
LONGITUDINAL EMPLOYER - HOUSEHOLD DYNAMICS

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Changing the Boundaries of the Firm: Changes in the Clustering of Human Capital (Presented at the AEA 2002)

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- Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the U.S. Census Bureau, Cornell University, or the National Science Foundation.
- Confidential data from the LEHD Program were used in this paper. The U.S. Census Bureau is preparing to support external researchers' use of these data under a protocol to be released in the near future. For further information, contact Ronald C. Prevost LEHD Program Director (ronald.c.prevost@census.gov).

Motivation

- Distinguish among similar businesses using the human capital of the employees
- Normal measures: employment and wages, sometimes hours
- Our measures: a variety of skill indices based on the portable part of the individual's wage rate
- Use the differences in the human capital input to help explain differences in the outcomes

Theoretical Framework

- The general human capital of an employee is represented by s .
- Z is the firm-specific part of the wage rate, used to model compensation design issues.
- S can be a vector but we use scalars in this work.
- The un-normalized distribution $f(s)$ measures the firm's human capital choices.
- Then, conventional employment, L , and total payroll, W , are as shown.
- Output is a functional of $f(s)$.

$$Q = Q(f(s), K, z)$$

$$L = \int f(s) ds$$

$$W = \int w(s + z) f(s) ds$$

Optimization

$$\pi = pQ - W$$

$$\frac{\partial \pi}{\partial f(s_0)} = 0 = p \frac{\partial Q}{\partial f(s_0)} - w(s_0 + z)$$

$$\forall s_0 \in [\underline{S}, \bar{S}]$$

- The demand for human capital is determined by solving the profit maximization problem for the function $f(s)$.

The Distribution of s

- Human capital s is a scalar on a finite interval.
- The normalized density $g(s)$ summarizes the distribution of human capital within the business.
- We use a nonparametric estimator of $g(s)$.

$$F(s) = \int_{\underline{S}}^s f(s) ds, s \in [\underline{S}, \bar{S}]$$

$$L = F(\bar{S})$$

$$G(s) = \frac{F(s)}{L}$$

$$g(s) = \frac{f(s)}{L}$$

Measurement of Human Capital

$$\ln w_{it} = \theta_i + x_{it}\beta + \psi_{J(i,t)} + \varepsilon_{it}$$

- We use a decomposition of the log real annualized full-time, full-year wage rate ($\ln w$) into person and firm effects.
- The person effect is θ .
- The firm effect is ψ , where $J(i,t)$ is the employer of i at t .
- Continuous, time-varying effects are in $x\beta$, where some of the x variables are human capital measures (labor force experience) and some correct for differential quality in our measure of full-time, full-year wage rate.

Measurement of Human Capital

$$\hat{s}_{it} = \hat{\theta}_i + \text{labor force experience part of } x_{it} \hat{\beta}$$

- Individual human capital, s , is the part associated with the person effect and the measurable time-varying personal characteristics (labor force experience).
- Alternatively, we can use θ directly.
- We can also decompose θ into the unobservable part and the part due to education and sex.

Data

- LEHD Program's Employment Dynamics Estimates project and the Economic Censuses.
- Individual: all persons employed in California (1992-1999), Florida (1994-1999), Illinois 1990-1998, and Maryland (1986-1999) covered by the UI reporting system (BLS estimate 98% of all employment in these states).
- Work history: quarterly UI earnings reports for all employees.
- Firm: UI-account based measure of firm links to ES-202 quarterly employer reports .
- Firm: EIN based links to Economic Censuses (1992, 1997) and
- Data are also available for Minnesota, Texas, North Carolina, Pennsylvania, and New Jersey to be added during 2002.
- Coverage: 60% of US work force when all 9 states have been processed

Creation of the Dependent Variable

- Full-time equivalent annualized wage rate
- Annualized wage rate is created from the quarterly wage rates by considering all possible quarterly histories and computing the expected annual earning conditional on the individual's work history
- Full-time status is multiply-imputed using variable common to the work history and the Current Population Survey

Estimation of s

- Decomposition of the log real annualized full-time, full-year wage rate ($\ln w$) into person and firm effects.
- S is the part associated with the person effect and the measurable personal characteristics (labor force experience, education).
- Z is the firm effect.
- Our human capital measure is not a simple ranking by wage rate.

$$\ln w_{ijt} = \theta_i + x_{it}\beta + \psi_j + \varepsilon_{ijt}$$

$$\hat{s}_{ijt} = \hat{\theta}_i + x_{it}\hat{\beta}$$

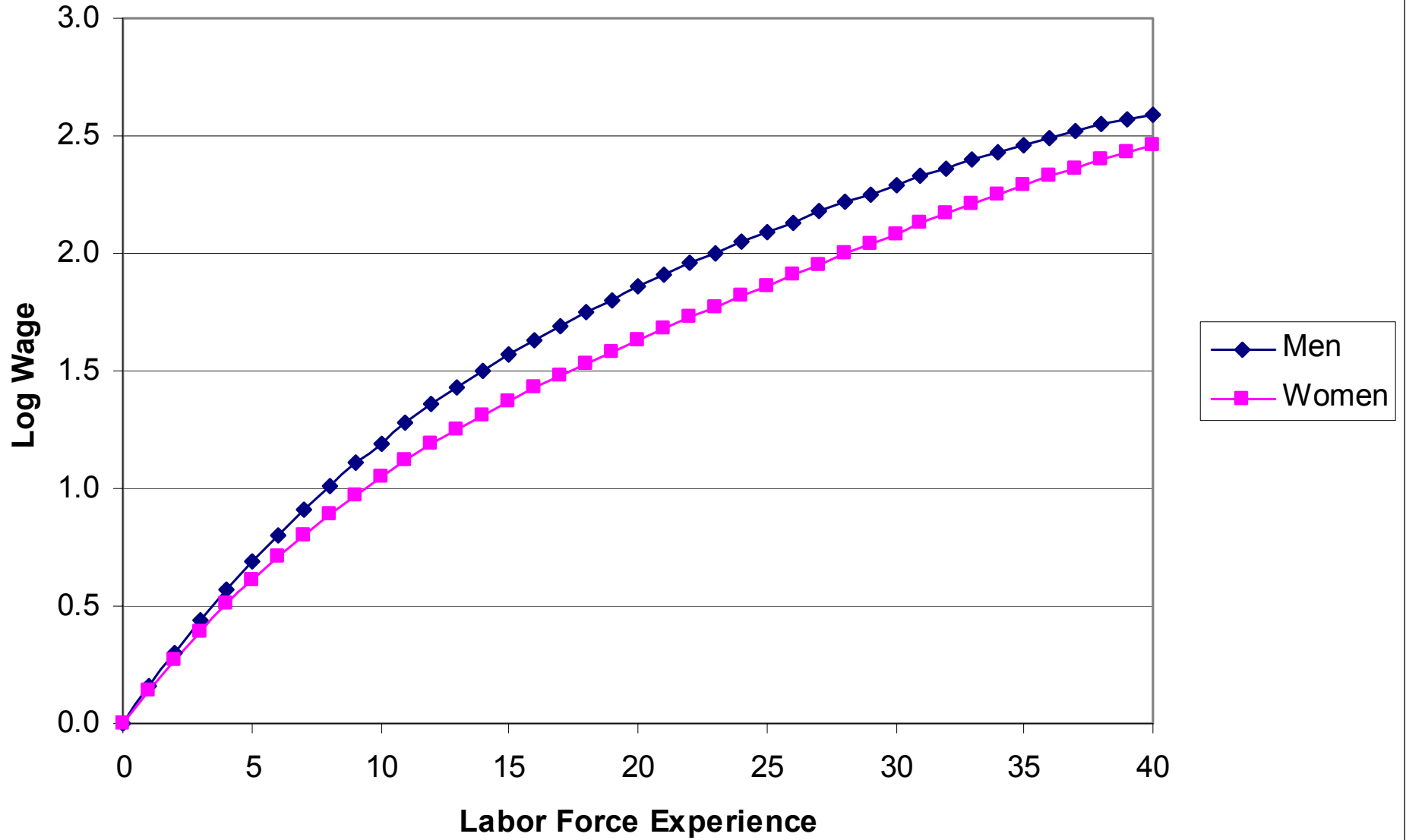
$$\hat{z}_j = \hat{\psi}_j$$

Table 1
Summary of Estimated Wage Equation^a

Component	Standard Deviation	Correlation with				
		<i>ln w</i>	θ	ψ	$x\beta$	ε
Log real annual wage rate (<i>ln w</i>)	0.895	1.000	0.498	0.494	0.232	0.408
Person effect (θ)	0.827	0.498	1.000	0.045	-0.591	0.000
Firm effect (ψ)	0.361	0.494	0.045	1.000	0.065	0.000
Time-varying personal characteristics ($x\beta$)	0.672	0.232	-0.591	0.065	1.000	0.000
Residual (ε)	0.365	0.408	0.000	0.000	0.000	1.000

Notes: a. Based on 204,504,929 annual observations for 46,642,010 persons and 2,604,330 firms in the states of California (1992-1999), Florida (1994-1999), Illinois (1990-1998), and Maryland (1986-1998).
Sources: Authors' calculations using the LEHD Program Employment Dynamics Estimates data base.

Experience Profiles



Estimation of $g_{jt}(s)$

- Use a kernel density estimator applied to all individuals working for firm j as of the end of the first quarter of 1992 and 1997.
- Apply a Bayesian prior to get a posterior estimated density that is strictly positive over the full range of s .
- Use the posterior estimate of $g_{jt}(s)$ to compute the CDF $G_{jt}(s)$.

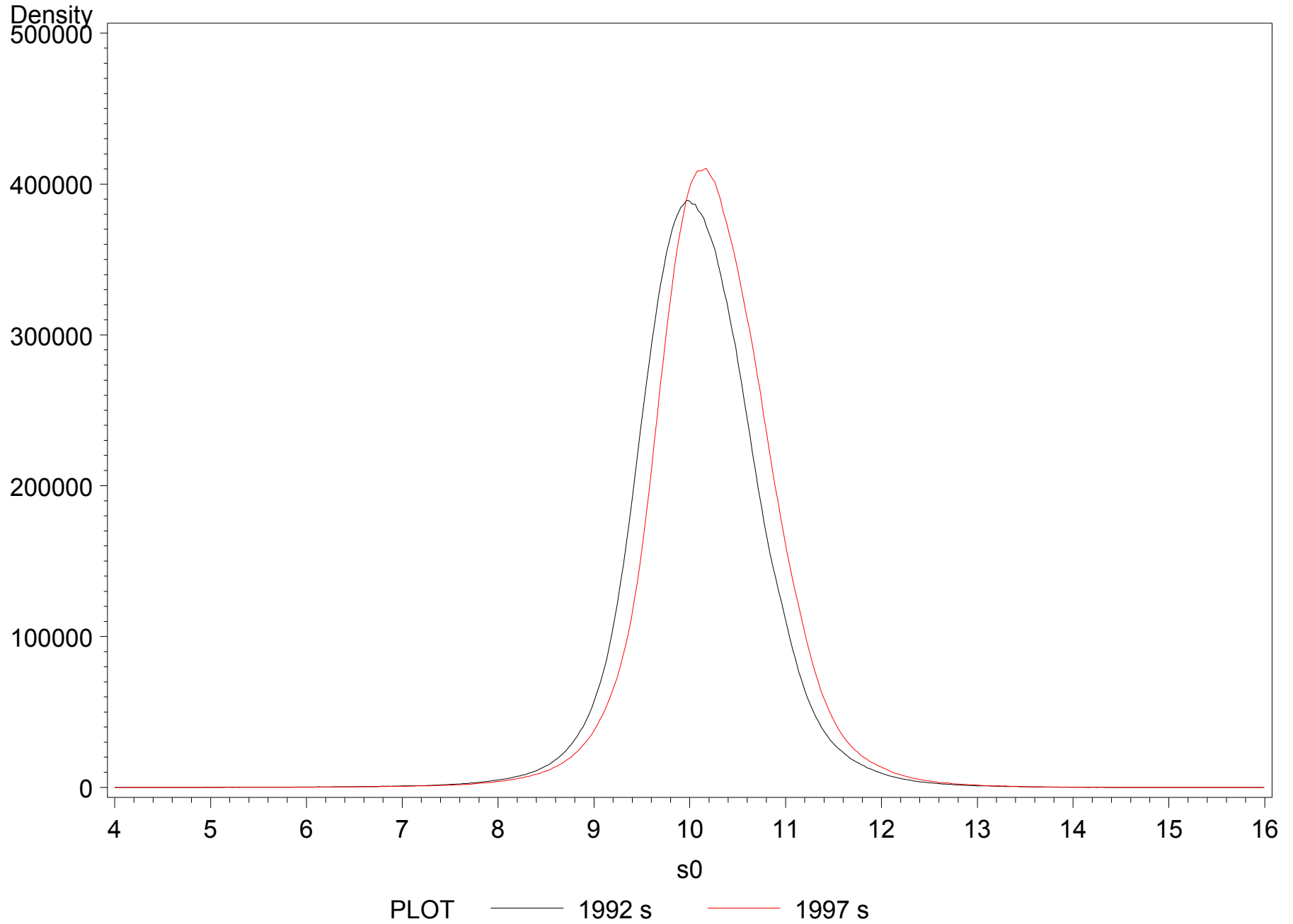
Estimation of Firm's Human Capital Summary Measures

- Compute deciles of s for entire population in 1992:1.
- Use these deciles, B_1, \dots, B_{10} , as fixed boundaries for summarizing the firm's use of s in 1992 and 1997, allowing for meaningful change measures
- Compute
$$\hat{G}_{jt}(B_{k-1}) - \hat{G}_{jt}(B_k)$$
- for $k=1, \dots, 10$ and $t = 1992, 1997$.

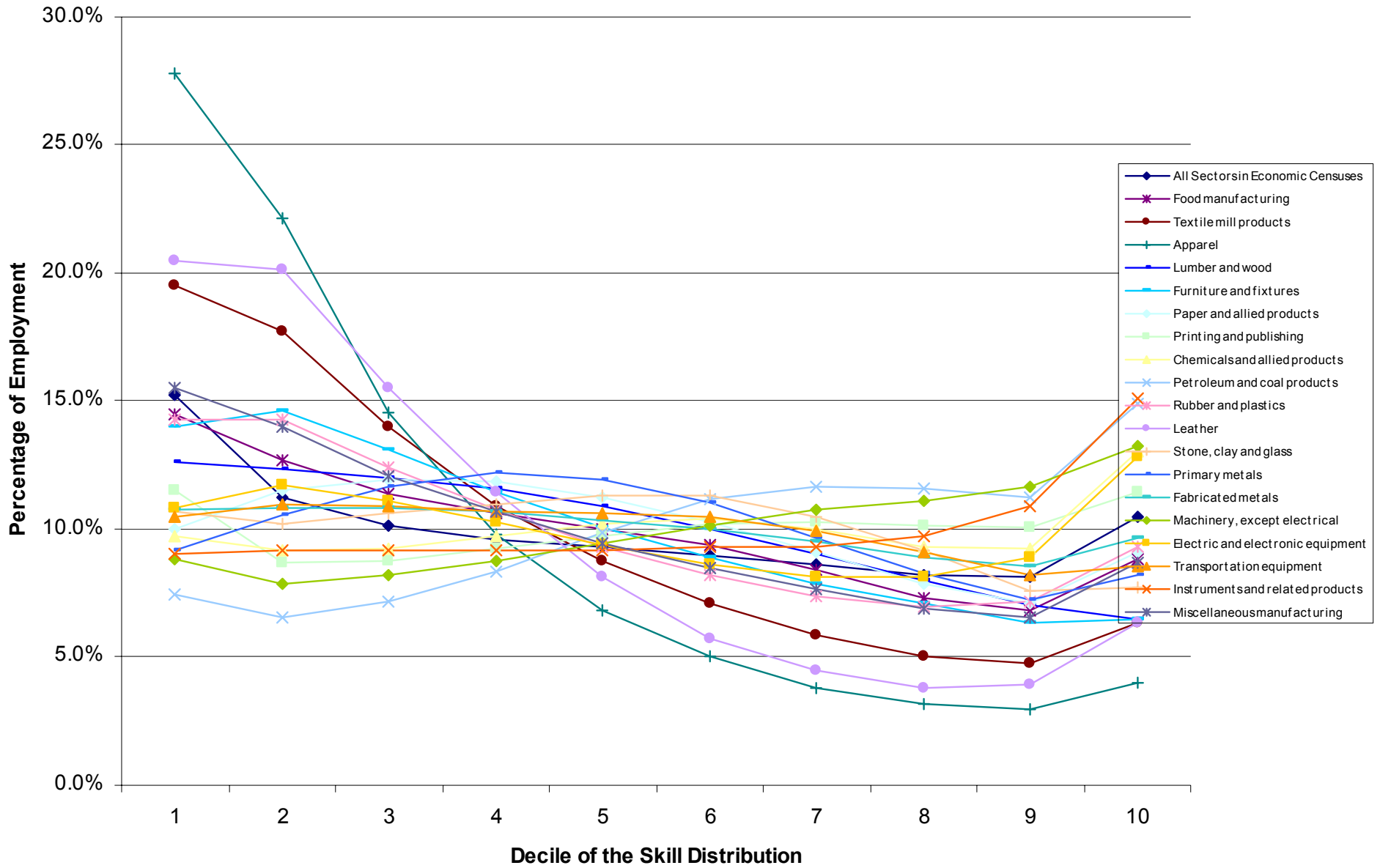
Results

- Charts for Manufacturing, Retail Trade and FIRE (all 1992 and 1997 SICs are covered)
- All 1992, 1997 active
- Exiters (present in 1992, gone in 1997)
- Entrants (present in 1997, not in 1992)
- Continuers (present in both 1992, 1997)

