

## Summary

Market data was included in the risk factor analysis for compliance with welfare legislation in dairy and beef cattle, sheep and pigs. The association between price and welfare compliance varied by enterprise type. There was a significantly reduced risk of non compliance as sheep and beef liveweight prices increased, however for cattle this was correlated with year of inspection and the effect became non significant when year was included in the model. In dairy cattle there was a significantly reduced risk of non compliance when milk price was increasing, though no association with absolute price. While for pigs no significant association between welfare compliance and market price was detected. In the future, analysis of a longer time window of data could further elucidate the relationship between market price and welfare compliance.

## Introduction

The relationship between economics and animal welfare has been well discussed (McInerney, 2004). Whilst animal welfare is a major public concern, demand for cheap food is strong, margins in animal production are small and action to improve animal welfare is frequently associated with increased costs (Appleby, 2005). It is recognised that animals that have little or no economic value (e.g. cull sheep in 1999) may be at particular risk of welfare compromise (FAWC, 2001). If farmers' actions to protect the welfare of their animals are sensitive to profit margins, either consciously or unconsciously, one might see more compliance with welfare legislation at times when market prices are higher. The aim of this study is to determine whether price fluctuation during 2003-2008 was associated with compliance with welfare legislation as inspected by Animal Health (AH).

## Method

### Market data

Market data on beef cattle, sheep, pig and dairy cow milk prices were provided by the Agricultural and Horticultural Development Board (AHDB). The price data presented in this report represent only a small number of the market indicators that AHDB analyse. Outcomes such as cull cow and weaner pig price, are available, however, it was beyond the scope of this study to include all possible predictors. No discussion or analysis of the price data *per se* is included in this report as this is comprehensively addressed in AHDB's own publications (see [www.bpex.org.uk](http://www.bpex.org.uk); [www.eblex.org.uk](http://www.eblex.org.uk); [www.dairyco.org.uk](http://www.dairyco.org.uk))

The geographic resolution of data available varied by species. For sheep and prime beef cattle the weekly Standard Quality Quotation (SQQ) average liveweight pence per kg from Scottish, English and Welsh auction marts were used. Monthly averages were calculated from the weekly data. For pigs, the monthly deadweight average pig price (DAPP) pence per kg (euro specification) for Britain was used, but was not available for Jan and Feb 2003. For milk, the average monthly farm gate price per litre for Britain was used.

### Animal Health inspection data

Data on 38,659 inspections between Jan 2003 and Dec 2008 were analysed. Data were provided on the date of the inspection, reason for the inspection, number of animals inspected, country and enterprise type. Data on membership of farm assurance and organic certification schemes was supplied by the scheme providers. See AW0512 report for detail on the AH and certification scheme data.

### Data analysis

The outcome of interest was compliance with welfare legislation (AH code A or B) as inspected by AH versus non compliance with legislation (code C or D). Binary binomial multilevel, multivariable models were developed to investigate the association between price and welfare compliance. Separate models were constructed for pigs, sheep, dairy and beef cattle. The beef cattle model included calf and growing cattle inspections, we recognise that a proportion of these inspections are of dairy enterprises, however, as AH do not classify inspections of these enterprises as dairy or beef it was not possible to exclude them.

Price data, pence per kg or per litre, were categorised into quintiles to check for a linear association with the outcome. Four predictor variables were tested; average price during the month of inspection, average price during the three months prior to inspection (including the inspection month), average price in the six months prior to inspection (including the inspection month) and direction of price fluctuation i.e. whether average price had increased or decreased from the previous month. As in previous analyses, all models controlled for enterprise type, visit type, country, number of animals inspected and certification status. The association between these variables and the outcome has been explored previously and will not be commented on further here. Random effects were included to account for the clustering of data within counties, locations (CPH / farm address) and enterprises (where appropriate). An additional variable was added to the models to control for the seasonal variation in welfare compliance. Year of

inspection was correlated with market price for some enterprises so models are presented with and without year to allow for comparison.

## Results

### Compliance with welfare legislation over time

There was a trend for compliance with welfare legislation to increase with calendar year (Graph 1 and see Tables 8 and 10-13 in AW0510 report for percent by year and for models accounting for year). The percent of AH inspections where the enterprise was compliant with legislation varied by season. Compliance in winter, spring, summer and autumn was; 66.2, 67.4, 76.3 and 77.6% respectively. A variable of winter / spring verses summer / autumn was used to control for this seasonal effect in the models.

In the raw data there was a trend for percent welfare compliance to increase with increasing price in cattle and dairy cows but not pigs or sheep (Table 1).

Graph 1. Percent of Animal Health inspections compliant with welfare legislation from Jan 2003 to Dec 2008

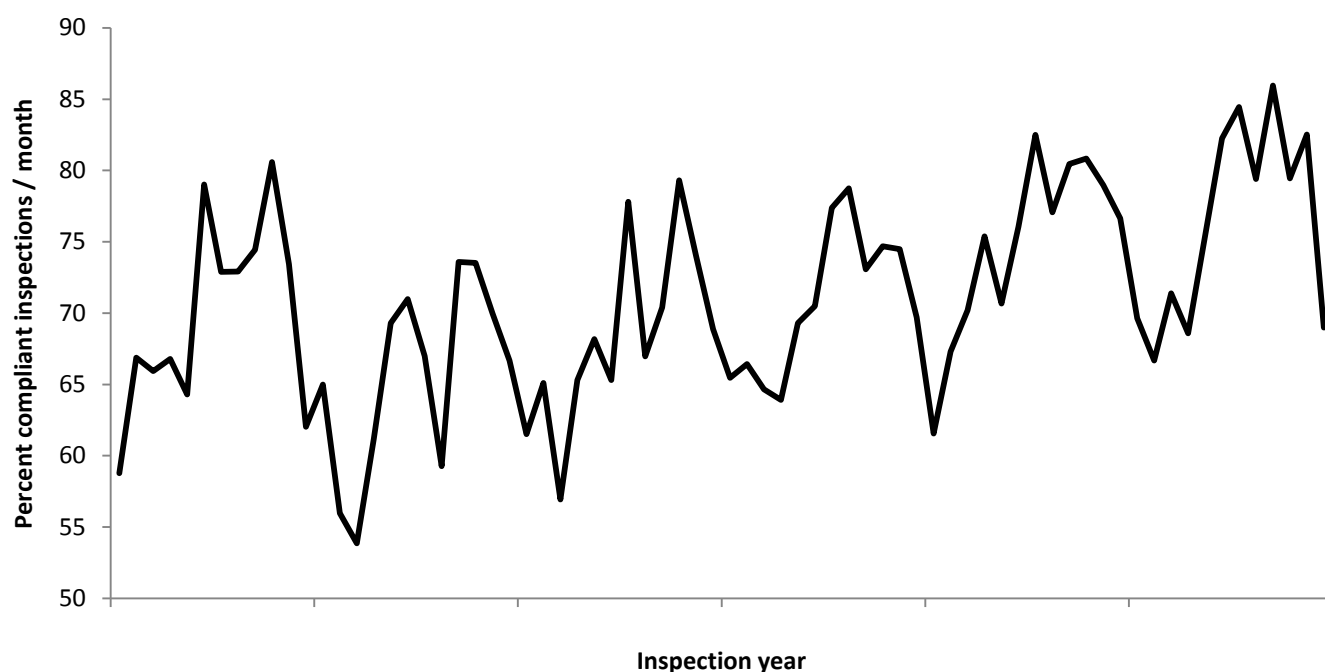


Table 1. Number and percent of inspections to beef cattle, sheep, pig and dairy cow enterprises compliant with welfare legislation by market price during inspection month, three month average, six month average or price change from previous month

		Beef cattle		Sheep		Pigs		Dairy cows	
		n	%	n	%	n	%	n	%
Quintiles of price in inspection month	Lowest 20%	2044	64.40	1283	67.56	629	71.07	301	67.95
	21 – 40%	1921	60.52	1229	64.72	607	68.59	298	67.27
	41 – 60%	2234	70.38	1283	67.56	635	71.75	284	64.11
	61 – 80%	2256	71.08	1349	71.04	616	69.60	348	78.56
	Highest 20%	2558	80.49	1326	69.53	631	71.22	376	84.88
Quintiles of three month average price	Lowest 20%	2036	65.91	1290	68.8	622	71.49	299	69.53
	21 – 40%	1834	59.37	1197	63.84	609	70.00	289	67.21
	41 – 60%	2248	72.77	1252	66.77	594	68.28	272	63.26
	61 – 80%	2193	70.99	1311	69.92	628	72.18	346	80.47
	Highest 20%	2494	80.63	1347	71.73	622	71.17	361	82.99
Quintiles of six month price average	Lowest 20%	1925	64.23	1247	68.67	566	66.51	284	67.46
	21 – 40%	1840	61.39	1174	64.65	625	73.44	282	66.98
	41 – 60%	2197	73.31	1210	66.63	621	72.97	273	64.85
	61 – 80%	2121	70.77	1187	65.36	593	69.68	341	81.00
	Highest 20%	2432	81.04	1375	75.80	613	71.78	349	83.10
Price change from previous month	Price decreasing	4382	69.12	3258	69.60	799	70.65	716	67.80
	Price increasing	6439	70.07	3038	66.56	922	70.49	876	77.32

