank sum test with continuity correction for Point Forecast accuracy comparing ARNN with Baseline models, ARIMA, Simple RNN, LSTM and GRU

	sMAPE								MASE							
	Quarter (1)		Year (1-4)		Long (5-6)		Total (1-6)		Quarter (1)		Year (1-4)		Long (5-6)		Total (1-6)	
<b>EBIT</b>																
Naive	111,677.0	.	104,333.0	***	95,318.0	***	100,776.0	***	118,898.0		92,945.0	***	83,400.0	***	87,064.0	***
Snaive	98,909.0	***	107,309.0	**	90,778.0	***	100,852.0	***	79,759.0	***	98,260.0	***	78,441.0	***	87,992.0	***
Drift	111,667.0	.	104,205.0	***	97,306.0	***	101,461.0	***	118,939.0		92,649.0	***	82,492.0	***	87,440.0	***
Holt	111,000.0	.	104,908.0	**	95,840.0	***	101,201.0	***	114,528.0		92,384.0	***	78,111.0	***	85,078.0	***
ARIMA	127,165.5		117,448.5		106,403.5	**	113,208.5		134,913.5		119,063.5		98,408.5	***	109,754.5	*
Simple	108,306.0	*	111,721.0	.	114,637.0		112,514.0		101,363.0	***	104,743.0	**	113,702.0		108,136.0	*
LSTM	102,957.0	***	107,050.0	**	109,235.0	*	107,654.0	**	94,147.0	***	95,623.0	***	105,842.0	**	99,112.0	***
GRU	104,388.0	**	108,982.0	*	113,497.0		110,371.0	*	96,866.0	***	100,569.0	***	112,578.0		105,143.0	**
<b>Net Income</b>																
Naive	113,202.0		108,330.0	*	101,412.0	***	105,751.0	**	118,195.0		96,117.0	***	88,689.0	***	91,452.0	***
Snaive	104,803.0	**	107,979.0	*	96,657.0	***	103,527.0	***	86,052.0	***	94,861.0	***	81,975.0	***	87,801.0	***
Drift	113,289.0		108,313.0	*	103,401.0	***	106,417.0	**	117,928.0		95,239.0	***	88,060.0	***	91,262.0	***
Holt	113,687.0		109,350.0	*	102,215.0	***	106,618.0	**	115,753.0		97,331.0	***	86,602.0	***	91,996.0	***
ARIMA	123,211.0		116,220.0		108,097.0	*	113,101.0		129,864.0		116,039.0		100,999.0	***	109,094.0	*
Simple	110,099.0	*	112,523.0		114,435.0		113,094.0		103,892.0	***	106,118.0	**	112,731.0		108,506.0	*
LSTM	106,502.0	**	109,548.0	*	111,464.0	.	110,136.0	*	97,646.0	***	98,862.0	***	108,412.0	*	102,143.0	***
GRU	108,887.0	*	111,755.0	.	114,745.0		112,689.0		103,491.0	***	104,905.0	**	114,643.0		108,753.0	*
<b>EPS</b>																
Naive	112,600.0		108,848.0	*	101,733.0	***	106,059.0	**	116,994.0		97,731.0	***	91,176.0	***	93,482.0	***
Snaive	104,397.0	**	108,037.0	*	95,946.0	***	103,306.0	***	85,419.0	***	93,320.0	***	82,975.0	***	87,046.0	***
Drift	112,681.0		108,716.0	*	104,082.0	***	106,811.0	**	116,671.0		97,862.0	***	90,816.0	***	94,207.0	***
Holt	114,180.0		111,335.0	.	105,964.0	**	109,277.0	*	116,761.0		102,798.0	***	93,888.0	***	98,456.0	***
ARIMA	123,195.0		117,170.0		109,777.0	*	114,233.0		129,013.0		118,463.0		103,921.0	***	112,032.0	.
Simple	110,782.0	.	113,288.0		114,689.0		113,706.0		105,051.0	**	106,563.0	**	112,942.0		109,156.0	*
LSTM	107,681.0	*	109,766.0	*	111,302.0	.	110,227.0	*	99,865.0	***	97,940.0	***	107,183.0	**	101,119.0	***
GRU	108,973.0	*	111,985.0	.	114,439.0		112,801.0		102,275.0	***	105,177.0	**	113,639.0		108,484.0	*

Note: . p < 0.1; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

## Prediction Interval Accuracy

Table 5: Wilcoxon rank sum test with continuity correction for accuracy measured by sMIS comparing ARIMA with Baseline models

	Quarter (1)			Year (1-4)		Long (5-6)		Total (1-6)		
<b>EBIT</b>										
Naive	100,719	***		102,203	***		99,036	***	102,172	***
Snaive	77,967	***		104,739	**		107,566	*	105,931	*
Drift	102,713	**		101,823	***		96,545	***	100,905	***
Holt	105,751	*		106,254	*		102,725	**	104,837	**
<b>Net Income</b>										
Naive	105,250	**		112,898			101,873	***	109,976	.
Snaive	87,103	***		109,763	.		112,981		111,977	
Drift	105,722	*		111,971			99,207	***	108,307	*
Holt	109,815	.		113,847			108,301	*	111,937	
<b>EPS</b>										
Naive	104,278	**		112,247			102,123	***	109,482	.
Snaive	82,842	***		104,557	**		107,223	*	106,614	*
Drift	105,588	**		111,402			99,616	***	108,129	*
Holt	111,812			112,654			106,123	*	110,074	.
<i>Note:</i> . p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001										

