9.15 CASE STUDY

Your directors are mainly interested in which of the other variables have most affect on (a) the market value and (b) the gross sales of food outlet they might open. They would also like to know how the gross sales affect the market value of the establishment.

Ignoring the results of previous normality tests for **each of the three types of outlet**:

a) Find the Pearson's correlation coefficient between the market value and any other continuous variables which you think may influence it. For the most significant association found, calculate the goodness of fit and state the regression equations.

b) Find the Pearson's correlation coefficient between the gross sales and any other continuous variables which you think may influence gross sales. For the most significant association found, calculate the goodness of fit and state the regression equations.

c) Find the Pearson's correlation coefficient between the market value and gross sales. If significant, calculate the goodness of fit, the regression equation and carry out residual analysis.

a) Find the Pearson's correlation coefficient between the market value and any other continuous variables which you think may influence it. For the most significant association found, calculate the goodness of fit and state the regression equations.

Takeaways

Correlations for takeaways only

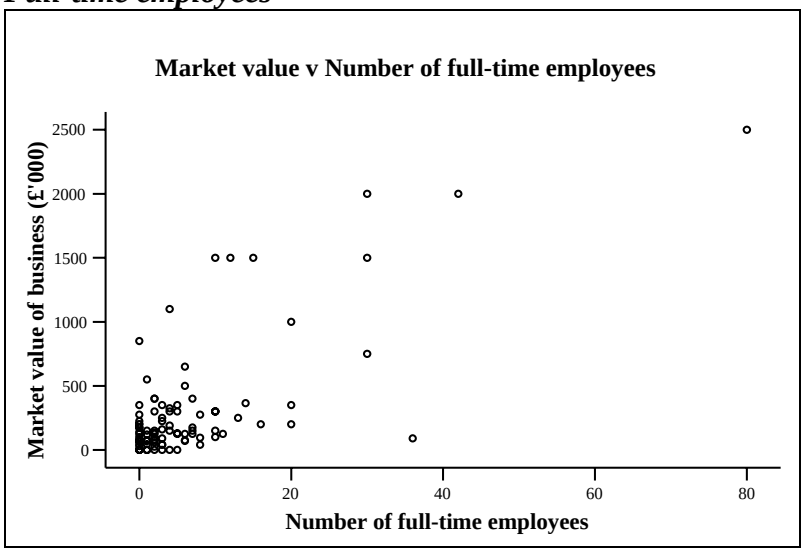
		Market value of business (£'000)	Wages as % of sales	Advertising as % of sales	Number of full-time employees	Number of part-time employees	New capital invested
Market value of business (£'000)	Pearson Correlation	1	.055	.052	.732**	.617**	.381**
	Sig. (2-tailed)		.600	.622	.000	.000	.000
	N	99	92	91	97	96	86
Wages as % of sales	Pearson Correlation	.055	1	-.025	.151	.145	.323**
	Sig. (2-tailed)	.600		.802	.135	.155	.003
	N	92	101	99	99	98	85
Advertising as % of sales	Pearson Correlation	.052	-.025	1	.046	.119	.076
	Sig. (2-tailed)	.622	.802		.653	.249	.490
	N	91	99	99	97	96	85
Number of full-time employees	Pearson Correlation	.732**	.151	.046	1	.450**	.215*
	Sig. (2-tailed)	.000	.135	.653		.000	.042
	N	97	99	97	106	105	90
Number of part-time employees	Pearson Correlation	.617**	.145	.119	.450**	1	.281**
	Sig. (2-tailed)	.000	.155	.249	.000		.008
	N	96	98	96	105	105	89
New capital invested	Pearson Correlation	.381**	.323**	.076	.215*	.281**	1
	Sig. (2-tailed)	.000	.003	.490	.042	.008	
	N	86	85	85	90	89	92

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Number of full-time employees has the highest correlation coefficient with market value. Part-time employees and new capital invested also both significant.