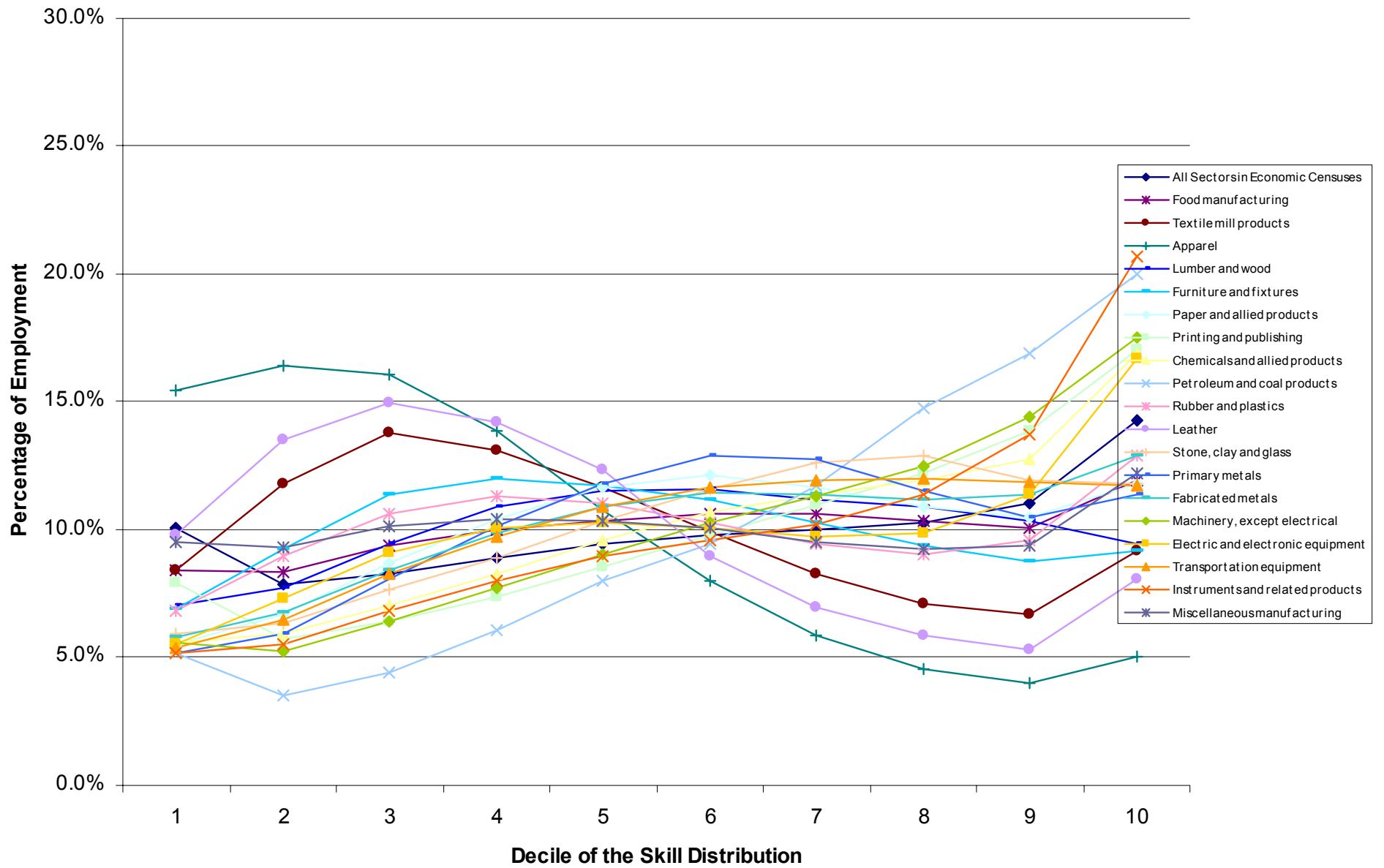
1992 and 1997 S Distribution



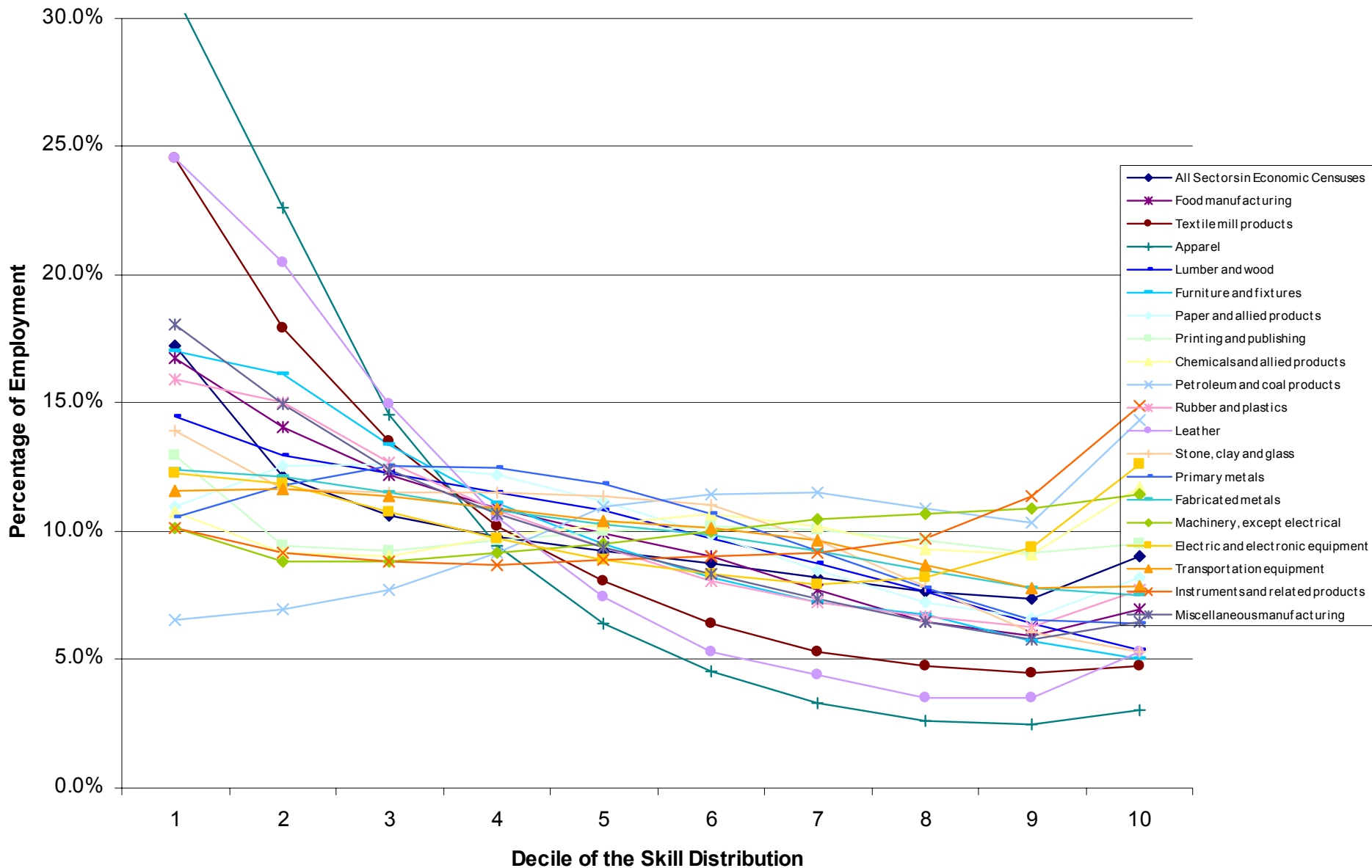
Distribution of Human Capital (s) for Manufacturing 1992



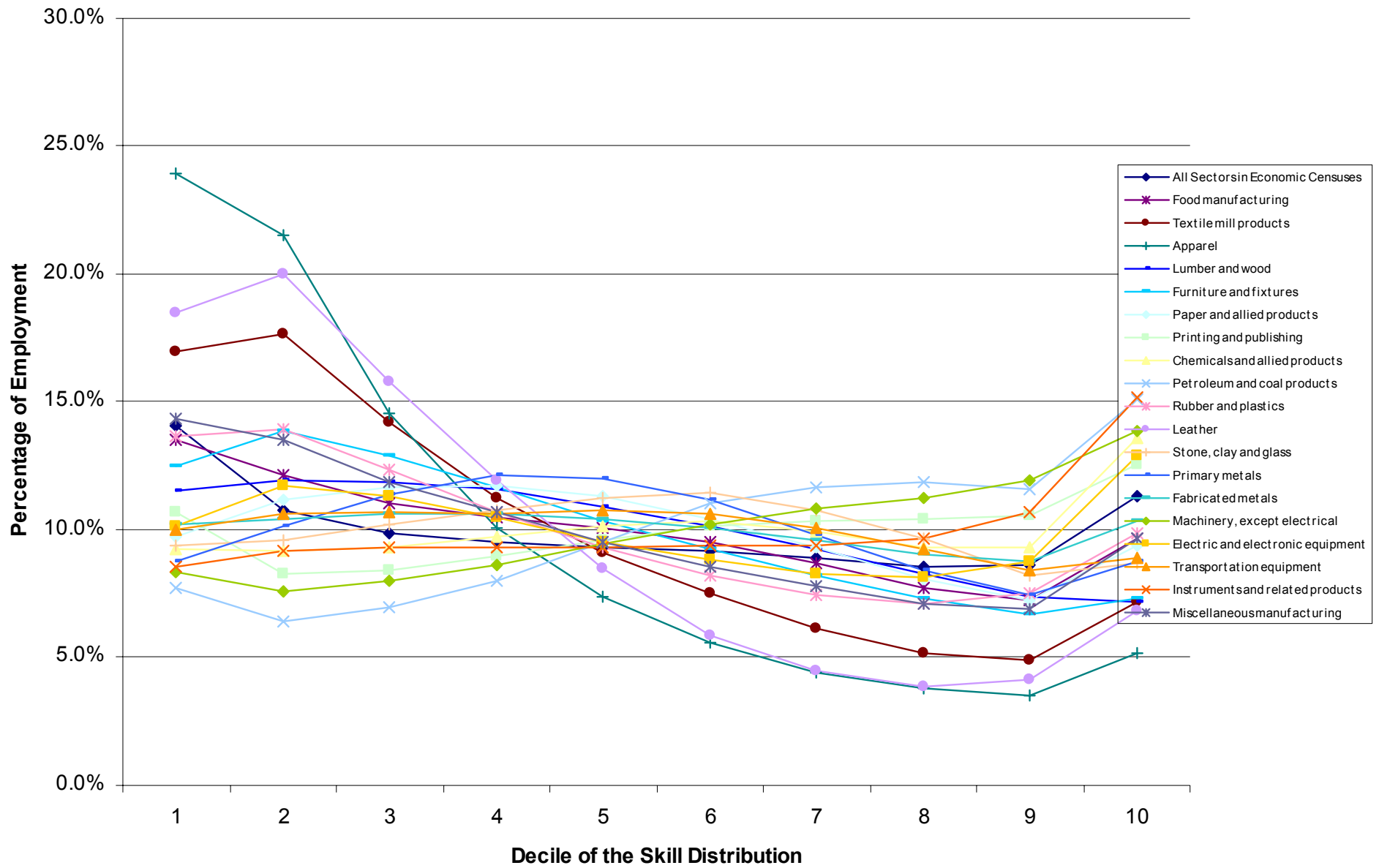
Distribution of Human Capital (s) for Manufacturing 1997



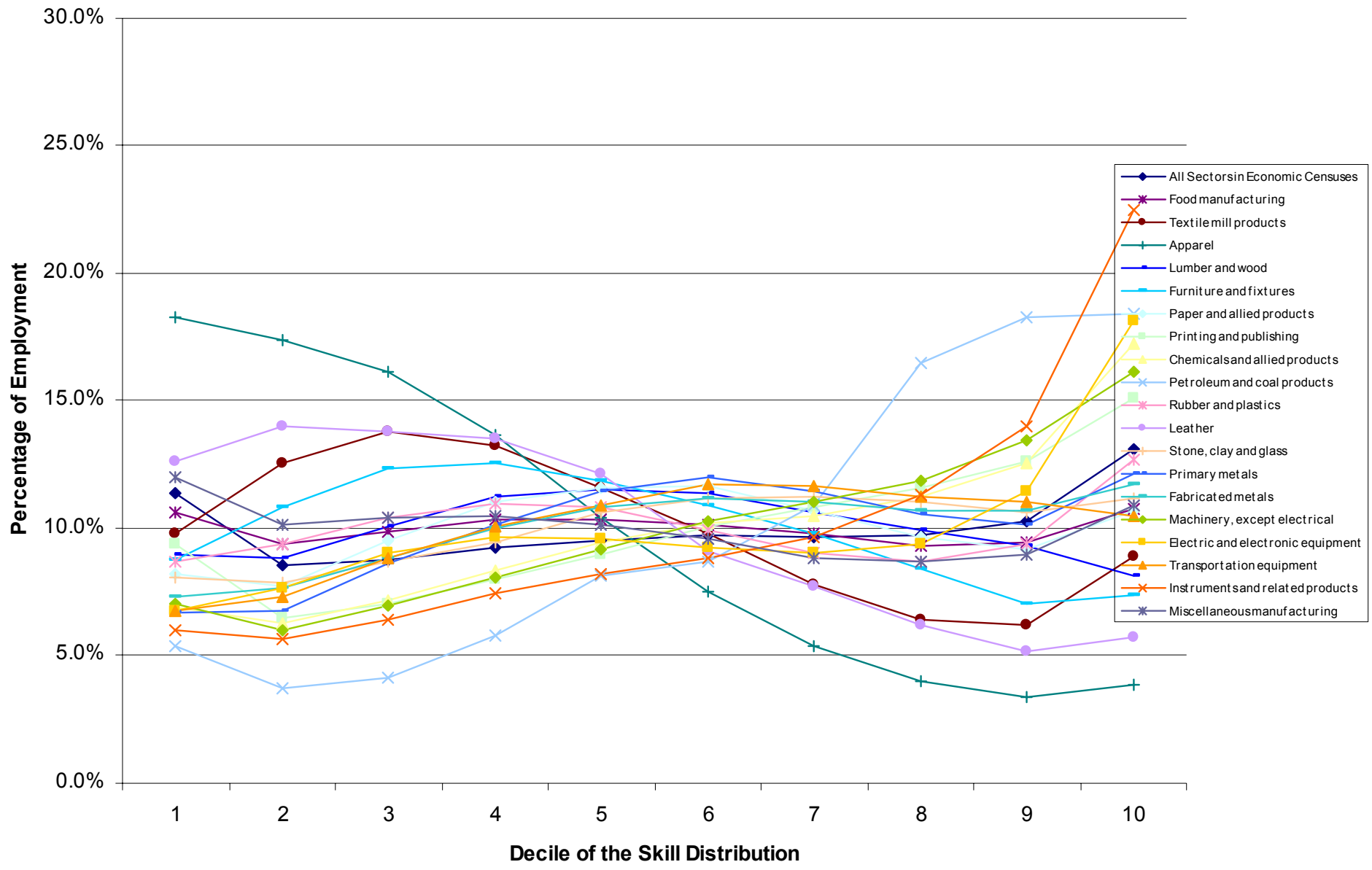
Distribution of Human Capital (s) for Manufacturing 1992, Exited



