

Valuing Human Capital Career Development: A Real Options Methodology

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Artificial intelligence and the next generation of competences :
How Digital – and Artificial Intelligence will impact jobs and competences profiles?

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Originality of Our Study

- There has been a long controversy in the literature on assessing the value of human capital --a long-sought but elusive and challenging task. The ability to quantify *flexible human capital* (FHC) has been a shortcoming in extant literature.
- This is the **first** article that attempts to quantify the value of a company's sequential (staged), flexible career development program under uncertainty using the **real options (RO) methodology**.
- Our article proposes the “dual” use of **RO modeling** (Trigeorgis, 1996) & **multi-case study** approach (Eisenhardt, 1989) in an effort to apply and extend ROT to the domain of SHRM showing how an organization's flexible HC career development program can increase its ability to create and capture value.

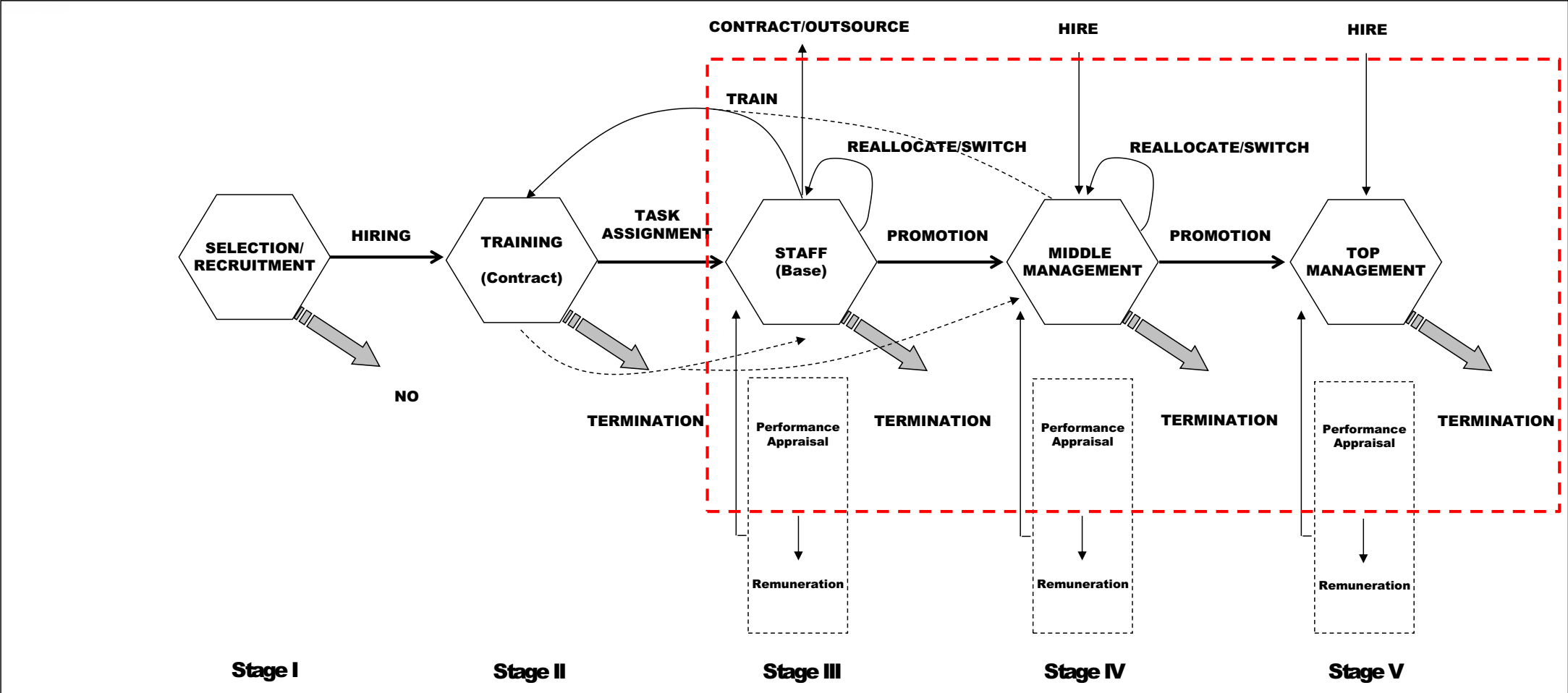
Implications for HR Scholars and Managers

- The multi-case study evidence involves 10 firms from *Fortune 500* “*best companies to work for*” showing that the value of employee career development is higher in more volatile sectors in line with ROT.
- A flexible perspective on HC offers **HR scholars** valuable direction as to how to value HRs as *staged investment processes* that enhance the firm’s ability to create and capture value. Our RO methodology has also significant implications for **HR managers**. It helps better manage sequential HR decisions concerning *where, when and how to invest in or redeploy HC*, accounting for the tradeoff between HR commitment and flexibility.