Full-time employees



Looks like a linear relationship.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	104.503	38.136		2.740	.007
	Number of full-time employees	31.121	2.970	.732	10.479	.000

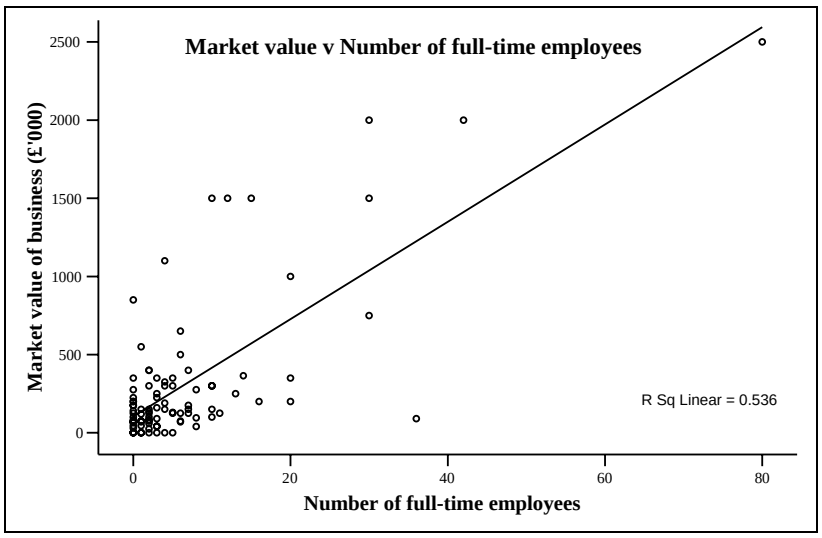
a. Dependent Variable: Market value of business (£'000)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.732[a]	.536	.531	322.222

a. Predictors: (Constant), Number of full-time employees

Market value = 104.5 + 31.1 x no. of full time employees Goodness of fit = 53.6%



Cafes only

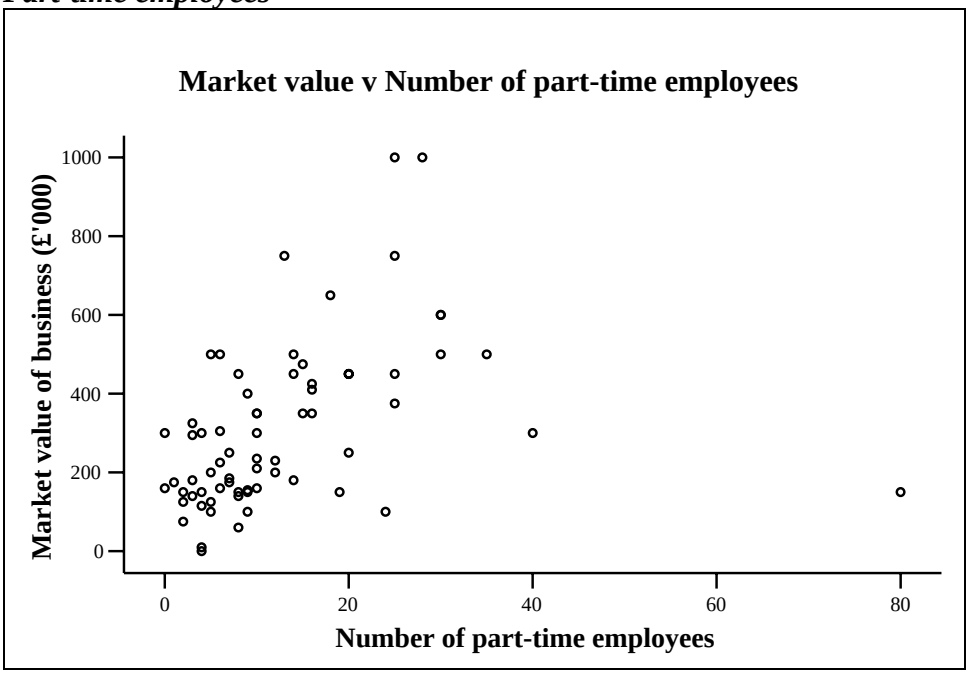
Correlations

		Market value of business (£'000)	Wages as % of sales	Advertising as % of sales	Number of full-time employees	Number of part-time employees	New capital invested
Market value of business (£'000)	Pearson Correlation	1	.117	.047	.217	.378**	.059
	Sig. (2-tailed)		.361	.713	.073	.002	.644
	N	71	63	63	69	68	63
Wages as % of sales	Pearson Correlation	.117	1	.172	.185	.128	.514**
	Sig. (2-tailed)	.361		.167	.143	.316	.000
	N	63	66	66	64	63	59
Advertising as % of sales	Pearson Correlation	.047	.172	1	-.097	-.085	.019
	Sig. (2-tailed)	.713	.167		.446	.509	.884
	N	63	66	66	64	63	59
Number of full-time employees	Pearson Correlation	.217	.185	-.097	1	.467**	.084
	Sig. (2-tailed)	.073	.143	.446		.000	.514
	N	69	64	64	72	71	63
Number of part-time employees	Pearson Correlation	.378**	.128	-.085	.467**	1	.052
	Sig. (2-tailed)	.002	.316	.509	.000		.685
	N	68	63	63	71	71	63
New capital invested	Pearson Correlation	.059	.514**	.019	.084	.052	1
	Sig. (2-tailed)	.644	.000	.884	.514	.685	
	N	63	59	59	63	63	65