Sheep

Compliance with welfare legislation was 68.1% of 9641 inspections of sheep enterprises. Monthly average compliance fluctuated between 48 and 89% between 2003 and 2008. Prices for Scotland, England and Wales varied minimally. Market prices peaked in spring / summer. There was a notable price increase in 2008 (Graph 2)

There was a significantly reduced risk of non compliance with welfare legislation when liveweight sheep prices in the inspection month were greater than 118 pence / kg (categories 4 and 5). Six and three month average price and price change direction were not significantly associated with compliance (Table 2). When year of inspection was added, the association between price during month of inspection and welfare compliance remained the same (Table 3)

Graph 2. Scotland, England and Wales monthly average liveweight Standard Quality Quotation sheep price and percent compliant Animal Health inspections from Jan 2003 to Dec 2008

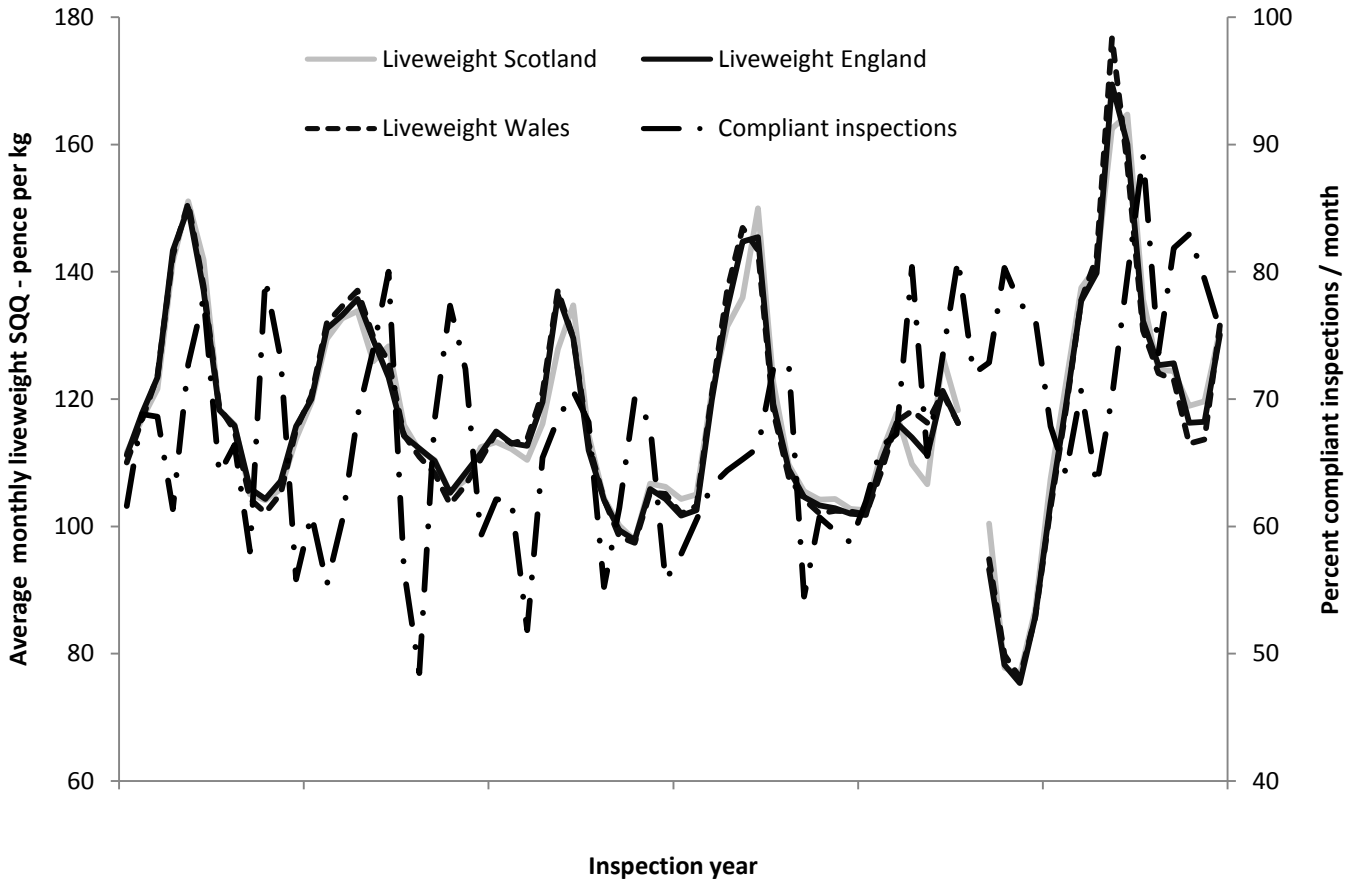


Table 2. Three level logistic binomial models of the association between liveweight sheep price and non compliance with welfare legislation on sheep enterprises in Britain from 2003 to 2008 adjusted by month of inspection, country, number of animals inspected, visit type and certification status

		Price in inspection month n=9641		Three month average price n=9378			Six month price average n=9078			Price change from previous month n=9245			
Intercept coefficient		-1.63		-1.74			-1.86			-1.69			
		OR	CI	OR	CI		OR	CI		OR	CI		
Sheep price <sup>1</sup>	Category 1	Ref		Ref			Ref						
	Category 2	1.04	0.89	1.22	1.14	0.97	1.34	1.10	0.94	1.30			
	Category 3	0.91	0.78	1.07	1.04	0.89	1.23	1.07	0.91	1.26			
	Category 4	<b>0.82</b>	<b>0.70</b>	<b>0.97</b>	0.96	0.82	1.14	1.17	0.99	1.38			
	Category 5	<b>0.81</b>	<b>0.68</b>	<b>0.95</b>	0.87	0.74	1.03	0.86	0.71	1.04			
Price change	Decreasing									Ref			
	Increasing									0.96	0.86	1.08	
Month of inspection	Winter/Spring	Ref		Ref			Ref			Ref			
	Summer/Autumn	<b>0.80</b>	<b>0.72</b>	<b>0.90</b>	<b>0.85</b>	<b>0.77</b>	<b>0.95</b>	0.89	0.78	1.01	<b>0.83</b>	<b>0.74</b>	<b>0.93</b>
Country	England	Ref		Ref			Ref			Ref			
	Scotland	<b>1.34</b>	<b>1.03</b>	<b>1.75</b>	1.28	0.98	1.67	1.29	0.98	1.68	1.28	0.98	1.66
	Wales	1.23	0.86	1.77	1.29	0.89	1.85	1.30	0.90	1.87	1.25	0.87	1.78
Number of animals inspected <sup>2</sup>	Category 1	Ref		Ref			Ref			Ref			
	Category 2	1.01	0.85	1.18	0.98	0.83	1.15	1.00	0.85	1.19	1.00	0.84	1.17
	Category 3	0.97	0.82	1.14	0.93	0.79	1.11	0.95	0.80	1.12	0.95	0.81	1.13
	Category 4	1.00	0.85	1.18	0.91	0.77	1.08	0.95	0.80	1.13	0.96	0.81	1.13
	Category 5	1.03	0.86	1.22	0.96	0.81	1.15	0.99	0.83	1.18	0.99	0.83	1.18
Visit type	Programmed												
	Elective	<b>0.46</b>	<b>0.29</b>	<b>0.72</b>	<b>0.43</b>	<b>0.27</b>	<b>0.68</b>	<b>0.43</b>	<b>0.27</b>	<b>0.70</b>	<b>0.43</b>	<b>0.27</b>	<b>0.68</b>
	Complaint	<b>3.93</b>	<b>3.00</b>	<b>5.14</b>	<b>3.93</b>	<b>2.99</b>	<b>5.16</b>	<b>4.24</b>	<b>3.21</b>	<b>5.61</b>	<b>3.80</b>	<b>2.89</b>	<b>4.99</b>
	Targeted	<b>2.26</b>	<b>1.72</b>	<b>2.96</b>	<b>2.30</b>	<b>1.75</b>	<b>3.03</b>	<b>2.42</b>	<b>1.83</b>	<b>3.21</b>	<b>2.22</b>	<b>1.69</b>	<b>2.92</b>
	XC risk based	0.95	0.68	1.35	0.98	0.22	4.34	1.04	0.73	1.48	0.92	0.65	1.30
	XC random	0.73	0.44	1.21	0.79	0.48	1.29	0.84	0.51	1.38	0.75	0.46	1.24
Certification status	Organic	<b>0.62</b>	<b>0.39</b>	<b>0.98</b>	<b>0.50</b>	<b>0.32</b>	<b>0.78</b>	0.57	0.32	1.02	<b>0.57</b>	<b>0.36</b>	<b>0.89</b>
	Assured	<b>0.60</b>	<b>0.53</b>	<b>0.69</b>	<b>0.68</b>	<b>0.60</b>	<b>0.77</b>	<b>0.68</b>	<b>0.60</b>	<b>0.77</b>	<b>0.69</b>	<b>0.61</b>	<b>0.78</b>
Random effects	County	0.16	0.04		0.16	0.04		0.16	0.04		0.16	0.04	
	Locations	0.66	0.07		0.65	0.07		0.64	0.07		0.66	0.07	

