FROM BUST TO BOOM: TOWARDS A STRATEGIC COGNITION PERSPECTIVE ON AUSTRALIAN MINING FIRMS' ADAPTATION

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KEYWORDS: managerial thinking and cognition, strategy, strategic decision-making, competitive environment, content analysis

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ABSTRACT

While the role of executives' cognition in organisations' responses to change is a central topic in strategic cognition research, changes in firms' environment are typically not measured directly but described either as an event (for example, new industry legislation) or represented by a time period (e.g. when a new technology impacted an industry). The Australian mining sector has witnessed a historically significant change in demand for its products and we begin by developing measures of changes in supply and demand for key commodities during the period 1992-2008. We identify sub-groups of firms based on their activities and commodity sector and examine the relation of these variables to executives' cognition and to firms' CapEx. We find industry, firm and cognitive variables are related to both strategic cognition and firms' CapEx.

KEYWORDS: strategic cognition, strategy, strategic decision-making, competitive environment, industry analysis

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'The year 2000 was ugly: it was a down period, prices were low and no one wanted to spend on capacity…Nobody foresaw the phenomenal surge in Chinese demand that was about to occur"

Interview with Greg Gailey, former CEO of Pasminco, one of the world's largest zinc miners. **The Weekend Australian**, December 19-20, 2009, p.23.

Simplifying somewhat, much managerial and organisational cognition research can be viewed as concerned with how managerial perceptions, judgments, attention, cognitive preferences and limitations (i.e. cognition) influence how firms respond to environmental change, and why firms respond differently, ranging from early response to no response (e.g. Barr & Huff, 1997; Hodgkinson, 2005; Kaplan, 2008). Narayanan, Zane and Kemmer (2011: 307) define the cognitive approach in the following terms: "… the cognitive perspective in strategy, or strategic cognition, ascribes causal importance to structures and processes of cognition in the explanation of strategy and, hence, the competitive advantage of firms. SC highlights how cognitive structures and processes develop in organizations, how these structures and processes generate business definitions and corporate and business strategies, and how they lead to major strategic initiatives".

However cognition researchers, while giving considerable attention to the measurement of cognitive variables have tended to treat changes in firms' environments or conditions in relatively limited ways, focusing either on single events such as changes in industry regulation (e.g. Barr & Huff, 2003; Cho & Hambrick, 2006), or treating change in terms a time period in which, for example, a new, disruptive technology emerged (e.g. Gilbert, 2005; Kaplan, 2008). So cognition researchers rarely if ever investigate how firms adapt to ongoing, 'normal', variations in the supply of and demand for firms' products which take place over extended periods.

Our manuscript proceeds in the following way. First, we describe the development of new measures of changes in supply and demand over time of key commodities produced by the Australian mining sector and consider associations between these measures. We next investigate the structure of the mining industry which we find does not consist of undifferentiated 'miners' but contains at least four, sub-industry or strategic groups (Cool & Schendel, 1987; Porter, 1980). Finally we examine the association between these industry- and firm-level factors and several aspects of executive cognition (managerial attention to the future, and focus on capacity or capability building) and firms' actual capital expenditure (CapEx).

Method

Database The Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES[1]) provides quarterly data for both prices and national production levels for the main agricultural and mining commodities produced in Australia. We focus on the 11, highest value commodities (ABARE,

[1] It was until recently known as Australian Bureau of Agricultural and Resource Economics (ABARE)

2009): aluminium, coal, iron ore, gold, manganese, nickel, lead, copper, zinc, oil and gas (both liquefied petroleum gas (LPG) and liquefied natural gas (LNG)). The ABARE prices data-series begins in the first quarter of 1988 and we had access to data until the second quarter of 2009; a total of 83 observation for prices, and 79 observations for production levels for 11 commodities.

Our goal was to derive, if possible parsimonious, aggregated measures of both prices (demand) and production (supply) data since it would clearly be difficult to model with 22 different variables (i.e. supply and demand for 11 commodities), thus an initial step was to try to reduce these data to a smaller set of measures using factor analysis.

RESULTS

We carried out exploratory factor analysis using the principal components method followed by Varimax rotation and while the number of observations (79) relative to the number of variables (11) was not large both the Kaiser-Meyer-Olkin (KMO) test of sampling adequacy and Bartlett's test of sphericity (Bartlett) indicated the suitability of the data for detecting underlying structures supported the potential value of factor analysis. Table 1 shows the rotated factor structure for supply and demand (i.e. prices) data.