**. Correlation is significant at the 0.01 level (2-tailed).

Only the number of part-time employees is significantly correlated with market value.

Part-time employees



Looks like a positive relationship

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	225.564	34.711		6.498	.000
	Number of part-time employees	6.446	1.946	.378	3.312	.002

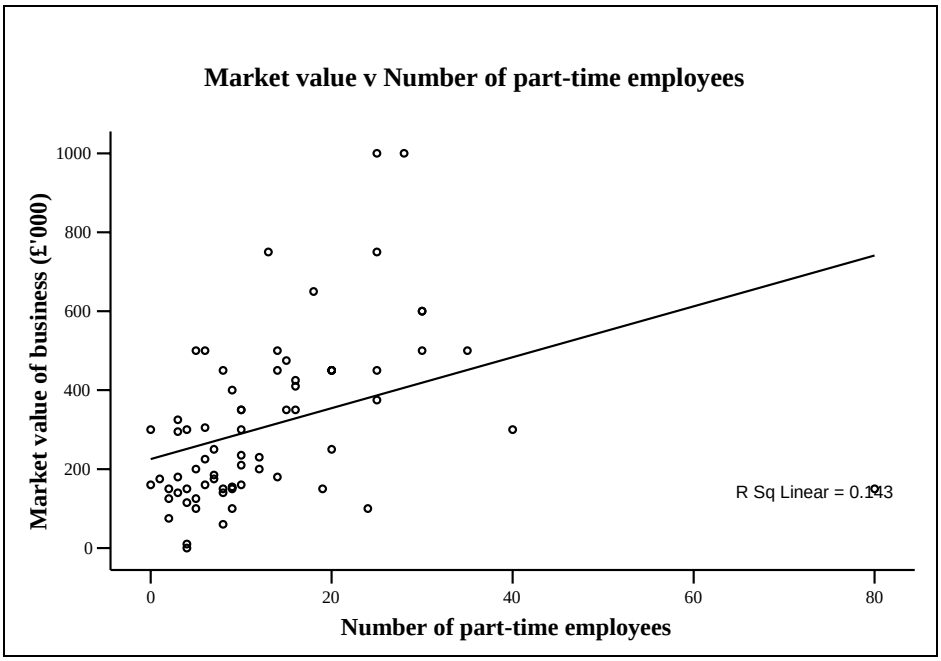
a. Dependent Variable: Market value of business (£'000)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.378[a]	.143	.130	196.227