<sup>1</sup> inspection month price per kg in pence; cat. 1≤104.2, cat. 2=104.2-111.9, cat. 3=112.0-118.3, cat. 4=118.4-131.1, cat. 5≥131.2; three month price per kg in pence; 1≤103.2, cat. 2=103.3-111.4, cat. 3=111.5-118.5, cat. 4=118.6-129.0, cat. 5≥129.1; six month price per kg in pence; 1≤103.9, cat. 2=104.0- 110.4, cat. 3=110.5-116.3, cat. 4=116.4-126.9, cat. 5≥127.0

<sup>2</sup>cat. 1≤24, cat. 2=25-60, cat. 3=61-150, cat. 4=151-300, cat. 5≥300

Table 3. Three level logistic binomial models of the association between liveweight sheep price and non compliance with welfare legislation on sheep enterprises in Britain from 2003 to 2008 adjusted by year, country, number of animals inspected, visit type and certification status

		Price in inspection month n=9641			Three month average price n=9378			Six month price average n=9078			Price change from previous month n=9245		
Intercept coefficient		-1.75			-1.88			-2.00			-1.96		
		OR	CI		OR	CI		OR	CI		OR	CI	
Sheep price <sup>1</sup>	Category 1	Ref			Ref			Ref					
	Category 2	0.99	0.84	1.17	1.05	0.88	1.24	1.06	0.89	1.25			
	Category 3	0.94	0.79	1.11	0.97	0.82	1.15	0.91	0.76	1.08			
	Category 4	<b>0.79</b>	<b>0.66</b>	<b>0.94</b>	0.90	0.75	1.08	0.98	0.82	1.17			
	Category 5	<b>0.79</b>	<b>0.66</b>	<b>0.95</b>	0.83	0.69	1.00	0.76	0.56	1.03			
Price change	Decreasing										Ref		
	Increasing										0.97	0.87	1.09
Year	2008	Ref			Ref			Ref			Ref		
	2007	0.94	0.78	1.13	0.97	0.80	1.18	0.97	0.80	1.18	1.08	0.91	1.28
	2006	<b>1.29</b>	<b>1.08</b>	<b>1.55</b>	<b>1.36</b>	<b>1.13</b>	<b>1.64</b>	<b>1.38</b>	<b>1.15</b>	<b>1.65</b>	<b>1.47</b>	<b>1.24</b>	<b>1.75</b>
	2005	<b>1.28</b>	<b>1.06</b>	<b>1.54</b>	<b>1.38</b>	<b>1.13</b>	<b>1.69</b>	<b>1.39</b>	<b>1.14</b>	<b>1.70</b>	<b>1.52</b>	<b>1.27</b>	<b>1.82</b>
	2004	<b>1.37</b>	<b>1.13</b>	<b>1.66</b>	<b>1.45</b>	<b>1.19</b>	<b>1.77</b>	<b>1.48</b>	<b>1.21</b>	<b>1.81</b>	<b>1.51</b>	<b>1.25</b>	<b>1.83</b>
	2003	1.09	0.89	1.33	1.18	0.95	1.47	<b>1.50</b>	<b>1.16</b>	<b>1.93</b>	1.23	1.00	1.51
Season	Winter/Spring	Ref			Ref			Ref			Ref		
	Summer/Autumn	<b>0.80</b>	<b>0.72</b>	<b>0.89</b>	<b>0.85</b>	<b>0.76</b>	<b>0.94</b>	0.90	0.79	1.04	<b>0.82</b>	<b>0.73</b>	<b>0.93</b>
Country	England	Ref			Ref			Ref			Ref		
	Scotland	<b>1.37</b>	<b>1.05</b>	<b>1.79</b>	1.30	1.00	1.70	1.30	0.99	1.71	1.29	0.99	1.68
	Wales	1.23	0.85	1.77	1.29	0.90	1.86	1.29	0.89	1.86	1.25	0.87	1.79
Number of animals inspected <sup>2</sup>	Category 1	Ref			Ref			Ref			Ref		
	Category 2	1.01	0.86	1.19	0.98	0.83	1.16	1.01	0.85	1.19	1.00	0.84	1.18
	Category 3	0.97	0.82	1.14	0.94	0.79	1.11	0.95	0.80	1.12	0.96	0.81	1.13
	Category 4	1.00	0.85	1.19	0.91	0.77	1.08	0.94	0.79	1.12	0.95	0.80	1.12
	Category 5	1.04	0.87	1.23	0.96	0.81	1.15	0.99	0.82	1.18	0.99	0.83	1.18
Visit type	Programmed	Ref			Ref			Ref			Ref		
	Elective	<b>0.45</b>	<b>0.28</b>	<b>0.70</b>	<b>0.42</b>	<b>0.26</b>	<b>0.67</b>	<b>0.42</b>	<b>0.26</b>	<b>0.69</b>	<b>0.41</b>	<b>0.26</b>	<b>0.66</b>
	Complaint	<b>3.91</b>	<b>2.98</b>	<b>5.13</b>	<b>3.88</b>	<b>2.96</b>	<b>5.10</b>	<b>4.25</b>	<b>3.20</b>	<b>5.63</b>	<b>3.76</b>	<b>2.86</b>	<b>4.95</b>
	Targeted	<b>2.26</b>	<b>1.72</b>	<b>2.97</b>	<b>2.33</b>	<b>1.77</b>	<b>3.08</b>	<b>2.50</b>	<b>1.88</b>	<b>3.32</b>	<b>2.27</b>	<b>1.72</b>	<b>3.00</b>
	XC Risk based	1.13	0.79	1.61	1.21	0.84	1.72	1.32	0.92	1.90	1.17	0.81	1.68
	XC random	0.87	0.52	1.45	0.96	0.59	1.58	1.05	0.63	1.74	0.95	0.57	1.58
Certification status	Organic	<b>0.63</b>	<b>0.40</b>	<b>0.99</b>	<b>0.55</b>	<b>0.35</b>	<b>0.87</b>	<b>0.57</b>	<b>0.36</b>	<b>0.89</b>	<b>0.57</b>	<b>0.36</b>	<b>0.89</b>
	Assured	<b>0.59</b>	<b>0.51</b>	<b>0.67</b>	<b>0.67</b>	<b>0.59</b>	<b>0.76</b>	<b>0.67</b>	<b>0.59</b>	<b>0.76</b>	<b>0.68</b>	<b>0.60</b>	<b>0.77</b>
Random effects	County	0.17	0.04		0.16	0.04		0.16	0.04		0.16	0.04	
	Locations	0.66	0.07		0.64	0.07		0.64	0.07		0.65	0.07	

<sup>1</sup> inspection month price per kg in pence; cat. 1≤104.2, cat. 2=104.2-111.9, cat. 3=112.0-118.3, cat. 4=118.4-131.1, cat. 5≥131.2; three month price per kg in pence; 1≤103.2, cat. 2=103.3-111.4, cat. 3=111.5-118.5, cat. 4=118.6-129.0, cat. 5≥129.1; six month price per kg in pence; 1≤103.9, cat. 2=104.0- 110.4, cat. 3=110.5-116.3, cat. 4=116.4-126.9, cat. 5≥127.0

<sup>2</sup> cat. 1≤24, cat. 2=25-60, cat. 3=61-150, cat. 4=151-300, cat. 5≥300

## Cattle

Overall 69.4% of 15988 inspections of calf, growing cattle and breeding beef enterprises were compliant with welfare legislation. Monthly average compliance fluctuated between 49 and 88% from 2003 to 2008. There was a trend for market prices to be approximately 10 pence / kg higher in Scotland compared with England and Wales. There was a notable price increase from late 2007 into 2008 (Graph 3)

There was a significantly reduced risk of non compliance in inspections of cattle enterprises when the monthly average price was 113 pence / kg or more (categories 4 and 5) during the month of inspection, or where the three month average was 112 pence /kg or more (categories 4 and 5) or where the six month average was 140 pence / kg or more (category 5). There was also a significantly reduced risk of non compliance when the price had increased from the previous month (Table 4). However, market price was correlated with year of inspection and when year was included in the model, price was no longer significant (Table 5). When the data were broken down by year, in 2003, 2007 and 2008 there was a trend for increased prices in the month of inspection to be associated with reduced risk of non compliance, however none of these effects were significant. In 2004, 2005 and 2006 there was no indication that price was associated with risk of non compliance (data not shown).