Insert Table 1 about here

Both analyses identified two factors that accounted for more than 80% of variance (90% in the case of demand) indicating there were strong, underlying structures. While there were some significant cross-loadings the structures in Table 1 are readily interpretable: for production (supply) factor 1 loads most strongly on ferrous-related commodities (coal, iron, manganese i.e. commodities related to steel) while the opposite is the case for factor 2; we labelled these two factors: Supply ferrous (Supply F) and Supply Non-ferrous (Supply NF) respectively. A similar interpretation applies to the Demand data, except in this case the factor order is the reverse of the one just described. We therefore called factor 1 - Demand Non-ferrous (Demand NF) and factor 2 – Demand ferrous (Demand F).

Discussion of Supply-Demand Factor Structures While not psychometrically ideal these findings are pragmatically and empirically valuable in the context of the larger research problem. It can reasonably be argued that it is possible to represent patterns of supply and demand over time for 11 key, mining commodities using just four factors: Supply Ferrous, Supply Non-Ferrous and Demand Ferrous and Demand Non-Ferrous.

Association Between Supply and Demand Figure 1 plots annual, mean scores for the four factor-based measures (demand and supply for each of two sectors) between 1992-2008[2], remembering that these are in standardised form (Z score) being outputs from a factor analysis.

FIGURE 1 about here

Several patterns are evident in Figure 1. Firstly, supply of ferrous and non-ferrous commodities follow different trajectories with ferrous supply relatively stagnant between 1992-1999 then increasing dramatically since 2003; non-ferrous supply surged between about 1997-2001 then declined. For ferrous-related commodities, demand (i.e. prices) seem to be related to supply, on the other hand there seems to be little association between non-ferrous supply and demand. To explore this issue further we estimated the annual variation in supply and demand based upon the standard deviation (SD) of the four quarterly measures. While not plotted in Figure 1 this suggested that this volatility-based measure of non-ferrous supply and demand provides a better description of their association, at least during the middle period (about 1996-2004). We subjected this annual, mean data to correlational analysis using Spearman's rank-order statistic (Table 2).

TABLE 2 about here

[2] We did not include pre-1992 data in analysis in order to match these data to the period for which we had measures of managerial cognition

Table 2 shows that Demand F and Supply F are strongly correlated whereas Supply NF and Demand NF are not correlated and there is also a strong correlation between Supply F and Demand NF (when the ferrous supply cycle is relatively 'mature', prices for non-ferrous commodities are strongest), and this association was also positive for Supply NF and Demand F (i.e. ferrous demand was positively associated with NF supply). These relationships allow several interpretations: for example, non-ferrous demand might be stimulated by a maturing ferrous supply cycle; and ferrous demand is stimulated by strong, non-ferrous availability. Overall it seems reasonable to conclude that there are meaningful relationships between the measures of supply and demand, particularly in the case of ferrous commodities, and that the two sets of commodities possibly had related but different patterns of supply and demand. This suggests that to understand differences in strategic cognition and behaviour, firms in different commodity sectors may need to be treated as members of different, industry sub-groups, an issue we explore next.

Identifying Sub-industry Groups or Clusters

Firms in the mining industry differ in at least one way that is likely to be important to executives' cognitions– they are involved with commodities that have supply and demand cycles differing over time. The most useful source of information about the mining activities of listed Australian firms we were able to identify was the Register of Australian Mining 2010/11 (Resources Information Unit (RIU), 2010) that contains information about more than 1,000 Australian mining firms, including 850, ASX-listed firms.

A total of 571 listed firms were identified as being involved with one or more of our commodities: 432 were involved with non-ferrous, 92 with ferrous, and 46 with both. The Register also revealed that firms differ not only in the commodities they deal with but also in their 'mining' activities. We identified four main types of activity: exploration, mining, production (e.g. oil, gas, coal, gold) and development (e.g. of new mines). Each firm was allocated four, bivariate scores based on whether it engaged in an activity (1=Yes; 0=No) and using these four variables firms were subjected to a two-step cluster analysis in SPSS-18; this resulted in a simple, readily interpretable cluster structure identifying five main types of firms. The largest cluster (N=291; 52% of total) consisted of pure explorers (i.e. involved only in exploration); three of the remaining four clusters combined exploration with another activity (i.e. 'explorers plus'): development (N=90; 16%), production (N=96; 17%), mining (N=47; 8%), while a small number (N=38) were not involved in exploration. Because by far the largest group were pure explorers and all the remaining firms carried out some type of post-explorer activity we simplified this categorisation to create two, relatively equally sized groups of firms: pure explorers (N=291; 51%) and post-explorers (N=271; 49%), the latter group being a combination of four clusters.

Because the number of firms in the ferrous sector is relatively small and the number of firms involved in two sectors is even smaller we combined these two groups into a single ferrous (or both sectors) group. Table 3 cross-tabulates firms on two variables: commodity sector (ferrous/non-ferrous (or both)) and type of miner (pure explorer/post-explorer).