## H3: LSTM vs. GRU

Table 6: Wilcoxon rank sum test with continuity correction for accuracy measured by sMIS comparing LSTM with Baseline models, ARIMA and Simple RNN

	Quarter (1)	Year (1-4)	Long (5-6)	Total (1-6)
<b>EBIT</b>				
Naive	179,625	181,834	165,703	177,865
Snaive	173,152	187,417	169,591	181,760
Drift	181,798	181,851	164,163	177,415
Holt	179,990	182,714	158,902	174,427
ARIMA	188,655	188,023	170,976	182,912
Simple	167,471	177,797	169,337	176,981
<b>Net Income</b>				
Naive	189,892	196,758	182,561	194,130
Snaive	185,279	197,061	181,643	193,029
Drift	190,989	196,478	181,009	193,319
Holt	189,083	192,941	171,143	186,244
ARIMA	191,885	194,513	180,126	191,280
Simple	168,710	181,423	172,567	181,168
<b>EPS</b>				
Naive	185,259	196,358	184,417	194,116
Snaive	177,061	193,993	179,658	189,747
Drift	186,715	195,791	182,697	193,082
Holt	184,344	191,808	171,024	185,345
ARIMA	187,764	194,440	181,545	191,473
Simple	166,441	182,947	176,161	183,113

*Note:* .  $p < 0.1$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

Table 7: Wilcoxon rank sum test with continuity correction for accuracy measured by sMIS comparing GRU with Baseline models, ARIMA and Simple RNN

	Quarter (1)	Year (1-4)	Long (5-6)	Total (1-6)
<b>EBIT</b>				
Naive	173,660	172,895	149,734	166,088
Snaive	165,827	178,665	155,319	170,578
Drift	176,008	172,809	147,789	165,546
Holt	174,521	173,707	144,203	162,475
ARIMA	183,654	180,102	157,667	172,347
Simple	160,410	167,739	154,005	164,261
<b>Net Income</b>				
Naive	177,799	185,566	164,871	180,083
Snaive	171,260	185,483	167,411	179,659
Drift	179,004	185,005	162,899	178,975
Holt	177,887	181,820	157,061	173,330
ARIMA	180,964	183,730	166,088	178,514
Simple	154,177	166,729	155,054	164,032
<b>EPS</b>				
Naive	179,636	186,818	166,444	181,894
Snaive	170,039	183,457	165,493	177,487
Drift	181,025	186,125	164,197	180,686
Holt	178,899	181,908	156,231	173,036
ARIMA	182,504	184,966	167,073	179,882
Simple	157,933	169,896	157,978	167,681

*Note:* . p < 0.1; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001



Table 8: Wilcoxon rank sum test with continuity correction for accuracy measured by sMIS comparing ARNN with Baseline models, ARIMA, Simple RNN, LSTM and GRU

	Quarter (1)		Year (1-4)		Long (5-6)		Total (1-6)	
<b>EBIT</b>								
Naive	126,675.0		122,074.0		104,655.0	**	116,112.0	
Snaive	106,853.0	**	126,896.0		114,670.0		121,303.0	
Drift	128,993.0		121,658.0		102,132.0	***	114,830.0	
Holt	130,608.0		124,500.0		106,006.0	**	116,594.0	
ARIMA	140,882.5		134,089.5		119,492.5		128,197.5	
Simple	107,346.0	**	111,517.0	.	112,126.0	.	111,327.0	.
LSTM	58,718.0	***	51,768.0	***	59,801.0	***	52,431.0	***
GRU	65,261.0	***	61,391.0	***	74,688.0	***	64,585.0	***
<b>Net Income</b>								
Naive	135,480.0		142,519.0		119,528.0		135,494.0	
Snaive	121,232.0		140,214.0		131,371.0		136,896.0	
Drift	136,480.0		141,499.0		116,729.0		133,737.0	
Holt	138,557.0		139,906.0		121,743.0		132,531.0	
ARIMA	142,970.0		142,280.0		129,837.0		137,708.0	
Simple	107,490.0	**	111,279.0	.	111,592.0	.	110,471.0	*
LSTM	57,397.0	***	48,493.0	***	56,168.0	***	48,518.0	***
GRU	71,238.0	***	62,520.0	***	73,186.0	***	64,675.0	***
<b>EPS</b>								
Naive	135,187.0		141,348.0		119,175.0		134,715.0	
Snaive	117,401.0		133,769.0		125,542.0		130,855.0	
Drift	136,504.0		140,256.0		116,342.0		132,906.0	
Holt	138,539.0		137,234.0		119,194.0		129,578.0	
ARIMA	142,604.0		140,949.0		129,690.0		136,641.0	
Simple	108,600.0	*	113,908.0		112,820.0		113,103.0	
LSTM	60,694.0	***	48,367.0	***	53,931.0	***	47,718.0	***
GRU	68,622.0	***	61,085.0	***	71,745.0	***	62,690.0	***

Note: . p < 0.1; \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

Table 9: Wilcoxon rank sum test with continuity correction for accuracy comparing LSTM and GRU

	sMAPE	MASE	sMIS
<b>EBIT</b>			
long	119,974	122,774	134,716
medium	117,289	121,121	129,334
short	116,778	118,555	124,750
total	118,224	122,380	132,429
<b>Net Income</b>			
long	118,896	121,945	134,855
medium	117,761	121,861	132,720
short	117,785	121,410	130,814
total	118,115	122,247	134,221
<b>EPS</b>			
long	118,827	122,111	136,736
medium	117,786	123,073	132,096
short	116,835	118,360	126,191
total	118,230	123,219	134,738

*Note:* .  $p < 0.1$ ; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$