Graph 3. Scotland, England and Wales monthly liveweight average prime cattle price and percent compliant Animal Health inspections from Jan 2003 to Dec 2008

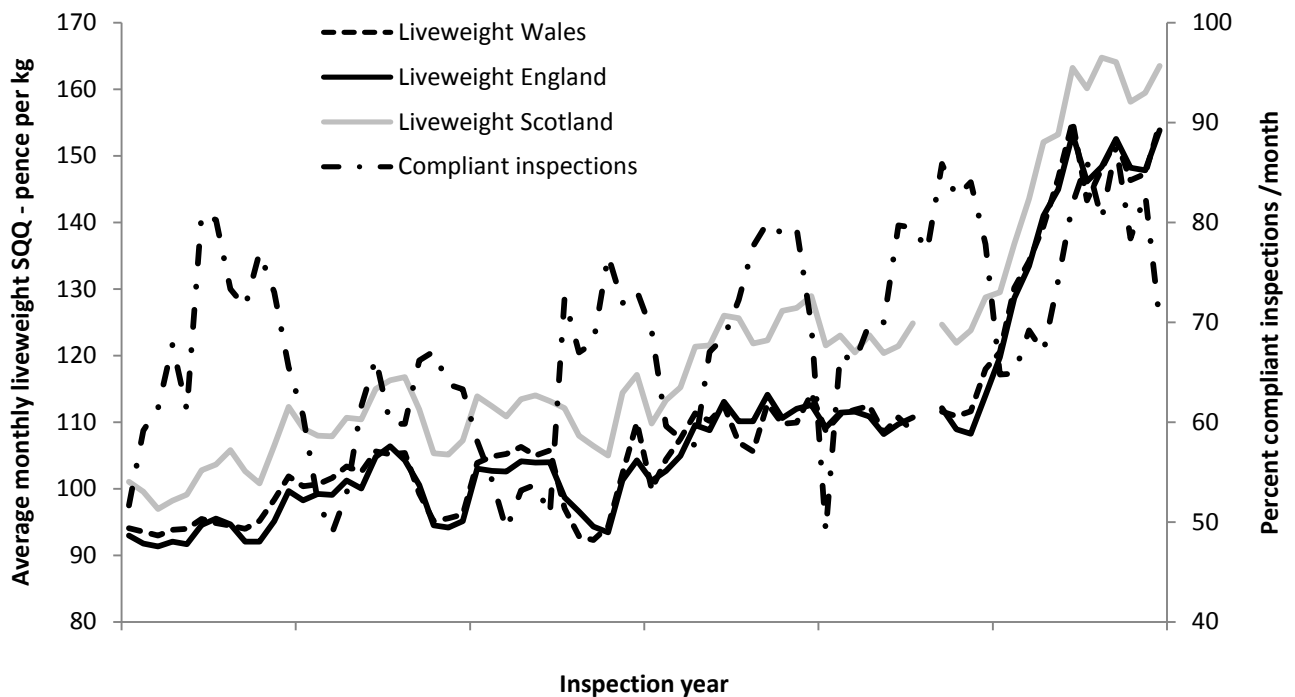


Table 4. Four level logistic binomial models of the association between prime liveweight cattle price and non compliance with welfare legislation on cattle enterprises in Britain from 2003-2008 adjusted by country, enterprise type, number of animals inspected, visit type and certification status

		Price in inspection month n=15874			Three month average price n=15449			Six month price average n=14989			Price change from previous month n=15529		
Intercept coefficient		-1.85			-1.87			-1.87			-1.40		
		OR	CI		OR	CI		OR	CI		OR	CI	
Cattle price <sup>1</sup>	Category 1	Ref			Ref			Ref					
	Category 2	1.00	0.86	1.15	1.08	0.94	1.25	1.13	0.97	1.30			
	Category 3	1.13	0.97	1.31	0.88	0.76	1.03	0.85	0.73	1.00			
	Category 4	<b>0.76</b>	<b>0.64</b>	<b>0.89</b>	<b>0.80</b>	<b>0.68</b>	<b>0.95</b>	0.84	0.71	1.00			
	Category 5	<b>0.71</b>	<b>0.59</b>	<b>0.86</b>	<b>0.80</b>	<b>0.67</b>	<b>0.97</b>	<b>0.77</b>	<b>0.63</b>	<b>0.94</b>			
Price change	Decreasing										Ref		
	Increasing										<b>0.89</b>	<b>0.81</b>	<b>0.98</b>
Season	Winter / spring	Ref			Ref			Ref			Ref		
	Summer / autumn	<b>0.73</b>	<b>0.66</b>	<b>0.81</b>	<b>0.73</b>	<b>0.66</b>	<b>0.81</b>	<b>0.71</b>	<b>0.64</b>	<b>0.79</b>	<b>0.71</b>	<b>0.64</b>	<b>0.79</b>
Country	England	Ref			Ref			Ref			Ref		
	Scotland	1.15	0.88	1.52	1.19	0.90	1.58	1.18	0.89	1.56	1.07	0.82	1.41
	Wales	0.98	0.66	1.43	1.00	0.67	1.48	1.00	0.67	1.48	0.98	0.67	1.45
Visit type	Programmed	Ref			Ref			Ref			Ref		
	Elective	1.12	0.79	1.57	0.99	0.69	1.42	1.02	0.71	1.46	1.04	0.73	1.48
	Complaint	<b>3.90</b>	<b>3.10</b>	<b>4.91</b>	<b>3.98</b>	<b>3.15</b>	<b>5.03</b>	<b>4.05</b>	<b>3.20</b>	<b>5.14</b>	<b>3.70</b>	<b>2.93</b>	<b>4.67</b>
	Targeted	<b>2.81</b>	<b>2.23</b>	<b>3.53</b>	<b>2.90</b>	<b>2.30</b>	<b>3.65</b>	<b>2.89</b>	<b>2.29</b>	<b>3.65</b>	<b>2.50</b>	<b>1.99</b>	<b>3.15</b>
	XC risk based	<b>1.45</b>	<b>1.10</b>	<b>1.92</b>	<b>1.46</b>	<b>1.10</b>	<b>1.94</b>	<b>1.49</b>	<b>1.12</b>	<b>1.97</b>	1.19	0.91	1.55
Number of animals inspected <sup>2</sup>	XC random	0.82	0.54	1.25	0.80	0.53	1.22	0.83	0.54	1.26	0.73	0.49	1.10
	Category 1	Ref			Ref			Ref			Ref		
	Category 2	1.00	0.86	1.15	1.06	0.91	1.23	1.06	0.91	1.23	1.10	0.95	1.28
	Category 3	0.89	0.76	1.03	1.14	0.98	1.33	1.16	0.99	1.36	<b>1.22</b>	<b>1.04</b>	<b>1.42</b>
	Category 4	<b>0.76</b>	<b>0.64</b>	<b>0.89</b>	<b>1.39</b>	<b>1.19</b>	<b>1.62</b>	<b>1.41</b>	<b>1.21</b>	<b>1.65</b>	<b>1.42</b>	<b>1.21</b>	<b>1.66</b>
Enterprise type	Category 5	<b>0.71</b>	<b>0.59</b>	<b>0.86</b>	<b>1.35</b>	<b>1.15</b>	<b>1.59</b>	<b>1.37</b>	<b>1.16</b>	<b>1.62</b>	<b>1.41</b>	<b>1.19</b>	<b>1.66</b>
	Breeding beef	Ref			Ref			Ref			Ref		
	Growing cattle	0.95	0.85	1.05	0.95	0.85	1.05	0.95	0.85	1.06	0.94	0.84	1.04
Certification status	Calves	0.89	0.79	1.01	0.90	0.79	1.02	0.90	0.79	1.02	0.88	0.77	1.00
	Organic	<b>0.35</b>	<b>0.20</b>	<b>0.60</b>	<b>0.33</b>	<b>0.19</b>	<b>0.58</b>	<b>0.31</b>	<b>0.17</b>	<b>0.55</b>	<b>0.33</b>	<b>0.19</b>	<b>0.59</b>
Random effects	Assured	<b>0.45</b>	<b>0.39</b>	<b>0.51</b>	<b>0.43</b>	<b>0.37</b>	<b>0.49</b>	<b>0.42</b>	<b>0.36</b>	<b>0.48</b>	<b>0.46</b>	<b>0.40</b>	<b>0.53</b>
	County	0.17	0.04		0.19	0.05		0.19	0.05		0.17	0.04	
	Locations	0.99	0.08		0.93	0.08		0.94	0.08		1.17	0.09	
	enterprise	0.73	0.08		0.84	0.08		0.86	0.08		0.61	0.08	

<sup>1</sup> inspection month price per kg in pence; cat. 1≤100.5, cat. 2=100.6-108.2, cat. 3=108.3-112.5, cat. 4=112.6-144.9, cat. 5≥145.0: three month price per kg in pence; 1≤100.3, cat. 2=100.4-109.5, cat. 3=109.6-111.6, cat. 4=111.7-139.7, cat. 5≥139.8: six month price per kg in pence; cat. 1≤100.0, cat. 2=100.1- 109.8, cat. 3=109.9-111.6, cat. 4=111.7-135.7, cat. 5≥135.8

<sup>2</sup>cat. 1≤10, cat. 2=11-24, cat. 3=25-48, cat. 4=49-97, cat. 5≥98

Table 5. Four level logistic binomial models of the association between cattle price and non compliance with welfare legislation on cattle enterprises in Britain from 2003-2008 adjusted by year, country, enterprise type, number of animals inspected, visit type and certification status