[TABLE 3 about here]

While we are not suggesting that this four cluster analysis of the Australian mining industry (two types of miners by two sectors) represents a full description of the structure of the industry or identifies all the potentially important strategic groups (Cool & Schendel, 1987; Porter, 1980) it represents an initial, simple description of some of the major groupings in the Australian mining sector (cf. Nath & Gruca's (1997) description of US pharmaceutical firms and Lewis and Thomas' (1990) of UK grocery retailers). The validity of these groupings is tested by their relation to differences in executives' strategic cognition and firms' behaviour.

Supply and Demand Factors and Executives' Strategic Cognition

We now explain our approach to measuring an aspect of strategic cognition that is likely to be important for understanding mining firms' strategic response to major changes in demand for their products –executives' attention to expanding a firm's production capabilities and capacities. Our approach to strategic cognition treats it as a form of attentional process which makes it amenable to measurement using content analysis of managerial communications that identifies that what managers attend to as well as the amount of attention managers give to different strategic issues. The method has advantages for the study of strategic cognition including its unobtrusive nature, utilisation of archival data available over time, and the access it offers to the cognitions of people who are difficult to access, and when combined with contemporary approaches to computer aided content analysis (Duriau, Reger & Pfarrer,, 2007; Kabanoff, 1996; Short et al, 2010) it allows for the efficient analysis of extremely large amounts of text.

We adopted the approach developed by Kabanoff and Brown (2008) who used a machine-learning (ML; Sebastiani, 2002) approach to analyse some 5,000 annual reports from firms between 1992-2003 and we applied it to a larger set of reports between 1992-2008 (> 10,500 reports). The main strategy factor of interest was one Kabanoff and Brown (2008) called Capacity and Capability Building that described the amount of managerial attention given to themes related to increasing the productive capacity, capability or infrastructure of a firm, including introducing new technologies, equipment, buildings, expanding or developing new mines, factories, opening new branches or other facilities, and so on.

We combined this strategic cognition measure with the earlier described supply-demand data as well as firms' industry group classification (ferrous/non-ferrous; pure explorer/post-explorer) to create a dataset allowing us to test the three, following propositions:

Proposition 1:The amount of attention executives give to capacity building is positively correlated with supply and demand signals from the environment

Proposition 2: The amount of attention executives in the ferrous sector give to capacity building is more strongly correlated with price and demand signals for ferrous commodities while executives' attention in the non-ferrous sector is more associated with signals for non-ferrous commodities.

Proposition 3: The amount of attention executives give to capacity building is more strongly correlated with supply and demand signals for the group of post-explorer firms than for pure explorers.

Proposition 3 was based on the view that capacity building is likely to be a more important issue for firms involved in post-exploration activities since they make greater use of ‘hard assets’ such as plant and equipment. Since propositions 2 and 3 suggest executives in different sectors and types of firms pay more or less attention to different environmental signals correlations were carried out for four different sub-groups of firms by splitting firms according to miner type and sector, as well as across the entire sample (Table 4).

TABLE 4 about here

The results in Table 4 clearly support proposition 1 – executives’ attention or cognition is related to signals about the supply and demand of mined commodities. Specifically, executives give more attention to expanding productive capacity and capability when there are higher levels of either supply or demand. This is the case whether we look at the sample overall or at the different sub-groups. The evidence for the second and third propositions is equivocal: there is limited evidence that cognition is more responsive to demand and supply signals for commodities specific to the firm’s sector, and in contradiction of proposition 3 –there seems to be a stronger association between cognition and price/demand factors among pure explorers.

Nevertheless these correlations in a key respect support the validity of our measures and our propositions about a significant relation between executive cognition and environmental signals. The next step involved a more rigorous, multivariate analysis of influences on executives’ cognition and we added a cognitive variable to the analysis that has been argued to be a significant factor in executives’ likelihood of investing for the future –executives’ temporal perspective (Kabanoff & Griffin, 2011; Zimbardo & Boyd, 1999).

Predicting Executives’ Capacity Building Focus Over Time Using Cognitive and Non-Cognitive Factors The regression model we tested involved six, hierarchical steps representing an approximate continuum from the broadest, most distal, environmental-level predictors such as time period (year), to firm level variables (e.g. size), more specific firm-level variables (e.g. miner type) and finally to the most, proximal cognitive predictor, that is executives' future focus in annual reports. The results of the regression analysis are shown in Table 5.