Career Development as Multi-Stage Option

- This novel perspective allows us to assess the value of **HC flexibility** embedded in the staged HC career development or internal promotion process.
- We illustrate how to estimate the **career development option value (CDOV)** for a company like Google, which might use the RO method to inform its staged career development program so as to create and capture value in an uncertain environment.
- Our focus is on the staging flexibility in HR as exemplified by the internal career development (promotion) process. This process can be viewed as a **multi-stage (compound) option** involving various types of HC uncertainty, HC options and associated HR practices.

Career Development as Multi-Stage Option



Findings & Contributions

- **(1) We model staging HR deployment** via the *option* to promote staff employees to middle-level management, itself embedding the *option* to rise to top management (see previous Figure).
- **(2) We provide practical guidelines on how this methodology can be applied** to companies like Google.
- **(3) To empirically validate** our valuation approach, we present **case study research** that enables quantifying *the option value of a career development program* for a sample of 10 public leading U.S. firms across industrial sectors.

Interaction of Various Literature Streams

- The paper builds upon long-standing debates in the management field concerning the **organizational view of career development programs** (Iles & Mabey, 1993; Herriot et. al. 1994), **flexible HR management** and its link to performance evaluation (e.g., Martin-Alcazar et al. 2008; Whyman et al. 2015), and **use of RO-based sequential decision-making** addressing the tradeoff between flexibility and commitment.
- Few past attempts to apply ROT to the HR context have been *qualitative* and *limited in scope* (Bhattacharya & Wright, 2005; Berk & Kase, 2010). ROT has been used more broadly in finance and strategy to improve strategic decisions (e.g., R&D problems, governance choices in JVs or acquisitions).
- Naturally, there is a *need*, and *value added*, to use a similar framework to improve decisions as to **how we manage people's career development**.



Addressing Recent Research Challenges

- Our ROT framework is well suited to address a “recent call” by Kryscynski & Ulrich (2015), who – noting that in the academic literature they don’t find “*much about how a company can redirect the actions and behaviors of its critical human capital to deliver on the changing demands of the external marketplace*” – encourage “**new conceptual frameworks and assumptions by bridging the theory practice gap**” and recommend to “**tie theoretical explanations to observable phenomena**” using theory to help explain interesting phenomena.
- They note that executives want to know how to take what we know about HR policies to affect selection that will maximize the value of the total HC resource to affect organizational outcomes.



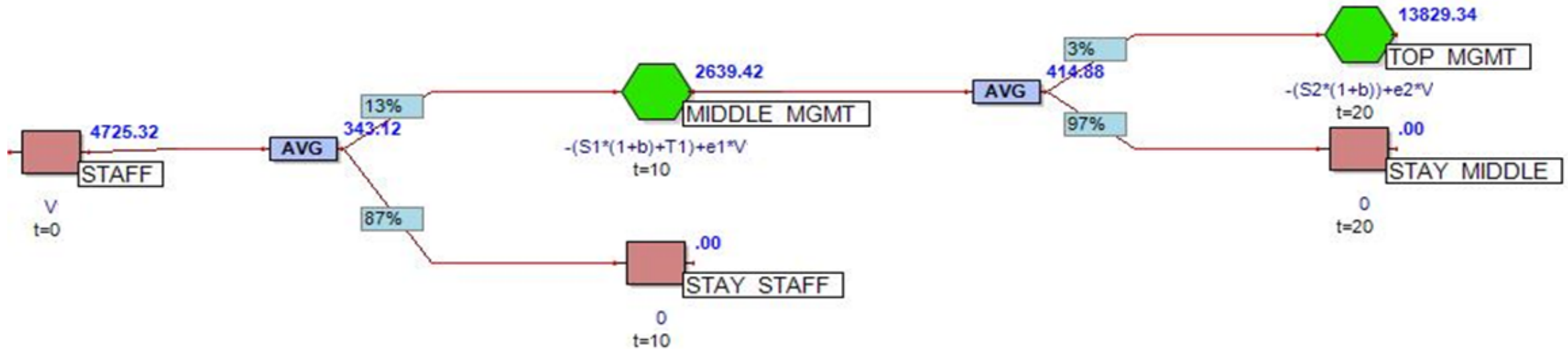
Addressing Recent Research Challenges (2)

