

Internet Appendix to “Labor-Technology Substitution: Implications for Asset Pricing”

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Abstract

In this Appendix, I provide supplementary results on (1) the most and the least routine occupations, (2) a difference-in-differences test of firm investment in machines before and after recessions, (3) a decomposition of market betas following [Campbell and Vuolteenaho \(2004\)](#), and (4) several robustness checks.

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Table IA.1
Most and Least Routine Occupations

This table reports the 10 occupations with the highest routine-task intensity (RTI) scores and the 10 occupations with the lowest, as of 2014.

SOC	Occupation Title	RTI Score
Panel A: Top 10 Occupations with the Highest RTI Score		
43-9051	Mail Clerks and Mail Machine Operators, Except Postal Service	1.66
43-4071	File Clerks	1.65
51-9031	Cutters and Trimmers, Hand	1.64
51-3093	Food Cooking Machine Operators and Tenders	1.62
51-9022	Grinding and Polishing Workers, Hand	1.61
51-6062	Textile Cutting Machine Setters, Operators, and Tenders	1.57
43-6012	Legal Secretaries	1.54
43-4021	Correspondence Clerks	1.47
53-7011	Conveyor Operators and Tenders	1.47
23-2091	Court Reporters	1.42
Panel B: Bottom 10 Occupations with the Lowest RTI Score		
39-9031	Fitness Trainers and Aerobics Instructors	-2.98
33-1021	First-Line Supervisors of Fire Fighting and Prevention Workers	-2.95
17-2021	Agricultural Engineers	-2.73
19-3092	Geographers	-2.73
11-9021	Construction Managers	-2.61
13-1141	Compensation, Benefits, and Job Analysis Specialists	-2.53
21-1094	Community Health Workers	-2.53
53-5031	Ship Engineers	-2.41
25-2012	Kindergarten Teachers, Except Special Education	-2.38
53-4011	Locomotive Engineers	-2.28

Table IA.2

Firm Investment in Machines and Recessions using Difference-in-Differences

This table reports the difference-in-differences results of firms' investment in machines before and after the 2001 and 2008-09 recessions conditional on their share of routine-task labor, $RShare$. $RShare$ is the ratio of the firm's total wage expense on routine-task labor relative to its total wage expense, and it is defined in the year before the recessions, i.e., 2000 and 2007, respectively. $Post_t$ is a dummy variable that equals 1 if the year is within one, two, or three years after the beginning of recessions (including the recession year), and 0 if the year is within one, two, or three years before recessions, for results in Columns (1)-(2), (3)-(4), and (5)-(6), respectively. The dependent variable is *Investment in Machines*, which is the real growth rate of machinery and equipment at cost (Compustat item FATE). See the Appendix in the paper for definitions of other firm-level variables. All standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively. The sample period is 1998-2003 and 2005-2010.

Panel A: Difference-in-Differences in Various Test Windows Around Recessions						
	1-Year Window		2-Year Window		3-Year Window	
	(1)	(2)	(3)	(4)	(5)	(6)
$RShare \times Post_t$	0.098** (0.045)	0.052 (0.044)	0.092*** (0.032)	0.067** (0.031)	0.075*** (0.028)	0.060** (0.028)
Log Tobin's Q_{t-1}		0.151*** (0.019)		0.127*** (0.012)		0.118*** (0.010)
Mkt.Lev $_{t-1}$		-0.186*** (0.060)		-0.216*** (0.035)		-0.243*** (0.027)
Cash Flow $_{t-1}$		-0.001 (0.003)		-0.001 (0.002)		-0.000 (0.002)
Cash Holding $_{t-1}$		0.425*** (0.077)		0.371*** (0.052)		0.350*** (0.041)
Log Asset $_{t-1}$		-0.035* (0.018)		-0.034*** (0.012)		-0.037*** (0.010)
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	8,022	6,498	15,432	12,571	22,214	18,153
Adjusted R^2	0.539	0.617	0.414	0.475	0.357	0.432