TABLE 5 about here

Notable features of Table 5 are that virtually every step in the regression model makes some contribution to predicting the level of focus on capacity building though the final amount of variance predicted is modest ($AdjR^2$=.25). Both time period (year) and firm size (operationalised as log normal transformation of total value of firm's assets) have significant but opposite effects with larger firms focusing less on capacity building over time while time period is positively related (i.e. attention is higher in later years). Financial Leverage, defined as total assets/investors' equity reflects the extent of firm borrowing and we introduced it as potentially associated with a capacity building which it turned out not to be.[3] The four measures of industry-level supply and demand were introduced next which resulted in two significant, negative effects being identified - Supply NF and Supply F, that is, high points in both non-ferrous and ferrous supply are associated with lower capacity building focus. Dummy variables (Hardy, 1993) representing miner type and commodity sector were entered next as a block, followed by their interaction term (miner type X sector). Miner type had no relation but firms in the non-ferrous sector focused more on capacity building; the interaction term was insignificant.

Strategic Cognition and CapEx We then examined whether strategic cognition influences firm-level actions – capital expenditure (CapEx) (Hodgkinson, 2001; Cho & Hambrick, 2006; Kabanoff & Griffin, 2011). A simple analysis of predicted capacity building[4] cognition regressed on CapEx resulted in a modest but significant level of prediction: $AdjR^2 = .14$; $F(1,868) = 177.8$, $p < .000$. Figure 2 shows an empirically derived model of the association between industry-, firm- and cognitive-level variables and mining firms' CapEx over time mediated through capacity building cognition.

[3] We investigated a number of other financial measures such as various measures of profitability, revenue and value of a firm's property, plant and equipment (PP&E) however these were so strongly correlated with total assets this created problems of multicollinearity and/or was not very useful in the case of many firms in the sample such as Pure Explorers that had few assets and had little or no revenue.
[4] This was the predicted score for capacity building from the regression reported in Table 5 and we used this measure in preference to the actual score since the predicted score captured the variation in cognition attributable to the theoretically meaningful variables.

FIGURE 2 about here

As a final step we tested a simple model in which CapEx was once again the dependent variable and both cognitive variables (future focus, attention to capacity building) were entered as predictors in the last step of a hierarchical regression that previously entered the industry- and firm-level variables as shown in Table 5. The value of this type of analysis is that it tests whether the cognitive variables, when entered after the industry- and firm-level variables still contribute to predicting CapEx. The results are shown in Table 6.

Table 6 about here

The results in Table 6 differ in some details from those in Table 5 but the general interpretation we place on them both are compatible. Both time period and firm size are related to CapEx in the same way they were to capacity building cognition. In this analysis ferrous and non-ferrous *demand* are positively related to CapEx rather than *supply* being negatively related as in Table 5. One possible explanation for this is that attention to capacity building in annual reports is to some extent a lagging as well as a leading indicator of capacity building decisions by firms. The non-ferrous sector has stronger CapEx (as for capacity building) and type of miner also has a relation, again consistent with the previous finding, with pure explorers spending relatively more. There is also a significant interaction between miner type and commodity sector (Figure 3). Figure 3 shows that post-explorer, ferrous firms invested relatively less on CapEx than other firms. In the current context the most significant finding is that the cognitive variables, specifically executive attention to capacity building added to the prediction of CapEx.

FIGURE 3 about here

Future focus did not, which suggests that the effect of future focus on CapEx is mediated through its relation to capacity building, which is theoretically meaningful since temporal perspective can be seen as a general, cognitive framing process (Kabanoff & Griffin, 2011).

DISCUSSION

We adopted a strategic cognition approach for studying Australian mining firms' adaptation to dramatic changes in industry conditions over 20 years, particularly in respect to the key strategic issue of executives focusing on and firms investing in increasing firms' productive capacities. While the study is exploratory in nature and has limitations, it produced a number of interesting findings.

The first contribution was to demonstrate that changes over time in supply and demand of 11 key commodities can be described by a simple, two factor structure. Our initial investigations of these measures suggest that ferrous and non-ferrous commodities have had different demand and supply cycles over the period 1992-2008 but that there may also be significant interdependencies between them. Consideration of this issue is beyond the scope of the present study but it is clearly one that needs to be investigated further.

A second contribution rests on our description of the broad structure of firms making up the Australian mining industry. While our simple, 2 X 2 description of the structure of the Australian mining industry almost certainly misses some other, strategically important dimensions (e.g. size; Porter, 1980), to our knowledge it is the only analysis of this type undertaken of Australian mining firms and represents a simple but hopefully useful beginning.

We found that variables across a number of levels ranging from the macro (year), through industry, firm and cognitive levels all exerted an influence on the extent of managerial focus on capacity building by firms. This suggests, to adopt Kaplan's (2008:693) phrase, that cognitive factors are 'tightly intertwined' with firm-level factors in influencing firm-level actions. It would be useful in future to develop more context specific measures of strategic cognition that could increase its predictive power and also to identify and measure other cognitions, such as executives' perceptions of environmental threats and opportunities (Chattopadhyay, Glick & Huber, 2001; Dutton & Jackson, 1987; Kennedy & Fiss, 2009).