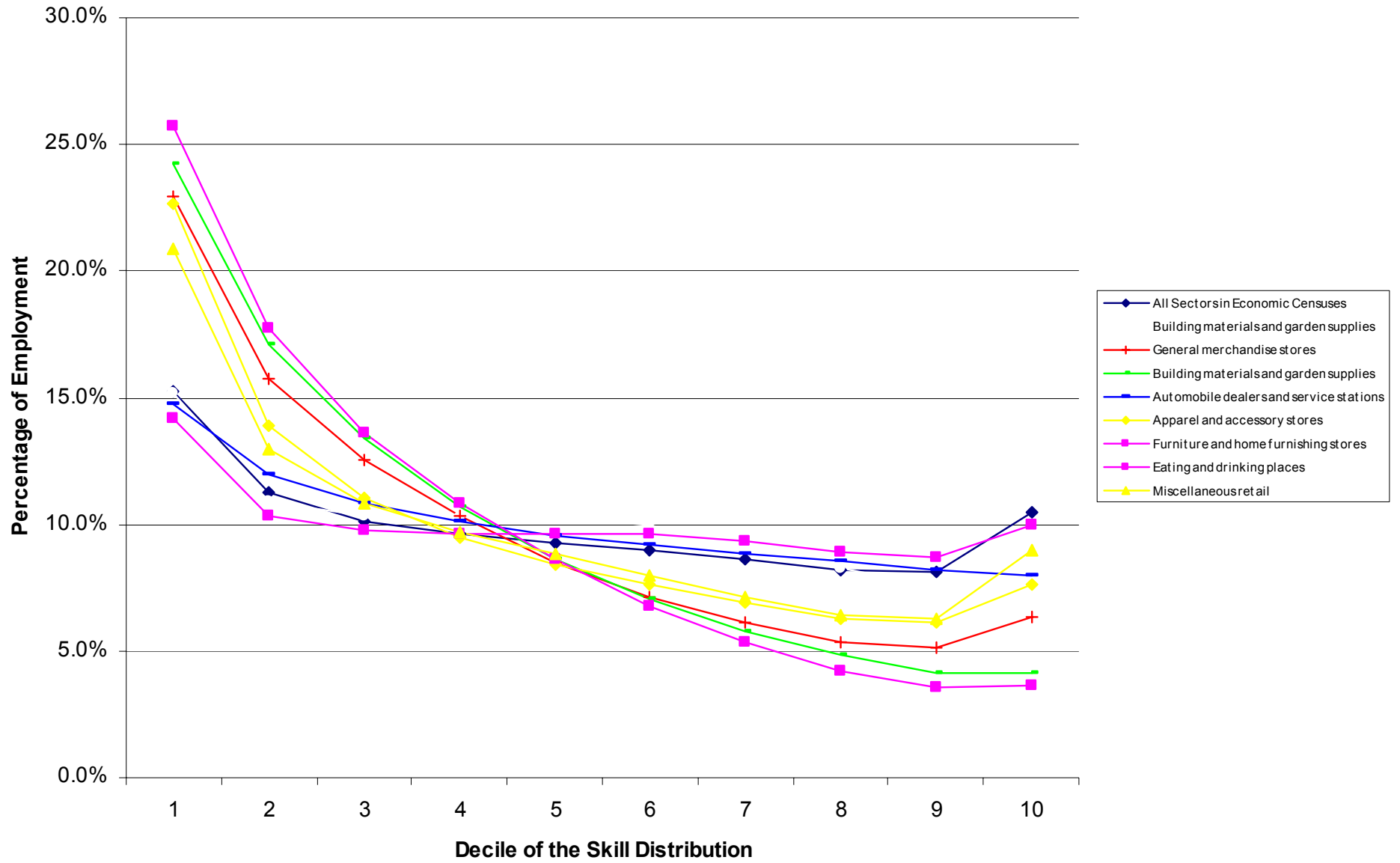
Distribution of Human Capital (s) for Manufacturing 1992, Continuers



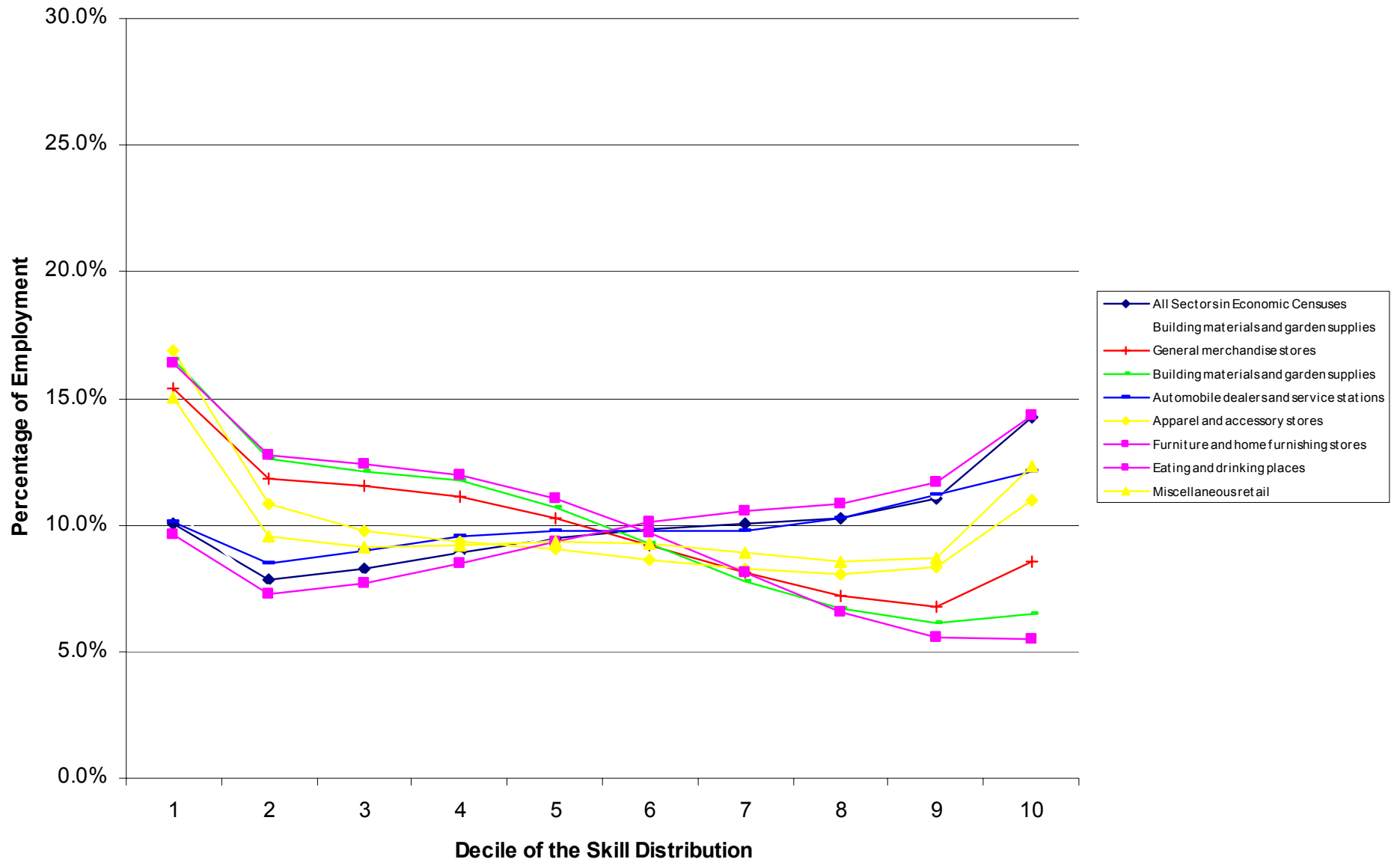
Distribution of Human Capital (s) for Manufacturing 1997, Entrants



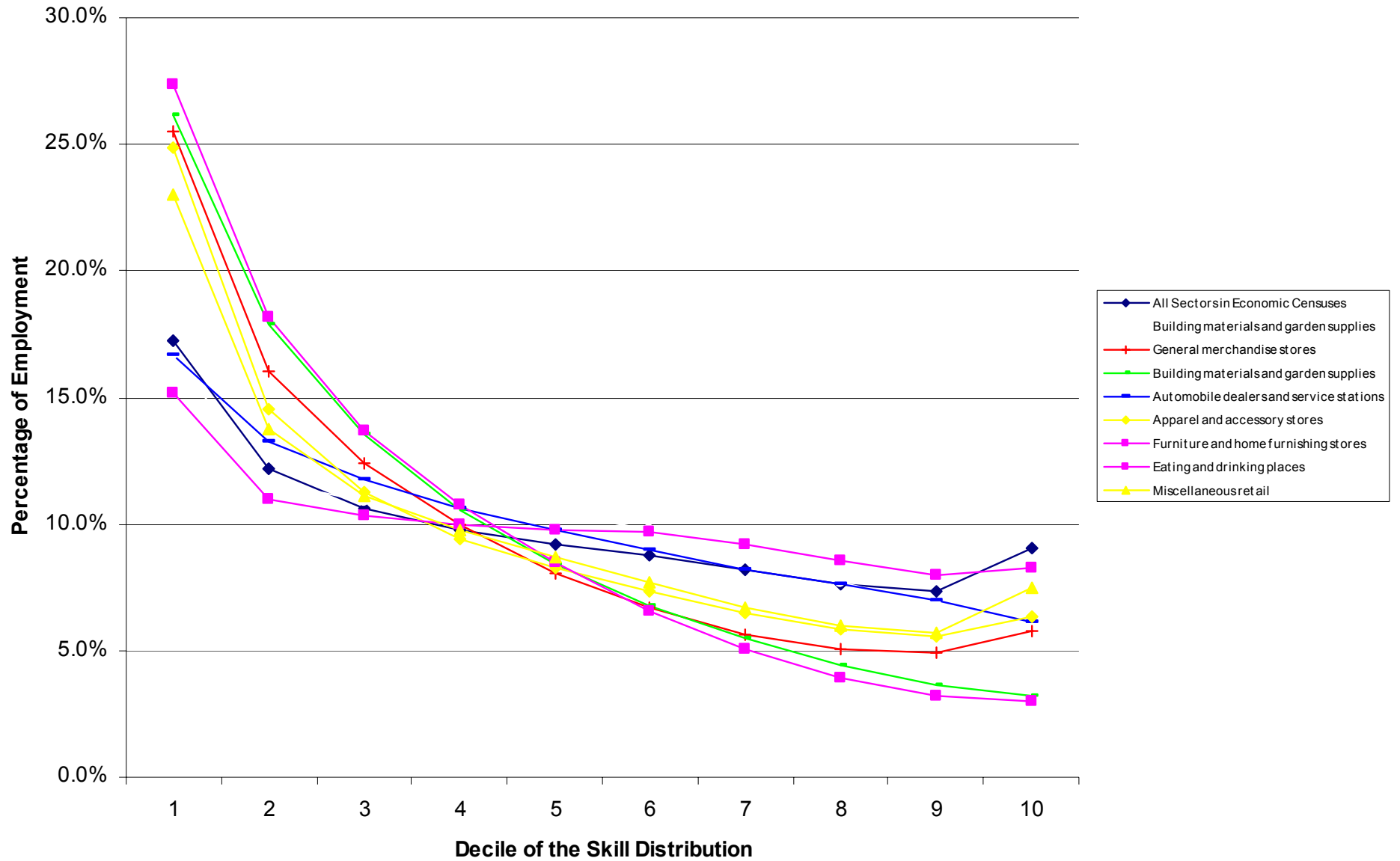
Distribution of Human Capital (s) for Retail Trade 1992



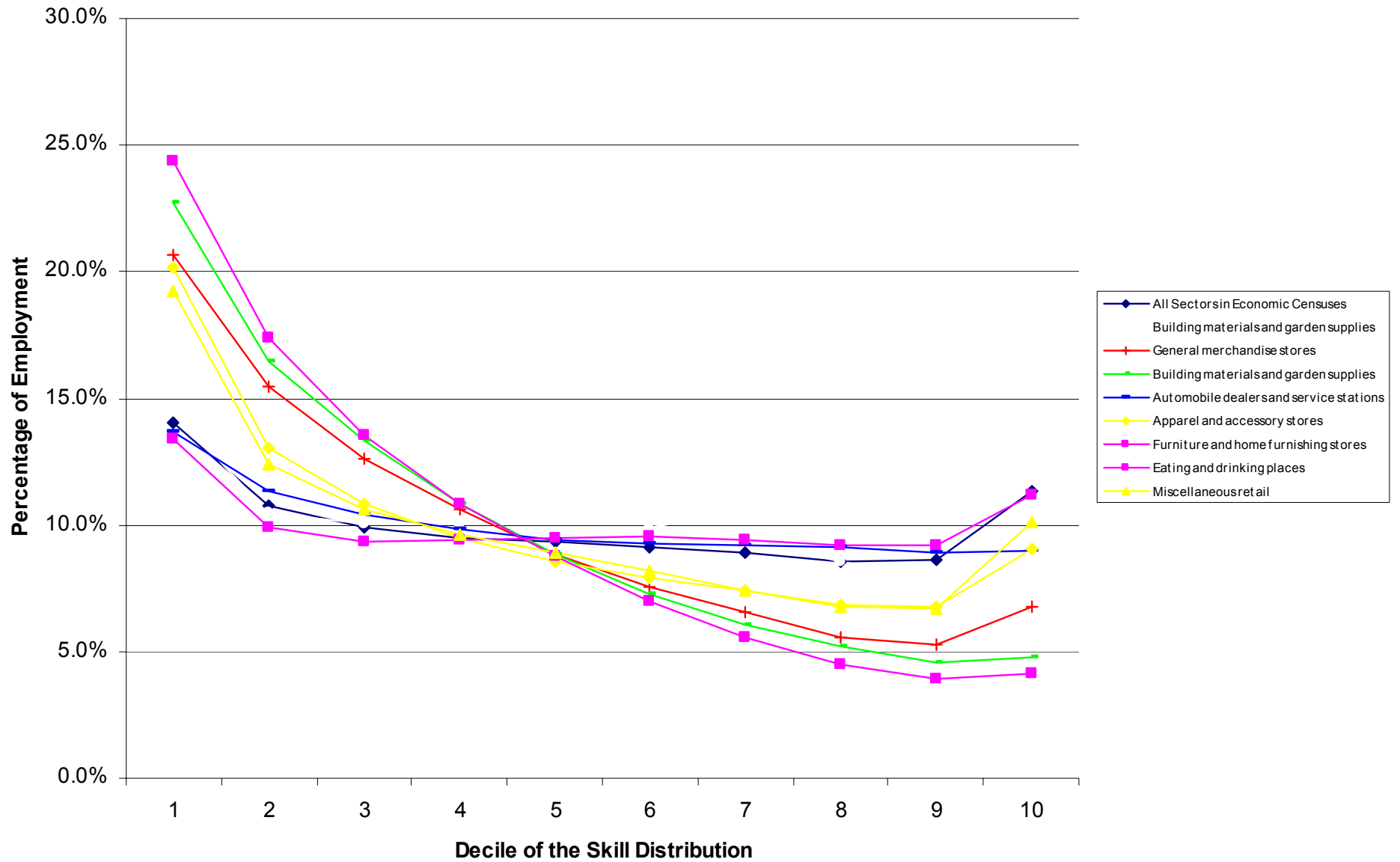
Distribution of Human Capital (s) for Retail Trade 1997