a. Predictors: (Constant), Number of part-time employees

Market value = 226 + 6.45 No. of part-time employees Goodness of fit = 14.3%



Restaurants only

Correlations

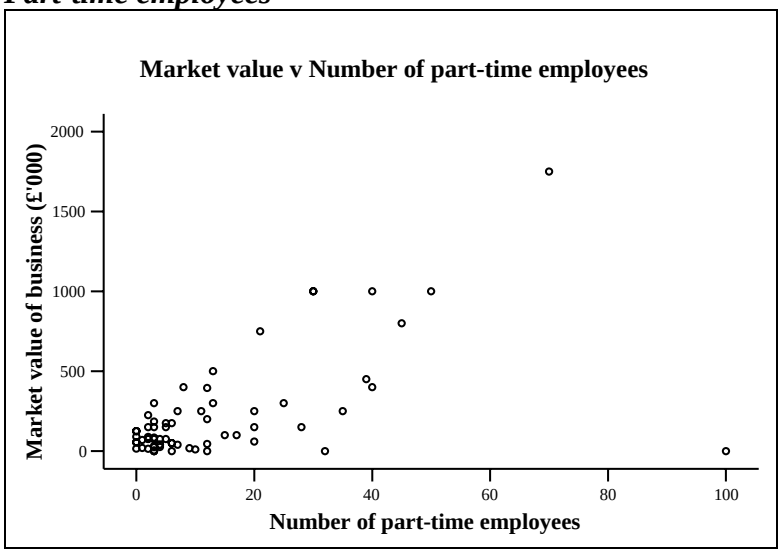
		Market value of business (£'000)	New capital invested	Wages as % of sales	Advertising as % of sales	Number of full-time employees	Number of part-time employees
Market value of business (£'000)	Pearson Correlation	1	.409**	.178	.151	.460**	.587**
	Sig. (2-tailed)		.001	.169	.245	.000	.000
	N	68	58	61	61	65	67
New capital invested	Pearson Correlation	.409**	1	.254	.058	.616**	.306*
	Sig. (2-tailed)	.001		.061	.676	.000	.018
	N	58	59	55	55	57	59
Wages as % of sales	Pearson Correlation	.178	.254	1	.036	.292*	.200
	Sig. (2-tailed)	.169	.061		.776	.021	.114
	N	61	55	65	65	62	64
Advertising as % of sales	Pearson Correlation	.151	.058	.036	1	.025	.004
	Sig. (2-tailed)	.245	.676	.776		.850	.977
	N	61	55	65	65	62	64
Number of full-time employees	Pearson Correlation	.460**	.616**	.292*	.025	1	.427**
	Sig. (2-tailed)	.000	.000	.021	.850		.000
	N	65	57	62	62	69	69
Number of part-time employees	Pearson Correlation	.587**	.306*	.200	.004	.427**	1
	Sig. (2-tailed)	.000	.018	.114	.977	.000	
	N	67	59	64	64	69	71

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Highest correlation coefficient for part-time employees. Full-time employees and new capital invested also both significant.

Part-time employees



Looks like a strong linear relationship.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	80.506	40.203		2.002	.049
	Number of part-time employees	10.514	1.797	.587	5.852	.000

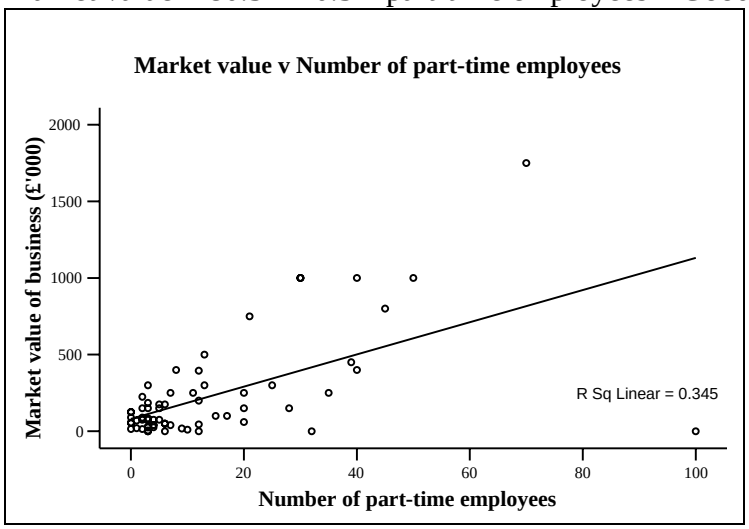
a. Dependent Variable: Market value of business (£'000)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.587[a]	.345	.335	262.509

a. Predictors: (Constant), Number of part-time employees

Market value = 80.5 + 10.5 x part-time employees Goodness of fit = 34.5%



One point has too strong an influence on the position of the regression line.

b) Find the Pearson's correlation coefficient between the gross sales and any other continuous variables which you think may influence gross sales. For the most significant association found, calculate the goodness of fit and state the regression equations.

Takeaways only

Correlations

		Gross sales (£'000)	New capital invested	Wages as % of sales	Advertising as % of sales	Number of full-time employees	Number of part-time employees
Gross sales (£'000)	Pearson Correlation	1	.357**	.127	.125	.685**	.812**
	Sig. (2-tailed)		.000	.216	.227	.000	.000
	N	104	92	97	95	102	101
New capital invested	Pearson Correlation	.357**	1	.323**	.076	.215*	.281**
	Sig. (2-tailed)	.000		.003	.490	.042	.008
	N	92	92	85	85	90	89
Wages as % of sales	Pearson Correlation	.127	.323**	1	-.025	.151	.145
	Sig. (2-tailed)	.216	.003		.802	.135	.155
	N	97	85	101	99	99	98
Advertising as % of sales	Pearson Correlation	.125	.076	-.025	1	.046	.119
	Sig. (2-tailed)	.227	.490	.802		.653	.249
	N	95	85	99	99	97	96
Number of full-time employees	Pearson Correlation	.685**	.215*	.151	.046	1	.450**
	Sig. (2-tailed)	.000	.042	.135	.653		.000
	N	102	90	99	97	106	105
Number of part-time employees	Pearson Correlation	.812**	.281**	.145	.119	.450**	1
	Sig. (2-tailed)	.000	.008	.155	.249	.000	
	N	101	89	98	96	105	105