- Our RO methodology helps rationalize the common practice among many organizations to be more “*open*” and *flexible* in the initial career development stages but exercise the option not to promote or to discontinue employment based on interim performance and evolving company needs.
- We also help address another “research challenge” posed by Mahoney & Kor (2015) regarding **how firms’ investments in human capital can be identified and measured.**

Career Development Option Value (CDOV)

- We estimate the **theoretical value** of the option to promote a typical employee from base staff to middle management, also accounting for the follow-on option to reach top management, as well as the probability of stage-by-stage successful promotion. We refer to this theoretical value as **Career Development Option Value (CDOV)**.
- A base employee's flexible career path is viewed and *modeled* as a *compound option* (the option tree *models* the staged career development process of previous Figure).
- Options here are represented with a hexagon, commitments with a box. The cash-flow outcome or payoff at the maturity of each option, indicating the resulting net value (value of cash flows received, V , net of costs incurred) if the option is exercised, is shown below the hexagon, along with its timing (maturity t).

Career Development Option Value (CDOV) (2)



Career Development Option Value (CDOV) (3)

- At stage 1 the firm (e.g., Google) has an option to promote a base employee (staff) to middle management, with payoff

$$\text{Max}(-(\text{S}_1 \cdot (1+b) + \text{T}_1) + \text{e}_1 \cdot \text{V} + \text{p} \cdot \text{C}, 0)$$

at year 10. Here p is the probability (as of stage 1) of successful promotion to top management.

- V is the expected or **average cash-flow value per typical base employee** (assuming the employee is replaced with a similar employee in perpetuity), representing the underlying human “asset” of the firm’s option to promote the employee in stage 1.
- When a typical employee is **promoted** from base staff (contributing value V at $t = 0$) to middle management in stage 1 (at year 10), her **direct value contribution to the firm increases by a multiplier e_1 to $e_1 \cdot V$** . Estimated as the ratio of the cash-flow-generation value contributed by a typical middle manager relative to that of a base employee (that is, **the ratio of their base compensations**).

Career Development Option Value (CDOV) (4)

- In addition, **the firm also receives**, with probability p , **the value of the option to promote the employee in the future to top management ($p \cdot C$)**.
- To exercise the option to promote base staff to middle management, **the firm incurs an incremental salary differential** (i.e., pays a salary increase), S_1 , amplified (multiplicatively) by **associated benefits**, such as health benefits, amounting to **$b\%$ of salary ($b \cdot S_1$)**, plus **incremental training costs** from promotion to middle management of T_1 thousand \$ (k) per employee.
- A similar analysis on an incremental basis occurs in the last option (hexagon labeled top management) in the last stage (stage 2 at year 20) involving subsequent promotion from middle to top management (not the CEO position).
- We assume there are no training costs for top management.
- **The average timing of a typical career move** in the illustrative example is **10 years**.

Firm-Specific Data as Option Model Inputs

- To implement the above, we obtained *firm-specific* data on 10 U.S. firms that correspond to standard (compound) options model **inputs**:
 - ✓ **average generated cash-flow value per typical base employee** replaced in perpetuity (underlying asset, V);
 - ✓ **basic salaries** for staff, middle and top management to estimate salary differentials from promotions (S_1 and S_2);
 - ✓ **incremental benefits** (including health) as % of salary increments ($b \cdot S_1$ and $b \cdot S_2$);
 - ✓ **incremental training costs** for promotion from base employee to middle manager (T_1);
 - ✓ **firm-specific probabilities of successful promotion to middle and top positions** by stage;
 - ✓ promotion /expanded **value contribution multiples** from promotion to middle (e_1) and to top (e_2) positions;
 - ✓ **average timing of a typical career move** (e.g., 10 or 20 years).



***Firm-Specific* Data as Option Model Inputs (2)**

- These *firm-specific* data - supplemented with **industry sector 10-year volatility** estimates and interest rates (discount factors) - are applied to each firm to estimate its theoretical RO value of staging/promotion.