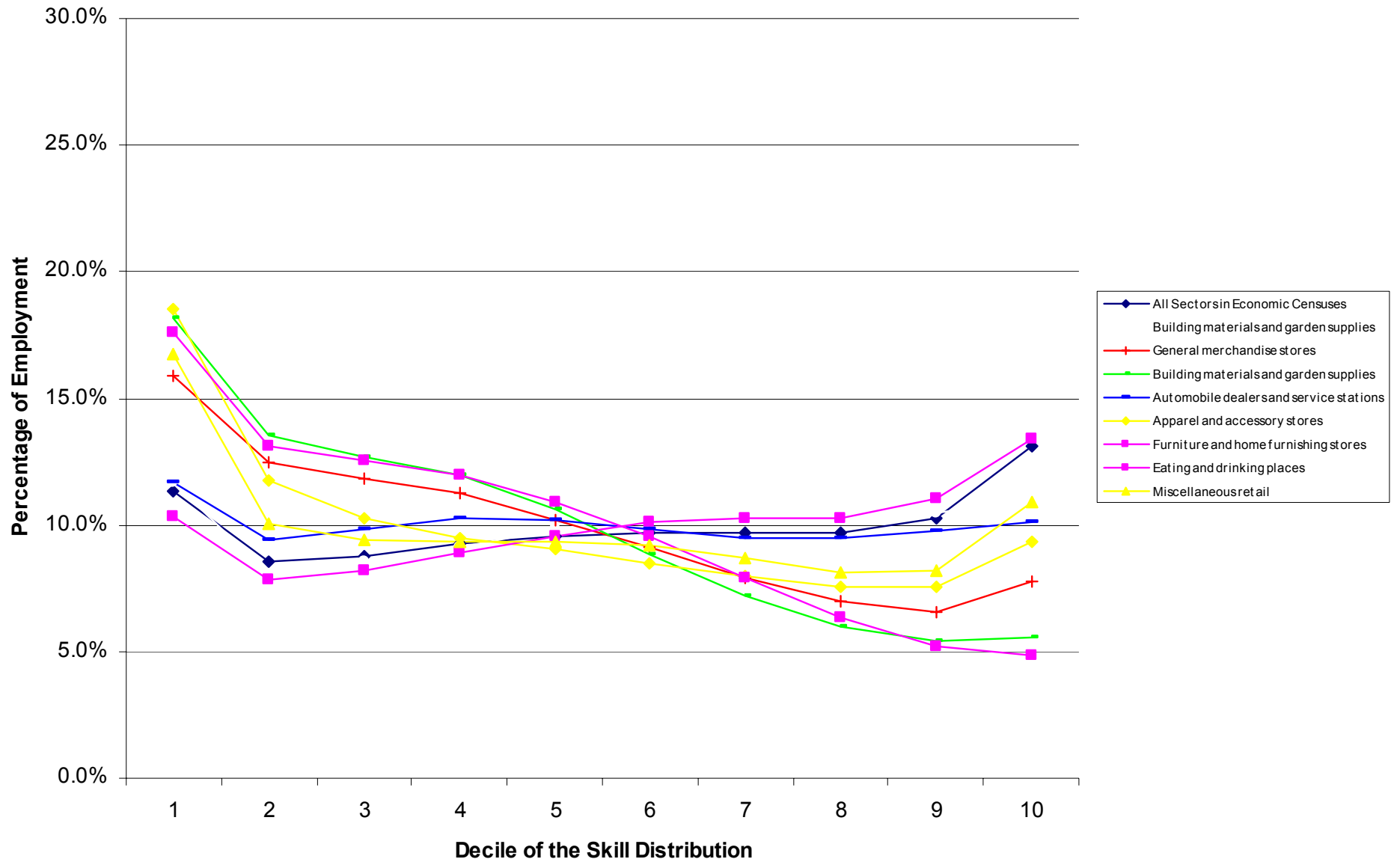
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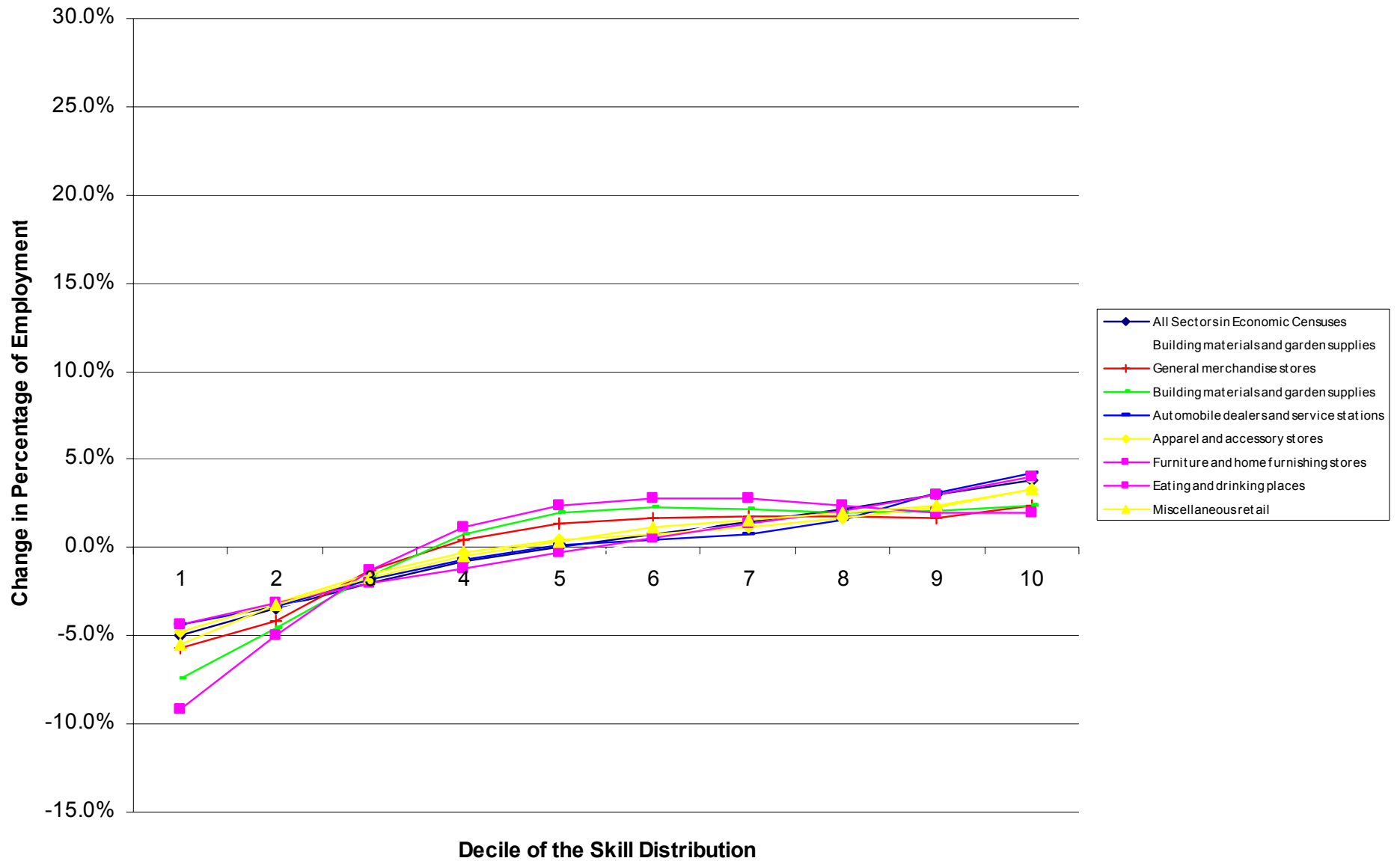
Distribution of Human Capital (s) for Retail Trade 1992, Continuers



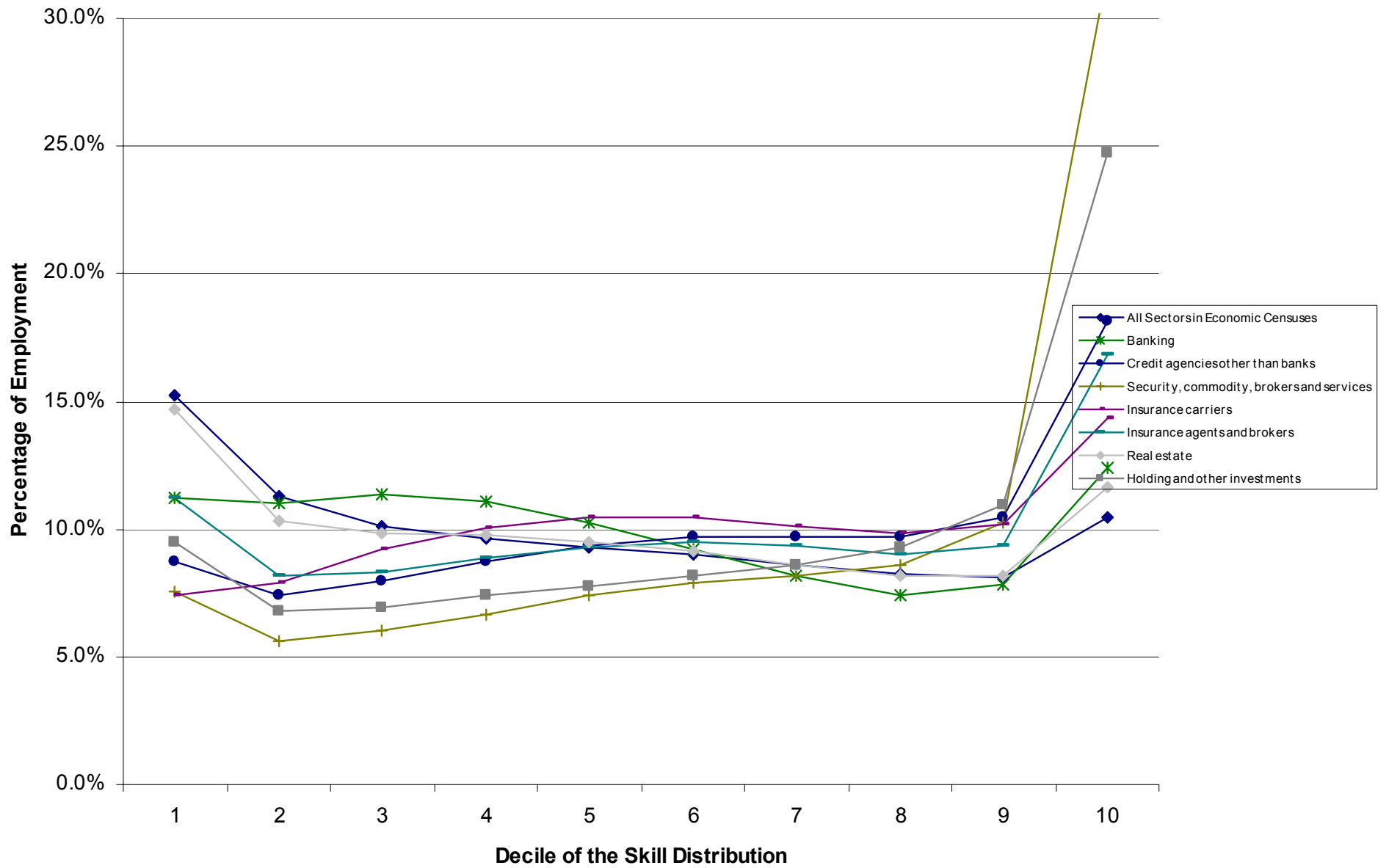
Distribution of Human Capital (s) for Retail Trade 1997, Entrants



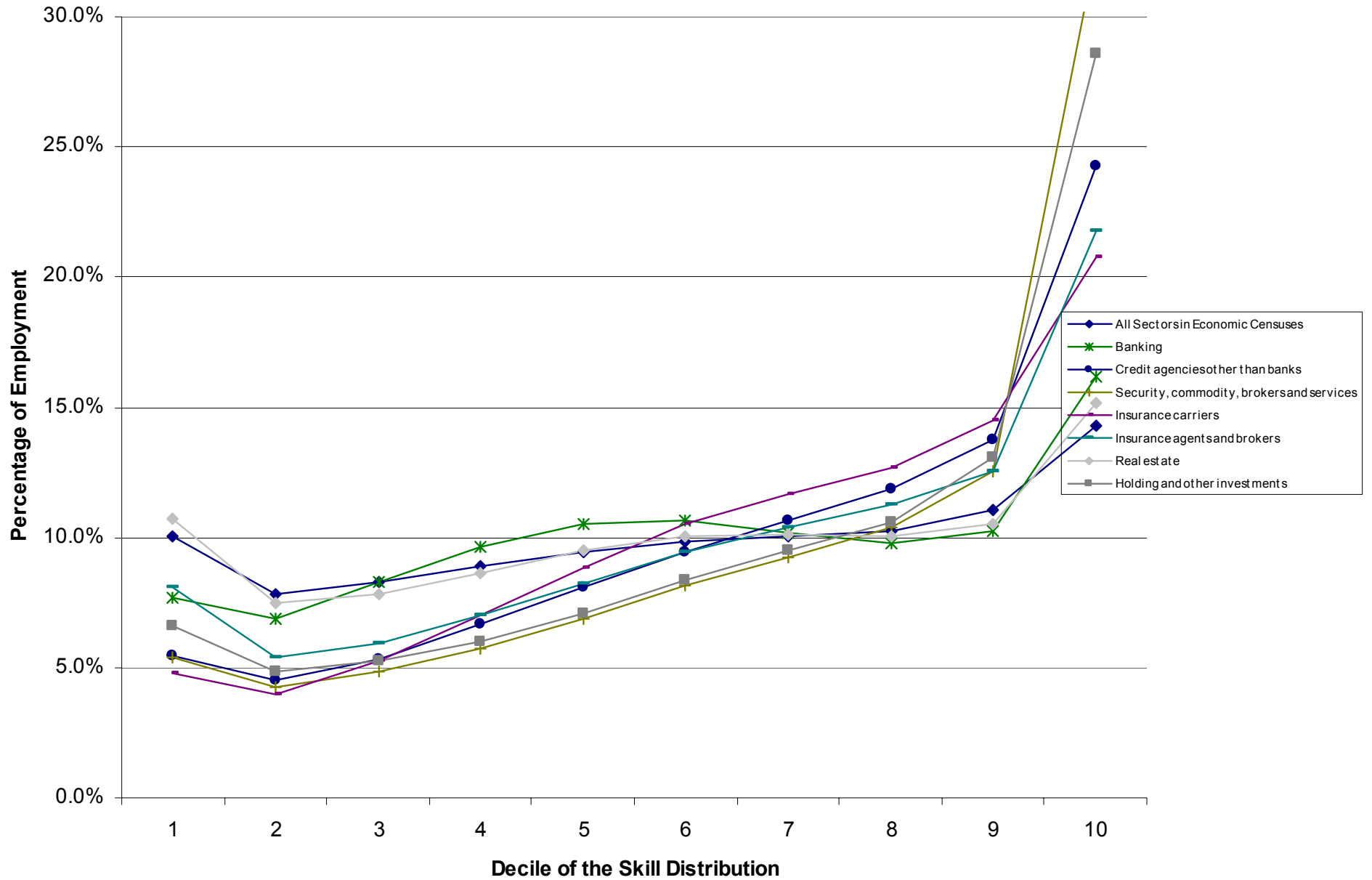
Distribution of the Change in Human Capital (s) for Retail Trade 1992-1997, Continuers



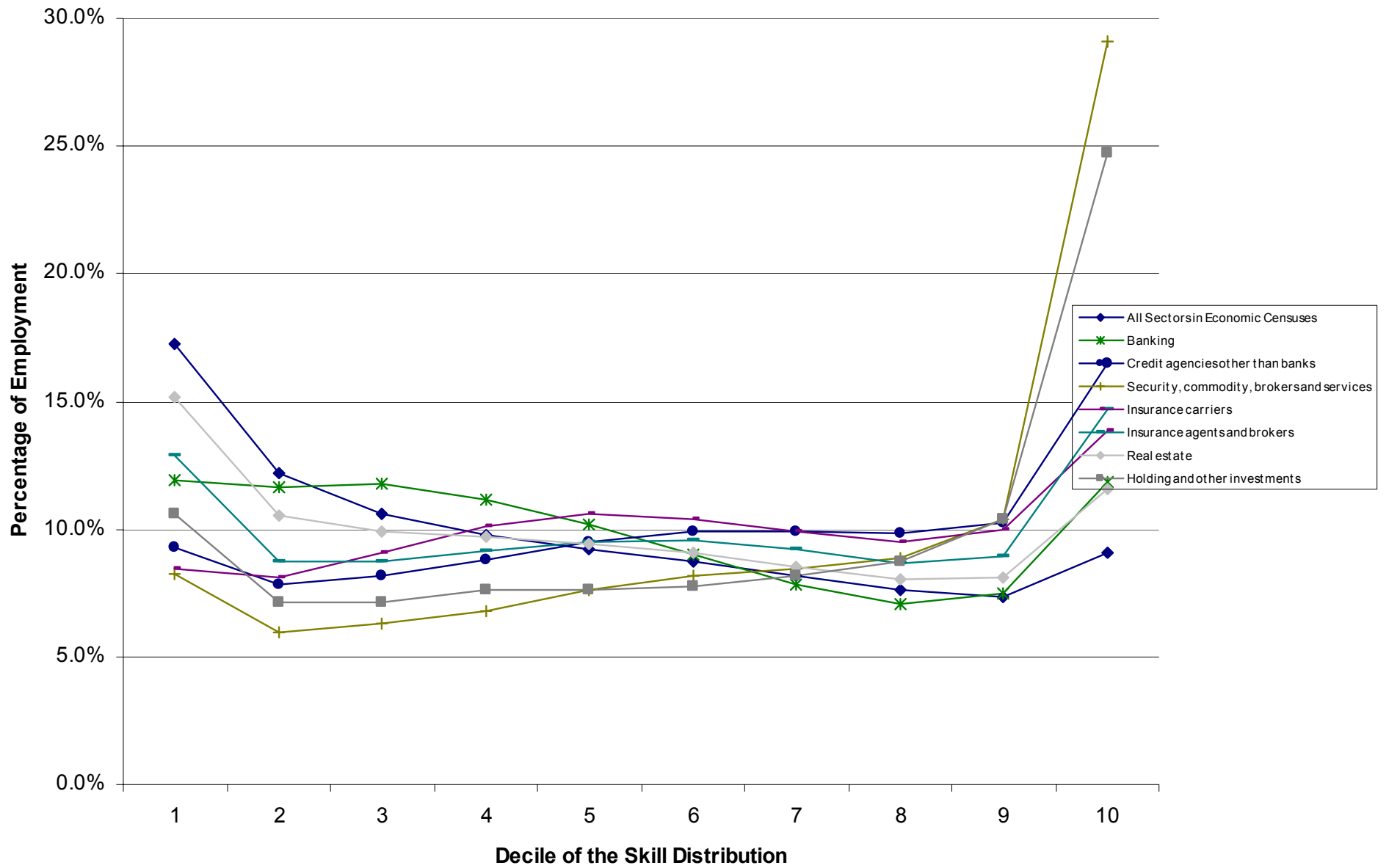
Distribution of Human Capital (s) for Finance, Insurance, and Real Estate 1992