		Price in inspection month n=15874			Three month average price n=15449			Six month price average n=14989			Price change from previous month n=15529		
Intercept coefficient		-2.10			-2.05			-2.07			-1.70		
		OR	CI		OR	CI		OR	CI		OR	CI	
Cattle price <sup>1</sup>	Category 1	Ref			Ref			Ref					
	Category 2	1.09	0.91	1.30	<b>1.23</b>	<b>1.03</b>	<b>1.46</b>	<b>1.20</b>	<b>1.02</b>	<b>1.42</b>			
	Category 3	1.23	0.96	1.57	1.23	0.94	1.59	1.05	0.82	1.36			
	Category 4	1.02	0.76	1.36	1.05	0.78	1.41	1.05	0.77	1.43			
	Category 5	0.91	0.63	1.33	0.93	0.63	1.37	0.96	0.64	1.46			
Price change	Decreasing										Ref		
	Increasing										0.95	0.85	1.05
Year	2008	Ref			Ref			Ref			Ref		
	2007	0.86	0.68	1.10	0.85	0.65	1.10	0.97	0.75	1.25	1.05	0.90	1.23
	2006	0.90	0.70	1.14	0.85	0.65	1.09	0.91	0.67	1.22	<b>1.55</b>	<b>1.31</b>	<b>1.85</b>
	2005	1.24	0.93	1.67	1.19	0.87	1.63	1.26	0.89	1.77	<b>1.37</b>	<b>1.15</b>	<b>1.64</b>
	2004	<b>1.49</b>	<b>1.08</b>	<b>2.07</b>	<b>1.43</b>	<b>1.02</b>	<b>1.99</b>	<b>1.45</b>	<b>1.02</b>	<b>2.05</b>	<b>1.59</b>	<b>1.33</b>	<b>1.92</b>
	2003	1.18	0.83	1.68	1.07	0.73	1.57	1.15	0.75	1.78	1.21	0.99	1.48
Season	Winter/spring	Ref			Ref			Ref			Ref		
	Summer/autumn	<b>0.72</b>	<b>0.64</b>	<b>0.80</b>	<b>0.72</b>	<b>0.64</b>	<b>0.80</b>	<b>0.69</b>	<b>0.61</b>	<b>0.78</b>	<b>0.71</b>	<b>0.64</b>	<b>0.79</b>
Country	England	Ref			Ref			Ref			Ref		
	Scotland	1.06	0.80	1.41	1.12	0.84	1.50	1.09	0.81	1.47	1.05	0.80	1.39
	Wales	0.98	0.67	1.45	1.01	0.68	1.50	1.01	0.68	1.51	0.99	0.67	1.46
Visit type	Programmed	Ref			Ref			Ref			Ref		
	Elective	1.13	0.80	1.59	0.98	0.69	1.40	1.02	0.71	1.46	1.06	0.74	1.51
	Complaint	<b>3.94</b>	<b>3.13</b>	<b>4.97</b>	<b>3.98</b>	<b>3.15</b>	<b>5.03</b>	<b>4.07</b>	<b>3.21</b>	<b>5.16</b>	<b>3.83</b>	<b>3.03</b>	<b>4.85</b>
	Targeted	<b>2.85</b>	<b>2.26</b>	<b>3.58</b>	<b>2.93</b>	<b>2.32</b>	<b>3.69</b>	<b>2.95</b>	<b>2.33</b>	<b>3.73</b>	<b>2.64</b>	<b>2.09</b>	<b>3.33</b>
	XC risk based	<b>1.52</b>	<b>1.14</b>	<b>2.02</b>	<b>1.50</b>	<b>1.13</b>	<b>1.99</b>	<b>1.53</b>	<b>1.14</b>	<b>2.04</b>	<b>1.47</b>	<b>1.10</b>	<b>1.96</b>
	XC random	0.87	0.57	1.33	0.83	0.54	1.27	0.85	0.56	1.30	0.89	0.58	1.35
Number of animals inspected <sup>2</sup>	Category 1	Ref			Ref			Ref			Ref		
	Category 2	1.10	0.95	1.27	1.05	0.90	1.22	1.05	0.90	1.22	1.08	0.93	1.26
	Category 3	<b>1.18</b>	<b>1.02</b>	<b>1.37</b>	1.13	0.97	1.32	1.15	0.99	1.35	<b>1.19</b>	<b>1.02</b>	<b>1.39</b>
	Category 4	<b>1.43</b>	<b>1.23</b>	<b>1.66</b>	<b>1.39</b>	<b>1.19</b>	<b>1.62</b>	<b>1.40</b>	<b>1.20</b>	<b>1.65</b>	<b>1.26</b>	<b>1.08</b>	<b>1.48</b>
	Category 5	<b>1.34</b>	<b>1.13</b>	<b>1.59</b>	<b>1.34</b>	<b>1.14</b>	<b>1.58</b>	<b>1.36</b>	<b>1.15</b>	<b>1.61</b>	<b>1.36</b>	<b>1.15</b>	<b>1.61</b>
Enterprise type	Breeding beef	Ref			Ref			Ref			Ref		
	Growing cattle	0.94	0.85	1.05	0.94	0.85	1.04	0.94	0.85	1.04	0.93	0.84	1.03
	Calves	0.89	0.78	1.01	0.89	0.78	1.01	0.89	0.78	1.01	<b>0.87</b>	<b>0.77</b>	<b>0.99</b>
Certification status	Organic	<b>0.34</b>	<b>0.20</b>	<b>0.60</b>	<b>0.32</b>	<b>0.18</b>	<b>0.57</b>	<b>0.30</b>	<b>0.17</b>	<b>0.54</b>	<b>0.34</b>	<b>0.19</b>	<b>0.60</b>
	Assured	<b>0.45</b>	<b>0.39</b>	<b>0.51</b>	<b>0.43</b>	<b>0.37</b>	<b>0.49</b>	<b>0.42</b>	<b>0.36</b>	<b>0.48</b>	<b>0.47</b>	<b>0.41</b>	<b>0.54</b>
Random effects	County	0.18	0.05		0.19	0.05		0.19	0.05		0.17	0.05	
	Locations enterprise	1.03	0.08		0.94	0.08		1.00	0.08		1.23	0.09	
		0.72	0.08		0.85	0.08		0.90	0.08		0.62	0.08	

<sup>1</sup> inspection month price per kg in pence; cat. 1≤100.5, cat. 2=100.6-108.2, cat. 3=108.3-112.5, cat. 4=112.6-144.9, cat. 5≥145.0: three month price per kg in pence; 1≤100.3, cat. 2=100.4-109.5, cat. 3=109.6-111.6, cat. 4=111.7-139.7, cat. 5≥139.8: six month price per kg in pence; cat. 1≤100.0, cat. 2=100.1- 109.8, cat. 3=109.9-111.6, cat. 4=111.7-135.7, cat. 5≥135.8

<sup>2</sup>cat. 1≤10, cat. 2=11-24, cat. 3=25-48, cat. 4=49-97, cat. 5≥98



## Pigs

Overall 70.3% of 4514 inspections of breeding and growing pig enterprises were compliant with welfare legislation. Average compliance by month was highly variable, fluctuating between 36 and 91%. Compliance appeared to peak in 2006 (Graph 4). Pig price fluctuated between 98 and 112 pence /kg from 2003-2007 with a notable price increase during spring and summer 2008 to a peak of 137 pence /kg (Graph 4).

There were no significant associations between pig price and compliance with welfare legislation on pig enterprises. There was a trend for a reduced risk of non compliance in inspections of pig enterprises as average three and six month pig price increased, however the effect was small and not significant (Table 6). These results remained unchanged when year was included in the model (Table 7).

Graph 4. British monthly deadweight average pig price and percent compliant Animal Health inspections from Jan 2003 to Dec 2008

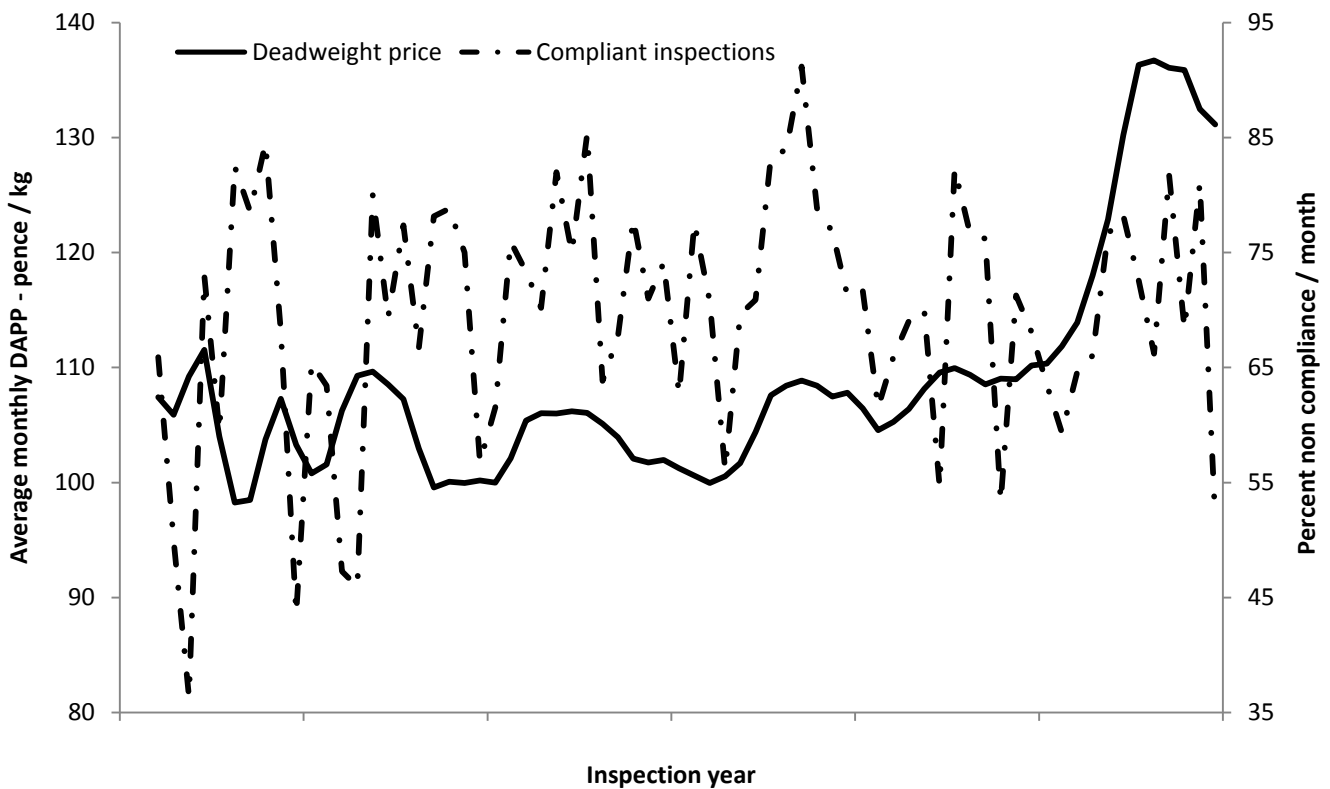


Table 6. Four level logistic binomial models of the association between pig price and non compliance with welfare legislation on pig enterprises Britain from 2003-2008 adjusted by country, enterprise type, number of animals inspected, visit type and certification status