Illustrating CDO Valuation at Google

- It involves **3 binomial trees**: (1) the tree for the underlying human “asset”, V , (2) the tree for the second-stage option of promotion to top management, and (3) the first-stage or compound option of promotion to middle management (accounting for the follow-on option to promote to top management).
- The **inputs** are:
 - ✓ $V = \$4,382$ thousand (k);
 - ✓ basic annual salaries for staff, middle and top management (not CEO) are \$119 k, \$185.4 k and \$3,817 k, resulting in annual salary increments of 66.4 k ($\$185.4 - 119$ k) and 3631.2 k, respectively;
 - ✓ S_1 is the PV (as of stage 1 or year 10) of future annual salary increments thereafter; discounted at a 9% WACC for Google it amounts to \$737.8 k ($= 66.4 \text{ k}/0.09$) (or alternatively \$3,018 k at the 2.2% riskless rate if the firm is obliged to make them). S_2 is similarly estimated at \$40,346.7 k (or \$165,073 k at 2.2%);
 - ✓ benefits (including health) are $b = 25\%$ of salary;
 - ✓ incremental training costs (from promotion to middle level) are \$2 k per employee;

Illustrating CDO Valuation at Google (2)

- ✓ probabilities of promotion to middle and top management positions are 13% and 3%;
- ✓ promotion/expansion value multiples from promotion to middle and to top management positions are $e_1 = 1.6$ (obtained as the ratio of \$185.4 k / \$119 k) and $e_2 = 32.1 (= 3,817/119)$.
- ✓ average timing of a typical career move is 10 years;
- ✓ 10-year industry sector volatility estimate is $\sigma = 0.23$ or 23% for Google's internet sector.

Excel Implementation of CDO Valuation for Google



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Stage 1

Stage 2

Underlying ("Human") Asset Value (V) Evolution

Period	Stage 1					Stage 2					
Year	0	1	2	3	4	6	7	8	9	10	
	0	2	4	6	8	12	14	16	18	20	
0	4,382	6,067	8,399	11,627	16,097	22,285	30,851	42,710	59,128	81,857	113,323
1		3,165	4,382	6,067	8,399	11,627	16,097	22,285	30,851	42,710	59,128
2			2,286	3,165	4,382	6,067	8,399	11,627	16,097	22,284	30,851
3				1,652	2,286	3,165	4,382	6,067	8,399	11,627	16,097
4					1,193	1,652	2,286	3,165	4,382	6,067	8,399
5						862	1,193	1,652	2,286	3,165	4,382
6							622	862	1,193	1,652	2,286
7								450	622	862	1,193
8									325	450	622
9										235	325
10											169

Option to Promote to Top Management (t = 10 or Year 20)

Period	Stage 1					Stage 2					
Year	0	1	2	3	4	6	7	8	9	10	
	0	2	4	6	8	12	14	16	18	20	
0	13,829	27,715	54,072	102,341	187,225	329,967	559,158	912,320	1,443,064	2,239,087	3,431,327
1		6,576	14,051	29,286	59,275	115,889	217,530	389,540	662,573	1,073,845	1,691,666
2			2,608	6,012	13,579	29,907	63,843	130,987	255,341	465,863	783,973
3				773	1,950	4,857	11,900	28,550	66,536	148,639	310,370
4					130	364	1,022	2,867	8,041	22,554	63,621
5						0	0	0	0	0	0
6							0	0	0	0	0
7								0	0	0	0
8									0	0	0
9										0	0
10											0

$\text{Max}(-S^2(1+b) + e^2V, 0)$

(Compound) Option to Promote to Middle Management (t = 5 or Year 10)

Period	Stage 1					
Year	0	1	2	3	4	
	0	2	4	6	8	
0	2,639	4,988	9,029	15,610	25,887	41,780
1		1,434	2,947	5,768	10,627	18,306
2			638	1,483	3,297	6,829
3				182	512	1,436
4					0	0
5						0

$\text{Max}(-S^1(1+b)+T^1+e^1V+p_{top}C, 0)$

Staff (t = 0)