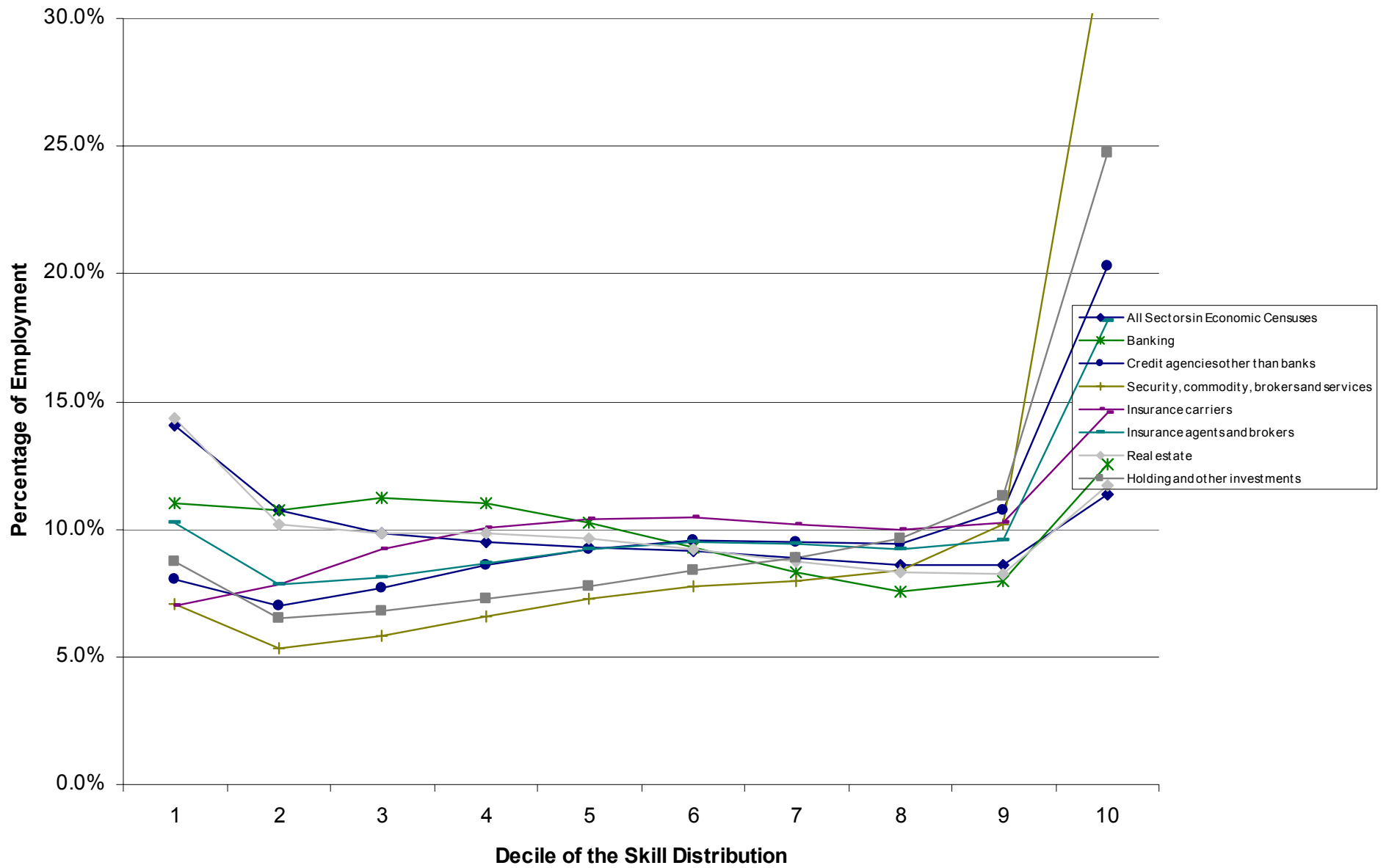
Distribution of Human Capital (s) for Finance, Insurance, and Real Estate 1997



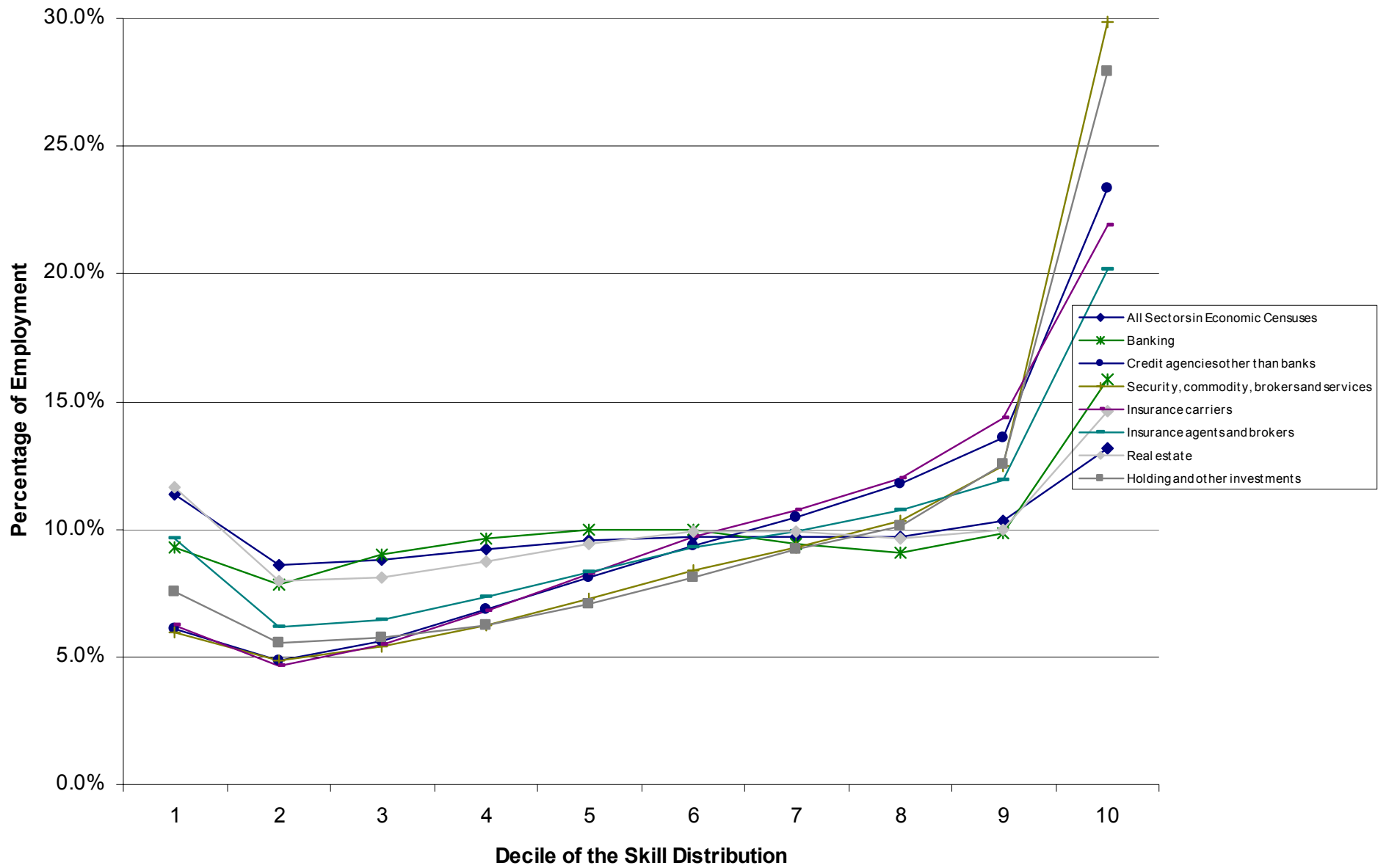
Distribution of Human Capital (s) for Finance, Insurance, and Real Estate 1992, Exited



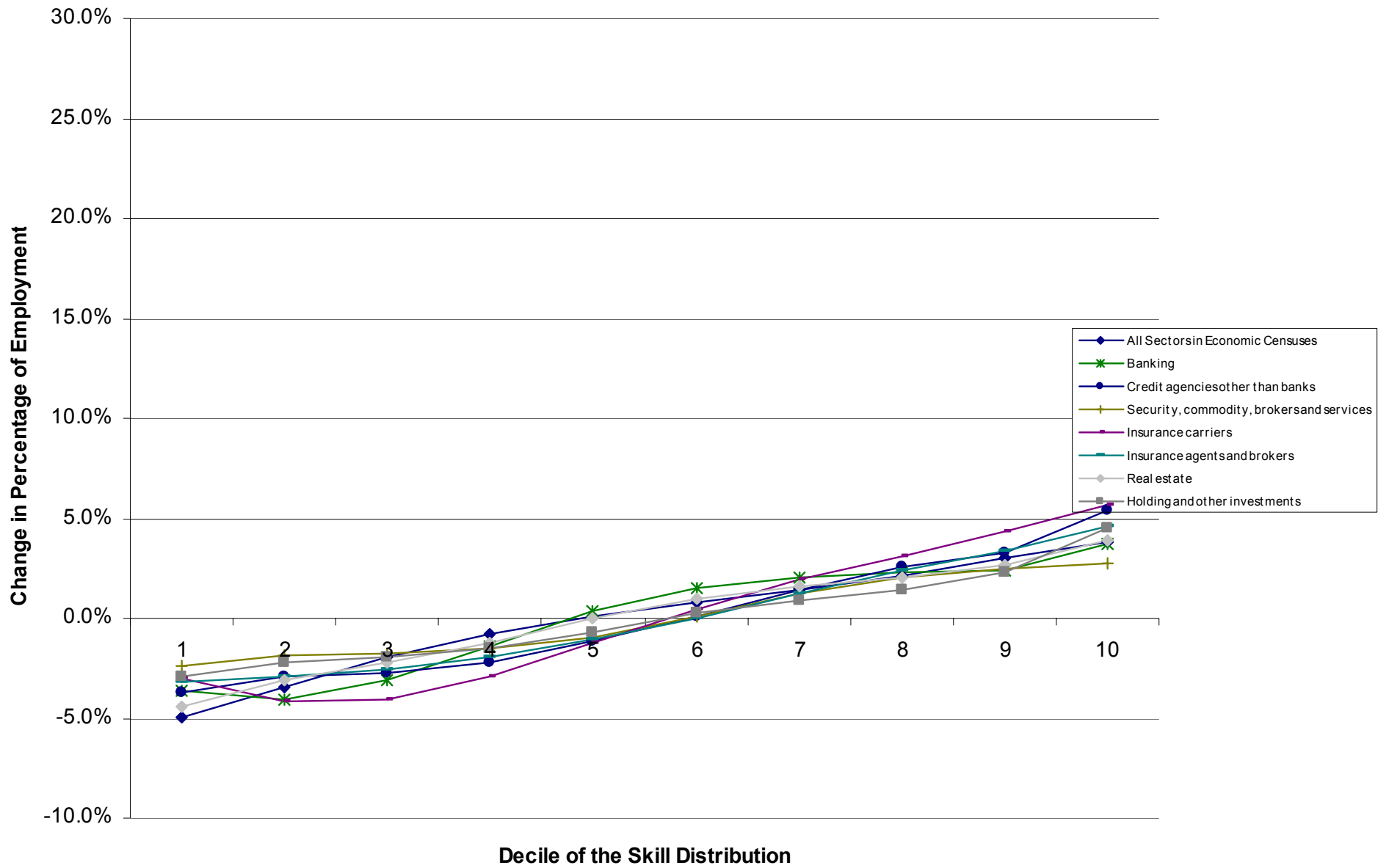
Distribution of Human Capital (s) for Finance, Insurance, and Real Estate 1992, Continuers



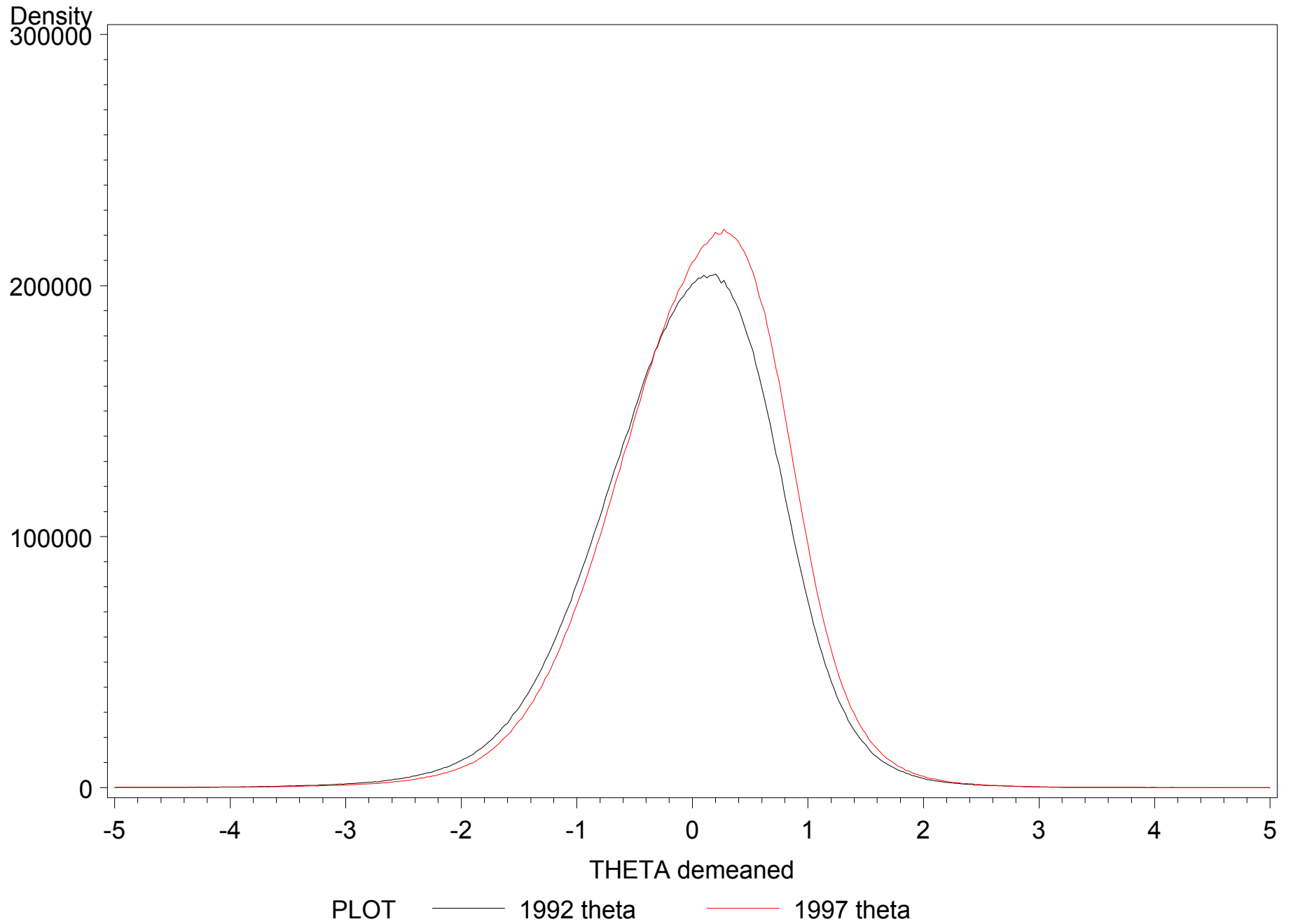
Distribution of Human Capital (s) for Finance, Insurance, and Real Estate 1997, Entrants