The study has some potential implications for our current understanding of firms' responses to the boom. Over the time period studied which was almost 20 years, executives from large, ferrous-sector, firms involved in post-explorer activities, on average gave the least attention to capacity building strategies as well having lower CapEx. This finding provides a new perspective on the debate we have seen over how and why 'infrastructure problems and bottlenecks' prevented Australian firms from being responding to increased demand, particularly for ferrous commodities. The present findings provide at least prima facie evidence that a number of factors contributed to executives in this sector giving relatively less attention to capacity building strategies. Figure 4 plots both capacity building cognition and CapEx over time separately for ferrous/non-ferrous firms.

FIGURE 4 about here

While Figure 4 is primarily descriptive it is interesting in showing that: both attention to capacity building and CapEx are generally higher for non-ferrous firms; changes in attention to capacity building and CapEx are associated, and a tentative suggestion is that the attention and CapEx 'deficits' among ferrous firms are not the result of their being slow to respond to improving conditions with both ferrous and non-ferrous firms beginning an upward trend in both attention and CapEx around 2002. Where ferrous firms seem to differ is in the extent of decline in both capacity building cognition and actual CapEx from approximately the mid-90's to a nadir in about 2000; ferrous firms appear to have to overcome a bigger 'loss of confidence' in comparison to non-ferrous firms[5]. Future analysis using more industry, firm and cognitive variables and the longitudinal qualities of these data (Kabanoff & Griffin, 2011; Preacher, Wichman, MacCallum & Briggs, 2008) can potentially contribute to a better understanding of this multi-level issue (Aguinis, Boyd, Pierce & Short, 2011). Perhaps the study's most important implication is that it is feasible to study empirically the role of strategic cognition in key, strategic decisions of firms in an industry central to Australia's economic and social well-being.

[5] Though this might also reflect the size of the upswing in the final years, given that variables have been standardised in a way that captures their relative differences over time. This highlights the need for a more sophisticated statistical modelling of these data in future work.

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TABLE 1

Rotated Factor Loadings of Quarterly Production and Price Data for Eleven Mined Commodities between 1988 – 2009.

Commodity	Production (N=79)[a]		Price (N=83)[a]	
	Factor 1	Factor 2	Factor 1	Factor 2
Aluminium	849[b]	480	892	147
Coal	741	642	154	949
Copper	912	308	850	445
Gold	761	-023	620	730
Iron	555	796	445	888
Lead	770	-096	805	424
Manganese	298	892	057	973
Nickel	749	197	944	165
Gas	734	584	-[c]	-
Oil	337	-775	709	608
Zinc	871	298	919	083
Eigenvalues	7.0	1.8	7.1	1.8
%Variance	64.4	16.3	71.3	18.4
%Total Variance	80.8		89.8	

[a] There were only two quarters of production data in 1988, 1989, 2009, and two quarters of price data in 1988 and 2009; the N's reflect the number of cases for which we have complete data.

[b] Underlined variables were used to interpret factors.

[c] Gas prices are linked to oil and not provided separately by ABARE.

TABLE 2

Spearman Correlations between Supply and Demand Factors (Ferrous and Non-Ferrous) Using Annual Means

		1	2	3	4	5
1	Supply F (M)					
2	Supply NF (M)	.22				
3	Demand F (M)	.60**	.48*			
4	Demand NF (M)	.69**	.18	.17		

[a] N = 21 [b] n = 22

*p< .05** p<.01

TABLE 3

Number of Firms and Observations for Each of Four Mining Clusters (Miner Type x Sector)

		Miner Type	
		Pure Explorer	Post-Explorer
SECTOR	Ferrous	31[a]	29
		(73)[b]	(118)
	Non- Ferrous	201	177
		(546)	(164)

[a] N of firms [b] N of observations (firm x year)

TABLE 4

Correlations between Strategic Cognition (Capacity Building) and Supply – Demand Factors for Different Sub-Groups of Mining Firms

Demand – Supply	All [a] Firms	Ferrous[b] Firms	Non-Ferrous[c] Firms	Pure[d] Explorer	Post-Explorer[e]	Pure Explorer[f] Ferrous	Post-Explorer[g] Ferrous	Pure[h] Explorer Non-Ferrous	Post-Explorer[i] Non-Ferrous
Demand Ferrous	.28**	.21*	.19**	.22**	.16**	.20*	.20*	.22**	.15**
Supply Ferrous	.29**	.38**	.32**	.45**	.25**	.60*	.26*	.42**	.26**
Demand Non-Ferrous	.26**	.26*	.20**	.28**	.15**	.45**	.13	.25**	.16**
Supply Non-Ferrous	-.05	-.22+	-.05	.07	-.10*	.03	-.32**	.06	-.08