Table IA.2 – *Continued*

Panel B: Difference-in-Differences in 3-Year Window Controlling for Cross-Terms						
	(1)	(2)	(3)	(4)	(5)	(6)
RShare \times Post _{<i>t</i>}	0.052* (0.028)	0.075*** (0.028)	0.064** (0.027)	0.050* (0.028)	0.069** (0.028)	0.040 (0.028)
Log Tobin's Q _{<i>t-1</i>}	0.178*** (0.011)					0.118*** (0.012)
Log Tobin's Q _{<i>t-1</i>} \times Post _{<i>t</i>}	-0.013 (0.009)					-0.008 (0.011)
Mkt.Lev _{<i>t-1</i>}		-0.528*** (0.033)				-0.241*** (0.035)
Mkt.Lev _{<i>t-1</i>} \times Post _{<i>t</i>}		0.113*** (0.021)				-0.021 (0.026)
Cash Flow _{<i>t-1</i>}			-0.001 (0.001)			-0.002 (0.002)
Cash Flow _{<i>t-1</i>} \times Post _{<i>t</i>}			0.003** (0.001)			0.002 (0.002)
Cash Holding _{<i>t-1</i>}				0.509*** (0.048)		0.392*** (0.046)
Cash Holding _{<i>t-1</i>} \times Post _{<i>t</i>}				-0.173*** (0.032)		-0.109*** (0.035)
Log Asset _{<i>t-1</i>}					-0.088*** (0.011)	-0.037*** (0.010)
Log Asset _{<i>t-1</i>} \times Post _{<i>t</i>}					0.009*** (0.002)	-0.000 (0.003)
Firm FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	18,216	18,205	21,772	22,208	22,212	18,153
Adjusted R ²	0.412	0.407	0.357	0.371	0.367	0.433

Table IA.3
Robustness Check: Response of Firm Investment to Aggregate Shocks
— Other Investments

This table shows the response of various types of investments to aggregate shocks for firms with different share of routine-task labor, $RShare$. $Capx$ is firms' capital expenditure (Compustat item CAPX) normalized by last year's total assets (AT). $\Delta All\ but\ Mach$ is the growth rate of total capital except for machinery and equipment at cost (PPEGT – FATE). $R\&D$ is firms' expenditure on research and development (XRD) normalized by last year's total assets. $\Delta PPENT$ is the growth rate of the net value of property, plant, and equipment (PPENT). $\Delta PPEGT$ is the growth rate of the gross value of property, plant, and equipment (PPEGT). ΔAT is the growth rate of total assets (AT). $Divest$ is firms' sales of property, plant, and equipment (SPPE) normalized by the previous year's total assets. All variables are constructed in real terms. $Shock$ is the growth rate of real GDP value added. Ind is the Fama-French 17 industry classification. See the Appendix for definitions of firm-level variables. All standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively. The sample period is 1990-2014.

Dep. Var.	Capx	$\Delta All\ but\ Mach$	R&D	$\Delta PPENT$	$\Delta PPEGT$	ΔAT	Divest
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$RShare_{t-1} \times Shock_t$	-1.731** (0.715)	-1.333 (1.362)	0.092 (0.164)	-1.066 (0.799)	-0.719 (0.531)	-0.189 (0.632)	0.182 (0.165)
$RShare_{t-1}$	0.042 (0.026)	0.013 (0.047)	-0.002 (0.006)	0.030 (0.029)	0.012 (0.018)	0.009 (0.021)	-0.005 (0.006)
Log Tobin's Q_{t-1}	0.191*** (0.008)	0.203*** (0.017)	0.031*** (0.002)	0.236*** (0.011)	0.154*** (0.007)	0.292*** (0.009)	-0.002** (0.001)
Mkt.Lev $_{t-1}$	-0.133*** (0.015)	-0.266*** (0.041)	0.014*** (0.005)	-0.353*** (0.022)	-0.256*** (0.015)	-0.288*** (0.017)	0.016*** (0.004)
Cash Flow $_{t-1}$	0.002 (0.001)	0.004 (0.003)	-0.001** (0.000)	0.001 (0.002)	0.000 (0.001)	0.003*** (0.001)	0.000 (0.000)
Cash Holding $_{t-1}$	0.505*** (0.031)	0.741*** (0.073)	-0.028*** (0.008)	0.658*** (0.042)	0.371*** (0.024)	-0.177*** (0.027)	-0.010** (0.004)
Log Asset $_{t-1}$	-0.030*** (0.006)	-0.067*** (0.013)	-0.044*** (0.002)	-0.058*** (0.008)	-0.029*** (0.005)	-0.183*** (0.006)	-0.006*** (0.001)
Firm FE	Y	Y	Y	Y	Y	Y	Y
Ind \times Year FE	Y	Y	Y	Y	Y	Y	Y
Observations	55,220	37,808	32,388	56,648	54,358	56,702	42,502
Adjusted R^2	0.473	0.340	0.811	0.346	0.419	0.418	0.333