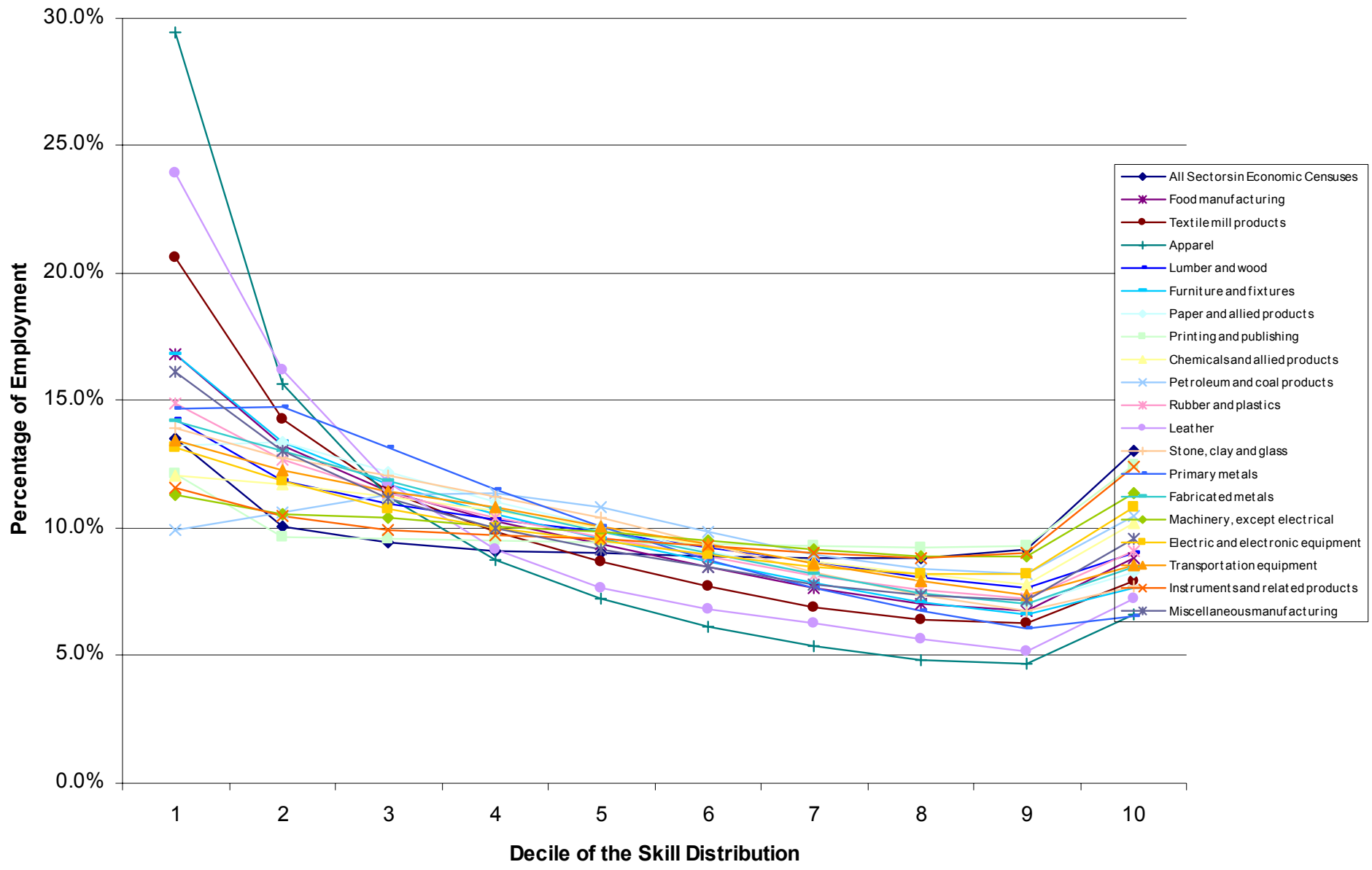
Distribution of Change in Human Capital (s) for Finance, Insurance, and Real Estate 1992-1997, Continuers



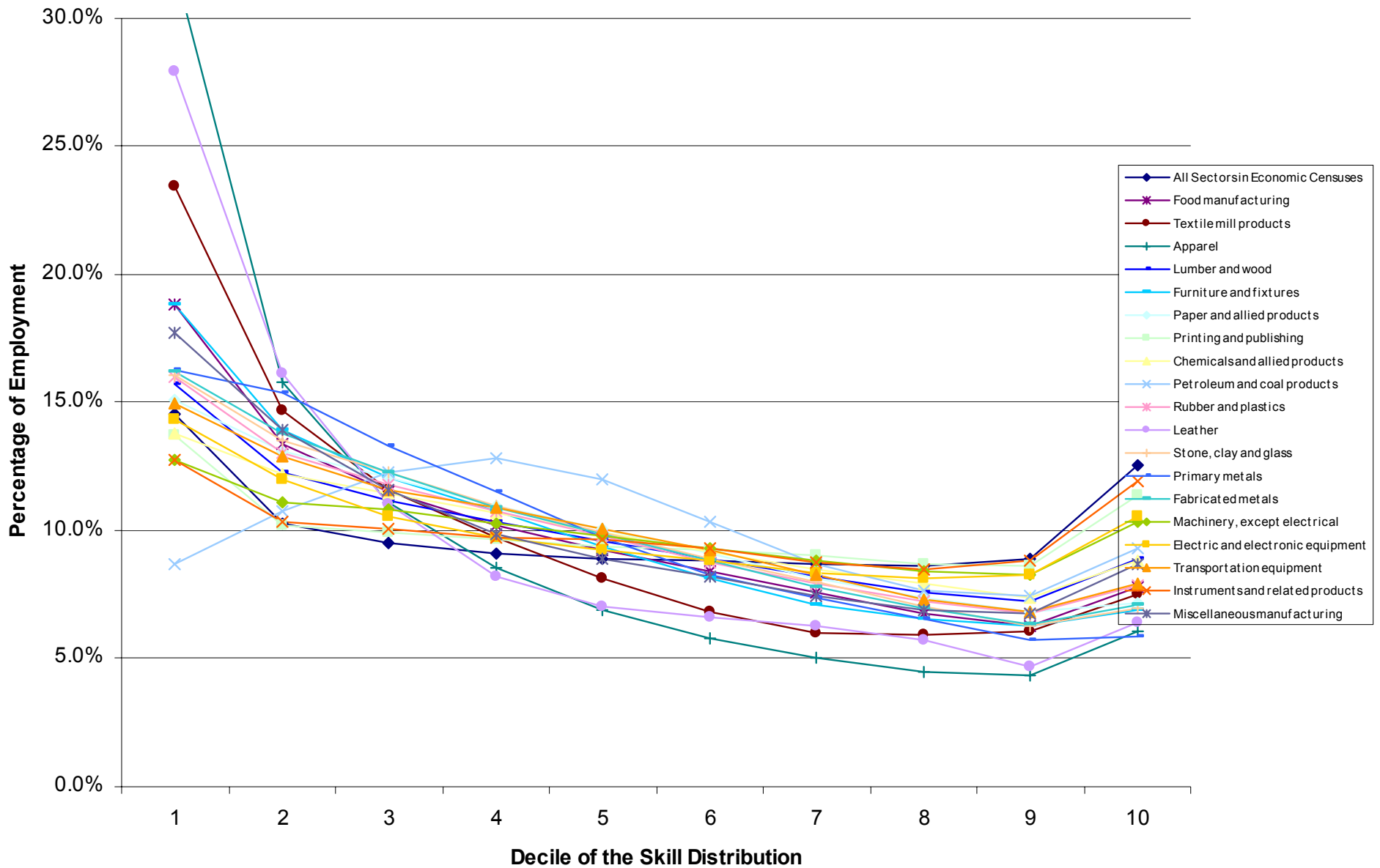
1992 and 1997 Theta Distribution



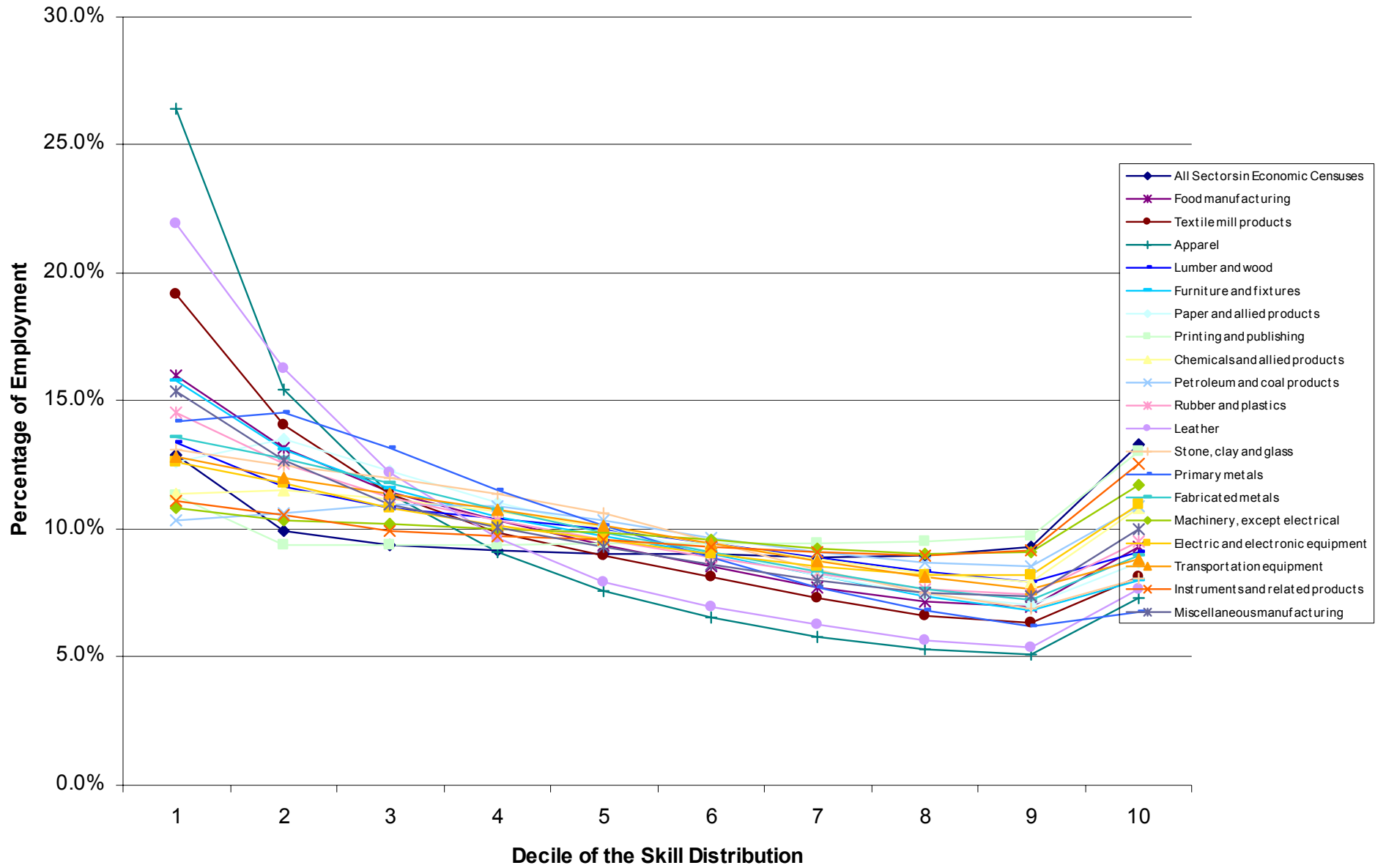
Distribution of Human Capital (Theta) for Manufacturing 1992



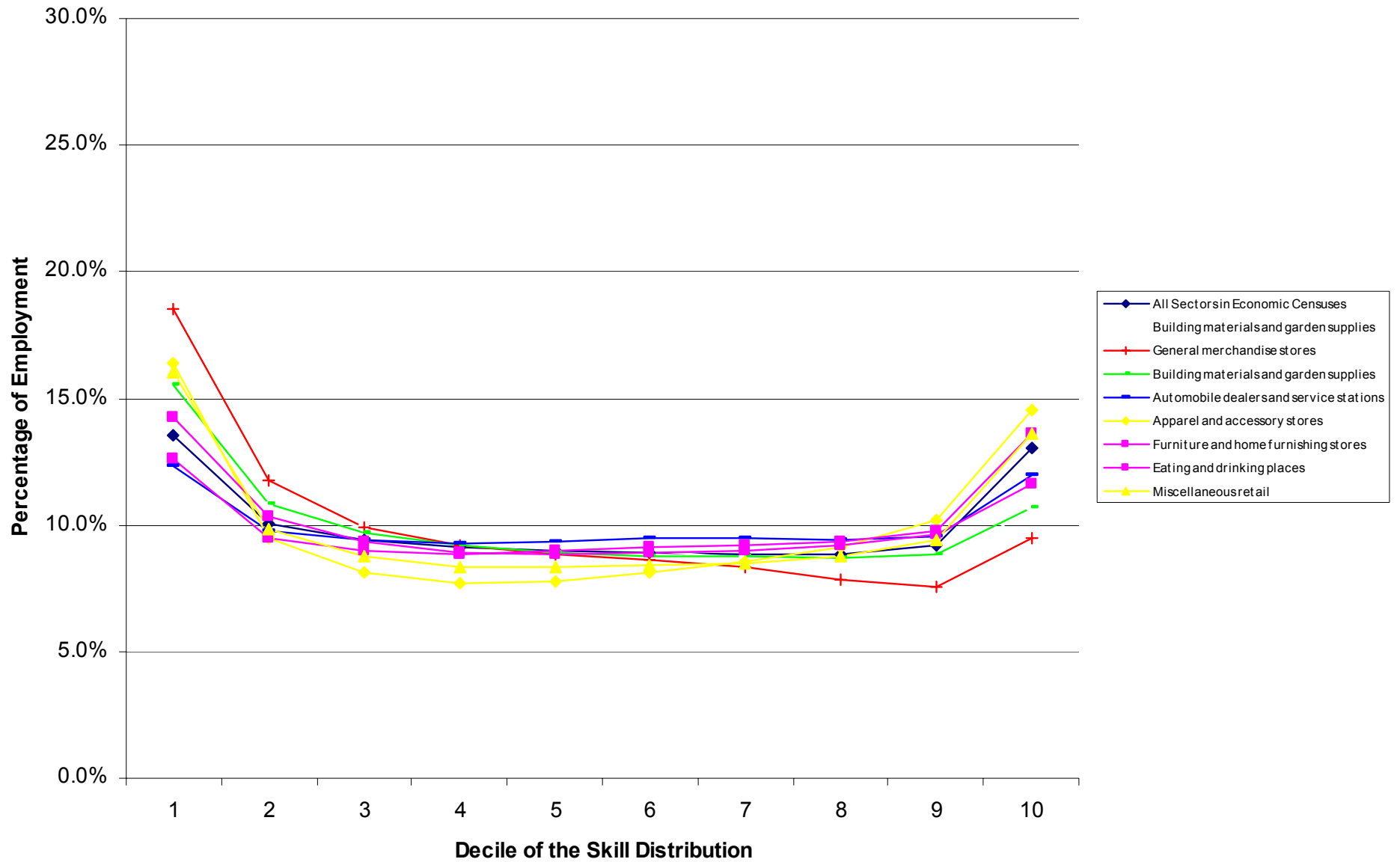
Distribution of Human Capital (Theta) for Manufacturing 1992, Exitters