+ $p<.10$ *$p<.05$ **$p<.01$

[a] N=928 [b] N=126 [c] N=802 [d] N=628 [e] N=300 [f] N=35 [g] N=91 [h] N=265 [i] N=537

TABLE 5

Hierarchical Regression Predicting Executive Attention to Capacity Building Using Industry and Firm Level Variables and Future Focus

	Step (Standardised ß)					
Predictor	1	2	3	4	5	6
Year ('92-'08)	.326**	.246**	.894*	.877*	.881*	.933*
Size ($ Total Assets)		-.278**	-.271**	-.281**	-.282**	-.253**
Financial Leverage		-.02	-.02	-.03	-.03	-.02
Supply Ferrous			-.730	-.736	-.741	-.925†
Supply Non-Ferrous			-.375†	-.389†	-.391†	-.447*
Demand Ferrous			-.085	-.074	-.074	-.036
Demand Non-Ferrous			-.072	-.059	-.059	-.003
Pure Explorer				-.029	-.007	.035
Non-Ferrous Sector				.134**	.139**	.118**
Type x Sector					-.025	-.062
Future Focus						.250**
Total Adjusted R^2	.11**	.18**	.18**	.20**	.20**	.25**
F	107.2	65.7	28.9	25.2	22.6	28.4
df	1,899	3,897	7,893	9,891	10,890	11,889
R^2 Change	.11**	.07**	.01**	.02*	.00	.06**
F	107.2	40.4	1.3	10.02	0.1	68.8
df	1,899	2,897	4,893	2,891	1,890	1,889

†$p<.10$ *$p<.05$ **$p<.01$

TABLE 6

Hierarchical Regression Predicting CapEx Using Industry, Firm and Cognitive Variables

Predictor	Step (Standardised ß)					
	1	2	3	4	5	6
Year ('92-'08)	.340**	.245**	.137	.174	.238	.058
Size ($ Total Assets)		-.340**	-.353**	-.265**	-.272*	-.217**
Financial Leverage		-.057	-.056	-.049	-.046	-.042
Supply Ferrous			-.228	-.313	.386	.223
Supply Non-Ferrous			-.035	-.050	-.078	.00
Demand Ferrous			.228*	.240*	.239*	.250**
Demand Non-Ferrous			.281*	.303*	.303*	.301**
Pure Explorer				.263**	.439**	.460**
Non-Ferrous Sector				.100**	.139**	.113**
Miner Type x Sector					-.197*	-.215*
Future Focus						-.018
Capacity Building						.208**
Total Adjusted R^2	.11**	.22**	.24**	.31**	.31**	.35**
F	55.5	45.4	36.9	28.4	24.9	30.9
df	1,850	3,848	4,847	6,845	7,844	8,843
R^2 Change	.11**	.11**	.02**	.07**	.01*	.03**
F	82.2**	47.3**	3.6**	31.9**	5.0*	15.7**
df	1,628	2,626	4,622	2,620	1,619	2,617