Table IA.4
Robustness Check: Response of Firm Investment to Aggregate Shocks
— All Variables Standardized and Controlling for Cross-Terms

This table shows the response of investment in machines to aggregate shocks for firms with different shares of routine-task labor, $RShare$. The dependent variable is *Investment in Machines*, which is the real growth rate of machinery and equipment at cost (Compustat item FATE). *Shock* is the growth rate of real GDP value added. All variables are standardized so that the mean equals 0 and the standard deviation equals 1. *Ind* is the Fama-French 17 industry classification. See the Appendix for definitions of firm-level variables. All standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively.

Dep. Var.	Investment in Machines						
	(1)	(2)	(3)	(4)	(5)	(6)	(6)
$RShare_{t-1} \times Shock_t$	-0.010** (0.005)	-0.011** (0.005)	-0.008* (0.005)	-0.009* (0.005)	-0.011** (0.005)	-0.004 (0.005)	-0.010** (0.005)
$RShare_{t-1}$	0.003 (0.008)	0.005 (0.008)	0.005 (0.007)	0.005 (0.008)	0.005 (0.008)	0.004 (0.007)	0.005 (0.008)
Log Tobin's Q_{t-1}	0.234*** (0.013)	0.236*** (0.013)	0.198*** (0.015)	0.233*** (0.013)	0.236*** (0.013)	0.232*** (0.013)	0.234*** (0.013)
Mkt Lever $_{t-1}$	-0.170*** (0.014)	-0.169*** (0.014)	-0.171*** (0.014)	-0.147*** (0.014)	-0.169*** (0.014)	-0.174*** (0.014)	-0.171*** (0.014)
Cash Flow $_{t-1}$	0.008 (0.020)	0.009 (0.020)	0.009 (0.020)	0.009 (0.020)	0.007 (0.021)	0.008 (0.020)	0.008 (0.020)
Cash Holding $_{t-1}$	0.971*** (0.088)	0.971*** (0.088)	0.967*** (0.088)	0.965*** (0.088)	0.971*** (0.088)	0.693*** (0.091)	0.965*** (0.088)
Log Asset $_{t-1}$	-0.069*** (0.017)	-0.066*** (0.017)	-0.062*** (0.017)	-0.065*** (0.017)	-0.066*** (0.017)	-0.066*** (0.017)	-0.051*** (0.017)
Log Tobin's $Q_{t-1} \times Shock_t$			0.050*** (0.013)				
Mkt.Lev $_{t-1} \times Shock_t$				-0.039*** (0.010)			
Cash Flow $_{t-1} \times Shock_t$					0.002 (0.018)		
Cash Holding $_{t-1} \times Shock_t$						0.071*** (0.013)	
Log Asset $_{t-1} \times Shock_t$							-0.073*** (0.017)
Firm FE	Y	Y	Y	Y	Y	Y	Y
Year FE	N	Y	Y	Y	Y	Y	Y
Ind \times Year FE	Y	N	N	N	N	N	N
Observations	38,616	38,616	38,616	38,616	38,616	38,616	38,616
Adjusted R^2	0.406	0.404	0.404	0.404	0.404	0.405	0.404

Table IA.5
Robustness Check: Response of Firm Investment to Aggregate Shocks
— Using An Alternative Classification of Routine-Task Labor

This table shows the response of investment in machinery capital (main test) and structural capital (placebo test) to aggregate shocks for firms with different shares of routine-task labor, $RShare$. $RShare$ is the ratio of a firm's total wage expense on its routine-task labor to its total wage expense, as defined in equation (24) using P75 instead of P80. The sample period is 1990-2014 for all columns except for Columns (3) and (4) which exclude 2002-2004 to rule out the impact of the Job Creation and Worker Assistant (JCWA) Act of 2002 (see Section B.4. in the paper for details about the JCWA Act). The dependent variables are *Investment in Machines*, which is the real growth rate of machinery and equipment at cost (Compustat item FATE), and *Investment in Structures*, which is the real growth rate of building (FATB), construction in progress (FATC), and land and improvements (FATP) at cost. *Shock* is the growth rate of real GDP value added. *Ind* is the Fama-French 17 industry classification. See the Appendix for definitions of firm-level variables. All standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively.