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Part-time employees highest correlation but full-time employees and new capital invested also both significant.

Part-time employees only

Looks like a strong linear fit.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	49.029	25.289		1.939	.055
	Number of part-time employees	20.112	1.451	.812	13.9	.000

a. Dependent Variable: Gross sales (£'000)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.812[a]	.660	.657	179.418

a. Predictors: (Constant), Number of part-time employees

Gross sales = 49.0 + 20.1x no. of part-time employees Goodness of fit = 66.0%

Cafes only

Correlations

		Gross sales (£'000)	New capital invested	Wages as % of sales	Advertising as % of sales	Number of full-time employees	Number of part-time employees
Gross sales (£'000)	Pearson Correlation	1	.123	.195	-.189	.418**	.297*
	Sig. (2-tailed)		.329	.120	.132	.000	.012
	N	73	65	65	65	71	70
New capital invested	Pearson Correlation	.123	1	.514**	.019	.084	.052
	Sig. (2-tailed)	.329		.000	.884	.514	.685
	N	65	65	59	59	63	63
Wages as % of sales	Pearson Correlation	.195	.514**	1	.172	.185	.128
	Sig. (2-tailed)	.120	.000		.167	.143	.316
	N	65	59	66	66	64	63
Advertising as % of sales	Pearson Correlation	-.189	.019	.172	1	-.097	-.085
	Sig. (2-tailed)	.132	.884	.167		.446	.509
	N	65	59	66	66	64	63
Number of full-time employees	Pearson Correlation	.418**	.084	.185	-.097	1	.467**
	Sig. (2-tailed)	.000	.514	.143	.446		.000
	N	71	63	64	64	72	71
Number of part-time employees	Pearson Correlation	.297*	.052	.128	-.085	.467**	1
	Sig. (2-tailed)	.012	.685	.316	.509	.000	
	N	70	63	63	63	71	71

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Number of full-time employees most significant, part-time employees also at 5%.

Full-time employees only

Looks reasonably linear

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	207.507	33.412		6.211	.000
	Number of full-time employees	10.749	2.811	.418	3.823	.000

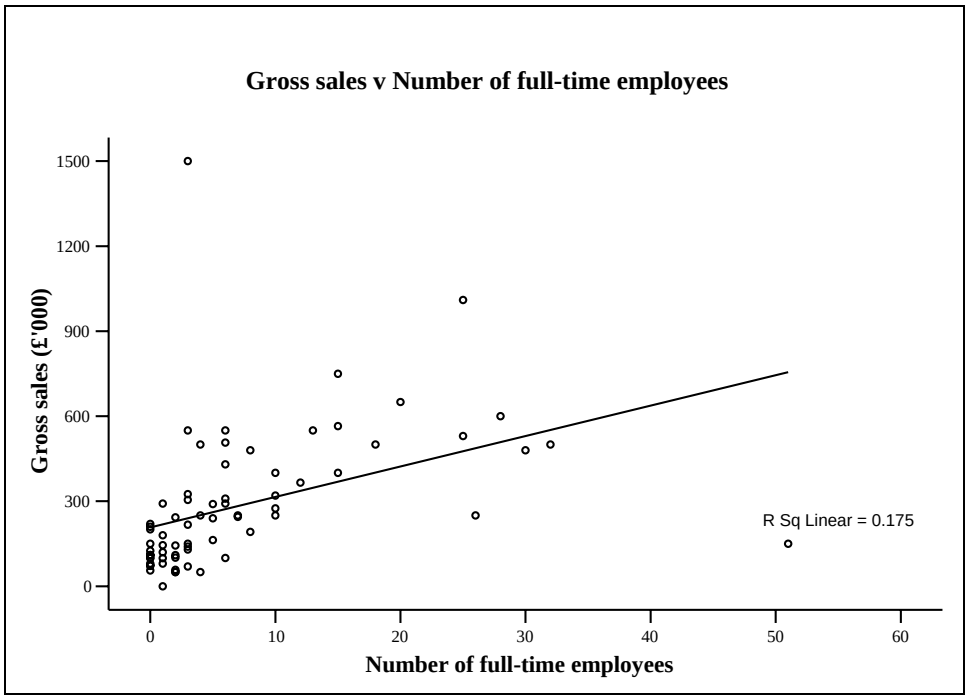
a. Dependent Variable: Gross sales (£'000)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.418[a]	.175	.163	225.295