*$p<.05$ **$p<.01$

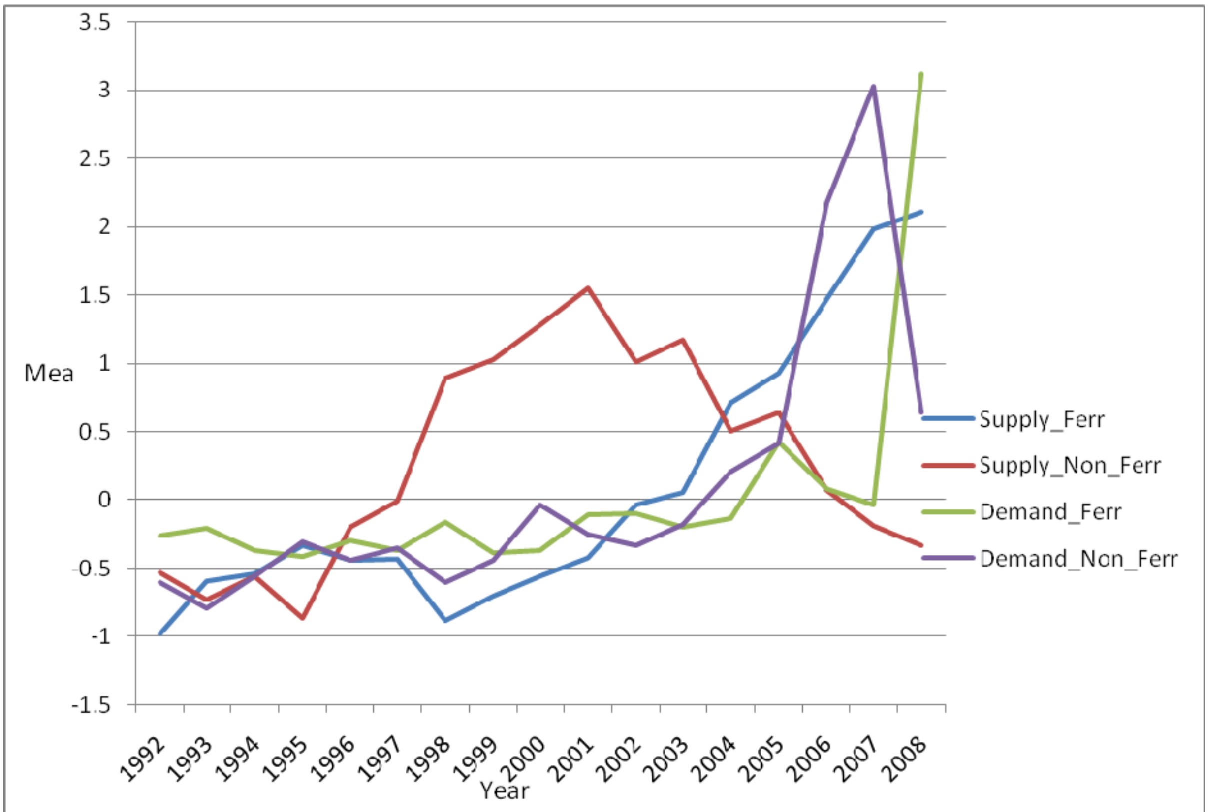

FIGURE 1
Annual Means Supply and Demand Factors

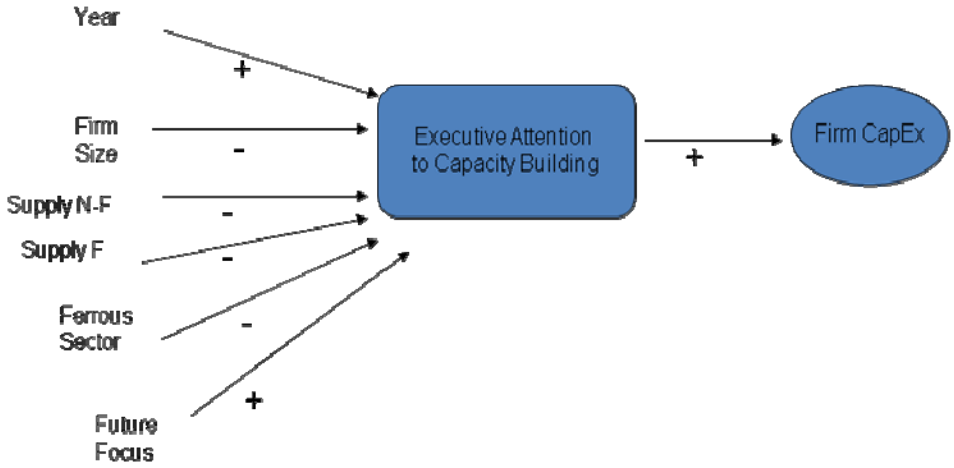

FIGURE 2
An Empirically Derived, Strategic Cognition Model of CapEx Spending by Mining Firms