Period	0
Year	0
0	343

$p_{mid}C_0$

Excel Implementation of CDO Valuation for Google

- Since the firm's decision in stage 1 (at $t = 5$ or in 10 years) whether to promote a staff employee to middle management involves a comparison of the incremental costs of promotion ($-S_1 \cdot (1+b) - T_1$) with the total incremental benefits comprising of the extra (expanded) value of cash flows ($e_1 \cdot V$) plus the expected option value of future promotion from middle to top management (C) [to be obtained at year 10 with probability of promotion $p = 0.03$], the latter **option value C needs to be estimated first**.
- Hence valuation starts from the end, at the maturity of the last option (in year 20), then working backward.
- The first binomial tree shows the evolution of V along different possible paths into the future (until $t = 20$). After one time period (here each time period dt is 2 years), **employee value** can go up by a multiplicative factor u ($= 1.3844$) to 6,067 or down by a reciprocal factor d ($= 0.7223$) to 3,165, all the way to the eleven values in the last column after 10 time steps.

Excel Implementation of CDO Valuation for Google

- Given the possible future “asset” values in the different scenarios shown in the last column of the 1st tree, Google management would make an optimal decision in the 2nd stage (at year 20) whether to promote the typical middle manager to top management, with the value outcomes shown in the last column of the 2nd tree.
- For example, in the topmost node representing the most optimistic future scenario, where the value of a base employee V would be 113,323, **the expanded benefits from promotion** ($e_2 * V = 32.1 * 113,323$) **exceed the incremental costs** ($-S_2 * (1+b) = -165,073 * 1.25$) by a positive margin and hence **the employee would be promoted**.
- By contrast, **in adverse future scenarios** (last 6 nodes in the last column in the 2nd tree) the value benefits to the firm are not sufficient to cover the incremental promotion costs and **the option to promote to top management will not be exercised**, resulting in a truncated value of 0.

Excel Implementation of CDO Valuation for Google

- The criterion for exercising the **option to promote the employee from staff to middle management** is to promote if $-(S_1*(1+b)+T_1) + (e_1*V + p*C)$ is > 0 , with probability $p = 0.03$. For example, in the uppermost node in the 3rd tree at $t = 5$, with $V = 22,285$ (for 1st “asset” tree) and $C = 329,967$ from 2nd, top management promotion tree, **the combined benefits of promotion**, $e_1*V + p*C = 1.6*22,285 + 0.03*329,967$, **exceed the total promotion costs**, $S_1*(1+b)+T_1 = 3,018*1.25+2 = 3,775$, and hence **the option to promote is exercised**. However, this is not the case in the last 2 states resulting in non-exercise of the option to promote to middle management (with values truncated to 0).
- The standard option valuation process is repeated step by step going back until $t = 0$, with a **time-0 value of the option to promote from staff to middle management** of **2,639**. Given an estimated 13% probability of promotion to middle management at $t = 0$ (to obtain this option value), the **CDOV** per typical Google employee is **\$343 k** [\$690,760 if the appropriate riskiness and discount rate for future salary increments is the WACC (9% for Google).



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CDOVs for a Sample of 10 U.S. “Best Companies to Work For” (Fortune’s 100, 2014)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dynamics	DJ Index	Volatility	Company	Business Description	Enterprise Value (EV)	N° of Staff Employees	Career Development Option Value (per employee)	Career Development Option Value (Company)	Career Development Option Value (% of EV)
					(\$billion)		(\$)	(\$billion)	(%)
Defensive	Consumer Goods	16%	General Mills	Food processing	\$38.24	30,420	\$41,730	\$1.27	3%
			Whole Foods Market	Natural and organic food distribution	\$12.70	50,692	\$4,900	\$0.25	2%
	Health Care	17%	Stryker	Medical equipment	\$27.19	19,117	\$142,980	\$2.73	10%
Normal	Consumer Services	20%	Nordstrom	Upscale fashion retail	\$15.63	54,346	\$15,110	\$0.82	6%
Sensitive	Telecom	21%	Qualcomm	Mobile technology	\$103.25	26,960	\$319,310	\$8.61	8%
	Technology	23%	Google	Internet	\$297.42	41,525	\$690,760	\$28.68	10%
			Intel	Semiconductors	\$150.81	47,745	\$266,800	\$12.74	8%
	Oil & Gas/Energy	29%	Devon Energy	Oil and gas exploration	\$34.45	5,109	\$742,940	\$3.79	11%
NuStar Energy			Storage and pipeline operations	\$6.53	1,642	\$136,690	\$0.22	3%	
Cyclical	Basic Materials	30%	EOG Resources	Natural resources development	\$55.47	2,268	\$2,899,310	\$6.58	12%
									Mean = 7%