Dep. Var.	Investment in Machines				Investment in Structures	
	(1)	(2)	(3)	(4)	(5)	(6)
$RShare_{t-1}$	0.046** (0.018)	0.040** (0.017)	0.048** (0.019)	0.043** (0.018)	-0.005 (0.089)	-0.008 (0.090)
$RShare_{t-1} \times Shock_t$	-1.145** (0.556)	-0.964* (0.532)	-1.334** (0.593)	-1.279** (0.562)	-1.744 (2.707)	-0.950 (2.680)
Log Tobin's Q_{t-1}		0.127*** (0.007)		0.128*** (0.008)		0.247*** (0.031)
Mkt.Lev $_{t-1}$		-0.222*** (0.018)		-0.222*** (0.019)		-0.258*** (0.065)
Cash Flow $_{t-1}$		0.000 (0.001)		0.000 (0.001)		0.033*** (0.008)
Cash Holding $_{t-1}$		0.305*** (0.028)		0.337*** (0.031)		0.931*** (0.125)
Log Asset $_{t-1}$		-0.022*** (0.005)		-0.027*** (0.006)		-0.149*** (0.023)
Firm FE	Y	Y	Y	Y	Y	Y
Ind \times Year FE	Y	Y	Y	Y	Y	Y
Observations	38,616	38,616	33,248	33,248	32,223	32,223
Adjusted R^2	0.355	0.406	0.384	0.436	0.253	0.271

Table IA.6
Robustness Check:
Response of Establishment Routine-Task Employment to Aggregate Shocks
— Using An Alternative Classification of Routine-Task Labor

Panel A shows the response of routine-task employment changes to aggregate shocks at establishment level. Workers with occupations that fall in the top quartile (instead of the top quintile) of the distribution, in terms of the occupations' routine-task intensity scores, are classified as routine-task labor. $Chg. Emp_{t-3,t}^R$ is the establishment's 3-year change in employment of routine-task labor normalized by the total number of employees three years earlier. $Chg. RShare_{t-3,t}^{Est,Emp}$ and $Chg. RShare_{t-3,t}^{Est}$ are the 3-year changes in the establishment's employment-based share of routine-task labor and share of routine-task labor, respectively. An establishment's (employment-based) share of routine-task labor is the ratio of its (total employment of routine-task labor) total wage expense on its routine-task labor to its (total number of employees) total wage expense. In all variable constructions, routine-task labor is defined at $t - 3$ and maintains the same definition for three years to form the time-series changes of the variables. $RShare_{t-3}$ is the establishment's parent firm's $RShare$ three years before in Columns (1), (3), and (5); and the establishment's $RShare$ three years before in Columns (2), (4), and (6). $Shock_{t-3,t}$ is the growth rate of real GDP value added from $t - 3$ to t . Ind is the Fama-French 17 industry classification. $State$ is the state in which the establishment is located. Panel B reports the response of routine-task employment to aggregate shocks in newly opened establishments. An establishment is identified as newly opened in year t if it does not exist in the Quarterly Census of Employment and Wages database in year $t - 1$ but exists in year t . $RShare_t^{Est,Emp}$ and $RShare_t^{Est}$ are the establishment's employment-based share of routine-task labor and share of routine-task labor, respectively. $RShare_{t-1}$ is the establishment's parent firm's $RShare$ in year $t - 1$. $Shock_t$ is the growth rate of real GDP value added in year t . Standard errors are clustered at the firm level in all cases except for Columns (2), (4), and (6) in Panel A, which are clustered at the establishment level, and reported in parentheses. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively. The sample period is 1996-2014 for Panel A, and 1990-2014 for Panel B.