a. Predictors: (Constant), Number of full-time employees

Gross sales = 208 + 10.7x no.of full-time employees Goodness of fit = 17.5%



Strong influence of outliers.

Restaurants only

Correlations

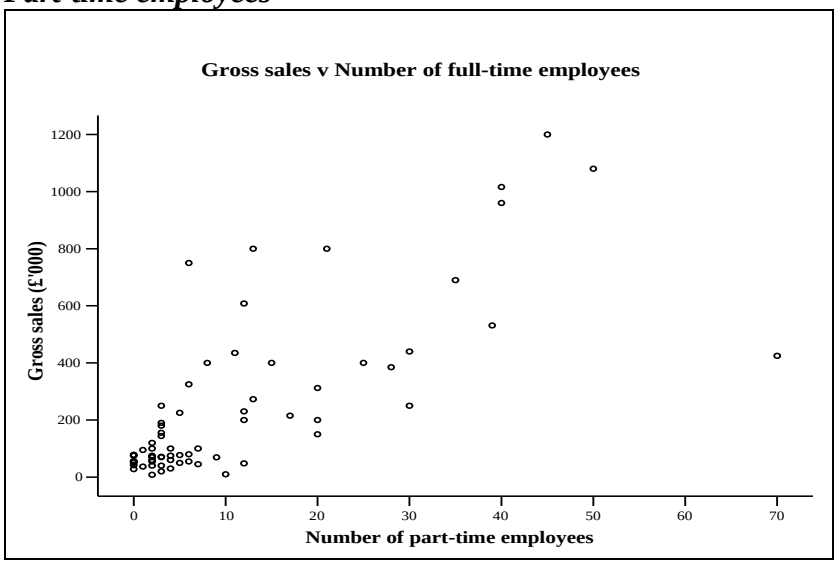
		Gross sales (£'000)	New capital invested	Wages as % of sales	Advertising as % of sales	Number of full-time employees	Number of part-time employees
Gross sales (£'000)	Pearson Correlation	1	.513**	.222	-.069	.724**	.737**
	Sig. (2-tailed)		.000	.089	.602	.000	.000
	N	67	58	60	60	64	66
New capital invested	Pearson Correlation	.513**	1	.254	.058	.616**	.306*
	Sig. (2-tailed)	.000		.061	.676	.000	.018
	N	58	59	55	55	57	59
Wages as % of sales	Pearson Correlation	.222	.254	1	.036	.292*	.200
	Sig. (2-tailed)	.089	.061		.776	.021	.114
	N	60	55	65	65	62	64
Advertising as % of sales	Pearson Correlation	-.069	.058	.036	1	.025	.004
	Sig. (2-tailed)	.602	.676	.776		.850	.977
	N	60	55	65	65	62	64
Number of full-time employees	Pearson Correlation	.724**	.616**	.292*	.025	1	.427**
	Sig. (2-tailed)	.000	.000	.021	.850		.000
	N	64	57	62	62	69	69
Number of part-time employees	Pearson Correlation	.737**	.306*	.200	.004	.427**	1
	Sig. (2-tailed)	.000	.018	.114	.977	.000	
	N	66	59	64	64	69	71

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Highest correlation for part-time employees. Full-time employees anf new capital invested both significant.