		Price in inspection month n=4426			Three month average price n=4354			Six month price average n=4258			Price change from previous month n=4382		
Intercept coefficient		-1.94			-1.94			-1.99			-2.35		
		OR	CI		OR	CI		OR	CI		OR	CI	
Pig price <sup>1</sup>	Category 1	Ref			Ref			Ref					
	Category 2	1.17	0.90	1.51	0.94	0.72	1.23	0.99	0.76	1.31			
	Category 3	0.89	0.69	1.16	0.89	0.69	1.16	0.81	0.61	1.07			
	Category 4	0.91	0.70	1.19	0.83	0.63	1.10	0.81	0.62	1.07			
	Category 5	0.95	0.71	1.27	0.86	0.65	1.14	0.83	0.61	1.12			
Price change	Decreasing										Ref		
	Increasing										1.09	0.92 1.30	
Country	England	Ref			Ref			Ref			Ref		
	Scotland	<b>2.29</b>	<b>1.50</b>	<b>3.48</b>	<b>2.24</b>	<b>1.47</b>	<b>3.41</b>	<b>2.25</b>	<b>1.47</b>	<b>3.46</b>	<b>2.35</b>	<b>1.54 3.58</b>	
	Wales	1.16	0.68	1.99	1.14	0.67	1.94	0.79	0.46	1.35	1.23	0.72 2.09	
Enterprise type	Growing pigs	Ref			Ref			Ref			Ref		
	Breeding pigs	0.94	0.79	1.10	0.94	0.80	1.10	0.95	0.81	1.13	0.95	0.81 1.12	
Number of animals inspected <sup>2</sup>	Category 1	Ref			Ref			Ref			Ref		
	Category 2	1.21	0.91	1.60	1.30	0.98	1.72	1.29	0.97	1.72	1.28	0.97 1.70	
	Category 3	<b>1.45</b>	<b>1.10</b>	<b>1.93</b>	<b>1.47</b>	<b>1.11</b>	<b>1.94</b>	<b>1.48</b>	<b>1.11</b>	<b>1.97</b>	<b>1.47</b>	<b>1.11 1.95</b>	
	Category 4	<b>1.69</b>	<b>1.27</b>	<b>2.25</b>	<b>1.73</b>	<b>1.30</b>	<b>2.30</b>	<b>1.71</b>	<b>1.28</b>	<b>2.29</b>	<b>1.75</b>	<b>1.31 2.33</b>	
	Category 5	1.26	0.91	1.73	1.29	0.94	1.78	1.25	0.90	1.74	<b>1.34</b>	<b>0.97 1.84</b>	
Visit type	Programmed	Ref			Ref			Ref			Ref		
	Elective	0.67	0.44	1.03	0.67	0.44	1.02	0.67	0.43	1.03	0.60	0.39 0.93	
	Complaint	<b>4.01</b>	<b>3.05</b>	<b>5.27</b>	<b>3.94</b>	<b>3.01</b>	<b>5.16</b>	<b>4.14</b>	<b>3.14</b>	<b>5.47</b>	<b>3.89</b>	<b>2.97 5.09</b>	
	Targeted	<b>3.15</b>	<b>2.42</b>	<b>4.10</b>	<b>3.12</b>	<b>2.41</b>	<b>4.05</b>	<b>3.12</b>	<b>2.38</b>	<b>4.09</b>	<b>2.98</b>	<b>2.30 3.86</b>	
	XC risk based	1.24	0.79	1.95	1.24	0.79	1.95	1.33	0.84	2.10	1.14	0.75 1.75	
	XC random	1.60	0.78	3.30	1.60	0.78	3.28	1.71	0.84	3.51	1.49	0.74 2.99	
Certification	Organic	0.78	0.39	1.55	0.74	0.37	1.49	0.75	0.37	1.55	0.79	0.39 1.57	
	Assured	<b>0.64</b>	<b>0.43</b>	<b>0.96</b>	<b>0.66</b>	<b>0.44</b>	<b>0.99</b>	0.66	0.44	1.01	<b>0.60</b>	<b>0.40 0.91</b>	
Random effects	County	0.23	0.08		0.23	0.08		0.22	0.08		0.22	0.08	
	Locations	1.02	0.14		1.04	0.14		1.13	0.14		1.10	0.13	
	Enterprises	0.17	0.14		0.17	0.13		0.00	0.00		0.00	0.00	

<sup>1</sup> inspection month price per kg in pence; cat. 1≤101.7, cat. 2=101.8-105.4, cat. 3=105.5-108.1, cat. 4=108.2-111.9, cat. 5≥112.0: three month price per kg in pence; 1≤101.9, cat. 2=102.0-105.0, cat. 3=105.1-108.0, cat. 4=108.1-110.8, cat. 5≥110.9: six month price per kg in pence; cat. 1≤103.1, cat. 2=103.2- 104.9, cat. 3=105.0-106.7, cat. 4=106.8-110.7, cat. 5≥110.8

<sup>2</sup>cat.1=≤3, cat. 2=4-10, cat. 3=11-30, cat. 4=31-200, cat. 5≥201

Table 7. Four level logistic binomial models of the association between pig price and non compliance with welfare legislation on pig enterprises in Britain from 2003-2008 adjusted by country, enterprise type, number of animals inspected, visit type and certification status

		Price in inspection month n=4426			Three month average price n=4354			Six month price average n=4258			Price change from previous month n=4382		
Intercept coefficient		-2.22			-2.25			-1.96			-2.48		
		OR	CI		OR	CI		OR	CI		OR	CI	
Pig price <sup>1</sup>	Category 1	Ref			Ref			Ref					
	Category 2	1.28	0.95	1.72	1.03	0.77	1.36	0.88	0.66	1.17			
	Category 3	0.97	0.73	1.28	1.00	0.75	1.33	0.78	0.57	1.08			
	Category 4	1.05	0.77	1.43	0.95	0.70	1.29	0.82	0.56	1.19			
	Category 5	1.27	0.67	2.42	1.15	0.61	2.15	0.78	0.41	1.47			
Price change	Decreasing										Ref		
	Increasing										1.09	0.92	1.30
Year	2008	Ref			Ref			Ref			Ref		
	2007	<b>1.09</b>	<b>0.61</b>	<b>1.92</b>	1.10	0.62	1.92	0.92	0.56	1.50	0.94	0.72	1.25
	2006	1.28	0.95	1.72	1.10	0.57	2.12	0.80	0.45	1.44	0.95	0.70	1.29
	2005	1.12	0.60	2.11	1.17	0.60	2.28	0.92	0.51	1.67	1.06	0.78	1.43
	2004	1.55	0.84	2.86	1.46	0.76	2.83	1.15	0.65	2.04	1.30	0.96	1.75
	2003	1.90	1.01	3.58	1.77	0.91	3.44	1.52	0.79	2.90	1.78	<b>1.27</b>	<b>2.49</b>
Country	England	Ref			Ref			Ref			Ref		
	Scotland	<b>2.23</b>	<b>1.46</b>	<b>3.41</b>	<b>2.20</b>	<b>1.45</b>	<b>3.36</b>	<b>2.21</b>	<b>1.44</b>	<b>3.40</b>	<b>2.30</b>	<b>1.50</b>	<b>3.53</b>
	Wales	1.18	0.69	2.00	1.16	0.68	1.97	1.28	0.75	2.19	1.23	0.72	2.10
Enterprise type	Growing pigs	Ref			Ref			Ref			Ref		
	Breeding pigs	0.92	0.78	1.09	0.93	0.79	1.09	0.95	0.80	1.12	0.94	0.79	1.10
Number of animals inspected <sup>2</sup>	Category 1	Ref			Ref			Ref			Ref		
	Category 2	1.22	0.92	1.63	1.30	0.98	1.72	1.28	0.96	1.71	1.29	0.97	1.71
	Category 3	<b>1.46</b>	<b>1.10</b>	<b>1.94</b>	<b>1.46</b>	<b>1.10</b>	<b>1.93</b>	<b>1.47</b>	<b>1.11</b>	<b>1.96</b>	<b>1.48</b>	<b>1.11</b>	<b>1.97</b>
	Category 4	<b>1.68</b>	<b>1.26</b>	<b>2.24</b>	<b>1.71</b>	<b>1.29</b>	<b>2.28</b>	<b>1.70</b>	<b>1.27</b>	<b>2.28</b>	<b>1.74</b>	<b>1.30</b>	<b>2.32</b>
	Category 5	1.22	0.88	1.69	1.24	0.90	1.71	1.22	0.87	1.70	1.28	0.92	1.77
Visit type	Programmed	Ref			Ref			Ref			Ref		
	Elective	0.68	0.44	1.05	0.68	0.44	1.04	0.68	0.44	1.05	<b>0.63</b>	<b>0.40</b>	<b>0.97</b>
	Complaint	<b>4.13</b>	<b>3.13</b>	<b>5.44</b>	<b>4.01</b>	<b>3.05</b>	<b>5.27</b>	<b>4.24</b>	<b>3.19</b>	<b>5.63</b>	<b>4.10</b>	<b>3.11</b>	<b>5.41</b>
	Targeted	<b>3.26</b>	<b>2.49</b>	<b>4.27</b>	<b>3.20</b>	<b>2.45</b>	<b>4.17</b>	<b>3.22</b>	<b>2.44</b>	<b>4.24</b>	<b>3.18</b>	<b>2.43</b>	<b>4.16</b>
	XC risk based	1.38	0.86	2.20	1.35	0.85	2.15	1.41	0.88	2.25	1.38	0.87	2.19
	XC random	1.76	0.85	3.67	1.73	0.83	3.58	1.80	0.87	3.72	1.78	0.86	3.67
Certification	Organic	0.79	0.39	1.58	0.74	0.37	1.49	0.75	0.37	1.55	0.79	0.48	1.31
	Assured	0.66	0.44	1.00	0.69	0.46	1.03	0.68	0.45	1.04	<b>0.64</b>	<b>0.42</b>	<b>0.97</b>
Random effects	County	0.22	0.08		0.23	0.08		0.22	0.08		0.22	0.08	
	Locations	1.08	0.15		1.09	0.15		1.16	0.14		1.15	0.14	
	Enterprise	0.16	0.14		0.15	0.13		0.00	0.00		0.00	0.00	