Panel A: Existing Establishments						
Dep. Var.	Chg. $Emp_{t-3,t}^R$		Chg. $RShare_{t-3,t}^{Est,Emp}$		Chg. $RShare_{t-3,t}^{Est}$	
<i>Level of $RShare_{t-3}$:</i>	Firm	Est.	Firm	Est.	Firm	Est.
	(1)	(2)	(3)	(4)	(5)	(6)
$RShare_{t-3}$	-0.900*** (0.079)	-0.833*** (0.015)	-0.744*** (0.058)	-0.812*** (0.009)	-0.679*** (0.055)	-0.750*** (0.008)
$RShare_{t-3}$ $\times Shock_{t-3,t}$	1.533** (0.752)	0.310 (0.197)	0.853** (0.378)	0.468*** (0.101)	0.775** (0.338)	0.326*** (0.094)
Firm FE	Y	Y	Y	Y	Y	Y
Ind×Year FE	Y	Y	Y	Y	Y	Y
State×Year FE	Y	Y	Y	Y	Y	Y
Observations	79,344	79,344	79,344	79,344	79,344	79,344
Adjusted R^2	0.160	0.240	0.134	0.380	0.137	0.395

Table IA.6 – *Continued*

Panel B: Newly Opened Establishments		
Dep. Var.	RShare _t ^{Est,Emp}	RShare _t ^{Est}
	(1)	(2)
RShare _{t-1}	0.516*** (0.114)	0.508*** (0.108)
RShare _{t-1} × Shock _t	0.073*** (0.020)	0.067*** (0.020)
Firm FE	Y	Y
Ind × Year FE	Y	Y
State × Year FE	Y	Y
Observations	7,478	7,478
Adjusted R ²	0.648	0.657

Table IA.7
Robustness Check:
Response of Establishment Routine-Task Employment to Aggregate Shocks
— Using The Sample of All Establishments

This table shows the response of labor composition to aggregate shocks of existing establishments with different shares of routine-task labor, using a sample of all establishments, including those that cannot be matched to the Compustat firms. $Chg. Emp_{t-3,t}^R$ is the establishment's 3-year change in employment of routine-task labor normalized by the total number of employees three years earlier. $Chg. RShare_{t-3,t}^{Est,Emp}$ and $Chg. RShare_{t-3,t}^{Est}$ are the 3-year changes in the establishment's employment-based share of routine-task labor and share of routine-task labor, respectively. An establishment's (employment-based) share of routine-task labor is the ratio of its (total employment of routine-task labor) total wage expense on its routine-task labor to its (total number of employees) total wage expense. In all variable constructions, routine-task labor is defined at $t - 3$ and maintains the same definition for three years to form the time-series changes of the variables. $RShare_{t-3}$ is the establishment's $RShare$ three years before. $Shock_{t-3,t}$ is the growth rate of real GDP value added from $t - 3$ to t . Ind is the establishment's industry classification at the SIC division level. $State$ is the state in which the establishment is located. $Firm$ is at the Employment Identification Number (EIN) level. Standard errors are clustered at the establishment level and reported in parentheses. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively. The sample period is 1996-2014.

	<u>Chg. $Emp_{t-3,t}^R$</u>	<u>Chg. $RShare_{t-3,t}^{Est,Emp}$</u>	<u>Chg. $RShare_{t-3,t}^{Est}$</u>
	(1)	(2)	(3)
$RShare_{t-3}$	-1.132*** (0.007)	-0.945*** (0.007)	-1.020*** (0.004)
$RShare_{t-3} \times Shock_{t-3,t}$	1.523*** (0.092)	1.233*** (0.097)	1.025*** (0.051)
Firm FE	Y	Y	Y
Ind×Year FE	Y	Y	Y
State×Year FE	Y	Y	Y
Observations	1,232,590	1,232,590	1,232,590
Adjusted R^2	0.248	0.223	0.467

Table IA.8

Comparison of $RShare$ in Existing and Newly Opened Establishments

This table reports the effect of aggregate shocks on the differences between newly opened establishments and existing establishments in terms of their share of routine-task labor ($RShare$). New_t is a dummy variable that equals 1 if the establishment is newly opened in year t . An establishment is identified as newly opened in year t if it does not exist in the Quarterly Census of Employment and Wages database in year $t - 1$ but exists in year t . $RShare_t^{Est,Emp}$ and $RShare_t^{Est}$ are the establishment's employment-based share of routine-task labor and share of routine-task labor in year t , respectively. $Shock_t$ is the growth rate of real GDP value added in year t . Ind is the establishment's industry classification at the SIC division level. $State$ is the state in which the establishment is located. Standard errors are clustered at the establishment level and reported in parentheses. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively. The sample period is 1990-2014.