Part-time employees



Looks linear

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	79.868	31.295		2.552	.013
	Number of part-time employees	14.774	1.695	.737	8.719	.000

a. Dependent Variable: Gross sales (£'000)

Model Summary

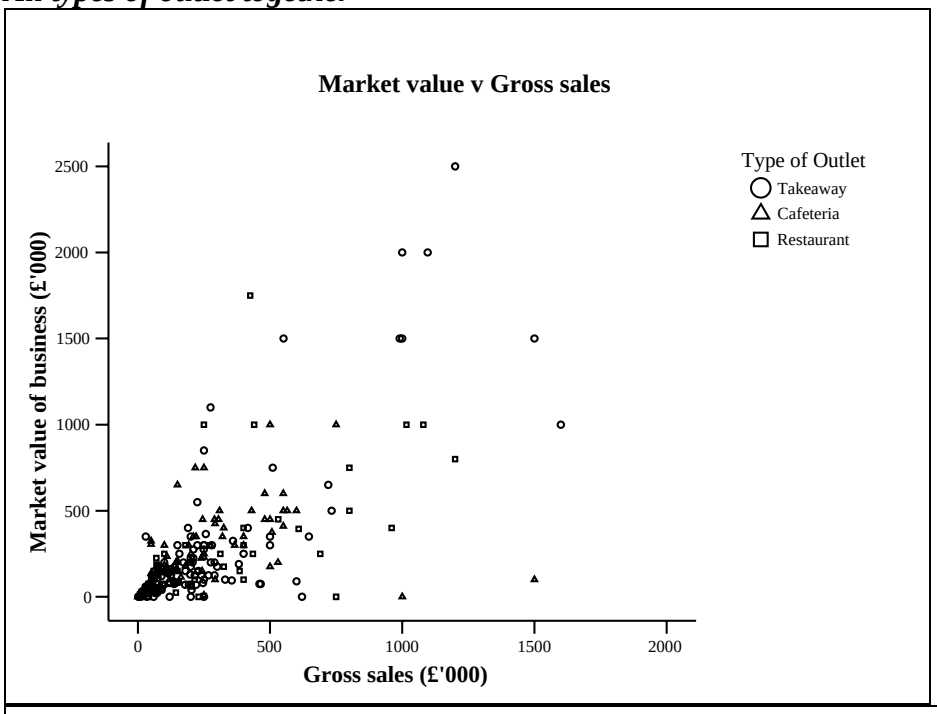
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.737[a]	.543	.536	196.919

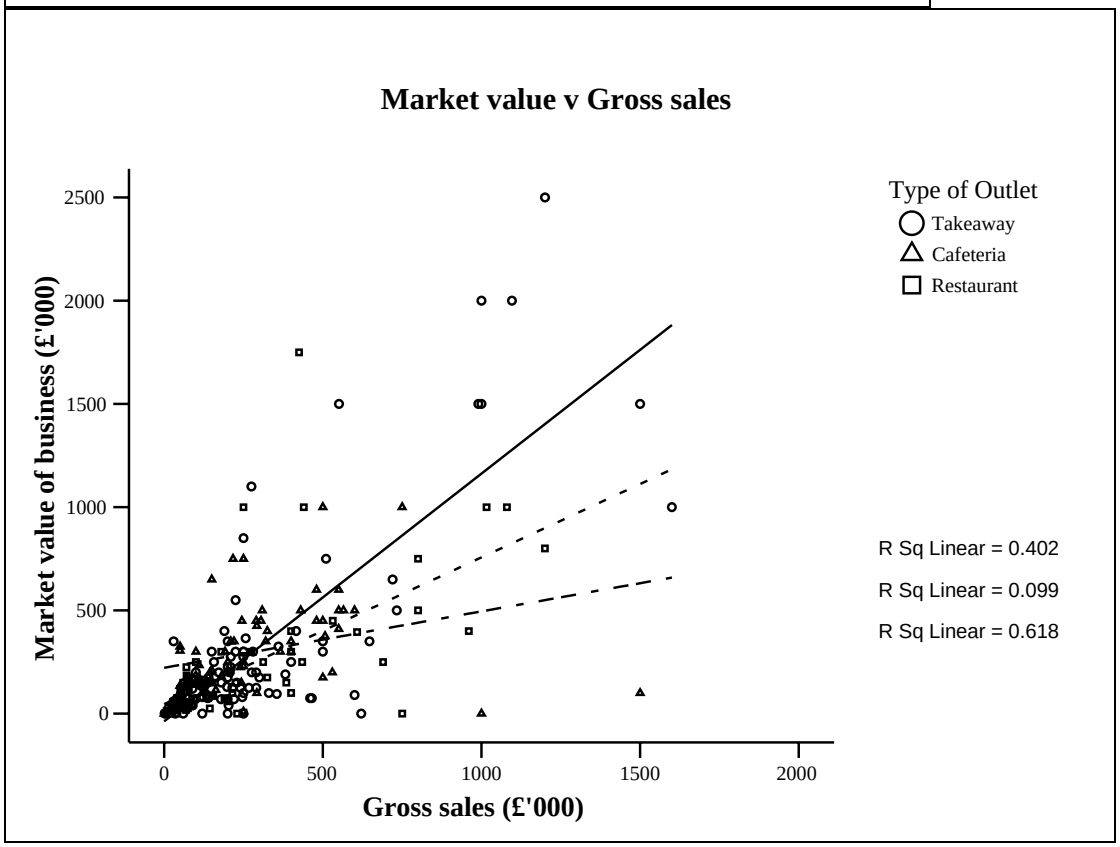
a. Predictors: (Constant), Number of part-time employees