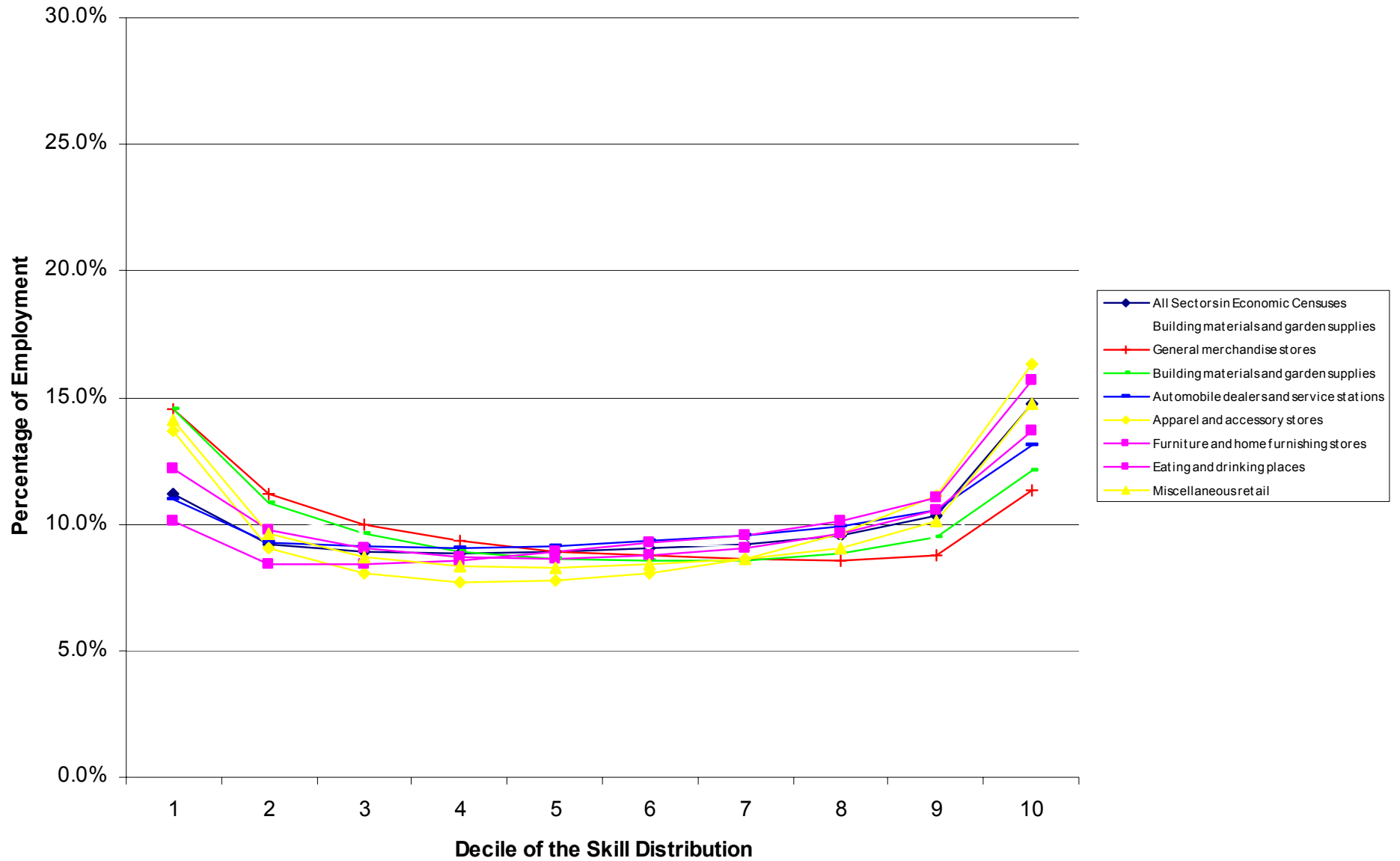
Distribution of Human Capital (Theta) for Manufacturing 1992, Continuers



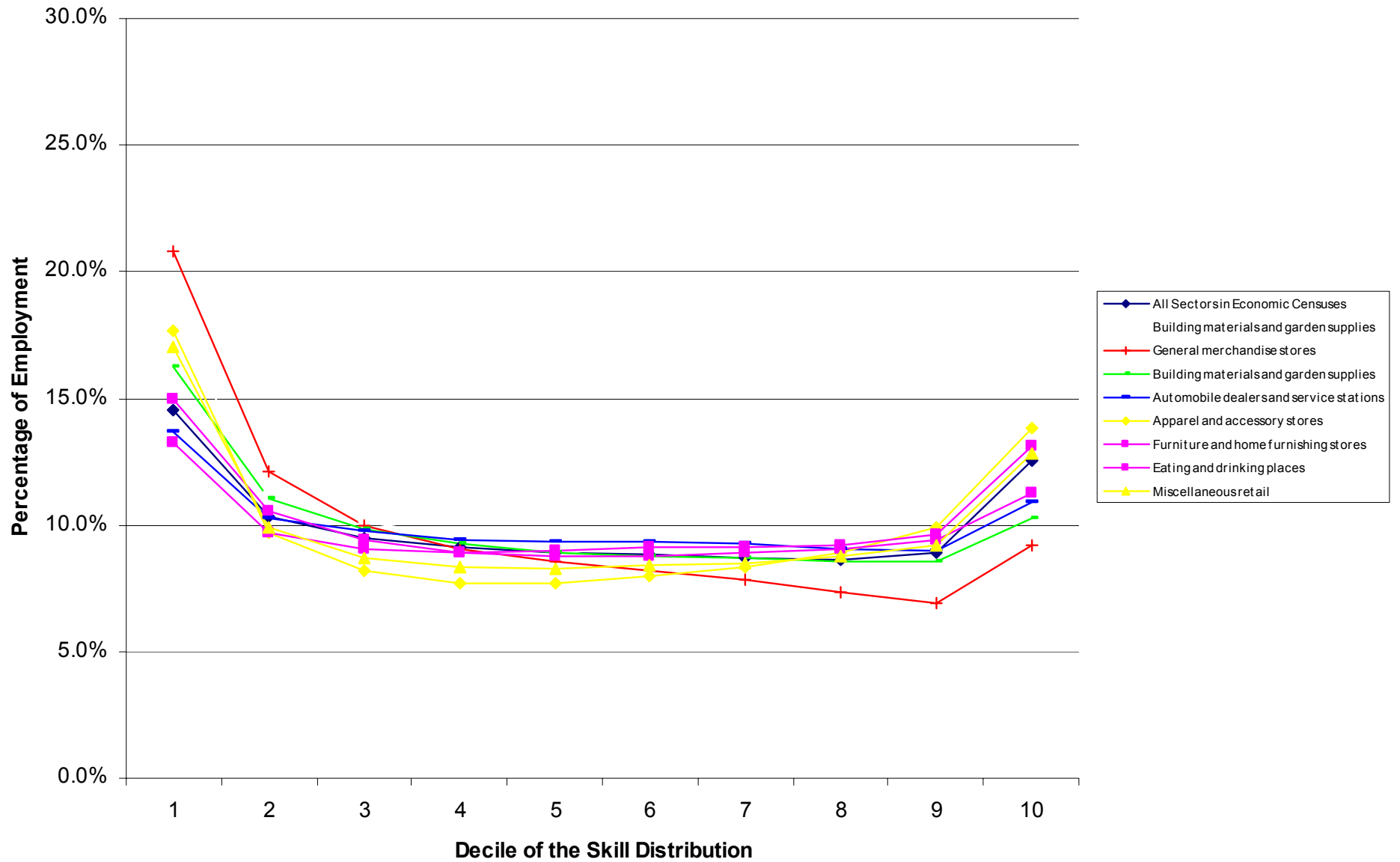
Distribution of Human Capital (Theta) for Retail Trade 1992



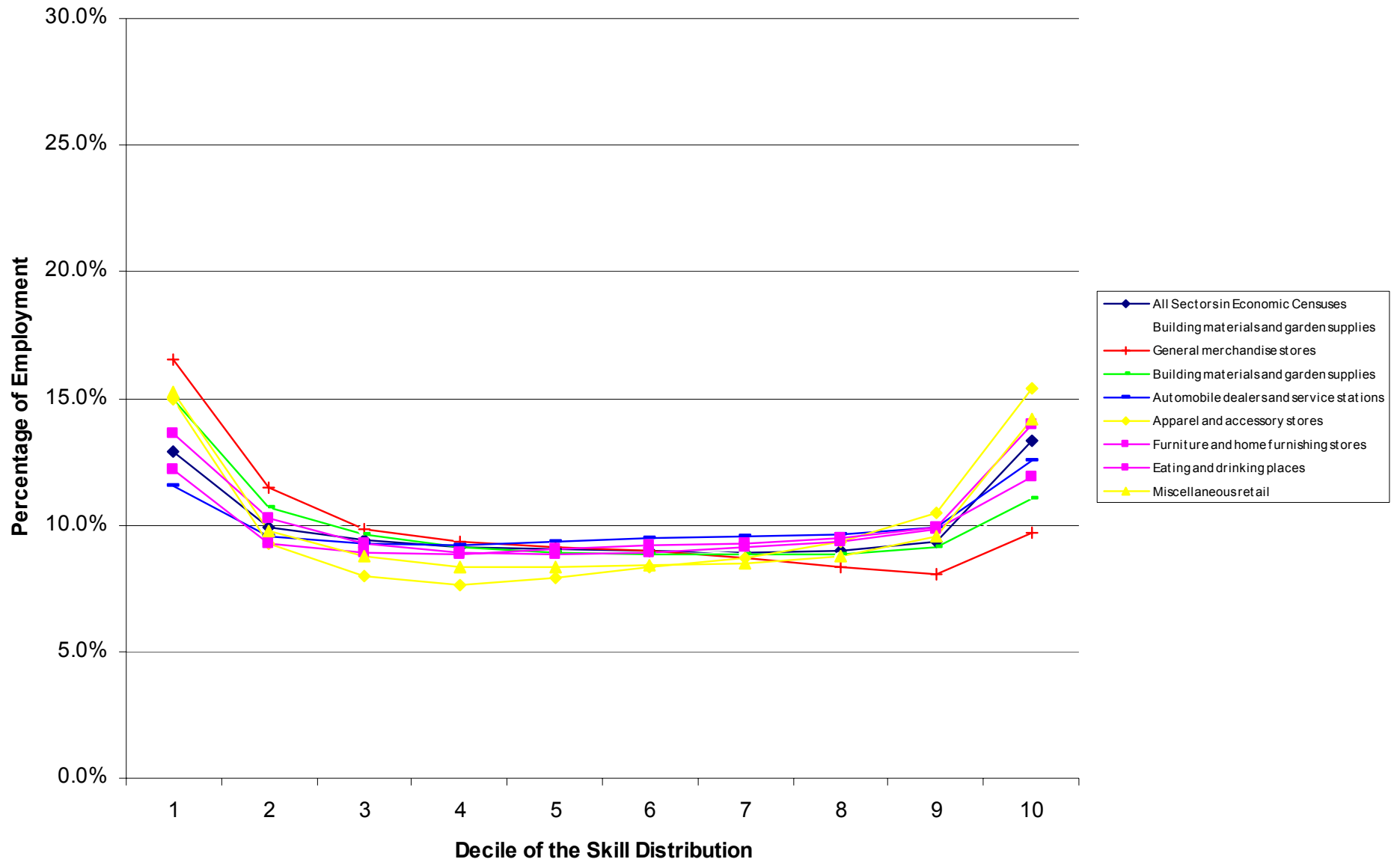
Distribution of Human Capital for Retail Trade 1997



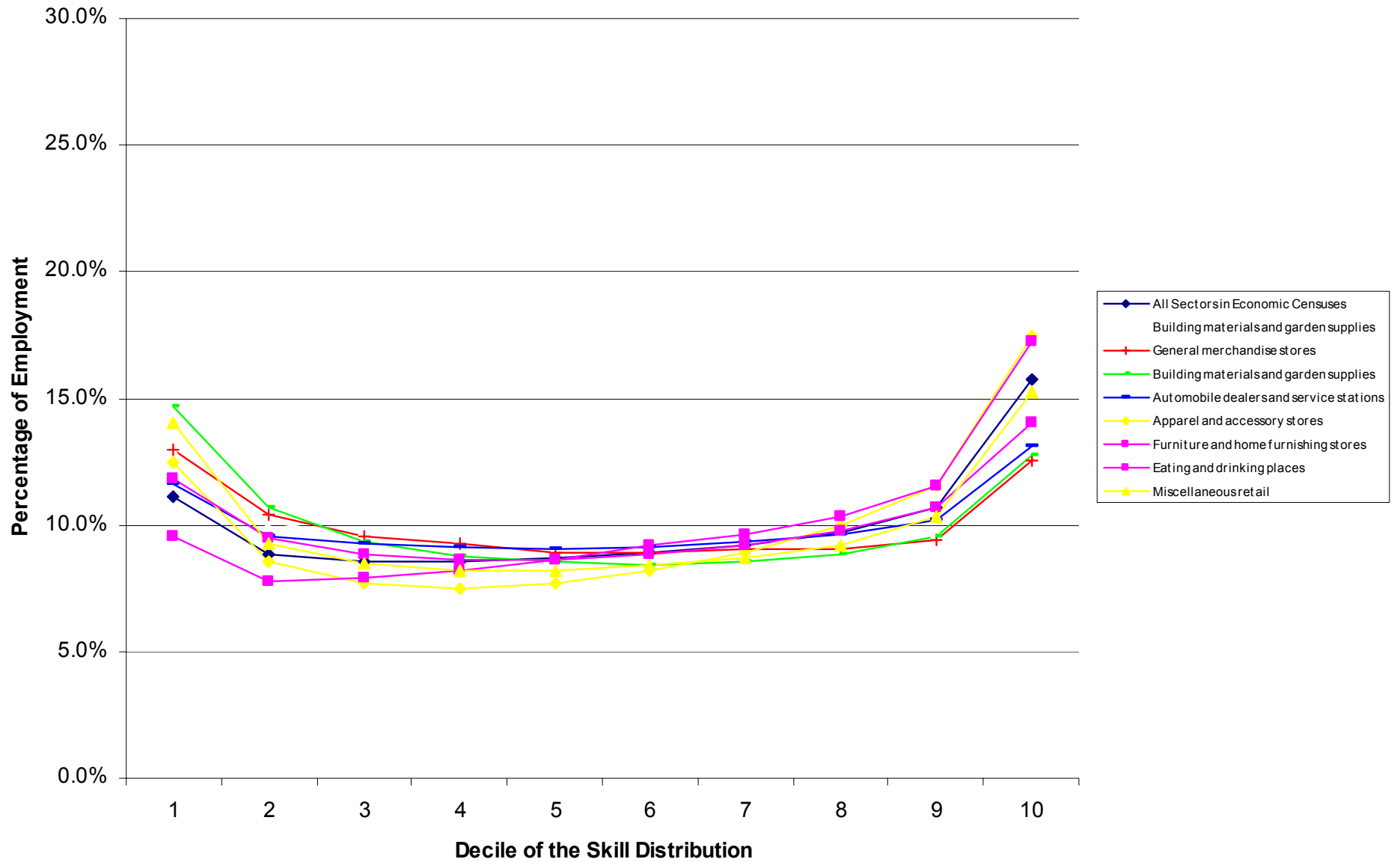
Distribution of Human Capital (Theta) for Retail Trade 1992, Exited



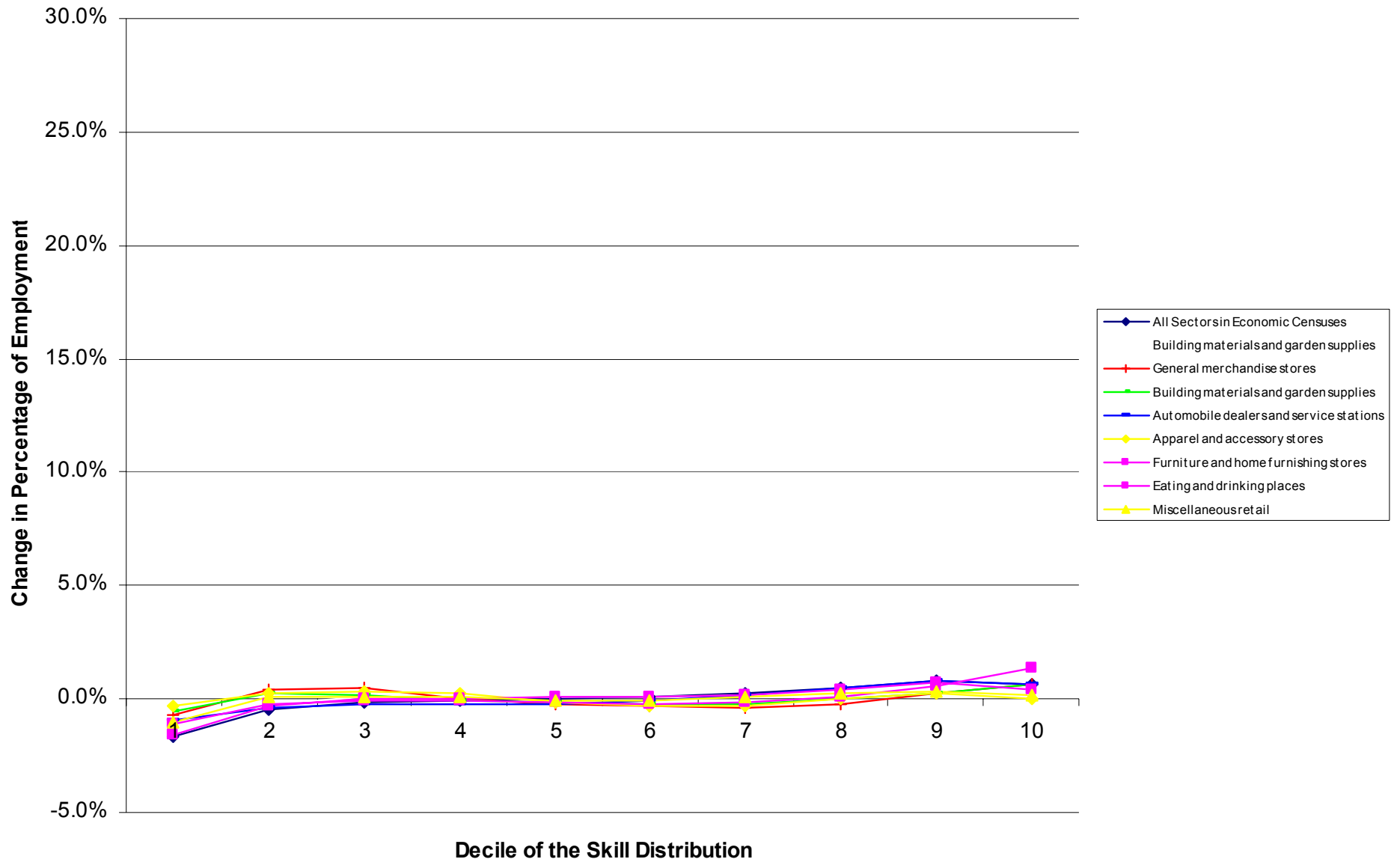
Distribution of Human Capital for Retail Trade 1992, Continuers