Dep. Var.	$RShare_t^{Est,Emp}$	$RShare_t^{Est}$
	(1)	(2)
New_t	0.006*** (0.002)	0.007*** (0.002)
$New_t \times Shock_t$	0.179*** (0.061)	0.159*** (0.056)
Ind \times Year FE	Y	Y
State \times Year FE	Y	Y
Observations	7,354,498	7,354,498
Adjusted R^2	0.103	0.104

Table IA.9
Robustness Check: Five Portfolios Sorted on $RShare$
— Sorting Across All Firms Instead of Within Industry

This table reports the time-series average of stock returns for five portfolios sorted on share of routine-task labor ($RShare$) across all firms (instead of within industry). At the end of each June, firms are sorted into five equally weighted portfolios based on their $RShare$. *Excess Returns* are monthly returns minus the 1-month Treasury bill rate. *Excess Unlevered Returns* are monthly unlevered returns, defined as in equation (28), minus the 1-month Treasury bill rate. *DGTW-Adjusted Returns* are monthly returns adjusted following Daniel, Grinblatt, Titman, and Wermers (1997). $RShare$ is lagged by 18 months. Newey-West standard errors (Newey and West (1987)) are estimated with four lags and reported in parentheses. All returns are annualized by multiplying by 12 and are reported in percentages. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively. The sample covers stock returns from July 1991 to June 2014.

	L	2	3	4	H	H-L
Panel A: Excess Returns						
$E[R] - r_f$ (%)	15.20*** (4.98)	12.14*** (4.45)	13.46*** (4.55)	11.81*** (4.50)	10.38** (4.38)	-4.82** (1.96)
σ (%)	76.55	69.00	68.05	66.59	64.12	32.00
Panel B: Excess Unlevered Returns						
$E[R^{Unlev}] - r_f$ (%)	12.73*** (4.27)	9.12** (3.53)	9.95*** (3.46)	8.49** (3.39)	7.92** (3.32)	-4.81*** (1.74)
σ (%)	65.51	55.22	52.54	50.52	49.13	28.92
Panel C: DGTW-Adjusted Returns						
$E[R^{DGTW}]$ (%)	4.63*** (1.64)	1.73 (1.09)	2.59* (1.35)	1.16 (1.48)	-1.34 (1.47)	-5.98*** (1.58)
σ (%)	24.50	18.46	20.71	20.01	22.06	25.76

Table IA.10
Robustness Check: CAPM Regressions
— **Sorting Across All Firms Instead of Within Industry**

This table reports the unconditional CAPM time-series regression results in Panel A and Conditional CAPM regression results in Panel B for five portfolios sorted on share of routine-task labor (*RShare*) across all firms (instead of within industry). At the end of each June, firms are sorted into five equally weighted portfolios based on their *RShare*. *RShare* is lagged by 18 months. Newey-West standard errors are estimated with four lags for the unconditional CAPM monthly estimations and with one lag for the conditional CAPM yearly estimation, reported in parentheses. CAPM alphas are annualized by multiplying by 12 and are reported in percentages. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively. The sample covers stock returns from July 1991 to June 2014.

	L	2	3	4	H	H-L
Panel A: Unconditional CAPM						
MKT β	1.25*** (0.05)	1.16*** (0.04)	1.13*** (0.07)	1.11*** (0.07)	1.03*** (0.07)	-0.22*** (0.06)
Constant	5.30* (2.77)	2.89 (2.29)	4.48* (2.51)	3.00 (2.54)	2.21 (2.53)	-3.08 (1.98)
R^2	0.71	0.76	0.73	0.74	0.68	0.12
Panel B: Conditional CAPM						
Avg. MKT β	1.59*** (0.12)	1.50*** (0.10)	1.35*** (0.07)	1.35*** (0.10)	1.30*** (0.09)	-0.29*** (0.07)
Avg. α (%)	4.67 (4.85)	0.92 (3.97)	4.75 (3.80)	2.54 (3.36)	1.06 (3.66)	-3.61 (2.41)
Avg. R^2	0.75	0.81	0.80	0.80	0.77	0.35

Table IA.11
Robustness Check: Five Portfolios Sorted on $RShare$ Within Industry
— Using An Alternative Classification of Routine-Task Labor