Gross sales = 79.9 + 14.8 x no. of part-time employees Goodness of fit = 54.3%

c) Find the Pearson's correlation coefficient between the market value and gross sales. If significant, calculate the goodness of fit, the regression equation and carry out residual analysis.

All types of outlet together





Takeaways only

Correlations

		Gross sales (£'000)	Market value of business (£'000)
Gross sales (£'000)	Pearson Correlation	1	.786**
	Sig. (2-tailed)		.000
	N	104	96
Market value of business (£'000)	Pearson Correlation	.786**	1
	Sig. (2-tailed)	.000	
	N	96	99

**. Correlation is significant at the 0.01 level (2-tailed).

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-36.759	41.106		-.894	.373
	Gross sales (£'000)	1.199	.097	.786	12.344	.000

a. Dependent Variable: Market value of business (£'000)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.786[a]	.618	.614	292.985

a. Predictors: (Constant), Gross sales (£'000)

b. Dependent Variable: Market value of business (£'000)

Market value = -36.8 + 1.20 x gross sales Goodness of fit = 61.8%

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-34.36	1881.96	311.40	371.052	96
Residual	-881.958	1097.722	.000	291.439	96
Std. Predicted Value	-.932	4.233	.000	1.000	96
Std. Residual	-3.010	3.747	.000	.995	96

a. Dependent Variable: Market value of business (£'000)

Cafes only

Correlations

		Gross sales (£'000)	Market value of business (£'000)
Gross sales (£'000)	Pearson Correlation	1	.315**
	Sig. (2-tailed)		.008
	N	73	70
Market value of business (£'000)	Pearson Correlation	.315**	1
	Sig. (2-tailed)	.008	
	N	70	71

**. Correlation is significant at the 0.01 level (2-tailed).

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	222.047	36.923		6.014	.000
	Gross sales (£'000)	.273	.100	.315	2.734	.008

a. Dependent Variable: Market value of business (£'000)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.315[a]	.099	.086	201.490

a. Predictors: (Constant), Gross sales (£'000)

b. Dependent Variable: Market value of business (£'000)

Market value = 222 + 0.273 x gross sales Goodness of fit = 9.9%

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	222.05	631.75	298.57	66.320	70
Residual	-531.746	641.386	.000	200.024	70
Std. Predicted Value	-1.154	5.024	.000	1.000	70
Std. Residual	-2.639	3.183	.000	.993	70

a. Dependent Variable: Market value of business (£'000)

Restaurants only

Correlations

		Gross sales (£'000)	Market value of business (£'000)
Gross sales (£'000)	Pearson Correlation	1	.634**
	Sig. (2-tailed)		.000
	N	67	65
Market value of business (£'000)	Pearson Correlation	.634**	1
	Sig. (2-tailed)	.000	
	N	65	68

**. Correlation is significant at the 0.01 level (2-tailed).

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	46.058	42.038		1.096	.277
	Gross sales (£'000)	.711	.109	.634	6.514	.000

a. Dependent Variable: Market value of business (£'000)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.634[a]	.402	.393	253.054

a. Predictors: (Constant), Gross sales (£'000)

b. Dependent Variable: Market value of business (£'000)

Market value = 46.1 + 0.711 x gross sales Goodness of fit = 40.2%

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	51.75	899.10	228.22	206.041	65
Residual	-579.209	1401.823	.000	251.069	65
Std. Predicted Value	-.856	3.256	.000	1.000	65
Std. Residual	-2.289	5.540	.000	.992	65

a. Dependent Variable: Market value of business (£'000)

The takeaways have the largest marginal increase in market value for a given increase in gross sales. This is from the best fitting model.