CDOVs for a Sample of 10 U.S. “*Best Companies to Work For*” (Fortune’s 100, 2014) (2)

- These 10 firms span U.S. *industrial sectors* and *industry dynamics*: from ‘**defensive**’ covering consumer goods (e.g., General Mills) and health care (e.g., Stryker), ‘**normal**’ such as consumer services (e.g., Nordstrom), to ‘**sensitive**’ sectors spanning telecom (Qualcomm), technology (Google and Intel), oil and gas/energy (e.g., Devon Energy), and ‘**cyclical**’ encompassing basic materials (EOG Resources).
- They are from *Fortune’s 100 Best Companies to Work For 2014*, with many cross-listed in *Forbes’/Glassdoor 50 Best Places to Work 2014*. This double check enhances validity and acceptance as to which are best-HC companies (cross-referenced from two independent sources), also ensuring that most are known companies from Fortune 500.
- We restrict our sample to public companies as we rely on market data for our compound-option model to estimate the CDOVs in these firms.

CDOVs for a Sample of 10 U.S. “*Best Companies to Work For*” (Fortune’s 100, 2014) (3)

- The previous table summarizes the results for Google and other firms in our sample when future annual salary increments from promotion are discounted at each company’s WACC.
- For **Google** (shaded area), at 9% WACC, the CDOV per employee is **\$690,760**. Multiplied by number of staff employees (column 7) it gives the CDOV for the whole company (**\$28.68 bln**) in Column (9), representing 10% of EV (column 10).
- Firms in medical equipment (Stryker with a 10% CDOV estimate), technology (Google with 10%), oil and gas exploration (Devon Energy 11%) and basic natural resources (EOG 12%) have high CDOV, whereas firms in consumer goods (General Mills with 3% CDOV) and fashion retailing (Nordstrom with 6%) have lower values. The average (mean) CDOV across industrial sectors is 7%.
- Anecdotal evidence supports the reasonableness of these estimates. According to *Fortune*, at **Google** employees can move at a fast pace, with most successful being those who take risks towards innovation.

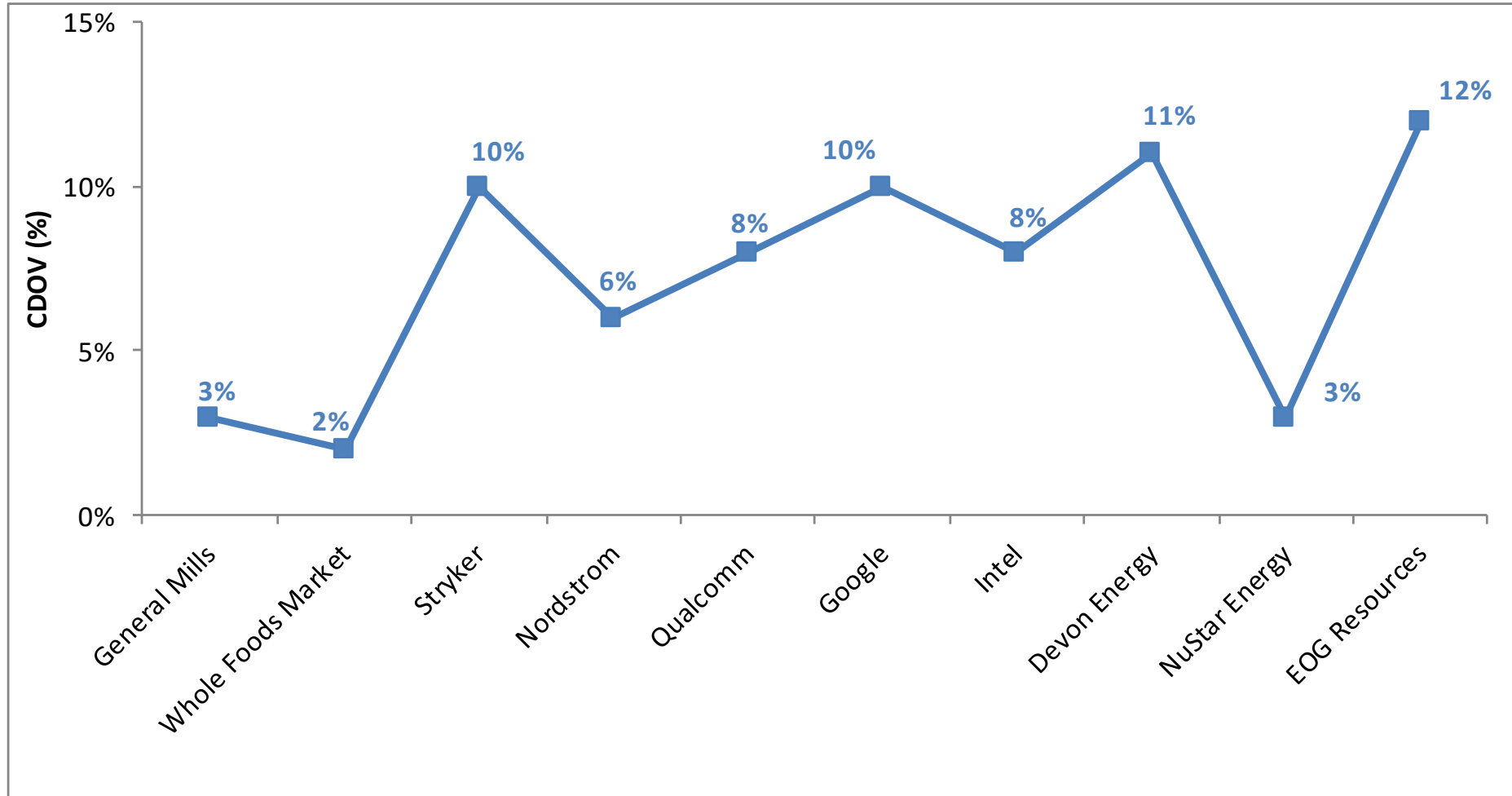
CDOVs for a Sample of 10 U.S. “*Best Companies to Work For*” (Fortune’s 100, 2014) (4)