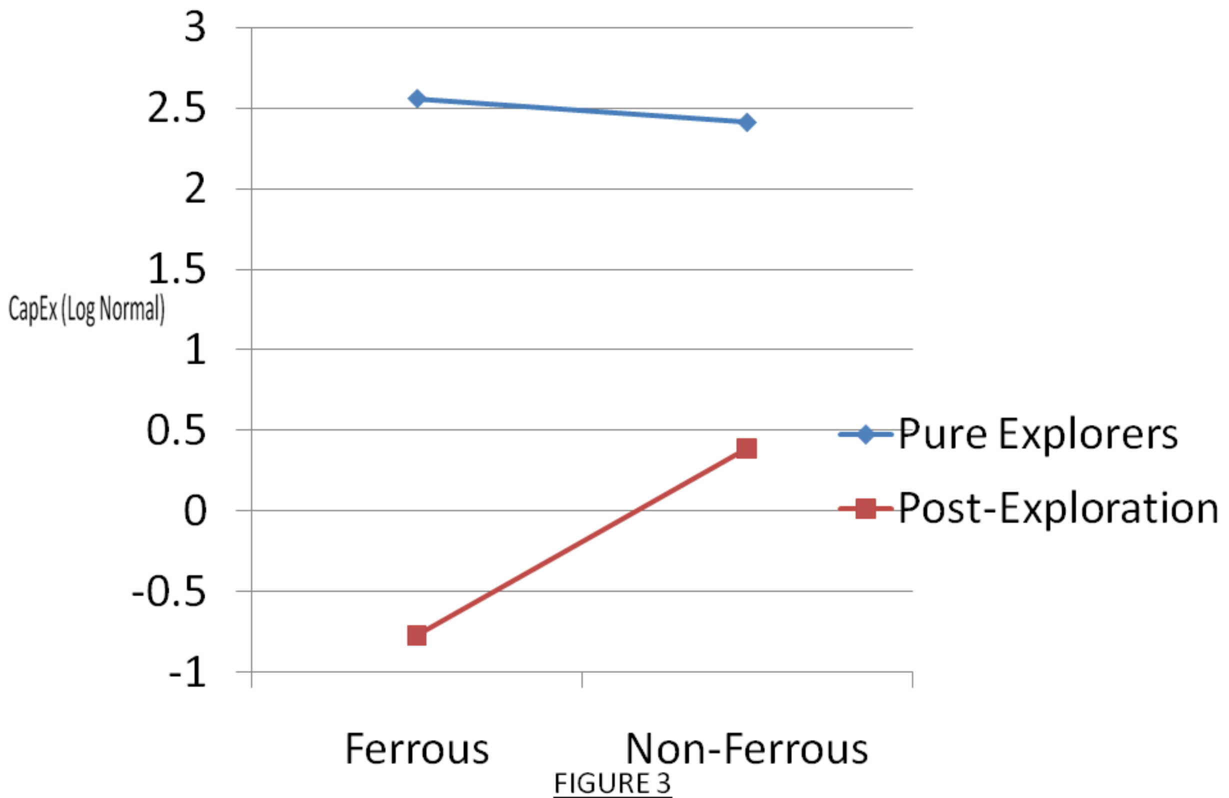

FIGURE 3

Miner Type By Sector Interaction for CapEx

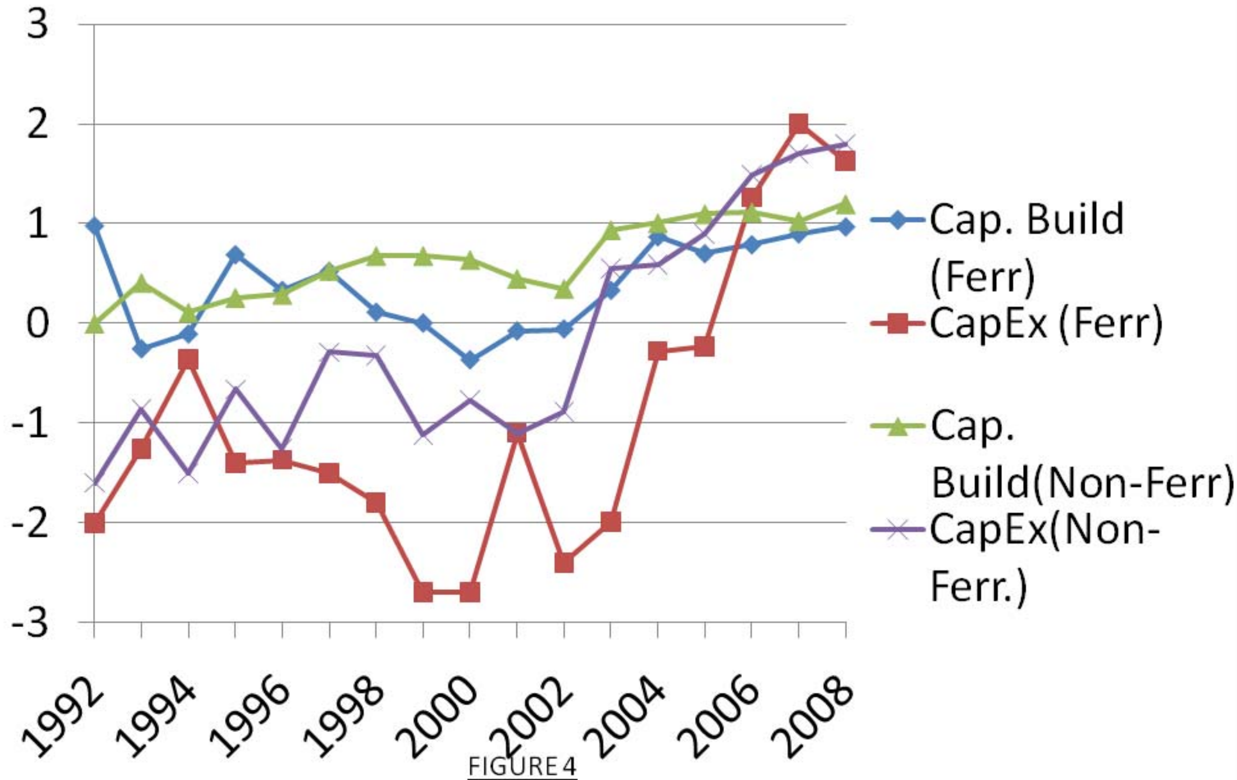

FIGURE 4

CapEx and Executive Focus on Capacity Building by Sectors