<sup>1</sup> inspection month price per kg in pence; cat. 1≤101.7, cat. 2=101.8-105.4, cat. 3=105.5-108.1, cat. 4=108.2-111.9, cat. 5≥112.0: three month price per kg in pence; 1≤101.9, cat. 2=102.0-105.0, cat. 3=105.1-108.0, cat. 4=108.1-110.8, cat. 5≥110.9: six month price per kg in pence; cat. 1≤103.1, cat. 2=103.2- 104.9, cat. 3=105.0-106.7, cat. 4=106.8-110.7, cat. 5≥110.8

<sup>2</sup>cat.1≤3, cat. 2=4-10, cat. 3=11-30, cat. 4=31-200, cat. 5≥201

## Dairy cow milk price

Overall 72.6% of 2215 inspections of dairy cow enterprises were compliant with welfare legislation. Average compliance by month fluctuated widely between 40 and 94%. Compliance increased during 2007 and 2008 (Graph 5). Milk prices fluctuated between 16 and 20 pence / litre from 2003 to mid 2007 after which it climbed steeply to a max of 27 pence / litre in 2008 (Graph 5). There was a clear seasonal variation with price per litre peaking during winter and falling during summer.

There was no significant association between milk price during month of inspection, or the three or six month average, and compliance with welfare legislation. However, there was a significantly reduced risk of non compliance with welfare legislation in months when milk price had increased from the previous month, compared with months where price had decreased from the previous month (Table 8). These association remained unchanged when year of inspection was added to the model (Table 9).

Graph 5. British monthly farm gate dairy cow milk price and percent compliant Animal Health inspections from Jan 2003 to Dec 2008

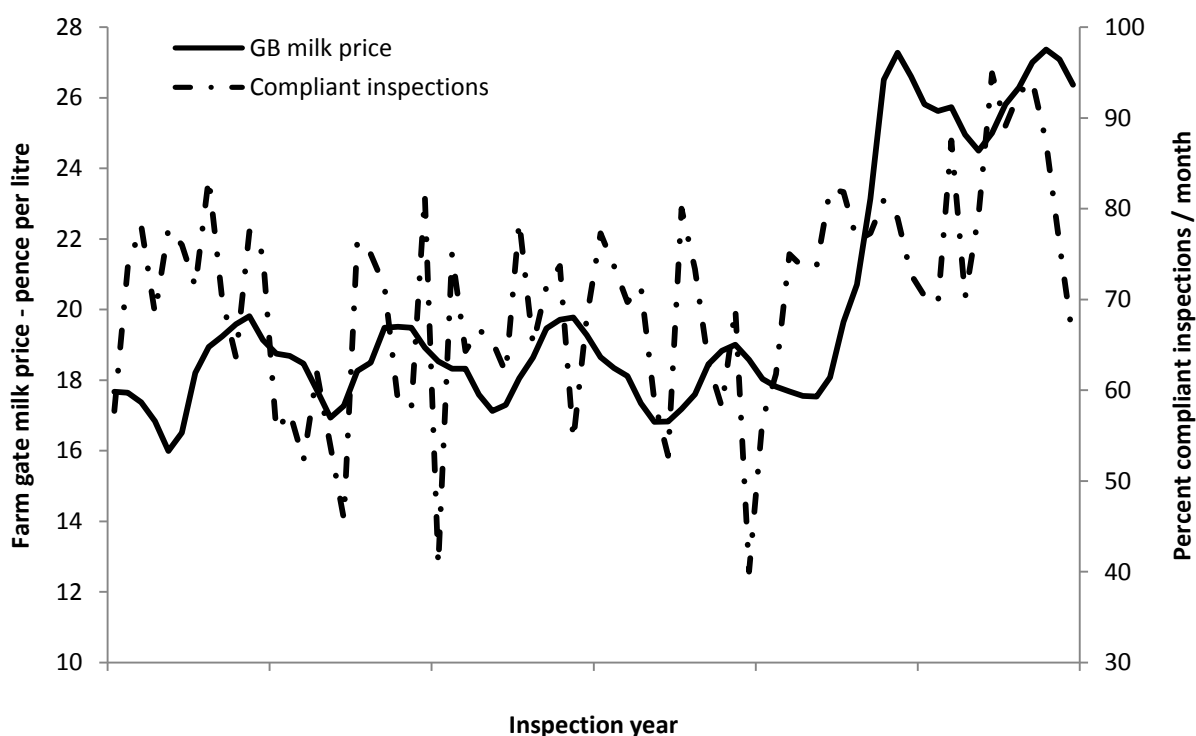


Table 8. Three level logistic binomial models of the association between farm gate milk price and AH inspection code C/D on dairy enterprises in Britain from 2003-2008 adjusted by year, season, country, number of animals inspected, visit type and certification status

		Price in inspection month n=2215			Three month average price n=2155			Six month price average n=2104			Price change from previous month n=2189		
Intercept coefficient		-1.72			-1.72			-1.74			-2.10		
		OR	CI		OR	CI		OR	CI		OR	CI	
Milk price <sup>1</sup>	Category 1	Ref			Ref			Ref					
	Category 2	0.94	0.66	1.34	1.03	0.72	1.47	0.99	0.69	1.42			
	Category 3	1.20	0.85	1.71	1.14	0.79	1.64	0.94	0.64	1.36			
	Category 4	1.09	0.66	1.80	1.06	0.67	1.70	1.05	0.64	1.70			
	Category 5	1.03	0.57	1.88	1.00	0.55	1.81	1.05	0.49	2.24			
Change	Decreasing										Ref		
	Increasing										<b>0.59</b>	<b>0.36</b>	<b>0.98</b>
Year	2008	Ref			Ref			Ref			Ref		
	2007	1.32	0.81	2.14	1.23	0.73	2.09	1.30	0.68	2.48	1.23	0.81	1.85
	2006	1.14	0.57	2.27	1.10	0.55	2.20	1.25	0.57	2.77	1.14	0.69	1.87
	2005	1.10	0.58	2.10	1.07	0.55	2.06	1.22	0.56	2.66	1.13	0.68	1.89
	2004	1.33	0.66	2.70	1.27	0.62	2.61	1.53	0.69	3.41	1.26	0.75	2.13
	2003	0.94	0.48	1.82	0.89	0.44	1.76	1.05	0.47	2.36	0.88	0.52	1.50
Season	Winter/Spring	Ref			Ref			Ref			Ref		
	Summer/Autumn	0.78	0.60	1.02	0.82	0.64	1.05	0.81	0.63	1.04	1.30	0.79	2.14
Country	England	Ref			Ref			Ref			Ref		
	Scotland	0.88	0.51	1.51	0.85	0.49	1.48	0.85	0.48	1.50	0.85	0.49	1.47
	Wales	0.90	0.47	1.76	0.94	0.48	1.84	0.95	0.48	1.90	0.91	0.47	1.76
Number of animals inspected <sup>2</sup>	Category 1	Ref			Ref			Ref			Ref		
	Category 2	1.15	0.79	1.67	1.12	0.77	1.64	1.09	0.74	1.59	1.12	0.77	1.63
	Category 3	1.24	0.85	1.81	1.19	0.82	1.73	1.15	0.79	1.69	1.23	0.85	1.78
	Category 4	0.98	0.66	1.46	0.98	0.66	1.45	0.94	0.63	1.41	0.97	0.66	1.44
	Category 5	0.84	0.56	1.26	0.80	0.53	1.20	0.80	0.53	1.21	0.80	0.53	1.20
Visit type	Programmed	Ref			Ref			Ref			Ref		
	Elective	0.43	0.12	1.46	0.45	0.27	0.77	0.46	0.13	1.60	0.44	0.13	1.49
	Complaint	<b>3.32</b>	<b>1.71</b>	<b>6.44</b>	<b>3.28</b>	<b>1.69</b>	<b>6.37</b>	<b>3.30</b>	<b>1.69</b>	<b>6.43</b>	<b>3.23</b>	<b>1.67</b>	<b>6.25</b>
	Targeted	<b>2.19</b>	<b>1.13</b>	<b>4.25</b>	<b>2.21</b>	<b>1.14</b>	<b>4.28</b>	<b>2.14</b>	<b>1.10</b>	<b>4.17</b>	<b>2.15</b>	<b>1.11</b>	<b>4.16</b>
	XC risk based	0.69	0.30	1.60	0.68	0.30	1.56	0.69	0.30	1.59	0.66	0.29	1.52
	XC random	0.40	0.10	1.55	0.39	0.10	1.51	0.39	0.10	1.53	0.39	0.10	1.51
Certification	Organic	0.31	0.08	1.12	0.31	0.08	1.15	0.32	0.09	1.19	0.31	0.09	1.13
	Assured	0.71	0.50	1.01	0.72	0.50	1.03	0.74	0.52	1.05	0.71	0.50	1.01
Random effects	County	0.25	0.11		0.26	0.12		0.28	0.13		0.25	0.11	
	Locations	1.03	0.19		0.96	0.19		0.99	0.19		0.98	0.19	