This table reports time-series average of stock returns for five portfolios sorted on share of routine-task labor ($RShare$) within industry. $RShare$ is the ratio of a firm's total wage expense on its routine-task labor to its total wage expense, as defined in equation (24) using P75 instead of P80. At the end of each June, firms in each Fama-French 17 industry are sorted into five equally weighted portfolios based on their $RShare$. *Excess Returns* are monthly returns minus the 1-month Treasury bill rate. *Excess Unlevered Returns* are monthly unlevered returns, defined as in equation (28), minus the 1-month Treasury bill rate. *DGTW-Adjusted Returns* are monthly returns adjusted following Daniel, Grinblatt, Titman, and Wermers (1997). $RShare$ is lagged by 18 months. Newey-West standard errors (Newey and West (1987)) are estimated with four lags and reported in parentheses. All returns are annualized by multiplying by 12 and are reported in percentages. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively. The sample covers stock returns from July 1991 to June 2014.

	L	2	3	4	H	H-L
Panel A: Excess Returns						
$E[R] - r_f$ (%)	14.38*** (4.91)	12.55*** (4.45)	12.96*** (4.60)	12.09*** (4.36)	11.00** (4.45)	-3.37** (1.70)
σ (%)	75.93	69.26	67.99	64.54	64.68	27.34
Panel B: Excess Unlevered Returns						
$E[R^{Unlev}] - r_f$ (%)	11.89*** (4.12)	9.83*** (3.67)	9.84*** (3.55)	8.83*** (3.32)	8.05** (3.29)	-3.84** (1.55)
σ (%)	63.89	57.16	52.68	49.76	48.62	25.01
Panel C: DGTW-Adjusted Returns						
$E[R^{DGTW}]$ (%)	3.72** (1.61)	2.09 (1.28)	2.22 (1.46)	1.27 (1.32)	-0.39 (1.35)	-4.11*** (1.47)
σ (%)	24.12	19.63	20.29	18.51	20.51	22.71

Table IA.12
Robustness Check: CAPM Regressions
— **Using An Alternative Classification of Routine-Task Labor**

This table reports the unconditional CAPM time-series regression results in Panel A and Conditional CAPM regression results in Panel B for five portfolios sorted on share of routine-task labor (*RShare*) within industry. *RShare* is the ratio of a firm’s total wage expense on its routine-task labor to its total wage expense, as defined in equation (24) using P75 instead of P80. At the end of each June, firms in each Fama-French 17 industry are sorted into five equally weighted portfolios based on their *RShare*. *RShare* is lagged by 18 months. Newey-West standard errors are estimated with four lags for the unconditional CAPM monthly estimations and with one lag for the conditional CAPM yearly estimation, reported in parentheses. CAPM alphas are annualized by multiplying by 12 and are reported in percentages. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively. The sample covers stock returns from July 1991 to June 2014.

	L	2	3	4	H	H–L
Panel A: Unconditional CAPM						
MKT β	1.25*** (0.05)	1.16*** (0.04)	1.13*** (0.06)	1.06*** (0.07)	1.05*** (0.07)	–0.20*** (0.05)
Constant	4.41* (2.62)	3.30 (2.44)	3.99 (2.52)	3.64 (2.47)	2.64 (2.49)	–1.76 (1.77)
R^2	0.73	0.75	0.74	0.72	0.70	0.15
Panel B: Conditional CAPM						
Avg. MKT β	1.59*** (0.11)	1.47*** (0.09)	1.37*** (0.09)	1.33*** (0.09)	1.32*** (0.08)	–0.27*** (0.07)
Avg. α (%)	3.46 (4.66)	2.08 (4.10)	4.27 (3.78)	2.83 (3.43)	1.52 (3.52)	–1.93 (2.20)
Avg. R^2	0.77	0.80	0.79	0.79	0.78	0.32

Table IA.13
Cash Flow Beta and Discount Rate Beta

This table shows the decomposition of the market betas for five portfolios sorted on share of routine-task labor. At the end of each June, firms in each Fama-French 17 industry are sorted into five equally weighted portfolios based on their *RShare*. *RShare* is lagged by 18 months. β_{CF} and β_{DR} are the cash flow beta and the discount rate beta, constructed following Campbell and Vuolteenaho (2004). See the Internet Appendix of Campbell and Vuolteenaho (2004) and Weber (2015) for more detailed descriptions of the estimation procedure. β is the sum of the two betas. The estimation period for the cash flow news and the discount rate news are from July 1962 to June 2014. The estimation period for the betas is from July 1991 to June 2014. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively.