- At shoe retailer **Nordstrom** (with 6% of value from CDOV), employees value internal mobility opportunities to move around the company in terms of positions and geography. *“If you are willing to re-locate for some roles, your professional growth is limitless,”* noted one employee. Moreover, there is high variability in salary scales across ranks through a commission pay structure, which raises the value of CDOV.
- At **Devon Energy** (with 11% of value from CDOV), 7 out of 10 workers believe managers award promotions to those who deserve them.
- At **EOG Resources** (with 12% of value from career development), employees praise the company’s salaries and benefits. 9 out of 10 employees feel they make a difference at the organization. *“The opportunities are tremendous. Advancement opportunities will be available. It is exciting to be in the growth and able to have a shot at moving up,”* noted another employee.

CDOVs for a Sample of 10 U.S. “*Best Companies to Work For*” (Fortune’s 100, 2014) (5)

- In the technology sector, although **Intel** is comparable to Google, its CDOV is somewhat lower (8%) partly because of a policy of flatter salary scales across ranks.
- The CDOV estimates for these 10 companies, expressed as % of their EV, are graphed *across US firms* (panel A) and *industrial sectors* (panel B) showing a **pattern that increases with volatility**.
- The above patterns are reasonable. Firms in less dynamic industries (e.g., defensive) rely more on committed employee modes and on internal development with flatter salary scales, while firms in volatile industries rely more on flexible human resource management, including more staging flexibility.