<sup>1</sup> inspection month price per litre in pence; cat. 1≤17.6, cat. 2=17.7-18.5, cat. 3=18.6-19.6, cat. 4=19.7-25.8, cat. 5≥25.9: three month price per litre in pence; cat. 1≤17.7, cat. 2=17.8-18.6, cat. 3=18.7-19.5, cat. 4=19.6-25.6, cat. 5≥25.7: six month price per litre in pence; cat. 1≤17.9, cat. 2=18.0-18.5, cat. 3=18.6-19.2, cat. 4=19.3-25.5, cat. 5≥25.6

<sup>2</sup>cat.1=≤46, cat. 2=47-85, cat. 3=86-130, cat. 4=131-200, cat. 5≥201

Table 9. Three level logistic binomial models of the association between farm gate milk price and AH inspection code C/D on dairy enterprises in Britain from 2003-2008 adjusted by season, country, number of animals inspected, visit type and certification status

		Price in inspection month n=2215			Three month average price n=2155			Six month price average n=2104			Price change from previous month n=2189		
Intercept coefficient		-1.60			-1.61			-1.45			-1.98		
		OR	CI		OR	CI		OR	CI		OR	CI	
Milk price <sup>1</sup>	Category 1	Ref			Ref			Ref					
	Category 2	1.00	0.71	1.42	1.06	0.75	1.51	1.00	0.70	1.43			
	Category 3	1.24	0.88	1.74	1.19	0.84	1.68	0.96	0.67	1.38			
	Category 4	0.99	0.66	1.49	0.99	0.66	1.48	0.96	0.64	1.46			
	Category 5	0.97	0.61	1.56	0.91	0.59	1.42	0.84	0.53	1.33			
Change	Decreasing										Ref		
	Increasing										<b>0.57</b>	<b>0.35</b>	<b>0.93</b>
Season	Winter/Spring	Ref			Ref			Ref			Ref		
	Summer/ Autumn	0.79	0.62	1.02	0.81	0.64	1.04	0.79	0.61	1.00	1.33	0.81	2.17
Country	England	Ref			Ref			Ref			Ref		
	Scotland	0.86	0.50	1.47	0.83	0.48	1.45	0.84	0.48	1.48	0.83	0.48	1.44
	Wales	0.90	0.46	1.75	0.93	0.47	1.82	0.94	0.47	1.87	0.89	0.46	1.73
Number of animals inspected <sup>2</sup>	Category 1	Ref			Ref			Ref			Ref		
	Category 2	1.16	0.80	1.69	1.14	0.78	1.66	1.12	0.76	1.64	1.13	0.78	1.65
	Category 3	1.25	0.86	1.82	1.20	0.82	1.75	1.17	0.80	1.72	1.24	0.85	1.80
	Category 4	1.00	0.67	1.48	0.99	0.67	1.47	0.97	0.65	1.45	1.00	0.68	1.48
	Category 5	0.86	0.57	1.29	0.82	0.55	1.23	0.82	0.55	1.24	0.82	0.54	1.22
Visit type	Programmed	Ref			Ref			Ref			Ref		
	Elective	0.41	0.12	1.41	0.44	0.13	1.53	0.45	0.13	1.56	0.42	0.12	1.44
	Complaint	<b>3.17</b>	<b>1.63</b>	<b>6.15</b>	<b>3.16</b>	<b>1.63</b>	<b>6.14</b>	<b>3.21</b>	<b>1.65</b>	<b>6.23</b>	<b>3.08</b>	<b>1.59</b>	<b>5.96</b>
	Targeted	<b>2.08</b>	<b>1.08</b>	<b>4.03</b>	<b>2.12</b>	<b>1.09</b>	<b>4.11</b>	<b>2.09</b>	<b>1.07</b>	<b>4.06</b>	<b>2.05</b>	<b>1.06</b>	<b>3.96</b>
	XC risk based	0.64	0.28	1.44	0.65	0.29	1.46	0.65	0.28	1.46	0.59	0.27	1.32
	XC random	0.38	0.10	1.48	0.38	0.10	1.47	0.37	0.10	1.45	0.36	0.09	1.40
Certification	Organic	0.30	0.08	1.11	0.31	0.08	1.14	0.31	0.08	1.17	0.30	0.08	1.10
	Assured	0.75	0.56	1.00	0.76	0.57	1.01	<b>0.73</b>	<b>0.55</b>	<b>0.98</b>	<b>0.72</b>	<b>0.55</b>	<b>0.92</b>
Random effects	County	0.25	0.11		0.26	0.12		0.28	0.12		0.25	0.12	
	Locations	1.06	0.19		0.99	0.19		1.00	0.19		1.01	0.19	

<sup>1</sup> inspection month price per litre in pence; cat. 1≤17.6, cat. 2=17.7-18.5, cat. 3=18.6-19.6, cat. 4=19.7-25.8, cat. 5≥25.9; three month price per litre in pence; cat. 1≤17.7, cat. 2=17.8-18.6, cat. 3=18.7-19.5, cat. 4=19.6-25.6, cat. 5≥25.7; six month price per litre in pence; cat. 1≤17.9, cat. 2=18.0-18.5, cat. 3=18.6-19.2, cat. 4=19.3-25.5, cat. 5≥25.6

<sup>2</sup>cat.1=≤46, cat. 2=47-85, cat. 3=86-130, cat. 4=131-200, cat. 5≥201

## Discussion

The association between welfare compliance and product price varied by enterprise type. In pigs there was no indication that welfare compliance was associated with deadweight price, compliance appeared to be relatively robust to changes in product price. In cattle there was a trend for the risk of non compliance with welfare legislation to be lower in months when the liveweight price was higher. However, cattle price increase was correlated with year and the association between welfare compliance and product price became non significant when year was added to the models. When split by year it was evident that there was a trend for a reduced risk within some years and not others, though none were statistically significant. Overall it remains unclear whether welfare compliance was influenced by product price, or other factors that might have improved welfare compliance between 2003 and 2008.

In dairy cows, absolute milk price was not associated with welfare compliance but a reduced risk of non compliance was associated with months when the milk price had increased from the previous month. Welfare compliance and milk price both fall during the first half and increase during the second half of the year, however the seasonal fluctuation in compliance is controlled for in the model, so this can not fully explain the correlation (price change is significant with and without season controlled for in the model). Analysis of dairy cows inspection data after the milk price increase of 2008 might be helpful in understanding this association.

In sheep the risk of non compliance reduced as price during the month of inspection increased and this remained significant having accounted for yearly and seasonal fluctuations. It was interesting to note that the effect was strongest, and statistically significant, for the month of inspection rather than the longer term averages. If hypothesising that that association is causal, this would suggest that the effect is determined by farmers' knowledge of the current price impacting on their decisions made regarding immediate welfare of their sheep. The most common causes of non compliance on sheep farms is failure to treat disease (27%) and failure to inspect regularly (13%) both of which are determined by the farmer's behaviour over a relatively short period of time so it is plausible this could be affected by the value the farmer is, perhaps subconsciously, placing on the animal. However it remains unclear why, if this effect occurs in sheep farmers, it is not evident across other species.

This was a basic analysis that fails to take production costs into account. It may be that a full analysis that captured enterprise income would provide a clearer picture. Repeating this analysis in the future with data from a longer time period may also be productive.

The general trend of the association between certification and compliance with welfare legislation was unaffected by inclusion of price data in the models.

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