	L	2	3	4	H	H-L
β_{CF}	0.87*** (0.09)	0.78*** (0.09)	0.78*** (0.10)	0.75*** (0.10)	0.74*** (0.09)	-0.13*** (0.02)
β_{DR}	0.66*** (0.10)	0.61*** (0.09)	0.60*** (0.09)	0.59*** (0.09)	0.56*** (0.09)	-0.10*** (0.03)
β	1.53*** (0.15)	1.40*** (0.15)	1.39*** (0.15)	1.35*** (0.15)	1.29*** (0.14)	-0.23*** (0.05)

Table IA.14
Robustness Check:
Panel Regressions of Conditional Betas and Annual Stock Returns on *RShare*
—Using An Alternative Classification of Routine-Task Labor

This table reports the predictability of firms' share of routine-task labor (*RShare*) on their conditional betas and annual stock returns while controlling for known firm characteristics that predict risk. Conditional betas are calculated following Lewellen and Nagel (2006) for each year t . *RShare* is the ratio of a firm's total wage expense on its routine-task labor to its total wage expense, as defined in equation (24) using P75 instead of P80. Realized annual stock returns are aggregated from July of year t to June of year $t + 1$ in percentage. *RShare* is lagged by 18 months. *Ind* indicates the Fama-French 17 industries. See the Appendix for definitions of firm characteristics. Standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent significance level of 10%, 5%, and 1%, respectively. The sample covers stock returns from July 1991 to June 2014.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Conditional Betas									
RShare $_{t-1}$	-0.54*** (0.08)	-0.50*** (0.08)	-0.53*** (0.08)	-0.53*** (0.08)	-0.57*** (0.08)	-0.57*** (0.08)	-0.55*** (0.08)	-0.54*** (0.08)	-0.52*** (0.08)
Cash Flow $_{t-1}$		-0.04*** (0.01)						-0.04*** (0.01)	-0.03*** (0.01)
Stock Ret $_{t-1}$			0.16*** (0.03)					0.21*** (0.03)	0.23*** (0.03)
Op.Lev $_{t-1}$				-0.01 (0.02)				-0.07*** (0.02)	-0.09*** (0.02)
Mkt.Lev $_{t-1}$					0.37*** (0.07)			0.33*** (0.08)	0.14* (0.08)
Size $_{t-1}$						-0.09*** (0.01)		-0.09*** (0.01)	-0.10*** (0.01)
B/M $_{t-1}$							0.11*** (0.03)	-0.04 (0.03)	-0.03 (0.03)
Fixed Effects	Ind×Yr	Yr							
Observations	41,080	41,080	41,080	41,080	41,080	41,080	41,080	41,080	41,080
Adjusted R^2	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.05

Table IA.14–Continued

Panel B: Annual Stock Returns									
RShare _{<i>t</i>-1}	-5.31*** (1.94)	-5.01*** (1.94)	-5.43*** (1.99)	-6.31*** (1.96)	-6.87*** (1.99)	-6.19*** (1.99)	-7.13*** (2.01)	-8.03*** (2.08)	-10.26*** (1.97)
Cash Flow _{<i>t</i>-1}		-0.36** (0.16)						-0.21 (0.16)	-0.23 (0.16)
Stock Ret _{<i>t</i>-1}			-4.85*** (0.72)					-3.23*** (0.71)	-3.20*** (0.69)
Op.Lev _{<i>t</i>-1}				2.71*** (0.47)				1.84*** (0.50)	0.69 (0.46)
Mkt.Lev _{<i>t</i>-1}					16.26*** (1.91)			2.91 (2.20)	1.34 (2.23)
Size _{<i>t</i>-1}						-2.55*** (0.21)		-1.18*** (0.21)	-1.25*** (0.21)
B/M _{<i>t</i>-1}							11.56*** (0.96)	9.10*** (1.13)	9.32*** (1.13)
Fixed Effects	Ind×Yr	Yr							
Observations	41,080	41,080	41,080	41,080	41,080	41,080	41,080	41,080	41,080
Adjusted <i>R</i> ²	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.07

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