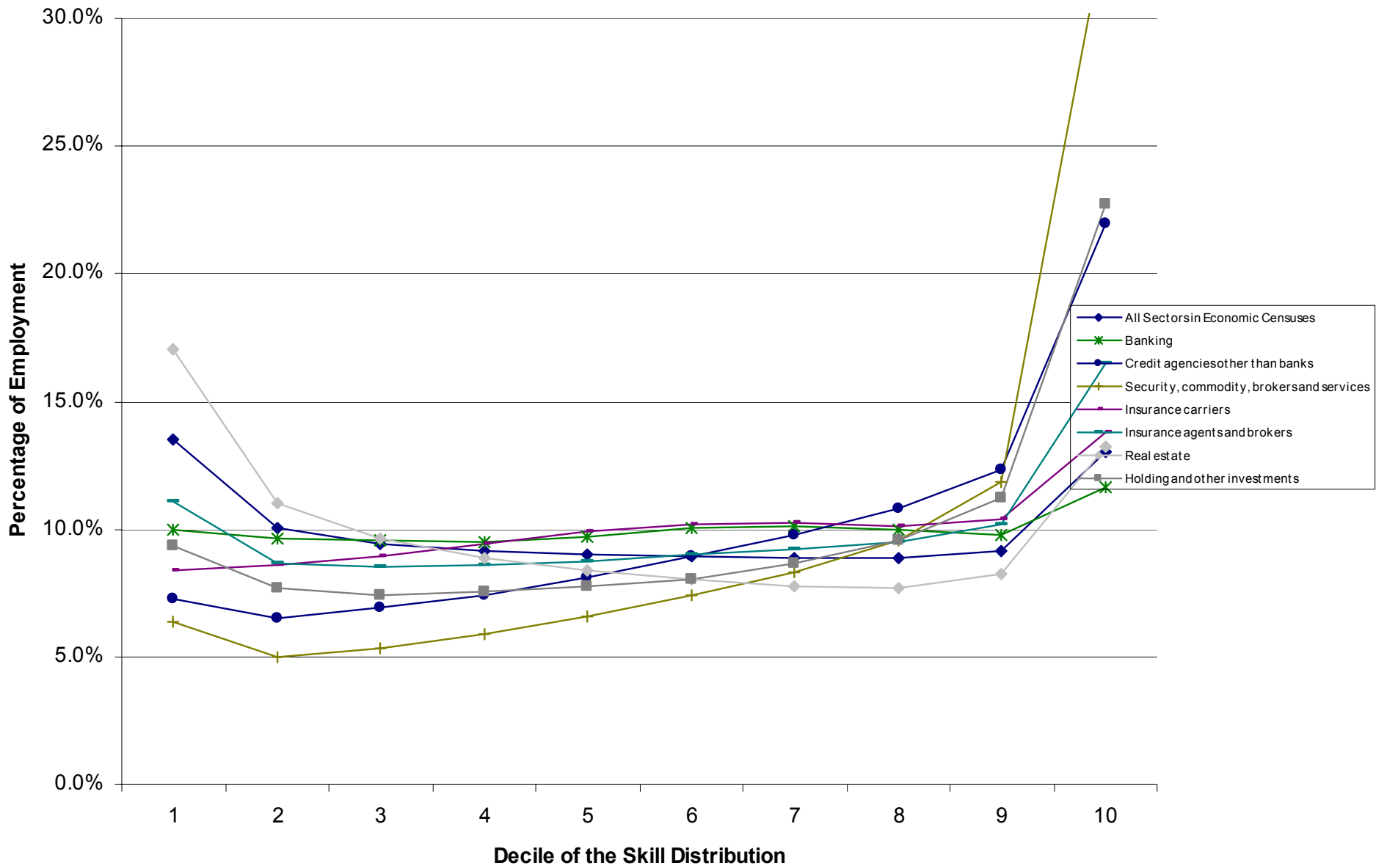
Distribution of Human Capital for Retail Trade 1997, Entrants



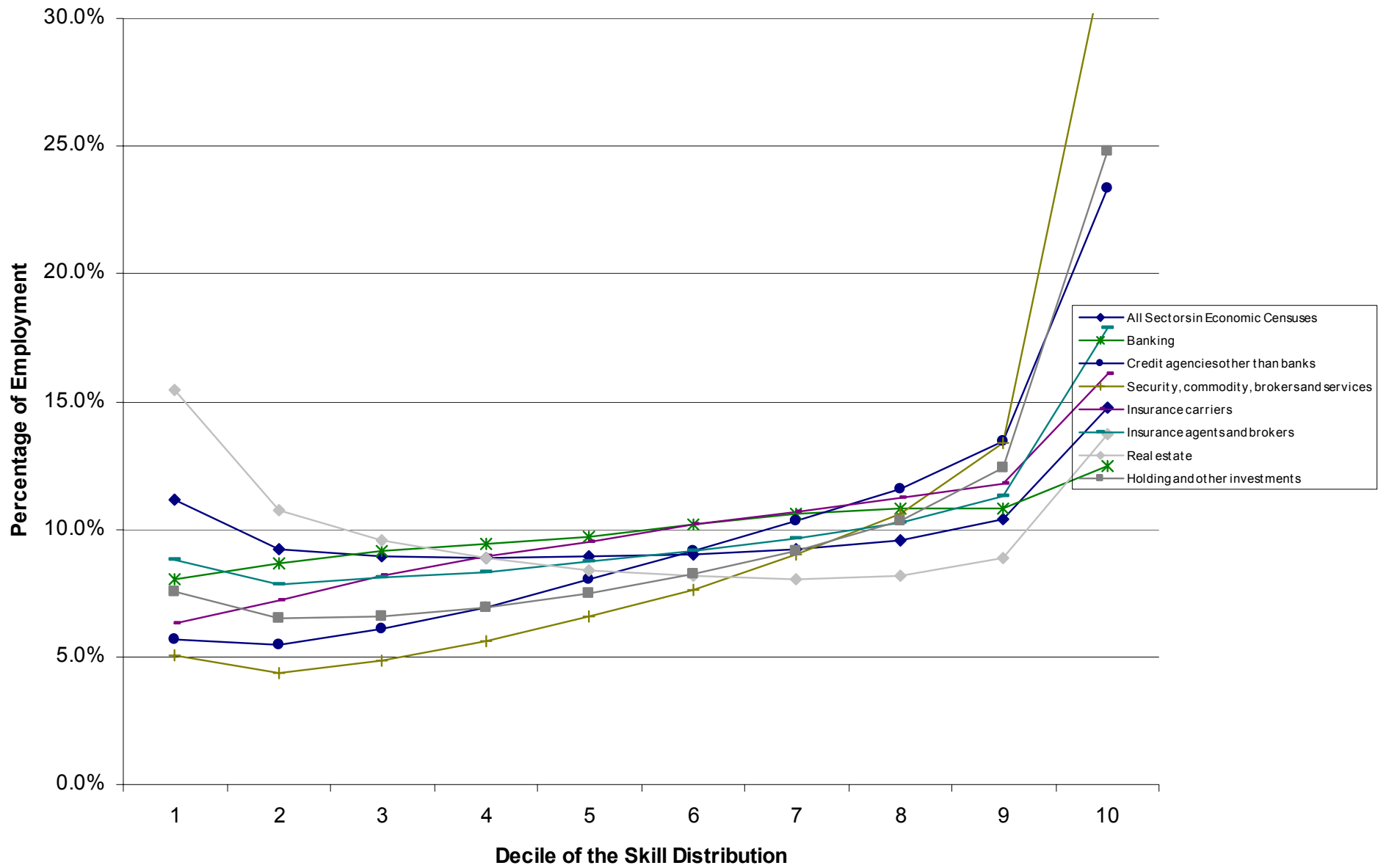
Distribution of Change in Human Capital (Theta) for Retail Trade 1992-1997, Continuers



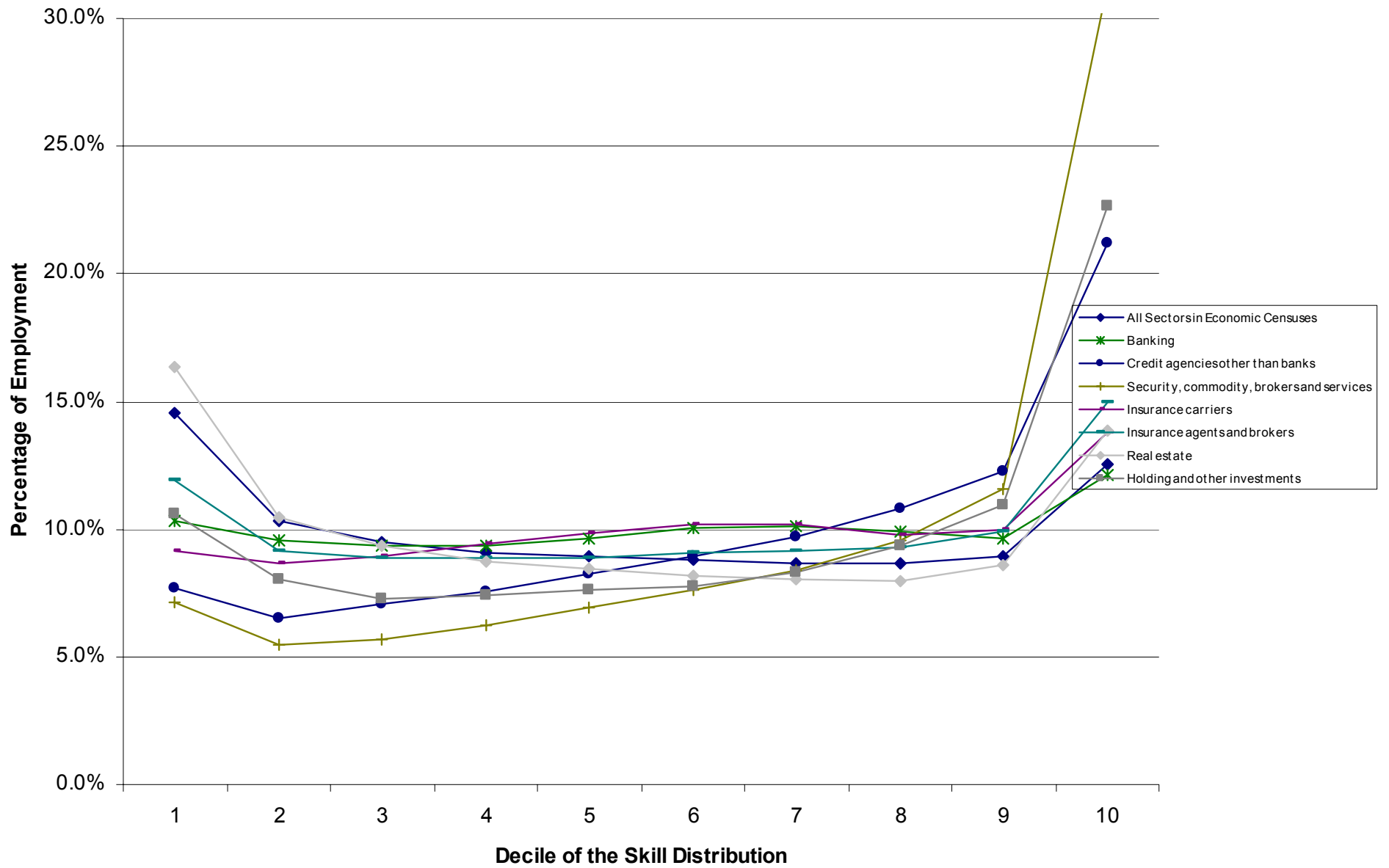
Distribution of Human Capital (Theta) for Finance, Insurance, and Real Estate 1992



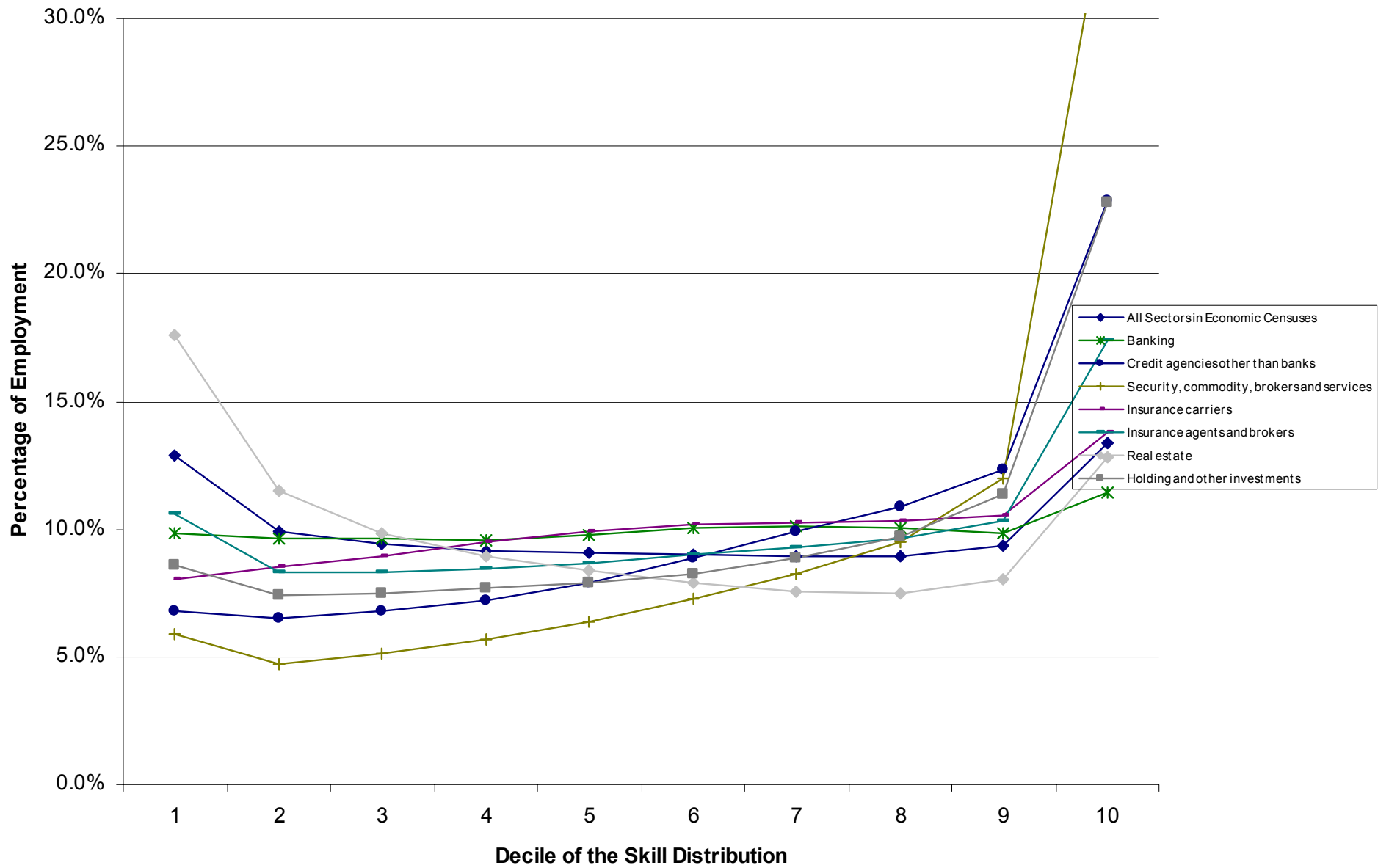
Distribution of Human Capital (Theta) for Finance, Insurance, and Real Estate 1997



Distribution of Human Capital (Theta) for Finance, Insurance, and Real Estate 1992, Exitors



Distribution of Human Capital (Theta) for Finance, Insurance, and Real Estate 1992, Continuers



Distribution of Human Capital (Theta) for Finance, Insurance, and Real Estate 1997, Entrants