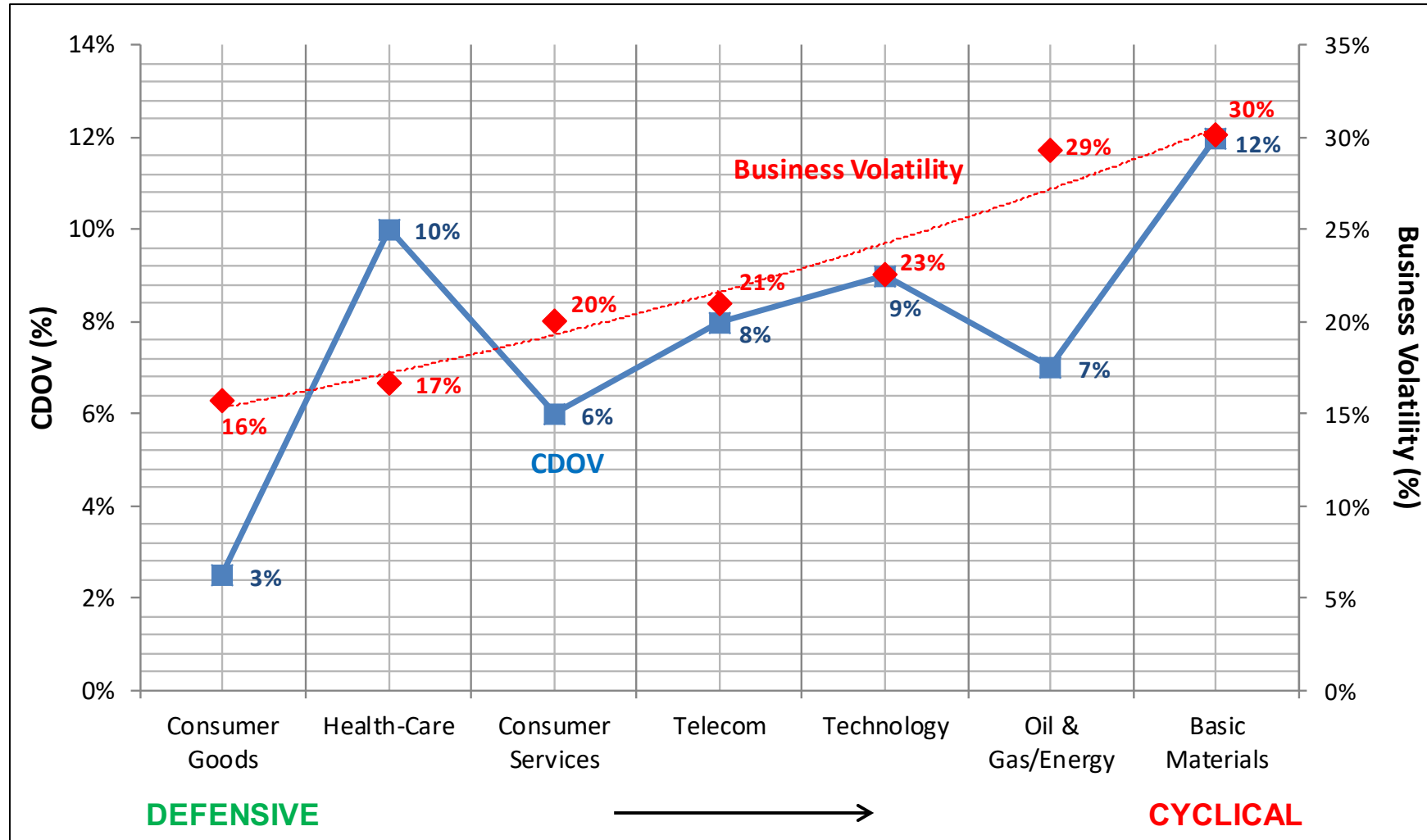
Estimates of CDOVs across U.S. Firms





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Estimates of CDOVs across U.S. Industrial Sectors



Implications for HR/Strategy Scholars and Managers

- Our proposed methodological approach to HC career development programs based on ROT has the potential to be both **impactful to HR scholarship** and **relevant for managerial practice**, thus addressing a call by Kryscynski & Ulrich (2015) to *make human capital theory both rigorous and relevant*.
- **HR scholars and managers** can determine the flexibility value unleashed from staging the deployment of HC resources in the face of unanticipated demand and skills shifts.
- **Strategy scholars and top managers** may better understand how developing a HR adaptive organizational capability can be a source of sustainable competitive advantage for firms in dynamic industries.

Conclusions

- In this paper, we have shown **how to value theoretically a multi-stage decision process in an organizational context involving HC career development programs** and provided an **innovative application of real options methodology to SHRM**.
- Assessing the value contribution of HRs is important for corporate value creation, objective corporate performance evaluation and the enhancement of competitive advantage, an objective that has eluded the management profession for decades.
- This article is *innovative* in being the first to quantify the value of HC's contribution to corporate value creation and provide objective evaluation in the context of organizational career development programs.
- Our RO approach offers guidance as to how to value HRs as a *sequential investment process* under uncertain demand or skill conditions.



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Conclusions (2)

- It rationalizes the common practice among many organizations to be more *flexible* in the initial career development stages and be more *cherry picking* as one moves higher-up the organizational hierarchy later on.